Tom A. Loski
Chief Regulatory Officer

16705 Fraser Highway
Surrey, B.C. V4N 0E8
Tel: (604) 592-7464
Cell: (604) 250-2722
Fax: (604) 576-7074
Email: tom.loski@terasengas.com
www.terasengas.com

Regulatory Affairs Correspondence
Email: regulatory.affairs@terasengas.com

May 28, 2008

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. ("Terasen Gas" or "TGI") and Terasen Gas (Vancouver Island) Inc. ("TGVI") (collectively the "Companies")
Energy Efficiency and Conservation Programs Application

On March 22, 2007, the British Columbia Utilities Commission (the "Commission") issued Order No. G-33-07 approving the Terasen Gas application for an extension for 2008-2009 of the 2004-2007 PBR Settlement Agreement; and Order No. G-34-07 approving the TGVI application for an extension for 2008-2009 of the 2006-2007 Revenue Requirements Negotiated Settlement Agreement (collectively the "Extended Settlements"). In the Terms of their respective Extended Settlements, included as Appendix A to the Orders (Terasen Gas at Pages 18 and 19 and TGVI at Page 12) under "Review of DSM funding and economic tests", it states:

> *"TGI committed, as part of its 2006 Annual Review and Mid-Term Assessment Review, to undertake in 2007 a review of the economic tests used to evaluate its DSM and efficiency related programs. This review will also assess the 2006 CPR study and the potential need for increased DSM funding and will take into consideration the anticipated Provincial 2007 Energy Plan. An application will be made to the Commission for review and approval in 2007, with implementation in 2008."*

On December 14, 2007, the Companies filed a letter with the Commission advising that as a result of the impact of aspects of the 2007 Energy Plan and recent Commission decisions, a delay was necessary in order to further consult with stakeholders. The Companies anticipated the submission of their Application would occur around the first quarter of 2008.

On April 7, 2008, the Companies filed a letter with the Commission advising that as a result of the introduction of BILL 15 Utilities Commission Amendment Act ("Bill 15"), the Companies believed that a further delay to the submission of their Energy Efficiency and Conservation Programs Application pending Royal Assent of Bill 15 was prudent.

On April 9, 2008, the Commission issued a letter (Log No. 24916) accepting the proposed delay pending Royal Assent of Bill 15 noting that the application should be made within 30 days of Royal Assent. On May 1, 2008, the British Columbia Legislature Bill 15 received Royal Assent.

Pursuant to Commission Orders No. G-33-07 and No. G-34-07 and in accordance with Commission letter dated April 9, 2008 (Log No. 24916), attached please find the Energy Efficiency and Conservation ("EEC") Programs Application on behalf of the Companies. The Companies have also provided this Application directly to all Intervenors and Registered Parties who participated in proceedings establishing each of the Companies' Settlement Agreements and Extended Settlements. The Companies have also provided notice of this Application directly to other stakeholders and organizations that may have an interest in the Application. A complete listing of all parties who were provided notice concurrent with the filing of the Application is included as Attachment 1.

Based on the feedback from stakeholder consultation to date, the Companies propose the regulatory review process for the Application to be by way of a Negotiated Settlement Process ("NSP") sponsored by the Commission. The Companies are of the view that publishing of a "Notice of Application" is unnecessary in this case because of the extensive stakeholder consultation conducted during the preparation of the Application and the wide distribution to all past and potential stakeholders and organizations who may have an interest in actively participating in the review of this Application.

The following proposed Regulatory Timetable supports obtaining a Commission decision on or before August 15, 2008 as requested in the application.

Action:	**Date:**
Intervenor Registration & Commission Information Request No. 1	Wednesday, June 11
Intervenor Information Request No. 1	Friday, June 20
Response to Commission & Intervenor Information Requests No. 1	Wednesday, July 16
Commission Sponsored Negotiated Settlement Process	Mon. July 21 or Tues. July 22
Decision	Friday, August 15

If you have any questions regarding this filing please contact the undersigned.

All of which is respectfully submitted.

Sincerely,

TERASEN GAS INC.

Original signed:

Tom A. Loski

Attachment

cc (e-mail only): Parties listed under Attachment 1

TGI-TGVI Energy Efficiency Conservation Programs Application

Consolidated List Intervenors, Stakeholders and Potential Interested Parties

Organization	First Name	Last Name	Title	Email
B.C. Hydro and Power Authority	Joanna	Sofield	Chief Regulatory Officer	bchydroregulatorygroup@bchydro.com
B.C. Hydro and Power Authority	Ray	Aldeguer	Senior Vice President, Legal, Regulatory Affairs and General Counsel	alice.ferreira@bchydro.com
B.C. Public Interest Advocacy Centre	Eugene	Kung	Articled Student	ekung@bcpiac.com
B.C. Public Interest Advocacy Centre	Leigha	Worth	Barrister & Solicitor	lworth@bcpiac.com
B.C. Public Interest Advocacy Centre	James	Quail	Executive Director	support@bcpiac.com
BC Utilities Commission	Brian	Williston	Engineering and Commodity Markets Manager	brian.williston@bcuc.com
BC Utilities Commission	Philip	Nakoneshny	Rates and Finance Senior Financial Analyst	philip.nakoneshny@bcuc.com
Boughton Law Corporation	Gordon	Fulton	Counsel for BCUC	gfulton@boughton.ca
Bull, Housser & Tupper Barristers & Solicitors	David	Bursey	Barrister & Solicitor	dwb@bht.com
Canadian Gas Association	Paula	Dunlop	Director, Communications and Climate Change	pdunlop@cga.ca
Canadian Home Builders Association - B.C.	M.	Whitemarsh	Chief Executive Officer	info@chbabc.org
CEC (Commercial Energy Consumers Association of BC)	David	Craig	President, Consolidated Management Consultant	dwcraig@allstream.net
CHBA - FV	Jan	Field	Executive Officer	jan@fvhba.com
CHBA Kamloops	Patsy	Bourassa	Executive Officer	chbakam@telus.net
CHBA Kelowna	Tammy	Jackson		info@chbakelowna.bc.ca
CHBA Penticton	Rhonda	Williams		chbaso@shaw.ca
CHBA Prince George	Sharon	Slager		sharon.pghba@shawcable.com
CHBA Victoria	Casey	Edge		cedge@chbavictoria.com
City Green	Peter	Sundberg	Executive Director	manager@citygreen.ca
City of Vancouver	Mark	Hartman	Building Energy Programs Manager	Mark.Hartman@vancouver.ca
CMHC	Lance	Jakubec	Senior Consultant Research and Information Transfer	ljakubec@cmhc.ca
Community Energy Association	Laura	Porcher	Executive Director	lporcher@communityenergy.bc.ca
COPE Local 378	Pat	Junnila	Vice-President	pjunnila@cope378.ca
Coral Energy Canada Inc.	Mary	McCordic		mary.mccordic@shell.com
Coral Energy Canada Inc.	Nick	Caumanns		nick.caumanns@shell.com
Corix Multi-Utility Services Ltd.	Ken	Donison	General Manager	ken.donison@corix.com
David Suzuki Foundation	Nicholas	Heap	Climate and Energy Policy Analyst (Climate Change Program)	nheap@davidsuzuki.org
Destination Conservatio	Darla	Simpson	Executive Director	darla@dcplanet.ca
Direct Energy Marketing Limited	Chad	Painchaud	Regulatory Analyst, Government & Regulatory Affairs, Western Region	chad.painchaud@directenergy.com
Direct Energy Marketing Limited	Gary	Newcombe		gary.newcombe@directenergy.com

TGI-TGVI Energy Efficiency Conservation Programs Application

Consolidated List Intervenors, Stakeholders and Potential Interested Parties

Organization	First Name	Last Name	Title	Email
Econalysis Consulting Services	James	Wightman		jwightman@econalysis.ca
Elk Valley Coal Corporation	David	Newlands		dnewlands@telus.net
First Solutions Inc.	Lloyd	Guenther		lguenther@novuscom.net
FortisBC	Keith	Veerman	Manager, Energy Efficiency	Keith.Veerman@fortisbc.com
FortisBC Inc.	Joyce	Martin	Manager Regulatory Affairs	regulatory@fortisbc.com
Fraser Basin Council	Bob	Purdy	Director, Corporate Development	bpurdy@fraserbasin.bc.ca
GVHBA	Peter	Simpson	CEO	peter@gvhba.org
Hearth, Patio & Barbecue Association of Canada	Kim	Rodgers	HPBAC Board of Directors	kimr@telus.net
Higgins Energy Management Services	Geoffrey	Higgins	Energy Consultant	higginsenergy@canada.com
HighCliff Energy Services Ltd.	Ron	Cliff	President	ron@highcliff.ca
Howe Sound Pulp and Paper Limited Partnership	Pierre	Lamarche	Manager, Energy	Pierre.Lamarche@hspp.ca
IGI Resources Inc., a BP Energy Company	Jim	Langley	Manager, Marketing Services	jim.langley@bp.com
Lang Michener Barristers & Solicitors	Karl	Gustafson	Counsel Representing Vancouver Island Gas Joint Venture (VIGJV)	kgustafson@lmls.com
MEMPR	Andrew	Pape-Salmon	Manager - Energy Efficiency and Community Energy Solutions	Andrew.PapeSalmon@gov.bc.ca
Miller Thomson LLP Barristers & Solicitors	Charles	Bois		cbois@millerthomson.ca
Ministry of Energy, Mines & Petroleum Resources	Paula	Barrett	Executive Director	paula.barrett@gov.bc.ca
Ministry of Energy, Mines & Petroleum Resources, Oil and Gas Policy Branch	Duane	Chapman	Senior Regulatory Advisor	Duane.Chapman@gov.bc.ca
Ministry of Environment	Ted	Sheldon	Policy Analyst	ted.sheldon@gov.bc.ca
NR Can	John	Cockburn	Senior Chief, Equipment Standards and Labelling Housing, Building and Regulations	jcockbur@nrcan.gc.ca
Owen Bird Barristers & Solicitors	Chris	Weafer	Counsel Representing Commercial Energy Consumers Association (CEC)	cweafer@owenbird.com
Pacific Northern Gas Ltd. & Pacific Northern Gas (NE) Ltd.	Craig	Donohue	Director, Regulatory Affairs & Gas Supply	cdonohue@png.ca
Pembina Institute, The	Matt	Horne	Sustainable Communities Group	matth@pembina.org
R.T. O'Callaghan & Associates Inc.	Richard	O'Callaghan		rto@rtocallaghan.com
Rental Owners & Managers Society of BC (ROMS BC)	Al	Kemp	CEO	alkemp@suites-bc.com
Sierra Club, BC Chapter	Tom	Hackney		thackney@shaw.ca
Thermal Environmental Comfort Association (TECA)	Nelle	Maxey	Manager	office@teca.ca
Urban Development Institute	Karen	Thompson	Administrative Coordinator	udikelowna@shaw.ca

TGI-TGVI Energy Efficiency Conservation Programs Application

Consolidated List Intervenors, Stakeholders and Potential Interested Parties

Organization	First Name	Last Name	Title	Email
Urban Development Institute - Pacific Region	Jeff	Fisher	Deputy Executive Officer	jfisher@udi.org
Willis Energy Services Ltd.	Penny	Cochrane	Senior Consultant	pcochrane@willisenergy.com

TERASEN GAS INC.

and

TERASEN GAS (VANCOUVER ISLAND) INC.

ENERGY EFFICIENCY AND CONSERVATION PROGRAMS APPLICATION

May 28, 2008

Executive Summary

Terasen Gas Inc. ("TGI") and Terasen Gas (Vancouver Island) Inc. ("TGVI"), (collectively referred to as the "Companies" or the "Terasen Utilities"), herein apply, pursuant to section 44.2 of the *Utilities Commission Act* (the "Act"), for approval of increased expenditures in support of an expanded Energy Efficiency and Conservation ("EEC") strategy, and approval to capitalize incremental EEC expenditures by charging the expenditures to a regulatory asset deferral account and amortizing the balance over 20 years. The specific relief sought is set out in Sections 2 and 6 of the Application, and is summarized in greater detail below. The Companies believe that the strategy outlined in this Application, and the related relief sought, is consistent with government's energy objectives as defined by the Act, is cost effective, and is in the interest of persons in British Columbia who receive or may receive service from the Companies. The Terasen Utilities respectfully submit that the relief sought should be granted. Approval is respectfully requested by August 15, 2008 in order to permit implementation of the EEC strategy as early as possible.

Funding for Terasen Gas (Whistler) Inc. ("TGW") has not been included in this Application, primarily due to the timing of the conversion from propane to natural gas, and the need for additional analysis once that work is completed. An EEC plan, including funding, appropriate to TGW will be developed following receipt of an appliance conversion audit currently being conducted by TGW as part of the pipeline extension project from Squamish to Whistler.

The Companies' EEC activity, referred to in previous filings with the Commission as Demand Side Management ("DSM") activity, has remained essentially unchanged since the late 1990's. For TGI, funding levels were established by Order No. G-85-97, at approximately $1.50 million for incentives, which funds were to be placed in a deferral account and amortized over three years. Additionally, non-incentive expenses of approximately $1.624 million annually are treated as Operations and Maintenance ("O&M") expense and are expensed in the year in which they are incurred. EEC initiatives for TGI have been focused on conservation.

For TGVI, Order No. C-02-05 directed TGVI to develop an EEC strategy and budgets, and to seek approval through the Resource Plan process for DSM strategy and budgets. TGVI has historically had EEC expenditures of approximately $650,000 annually for incentives, plus $500,000 annually for non-incentive costs. Incentive expenditures are placed in a deferral account and fully amortized the year following that in which they were incurred. Non-incentive costs are treated as O&M and are expensed in the year in which they are incurred. EEC initiatives for TGVI have been focused on capturing additional economic customers within the TGVI service area (load-building) and encouraging customers using other fuels to connect to the natural gas distribution system (fuel-switching).

The Terasen Utilities have enjoyed success with the limited funding that they have had available for EEC activity. TGI's EEC activity in 2007 produced a yield of $2.58 spent/GJ conserved, well below customer gas cost rates including midstream cost that averaged $8.33 Cdn/GJ for residential lower mainland customer in 2007.

This Application fulfills the commitment the Terasen Utilities made in their respective negotiated settlement agreements to bring forth such an Application addressing EEC. Commission Order No. G-33-07 approved the extension for 2008-2009 of the 2004-2007 TGI PBR Settlement Agreement[1] ("TGI PBR Extended Settlement"); and Order No. G-34-07 approved the extension for 2008-2009 of the 2006-2007 TGVI Revenue Requirements Negotiated Settlement Agreement[2] (TGVI RR Extended Settlement") (collectively the "Extended Settlements").

Although the Companies have enjoyed success with the current EEC programs, existing budget constraints have not allowed the Companies and customers to take full advantage of the potential energy savings activity available. A great deal has changed since the Companies' approved levels of EEC expenditures were established, and there is an opportunity to expand EEC strategies in a manner consistent with government's energy objectives, with favorable results for customers. Rising energy costs - in BC, natural gas rates have more than doubled since 1998 - present greater potential for cost effective EEC initiatives and have made the public more receptive to these initiatives. An expanded EEC strategy for the Companies dovetails with government's energy objectives of, for instance, conservation, reduction of greenhouse gas (GHG) emissions, and electricity self-sufficiency. The Province set out

[1] Order No. G-51-03 approved the Terasen Gas Inc. 2004-2007 Multi-Year Performance-Based Rate Plan Settlement Agreement

[2] Order No. G-126-05 approved the Terasen Gas (Vancouver Island) Inc. 2006-2007 Negotiated Settlement Agreement

ambitious objectives regarding these items in its 2007 Energy Plan and has further demonstrated its commitment to these policies by enacting legislation to amend the *Utilities Commission Act* to require the Commission to address government's energy objectives in considering applications under section 44.2, among other things.[3] Despite the Province's leadership in developing conservation and GHG policies, the Terasen Utilities – which together are British Columbia's largest public utilities in terms of delivered energy - currently invest less on conservation in BC (in absolute dollars and on a per customer basis) than other utilities, both in BC and elsewhere in North America.

In 2005, the Terasen Utilities retained Marbek Resource Consultants Ltd. ("Marbek") to undertake a Conservation Potential Review ("CPR"), a review which had been contemplated in the 2004 Resource Plans for TGI and TGVI. The CPR was received by the Companies in 2006. The findings of the CPR were further refined through consultation with Habart and Associates Consultants ("Habart"). The Companies also developed "portfolio level" initiatives in addition to traditional energy efficiency and fuel switching programs. The strategies outlined in this Application, and the expenditures for which approval is being sought, are based to a significant degree on the findings of the CPR and the subsequent work undertaken with Habart. These cost-effective initiatives will lead to significant energy savings for customers and will result in a reduction in GHG emissions.

In summary, there are four components to the relief sought in this Application:

1. The Companies are seeking to expand overall EEC expenditures to a total of $56.6 million over three years, representing $46.944 million for TGI and $9.667 million for TGVI.
2. The Companies are proposing to capitalize incremental EEC expenditures, include them in a regulatory asset deferral account and amortize the balance of the account over a period of 20 years.
3. The Companies are proposing to increase the amortization period to 20 years for incentive amounts that are added to deferral accounts in 2008 and 2009 as part of the TG PBR Extended Settlement and TGVI RR Extended Settlement, which will align with the amortization period for incremental EEC expenditures.

[3] Bill 15, *Utilities Commission Amendment Act, 2008*

4. The Companies are proposing a methodology for evaluating the costs and benefits of the overall EEC portfolio.

The specific relief sought is detailed in Section 2 “Application”, but is summarized below.

Expanded EEC Funding

The TGI PBR Extended Settlement already includes DSM funding totaling $3.124 million ($1.50 million for incentives and $1.624 million for expense), in each of 2008 and 2009. Similarly, TGVI RR Extended Settlement includes DSM funding totaling $1.150 million ($0.650 million for incentives and $0.500 million for expense), in each of 2008 and 2009. The respective Extended Settlements specify how these DSM related expenditures are to be included in revenue requirements and rate determinations for 2008 and 2009. The two year total (2008 plus 2009) of DSM related expenditures for both Companies that are included in the Extended Settlements is $8.548 million ($3.124 million *2 plus $1.15 million *2). The Companies’ current approved EEC expenditures are outlined in Table 1 below.

The Companies are proposing incremental EEC/DSM expenditures over three years of $40.696 million for TGI and $7.366 million for TGVI. On a combined basis, the total additional funding for the three years ending 2010 over and above the approved levels stipulated in Extended Settlements for the two years ending 2009 is $48.062 million, bringing the three year total for both Companies to $56.61 million. This information is summarized in Table 1, below. While this funding increase will allow for a comprehensive set of expanded programs the Companies will continue to explore where the programs may be enhanced as experience is gained. Should beneficial opportunities be identified the Companies may bring additional applications forward as appropriate.

Table 1 – Current, Proposed, and Incremental EEC expenditures, by Utility

Current Level of Spend for 2008 and 2009 ($million)

Utility	O&M	Incentive	Total
TGI	$1.624	$1.500	$3.124
TGVI	$0.500	$0.650	$1.150
Total	$2.124	$2.150	$4.274

Proposed ($million)

Utility	2008	2009	2010	Total by Utility
TGI	$13.996	$15.752	$17.196	$46.944
TGVI	$2.830	$3.043	$3.793	$9.666
Total	$16.826	$18.795	$20.989	$56.610

Incremental ($million)

Utility	2008	2009	2010	Total by Utility
TGI	$10.872	$12.628	$17.196	$40.696
TGVI	$1.680	$1.893	$3.793	$7.366
Total	$12.552	$14.521	$20.989	$48.062

Much of the expenditure being requested, and the activity described in the Application, is based upon the CPR, conducted by Marbek, and received by the Companies in May 2006, as discussed in the 2006 Resource Plans for TGI and TGVI. The findings of the CPR were further refined through consultation with Habart, and the high-level program planning work was begun. The Companies also developed "portfolio level" initiatives in addition to traditional energy efficiency and fuel switching programs.

The Companies are seeking Commission approval for the overall incremental expenditures in Table 1 based on the contemplated program areas and funding described outlined in Table 2 below and described in detail in Section 6. This approach preserves the Companies' ability to subsequently redirect funds from one program area to another program area that the Companies conclude is generating more favorable results based on the assessment criteria outlined in this Application. One of the program areas is $500,000 for a new CPR study to be completed in 2009 for the purposes of developing new EEC programs and funding proposals, including a future application to the Commission. The expenditures set out in Tables 1 and 2 do not include contributions from partners for joint programs where there are electrical savings, which total about $5.5 million over the three year time period. The Terasen Utilities have proposed mechanisms in Section 6.14 to permit the Commission and stakeholders to review how the money has been spent and ensure accountability.

Table 2 - Proposed EEC Expenditure by Program Area

Spend by Program Area 2008 - 2010 ($000's)	TGI	TGVI	Totals
Residential Energy Efficiency	$8,552	$734	$9,286
Commercial Energy Efficiency	$19,592	$2,199	$21,791
Residential Fuel Switching	$1,332	$2,367	$3,699
Conservation Education and Outreach	$11,068	$2,767	$13,835
Joint Initiatives	$2,400	$600	$3,000
Trade Relations	$1,200	$300	$1,500
2009 Conservation Potential Review	$400	$100	$500
Innovative Technologies, NGV and Measurement	$2,400	$600	$3,000
Total	$46,944	$9,667	$56,611

The funding budgets for each program area were derived based on the Companies' expectation that they will be undertaking the initiatives identified in Section 6.

The Terasen Utilities believe that by targeting the above areas, the energy savings from the proposed increase in expenditure and activity are significant. The present value of the savings from energy efficiency is estimated to be almost 10 million GJs over the lives of the various measures proposed, while it is estimated that the proposed activities designed to switch people who currently use a less efficient energy source as compared to natural gas (i.e. fuel switching activities) would result in additional load with a present value of approximately 2.3 million GJs. The net energy savings from the contemplated energy efficiency and fuel-switching activity is anticipated to be approximately 7.7 million GJs. This does not include potential savings resulting from Conservation Education and Outreach, Joint Initiatives, or Innovative Technologies, NGV and Measurement. The Companies anticipate that the proposed EEC activity will continue to provide good value for customers in a manner that is consistent with government's energy objectives. For example, the Energy Efficiency activity that the Companies are contemplating for customers of TGI produces a simple yield of $3.15 spent/GJ saved. The EEC portfolio contemplated in this Application, when assessed in accordance with the proposed evaluation methodology, has a Total Resource Cost ("TRC") ratio of 3.1 and a net financial benefit to customers of $165.1 million.

The Companies will continue to assess over the course of the Program Period whether customers would benefit from additional EEC spending over and above the funding sought in this Application, and will bring forward any further applications as appropriate.

Financial Treatment

As discussed in more detail in Section 6, this EEC Application proposes to treat the incremental EEC expenditures above amounts already approved as part of TG PBR Extended Settlement and TGVI RR Extended Settlement as capital. An amortization period of 20 years has been selected to match the benefit received by customers from the EEC expenditures resulting in appliance and energy system installations with a weighted average measurable life of 22.5 years. In addition to closely matching the cost recovery to the period over which benefits will accrue to customers, the proposed amortization period will smooth impacts to rates from the proposed increase in expenditure. The Terasen Utilities propose that the incremental EEC expenditures and existing incentive amounts in TG PBR Extended Settlement and TGVI RR Extended Settlement (TG - $1.5 million and TGVI - $.650 million) be charged to a regulatory asset deferral account on a tax-adjusted basis, the balance of which is amortized over twenty years, with amortization commencing the year following the year the expenditure is made. As indicated above, the longer amortization period than the periods contemplated in the Extended Settlements will smooth the impact to rates from the proposed increase in expenditure, and is more representative of the longevity of the energy savings resulting from the expenditure and from the new appliances to be installed by customers as a result of expenditures. This financial treatment is consistent with an approach used by other utilities in British Columbia, and the approach identified in the Commission's 1995 Guidelines in respect of the financial treatment of DSM.[4]

Evaluation Methodology

The Application also outlines specific approaches for evaluating the performance of the programs undertaken. The Companies are proposing a portfolio approach to cost-benefit analysis, so that rather than evaluating cost-effectiveness on a program-by-program basis, the overall EEC portfolio must maintain a TRC ratio of 1.0 or higher. This approach will allow the Companies to undertake the important portfolio-level activities needed to support the EEC activity, as well as to encourage market penetration of technologies that have a TRC of less than one because they have not yet reached economies of scale but have longer term potential for a higher TRC ratio. Further, the portfolio approach will allow the Companies to offer programs to customers in service areas where the TRC may have a result of less than 1.0 due

4 British Columbia Utilities Commission Order No. G-55-95, Amendments to the Uniform System of Accounts for Gas and Electric Utilities

to lower usage patterns, to support the Companies' goal of making the same programs available to customers across the service territory. The Companies propose that the "benefits" input to the cost-benefit analysis be based on gross energy savings rather than net savings (thus eliminating consideration of the perceived effects of free riders), due in part to uncertainties around free ridership rates. Free riders are customers who participate in an EEC program, who notionally would have undertaken the same conservation actions even if the program were not offered. The Companies are of the view that the inclusion of the notional free rider effects in the cost-benefit tests for EEC programs will distort test results and consequently may lead to results that run counter to the objectives of energy policies. The Companies further propose that the "benefits" input to the cost-benefit analysis include energy savings resulting from future regulations that may be introduced partly as a result of the Companies' EEC activity. The TRC ratios referenced in the Application have been derived using this approach.

Mechanics of Implementation

As discussed above, the TGI PBR Extended Settlement includes DSM funding totaling $3.124 million ($1.50 million for incentives and $1.624 million for expense), in each of 2008 and 2009. Similarly, TGVI RR Extended Settlement includes DSM funding totaling $1.150 million ($0.650 million for incentives and $0.500 million for expense), in each of 2008 and 2009. The respective Extended Settlements specify how these DSM related expenditures are to be included in revenue requirements and rate determinations for 2008 and 2009. The two year total (2008 plus 2009) of DSM related expenditures for both Companies that are included in the Extended Settlements is $8.548 million ($3.124 million *2 plus $1.15 million *2).

The Terasen Utilities propose that the incremental expenditures for the 2008 and 2009 years be added to the DSM expenditures that have previously been approved by the Commission for inclusion in the Companies respective revenue requirements and rate determinations as set out in the Extended Settlements for 2008 and 2009.

The result of the mechanics described above based on the EEC expenditures proposed with this Application, the Companies expect that total EEC expenditures of $14.702 million ($16.826 less $1.624 less $0.500) will be added to the deferral accounts of the Terasen Utilities in 2008 on a before tax basis. The 2008 amortizations will remain unchanged from the amounts approved under the previous TGI Annual Review and the TGVI Settlement Update. Amortization for 2009 will equal one-twentieth (1/20th) of the forecasted year ending balance in the deferral account as at December 31, 2008. For 2009, in aggregate, the Companies expect that $16.671 million ($18,795 million less $1.624 less $0.500) will be added to the deferral accounts of the Terasen Utilities on a before tax basis. The deferral accounts will be included in rate base, on an after tax basis.

Stakeholders

The Terasen Utilities have undertaken to consult with stakeholders in its preparation of the Application. Feedback has been generally supportive. In consideration of this feedback, the Companies are of the view that a written regulatory review process culminating in a Negotiated Settlement Process is appropriate for this Application.

Conclusion

The Companies are of the view that proposals set out in this Application are consistent with government's energy objectives and will provide significant value to customers. Additionally, the Companies are of the view that the capitalization of incremental EEC expenditures is reasonable in light of the significant benefits that customers will realize with the successful introduction of the EEC programs proposed with this Application. The proposed portfolio approach to evaluation will allow the companies to undertake a broad range of programs throughout the Companies' service area. Accordingly, the Terasen Utilities are of the opinion that the proposals set out in this Application are fair, reasonable and in the best interests of customers.

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LIST OF APPENDICES

1. Introduction

Terasen Gas Inc. ("TGI") and Terasen Gas (Vancouver Island) Inc. ("TGVI"), (collectively referred to as the "Companies" or the "Terasen Utilities"), herein apply pursuant to the new Section 44.2 of the *Utilities Commission Act*[5] (the "Act") for approval of increased expenditures in support of an expanded Energy Efficiency and Conservation ("EEC") strategy (the "Application"). 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, either through conservation activity or through load-building/fuel switching activity. The specific relief sought is set out in Sections 2 and 6 of the Application, and is summarized in greater detail below. The Companies believe that the strategy outlined in this Application, and the related relief sought, is in the public interest and respectfully submit that the relief sought should be granted. The relief sought, if granted, will permit the Terasen Utilities to respond in a cost-effective manner to the increasing value being placed on conservation and efficiency opportunities.

Approval is respectfully requested by August 15, 2008 in order to permit implementation of the EEC strategy as early as possible.

This Application does not seek any order in respect of Terasen Gas (Whistler) Inc. ("TGW"). To address energy efficiency for Whistler, TGW intends to review the results of an appliance audit that is currently being conducted as part of the project to convert customers in Whistler from propane to natural gas once the natural gas pipeline extension to Whistler is completed. TGW expects to receive the results of the audit by the end of June 2008. Based on the inventory and age of both heating and lifestyle appliances in the homes and businesses of customers in Whistler, an energy efficiency plan for Whistler will be developed, and if necessary, the appropriate funding applied for in a separate application to the Commission, or in the next funding request for EEC expenditure.

5 Bill 15, the *Utilities Commission Amendment Act, 2008* was brought into force on May 1, 2008. Bill 15 is described in detail in Section 5.1 of the Application. The new section 44.2 provides in part: "(1) A public utility may file with the commission an expenditure schedule containing one or more of the following: (a) a statement of the expenditures on demand-side measures the public utility has made or anticipates making during the period addressed by the schedule;"

1.1. The Terasen Utilities

TGI is a company incorporated under the laws of the Province of British Columbia and is a wholly-owned subsidiary of Terasen Inc. TGI is a public utility that owns and operates natural gas transmission and distribution networks, distributing natural gas to over 825,000 customers in the Interior and Lower Mainland of British Columbia.

TGVI, a sister company to TGI, is also a company incorporated under the laws of the Province of British Columbia and is also a wholly-owned subsidiary of Terasen Inc. TGVI is a public utility which owns and operates a natural gas transmission and distribution system on Vancouver Island and along the Sunshine Coast of BC. TGVI distributes natural gas to approximately 90,000 customers.

Terasen Inc. is a Canadian corporation headquartered in British Columbia and the parent company of TGVI, TGI, as well as TGW, and Terasen Energy Services Inc. Terasen Inc. is a subsidiary of Fortis Inc.

Fortis Inc. is the largest investor-owned distribution utility in Canada, serving almost 2,000,000 gas and electric customers. Its regulated holdings include the Terasen companies and electric utilities in 5 Canadian provinces and 3 Caribbean countries. Fortis owns non-regulated hydroelectric generation assets across Canada and in Belize and upper New York State. It also owns hotels and commercial real estate in Canada.

1.2. Regulatory Context

The Companies' DSM activity has remained essentially unchanged since the late 1990's. For TGI, funding levels were established by Order No. G-85-97, at approximately $1.50 million for incentives, which funds were to be placed in a deferral account and amortized over three years. Non-incentive expenses of $1.624 million annually are treated as Operations and Maintenance ("O&M") and are expensed in the year in which they are incurred. DSM initiatives for TGI have been focused on conservation.

For TGVI, Order No. C-02-05 directed TGVI to develop a DSM strategy and budgets, and to seek approval through the Resource Plan process for DSM strategy and budgets. TGVI has historically had DSM expenditures of approximately $650,000 annually for incentives, and $500,000 annually for non-incentive costs. Incentive expenditures are placed in a deferral account and amortized the year following that in which they were incurred. Non-incentive costs are treated as O&M and are expensed in the year in which they are incurred. DSM initiatives for TGVI have been focused on capturing additional economic customers within the TGVI service area (load-building) and encouraging customers using other fuels to connect to the natural gas distribution system (fuel-switching).

The history of DSM programs for the Terasen Utilities is discussed in Section 3 of the Application. In 2004 TGVI filed its 2004 Resource Plan with the Commission, which provided information on the state of TGVI's DSM strategy and programs. In Order No. C-02-05, the Decision regarding TGVI's 2004 Resource Plan, the Commission noted that:

> *"The 2004 Resource Plan does not have sufficient information related to the DSM strategy and programs (T2: 293). Currently, the DSM strategy is mixed with marketing efforts and is not isolated from the natural growth load forecast as contemplated in the RP Guidelines (RP Guidelines, p. 3, Item #2; Exhibit B-6, MEM IR 4.10). The Commission Panel recognizes that the Utility is in an early stage of development of its DSM strategy and has not clearly defined the respective roles of its marketing and DSM functions (Exhibit B- 3, BCUC IR 13.1.1; 13.1.2)."*[6]

The Commission further noted that:

> *"The Commission Panel expects that a more detailed long-term DSM plan will accompany future annual updates and will contain information as outlined in the Recommendations in Chapter 6 of the Decision. The Commission Panel recommends*

[6] British Columbia Utilities Commission, Decision February 15, 2005, Terasen Gas (Vancouver Island) Inc., 2004 Resource Plan filing and Certificate of Public Convenience and Necessity Application for a Liquified Natural Gas ("LNG") Storage Project, page 30

that TGVI seek approval through the Resource Plan review process for the DSM budgets and projects, as appropriate, contained in the annual Resource Plan updates."[7]

The 2006 TGI and TGVI Resource Plans provided additional information on DSM initiatives and strategy. TGI stated in its 2006 Resource Plan:

"Based on the findings of the CPR [Conservation Potential Review], as well as an investigation of the magnitude and nature of DSM activities of other gas utilities in North America, TGI will be establishing a long-term DSM strategy."[8]

TGI further commented in the Recommendations that:

"The results of the CPR will be presented in more detail in the fall of 2006. TGI will evaluate the potential for an expanded DSM strategy based on the CPR results. Where increased funding is required to support expanded DSM activities, TGI will submit a request to the Commission this fall seeking outlining [sic] the additional funding requirements and the scope of the DSM activities planned."[9]

The 2006 Resource Plan for TGVI provided similar information on DSM to the 2006 Resource Plan for TGI.[10]

Order No. G-33-07 approved the extension for 2008-2009 of the 2004-2007 TGI PBR Settlement Agreement[11] ("TGI PBR Extended Settlement"); and Order No. G-34-07 approved the TGVI application for an extension for 2008-2009 of the 2006-2007 Revenue Requirements Negotiated Settlement Agreement[12] ("TGVI RR Extended Settlement") (and collectively the "Extended Settlements"). The terms of the respective Extended Settlements, included as

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7 Ibid
8 Terasen Gas Inc., "2006 Resource Plan", page 52
9 Ibid, page 68
10 TGVI, 2006 Resource Plan, page 53 and 67
11 Order No. G-51-03 approved the Terasen Gas Inc. 2004-2007 Multi-Year Performance-Based Rate Plan Settlement Agreement
12 Order No. G-126-05 approved the Terasen Gas (Vancouver Island) Inc. 2007-2007 Negotiated Settlement Agreement

Appendix A to each of the Orders, under "Review of DSM funding and economic tests"[13], states:

> *"TGI committed, as part of its 2006 Annual Review and Mid-Term Assessment Review, to undertake in 2007 a review of the economic tests used to evaluate its DSM and efficiency related programs. This review will also assess the 2006 CPR study and the potential need for increased DSM funding and will take into consideration the anticipated Provincial 2007 Energy Plan. An application will be made to the Commission for review and approval in 2007, with implementation in 2008."*

The Companies' respective Extended Settlements for 2008 and 2009 include approved DSM expenditures.

As discussed in Section 3 of this Application, there have been developments in DSM initiatives across North America, and the Terasen Utilities currently lag behind other utilities in British Columbia and North America in terms of EEC expenditures. Government policy developments, in particular the Province's 2007 Energy Plan, have provided additional impetus for an expanded EEC strategy. The *Utilities Commission Amendment Act, 2008,* (Bill 15) demonstrates Government's ongoing commitment to energy efficiency and conservation. The new section 44.2 of the Act, pursuant to which the Terasen Utilities bring this Application, requires the Commission to consider "government's energy objectives" in determining whether to approve proposed demand side management expenditures. The term "government's energy objectives" is defined in section 1 of the Act as being:

> (a) to encourage public utilities to reduce greenhouse gas emissions;
> (b) to encourage public utilities to take demand-side measures;
> (c) to encourage public utilities to produce, generate and acquire electricity from clean or renewable sources;
> (d) to encourage public utilities to develop adequate energy transmission infrastructure and capacity in the time required to serve persons who receive or may receive service from the public utility;
> (e) to encourage public utilities to use innovative energy technologies

13 TGI Order No. 33-07, Appendix A, pages 18 and 19; TGVI Order No. 34-07, Appendix A, page 12

(i) that facilitate electricity self-sufficiency or the fulfillment of their long-term transmission requirements, or

(ii) that support energy conservation or efficiency or the use of clean or renewable sources of energy;

(f) to encourage public utilities to take prescribed actions in support of any other goals prescribed by regulation.

The Terasen Utilities believe that this Application is consistent with government's energy objectives.

1.3. Conservation Potential Review (CPR)

As discussed in Section 4, the Companies retained Marbek in 2005 to undertake a CPR. Included in Appendix 1 is the full CPR Report. Based on the CPR findings, the Companies performed initial high level energy efficiency and conservation program design, which in turn allowed the Companies to build the EEC programs contemplated in this Application "from the ground up". That is, the CPR provided direction as to areas of program activity. However, in order to build a budget for programs, assumptions needed to be made and tested about potential costs and participant uptake for both incentive and non-incentive based energy efficiency and conservation programs. The findings of the CPR were further refined through consultation with Habart. The need to refine the findings from the 2006 CPR conducted by Marbek delayed the filing of this Application beyond what the Companies had initially anticipated.

The CPR and the subsequent analysis conducted by the Companies recognized that the landscape in which the Companies operate has changed significantly since the initial DSM programs were introduced in the 1990s. In particular, energy prices have increased significantly. Customers have also become more attuned to environmental issues, with energy choice and use at the forefront. There is increased customer and societal desire for finding innovative ways to increase energy efficiency and use less energy. Other utilities have significantly increased their EEC initiatives. Government policy and direction has responded to public interest concerns and energy utilities are being encouraged and directed to invest more resources into energy efficiency and conservation activities in order to meet public objectives. The *Utilities Commission Amendment Act, 2008* gives new importance in the regulatory context to the principles of energy efficiency and conservation. It is therefore timely that the Companies review the opportunity to expand and enhance the conservation and energy efficiency products and services that are offered to the Terasen Utilities' customers.

The CPR review determined that current levels of funding, which were established a number of years ago (in TGI's case over ten years ago), are inadequate for the Terasen Utilities to respond to the new market conditions. Additionally, and by various measures, the funding for the Terasen Utilities is substantially lower than that of other utilities, both in absolute dollars and on a per customer basis.

The Terasen Utilities believe that the CPR, and subsequent analysis, demonstrates a need to expand cost-effective EEC programs.

1.4. Overview of Relief Sought

In summary, there are four components to the relief sought in this Application:

1. The companies are seeking to expand overall EEC expenditures to a total of $56.6 million over three years, representing $46.944 million for TGI and $9.667 million for TGVI.
2. The Companies are proposing to capitalize incremental EEC expenditures, include them in regulatory asset deferral account and amortize the balance of the account over a period of 20 years.
3. The Companies are proposing to increase the amortization period to 20 years for incentive amounts that are added to deferral accounts in 2008 and 2009 as part of the TG PBR Extended Settlement and TGVI RR Extended Settlement, which will align with the amortization period for incremental EEC expenditures.
4. The Companies are proposing a methodology for evaluating the costs and benefits of the overall EEC portfolio.

The specific relief sought is detailed in Section 2 "Application", but is summarized below.

1.4.1. Expanded EEC Expenditures

The Companies' current approved EEC expenditures are outlined in Table 1.4.1 below.

Table 1.4.1 – Current, Proposed, and Incremental EEC expenditures, by Utility ($000's)

Current Level of Spend for 2008 and 2009 ($million)

Utility	O&M	Incentive	Total
TGI	$1.624	$1.500	$3.124
TGVI	$0.500	$0.650	$1.150
Total	$2.124	$2.150	$4.274

Proposed ($million)

Utility	2008	2009	2010	Total by Utility
TGI	$13.996	$15.752	$17.196	$46.944
TGVI	$2.830	$3.043	$3.793	$9.666
Total	$16.826	$18.795	$20.989	$56.610

Incremental ($million)

Utility	2008	2009	2010	Total by Utility
TGI	$10.872	$12.628	$17.196	$40.696
TGVI	$1.680	$1.893	$3.793	$7.366
Total	$12.552	$14.521	$20.989	$48.062

The Application requests approval for an increase in allowed expenditures for EEC activity for TGI and TGVI to a total of approximately $56.6 million over the three year period 2008 through 2010 (the "Program Period"). $40.696 million of incremental EEC activity is being requested for TGI, and $7.336 million of incremental EEC activity is being requested for TGVI, as set out in Table 1.4.1 above.

The proposed overall funding for the Program Period, for which approval is being sought, was developed with reference to the more specific program areas summarized in Table 1.4.1a.

Table 1.4.1a - Proposed EEC Expenditure by Program Area by Utility

Spend by Program Area 2008 - 2010	TGI	TGVI	Total
Residential Energy Efficiency	$8,552	$734	$9,286
Commercial Energy Efficiency	$19,592	$2,199	$21,791
Residential Fuel Switching	$1,332	$2,367	$3,699
Conservation Education and Outreach	$11,068	$2,767	$13,835
Joint Initiatives	$2,400	$600	$3,000
Trade Relations	$1,200	$300	$1,500
Conservation Potential Review	$400	$100	$500
Innovative Technologies, NGV and Measurement	$2,400	$600	$3,000
Total	**$46,944**	**$9,667**	**$56,611**

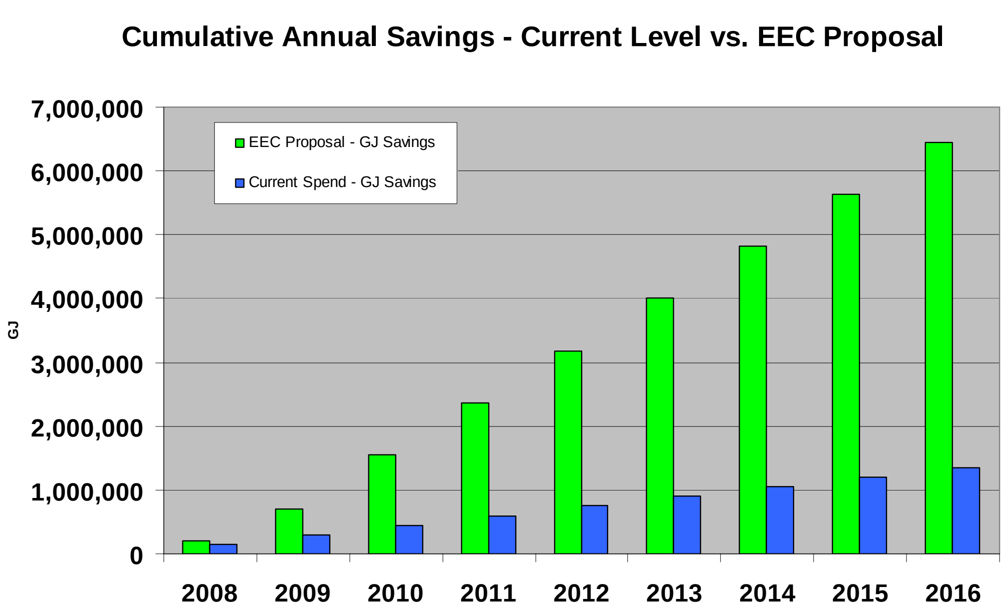
The Companies are seeking Commission approval for the overall incremental expenditures in Table 1.4.1 based on the contemplated program areas and funding summarized in Table 1.4.1a and described in Section 6. This approach preserves the Companies' ability to subsequently redirect funds from one program area to another program area that the Companies conclude is generating more favorable results based on the assessment criteria outlined in this Application. The Terasen Utilities have proposed mechanisms in Section 6.14 to permit the Commission and stakeholders to review how the money has been spent, and to ensure accountability.

The specific initiatives that the Companies anticipate will make up each of the above program areas, and an explanation of how the program area budget amounts were derived, are discussed in detail in Section 6. Briefly, the amounts outlined above for residential and commercial energy efficiency and for residential fuel switching were developed based on the results of the CPR. The amount for Conservation Education and Outreach was developed based upon a third party quote for the cost of preparing an effective communications strategy. The amounts for Joint Initiatives, Trade Relations and the 2009 CPR were developed by the Companies based on the Companies' best estimates of effective expenditure levels for these three program areas. The $3,000,000 for Innovative Technologies, NGV and Measurement is a proposed expenditure over the three year Program Period. The actual amount allocated for the Innovative Technologies, NGV and Measurement program area will depend on whether an effective program in Innovative Technologies, NGV and Measurement can be developed over the funding timeframe, and the optimal level of funding for such a program. One of the program areas is $500,000 for a new CPR study to be completed in 2009 for the purposes of developing new EEC programs and funding proposals, including a future application to the Commission, for the period commencing 2011. The expenditures set out in Tables 1.4.1 and 1.4.1a do not include contributions from partners for joint programs where there are electrical savings, which contributions total about $5.5 million over the three year time period.

The Terasen Utilities believe that, by targeting the areas identified in Table 1.4.1a, the energy savings from the proposed increase in expenditure and activity are expected to be significant. The energy efficiency measures are expected to result in savings with a present value of almost 10 million GJs over the lives of the various measures proposed, while the fuel switching activity being proposed is estimated to result in additional load with a present value of approximately 2.3 million GJs. The anticipated present value of the net energy savings from the energy efficiency and fuel-switching activity being proposed in this Application is approximately 7.7 million GJs. This does not include potential savings arising from Conservation Education and Outreach, Joint Initiatives, or Innovative Technologies, NGV and Measurement program areas.

The increased level of EEC spending contemplated in this Application, as compared to the existing funding levels, will provide customers greater opportunities to realize energy savings. The graph below (Figure 1.4.1b) indicates the magnitude of the opportunity for additional natural gas energy efficiency and conservation activity that is being foregone at the current DSM expenditure levels (figures are nominal, not present value).

Figure 1.4.1b - Potential Savings from Increased EEC Activity by the Terasen Utilities



If DSM expenditures and activity continue at current levels, cumulative annual savings in nominal (as opposed to present value) GJs are expected to result in savings of approximately 1.3 million GJs by 2016. If DSM expenditure and activity were expanded to the degree requested in this Application, cumulative annual savings in nominal (as opposed to present value) GJs are expected to result in savings of approximately 6.4 million GJs by 2016.

One of government's energy objectives that the Commission is required to consider under section 44.2 relates to reduced GHG emissions. The expanded funding contemplated in this Application will help to achieve that objective by reducing GHG output by over 1 million tonnes. See Section 7.2 for more details.

1.4.2. Financial Treatment of EEC Expenditures

As discussed in more detail in Section 6, this EEC Application proposes to treat the incremental EEC expenditures above amounts already approved as part of TG PBR Extended Settlement and TGVI RR Extended Settlement as capital. The Terasen Utilities propose that the incremental EEC expenditures and existing incentive amounts in TG PBR Extended Settlement and TGVI RR Extended Settlement (TG - $1.5 million and TGVI - $.650 million) be charged to a regulatory asset deferral account on a tax-adjusted basis, the balance of which is amortized over twenty years, with amortization commencing the year following that in which the expenditure is made. An amortization period of 20 years has been selected to match the benefit received by customers from the EEC expenditures resulting in appliance and energy system installations with a weighted average measurable life of 22.5 years. In addition to closely matching the cost recovery to the period over which benefits will accrue to customers, the proposed amortization period will smooth impacts to rates from the proposed increase in expenditure.

1.4.3. Evaluation Criteria

The Application also outlines specific approaches for evaluating the performance of the programs undertaken. The Companies are proposing a portfolio approach to cost-benefit analysis, meaning that the overall EEC portfolio must maintain a Total Resource Cost ("TRC") ratio of 1.0 or higher. This approach will allow the Companies to undertake the important portfolio-level activities needed to support the EEC activity, as well as to encourage market penetration of technologies that have a TRC of less than one because they have not yet reached economies of scale. Further, the portfolio approach will allow the Companies to offer programs to customers in service areas where the TRC may have a result of less than 1.0 due to usage pattern, as well as to customers in the Affordable Housing sector (the Companies' name for low income market sector). The Companies propose that the "benefits" input to the cost-benefit analysis be based on gross energy savings rather than net savings (thus eliminating consideration of the effects of free riders). The Companies further propose that the "benefits" input to the cost-benefit analysis include energy savings resulting from regulation introduced partly as a result of the Companies' DSM activity. The Companies are further proposing to align EEC activity across TGI and TGVI, so that customers of TGI and TGVI have access to essentially the same Energy Efficiency and Conservation opportunities. The EEC portfolio proposed by the Companies with this Application has a TRC ratio of 3.1 and a net financial benefit to customers of $165.1 million.

1.5. Mechanics of Implementation

The mechanics of implementing the relief sought in this Application in the context of the Extended Settlements is addressed in detail in Section 2. For the purposes of this Application, "residential" customers are defined as customers of Rate Schedule 1 for TGI and Rate Schedule RGS for TGVI. "Commercial" customers are defined as all other customers with the exception of (i) those customers served under Rate Schedules 7, 22 and 27 for TGI, and (ii) transportation customers on the TGVI High Pressure Transmission System including British Columbia Hydro and Power Authority ("BC Hydro") for service to the Island Cogeneration Plant ("ICP") and the Vancouver Island Gas Joint Venture ("VIGJV").

The Companies introduced the details of the EEC Application to the 2008 Resource Plan Stakeholder workshop, held in Vancouver on February 12, 2008. Since that time, the Companies have been holding individual meetings with Regulatory Stakeholders in order to brief them on the content of the Application, and to receive their feedback. Feedback has been generally supportive. In consideration of this feedback, the companies are of the view that a written regulatory review process culminating in a Negotiated Settlement Process is appropriate for this Application.

1.6. Organization of the Application

This Application contains the following Sections:

- **Section 1: Introduction**
- **Section 2: Application** - sets out the specific items for which the Companies are seeking approval in this Application. Further details concerning the items for which the Companies are seeking approval can be found in Section 6.
- **Section 3: Background** - discusses
    - energy use in British Columbia;
    - Terasen Utilities historical DSM activity;
    - natural gas pricing and rates;
    - customer usage rates:
    - EEC Expenditures at Other Utilities - reviews in summary form the EEC activity at other gas and electric utilities in North America; and
    - Government Policy - reviews recent policy developments at various levels of government.
- **Section 4: Conservation Potential Review** - discusses the process the Companies undertook to develop this Application.
- **Section 5: Program Principles** - outlines the proposed principles under which the Companies would deliver EEC activity.
- **Section 6: Expanded Funding and EEC Program Proposal**
- **Section 7: Customer Impacts, Benefits and Advancement of Government's Energy Objectives**
    - Customer Savings and Revenue Requirement impacts
    - Greenhouse Gas Emission Reduction
    - Government's Energy Objectives of Promoting Demand Side Management
- **Section 8: Conclusion**.

2. Application

The Section below summarizes, in point form, the elements of the Companies' proposal for Energy Efficiency and Conservation activity. The Companies seek the following relief pursuant to section 44.2 of the Act:

1. An order approving an increase EEC spending for TGI to a total of $46.9 million and for TGVI to a total of $9.7 million over the three year period 2008 through 2010, totaling $56.6 million on a combined basis. The proposed incremental EEC expenditure compared to the amount approved in the Extended Settlements, by utility, for each of the three years is indicated in Table 2 below:

Table 2 - Breakdown of Proposed Incremental EEC Expenditure by Utility

Incremental ($million)

Utility	2008	2009	2010	Total by Utility
TGI	$10.872	$12.628	$17.196	$40.696
TGVI	$1.680	$1.893	$3.793	$7.366
Total	$12.552	$14.521	$20.989	$48.062

These funds will be spent in the following program areas: Residential and Commercial Energy Efficiency, Residential Fuel Switching, Conservation Education and Outreach, Joint Initiatives, Trade Relations, Conservation Potential Review and Innovative Technologies, NGV and Measurement.

The Companies have undertaken a significant amount of work to outline a potential EEC portfolio of activity. More detail on the proposed program areas can be found in Section 6. A number of specific EEC initiatives/programs have been identified under each of the program areas mentioned above, and are also discussed in Section 6. The initiatives/programs identified in Section 6 are programs that have been identified thus far in the course of the CPR and subsequent EEC portfolio analysis. The Terasen Utilities continue to investigate new opportunities for cost effective EEC programs. In order to permit the Terasen Utilities to respond to new opportunities, the Companies propose that once the overall level of expenditure and areas of program activity are approved, the Terasen Utilities will design and implement individual programs within those program areas and overall funding levels without further approval from the Commission. Thus, if the Companies determine during the three year EEC Program Period that a given EEC program area has relatively better success than another program area, the Companies will then be permitted to redirect funds to a more efficient use without further order of the Commission.

In the event the Terasen Utilities spend more or less than the approved amount for a particular year, the over or under-spend shall be factored into the EEC spending in the following year, but the total amount expended by the Companies on EEC activity between approval and 2010 would not exceed $56.6 million, unless otherwise approved by the Commission. The Companies will continue to assess over the course of the Program Period whether customers would benefit from additional EEC spending over and above the funding sought in this Application, and will bring forward any further applications as appropriate.

2. An order that all incremental EEC expenditures as set out in Table 2 are to be capitalized by way of being charged to a regulatory asset deferral account on an after tax basis.

3. An order that sets the amortization period of 20 years, for all costs charged to the regulatory asset deferral account on an after tax basis. For clarity, this would include all costs charged, regardless of whether the source of the funds is amounts added to deferral accounts under the Extended Settlements or the incremental expenditures sought in this Application. Amortizations for expenditures incurred in 2008 and thereafter will commence in the year following that in which the cost was incurred.

4. An order approving certain changes to the cost-benefit analysis undertaken in respect of EEC expenditures as set out in Section 6.13. A summary of the changes requested are outlined below:
   - To implement a portfolio approach to cost-benefit analysis, such that the Total Resource Cost ("TRC") test result, for all programs combined, must return an overall combined result of one or greater

- To eliminate the requirement to include free riders in cost-benefit tests, as the energy and emissions reduction goals of the government are absolute goals and do not consider free ridership effects
- For programs aimed at preparing the marketplace for introduction of regulation of minimum efficiency levels for a piece of equipment, a building, or an energy system, savings associated with the implementation of the applicable regulation will be included in the benefits for a program.
- The impact of carbon pricing is to form one of the inputs to the cost-benefit tests

5. An order requiring the Companies jointly to submit annually to the Commission, by the end of the first quarter following year end, for each year of the Funding Period, a report of all EEC initiatives and activities, expenditures and results, for TGI and TGVI. More detail on the proposed reporting procedures can be found in Section 6.14

In order to implement the EEC strategy and optimize the conservation and efficiency opportunities as early as possible, the Companies respectfully request that the Commission issue a decision regarding the EEC Application by August 15, 2008.

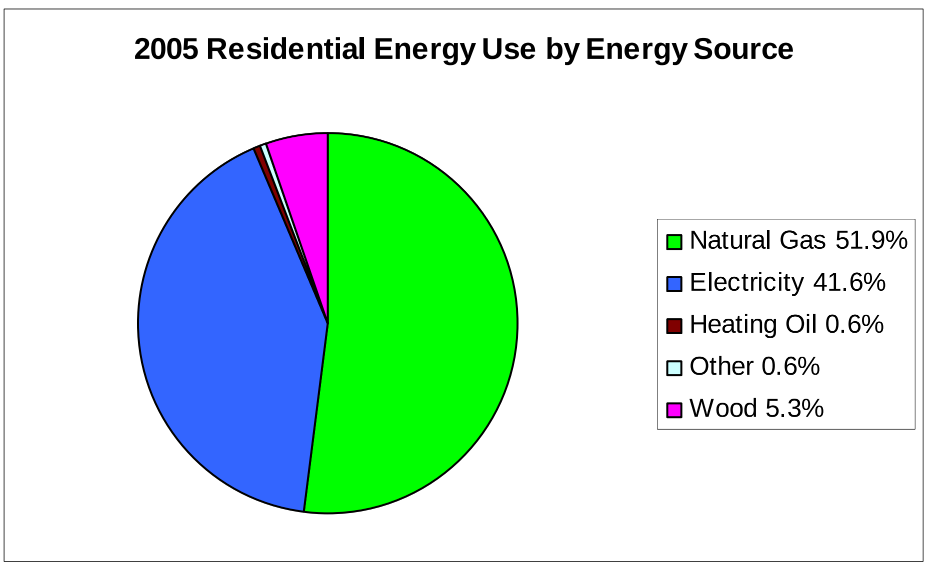
3. Background

This Section provides background information regarding energy usage in British Columbia, a brief history of the Companies' EEC activity and results to date, and a history of natural gas pricing. It is intended to provide a context around the importance of natural gas in the energy mix in British Columbia, the Companies' historical efforts to affect energy usage in the Province, and impacts of changing energy prices and the resultant increased importance for the Companies of helping customers to manage their energy bills.

3.1. Energy Use in British Columbia

Figures 3.1 and 3.1a below provide a breakdown of energy consumption by energy source and end use in British Columbia for residential applications.

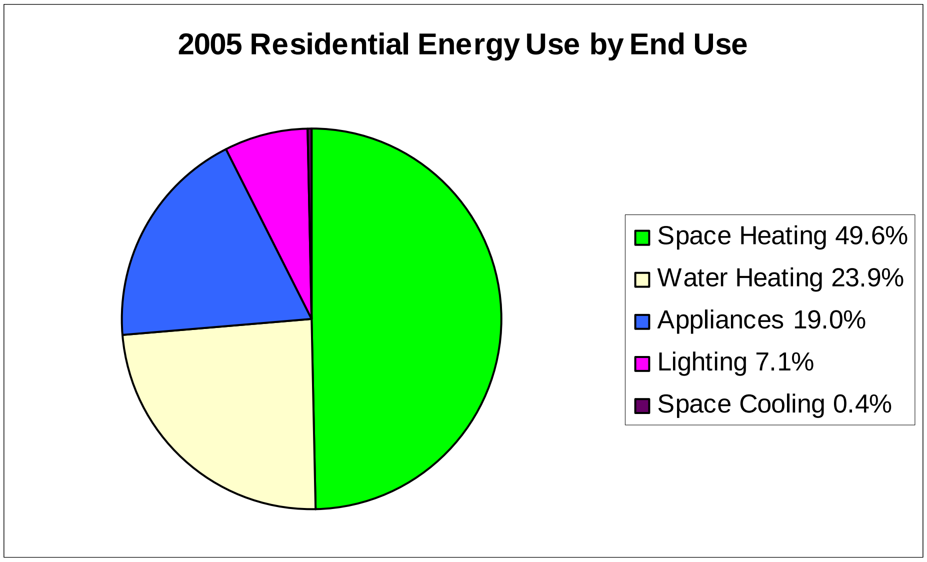
Figure 3.1 - 2005 Residential Energy Use by Energy Source



source: http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/comprehensive_tables/index.cfm?attr=0

note: the data presented by Natural Resources Canada includes data for the Territories

Figure 3.1a - 2005 Residential Energy Use by End Use



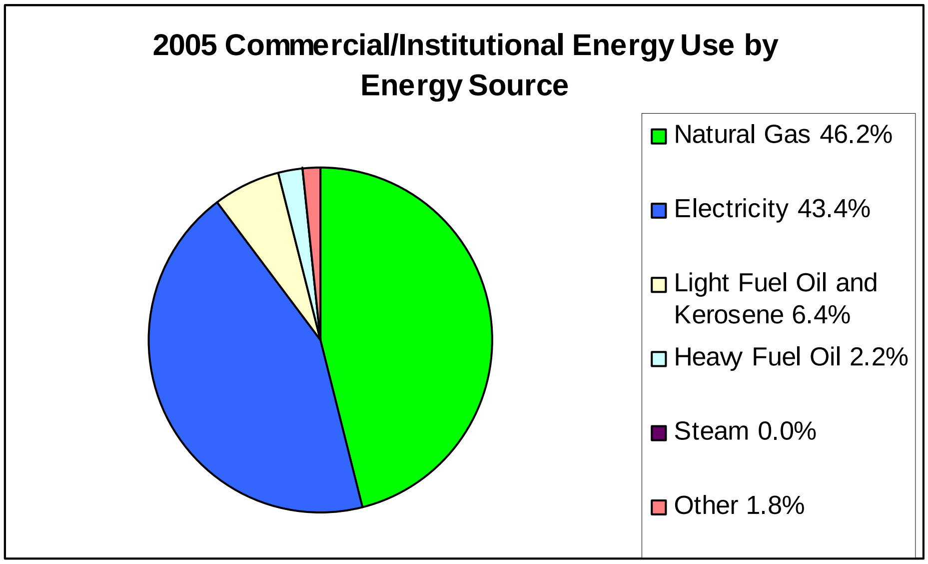
source: http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/comprehensive_tables/index.cfm?attr=0

note: the data presented by Natural Resources Canada includes data for the Territories

The Natural Resources Canada ("NRCan") data presented above emphasizes the significant role currently played by natural gas in meeting the residential energy demands of British Columbians. The data also reflects that the majority of household energy use is consumed for space and water heating, for which natural gas is well suited. The Companies have historically been active, though in a limited way, in DSM programs targeting space and water heating because these end uses comprise such a large proportion of residential energy usage. The Companies continue to believe that these are the residential end uses with the greatest potential for energy savings; therefore, this Application proposes to expand activity in these particular end uses. The areas of EEC activity proposed in this Application are discussed in more detail in Section 6.

The NRCan data suggests that energy usage patterns are very similar for the commercial and institutional buildings that the Terasen Utilities serve with Rate Schedules 2, 3, 4, 5, 6, 23, and 25 for TGI and those on SCS1, SCS2, LCS1, LCS2, AGS, LCS3, HLF, and ILF for TGVI. Natural gas is the dominant energy source, though to a slightly less degree than in the residential market segment, with less than half of the overall energy use by this sector, as shown in Figure 3.1b. However, as with the residential sector, space and water heating are the predominant uses of energy in commercial/institutional buildings, as shown in Figure 3.1c below.

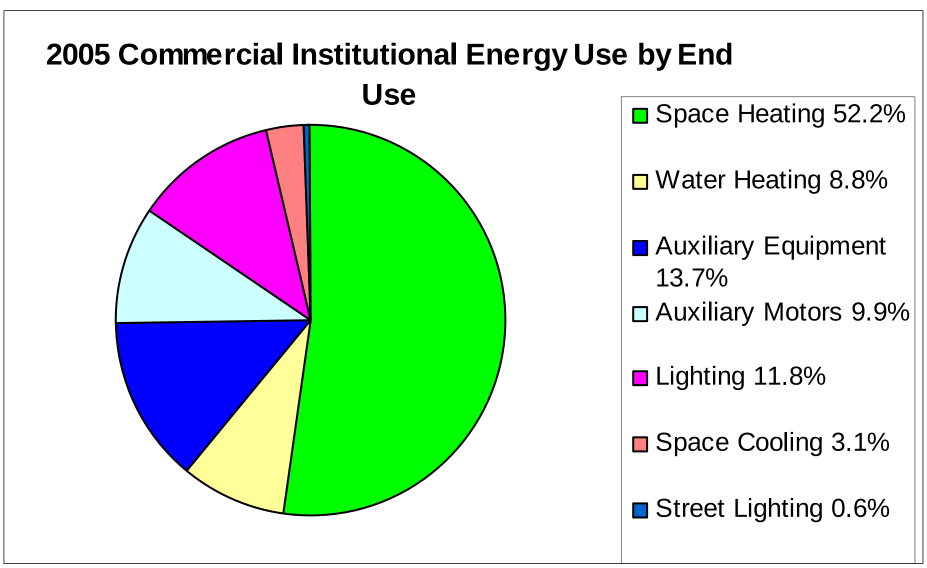
Figure 3.1b - Commercial/Institutional Energy Use by Energy Source



source: http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/comprehensive_tables/index.cfm?attr=0

note: the data presented by Natural Resources Canada includes data for the Territories

Figure 3.1c - Commercial/Institutional Energy Use by End Use



source: http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/comprehensive_tables/index.cfm?attr=0

note: the data presented by Natural Resources Canada includes data for the Territories

TGI has historically offered limited DSM programming related to space heating in Commercial and Institutional buildings with the Efficient Boiler Program. TGVI has not historically offered DSM programs to rate classes other than residential customers (discussed in more detail in Section 3.2.2). Given the magnitude of energy usage by space and water heating in commercial and institutional buildings, there is significant untapped potential for EEC activity in this arena. This Application is intended to expand EEC activity significantly for commercial and institutional buildings as discussed in Section 6.3.2, "Commercial Energy Efficiency Program Area".

Table 3.1 shows the breakdown of customers, by number of accounts and by energy consumption, by Rate Class, for TGI. Table 3.1a shows information for TGVI.

Table 3.1 - TGI Customer Count and Usage by Rate Class

TGI			
Rate Schedules	Rate Schedules Description	# of Customers	Annual Consumption (TJ)
1	Residential Service	757,261	75,393
2	Small Commercial	75,020	22,675
3	Large Commercial	4,695	16,214
4	Seasonal Firm Service	18	121
5	General Firm Service	398	4,206
6	Natural Gas Vehical Service	40	218
7	General Interruptible Service	4	54
22	Large Volume Transportation	55	35,843
23	Commercial Transportation	1,185	5,212
25	General Firm Service	576	16,095
27	General Interruptible Service	98	6,296
Totals		**839,350**	**182,327**
Sub Total	**Excluding Rate 7, 27, and 22**	**839,193**	**140,134**

Please note that the funding being requested in this Application is not intended to be used for programs for customers of Rates 7, 22 and 27, nor is it proposed that EEC costs be recovered from customers of Rates 7, 22 and 27. Information about the number of customers and gas volumes for these rates is provided in this Table for completeness only.

Table 3.1a - TGVI Customer Count and Usage by Rate Class

TGVI			
Rate Schedules	Rate Schedules Description	# of Customers	Annual Consumption (TJ)
RGS	Residential General	85,030	4,806
SCS1	Small Commercial	4,153	275
SCS2	Small Commercial	1,855	540
LCS1	Large Commercial	1,539	1,378
LCS2	Large Commercial	573	1,329
AGS	Apartment General	827	1,138
LCS3	Large Commercial	132	2,370
HLF	Large Commercial High Load Factor	7	273
ILF	Large Commercial Inverse Load Factor	8	158
Totals		**94,124**	**12,267**

Please note that the funding being requested in this Application is not intended to be used for programs for BC Hydro for service to ICP, or for the VIGJV, nor is it proposed that EEC costs be recovered from BC Hydro or the VIGJV. Information about the number of customers and gas volumes for these rates is provided in this Table for completeness only.

The energy distributed in British Columbia by the Terasen Utilities and subsequently consumed by the Companies' customers in space and water heating is a significant part of the energy picture in British Columbia. The Companies have over 900,000 customers, and transport over 200,000 TJ of energy annually to all customers. Given the amount of energy consumed by the Companies' customers, continued and expanded EEC activity for natural gas will be an important component in achieving government's energy objectives. It is the intent of the Terasen Utilities with this Application to give its customers critical tools and information to manage their energy consumption, thus reducing their energy costs.

3.2. History of Demand Side Management Programs

The Terasen Utilities' DSM activity has remained essentially unchanged for a number of years. While the Companies have enjoyed a degree of success with the current programs, it is evident from the CPR and subsequent analysis that the amount the Companies spend on EEC programs should be significantly increased to accommodate cost effective EEC programs that currently cannot be pursued due to lack of funding.

3.2.1. Terasen Gas Inc. EEC Initiatives

On July 23, 1997, by Order No. G-85-97, TGI received approval from the Commission for its 1998-2002 Revenue Requirements Application. Through the DSM Achievement Incentive, the Commission endorsed a mechanism to pursue DSM resources. At that time, the DSM expenditure level for incentives and grants was set at $1.50 million (where it remains today – non-incentive expenditures are $1.624 million). The expenditure was treated as a Defined Required Incremental Activity ("DRIA"), and was designed to encourage TGI to pursue cost-effective DSM resources. Only energy efficiency programs were permitted; no funding for fuel-switching or load-building was included. A threshold level of 75% of the annual forecast gas savings had to be achieved before any DSM Incentive was earned. Calculation of an incentive payment for gas savings greater than the threshold was based on the net TRC benefits. A protocol for measuring DSM savings and TRC benefits needed to be established with the Commission and interested parties prior to the incentive mechanism taking effect. The Companies to date have not submitted a protocol for measuring DSM savings and TRC benefits with the Commission and stakeholders for the purpose of collecting a DSM incentive mechanism, and therefore TGI has not to date applied to receive the DSM Achievement Incentive. TGI was allowed to reallocate resources to modify existing programs, discontinue programs and develop new programs as necessary. TGI was to apply to the Commission for program changes where required. The status of all DSM programs was to be reviewed on a semi-annual basis with a report provided in the Annual Review. These reports for 2005, 2006 and 2007 are attached as Appendix 2.

On July 29, 2003, by Order No. G-51-03, TGI received approval from the BCUC for a Multi Year Performance Based Rate Plan ("PBR") for the period 2004-2007. This settlement was extended by Commission Order No. G-33-07 for the 2008-2009 period and approved DSM incentive grants for deferral of grants of $1.50 million per year. Appendix A to Order No. G-51-03 stated that:

> "Incentives for load building initiatives may be developed and submitted prior to an annual review. The incentive would only apply to initiatives which are determined to be beneficial to ratepayers after a DSM like assessment of each initiative"[14]

Load building or fuel switching incentives have not to date been implemented by TGI, as until recently, the TGI has not had data such as that available from the CPR upon which to base such programs. DSM Incentive Grants are amortized over three years. The deferral account is only used to collect incentive payments and rebates to customers. Costs associated with advertising (including awareness programs), program promotion, program design, administration, research and evaluation are base O&M expenses of $1.624 million per year.

DSM Activities currently undertaken by TGI are outlined every year in the Annual Review. The summary Table 3.2.1 show excerpted from the DSM Sections of the Annual Reviews for 2005, 2006 and 2007, and the entire DSM Sections from the Annual Reviews are attached as Appendix 2. Energy efficiency initiatives offered by TGI have been limited to a furnace upgrade program for residential customers and builders, a fireplace pilot program for residential customers, and a boiler upgrade and commercial energy assessment program for commercial customers. Program offerings have been constrained by the lack of resources available to design and support new programs. The existing programming that consumes the existing DSM budgets has remained essentially unchanged since the late 1990's, and there has been little variation in DSM programming in recent years.

[14] British Columbia Utilties Commission, Appendix A to Order G-51-03, page 4

Table 3.2.1 - TGI Historical Summary DSM Programs

	Program Name	Number of Participants	Savings per Participant per Year (GJ)	Measure Life (Years)	Annual Savings (GJ)	TRC Cost Benefit Ratio	TRC Net Benefit	Costs ($000) [6]
2005	Energy Star Heating System Upgrade Program	3,000	14	20	41,400	1.73	n/a	
	Residential New Construction Heating Program (RNCHP)	750	9	20	6,825	1.85	n/a	
	Commercial Energy Assessment Program	90	600	15	31,500	n/a	n/a	
	Efficient Boiler Program (EBP)	15	1,570	25	23,535	3.0	n/a	
	Destination Conservation	20	n/a [1]	3	4,000	n/a	n/a	
	Total 2005	**3,875**	**n/a**	**n/a**	**107,260**	**2.92** [4]	$ 5,800,000 [5]	**$ 1,548,336**
2006	Energy Star Heating System Upgrade Program (VSM)	2,343	14	20	32,333	1.29	$ 440,584	
	Energy Star Heating System Upgrade Program (No VSM)	1,220	14	20	16,836	1.29	$ 229,412	
	Residential New Construction Heating Program (RNCHP)	1,180	9	20	10,738	1.60	$ 394,026	
	Efficient Boiler Program (EBP)	30	n/a [2]	25	30,849	1.96	$ 1,671,723	
	Commercial Energy Assessment Program	18	600	15	10,800	2.66	$ 604,300	
	Destination Conservation	4	113	3	452	0.01	$ (7,987)	
	Total 2006	**4,795**	**n/a**	**n/a**	**102,008**	**1.65**	**$ 3,340,045**	**$ 2,106,192**
2007	Energy Star Heating System Upgrade Program	4,316	13.8	20	59,561	1.39	$ 1,123,000	
	Residential New Construction Heating Program (RNCHP)	2,981	9.1	20	27,127	1.73	$ 1,222,000	
	Efficient Boiler Program (EBP)	20	n/a [3]	25	14,650	1.47	$ 571,000	
	Destination Conservation	44	113	3	4,972	1.56	$ 55,000	
	Commercial Energy Assessment Program	100	600	15	60,000	3.03	$ 3,397,000	
	Total 2007	**7,461**	**n/a**	**n/a**	**166,310**	**1.85**	**$ 6,368,000**	**$ 2,108,633**

Note that the numbers above are based on combination of actual and estimates as presented in the 2005, 2006 and 2006 Annual Reviews

1 The savings for Destination Conservation were presented as an aggregate of savings in 2005

2, 3 The savings for the Efficient Boiler Program are not presented per participant per year, but are instead an aggregate of savings for all participants for the year

4, 5 In 2005, TRC Cost Benefit Ratio and TRC Net Benefit were not reported as aggregates.

6 Please note that costs include accruals from the previous year as well as partner contributions

TGI has enjoyed success with the DSM budget available. For example, the Efficient Boiler Program originally included both boilers for new construction, and replacement boilers for equipment retrofits. The retrofit portion of the Efficient Boiler Program was so popular that it had to be terminated in 2007, as incentives for boiler replacements would have consumed the entire incentive budget available to TGI, had the retrofit portion of the program been continued. If the increased DSM expenditure being requested in this Application is approved, the retrofit portion of the Efficient Boiler Program would be reinstated, providing customers in Multi-family Residential and Commercial Buildings with a financial incentive to help offset the cost of replacing old boilers with efficient equipment.

For both TGI and TGVI, the costs reported in Tables 3.2.1 and 3.2.2 are net of partner contributions (and accruals) and so do not reflect the total costs for the Companies' historical DSM portfolio. Total costs for the Companies' DSM portfolio are significantly higher. For example, for 2006, TGI's programs had a total customer incentive paid of approximately $3.5 million - $1.4 million of that came from partners. Contributions from funding partners for the incentives have been dependent on program uptake; that is, partners have contributed a certain amount per customer incentive, with the total amount of the partner contribution being dependent on the number of participants in any given program. Because program uptake and therefore partner contribution cannot be predicted with accuracy, managing the Companies' DSM expenditures to budgets has been challenging. Further, the Companies cannot count on receiving partner contributions or a partner contribution amount year over year. It should be noted that for 2006 and 2007, the gross amount of incentives paid by the Companies were about $3.5 million and $5 million respectively, which would indicate that in the absence of certainty around partner funding, an increase in EEC expenditures by the Companies is warranted.

In terms of cost-effectiveness, in 2007 the programs for TGI provided a present value of savings over the measure life of 1,203,596 GJ, and the allowed DSM expenditure was $3.1 million, providing a yield of $2.58/GJ, which is significantly lower than Terasen Gas Inc. gas cost rates including midstream cost that averaged $8.33 Cdn/GJ for residential lower mainland customer in 2007. TGI’s historical DSM activity has provided good value for customers. The DSM expenditure per customer, for all TGI customers in 2007, was $3.69 per customer.

3.2.2. Terasen Gas (Vancouver Island) Inc. EEC Initiatives

DSM activity for TGVI has not been as well-defined, or as well-reported upon, as the activity for TGI. In Order No. C-02-05, the Decision regarding TGVI's 2004 Resource Plan, the Commission noted that:

> *"The 2004 Resource Plan does not have sufficient information related to the DSM strategy and programs (T2: 293). Currently, the DSM strategy is mixed with marketing efforts and is not isolated from the natural growth load forecast as contemplated in the RP Guidelines (RP Guidelines, p. 3, Item #2; Exhibit B-6, MEM IR 4.10). The Commission Panel recognizes that the Utility is in an early stage of development of its DSM strategy and has not clearly defined the respective roles of its marketing and DSM functions (Exhibit B- 3, BCUC IR 13.1.1; 13.1.2)."*[15]

The Commission further noted that:

> *"The Commission Panel expects that a more detailed long-term DSM plan will accompany future annual updates and will contain information as outlined in the Recommendations in Chapter 6 of the Decision. The Commission Panel recommends that TGVI seek approval through the Resource Plan review process for the DSM budgets and projects, as appropriate, contained in the annual Resource Plan updates."*[16]

This Application represents TGVI's request for approval for DSM budgets and projects, as contemplated in the Commission's decision.

Currently, an allowed expenditure of $650,000 annually for incentives has been allocated to a deferral account, to be fully amortized the year after which the expenses are incurred. Non-incentive expenses are approximately $500,000 annually, and are treated as O&M. TGVI, due to the relatively young age of the utility, has not used utility funding for energy efficiency activities designed to reduce load on the system. Rather its activities have had the goal of increasing economical load on the TGVI system. For 2006 and 2007, there were no programs for commercial customers, and programs for residential customers were related to furnace,

[15] British Columbia Utilities Commission, Decision February 15, 2005, Terasen Gas (Vancouver Island) Inc., 2004 Resource Plan filing and Certificate of Public Convenience and Necessity Application for a Liquified Natural Gas ("LNG") Storage Project, page 30

[16] Ibid

water heater and appliance installation incentives. Until 2007, programs for TGVI were evaluated based on a “Regulatory NPV model”. In Appendix A to Order No. G-161-06, the Commission ordered TGVI to plan and evaluate deferred incentive programs based on the standard RIM and Participant cost tests.[17] This led to the incentive programs for TGVI being halted due to their load-building nature, until such time as this Application could be submitted and programs and cost-benefit analysis for TGVI could be submitted as part of a larger portfolio of EEC activity.

The table 3.2.2 shows the results of the DSM activities for 2005 to 2007 for TGVI. As noted above, the DSM programs for TGVI have not historically been evaluated and reported upon using the TRC, RIM, Participant Cost and Utility Cost tests, thus these cost-benefit results are not included below. It is the intent of the Companies moving forward to standardize testing and reporting methods for all programs for all customers, to include the cost-benefits tests referred to above, as discussed in Section 6.13.

[17] British Columbia Utilities Commission, Appendix A to Order G-161-06, page 3

Table 3.2.2 - TGVI Historical Summary DSM Programs

	Program Name	Number of Participants	Savings per Participant per Year (GJ)	Annual Savings (Gj)	TRC Cost Benefit Ratio	TRC Net Benefit	Costs ($000)
2005	Fireplace Program (2004 carry over)	10	10	100			
	Build Smart	805	5	4,025			
	Home Builders' Grant	452	80	36,160			
	Water Heating Rebate	402	25	10,050			
	H/E Furnace Installation (2004 carry over)	54	55	2,970			
	Fireplace/Water Heater Combination	16	30	480			
	Existing Customer Water Heater Conversion	60	25	1500			
	Clean Choice	132	55	7260			
	Think Grand	59	80	4,720			
	Switch & Save	182	55	10,010			
	Switch & Save (water heater only)	81	25	2,025			
	Total 2005	**2,253**	**445**	**79,300**	**N/A** [1]	**N/A** [4]	**1,018,738**
2006	Think Grand	344	80	40,000			
	Build Smart	408	5	2,500			
	Yank the Tank	94	25	2,500			
	Energy Bandit	161	55	33,000			
	PowerSmart New Home	431	85	8,500			
	Total 2006	**1,438**	**250**	**86,500**	**N/A** [2]	**N/A** [5]	**931,222**
2007	Think Grand	276	80	40000			
	Build Smart	18	5	2500			
	Yank the Tank	67	25	2500			
	Energy Bandit	278	55	33000			
	PowerSmart New Home	0	85	8500			
	Total 2007	**639**	**250**	**86,500**	**N/A** [3]	**N/A** [6]	**553,467**

1, 2, 3, 4, 5&6 TRC Cost Benefit Ratio and TRC Net Benefit indicators were not reported for TGVI programs

TGVI reports changes in gas usage as a result of DSM programs, rather than "savings", as the programs for TGVI have in the past been load building programs rather than energy efficiency programs; therefore, a "yield" of energy savings in $/GJ cannot be calculated and reported upon. The average cost on a per customer basis in 2007, using all TGVI customers as the denominator was $12.22. As with TGI, the expenditures reported above are net of partner contributions.

The Terasen Utilities have a track record of success within the limited DSM budgets available. Some programs, such as the retrofit portion of the Efficient Boiler Program, available only to customers of TGI, have been so successful that they have had to be terminated due to funding restrictions. The increase in funding requested in this Application would allow the Companies to offer customers access to a wider variety of cost-effective programs, and also to make energy efficiency programs available to customers of TGVI, and to a lesser extent, make fuel-switching programs available to customers of TGI. Areas of expanded program activity are discussed in more detail in Section 6.

3.3. Natural Gas Pricing and Rate Background

Prices for almost all forms of energy have been facing increased upward price pressures in recent years and natural gas is no exception. One of the Companies' primary reasons for submitting this Application is to help customers better manage their energy bills in the face of rising costs. EEC programs help customers to reduce their energy bills.

Rates have more than doubled since the current level of DSM funding was established for the Terasen Utilities in 1997. Figures 3.3 and 3.3a below provide a history of TGI Rate Schedules 1 and 2 since 1998. Additional rate histories are provided in Appendix 3. Please note that the 2008 rates that are set out below and in Appendix 3, reflect the approved rate changes that have occurred through April 1, 2008.

Figure 3.3 - TGI Lower Mainland Residential Rate History (Rate Schedule 1)

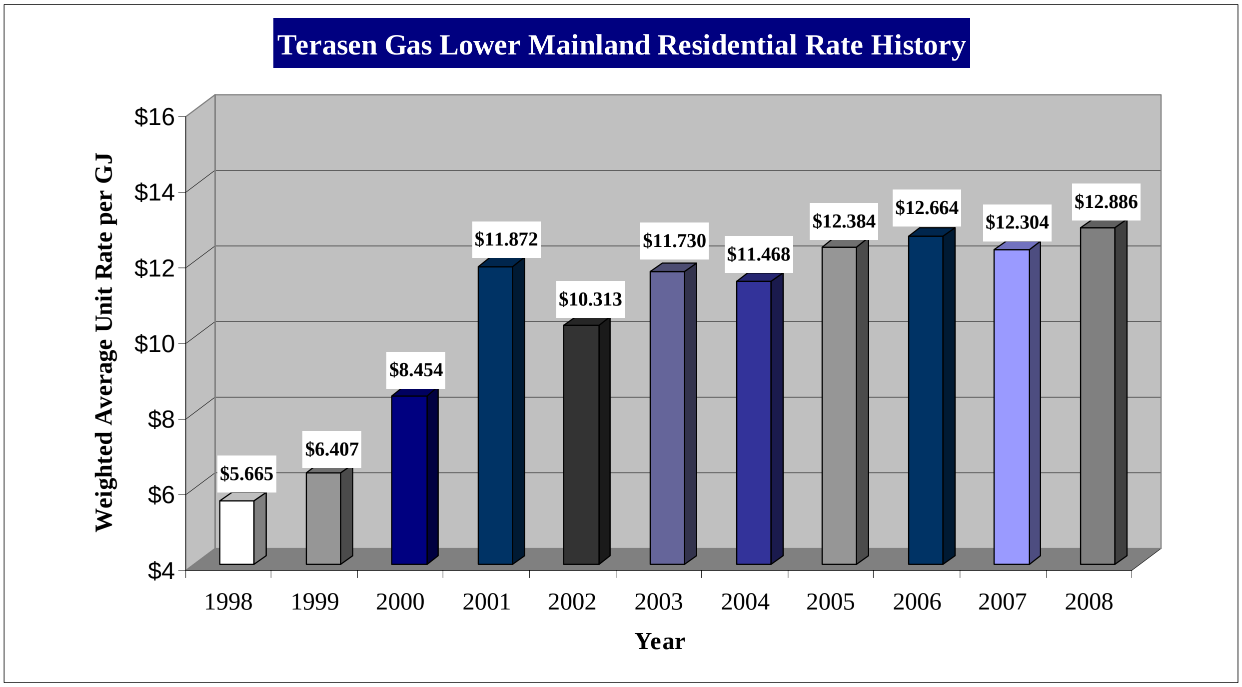
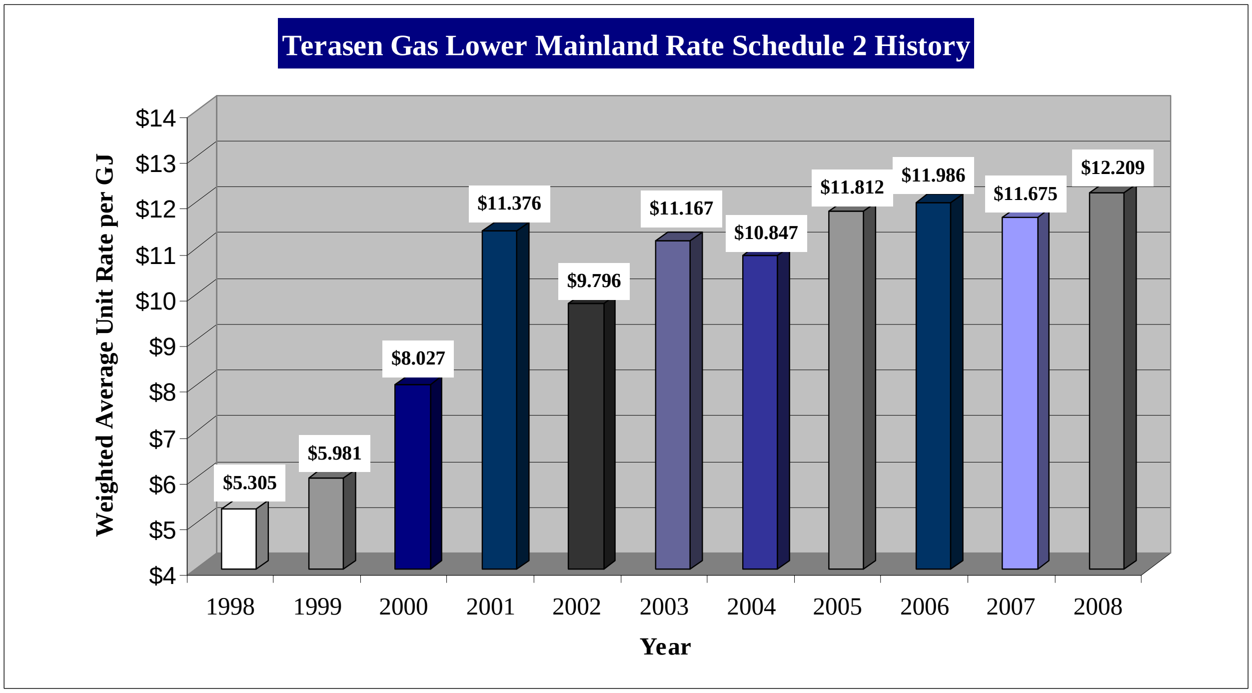


Figure 3.3a - TGI Lower Mainland Commercial Rate Schedule 2 History



As stated above, for most of the Terasen Utilities' customers, rates have more than doubled since DSM expenditure levels were originally established. Increases in energy costs result in a higher potential for cost-effective opportunities for DSM activity. The Companies commissioned the CPR, discussed in Section 4, to provide some high-level information as to how much DSM activity overall could be undertaken cost-effectively. The programs outlined in this Application will assist customers in managing the impacts of increased energy costs on their natural gas bills by providing greater access to cost-effective programs and information designed to encourage them to install more efficient gas equipment, as well as encouraging them to employ the most efficient fuel for the particular end use. A discussion of proposed expanded program activity can be found in Section 6.

3.4. Customer Usage Rates

Figure 3.4 below shows that usage rates for residential customers in the TGI service area have been declining.

Figure 3.4 - TGI Residential (Rate Schedule 1) Use Rate History

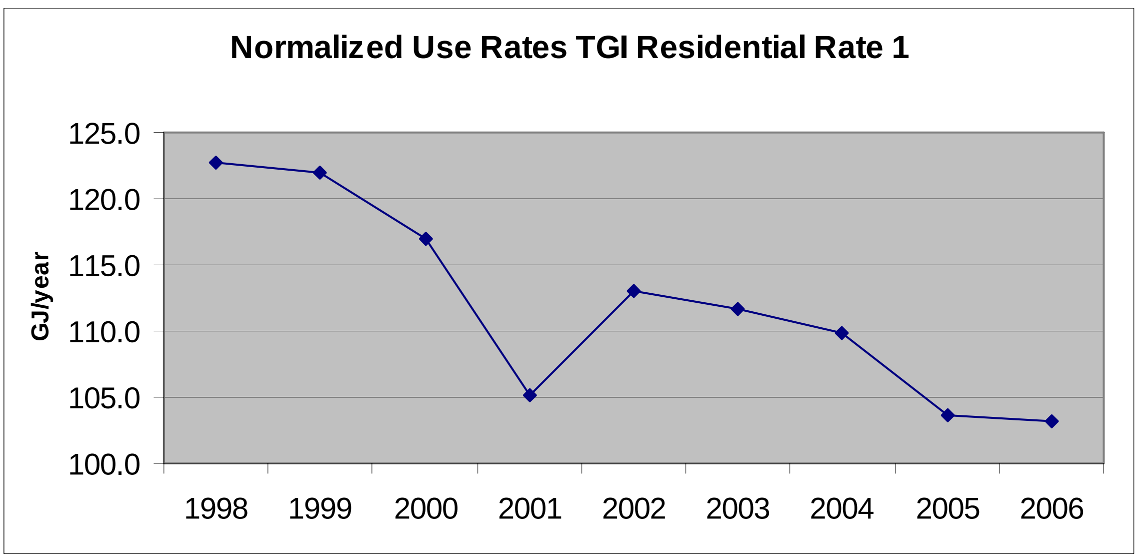
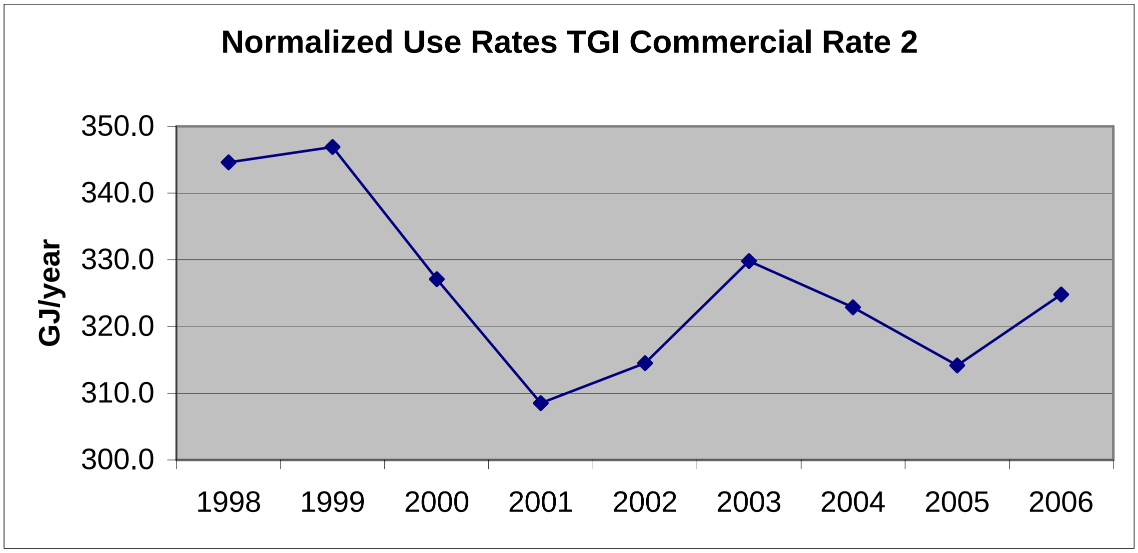


Figure 3.4a, using Rate Schedule 2 as an example shows the historical use rate for a commercial customer.

Figure 3.4a - TGI Commercial Rate Schedule 2 History



The same is true of usage rates on Vancouver Island. Figure 3.4b below shows usage rates since 1998 for residential customers served under the RGS Rate Schedule. Figure 3.4c is intended to provide an example of TGVI commercial customer's usage rates and shows usage rates for customers of Rate Schedule SCS-2.

Figure 3.4b - TGVI Residential (RGS) Use Rate History

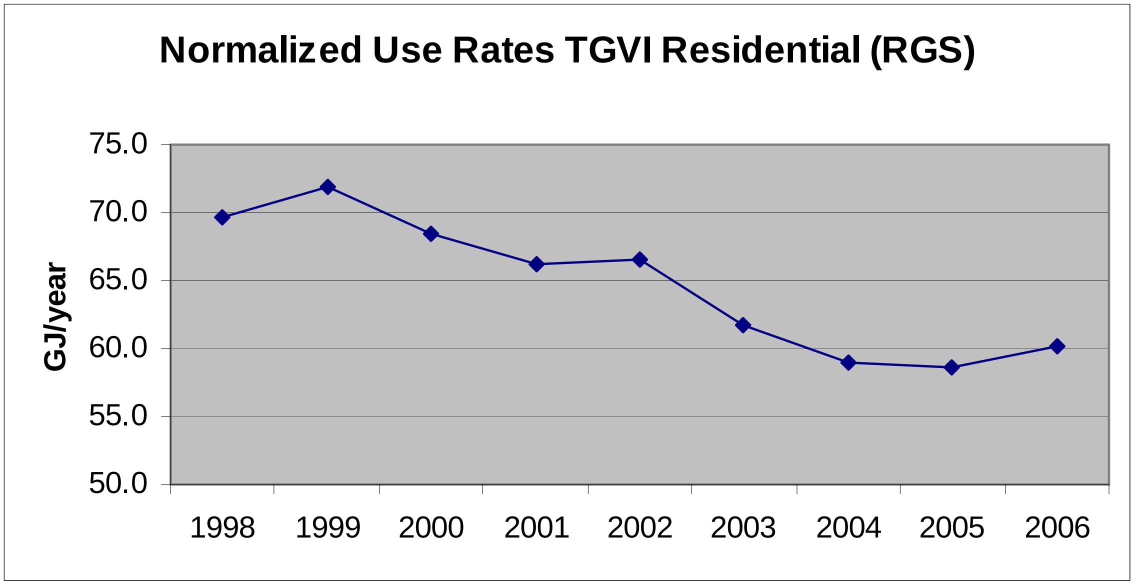
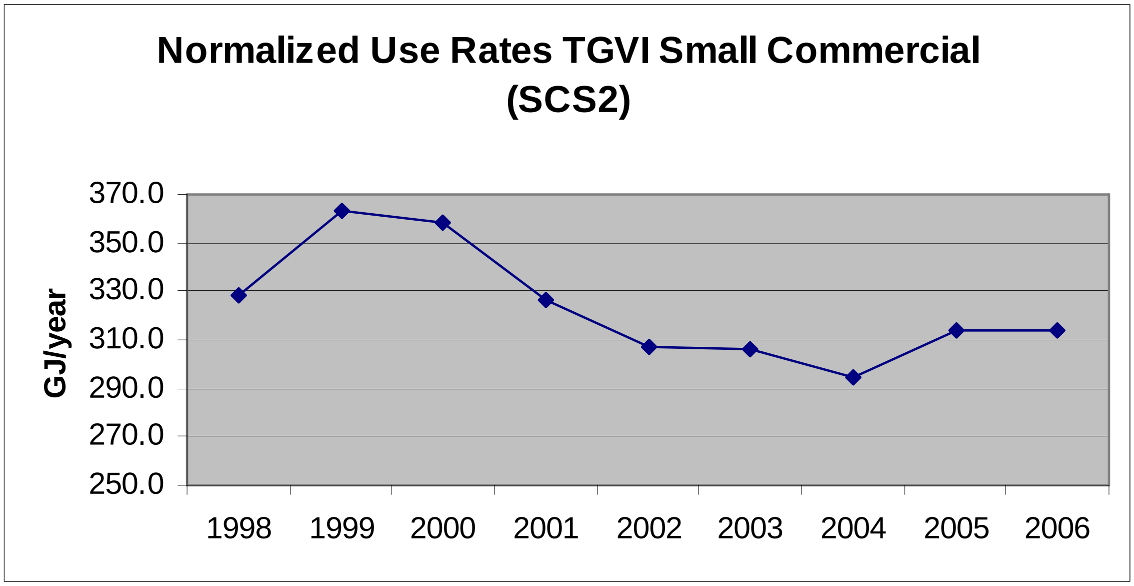


Figure 3.4c - TGVI Commercial (SCS2) Use Rate History



While this decline in usage rates can, to some degree, be attributed to customer response to increased costs for energy, increased building and equipment efficiency can also be credited. The Terasen Utilities have been actively, though modestly, engaged in programs intended to increase equipment efficiency. It is the Companies' intent through this Application to expand efforts to assist customers in managing energy costs through increasing the market penetration of efficient natural gas equipment and buildings in British Columbia. The Companies are requesting funding in this Application to increase customers' use of efficient natural gas equipment and buildings, which will continue to drive customer use per account down, in accordance with government policies related to conservation.[18]

[18] Government policy is discussed in Section 5.

3.5. EEC Expenditures at Other Utilities

The Companies spend less on EEC programs, both in absolute dollars and on a per customer basis, than the two major electric utilities in British Columbia. As a result, the Terasen Utilities' customers are not being provided with the same level of opportunity to reduce their consumption and arrive at an optimal resource mix as the customers of the electric utilities. The Companies believe that there is significant opportunity to offer our customers cost-effective programs more in line with what customers of other utilities within the province receive.

In order to understand the level of DSM/EEC expenditure at other utilities, as well as the type and scope of programs being offered, the Companies carried out a research study using internal resources that reviewed and evaluated EEC programs offered by other North American utilities. Background research was collected via the internet from utility websites, public websites, utility commission and government websites. Initial findings were followed up by personal telephone interviews with key personnel responsible for DSM activities at these utilities. The results of the research are summarized in Table 3.5 below, and more detail is attached as Appendix 4.

Table 3.5 - Summary Information Other Utilities DSM Activity

Company Name	Utility Type	2007 DSM Annual Budget ($ in millions)	Start DSM year	DSM Funding Treatment	Company Earns on DSM [5]	Customer Base	F/T DSM Employees	Total Employees	2006 Asset Base ($ in millions)	2006 Total Revenues ($ in millions)	% Spent on DSM of Revenue	DSM Spend per customer	2006 Annual Sales Volume (PJs)
Pacific Gas and Electric Company ("PG&E")	Combined	279.0 [1]	mid-1970's	Public Purpose Fund	Yes	4,200,000 [8]	350 [9]	20,000	34,800	12,530	2.23%	$66.43	425.9
Manitoba Hydro	Combined	9.0	1989	DSM costs are treated as capital and amortized over a fixed time period.	No	258,000	50	3,200	11,000	517	1.74%	$34.88	147.6 [12]
Southern California Gas Company ("SoCal Gas")	Natural Gas	56.6 [3]	mid 1980's	Public Purpose Fund	Yes	5,600,000	30	3,000	6,360	4,180	1.35%	$10.11	946.0
BC Hydro and Power Authority ("BC Hydro")	Electric	52.3 [2]	late-1980's	DSM costs are treated as capital and amortized over a fixed time period.	Yes	1,704,671	131	4,200	12,484	4,311	1.21%	$30.68	190.5
FortisBC	Electric	2.5	1989	DSM costs are treated as capital and amortized over a fixed time period.	Yes	154,000	8	570	731	208	1.19%	$16.06	11.1
Northwest Natural Gas Company ("NW Natural")	Natural Gas	11.0 [4]	1980	Public Purpose Fund	No [6]	636,000	1	1,211	1,957	1,000	1.10%	$17.30	125.8
Union Gas	Natural Gas	17.0	1997	DSM costs are recovered through rate base	Yes	1,300,000	45	2,200	4,600	2,100	0.81%	$13.08	1,303.0 [13]
Enbridge Gas Distribution ("Enbridge")	Natural Gas	22.0	1995	DSM costs are recovered through rate base	Yes	1,800,000	45	1,961	3,323	3,016	0.73%	$12.22	445.0
Gaz Metro Limited Partnership ("Gaz Metro")	Natural Gas	8.8	1999	as O&M	Yes	167,000	6 [10]	1,500	2,700	2,000	0.44%	$52.69	271.8
The Terasen Utilities	Natural Gas	4.3	1991	Program costs as O&M; program incentives are amortized over fixed time period	No	911,935	4	1,237	2,900	1,635 [11]	0.26%	$4.69	208.0 [14]
Puget Sound Energy ("PSE")	Combined	6.1	early-1980's	DSM costs are recovered via a rider on customer bill	Yes [7]	718,000	80	2,400	7,061	2,905	0.21%	$8.52	205.1
SaskEnergy	Natural Gas	1.6	2001	as O&M	No	325,000	4	1,000	1,322	1,254	0.13%	$4.92	125.0
ACTO Gas	Natural Gas	Part of marketing budget	2001	as O&M	No	969,200	8 - 12	1,700	7,698	2,890	n/a	n/a	219.0

Notes:

[1] This figure reflects the 2007 DSM budget for electrical and gas initiatives. This covers labour, rebates and advertising. An additional $24 million will be spend on research and evaluation. On average, 86 per cent of funds are related to the electric side of the utility.

[2] This figure is comprised of the following components: $4.9 million (operating costs) and $47.3 million in deferred capital - note that it is an actual figure rather than a budget figure.

[3] This figure reflects the 2007 DSM budget which covers labour, rebates and advertising. An additional $4.3 million will be spend on research and evaluation.

[4] This figure is the sum of $9 million that is dedicated for DSM and market transformation programs implemented through the Energy Trust of Oregon (ETO) and $2 million for low income weatherization administrated by NW Natural.

[5] The utility either earns a return on equity or on a financial incentive or penalty based on DSM Mechanism

[6] There is a separate line on customers' bill; DSM costs are treated as flowthrough costs

[7] PSE has an incentive and penalty mechanism for electric programs.

[8] This figure refers to Natural Gas customers only at PG&E.

[9] This figure reflects the total number of DSM staff at PG&E, approximately 80% of them spend their time on natural gas DSM programs.

[10] Overall, over 200 employees, contractors, business partners involved in the delivery of DSM programs at Gaz Métro.

[11] These are combined revenues for Terasen Gas Inc. and Terasen Gas Vancouver Island

[12] Includes sales for residential, commercial and industrial sectors (53PJ) and transportation services (23PJ)

[13] This number is comprised of 509 PJ for distribution and 794 PJ for transportation.

[14] This includes the total volume numbers for TGVI (including ICLP/Hydro; VIGJV-Inland & Squamish Gas) and TGI.

The research conducted indicates that there is no one common method of establishing appropriate levels for DSM expenditure; each jurisdiction acts differently and independently. Most of the utilities surveyed offer both residential and commercial/institutional/industrial customers access to DSM programs. In most instances, DSM activity is carried out primarily by the utility; however in some jurisdictions, such as Oregon, certain DSM activities are also conducted by a third party agency.

It is clear from the analysis that, compared to other major North American utilities, the approved EEC expenditure levels for the Terasen Utilities are not providing the Companies' customers with the same opportunities to participate in EEC activities enjoyed by customers of other utilities. For example, BC Hydro invested a total of $52.3 million in Power Smart in 2007, more than 12 times the amount that the Terasen Utilities invested, even though BC Hydro and the Terasen Utilities transport approximately the same amount of energy annually, as shown in the "throughput" column. BC Hydro has proposed that its Power Smart expenditures increase significantly for F2009 and F2010 to $105 million and $122 million respectively[19], more than 24 times the amount that the Terasen Utilities will invest in EEC activity in 2007.

Although the avoided cost structures of gas and electric utilities are different, in that electricity companies are vertically integrated and have generation and transmission costs that can potentially be avoided through DSM activity, gas utility customers pay for gas commodity, midstream and distribution costs. Gas and electric customers should therefore have access to the same level of efficiency and conservation services provided by their respective utilities. In reviewing the cost allocated by gas and electric utilities in British Columbia to providing conservation services to their customers, it is apparent that the Terasen Utilities' customers are not being provided with the same level of opportunity as the customers of the electric utilities. The Terasen Utilities spend about $4.69 per customer annually on conservation, while FortisBC spends $16.06 per customer, and BC Hydro spends $30.68 per customer, based on 2007 expenditure levels. If BC Hydro's proposed PowerSmart expenditures for F2010 are approved it would result in costs per customer close to doubling over current levels. It is the Terasen Utilities' intent with this Application to bring expenditure per customer on conservation initiatives closer to the level of other utilities in British Columbia, expanding the Companies' customers' access to more opportunities to conserve. Stakeholders have historically approved the higher

[19] BC Hydro F09/F10 Revenue Requirement Application, Section 5, Page 7, Table 5-1, "Capital Expenditures by Business Function"

expenditure on DSM for electrical customers. Given that natural gas comprises approximately the same percentage of the energy consumed in British Columbia as electricity, it is the view of the Terasen Utilities that natural gas customers should have the same access to programs to help them conserve energy as do electricity customers.

Through the CPR, and the subsequent work by Habart, a consultant engaged by the Companies to refine the results of the CPR, the Terasen Utilities have identified numerous initiatives where, with adequate funding, customers could participate in programs designed to lower their energy consumption and therefore their energy bills. These initiatives are discussed in more detail in Section 6. The expenditure proposed in this Application for 2008 in order to implement the programs, at approximately $16.8 million for 2008 representing an expenditure of approximately $18 on a per customer basis, which would still be below the other large BC utilities. It is the position of the Companies that this level of expenditure is prudent, fair and in the public interest and as such should be approved.

3.6. Government Policy

This Section describes policy goals of various levels of government, focusing on the Government of British Columbia.

3.6.1. Provincial Policies

While energy efficiency has been a priority for British Columbians and for the Companies, the expectations, costs and perceived consequences of inaction on managing energy usage have increased dramatically in recent years. This necessitates a re-examination by the Companies of current programs and funding available to support efficiency objectives. Furthermore, the link between effective and efficient use of BC's energy resources and the impact this use has on the environment has increased the sense of urgency for policy makers. The Government of British Columbia ("the Province") has communicated its policies in a number of ways, including in the Speech from the Throne on February 13, 2007, the "BC Energy Plan: A Vision for Clean Energy Leadership", which was released February 27, 2007, and is attached as Appendix 6.
(the "2007 Energy Plan"), the introduction of a Carbon tax, and most recently in the *Utilities Commission Amendment Act*, 2008, which received Royal Assent on May 1, 2008.

❖ Speech from Throne and Energy Plan 2007

In the Speech from the Throne on February 13, 2007, the Province vowed to "take concerted provincial action to halt and reverse the growth in greenhouse gases", and suggested that "Leaders from business, community groups, and citizens themselves are calling for a new environmental playing field that is fair and balanced but that recognizes we all need to change. We all need to be part of the solution"[20]. The Province also stated that a plan would be established with an "…aim to reduce B.C.'s greenhouse gas emissions by at least 33 per cent below current levels by 2020. This will place British Columbia's greenhouse gas emissions at 10 per cent under 1990 levels by 2020." The 2008 Speech from the Throne, delivered February 12, 2008, made further commitments to legislated targets, to a climate action plan, and to

[20] http://www.leg.bc.ca/38th3rd/4-8-38-3.htm

"carbon smart communities."[21] Both the 2007 and 2008 Throne Speeches are attached as Appendix 5.

Many of the initiatives outlined in the Speech from the Throne were expanded upon in the Policy Actions contained within the "BC Energy Plan: A Vision for Clean Energy Leadership", which was released February 27, 2007, and is attached as Appendix 6.

Policy Actions from the "BC Energy Plan: Vision for Clean Energy Leadership" that are addressed by the Application are:

a) Policy Action #1 - "Set an ambitious conservation target, to acquire 50% of BC Hydro's incremental resource needs through conservation by 2020"
b) Policy Action #2 - "Ensure a coordinated approach to conservation and efficiency is activity pursued in British Columbia"
c) Policy Action #3 - "Encourage utilities to purse cost effective and competitive demand side management opportunities"
d) Policy Action #4 - "Explore with BC utilities new rate structure that encourage energy efficiency and conservation"
e) Policy Action #5 - "Implement Energy Efficiency Standards for Buildings by 2010"
f) Policy Action #6 - "Undertake a pilot project for energy performance labeling of homes and buildings in coordination with local and federal governments, First Nations, and industry associations"
g) Policy Action #9 - "Increase the participation of local governments in the Community Action on energy Efficiency Program and expand the first Nations and Remote Community Clean Energy Program"
h) Policy Action #10 - "Ensure self-sufficiency to meet electricity needs, including insurance"

The Policy Actions supported by this Application are discussed in more detail in Section 7.3

[21] http://www.gov.bc.ca/premier/2008_throne_speech/index.html

❖ The Carbon Tax

In the Provincial budget delivered February 19, 2008, the Government of British Columbia announced a carbon tax on the end use of energy forms that, when consumed, result in GHG emissions. The planned carbon tax is equivalent to $10/tonne of carbon dioxide equivalent (“CO2e”) in the first year, rising to $30/tonne of CO2e by 2012. Programs such as those contemplated in Section 6 of this EEC Application will assist British Columbians in managing the impact of the carbon tax on their natural gas bills. While the market signal for natural gas created by the carbon tax is more immediate and obvious to the consumer, government energy and environmental policies will also inevitably impact the rates that consumers pay for electricity. Through the energy policy mandates related to electricity self-sufficiency and net zero GHG emissions, government will cause the cost of carbon-free electricity to increase. By not attaching an explicit carbon tax to recognize the regional carbon impact of electricity imports however, there is considerable risk that consumers will receive signals and make decisions on energy source based solely on today’s energy prices that will cost them, the province and the region more in the long run.

The Companies propose that additional customer bill savings from the implementation of the tax should be included in the cost-benefit analysis for EEC programs and the analysis presented in Section 6.13 includes carbon tax savings. The Companies propose that the activities supported by the EEC Application will contribute to consumer education and provide consumers with tools to help them reduce the impact of the proposed carbon tax on their energy expenditures.

The Province of British Columbia, through the Policy Actions laid out in the 2007 Energy Plan, as well as the introduction of the Carbon Tax, is leading the country in environmental initiatives. The Terasen Utilities feel that rather than lagging behind the rest of the country in EEC activity and spending, as British Columbia utilities, the Companies should be given the opportunity to lead with conservation initiatives. This Application is a step toward the Terasen Utilities increasing EEC activity to a more appropriate level, though the Companies will still be toward the middle of the pack with respect to other utilities.

❖ Bill 15: *Utilities Commission Amendment Act, 2008*

Bill 15, the recently enacted amendments to the *Utilities Commission Act,* represents another indication of the Province's renewed focus on energy conservation and climate change.

The *Utilities Commission Amendment Act, 2008* adds a new definition of "government's energy objectives" to section 1 of the *Utilities Commission Act.* These objectives are:

(a) to encourage public utilities to reduce greenhouse gas emissions;

(b) to encourage public utilities to take demand-side measures;

(c) to encourage public utilities to produce, generate and acquire electricity from clean or renewable sources;

(d) to encourage public utilities to develop adequate energy transmission infrastructure and capacity in the time required to serve persons who receive or may receive service from the public utility;

(e) to encourage public utilities to use innovative energy technologies

(i) that facilitate electricity self-sufficiency or the fulfillment of their long-term transmission requirements, or

(ii) that support energy conservation or efficiency or the use of clean or renewable sources of energy;

(f) to encourage public utilities to take prescribed actions in support of any other goals prescribed by regulation.

Section 44.2 of the *Act*, pursuant to which the Companies bring this Application, requires the Commission to consider government's energy objectives. In the future, pursuant to section 44.1 the Terasen Utilities will have to justify why the demand identified in its mandatory long-term resource plan cannot be met by DSM. The Terasen Utilities believe that the EEC strategy contemplated in this Application is absolutely consistent with "government's energy objectives", and the requirements imposed on public utilities under the amendments.

3.6.2. Municipal Policies

Many municipalities also have various policies and initiatives aimed at energy efficiency and conservation. A portion of increased EEC funding, as discussed in Section 6.6.4, will be used to co-fund specific municipal programs, such as Community Action on Energy Efficiency, as well as municipality-led education and outreach to residents about conservation issues, and to promote programs to the development community that provide incentives such as reduced development permit charges for development applications, and increased Floor Space Ratio allowances for buildings that offer greater energy efficiency. The Terasen Utilities recognize that municipalities have great potential to affect changes in behavior and consumption, as they directly control land use in urban and suburban areas. Increased EEC funding will also support municipalities with upgrading their own facilities as municipalities would certainly be eligible to participate in all incentive programs. The Companies have provided funding to the Community Energy Association and have co-funded various pilot programs launched by the City of Vancouver. Increasing EEC funding would allow the Companies to increase co-funding for specific measures as appropriate to individual communities, thus increasing the overall efficiency of the distribution system for all ratepayers.

3.6.3. Federal Policies

The Government of Canada has put into place the Eco-Energy program[22], which offers Canadians an opportunity to receive grants for various energy efficiency measures, once the applicant has completed a pre- and post- upgrade audit. This EEC proposal supports that particular program by offering Terasen Utilities' customers an incentive to offset the costs of either the initial or the final audit as discussed in Section 6.6 on "Funding for Joint Initiatives Program Area".

The discussion above suggests that all levels of government are engaged in energy issues, with the Government of British Columbia having outlined the greatest number of policy actions. It is the intention of the Terasen Utilities with this Application to provide material support for these policies as outlined above, by increasing the opportunities for its customers to participate in programs to help them to manage their energy use.

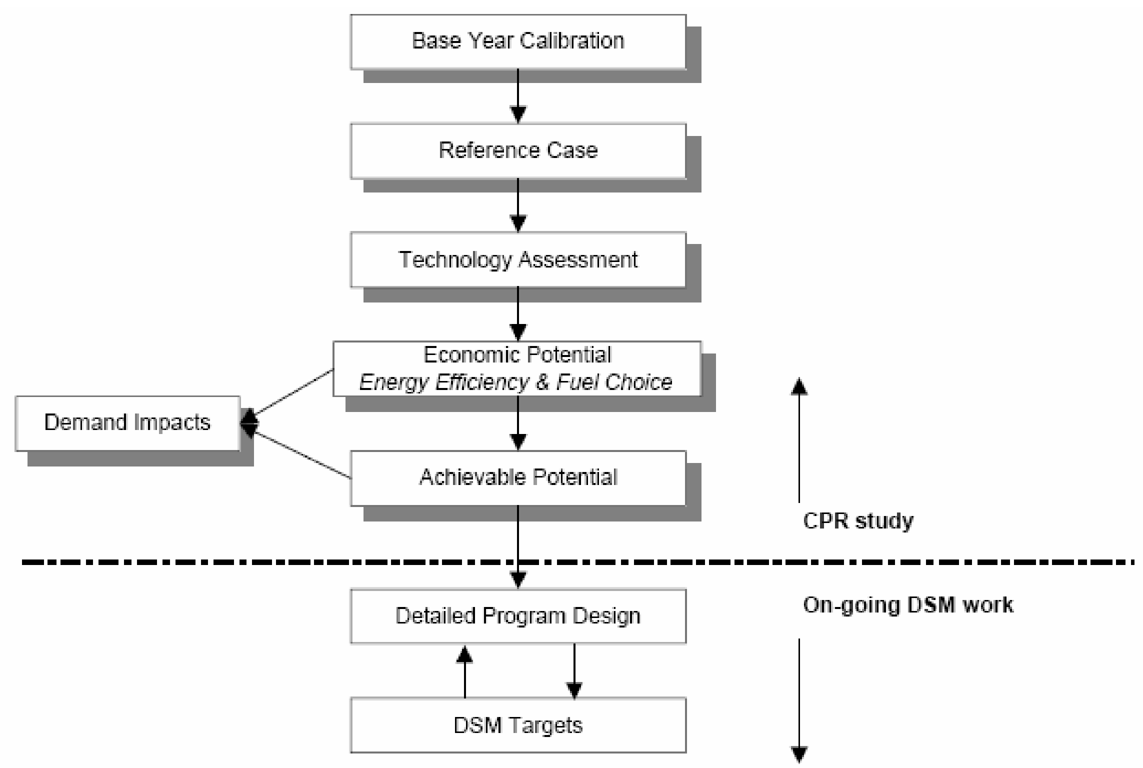
[22] http://www.oee.nrcan.gc.ca/corporate/retrofit-summary.cfm

4. Conservation Potential Review

As stated in the 2004 Annual Review, at that time the Companies had started preliminary work on an extensive CPR study designed to analyze the amount of DSM potential in different geographical areas in the Companies' service territory. At the time the study was commissioned by the Companies, the intent was to submit an application to the Commission for increased DSM activity, based on the outcome of the CPR. This Application fulfils that original intent.

In May 2006, the Companies received the final CPR from Marbek. The process for the CPR was described extensively in the 2006 Resource Plans for TGI[23] and TGVI.[24] The major steps involved in the CPR analysis are shown in Figure 4 below.

Figure 4 - Conservation Potential Review Process Flow



[23] Terasen Gas Inc., 2006 Resource Plan, pages 54 - 64
[24] Terasen Gas (Vancouver Island) Inc., 2006 Resource Plan, pages 55 - 63

The key finding of the CPR was the Achievable Potential. Achievable Potential is the proportion of savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is practically difficult to induce customers to purchase and install all the energy efficiency or fuel choice options that are defined by the Economic Potential Forecast. It should be noted that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design. For both utilities combined, the Achievable Potential from the CPR is outlined in Table 4.1 below.

Table 4.1 - CPR Findings

By 2015/2016, GJ per year	TGVI	Lower Mainland	Interior	Total
Residential EE	-369,000	-5,298,000	-1,847,000	-7,514,000
Commercial EE	-385,000	-1,396,000	-431,000	-2,212,000
Industrial EE	-32,430	-933,064	-924,210	-1,889,704
Subtotal	**-786,430**	**-7,627,064**	**-3,202,210**	**-11,615,704**
Residential Fuel Subsitution				1,453,000
Potential Annual Impact				**-10,162,704**

Please note that this Application does not include a request for funding for Industrial Energy Efficiency activity as it was defined in the CPR. Energy Efficiency activity for Industrial customers is discussed in Section 6.10.

Work on converting the CPR results to DSM programs commenced in the fall of 2006, after the completion of the Resource Plans for TGI and for TGVI. In early 2007, Habart was commissioned by the Companies to rescreen and summarize the results of the CPR, and to assist with preliminary program design such that estimates of incentive levels, program uptake rates and program costs could be developed and a budget developed as the basis for this Application. The Habart report is attached as Appendix 9.

Both the CPR and the subsequent Harbart analysis found significant opportunity for increased conservation and efficiency activity by the Companies. In fact, the CPR confirmed the existence of significant potential cost-effective natural gas efficiency improvements in British Columbia's residential and commercial sectors. The Marbek study states, for instance, that:

> *"A significant increase in annual DSM investment and in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels. This level of investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario."*[25]

The CPR also found that interactions between the Terasen Utilities and the Companies' customers would increase very significantly:

> *"Furnace and fireplace actions combined, could affect up to 25% of residential customers by 2015/2016."*[26]

This increase in interaction between the Terasen Utilities and customers is beneficial because it increases the opportunities for the Companies to communicate general conservation information in addition to program-specific information at the time of customer interaction. This amplifies the effectiveness of program and conservation communications expenditures.

Opportunities for increased activity derived from the CPR are discussed in more detail in Section 6. Approval for the funding required for that increased activity is requested in Section 2, "Application".

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[25] Terasen Gas Conservation Potential Review, Residential Sector Report, April 2006, Marbek Resource Consultants in association with Habart and Associates and Innes Hood Consulting, page E-xi.

[26] Ibid

5. Program Principles

Below, the Terasen Utilities have identified the key principles that guided the selection of particular EEC initiatives and programs within the program areas identified in this Application, and would guide the development and implementation of the initiatives and programs should the increased EEC funding be approved. Many of the principles are based on the "DSM Best Practices" report prepared for the Canadian Gas Association in 2005 by IndEco Consulting in association with B. Vernon and Associates, which is attached at Appendix 10.

1. Programs will have a goal of being universal, offering access to energy efficiency and conservation for all residential and commercial customers, including low income customers through the DSM for Affordable Housing initiative.
2. Wherever possible, programs will be uniform, so that customers in one part of the service territories of the Terasen Utilities have access to the same programs as customers throughout the service territories.
3. EEC expenditures will be efficient, with non-incentive costs not exceeding 50% of the expenditure in a given year.
4. Program results will be analyzed on a portfolio-wide basis.
5. The Total Resource Cost/Benefit of the Portfolio over the funding period will have a ratio of 1 or higher
6. The Terasen Utilities will submit an Annual EEC Report to the BCUC, by the end of the first quarter of each year, that details the results of the previous year's programs and anticipates program activity and spending for the upcoming (current) year.
7. To every extent practical, programs will support the objectives of established government policies.
8. The Companies will continue to seek funding for programs from additional sources, such as the provincial and federal governments, other utilities, and equipment suppliers and manufacturers, in order to minimize the cost impacts of EEC programs to ratepayers, and in recognition of the broader societal benefits resulting from successful program development and implementation.
9. Incentives may be directed to the end users of an appliance, to the customer point of contact at the time that an equipment purchase decision is made (for example, to the gas contractor in the case of a furnace), to a system designer or engineer, or to an

equipment developer, supplier or manufacturer. The most effective use of incentives will be determined through the program design process.

10. Education and outreach regarding conservation will be part of the Companies' EEC activity.
11. Programs will be multi-year so as to create a sense of funding certainty necessary to effective implementation in the marketplace – this Application requests funding for a three-year Portfolio of EEC programs.
12. Programs will have market transformation as their ultimate goal, and program plans will describe how a program will contribute to market transformation.
13. Programs will aim to develop capacity within the market through manufacturers, distributors, vendors and installers.
14. To ensure value creation and alignment with the market, the Companies will establish and engage an EEC stakeholder group, comprised of governments, industry, trades, manufacturers, NGOs, advocacy groups, other utilities and customers to provide it with advice on effective program design and implementation, as well as some oversight of the Companies' EEC activity and expenditure. Consideration may be given by the Companies to consolidate the Terasen Utilities' EEC Stakeholder activity with stakeholder activity currently being undertaken by other utilities in order to reduce potential "stakeholder fatigue".

6. Expanded Funding and EEC Program Proposal

This Section provides more detail about the specific items in this Application for which the Companies are requesting Commission approval. The Companies have long been focused on promoting conservation and responsible energy use, and the progression of economic and environmental factors and societal expectations necessitates a revised approach to the funding and creation of programs in support of this objective.

6.1. Increase Funding to EEC Program Area

The Terasen Utilities request approval for overall expenditures for the EEC Program Period in the amount of approximately $46.9 million for TGI and approximately $9.7 million for TGVI, for a total of approximately $56.6 million. The Companies are proposing incremental EEC/DSM expenditures over three years of $40.696 million for TGI and $7.366 million for TGVI. On a combined basis, the total additional funding for the three years ending 2010 over and above the approved levels stipulated in Extended Settlements for the two years ending 2009 is $48.062 million, bringing the three year total for both Companies to $56.61 million. The annual total per utility is outlined in Table 6.1 below.

Table 6.1 - Proposed EEC expenditures, by Utility ($000's)

Utility	2008	2009	2010	Total by Utility
TGI	$13,996	$15,752	$17,196	$46,944
TGVI	$2,830	$3,043	$3,793	$9,667
Subtotal by year	$16,826	$18,795	$20,990	$56,611

These proposed expenditure figures are "budget year" totals; that is they are the amount of the total proposed EEC budget by year in the year that the funds would be spent or committed. Further, these are the figures for the Terasen Utilities' contribution to energy efficiency and conservation initiatives. In instances where there are electricity savings from a certain measure, the Companies anticipate partnering with electrical utilities and potentially, governments, to deliver joint programs. Partner funding is discussed further in Section 6.2.2.

The Companies have developed the overall proposed expenditure in Table 6.1, for which approval is sought, based on the allocation of funding to the program areas as outlined in Table

6.1a. The program areas that the Companies intend to pursue with approval of this Application are expanded over the program areas currently addressed. The Companies intend to pursue the following program areas of EEC activity for each utility for both residential and commercial customers: Energy Efficiency and Fuel Switching measures, Conservation Education and Outreach activity, Trade Relations, Joint Initiatives, and Innovative Technologies, Natural Gas Vehicles ("NGV") and Measurement. For funding beyond 2010, the Companies propose that a CPR be commenced in 2009, to determine potential areas of energy efficiency and conservation program for the period 2011 to 2014. It is proposed that a submission to the Commission would be made by the Companies in 2010, based on the findings from the 2009 CPR, for funding for the period 2011 to 2014. Additional funding, estimated at $500,000 for the CPR is included in the $56.6 million total for which approval is being sought. Once this Application is approved,, the Companies would proceed to an Request for Proposals for the CPR.

The allocation of funding as among the program areas was derived with reference to specific initiatives contemplated within each program area.

Table 6.1a - Proposed EEC Expenditure by Program Area by Utility

Spend by Program Area 2008 - 2010	TGI	TGVI	Total
Residential Energy Efficiency	$8,552	$734	$9,286
Commercial Energy Efficiency	$19,592	$2,199	$21,791
Residential Fuel Switching	$1,332	$2,367	$3,699
Conservation Education and Outreach	$11,068	$2,767	$13,835
Joint Initiatives	$2,400	$600	$3,000
Trade Relations	$1,200	$300	$1,500
Conservation Potential Review	$400	$100	$500
Innovative Technologies, NGV and Measurement	$2,400	$600	$3,000
Total	**$46,944**	**$9,667**	**$56,611**

The Companies believe that it is most efficient for the Commission to approve the overall expenditure level, by utility, for the Funding Period, rather than approving the funding by program area, or by individual program initiative. This approach will allow the Companies' to respond quickly to changes within initiatives and to new opportunities that might arise. For example, if a particular initiative within the commercial energy efficiency program area has a higher than expected number of participants, and a strong cost-benefit ratio, the Companies would like to have the ability to shift funds from another, underutilized program area to that commercial energy efficiency initiative, without coming back to the Commission for approval to do so. Not only will this allow the Companies' to respond quickly to opportunities, it will also reduce the Companies' administrative burden related to EEC activity, and both the speed of response and reduced administrative burden will increase the value to customers of the Companies' EEC activity.

The funding level adjustments are warranted as levels have not been adjusted in many years. The increase proposed will bring the Terasen Utilities' EEC funding closer to the levels of other utilities' EEC spending. As a point of comparison with other utilities, the level of funding proposed for 2008 amounts to approximately 1% of projected gross revenue for 2008, a significant increase over current funding levels of approximately 0.26% of gross revenues. When considering EEC Activity on a per customer basis, approval of the Companies' expenditure as outlined above would mean that in, for example, 2009, the Companies would spend approximately $20 per customer on EEC, an increase from the current expenditure of approximately $5 per customer, but well below BC Hydro's proposed Power Smart expenditure for F2010 at over $60 per customer.

The Terasen Utilities believe that the proposed overall EEC expenditure will provide greater cost-effective assistance to customers manage their energy costs, and support the government's energy objectives as defined in Bill 15 and detailed in the 2007 Throne Speech and the Energy Plan. The Companies will continue to assess over the course of the Program Period whether customers would benefit from additional EEC spending over and above the funding sought in this Application, and will bring forward any further application as appropriate.

6.2. EEC Program Area Budget Development Process

The budget numbers for residential energy efficiency, for commercial energy efficiency, and for residential fuel switching were developed based upon the work done in 2006 in the CPR. The CPR was received by the Companies in May 2006. At a high level, funding allocations for the activities planned are outlined in Table 6.1a. While a CPR can provide an estimation of Achievable Potential, more work must be done to develop a DSM plan based upon a CPR. From the Residential section of the CPR:

"…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."[27]

Therefore the Companies retained the services of Habart early in 2007 to assist with further program and budget development. The methodology used by Habart in developing the budget estimates for residential energy efficiency, commercial energy efficiency and residential fuel switching is detailed in Appendix 9. At a high level, the measures explored in the CPR were re-screened to determine which might be the best candidates for further program development work. For each promising measure, estimates were developed of the incentive dollars needed to elicit participation, program uptake, and non-incentive costs (administration, marketing and promotion, and evaluation). Estimates were derived using internal expertise, as well as external data sources such as residential new construction rates. The measures and associated incentive and non-incentive budgets were then screen in accordance with the California Standard Practice Manual (attached as Appendix 12) tests for cost-effectiveness, and the measures with a TRC of 1 or greater were included in budget development.

6.2.1. Consumer Education and Outreach

The Conservation Education and Outreach budget figure was developed in consultation with the Companies' advertising agency. The Companies approached their advertising agency, requesting an initial action plan and associated costing for a Conservation Education campaign, aimed at the public, of the magnitude of the Customer Choice campaign. The advertising agency responded with a plan, and after some discussion between the Companies and the agency, and subsequent refinement of the plan, a cost for such a campaign was derived. The outline for the plan, and the associated budget, is attached as Appendix 8.

[27] Terasen Gas Conservation Potential Review, Residential Sector Report, April 2006, Marbek Resource Consultants in association with Habart and Associates and Innes Hood Consulting, pages E-i and E-ii, Marbek and

6.2.2. Joint Initiatives, Trade Relations and the 2009 CPR

The amounts for Joint Initiatives, Trade Relations and the 2009 CPR were developed by the Companies based on the Companies' best estimates of potential expenditure levels for these three program areas. The Joint Initiatives program area is estimated to require funding of approximately $1 million per year, however more funding may be required for this program area if additional opportunities for initiatives with partners should arise. Should this occur, the Companies would expect to shift funds from under-performing areas to this program area. The Trade Relations program area is estimated to require funding of approximately $0.5 million per year and this would cover one staff member, and various outreach activities aimed at trade allies, as described in Section 6.7. The estimate for the 2009 CPR is based upon a cost to perform the previous CPR of approximately $300,000, and includes an allowance for the kind of work done by Habart to refine the CPR results into a DSM program. The amount for Innovative Technologies, NGV and Measurement will need to be refined – if an effective program in Innovative Technologies, NGV and Measurement can be developed over the funding timeframe, the Companies wish to have to the ability to fund such a program over the funding timeframe.

The analysis and budget derivation presented above in Table 6.1 and in the following Table 6.1a does not include an anticipated contribution from BC Hydro or from other partners for electrical savings. The total amounts for all programs, including partner contributions from BC Hydro or others for those commercial energy efficiency measures where there are electrical savings, are presented in Table 6.2b (Please note that the contributions outlined are only for incentives for electrical savings in certain commercial initiatives; there is zero partner contribution assumed for the fuel switching initiatives, nor is there a contribution contemplated for non-incentive expenditures such as promotion costs.)

It should be noted in the Tables 6.2a and 6.2b below showing the breakdown of EEC expenditures proposed by the Companies adheres to the Principle #9 regarding efficient spending as discussed in the previous Section 5 on "Program Principles". Incentives comprise just over $30 million of the total proposed three year expenditure of $56.6 million. Therefore non-incentive program costs are proposed to be under 50%, as outlined in the principle regarding efficient spending.

Table 6.2a - Proposed EEC Expenditure Detail - TGI and TGVI

			Budget Amount - Terasen Only								
			2008			2009			2010		
Utility	**Sector**	**Nature of Program**	**Incentives**	**Program Costs**	**Total**	**Incentives**	**Program Costs**	**Total**	**Incentives**	**Program Costs**	**Total**
TGI	Residential	Conservation Potential Review	$0	$0	$0	$0	$200,000	$200,000	$0	$0	$0
TGI	Residential	Energy Efficiency	$1,925,000	$981,000	$2,906,000	$2,350,000	$874,000	$3,224,000	$1,675,000	$747,000	$2,422,000
TGI	Residential	Fuel Switching	$195,000	$164,000	$359,000	$270,000	$139,000	$409,000	$345,000	$219,000	$564,000
TGI	Commercial	Energy Efficiency	$3,245,700	$1,289,000	$4,534,700	$4,640,000	$1,643,000	$6,283,000	$6,223,050	$2,551,000	$8,774,050
TGI	Residential	Joint Initiatives	$600,000	$200,000	$800,000	600000	$200,000	$800,000	$600,000	$200,000	$800,000
TGI	Residential	Conservation Education and Outreach	$0	$2,098,000	$2,098,000	0	$1,718,000	$1,718,000	$0	$1,718,000	$1,718,000
TGI	Residential	Trade Relations	$0	$200,000	$200,000	0	$200,000	$200,000	$0	$200,000	$200,000
TGI	Commercial	Conservation Potential Review				0	$200,000	$200,000			
TGI	Commercial	Conservation Education and Outreach	$0	$2,098,000	$2,098,000	$0	$1,718,000	$1,718,000	$0	$1,718,000	$1,718,000
TGI	Commercial	Trade Relations	$0	$200,000	$200,000	$0	$200,000	$200,000	$0	$200,000	$200,000
TGI	Residential	Innovative Technologies, NGV and Measurement	$400,000	$0	$400,000	$400,000	$0	$400,000	$400,000	$0	$400,000
TGI	Commercial	Innovative Technologies, NGV and Measurement	$400,000	$0	$400,000	$400,000	$0	$400,000	$400,000	$0	$400,000
TGVI	Residential	Conservation Potential Review				$0	$50,000	$50,000			
TGVI	Residential	Energy Efficiency	$86,000	$97,000	$183,000	$168,000	$54,000	$222,000	$257,000	$72,000	$329,000
TGVI	Residential	Fuel Switching	$401,000	$276,000	$677,000	$558,000	$198,000	$756,000	$731,000	$203,000	$934,000
TGVI	Commercial	Energy Efficiency	$310,090	$111,000	$421,090	$470,490	$136,000	$606,490	$922,490	$249,000	$1,171,490
TGVI	Residential	Joint Initiatives	$150,000	$50,000	$200,000	$150,000	$50,000	$200,000	$150,000	$50,000	$200,000
TGVI	Residential	Conservation Education and Outreach	$0	$524,500	$524,500	$0	$429,500	$429,500	$0	$429,500	$429,500
TGVI	Residential	Trade Relations	$0	$50,000	$50,000	$0	$50,000	$50,000	$0	$50,000	$50,000
TGVI	Commercial	Conservation Potential Review				$0	$50,000	$50,000			
TGVI	Commercial	Conservation Education and Outreach	$0	$524,500	$524,500	$0	$429,500	$429,500	$0	$429,500	$429,500
TGVI	Commercial	Trade Relations	$0	$50,000	$50,000	$0	$50,000	$50,000	$0	$50,000	$50,000
TGVI	Residential	Innovative Technologies, NGV and Measurement	$100,000	$0	$100,000	$100,000	$0	$100,000	$100,000	$0	$100,000
TGVI	Commercial	Innovative Technologies, NGV and Measurement	$100,000	$0	$100,000	$100,000	$0	$100,000	$100,000	$0	$100,000
		Subtotals	$7,912,790	$8,913,000	$16,825,790	$10,206,490	$8,389,000	$18,795,490	$11,903,540	$9,086,000	$20,989,540

Table 6.2b below provides a total budget figure, including assumed contributions to joint programs from partners for electrical savings from certain Commercial sector initiatives. There is no assumed contribution from partners for avoided electricity load resulting from the proposed residential fuel switching activities, or for incidental electricity savings resulting from natural gas energy efficiency initiatives in the residential sector.

Table 6.2b - Proposed EEC Expenditure Detail - TGI, TGVI and Partners

			Budget Amount Including Partner Contributions								
			2008			2009			2010		
Utility	Sector	Nature of Program	Incentives	Program Costs	Total	Incentives	Program Costs	Total	Incentives	Program Costs	Total
TGI	Residential	Conservation Potential Review	$0	$0	$0	$0	$200,000	$200,000	$0	$0	$0
TGI	Residential	Energy Efficiency	$1,925,000	$981,000	$2,906,000	$2,350,000	$874,000	$3,224,000	$1,675,000	$747,000	$2,422,000
TGI	Residential	Fuel Switching	$195,000	$164,000	$359,000	$270,000	$139,000	$409,000	$345,000	$219,000	$564,000
TGI	Commercial	Energy Efficiency	$4,112,700	$1,289,000	$4,534,700	$6,162,500	$1,643,000	$6,283,000	$8,749,050	$2,551,000	$8,774,050
TGI	Residential	Joint Initiatives	$600,000	$200,000	$800,000	$600,000	$200,000	$800,000	$600,000	$200,000	$800,000
TGI	Residential	Conservation Education and Outreach	$0	$2,098,000	$2,098,000	$0	$1,718,000	$1,718,000	$0	$1,718,000	$1,718,000
TGI	Residential	Trade Relations	$0	$200,000	$200,000	$0	$200,000	$200,000	$0	$200,000	$200,000
TGI	Commercial	Conservation Potential Review	$0	$0	$0	$0	$200,000	$0	$0	$0	$0
TGI	Commercial	Conservation Education and Outreach	$0	$2,098,000	$2,098,000	$0	$1,718,000	$1,718,000	$0	$1,718,000	$1,718,000
TGI	Commercial	Trade Relations	$0	$200,000	$200,000	$0	$200,000	$200,000	$0	$200,000	$200,000
TGI	Residential	Innovative Technologies, NGV and Measurement	$400,000	$0	$400,000	$400,000	$0	$400,000	$400,000	$0	$400,000
TGI	Commercial	Innovative Technologies, NGV and Measurement	$400,000	$0	$400,000	$400,000	$0	$400,000	$400,000	$0	$400,000
TGVI	Residential	Conservation Potential Review	$0	$0	$0	$0	$50,000	$50,000	$0	$0	$0
TGVI	Residential	Energy Efficiency	$86,000	$97,000	$183,000	$168,000	$54,000	$222,000	$257,000	$72,000	$329,000
TGVI	Residential	Fuel Switching	$401,000	$276,000	$677,000	$558,000	$198,000	$756,000	$731,000	$203,000	$934,000
TGVI	Commercial	Energy Efficiency	$348,490	$111,000	$421,090	$532,890	$136,000	$606,490	$1,477,790	$249,000	$1,171,490
TGVI	Residential	Joint Initiatives	$150,000	$50,000	$200,000	$150,000	$50,000	$200,000	$150,000	$50,000	$200,000
TGVI	Residential	Conservation Education and Outreach	$0	$524,500	$524,500	$0	$429,500	$429,500	$0	$429,500	$429,500
TGVI	Residential	Trade Relations	$0	$50,000	$50,000	$0	$50,000	$50,000	$0	$50,000	$50,000
TGVI	Commercial	Conservation Potential Review	$0	$0	$0	$0	$50,000	$50,000	$0	$0	$0
TGVI	Commercial	Conservation Education and Outreach	$0	$524,500	$524,500	$0	$429,500	$429,500	$0	$429,500	$429,500
TGVI	Commercial	Trade Relations	$0	$50,000	$50,000	$0	$50,000	$50,000	$0	$50,000	$50,000
TGVI	Residential	Innovative Technologies, NGV and Measurement	$100,000	$0	$100,000	$100,000	$0	$100,000	$100,000	$0	$100,000
TGVI	Commercial	Innovative Technologies, NGV and Measurement	$100,000	$0	$100,000	$100,000	$0	$100,000	$100,000	$0	$100,000
		Subtotals	$8,818,190	$8,913,000	$17,731,190	$11,791,390	$8,589,000	$20,380,390	$14,984,840	$9,086,000	$24,070,840

Table 6.2c below provides the net assumed contributions from partners to joint programs for electrical savings from Commercial Initiatives.

Table 6.2c - Summary Table, EEC Contributions by Partners

Net Assumed Partner Contribution											
		2008			2009			2010			Totals
Utility	Sector	Incentives	Program	Total	Incentives	Program	Total	Incentives	Program	Total	2008 - 2010
TGI	Commercial	$867,000	$0	$867,000	$1,522,500	$0	$1,522,500	$2,526,000	$0	$2,526,000	$4,915,500
TGVI	Commercial	$38,400	$0	$38,400	$62,400	$0	$62,400	$555,300	$0	$555,300	$656,100
	Totals			**$905,400**			**$1,584,900**			**$3,081,300**	**$5,571,600**

The total assumed contribution from partners is approximately $5.5 million and does not include any non-incentive costs such as program promotion costs. The assumed contribution is for electrical savings in the Commercial sector only. If partner funding was not available for electrical savings, the natural gas initiatives for the Commercial sector would proceed, but on the basis of providing incentives for natural gas savings alone, rather than combining incentives for natural gas and electrical savings. This assumed contribution does not include any contribution from partners for Residential Fuel Switching programs.

6.3. Energy Efficiency Program Areas

Under the Companies' current guidelines, customer-level marketing and energy efficiency activities for the Lower Mainland and Interior are different from those for Vancouver Island. For the Lower Mainland and Interior, DSM activities at TGI are focused solely on peak shaving and conservation initiatives (also termed "energy efficiency" throughout this document) that aim to reduce natural gas usage by customers, and do not encompass other aspects of DSM such as load building through encouraging fuel switching. TGVI currently only offers customers fuel switching programs, and does not offer customers energy efficiency programs. With this Application, the Companies would like to expand EEC activities so as to offer all customers, regardless of service territory, access to an expanded array of programs. That is, the Companies would like to be able to offer customers on Vancouver Island access to energy efficiency programs and would like to offer Lower Mainland and Interior customers access to fuel switching programs.

The information presented in this sub-section regarding energy efficiency program areas is done so sector (Residential and Commercial) basis. The Residential and Commercial sectors are broken down into initiatives intended for new construction and initiatives intended for the retrofit market. Fuel substitution program area and activities are described under Section 6.4.

6.3.1. Residential Energy Efficiency Program Area ($9.2 million)

Energy Efficiency programs for the residential sector fall under two types of offers – new construction and retrofit. They are summarized in Table 6.3.1 below.

Table 6.3.1 - Residential Energy Efficiency

Program	Components	TGI	TGVI
Residential Energy Efficiency – New Contruction			
EnerChoice Fireplace	EnerChoice Fireplace	X	X
ENERGY STAR Appliances	E* Clothes Washer	X	X
	E* Dish Washer	X	X
Residential Energy Efficiency - Retrofit			
ENERGY STAR Furnace Upgrade	E* Furnace	X	X
EnerChoice Fireplace Upgrade	EnerChoice Fireplace	X	X
ENERGY STAR Appliance Upgrades	E* Clothes Washer	X	X
	E* Dish Washer	X	X

Energy Efficiency for Residential New Construction

The program is targeted at all potential residential new construction customers. It is intended to be complementary to the Companies' System Extension and Customer Connection Policies Review Application, submitted to the BCUC July 31, 2007. In Order No G-152-07 of December 6, 2007 the Commission stated that "Terasen is encouraged to apply for the approval for such [DSM] programs in another forum, where their impact and efficiency as DSM programs can be tested." This document constitutes the Companies' Application for DSM programs for the New Construction market. The key decision makers in this market for the programs detailed below are builders and developers who build single family homes and row-houses. In addition, a number of single-family homes are project-managed by the owners themselves who make planning and purchasing decisions and could be considered in an outreach campaign. There may also be some builders of multi-family dwellings that participate in the incentive programs outlined below. The new construction EEC portfolio in the residential market will include programs that encourage customers, whether they be individuals building a new home, or builders and developers, to install energy efficient appliances. The following programs will be offered to customers and builders:

EnerChoice Fireplace - an incentive will be provided to encourage the purchase and installion an EnerChoice rated fireplace, insert or free-standing stove. (Since there is no Energy Star designation for fireplaces, the Hearth Products Industry has developed the EnerChoice designation, which is applied to fireplaces that are in the top 25% efficiency ranking out of all the fireplaces available in the marketplace.)

Energy Star Clothes Washer and/or Dishwasher – similar to the program offered to customers in the retrofit market, participants who use natural gas as a heating source for Domestic Hot Water ("DHW") will be encouraged to install an Energy Star dishwasher and/or Energy Star clothes washer. The incentive amount will be based on whether they choose to install one or both appliances.

Energy Efficiency for Residential Retrofits

The retrofit program targets all existing residential customers of the Terasen Utilities. The key decision makers in this market are owners and possibly landlords of single-family and row-houses who are either replacing failed equipment or looking to upgrade/improve energy efficiency in existing housing stock.

The retrofit programs will consist of a combination of advertising and promotion and incentives for customers who install Energy Star and/or EnerChoice rated products.

Energy STAR Heating System Upgrade – this program will be a reiteration (since similar versions of this program have been running for a number of years) of the TGI Energy Star Heating System Upgrade program. Customers who install an Energy Star heating system will receive a credit on their Terasen Utilities bill. It should be noted that due to new federal regulations for furnace upgrades in retrofit residential buildings coming into effect December 31, 2009, this program will conclude prior to that date.

At the time that the CPR was conducted, there were found to be a total of 1,534,248 residential units in the TGI service area, of which 155,809 units were pre-1976 single family dwellings ("SFD") or duplexes with gas.[28] These dwelling units would be good candidates to upgrade existing furnaces to high-efficiency models. To contextualize the projections used to derive the

[28] Terasen Gas Conservation Potential Review, Residential Sector Report, Marbek Resource Consultants, April 2006, page 8

funding levels in this Application, the Application contemplates funding a total of 8,180 furnace upgrades up to the end of 2009, at which time a federal regulation is proposed that would make 90% efficiency levels the minimum for all furnaces sold in Canada so utility incentive funding is assumed to cease. This incentive participation level represents funding for incentives for furnace upgrades in 5.3% of pre-1976 single family dwellings (“SFDs”) and duplexes with gas in the Companies’ service territory, and it is based upon current program participation rates.

EnerChoice Fireplaces – customers will be incented if they purchase and install an EnerChoice rated fireplace, insert or free-standing stove. The pilot program will be launched in 2008 in partnership with Hearth, Patio & Barbeque Association of Canada (HPBAC) who will provide assistance in promotional and educational aspects of the program.

Energy Star Appliances – existing customers who use natural gas as a heating source for Domestic Hot Water (“DHW”) will be encouraged to install an Energy Star dishwasher and/or Energy Star clothes washer. The incentive amount will be based on whether they choose to install one or both appliances. These measures provide savings by reducing the amount of water that needs to be heated by gas, but they also result in ancillary electricity savings from more efficient electric motors.

The Energy Star Heating Upgrade Initiative has existed in different forms since the current level of DSM funding available to TGI was established in 1997. In the 1997 DSM Semi-Annual Status Report, submitted by BC Gas Utility Ltd. on November 19, 1997, the number of participants in the heating upgrade program was 68 at the time of reporting, projected to grow to 205 by year-end. This year’s program, running as noted above from September 1 2007 to March 31 2008 is projected to have 3300 participants, a notable gain in program participation.

6.3.2. Commercial Energy Efficiency Program Area ($21.7 million)

As with the residential sector, energy efficiency initiatives for the commercial sector will also fall under retrofit and new construction programs.

Energy Efficiency for Commercial New Construction

The new construction program is targeted at all commercial new construction which might use natural gas space and water heating. Looking at current new commercial construction, the immediate opportunities are likely to be Multi-Family Dwellings ("MFDs") and Commercial office space. Eligible buildings may also include some institutional (government buildings, schools and post-secondary institutions). It should be noted that incentives, building design and heating and hot water systems for MFDs are covered by the program proposals below, in the Commercial Section of this program activity description, rather than in the Residential Section.

The key decision makers in this market are owners including: governments; builders/developers; architects; engineers; interior designers; mechanical consultants; and contractors.

Table 6.3.2 below lists some potential areas for activity in the Commercial New Construction sector. Program design is complex in the Commercial New Construction sector, so the table below merely summarizes areas of program activity.

Table 6.3.2 - Commercial Energy Efficiency - New Construction

Program	Components	TGI	TGVI
Efficient New Construction	Efficient Design (30% Below Current Practice, Large Commercial Buildings)	X	X
	Efficient Design (30% Below Current Practice, Medium Commercial Buildings)	X	X
	Efficient Design (60% Below Current Practice)	X	X
	High Insulation Technology (HIT) Windows	X	X
Boilers	Near Condensing Boilers	X	X
	Condensing Boilers	X	X
Water Heating	Instantaneous DHW Heaters	X	X
	Condensing DHW Boilers	X	X
	Condensing DHW Heaters	X	X
	Drainwater Heat Recovery	X	X

Energy Efficiency for Commercial Retrofits

The commercial retrofit program is targeted at all commercial and industrial buildings with existing natural gas fired space and water heating equipment. These include, but are not limited to:

- MFDs and commercial office space;
- Institutional (any government buildings, post-secondary campuses and schools);
- Hospitals;
- Hotel/motel buildings;
- Malls.

The key decision makers for retrofit equipment replacement decisions are building managers and owners.

There are two drivers for replacing/upgrading existing equipment in retrofit markets: equipment at the end of life and products that are replaced before the end of life to obtain energy efficiency savings. The table below lists some potential areas for activity in the Commercial retrofit market. Due to the potential complexity of programs for the commercial sector, Table 6.3.2a below merely summarizes areas of program activity. More detailed program development work must be completed by the Companies in conjunction with industry groups before these programs are rolled out.

Table 6.3.2a - Commercial Energy Efficiency - Retrofits

Program	Components	TGI	TGVI
Boilers	Near Condensing Boilers	X	X
	Condensing Boilers	X	X
Building Recomissioning		X	X
Next Generation Building Automation Systems (“BAS”)	Next Generation BAS	X	X
Demand Control Ventilation (“DCV”)	DCV (Large Commercial Buildings)	X	
	DCV (Medium Commercial Buildings)	X	
High Efficiency (“HE”) Rooftop Units	HE Rooftop units	X	X
Water Heating	Instantaneous DHW Heaters	X	X
	Condensing DHW Boilers	X	X
	Condensing DHW Heaters	X	X
	Drainwater Heat Recovery	X	

Programming for the Commercial sector in general is intended to offer qualified commercial customers a menu of programs from which to choose. Terasen Utilities staff will work with the participants in selecting the most appropriate program and/or component.

6.4. Residential Fuel-Switching Program Area ($3.7 million)

The Terasen Utilities firmly believe that the use of natural gas where available for high-efficiency end-use appliances in place of electricity results in lower GHG emissions overall in the region, as it makes more of BC's "green" electricity resource available to its best use to displace coal and lower efficiency gas fired generation throughout the region.[29]

Fuel substitution initiatives benefit all customers by ensuring that the Terasen Utilities' distribution infrastructure is used to its maximum efficiency. This is especially true of TGVI, where homes that have not made the step to connect to gas exist in proximity to gas mains. Existing customers have already invested in putting those gas mains in the ground, therefore connecting as many customers as possible to the natural gas distribution system will keep overall system costs down. It should be noted that the fuel switching activity for the retrofit market is focused on Vancouver Island, and would be based on encouraging residents in the TGVI service area to get off oil, and onto efficient natural gas, resulting in lower GHG emissions. Table 6.4 below summarizes at a very high level the program areas for fuel switching activity.

Table 6.4 - Residential Fuel Switching

Program	Components	TGI	TGVI
Residential Fuel Switching – New Construction			
Natural Gas Water Heating	NG DHW		X
Natural Gas Appliances	NG Range	X	X
	NG Dryer	X	X
Residential Fuel Switching – Retrofits			
Natural Gas Appliances	FS Range		X
	FS Dryer		X
Furnace Fuel Substitution	Furnace		X
Fireplace Fuel Substitution	EnerChoice Fireplace		X

29 Coal and gas fired generation are on the margin throughout the western interconnection. New combined cycle gas turbines operate at only approximately 50% efficiency, whereas newer natural gas water heaters and space heaters can operate as high as 95% efficiency.

Fuel Switching for Residential New Construction

Provincial regulations taking effect January 1, 2008, require that all natural gas forced air furnaces in all new construction meet the Energy Star standard. This presents two major areas of concern from the perspective of fuel efficiency and GHG emissions. As discussed previously, gas water and space heating is more efficient and results in lower GHG emissions on a regional basis than electric space and water heating. First, the higher relative cost of the Energy Star rated natural gas furnaces may persuade some builders to switch to electric space heat. Second, non-Energy Star natural gas furnaces were able to be vented in such a manner ("b-vented") that the vent for the furnace could be shared with the vent for a natural gas hot water tank. Energy Star furnaces cannot share a vent with a natural gas hot water tank, so the regulation for Energy Star furnaces may cause builders to install electric hot water installations to avoid the cost of venting for the already more expensive natural gas hot water tank.

To encourage the usage of natural gas among its customers, the Terasen Utilities would offer the following fuel-substitution programs:

Installation of **natural gas water heating** along with natural gas space-heating equipment – the Companies may bundle this program as a package with Energy Star appliances.

Installation of **natural gas range** and/or **dryer** – TGVI and TGI qualified applicants will receive an incentive if they install one or both appliances.

The primary objective of the fuel-switching offers is to promote the most optimal balance in energy share between electricity and natural gas, preserving BC Hydro's generation and transmission systems for its highest value – in running lights, computers and other technology.

Fuel Switching for Residential Retrofits

TGVI has been running residential programs on Vancouver Island and the Sunshine Coast for a number of years. These programs have encouraged owners of existing homes on Vancouver Island and the Sunshine Coast to convert from higher emission propane and fuel oil to natural gas. Incentive funding for fuel substitution retrofits is only contemplated for TGVI and not for TGI, as it is felt that the bulk of the potential in the TGI service territory has already been addressed. The benefits from fuel substitution programs for existing homes on Vancouver

Island as described below are significant: GHG emissions are reduced through the switch from wood, propane or fuel oil to natural gas for space heating and fireplaces, and BC Hydro and BCTC avoid adding additional capacity to serve water heating, cooking and clothes drying load on an already stressed transmission and distribution system. TGVI would like to initiate a fuel-substitution portfolio intended to retrofit homes on Vancouver Island to include the following programs:

Natural Gas Heating System Upgrade - customers who switch to a natural gas heating system in an existing home will receive an incentive from Terasen Gas. Existing residences in the TGVI service territory will be offered an incentive not only for switching to natural gas, but also for installing Energy Star equipment. The current regulatory regime for TGVI does not allow Terasen to offer customers who switch to natural gas an incentive to install Energy Star equipment. We would like to be able to do so and would in fact restrict the provision of an incentive to furnaces and boilers rated Energy Star.

Fireplace - customers in existing homes will be incented if they purchase and install an EnerChoice rated fireplace, insert or free-standing stove.

Natural Gas Range and Dryer – these two additional fuel-switching programs will encourage customers to replace their existing electric or propane range and/or an electric or propane dryer to a natural gas range and/or dryer.

6.5. Conservation Education and Outreach Program Area ($13.8 million)

In addition to program-specific education and outreach funding (that is, funding designed to communicate information to potential participants concerning a specific DSM program), the Terasen Utilities are also requesting funding with this Application for non-program-specific education and outreach activities as part of this program area. These are projected to include:

- Stakeholder industry group relations activities (for example, the first time homebuyers' and renovation seminars that are mounted by various homebuilder and realtor groups)
- Increasing the activity of "Team Terasen", a public outreach team that attends public events in the Lower Mainland, with a goal of informing the public about actions that they can take to improve the energy consumption of their homes

- Supporting conservation education within BC's schools
- Partnering with others to support an annual Energy Forum for British Columbia
- A comprehensive communications campaign, outlined in the attached proposal from Wasserman Partners, aimed at supporting the creation of a "culture of conservation" in British Columbia

The Conservation Campaign contemplates funding of $5.245 million in the first year, and $4.295 million per year in years two and three. The Companies feel that the greenhouse gas reduction goals of the Province will require a shift in consumer activity even more challenging to achieve than educating Terasen Gas' residential gas customers about the opportunity to sign a fixed rate contract with a gas marketer. As such, the level of spending being contemplated is higher than approved for Residential Unbundling. The key focus of the education and outreach initiative would be to educate customers, equipment installers, and the public at large about the importance and benefits of managing energy consumption.

6.6. Funding for Joint Initiatives Program Area ($ 3 million)

The Companies propose with this Application that $1 million per year in each of 2008, 2009 and 2010 be approved for development and pursuit of joint initiatives as they arise. Three such joint initiatives that the Companies will pursue if the Application is approved are outlined below. The funding of this program area will be used to support the initiatives of partners, and as such, the initiatives outlined below are those that the Companies are aware of today. Other Joint Initiatives may arise in the future, and if additional funding is warranted for future Joint Initiatives, the Companies intend to re-allocate funding from another program area if there is one that is under-spent. Alternatively, if all funds for each program area approved with this Application are expected to be used, the Companies would expect to make separate application to the Commission for approval of additional EEC expenditures for Joint Initiatives.

6.6.1. DSM for Affordable Housing

The Companies recognize that all British Columbians across all income sectors need access to energy efficiency programs. The low income sector is distinct in that there are significant capital and other barriers that are more difficult to overcome than in the "able to pay" market segments.

The natural priorities of this sector are such that many energy efficiency and conservation opportunities fall out of reach. The Ministry of Energy, Mines and Petroleum Resources has asked that the Terasen Utilities lead a working group on DSM for Affordable Housing. The Terasen Utilities' have convened the group, which has had three meetings to date. The goal of the working group is to find ways and means to deliver Energy Efficiency to the Affordable Housing sector in British Columbia. Funding for the Companies' participation in a DSM incentive program for the Affordable Housing sector will come from the Joint Initiatives allocation, if the Application is approved.

6.6.2. Support for Audits for a Provincial Home Retrofit Program

The Ministry of Energy, Mines and Petroleum Resources has expressed its intention to implement a province-wide home retrofit program, known as LiveSmartBC, to work with the Government of Canada's eco-Energy program. The Companies understand that the proposed provincial program does not currently contemplate funding for the post-retrofit audits that are required in order to claim the federal eco-Energy grants. One possible area of joint activity for the Companies and the Ministry would be for the Companies to fully or partially fund the post-audits required for the Companies customers to be able to claim the provincial and federal retrofit incentives available under this program. Customers would benefit by having a potential barrier to participation (the cost of the post-audit) reduced or removed, and would therefore be able to participate more readily in any such program. Funding for the Companies' participation in a post-retrofit audit program will come from the Joint Initiatives allocation, if the Application is approved.

6.6.3. Building Labeling

Policy Action 6 in the 2007 Energy Plan contemplates a pilot project for energy performance labeling of homes and buildings. Labeling buildings with information about building efficiency, and the resultant energy consumption and costs is a key part of informing the public about the importance of energy conservation. The Terasen Utilities intend to undertake a co-funding a pilot energy performance labeling program for new and existing gas-heated homes if the Application is approved. The amount of incremental DSM funding that Terasen would allocate to support such an initiative would be dependent on the size of the pilot program. Labeling benefits ratepayers by providing them with a means to compare energy consumption levels between homes. Building energy consumption labeling could be made a requirement for participation in incentive programs, particularly in new construction. Funding for the Companies' participation in a building labeling program will come from the Joint Initiatives allocation, if the Application is approved.

6.6.4. Community Action on Energy Efficiency ("CAEE")

The Companies have participated in the program committee for this provincial initiative (Policy Action #9 from the 2007 Energy Plan), and have contributed funds to print a policy manual that came out of Community Action on Energy Efficiency. The Companies believe this is a worthwhile initiative, since municipalities have the ability to influence the energy consumption levels of new construction in their communities through such processes and methods as permit costs and priorities, zoning changes and floor area ratio bonusing. The Companies would make a financial contribution to the pool of funds to which municipalities can apply under the CAEE initiative, should this Application be approved.

6.7. Trade Relations Program Area ($1.5 million)

The support and education of skilled trades, equipment manufacturers, distributors, suppliers and retailers, as well as appliance and equipment salespeople and Realtors, is crucial to the success of an Energy Efficiency and Conservation program. The funding being requested for Trade Relations with this Application will support the activities of a Terasen Utilities staff member focused on Trade Relations as it relates to energy efficiency. Areas of activity that the Companies will undertake following approval of the Application are anticipated to include the following:

- manufacturer and supplier relations initiatives
- working with trade associations to educate their membership on the benefits of various energy efficient technologies, as well as working to ensure that skilled tradespeople are adequately trained on the installation of energy efficient technology
- working with Home Builders Associations to educate their membership on the benefits of energy efficient homes
- working with Realtors' Associations to educate their membership on how to promote a homes' energy efficiency features

- working with manufacturers and distributors to ensure that energy efficient technologies are available in the marketplace
- working with appliance salespeople to educate them about the benefits to their customers of selecting a more energy efficient appliance

6.8. Conservation Potential Review ($500,000)

Funding is being requested with this Application to update the Terasen Utilities Conservation Potential Review in 2009. The updated Conservation Potential Review Study would be received in 2010, and would then form the basis of an application to the Commission for the next tranche of Energy Efficiency and Conservation funding for the period 2011 to 2014.

6.9. Innovative Technologies, NGV and Measurement Program Area ($3 million)

The Companies are in a unique position to foster and further the deployment of forward-looking low carbon technologies, including measurement technologies, and are therefore seeking funding with this Application, specific to this arena. The amount and activity for Innovative Technologies, NGV and Measurement will need to be refined – if an effective program in Innovative Technologies, NGV and Measurement can be developed over the funding timeframe, the Companies wish to have to the ability to fund such a program over the funding timeframe. The activity in this area would be in the nature of pilot programs, with limited time frames, geographic areas and number of installations. Some reasons that program activity would be considered not viable would be if the technologies prove to be prohibitively costly, or cannot be readily installed or serviced using local tradespeople, or are found to not provide adequate long term potential for widespread implementation.

This Section of the Application provides an overview of potential areas of opportunity for innovative technology investment that the Companies intend to pursue if the Application is approved. The information is divided into energy efficiency and fuel substitution activities, and by sector (Residential and Commercial).

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, all having the same underlying characteristics:

1) Each promotes the efficient use of natural gas through sustainable design
2) None are currently a mainstream technology
3) Each offers the potential for at least a 10% GHG benefit.

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.

Funding eligibility and incentive amounts are provided in Table 6.9.6 for budgetary purposes, but would require further analysis before implementation and would include both new construction and retrofit opportunities.

6.9.1. Innovative Technologies

This Section provides an overview of energy efficiency initiatives the Companies intend to pursue through the use of innovative technologies, if the Application is approved. The target market would include all residential and commercial applications.

Residential

Hydronic based heating systems - Hydronic heating systems use liquid (heated water or glycol usually) to distribute energy for space and domestic hot water heating through a supply and return closed-loop insulated piping system. The methods can include radiators, baseboards or fan coils, or a combination. The flexible nature of this system is that the heat input can be changed with changes in technology, knowledge or public policy, thus promoting a more sustainable energy design. Where an old low efficiency boiler might have been used an upgrade can be made to a high efficiency condensing boiler, and eventually a change could be made to supply heat to the water from biomass, ground or solar sources. By utilizing this type of system, an owner will be in a position to replace one type of heat source with another that is cleaner as technology advances. Given existing technologies, upgrading from a low-efficient boiler to a high efficient boiler could result in a 20-30% reduction in natural gas consumption. For the average family home this alone would be equivalent to 725 to 900 Kg of CO2e/yr.

The cost on average for hydronic underfloor system materials is estimated to be about $4,000, not including the boiler. The average cost of hydronic baseboard materials is estimated to be about $2,000, again not including the boiler.

In order to promote a sustainable energy design, the Companies would consider providing incentives up to 25% of cost of the hydronic underfloor piping materials (oxygen barrier tubing) to a maximum of $1,000 and hydronic baseboard materials up to 25% and a maximum of $500.

Integrated Energy Systems (or combo systems) - Integrated Energy or “combo” Systems are defined as a single appliance supplying both space and domestic hot water (DHW) heating. Combo heating systems can be cost effective and increase the operating efficiency of tank-style water heaters by reducing their normal standby energy losses. The hot water tank can be connected to a fan coil to provide forced air heating, and the fan coils can be upgraded to provide air conditioning as well. Combo systems can also be connected to in-floor tubing to provide in-floor radiant heat.

TGI is already encouraging efficient boilers in new construction with heat exchangers through the existing Efficient Boiler Program, although the smallest boiler is 300,000 Btu/hour, thus precluding residential boilers from this program. There is a possibility that more high efficient hot water tanks could be utilized in combo systems.

GHG savings would be accomplished through energy use improvements in domestic water heating. Standard gas hot water tanks are about 60% efficient and moving this part of the load to above 90% efficiency would certainly reduce GHGs.

A program to fund high efficiency (condensing) hot water tanks used for space and domestic hot water heating would help to drive demand for high efficiency gas hot water tanks. Right now these types of tanks cost about $3,000-$3,500 compared to $450-650 for a standard gas hot water tank. Installation costs would be comparable for both tanks. Instantaneous or tankless systems can be used for this Application as well. Given that the average single family dwelling consumes 25 GJs of gas for domestic hot water, moving from 60% to 90% efficiency would produce savings of about 8.3 GJs per household per year. This could equate to a reduction of about 400 kilograms/year of CO2e on the domestic hot water side. The Terasen Utilities would consider providing incentives up to 25% of total cost of condensing hot water tanks to a maximum of $1000. This would cover condensing instantaneous and condensing storage type of water heaters.

Solar thermal - A subset of hydronic heating systems, solar systems also use water or glycol heated by the sun, with the thermal energy transferred for domestic hot water or space heating. Solar space and water heating is usually supplemental to existing systems, reducing the requirement for the primary energy source used in the system.

Solar thermal space heating is cost prohibitive today and would likely add about $30,000 to the cost for average new home construction. Solar thermal domestic water heating costs about $8 000 for an average house and can be used as a supplement to the existing hot water tank to supply roughly half of the yearly water heating energy requirements.

Any solar energy usage results in GHG savings for that part of the load that it displaces. As a result, GHG production can be reduced by about 50%.

The average household uses approximately 25GJ/year for domestic water heating. If there was an annual reduction in gas usage of 12.5 GJ/year, that would reduce household greenhouse gas production by approximately 600 kilograms/year of CO2e.

The Companies would consider providing incentives of $500 towards solar pre-piping as long as a gas hot water tank is installed.

Commercial

As with the residential sector, energy efficiency programs for the commercial sector will include retrofit and new construction programs.

These include, but are not limited to:
MFDs and commercial office space;

Institutional (any government buildings, post-secondary campuses and schools);
Hospitals;
Hotel/motel buildings;
Malls.

Hydronic based heating systems – As with residential applications hydronic heating systems for commercial applications use water or glycol to distribute energy for space and domestic hot water heating through a supply and return closed-loop insulated piping system. In commercial applications or multi-unit residential buildings, the initial heat is usually supplied through a central boiler system. Along with supply through radiators, baseboards or fan coils, independent in-suite hydronic installations are available through compact boilers and dual mode hot water tanks. Again, the flexible nature of these systems is that the heat input can be changed with advances in technology, thus promoting the latest sustainable energy practices. Even further efficiencies can be gained in MFDs if suites are individually metered as there are studies that show 20 – 30% reductions in natural gas consumption and GHG emissions when consumption is measured and known.

The cost of a particular hydronic system is based largely on the size of commercial building. As with residential systems, the Companies are contemplating offering an incentive for a portion of the cost of either underfloor piping materials or hydronic baseboard materials in commercial buildings, including MFDs. Due to the high degree of variability in hydronic system installation costs in commercial buildings, further program development must be undertaken to develop an appropriate incentive level for this heating technology.

Solar thermal – For Commercial applications, solar heating can be a great fit with gas water and space heating. As with residential applications, solar heating is supplemental and allows reductions in gas use by as much as half. As a result GHG emissions can also be reduced up to 50%.

For commercial buildings the Companies would consider matching all or part of the ecoEnergy incentives which pay $10/GJ saved up to 25% of the project and up to $50,000 total. The GHG savings are easily calculated at .05 tonnes of CO2e/GJ conserved.

6.9.2. Fuel-Substitution Initiatives

Similar to the Innovative Technologies programs, the Terasen Utilities fuel-substitution initiatives will target new construction and retrofit markets in both TGI and TGVI. Fuel-substitution under this category refers to the displacement of natural gas using cleaner renewable technologies. GHG benefits will come from burning a cleaner fuel and or from blending such fuels with natural gas. Any overall energy efficiency gains combined with the volume of natural gas displaced results in fewer GHG emissions.

Due to the potential complexity of programs for this initiative, the discussion below merely summarizes areas of potential program activity. More detailed program development work must be completed by Terasen in conjunction with industry groups before such programs are rolled out. The Companies would only allocate funding to such initiatives if it appears that effective programs can be developed.

Residential

Hydrogen / Fuel Cell Power Generation - Hydrogen and hydrogen fuel cell projects currently appear to be some time away from being commercially viable. However, natural gas reformation is presently one of the most economic ways to produce hydrogen. The Companies are monitoring developments in this industry closely and are currently a member of Hydrogen Fuel Cells Canada. In some applications, burning hydrogen from natural gas reformation can be 30% more efficient than burning natural gas directly, and therefore, involvement in this field will likely continue to be important.

Stationary natural gas fuel cell projects for residential homes are currently underway in Japan where customers are seeing a 20-30% savings on their energy bill. This program is heavily subsidized by the government and would likely only be feasible on a small scale demonstration project.

The Companies would consider offering incentives on a trial basis for demonstration projects that support the hydrogen industry using natural gas as its primary fuel source.

Commercial

Biogas – the Terasen Utilities are in the process of conducting a feasibility study on the development of a biogas market in British Columbia and the role the Companies may play in the industry. TGI has been approached by a handful of parties interested in participating in a pilot project to inject pipeline quality biogas into its distribution system.

Preliminary economic analysis has determined that many biogas projects are unlikely to stand on their own from a financial perspective. As such, they would require subsidization or support through a relative premium paid for the commodity. TGI has been working with Metro Vancouver and their Lions Gate Treatment Plant to examine the possibility of injecting upgraded biogas produced from its operations into the Companies' distribution system.

Efforts have begun through dialogue with provincial government employees from Ministry of Energy Mines and Petroleum Resources, the Ministry of Agriculture, the Ministry of Environment, and the Premier's Technology Council to evaluate the environmental and community benefits of the development of a biogas industry in British Columbia.

While investigation into this field is preliminary, the Companies feel there may be a an opportunity to invest in several biogas projects over the next few years which would supplement the distribution systems with renewable fuels, thus displacing natural gas by the amount of biogas accepted into the distribution system.

6.9.3. NGV - Natural Gas Vehicle projects

Natural gas vehicle projects have a number of opportunities to reduce GHG emissions over conventional fuel choices and further increase energy efficiency and emission savings by utilizing liquefied natural gas in heavy-duty vehicle applications or utilizing renewables or hydrogen in combination with natural gas in specific transportation applications.

Vehicle Grants – In order to continue to promote the use of a growing variety of natural gas vehicle applications, customers that would not otherwise be eligible for grants under Rate 6 may be eligible through this fund instead. Grants for light duty vehicles are currently $1,500-$2,500 per vehicle, medium duty vehicles are $5,000 and heavy duty vehicles are $10,000. Special demonstration grants are available as well of up to $100,000 per year.

Hydrogen / Compressed Natural Gas blended projects (“HCNG”) - Unlike conventional Compressed Natural Gas (“CNG”) vehicles, new technology is emerging whereby hydrogen is blended at the pump with compressed natural gas: a 20% blend of hydrogen is added to the fuel. The mix is then dispensed into a tank on the vehicle and the 80/20 blend is burned in a standard natural gas engine. TransLink has a demonstration project underway with 4 buses utilizing this blend. HCNG is one of the most promising near-term opportunities for utilizing hydrogen in vehicles and moving towards a more hydrogen driven economy. As hydrogen burns cleaner than natural gas, further emission reductions are gained and 10-20 % GHG reductions over CNG can be achieved. Other HCNG initiatives may include fuel for trains, fleets and other vehicle applications.

The Companies see participation in this field as a viable opportunity to promote cleaner natural gas vehicles and projects would be reviewed on an individual basis.

Biogas vehicles - Biogas as explained above is the capture of methane from organic waste. This methane can be cleaned up and utilized in several different ways, one of them being as a vehicle fuel. The emission reductions from such initiatives can be significant.

6.9.4. Stationary Power Generation

There are several new stationary power generation projects underway whereby natural gas is used as the feedstock to provide heat and power to homes, ships and other commercial buildings. As mentioned above, the Terasen Utilities are keeping a close eye on this industry and foresee the potential for participation in this field. Funding would only be allocated to this initiative if further potential developed.

6.9.5. Measurement

Residential

The target market for real-time energy consumption would be multi-family complexes such as town-houses, row-houses and high-rise multi unit buildings.

Real-time energy consumption measurement - Real-time energy consumption metering can be an important tool in energy measurement and management. A reduction in energy use of 20-30% in multi-family developments can result from enhanced visibility and individual energy measurement with the installation of individual meters. The program objective will be to provide customers with the initial tools and data necessary to reduce energy use and increase efficiencies.

The Companies would consider providing an incentive for builders and developers of $100 per suite to install individual meters or thermal metering to cover the cost of added fittings, valves and promote the use of energy measurement.

6.9.6. Other

Other potential Innovative Technologies include natural gas powered generation for ships while in Port (to reduce or eliminate the need to idle on diesel), net zero buildings and district energy solutions using renewables.

Table 6.9.5 below shows the breakdown for expenditures in all program areas:

Table 6.9.5 - Proposed Expenditure Innovative Technologies, NGV and Measurement

Innovative Technologies, NGV and Measurement						
Utility	Sector	Nature of Proposed Expenditure	2008	2009	2010	Total
TGI	Residential	Incentives	$400,000	$400,000	$400,000	$1,200,000
TGI	Commercial	Incentives	$400,000	$400,000	$400,000	$1,200,000
TGVI	Residential	Incentives	$100,000	$100,000	$100,000	$300,000
TGVI	Commercial	Incentives	$100,000	$100,000	$100,000	$300,000
		Total	$1,000,000	$1,000,000	$1,000,000	$3,000,000

6.10. The Industrial Sector

The Companies have not included energy efficiency initiatives for industrial customers, namely those in TGI Rate Classes 22, 27 and 7 or the three TGVI transportation customers (BC Hydro, the VIGJV and TGI for Squamish), within this Application. The Companies did not originally plan for specific programs for industrial customers based upon the following:

- The Companies' industrial customers typically have diverse needs that may not be met by a generic EEC program. Individualized EEC programs may be required to meet specific customer requirements. Further, separate tariff supplements or rates approved by the Commission may be required.
- The Companies' industrial customers generally make energy efficiency decisions based largely on the economic payback. As such, it may be difficult for the Companies to provide the level of EEC financial support that would make an energy efficient decision economic to an industrial customer.
- The majority of an industrial customer's gas energy cost is the cost of commodity which is supplied by a gas marketer, not the Terasen Utilities. Further, because industrial customers pay market rates for commodity, they make energy decisions, including fuel switching, based upon the price of commodity. Increases in gas commodity prices have resulted in many customers switching to other fuel types; energy efficiency is not the main driver for this action.
- The Terasen Utilities had not received significant demand from industrial customers for such initiatives.

However, at a recent workshop the Companies had inquiries from stakeholders about the possibility for EEC programs for industrial customers. Further, with the release of the 2007 Energy Plan and the introduction of the carbon tax, the Company believes that there is a greater need for industrial EEC programs. At this stage, the Companies believe that some potential areas of activity in the industrial sector are individual customer CPRs at large industrial sites, equipment-specific feasibility studies, and measurement and contributions to efficiency improvements for lumber kilns.

In the event that the Application is approved, the Terasen Utilities intend to establish an industrial customer EEC working group and convene in Q3 2008 to determine the need for industrial EEC programs, the type of programs that would be beneficial to the industrial customer base, and the funding required in support such programs. Should the results of the working group indicate that programs and expenditures are warranted, and the Companies are supportive of the programs and expenditures, the Companies would submit a report and request for additional funding and approval as part of the TGI Annual Review and TGVI Settlement Update in Q4 2009.

6.11. Staffing

Implicit in increased Energy Efficiency and Conservation activity will be a need for an increase in staffing at Terasen Gas. Costs associated with staffing for programs have been included in Program Costs for each measure, and are incremental requirements by program. Program and incentives are broken down in Table 6.1a in Section 6. These staffing costs are included in the $56.6 million for EEC expenditures for which approval is being sought in this Application. The required total person years ("py") to support the EEC programs proposed in this Application are summarized in Table 6.11, by year:

Table 6.11 - Proposed EEC Staffing Levels, in Person Years, by Year

	2008 (py)	2009 (py)	2010 (py)	Total (py)
Program Development	1.6	0	0	1.6
Program Operations	9.6	12.9	16.5	39.1
Evaluation	0.8	0.1	5.2	6.0
Total Staffing	12.0	13.0	21.7	46.7

The Terasen Utilities currently has a core Energy Efficiency and Marketing staff of four. Support for the Terasen Utilities current DSM activity is provided by the Technical Sales Support staff (four staff), the Commercial and Industrial Account Management team (eight staff), and the Residential New Construction Account Management team (eleven staff), on a part-time, as-needed basis. The Companies anticipate increasing core staffing as well as using the resources of outside consultants where appropriate to design, implement, deploy and manage the EEC activity outlined in this Application. This Application contains a request for funding to 2010. The Companies anticipate filing an Application for activity post-2010 during that year, so presumably would have an ongoing need for a certain level of DSM staffing.

6.12. Financial Treatment for Energy Efficiency and Conservation Expenditures

This section discusses the financial treatment of EEC expenditures.

Current Regulatory Accounting

As discussed in Section 3, for TGI, program costs are currently recorded as O&M, and incentives and rebates are charged to a regulatory asset deferral account and amortized over three years. For TGVI, program costs are recorded as O&M and incentives and rebates are charged to a regulatory asset deferral account and amortized over one year. The Companies propose to treat the incremental EEC expenditures above amounts already approved as part of TG PBR Extended Settlement and TGVI RR Extended Settlement as capital.

Regulatory Accounting For Incremental EEC Expenditures

The Terasen Utilities propose that the incremental EEC expenditures and existing incentive amounts in TG PBR Extended Settlement and TGVI RR Extended Settlement (TG - $1.5 million and TGVI - $.650 million) be treated in the same manner by charging them to a regulatory asset deferral account on a tax-adjusted basis, the balance of which is amortized over twenty years, with amortization commencing the year following the year in which the expenditure is made. Proposed EEC expenditures will be recovered from the customers of each utility based on the expenditures incurred by each utility. Allocations of costs to customer classes will be done in a manner consistent with current practice for each utility. The change in amortization period will smooth the impact to rates from the proposed increase in expenditure. The twenty year period is more representative of the benefit received by customers from the EEC expenditures resulting in appliance and energy system installations with a weighted average measurable life of 22.5 years. Many of the measures proposed have equipment lives of greater than twenty years, the Companies believe that it is reasonable to expect that the savings from the measures proposed in this Application will persist for at least twenty years, thus the twenty year amortization period was selected. BC Hydro currently amortizes DSM expenditures over a ten year period, while FortisBC amortizes DSM expenditures over the life of the measure being funded, and thus has some DSM expenditures that are amortized over thirty years.

Twenty years was selected by the Companies as being a good balance between recognizing the persistence of savings, and keeping natural gas rates competitive with other energy forms by avoiding an excessively short amortization period. Customer rate impacts are discussed further in Section 7.1. A twenty year amortization period is consistent with the Commission's guidelines regarding accounting for DSM expenditures, as per Commission Order No. G-55-95, dated June 29, 1995, that states "A utility may apply for a normal write-off longer than 10 years". It is the Companies view that the amortization period of twenty years better matches the cost recovery to the period over which benefits will accrue to customer.

Practices of Other Utilities

This financial treatment is consistent with an approach used by other utilities in British Columbia.

British Columbia's two major electric utilities, BC Hydro and FortisBC, capitalize EEC expenditures in a regulatory deferral account.[30] BC Hydro and FortisBC's DSM programs are discussed in detail in Appendix 4, "Other Utilities Detail".

Although some utilities have a DSM incentive based on energy savings targets, the Companies felt that setting such a target on which an incentive would be paid could prove to be challenging and contentious, given that the Companies have not previously established a target for energy savings from DSM expenditures. Setting a target could also be a time-consuming and costly exercise, as first a target would need to be developed and proposed by the Companies, which target would then need to be investigated and debated by stakeholders.

International Financial Reporting Standards (IFRS)

The proposed financial treatment of EEC expenditures is currently permitted under Canadian Institute of Chartered Accountants ("CICA") Handbook section 3062 "Goodwill and Other

[30] Prior to early 2008, the funding of BC Hydro's capital expenditures (including capitalized Power Smart DSM spending) for revenue requirement purposes was considered to be 100% debt based on the definition of equity for BC Hydro set out in Heritage Special Directions HC1 and HC2. In early 2008 the provincial government amended the definition of equity for BC Hydro by Orders-in-Council 27 and 28 dated January 17, 2008. The new equity definition includes a deemed equity component of 30% for revenue requirement purposes. This means that new capital expenditures (including capitalized Power Smart DSM spending) will now be funded by a combination of debt and equity and that BC Hydro will earn an equity return on the deemed 30% portion of capital spending.

Intangible Assets". Effective for 2009, a new CICA Handbook section 3064 "Goodwill and Intangible Assets" will replace section 3062. Under the new section, DSM expenditures are expected to continue to meet the requirements of the Handbook for deferral. Should DSM expenditures fail to meet those criteria, they would qualify for deferral in the GAAP hierarchy under the provisions of SFAS 71 "Accounting for the Effects of Certain Types of Regulation". However, the Accounting Standards Board of Canada has recently adopted the strategy of replacing Canadian Generally Accepted Accounting Practices ("GAAP") with International Financial Reporting Standards ("IFRS"). This change will be effective 2011 for all publicly accountable entities, including the Companies, and thus will not affect the expenditures incurred in 2009 and 2010. The Companies are of the view that the proposed financial treatment of EEC funding also meets the requirements of IFRS. If, however, after further discussion and closer examination in conjunction with auditors and other utilities, the EEC funding failed to pass these tests, then the Terasen Utilities will revisit the program to ensure that it continues in a fashion which maintains an alignment on interests between customers, investors and government policy.

6.13. Portfolio Approach to EEC Programs, and Alignment of Program Cost/Benefit Analysis Practices Across the Terasen Utilities

In this Application the Companies are recommending that to evaluate EEC programs the following filters apply:

a) Portfolio Approach
b) Exclude Free Riders Effect
c) Attribution.

These filters are discussed below.

Portfolio Approach

The Terasen Utilities propose that all energy efficiency and fuel switching initiatives for both TGI and TGVI be evaluated using the cost-benefit tests outlined in the "California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects", which is attached as Appendix 12. The Companies propose that the EEC portfolio be evaluated on an overall combined basis, rather than on individual initiatives or program areas. That is, some individual initiatives may have a TRC test result of less than one, however the overall EEC portfolio would need to have a TRC test result of at least one.

By following this approach, the Companies would be in a position to encourage ever-increasing levels of efficiency in natural gas equipment, including that equipment which is relatively new to the market and as such, has a higher initial cost due to the fact that it has not yet reach economies of scale and therefore may have a TRC lower than 1.0. Further, usage patterns in some geographic regions may change over the program period from 2008 to 2010, resulting in TRCs of lower than 1.0 for some particular measures in some particular geographic regions. A portfolio approach to cost-benefit analysis would allow the Companies to maintain the principles of uniformity (providing the same programming to customers throughout the Companies' service territories) in instances where there may be regional differences in usage patterns may drive the TRC below 1.0 in that particular region. At this time, there are no initiatives contemplated for residential and commercial energy efficiency, and for residential fuel switching, that have a TRC of below 1.0.

This portfolio approach is consistent with the Companies' proposed approach recently approved by the Commission in the System Extension and Customer Connection Policies Review Application, where the total annual aggregate Profitability Index for Main Extension tests in a given year must be at least 1.1 or higher. The energy efficiency and fuel switching programs would be planned and evaluated on the TRC, the RIM test, the Utility Cost ("UC") test and the Participant test, and the overall portfolio TRC test results would have to be greater than 1.0 to proceed.

The Portfolio Level analysis includes the costs for the proposed investment in Conservation Education and Outreach, in Joint Initiatives, in Innovative Technologies, NGV and Measurement and in Trade Relations, but does not include any accounting for energy savings benefits from these afore-mentioned activities. In the case of Conservation Education and Outreach and Trade Relations, the Companies propose to monitor the effectiveness of these two initiatives through awareness tracking. In the case of the Conservation Education and Outreach initiative, the Companies would include a significant Advertising Tracking and Customer Research component in this communications program so as to gauge the effectiveness of both the messaging and the media being employed. In the case of Trade Relations, targeted trades groups would be surveyed annually so as to monitor the effectiveness of the Companies' outreach and training efforts with these trades groups. In both cases, the Companies would hope to develop an understanding of energy savings from these initiatives between now and 2010, with a view to including energy savings as a benefit in future analyses.

In the Joint Initiatives program area, the traditional DSM cost-benefit tests for the Affordable Housing Sector may not provide for a high enough level of financial incentive to spur efficiency upgrades. The initial comments from the Working Group for DSM for Affordable Housing that Terasen Gas is leading indicate that in order to be effective, energy efficiency programs for this sector must provide a financial incentive that covers almost the entire cost of an equipment upgrade, rather than just a portion of the increment for efficient equipment. To give a specific example, incentives for furnace upgrades for this sector may need to cover the entire cost of a new furnace rather than just a portion of the cost differential between an Energy Star furnace and a mid-efficiency furnace. The Terasen Utilities are of the view at this time, that the Companies should not act alone as a social instrument, but rather in concert with others, to establish a DSM program for Affordable Housing. Currently the Terasen Utilities anticipate that funding for such a program, over and above the amounts requested by the Companies with this Application, would be made available by Government as a matter of social policy. Alternatively, additional funding could be sought by the Companies in a separate, future application to the Commission, if the findings of the Terasen Utilities and the Working Group suggest this is a viable alternative. The Working Group for DSM for Affordable Housing that the Terasen Utilities are leading will continue to find a way to measure the costs and benefits of incentives, as well as find ways to actually deliver energy efficiency upgrades, to this unique sector.

In the case of the Innovative Technologies and Measurement components of the proposed funding (refer to Section 6.9), the relative newness of some of these technologies under consideration mean that equipment costs are high due to low market penetration. Further, good data on energy savings from deploying these new technologies in the Companies' service area may not be available due again to the relative newness of the technology. The Companies propose that programs in this area would be in the nature of pilot programs, where installations are restricted in both number and by geography, so as to give the Companies a better understanding of the costs and benefits of these newer technologies.

In the case of the Natural Gas Vehicles components of the proposed funding (refer to Section 6.9) the Companies suggest that a simple payback analysis would be appropriate, given the low penetration of these vehicles in the marketplace.

Proposal to Exclude Free Rider Effects

Table 6.13 below shows the results of the standard Demand Side Management cost-benefit tests for the proposed Residential and Commercial Energy Efficiency and Residential Fuel Switching initiatives for the Terasen Utilities, including free rider effects, as well as Portfolio level results. Free riders are customers who participate in a program, but would have undertaken the same conservation actions even if the program were not offered. The cost-benefit analysis presented in Tables 6.13 and 6.13a below includes the impact of the carbon tax on customer savings. Further detail on cost-benefit tests can be found in Appendix 11,"EEC Portfolio Cost-Benefit Results".

Table 6.13 - Cost-Benefit Results for EEC Portfolio including Free Rider Factor

	RatePayer Impact Measure	Utility	Participant	Total Resource Cost	TRC benefit
Residential Energy Efficiency	0.6	2.6	14.4	2.4	$15,048,000
Residential Fuel Subsitution	1.2	FS	0.9	2.5	$37,723,000
Commercial Energy Efficiency	0.7	3.3	8.1	3.7	$108,512,000
Portfolio Level	0.5	1.4	8.7	2.9	$139,448,000

Please note that the analysis above accounts for free rider effects, meaning that the companies have endeavored to apply a notional free ridership factor.

Although the cost-benefit test results shown above in Table 6.13 include a net-to-gross or "free ridership" factor, the Companies propose that the requirement to net out energy savings resulting from the participation of "free riders" be eliminated from the cost/benefit analyses for EEC programs in British Columbia. Table 6.13a below shows the cost-benefit test results excluding a free rider factor, where the benefits are the gross energy savings from the EEC activity.

Table 6.13a - Cost-Benefit Results for EEC Portfolio excluding Free Rider Factor

	RatePayer Impact Measure	Utility	Participant	Total Resource Cost	TRC benefit
Residential Energy Efficiency	0.6	3.5	13.7	3.1	$23,456,000
Residential Fuel Subsitution	1.2	FS	0.8	2.4	$41,648,000
Commercial Energy Efficiency	0.7	3.8	7.9	3.9	$121,880,000
Portfolio Level	0.6	1.6	8.6	3.1	$165,149,000

The proposed threshold TRC test results both increase slightly when free rider factor is excluded from the cost-benefit tests, because the savings or benefits from EEC activity are expressed as 100% of the gross energy savings from the EEC activities. The overall TRC ratio increases for the same reason.

Free rider ratios are the subject of great debate as there is no definitive method to determine the number of free riders in a program. The methodology and reporting of free riders is subjective, even when program participants are surveyed regarding a program's influence over their purchase decisions. Free rider rates are notional. Further, the net-to-gross ratio of energy savings from EEC activity is complicated by "free driver" effects. The free driver effect is very difficult to quantify, but it will tend to cancel out the free rider effect. If the goal of municipal, provincial and federal policies is to reduce energy consumption overall, programs that help to achieve these goals should be evaluated based on gross energy savings, regardless of program participant motivation. The Companies believe that if a program participant receives an incentive for undertaking an activity that results in a desirable energy outcome, it should be the outcome that matters, not the way in which it was achieved. Including, the notional effects of free riders in the cost-benefit tests serves to reduce the number of programs that can be offered and consequently reduces the overall energy savings that customers will be able to realize through EEC programs. The Companies are of the view that the inclusion of the effects of free riders in the cost-benefit test for EEC programs distorts the value of EEC programs and is counter to the objectives of the energy plan.

Attribution

It is possible, as a matter of practice regarding cost-benefit tests for DSM programs, for utilities to include savings resulting from, or attributed to the projected introduction of regulation resulting from certain EEC programs. This is a practice known as "attribution". The cost-benefit test results that the Terasen Utilities have completed in support of its proposed slate of programs, as shown above in Tables 6.13 and 6.13a, do not include savings related to attribution. However, with this Application, the Companies seek approval to include attribution savings in its cost-benefit tests in the future, at the point in time which new regulations go into effect. Specifically the Companies propose that once a proposed regulation and implementation date for minimum efficiency standards for an appliance or building or energy system is announced by a regulating body, the Companies be permitted to attribute savings to market transformation programs for that particular appliance, building or energy system in its cost-benefit tests at that time. The attribution rates proposed by the Company, which it is seeking approval for with this Application, for any such future regulation are outlined in Table 6.13b below.

Table 6.13b - Attribution Rates

Regulation Year	Percentage of Savings Attributed to Program
1	50
2	40
3	30
4	20
5	10

Results

The Companies believe that the cost-benefit results for the proposed EEC expenditure in this Application are under-stated, because the benefits used in the calculations include free-riders, effectively reducing the net energy savings, and exclude attribution effects, as well as excluding savings from the proposed expenditure on Joint Initiatives, Trade Relations, Conservation Education and Outreach and Innovative Technologies, Measurement and NGV. However, even with this approach, which could be considered conservative, the Total Resource Cost test result for the EEC portfolio as a whole is positive, with a ratio of 2.9., and a net financial benefit of

$139.4 million. If free rider effects are excluded, as the Companies are proposing, the EEC portfolio has a TRC ratio of 3.1 and a net financial benefit of $165.1 million.

6.14. Reporting and Stakeholder Group

The Companies recognize the need for accountability for the funds approved for EEC programs. This section describes the type of reporting on EEC programs that the Companies are proposing, as well as the formation of an EEC Stakeholder Group to provide the Companies with input on EEC activity. The Terasen Utilities believe that the proposals below should provide the Commission and stakeholders with an adequate level of comfort that the funds are being well-spent.

6.14.1. Reporting

It is anticipated that the Companies' Executive Team will approve the EEC activity for the upcoming year early in that year, permitting the Companies to file an Annual EEC Report with the Commission by the end of the first quarter every year. The Report would detail program activity, expenditures, and cost-benefit results for the previous year, as well as describe program activity and provide forecasts for the upcoming year.

6.14.2. Stakeholder Group

The Companies believe that engaging an EEC stakeholder group to guide and inform the Companies' EEC activities will be a key success factor. The Companies have discussed this Application at a high level with Regulatory Stakeholders (those that have historically intervened in the Terasen Utilities' regulatory proceedings). In the event that the relief sought is granted, the Companies would form and engage an EEC stakeholder group with membership representing both TGI and TGVI from the following areas:

- Provincial and municipal governments
- Non-Governmental Organizations
- Consumer advocates, representing residential customers
- Affordable housing advocates, representing the low-income sector
- Commercial customers
- Trade organizations

- Equipment manufacturers
- Other utilities

The Companies intend to hold annual EEC workshops with stakeholders, at which the Companies would present updates on program progress. The workshops would also be a forum for stakeholder input on developing new programs and refining existing programs, as well as providing some opportunity for oversight and comment by the Stakeholders on the Companies' EEC activity. The Companies would consider consolidating the Terasen Utilities' stakeholder activity with that of other utilities and the Province, in order to avoid potential "stakeholder fatigue".

7. Customer Impacts, Benefits and Advancement of Government Energy Objectives

This Section examines how customers will benefit from EEC programs and also how this Application advances government's energy objectives.

The programs contemplated in this EEC Application are expected to provide the following outcomes:

- Provide customers access to a wider variety of energy efficiency and conservation incentive programs, assisting them to reduce energy consumption, thereby lowering customer energy bills and reducing the individual and societal impacts associated with energy use.
- Expand the range of customers for whom energy efficiency and conservation programs are available. For example, the commercial program portfolio is proposal is a significant expansion over the Companies' current efforts, and in the residential sector, funding is contemplated specifically for DSM for Affordable Housing, as outlined in the Section 6.6
- Provide education for customers and the public at large about energy and conservation issues, leading to customers making more informed choices about energy equipment and actions, as outlined in the proposal received from Wasserman and Partners, attached as Appendix 8
- Recognize the need to maintain a competitive cost for using natural gas an energy source, thus maintaining the energy balance in the province, and ensuring that customers have a wide variety of cost-competitive energy sources to choose from
- Support BC Hydro and FortisBC in achieving their conservation goals, through both incidental electrical savings from such items as efficient motors in efficient natural gas appliances, and through the residential fuel switching measures proposed herein, thus helping to minimize the need for the customers of the electric utilities to invest in additional generation and transmission infrastructure
- Recognize the continued value in adding efficient cost-effective customers to the Terasen Utilities distribution system, keeping the use of natural gas and other energy forms competitive for all customers

- Recognize that individual metering technologies can help to inform customers as to their individual consumption, which is shown to lead to reduced overall consumption of up to 30%[31], as noted in Section 7.3
- Encourage the utilization of new and alternative technologies that have not to date enjoyed strong market penetration in British Columbia
- Support the development and training of skilled tradespeople that are fluent in the merits of conservation and efficient technology

7.1. Customer Savings

The portfolio of EEC measures that the Companies contemplated in this Application will help customers use energy more efficiently and wisely. This will have the effect of reducing a customer's energy costs.

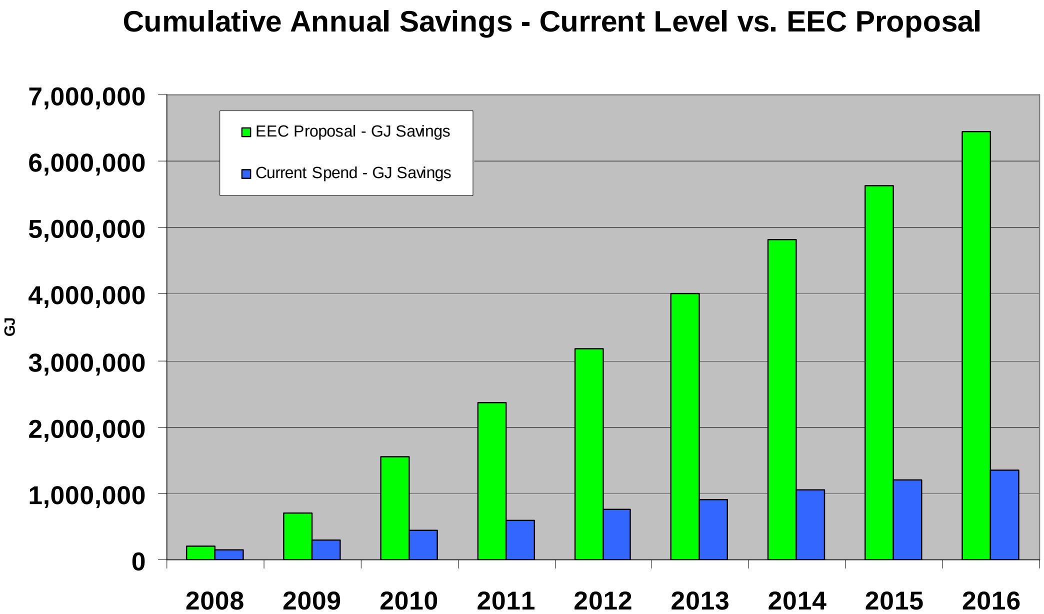
7.1.1. Expected Effect on Consumption and Associated Bill Impact

The Terasen Utilities believe that, by targeting the program areas identified in Table 1.4.1a, the energy savings from the proposed increase in expenditure and activity are likely to be significant. The estimated present value of the savings from energy efficiency is almost 10 million GJs over the lives of the various measures proposed, while the fuel switching activity being proposed is estimated to result in additional load of approximately 2.3 million GJs (present value). The anticipated net present value of the energy savings from the energy efficiency and fuel-switching activity being proposed in this Application is approximately 7.7 million GJs. This does not include potential savings arising from Conservation Education and Outreach, Joint Initiatives, or Innovative Technologies, NGV and Measurement program areas.

The increased level of EEC spending contemplated in this Application, as compared to the existing funding levels, will provide customers greater opportunities to realize energy savings. The graph below (Figure 7.1.1) suggests the magnitude of the opportunity for additional natural gas energy efficiency and conservation activity that is being foregone at the current DSM expenditure levels (figures are nominal).

[31] Article, "The installation of meters leads to permanent changes in customer behaviour", Lars Gullev and Michael Poulson, "News from DBDH", March 2006

Figure 7.1.1 - Potential Savings from Increased EEC Activity by the Terasen Utilities



This section of the Application addresses customer's rates if funding level increases are approved.

There is also a benefit associated with reduced Carbon Tax costs, which is discussed in the context of GHG emission reductions below.

7.1.2. Revenue Requirements and Rate Impacts

Below is detail information about how the funding request of an additional $40.696 million for TGI and $7.336 million for TGVI will impact revenue requirements for each utility and customers.

The TGI PBR Extended Settlement includes DSM funding totaling $3.124 million ($1.50 million for incentives and $1.624 million for expense), in each of 2008 and 2009. Similarly, TGVI RR Extended Settlement includes DSM funding totaling $1.150 million ($0.650 million for incentives and $0.500 million for expense), in each of 2008 and 2009. The respective Extended Settlements specify how these DSM related expenditures are to be included in revenue requirements and rate determinations for 2008 and 2009. The two year total (2008 plus 2009) of

DSM related expenditures for both Companies that are included in the Extended Settlements is $8.548 million ($3.124 million *2 plus $1.15 million *2). The Companies' current approved EEC expenditures are outlined in Table 7.1.2 below.

The Companies are proposing incremental EEC/DSM expenditures over three years of $40.696 million for TGI and $7.366 million for TGVI. On a combined basis, the total additional funding for the three years ending 2010 over and above the approved levels stipulated in Extended Settlements for the two years ending 2009 is $48.062 million, bringing the three year total for both Companies to $56.61 million. This information, in addition to the proposed amounts to be charged to the deferral account and O&M expense, is summarized in Table 7.1.2.1, below.

Table 7.1.2.1 – Current, Proposed, and Incremental EEC expenditures, by Utility ($000's)

	2008	2009	2010	Total
Currently Approved Expenditures				
TGI - Expense	$1.62	$1.62	$0.00	$3.25
TGI - Incentives	$1.50	$1.50	$0.00	$3.00
Total TGI	$3.12	$3.12	$0.00	$6.25
TGVI - Expense	$0.50	$0.50	$0.00	$1.00
TGVI - Incentives	$0.65	$0.65	$0.00	$1.30
Total TGVI	$1.15	$1.15	$0.00	$2.30
Combined - Expense	$2.12	$2.12	$0.00	$4.25
Combined - Incentives	$2.15	$2.15	$0.00	$4.30
Total Combined TGI & TGVI	$4.27	$4.27	$0.00	$8.55
Incremental Expenditures as proposed				
TGI - Incentives	$10.87	$12.63	$17.20	$40.70
TGVI - Incentives	$1.68	$1.89	$3.79	$7.37
Total Combined TGI & TGVI Incentives	$12.55	$14.52	$20.99	$48.06
Total Proposed EEC Expenditures				
TGI - Expense	$1.62	$1.62	$0.00	$3.25
TGI - Incentives	$12.37	$14.13	$17.20	$43.70
Total TGI	$14.00	$15.75	$17.20	$46.94
TGVI - Expense	$0.50	$0.50	$0.00	$1.00
TGVI - Incentives	$2.33	$2.54	$3.79	$8.67
Total TGVI	$2.83	$3.04	$3.79	$9.67
Combined - Expense	$2.12	$2.12	$0.00	$4.25
Combined - Incentives	$14.70	$16.67	$20.99	$52.36
Total Combined TGI & TGVI	$16.83	$18.80	$20.99	$56.61

The result of the mechanics described above based on the EEC expenditures proposed with this Application, the Companies expect that total EEC expenditures of $14.702 million ($16.826 less $1.624 less $0.500) will be added to the deferral accounts of the Terasen Utilities in 2008 on a before tax basis. For 2009, in aggregate, the Companies expect that $16.671 million ($18.795 million less $1.624 less $0.500) will be added to the deferral accounts of the Terasen Utilities on a before tax basis. The deferral accounts will be included in rate base, on an after tax basis and 2009 amortizations will equal one-twentieth of the forecast balance in the deferral account at December 31, 2008.

Terasen Gas Inc.

As part of TGI 2008 revenue requirement there is a total of $3.124 million per year for EEC activity. Over a two year time period 2008-2009 as per Extended Settlement a total of $6.248 million could be spent on EEC activity. Therefore, the incremental funding request for EEC activity over three years would be $40.696 million for TGI. Impact of this incremental funding on TGI revenue requirement is shown in Table 7.1.2.2.

Table 7.1.2.2 TGI - Impacts of Total EEC Expenditure on Annual Revenue Requirements ($000's)

2008-2020
Amortization Period 20 Years

Line No.	Particulars	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	**Current DSM**													
2	Beginning of Year Balance	$ 1,526	$ 754	$ 370	$ 17	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	Additions	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Tax Adjustment	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Net Additions	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Amortization	(772)	(384)	(353)	(17)									
7	End of Year Balance	754	370	17	-	-	-	-	-	-	-	-	-	-
8														
9	**New EEC**													
10	Beginning of Year Balance	-	8,537	17,999	29,287	27,756	26,224	24,692	23,160	21,628	20,097	18,565	17,033	15,501
11	Additions	12,372	14,128	17,196	-	-	-	-	-	-	-	-	-	-
12	Tax Adjustment	(3,835)	(4,238)	(4,987)	-	-	-	-	-	-	-	-	-	-
13	Net Additions	8,537	9,890	12,209	-	-	-	-	-	-	-	-	-	-
14	Amortization	-	(427)	(921)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)
15	End of Year Balance	8,537	17,999	29,287	27,756	26,224	24,692	23,160	21,628	20,097	18,565	17,033	15,501	13,970
16														
17	**Total Deferred DSM**													
18	Beginning of Year Balance	1,526	9,291	18,369	29,304	27,756	26,224	24,692	23,160	21,628	20,097	18,565	17,033	15,501
19	Additions	12,372	14,128	17,196	-	-	-	-	-	-	-	-	-	-
20	Tax Adjustment	(3,835)	(4,238)	(4,987)	-	-	-	-	-	-	-	-	-	-
21	Net Additions	8,537	9,890	12,209	-	-	-	-	-	-	-	-	-	-
22	Amortization	(772)	(811)	(1,274)	(1,549)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)	(1,532)
23	End of Year Balance	9,291	18,369	29,304	27,756	26,224	24,692	23,160	21,628	20,097	18,565	17,033	15,501	13,970
26														
27	**Cost of Service**													
28	Operating & Maintenance Expense	$ 1,624	$ 1,624	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
29	Amortization Expense	772	811	1,274	1,549	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532
30	Income Tax Expense	420	526	814	961	935	917	898	880	862	843	825	806	788
31	Earned Return	404	1,034	1,782	2,133	2,018	1,904	1,789	1,675	1,560	1,445	1,331	1,216	1,102
32	Total Cost of Service	$ 3,221	$ 3,995	$ 3,871	$ 4,643	$ 4,485	$ 4,352	$ 4,219	$ 4,086	$ 3,953	$ 3,820	$ 3,687	$ 3,554	$ 3,421
33	Volume (TJ/year)	139,909	141,993	143,432	145,157	146,805	148,459	150,068	151,673	153,211	154,644	155,987	157,296	158,554
34	Cost $/GJ	$0.0230	$0.0281	$0.0270	$0.0320	$0.0306	$0.0293	$0.0281	$0.0269	$0.0258	$0.0247	$0.0236	$0.0226	$0.0216

This increase in revenue requirement has the greatest impact on annual customer costs in 2011 when rates will increase by $.032/GJ. Based on a TG LML residential customer this would increase the cost per customer approximately $3.20 in 2011 based on 100 GJ of annual consumption.

Terasen Gas (Vancouver Island) Inc.

As part of TGVI 2008 revenue requirement there is a total of $1.15 million per year for EEC activity. Over a two year time period 2008-2009 as per Extended Settlement a total of $2.3 million could be spent on EEC activity. Therefore, the incremental funding request for EEC activity over three years would be $7.367 million for TGVI. Impact of this incremental funding on TGVI revenue requirement is shown in Table 7.1.2.3

Table 7.1.2.3 TGVI – Impacts of Total EEC Expenditure on Revenue Requirements ($000's)

2008-2020
Amortization Period 20 Years

Line No.	Particulars	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	**Current DSM**													
2	Beginning of Year Balance	$ 195	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	Additions	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Tax Adjustment	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Net Additions	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Amortization	(195)												
7	End of Year Balance	-	-	-	-	-	-	-	-	-	-	-	-	-
8														
9	**New EEC**													
10	Beginning of Year Balance	-	1,608	3,307	5,831	5,527	5,223	4,919	4,615	4,311	4,007	3,703	3,399	3,095
11	Additions	2,330	2,543	3,793	-	-	-	-	-	-	-	-	-	-
12	Tax Adjustment	(722)	(763)	(1,100)	-	-	-	-	-	-	-	-	-	-
13	Net Additions	1,608	1,780	2,693	-	-	-	-	-	-	-	-	-	-
14	Amortization	-	(80)	(169)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)
15	End of Year Balance	1,608	3,307	5,831	5,527	5,223	4,919	4,615	4,311	4,007	3,703	3,399	3,095	2,791
16														
17	**Total Deferred DSM**													
18	Beginning of Year Balance	195	1,608	3,307	5,831	5,527	5,223	4,919	4,615	4,311	4,007	3,703	3,399	3,095
19	Additions	2,330	2,543	3,793	-	-	-	-	-	-	-	-	-	-
20	Tax Adjustment	(722)	(763)	(1,100)	-	-	-	-	-	-	-	-	-	-
21	Net Additions	1,608	1,780	2,693	-	-	-	-	-	-	-	-	-	-
22	Amortization	(195)	(80)	(169)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)
23	End of Year Balance	1,608	3,307	5,831	5,527	5,223	4,919	4,615	4,311	4,007	3,703	3,399	3,095	2,791
24														
27	Cost of Service													
28	Operating & Maintenance Expense	$ 500	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
29	Amortization Expense	195	80	169	304	304	304	304	304	304	304	304	304	304
30	Income Tax Expense	100	66	126	190	186	182	179	175	171	168	164	160	157
31	Earned Return	67	184	342	425	402	379	356	334	311	288	266	243	220
32	Total Cost of Service	$ 862	$ 830	$ 637	$ 918	$ 892	$ 865	$ 839	$ 813	$ 786	$ 760	$ 733	$ 707	$ 681
33	Volume (TJ/year)	12,282	12,649	13,018	13,415	13,873	14,254	14,590	14,925	15,246	15,543	15,809	$ 16,053	$ 16,280
34	Cost $/GJ	$0.0702	$0.0656	$0.0489	$0.0684	$0.0643	$0.0607	$0.0575	$0.0544	$0.0516	$0.0489	$0.0464	$0.0440	$0.0418

This increase in revenue requirement has the greatest impact on customer rates in 2011 when costs will increase by approximately $0.0684/GJ. Based on a TGVI residential customer this would increase the cost per customer by approximately $4.104 in 2011 based on 60 GJ of annual consumption.

7.2. Greenhouse Gas Emission Reductions

One of "government's energy objectives" that must be considered by the Commission in reviewing an application under section 44.2 is "to encourage public utilities to reduce greenhouse gas emissions". The following Section discusses some of the estimated results in terms of energy and Greenhouse Gas ("GHG") or Carbon Dioxide equivalent ("C02e") savings anticipated from the overall portfolio of EEC activity presented in this Application.

The energy efficiency activities outlined herein will also result in a relative reduced consumption of natural gas and in some measures, electricity as well, in turn reducing GHG emissions. Since natural gas has lower associated greenhouse gas and air contaminant emissions than many other energy sources, including propane, fuel oil, transportation petroleum, and electricity created using thermal electricity generation, efficient use of natural gas in the right applications will further support British Columbia's environmental aspirations. This Application therefore includes a request for funding to support fuel switching activity to encourage the adoption of natural gas taking the place of more environmentally detrimental alternatives. Since environmental issues have local, provincial and global implications, the Companies support an end-to-end analytic approach and conclude that using natural gas in specific end uses has a lower overall regional GHG impact than using other energies including electricity for those same end uses.

The Companies believe that the province's GHG reduction goals are best achieved by optimally utilizing other environmentally responsible alternative energy resources, including natural gas, to avoid or defer as much new electrical load as possible and preserve existing resources for the greatest value uses. Since B.C.'s electrical grid is integrated with the larger grid in Western North America, the efficient direct end use of natural gas and other energy sources in BC results in regionally lower GHGs, as it reduces the need for electricity imports from jurisdictions where the marginal source of generation is coal or gas fired, and makes power from lower impact sources such as hydroelectric facilities available to the remainder of Western North America.

This Application includes a request for funding for fuel switching and innovative technology activities that drive change from higher-carbon fuel sources or avoid requirements for increased electricity consumption resulting in lower GHG and air contaminant emissions for the region.

Table 7.2 below details the overall natural gas, electricity and GHG savings resulting from the proposed increase in EEC expenditure.

Table 7.2 - Energy Savings by Activity by Sector by Utility

	Consumption Impact			
Sector and Activity	**Natural Gas (GJ)**	**GHG Impact (tonnes C02e)**	**Electricity (MWh)**	**GHG Impact (tonnes CO2e)**
TGI Residential Energy Efficiency	(2,087,000)	(105,790)	(41,000)	(22,550)
TGI Residential Fuel Switching	831,000	42,123	(174,000)	(95,700)
TGI Commercial Energy Efficiency	(6,858,000)	(347,632)	(511,000)	(281,050)
TGVI Residential Energy Efficiency	(181,000)	(9,175)	(4,000)	(2,200)
TGVI Residential Fuel Switching	1,446,000	73,298	(376,000)	(206,800)
TGVI Commercial Energy Efficiency	(833,000)	(42,225)	(69,000)	(37,950)
Subtotal - Energy Efficiency	**(9,959,000)**	**(504,822)**	**(625,000)**	**(343,750)**
Subtotal - Fuel Switching	**2,277,000**	**115,421**	**(550,000)**	**(302,500)**
Totals	**(7,682,000)**	**(389,401)**	**(1,175,000)**	**(646,250)**

These results reflect the present value of energy consumption impacts over the life of the measures proposed for implementation over the 2008 – 2010 timeframe. The CO2e factors that used were 0.05069 tonnes/GJ for natural gas and 550 tonnes/GWh for electricity[32]. The results do not include energy savings projections for the proposed Joint Initiatives, for the Conservation Education and Outreach funding, for the Trade Relations activity, or for savings arising from funding for Innovative Technologies, NGV and Measurement. It is clear from this table that customers would save a significant amount resulting from energy savings and avoided carbon tax impacts. A calculation, using a value of $11/GJ as the customers' avoided cost of natural gas, and the current residential electrical rate of 6.55 cents/KWh, and the proposed carbon tax on natural gas at $10/tonne is presented in Table 7.2a below.

[32] BC Hydro, 2007 Conservation Potential Review, Summary Report, Date Nov 20, 2007, page 12

Table 7.2a – Potential Customer Bill Impacts, by Activity

	Natural Gas				Electricity		
Activity Description	Consumption (GJ)	Bill Impacts	GHG Impact (tonnes C02e)	Carbon Tax Impact	Consumption (MWh)	Bill Impact	GHG Impact (tonnes CO2e)
Energy Efficiency	-9,959,000	-$109,549,000	-504,822	-$5,048,217	-625,000	-$40,937,500	-343,750
Fuel Switching	2,277,000	$25,047,000	115,421	$1,154,211	-550,000	-$36,025,000	-302,500
Totals	-7,682,000	-$84,502,000	-389,401	-$3,894,006	-1,175,000	-$76,962,500	-646,250

Using an avoided cost more reflective of marginal cost for electricity of 8.8 cents/KWh, financial savings from electricity conservation are even more significant at $103.4 million. More detail on savings resulting from specific program areas can be found in Appendix 11.

7.3. Government's Energy Objective of Promoting Demand Side Management

One of government's energy objectives under section 44.2 is the promotion of demand side measures. This Application supports government's energy objectives in several ways. Below is detailed support of how EEC this Application supports government's energy objective of promoting DSM, with reference to related Policy Actions from the BC Energy Plan from 2007.

7.3.1. Policy Action #1:

"Set an ambitious conservation target, to acquire 50 per cent of BC Hydro's incremental resource needs through conservation by 2020"[33]

Both the energy efficiency and fuel switching activities detailed in Section 6 support this Policy Action. Natural gas energy efficiency programs reduce customers' energy bills, making the choice of natural gas for space and water heating a more attractive option. This is important because natural gas is a more efficient fuel source for these end uses, and incenting British Columbians to install natural gas space and water heating helps to reduce BC Hydro's need for incremental electricity resources. Actively encouraging both new and existing customers to

[33] The BC Energy Plan: A Vision for Clean Energy Leadership, "Energy Conservation and Efficiency Policies", page 1

choose efficient natural gas end uses through fuel switching programs also reduces BC Hydro's need to add incremental resources.

7.3.2. Policy Action #2:

"Ensure a coordinated approach to conservation and efficiency is actively pursued in British Columbia"[34]

The Terasen Utilities have enjoyed partnerships delivering incentive, education and training energy efficiency programs with BC Hydro and FortisBC, the Province, the federal government, manufacturers, industry associations, non-profit organizations and local governments. Examples would be the financial contributions made by BC Hydro and FortisBC to the Variable Speed Motor component of TGI's Energy Star Heating System upgrade program, and the Companies' participation in incentives for gas-heated homes in the BC Hydro PowerSmart New Homes Program. The Terasen Utilities have worked with the Ministry of Energy Mines and Petroleum Resources ("MEMPR") under a Contribution Agreement from the Opportunities Envelope, and at the Federal level, have enjoyed financial contributions by NRCan to various programs including the Efficient Boiler Program, the Residential New Construction Heating Program, the Switch and Save Program and the Think Grand Program. The Terasen Utilities also participate in research programs led by other utilities and by government agencies, helping to co-fund research initiatives. Furnace and boiler manufacturers have joined in the Terasen Utilities' Energy Star Heating Upgrade (for TGI) and Energy Bandit (for TGVI) programs to offer coupons to customers, piggybacking on the Companies marketing channels for these programs. TGI funds the first year of Destination Conservation, a conservation program aimed at schools and delivered by the Pacific Resource Conservation Society, a non-profit group. More funding for the initiatives outlined, and requested with this Application would allow the Companies to expand its incentive and education program efforts, in partnership with other entities offering effective joint programs.

The Companies' ability to expand joint program offerings today is limited by the available funding; current EEC funding levels for the Terasen Utilities are completely consumed by the

[34] The BC Energy Plan: A Vision for Clean Energy Leadership, "Energy Conservation and Efficiency Policies", page 2

fairly limited programs currently offered. Partnerships and coordinated efforts benefit customers by minimizing the Companies' investment in marketing, promotion and communications for programs, and by lessening the amount of market confusion by combining multiple offerings from different entities into one combined program offering aimed at a particular market segment. The Companies are actively participating in consultations being conducted by the MEMPR on coordination of energy efficiency activity in the province. However without additional funding, the Terasen Utilities would not be in a position to implement coordinated programs that are incremental to current levels of DSM activity. Examples of potential programs include appliance programs in partnership with the electric utilities so that gas customers have the same access to appliance incentives as electric customers, and participation in a potential provincial initiative to fund post-retrofit home energy audits.

One important aspect of coordination is the alignment of DSM treatments, practices and protocols across the utilities in British Columbia. With this Application, the Companies are proposing and requesting approval for a financial treatment for EEC expenditure that is more closely aligned with that used by BC Hydro and Fortis BC, namely to treat EEC expenditures as capital, by way of a Regulatory Deferral Account to be amortized over a twenty year period.

7.3.3. Policy Action #3:

"Encourage utilities to pursue cost effective and competitive demand side management opportunities"[35]

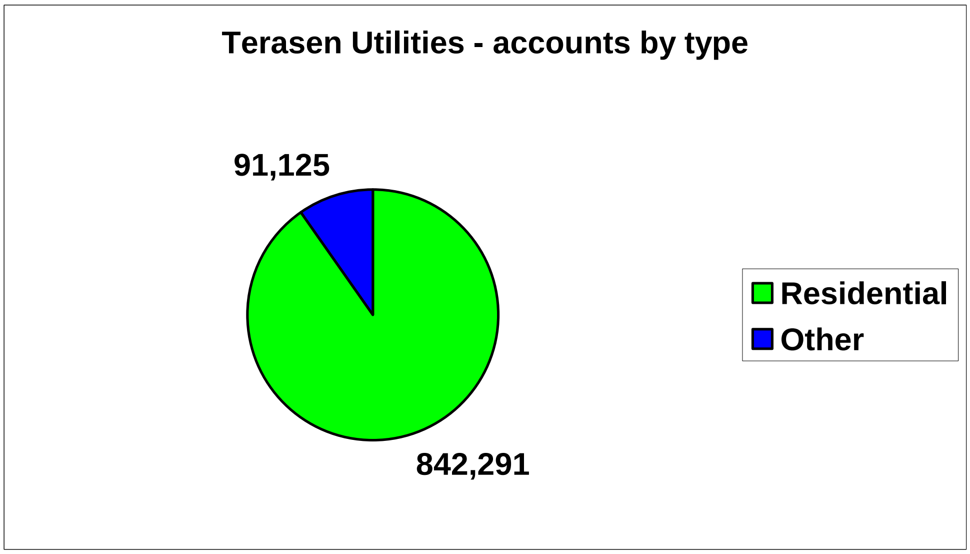
In May 2006, the Terasen Utilities received the CPR from Marbek. The goal of the CPR was to identify, at a very high level, the potential for natural gas EEC opportunities in British Columbia. In March 2007, the Terasen Utilities engaged Habart to review and refine the assumptions in the 2006 CPR, in order to arrive at a deeper understanding of both energy efficiency and fuel switching potential. The Application reflects the findings of the Habart's report, which quantified further all the cost-effective traditional DSM measures in the residential and commercial sectors available to the utility. This Application reflects a request for funding for costs for all the cost-effective measures in the Habart report. Cost-effective demand-side investments are defined in

[35] The BC Energy Plan: A Vision for Clean Energy Leadership, "Energy Conservation and Efficiency Policies", page 2

the Policy Action as "those that are equal to or lower in cost than supply side resources" and certainly both the energy efficiency and fuel switching measures delineated in the Habart report meet that criteria.

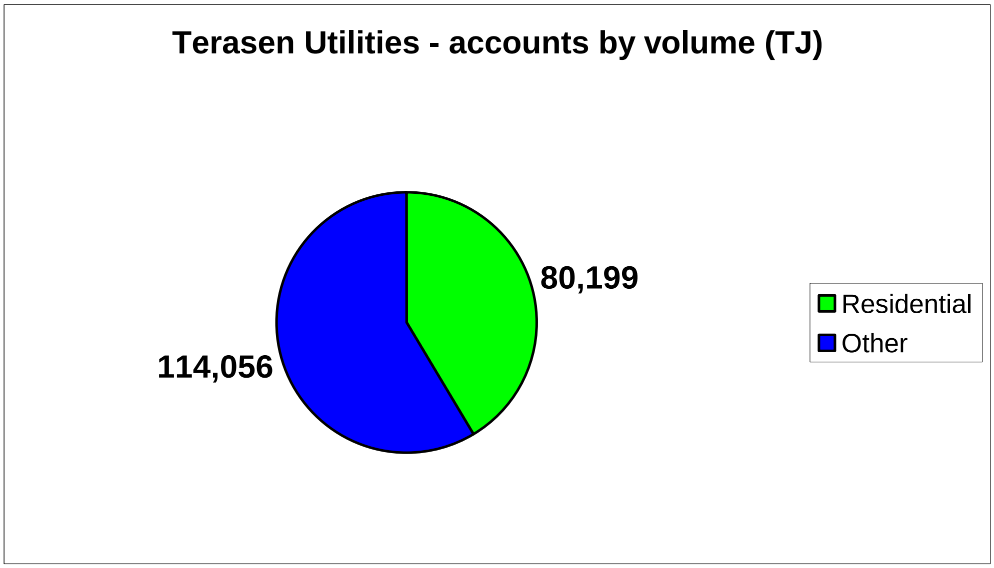
The Policy Action also encourages utilities to develop a diversified portfolio of programs, and the proposed areas of program activity in this EEC Application cover residential and commercial customers, for both retrofits and new construction. Figures 7.3 and 7.3a show gas volumes for residential and commercial customers, as well as residential and commercial customer counts.

Figure 7.3 - Number of accounts by customer type (TGI and TGVI)



Source: Application by the Companies for a CPCN for Mt. Hayes LNG Storage Facility, June 5, 2007, Appendix D – TGVI Demand Forecast Details (excluding ICP and the VIGJV), page 1-2, and Appendix E – TGI Demand Forecast Details Base Demand Scenario page 1-6

Figure 7.3a - Gas volumes by customer type (TGI and TGVI)



Source: Application by the Companies for a CPCN for Mt. Hayes LNG Storage Facility, June 5, 2007, Appendix D – TGVI Demand Forecast Details (excluding ICP and the VIGJV), page 1-2, and Appendix E – TGI Demand Forecast Details Base Demand Scenario page 1-6

While residential customers comprise the greatest number of accounts, the non-residential customers ("other" in the graphs above) comprise the greatest volume of gas consumed. It is one of the goals of this Application to increase the number of programs and initiatives available to all customers, be they residential or commercial, so that the Companies can make cost-effective DSM programs available to the greatest number of residential customers, as well as offering programs to the non-residential customer segment which could provide the greatest "bang for the buck" in terms of consumption reductions. Further, the EEC Application requests $1 million annually for "Joint Initiatives", one of which is Demand Side Management for the Affordable Housing sector. (Joint Initiatives are discussed in more detail in Section 6.2.2) The MEMPR has requested that the Terasen Utilities lead the establishment of a working group to deliver energy efficiency and conservation programs to the Affordable Housing sector, and this work is underway. A list of members in the "DSM for Affordable Housing Working Group" is attached as Appendix 7. The Working Group is focused on finding a set of common principles for the delivery of energy efficiency and conservation to Affordable Housing, and also in exploring opportunities for joint, co-funded programming for this sector. The Terasen Utilities currently do not have any funding set aside for energy efficiency and conservation for Affordable Housing as the entire existing DSM funding is consumed by existing programs. Energy efficiency and conservation for this sector would be incremental activity and therefore requires incremental funding, as requested with this Application. Continuation of the Terasen Utilities' leadership of the DSM for Affordable Housing Working Group is dependent on the Companies having approval for increased EEC expenditure in order to undertake actual programming for DSM for Affordable Housing.

The text for this Policy Action states that "…the Ministry will assess whether additional measures are needed to ensure appropriate incentives are in place to encourage investor-owned utilities to identify and pursue cost-effective DSM programs…". This EEC Application aims to encourage shareholder investment in DSM activity through capitalization of EEC funding. The proposed financial treatment is discussed in more detail in Section 6.

7.3.4. Policy Action #4:

"Explore with BC utilities new rate structures that encourage energy efficiency and conservation"36

In December 2007, the Commission issued Order No. G-152-07, a Decision on the Companies System Extension and Customer Connection Policies Review. The Commission stated that "the Commission agrees with Terasen that a situation whereby potential customers who propose to use high efficiency appliances might fail an MX test and be required to make a contribution based upon their forecast consumption, whereas they would pass the test based upon their forecast consumption using less efficient appliances, would indeed be perverse".[37] As such the Commission approved the Companies' request to incorporate a volume credit for consumption levels where customers install high efficiency space and water heating, with a further volume credit for consumption levels where new customers install high efficiency space and water heating and attain a LEED certification. However, further the Commission states that, "The proposed increases in the [Service Line Cost] allowance are more in the nature of DSM programs.[38] The Terasen Utilities are encouraged to apply for the approval for such programs in another forum, where their impact and efficiency as DSM programs can be tested." This Application constitutes such an application in that the fuel switching measures for new construction function as an inducement to customers, and builders and developers to select

[36] The BC Energy Plan: A Vision for Clean Energy Leadership, "Energy Conservation and Efficiency Policies", page 3

[37] Terasen Gas Inc. and Terasen Gas (Vancouver Island) Inc. System Extension and Customer Connection Policies Review, Decision dated December 6, 2007, page 51

[38] Ibid, page 52

natural gas, much as the proposed increased Service Line Cost Allowances in the System Extension and Customer Connection Policies Review were to function as an inducement to new customers. Further, this Application includes a request for funding for "Innovative Technologies, NGV and Measurement". It is anticipated that part of this particular funding envelope could be directed to the provision of unique individual metering solutions (involving for example, diaphragm meters in mini-meter cabinets at suite entrances, or advanced meters that communicate use directly to the consumer) in multi-family dwellings that would otherwise be served with a single meter.

In TGI's Application to the Commission for "Tariff Changes to allow for Thermal Metering", dated May 8, 2007, TGI appended an article stating that "Providing individual suite metering has been shown in other jurisdictions to reduce individual consumption by up to 30%.[39] The Commission noted in Order No. G-65-07 approving the Tariff Changes to allow for Thermal Metering that, "Thermal metering has been in use in other jurisdictions, and has led to demonstrably improved energy efficiency and conservation" and that "Thermal metering is consistent with the BC Energy Plan objective of encouraging energy efficiency and conservation."[40] The Companies are hopeful that the "Innovative Technologies, NGV and Measurement" initiatives will result in increased conservation due to the increased focus on measurement, in a fashion to similar to that experienced in individual suites as referenced above.

7.3.5. Policy Action #5:

"Implement Energy Efficiency Standards for Buildings by 2010"[41]

The Terasen Utilities have identified specific areas of activity that would support this Policy Action, and that the Companies could undertake with an increase in EEC funding, such as contributing to design costs for buildings operating at 60% below the Model National Energy Code for Buildings. These specific areas of activity are outlined in more detail in Section 6 of this document.

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39 Article, "The installation of meters leads to permanent changes in customer behaviour", Lars Gullev and Michael Poulson, "News from DBDH", March 2006

40 British Columbia Utilities Commission Order No. G-65-07, June 14, 2007, page 1

41 The BC Energy Plan: A Vision for Clean Energy Leadership, "Energy Conservation and Efficiency Policies", page 3

7.3.6. Policy Action #6:

"Undertake a pilot project for energy performance labeling of homes and buildings in coordination with local and federal governments, First Nations, and industry associations"[42]

The Terasen Utilities existing DSM funding envelope does not allow for participation in new initiatives such as labeling. Labeling buildings with information about building efficiency, and the resultant energy consumption and costs is a key part of informing the public about the importance of energy conservation. As outlined in the "Joint Initiatives" discussion (Section 6.2.2), the Terasen Utilities will pursue co-funding a pilot energy performance labeling program for new and existing gas-heated homes, if this Application is approved. Labeling benefits ratepayers by providing them with a means to compare energy consumption levels between homes and is discussed further in Section 6.5, as building energy consumption labeling could be made a requirement for participation in incentive programs, particularly in new construction.

7.3.7. Policy Action #9:

"Increase the participation of local governments in the Community Action on Energy Efficiency Program and expand the First Nations and Remote Community Clean Energy Program"43

The Terasen Utilities have supported Government's Community Action on Energy Efficiency Program by participating on the program committee, and by providing funds for printing a policy manual that came out of this initiative. An increase in the EEC funding available to the Terasen Utilities will allow the Companies to commit more time towards advocating for the adoption of some of the policy tools that came out of Community Action on Energy Efficiency. As well, if the Application is approved, the Companies intend to contribute funding to the pool of monies to which Communities apply under the Community Action on Energy Efficiency, as part of the and

[42] The BC Energy Plan: A Vision for Clean Energy Leadership, "Energy Conservation and Efficiency Policies", page 4

[43] Ibid, page 6

Joint Initiatives program area described in Section 6. Participating local governments commit to reducing energy consumption in their own buildings, as well as in their communities, which in turn benefits ratepayers, partially by keeping local government energy bills and therefore property taxes down.

7.3.8. Policy Action #10:

"Ensure self-sufficiency to meet electricity needs, including insurance"[44]

Both the natural gas energy efficiency and fuel switching activities outlined in Section 6 in this Application will reduce the additional resources that BC Hydro would otherwise have to procure in the future, due to electrical efficiency co-benefits (generally motors and fans) from the installation of efficient natural gas equipment, as well as by avoiding suboptimal electrical load from heat, hot water, cooking and clothes drying. These fuel switching activities were derived from the CPR and are based upon programs that would be administered by the Companies. The CPR recently conducted by BC Hydro found that while there was significant economic potential for fuel switching, there was no achievable potential for BC Hydro PowerSmart to engage in fuel switching programs, given BC Hydro's Power Smart program guidelines. The economic potential of fuel switching in the BC Hydro CPR was found to be 24.02 PJ equivalent (6,674 GWh/year) by 2026 in the current gas supply cost scenario, and 11.85 PJ equivalent (3,293 GWh/year) by 2026 in the high gas supply cost scenario.[45] The energy efficiency and fuel switching activities covering the time period 2008 to 2010 for which funding is being requested in this Application are anticipated to result in 1,174 GWh of reduced electrical load.

Almost all of the natural gas that is consumed in British Columbia comes from British Columbia, and the Province is a net exporter of natural gas. As noted in the BCUC's Order G-152-07 dated December 6, 2007, on Terasen Gas's System Extension and Customer Connection Policies Review:

44 The BC Energy Plan: A Vision for Clean Energy Leadership, "Electricity Policies", page 1
45 BC Hydro 2007 Conservation Potential Review Summary Report, Marbek Resource Consultants Ltd., November 2007, p. 45

"The Commission Panel continues to agree with Terasen that the use of natural gas (as opposed to electricity) for space and water heating in BC will make additional energy available to displace coal or gas-fired generation at the margin in the Pacific Northwest."

The Decision notes further that:

"The Commission Panel does not, however, consider that it is the role of the Commission to determine governmental policy in respect of fuel choice for residential space and water heating. The Commission Panel is of the view that BC Hydro and Terasen must resolve with the Provincial Government any "ambiguity" they perceive in the 2007 Energy Plan. Accordingly, the Commission Panel makes no determinations in this regard."

The Commission further states that:

"the public interest can be served by an environment in which customers in the province have the right to choose their fuel source; in which the cost consequences of their choice are transparent; and where rate design does not hinder that choice."[46]

In the absence of specific government policy, the Companies believe that the Terasen Utilities are acting in the best interests of customers, both existing and new, by encouraging the use of efficient natural gas appliances. Energy efficiency programs assist existing customers by helping them to manage energy bills, making natural gas an attractive energy choice, keeping existing customers attached to the system thus maximizing the efficient use of the Companies' assets.

The Companies believe that encouraging natural gas energy efficiency and fuel switching activities support transparent consumer information and therefore helping customers to make the optimal decision on fuel source. As noted in the response to BC Hydro IR No. 1, Question 1 of the Companies' System Extension and Customer Connection Policies Review Application, "Terasen does not agree with the statement that the use of natural gas to provide space and water heating will result in higher greenhouse gas emissions". Consumers that are encouraged to choose natural gas for space and water heating, and for cooking and clothes drying, are likely to cause lower GHG impacts than those consumers that choose electricity for these end uses.

[46] Terasen Gas Inc. and Terasen Gas (Vancouver Island) Inc. System Extension and Customer Connection Policies Review, Decision dated December 6, 2007

In the final argument to the Companies' System Extension and Customer Connection Policies Review Application Section 27 the Companies state:

> *"The electrical grid in British Columbia is not an island. British Columbia is not isolated from the remainder of the grid in North America; the grid is interconnected and a significant portion of both current and new electrical generation in western North America is from the inefficient combustion of one form or energy – coal or natural gas – to create another form of energy – electricity. For so long as coal or gas fired electrical generation continues to be the marginal source of electrical generation in western North America, the use of gas for space and water heating will "make additional energy available to displace coal or gas fired generation at the margin in the Pacific Northwest". Given that production of electricity by coal and gas fired generation is less efficient than using gas for space and water heating, GHG emission will be reduced if customers use gas rather than electricity for space and water heating."*

The Companies consider that information concerning comparative GHGs as well as general conservation messaging to support the creation of a "culture of conservation" in the province would likely be part of the information provided not only to program participants, but also as part of the larger Conservation Education and Outreach initiative, outlined in Section 6.5 of the Application, and in the proposal for Conservation Education and Outreach from Wasserman and Partners, attached as Appendix 8.

The cost consequences for consumers that choose electricity and other forms of energy over natural gas are not transparent today. This is especially true in the case of space heating, where electric baseboard heaters can be installed relatively inexpensively compared to a natural gas forced air or hydronic system, but will generate higher annual energy costs per unit than would a high efficiency natural gas heating system. The funding for fuel switching activity that the Companies are proposing in this Application would help to address the disparity in capital costs between natural gas and electrical equipment, so as to encourage more customers to choose efficient natural gas appliances over their electric equivalents which would also have the effect of lowering regional GHGs.

7.3.9. Policy Actions 29, 30, 31, 34 and 35 regarding Alternative Energy[47]

The Terasen Utilities propose to make a portion of the funding requested in this Application available to programs demonstrating and promoting innovative low-carbon technologies that provide greater expected benefits than natural gas for certain uses or under certain circumstances, but face some economic or educational hurdle. The Companies recognize that there are new, innovative non-gas technologies available such as solar hot water pre-heating, that can reduce fossil fuel consumption, and support government's policy goals, and are therefore requesting funding specifically for Innovative Technologies, NGV and Measurement. Potential programs for this funding are discussed in more detail in Section 6.9 of this document.

7.3.10. Policy Actions regarding Skills Training and Labour Policies[48]

In order to be successful in implementing an expanded natural gas EEC program, the support and training of those that actually install natural gas equipment is crucial. Therefore, with increased EEC funding, the Companies would look to increase trade relations and trades training activity on efficient gas equipment and the optimal operation of energy efficient buildings. Trades people are often the primary interface with customers at the time that the customer makes a purchase decision and the information that they provide to the customer can influence whether a customer buys a high-efficiency appliance or a standard efficiency appliance. It is therefore important that the Companies educate trades people on the benefits of high-efficiency equipment. High-efficiency natural gas equipment can be more complex to install than standard efficiency equipment, therefore training of trades people on equipment is needed to ensure that equipment is installed safely and according to design. Building operations are a key component in reducing energy consumption and GHG emissions; if a building has been designed to be efficient but is not being operated as it was designed, many or even all the benefits of that efficient design are lost. Building operators are key players in the success of any energy efficiency program. Benefits to ratepayers from an increased investment

[47] The BC Energy Plan, A Vision for Clean Energy Leadership, "Alternative Energy Policies", pages 1 - 4

[48] The BC Energy Plan, A Vision for Clean Energy Leadership, "Skills, Training and Labour Policies, pages 2 and 3

by the Companies in trade relations and training would include more accurate information received from contractors, and greater confidence that equipment is being installed as it should be, and that buildings will be operated as they were designed. An additional benefit to the province as a whole would be a more trained and skilled workforce in the field of installing efficient equipment, which will in turn support the Province's Energy Efficient Buildings initiative.

If this Application is approved, the Terasen Utilities will increase its staffing levels to design, implement and evaluate the expanded energy efficiency and conservation program. The incremental costs associated with this staffing requirement is included in the total funding request of $56.6 million as described elsewhere in this Application. As outlined in the Habart report attached as Appendix 9, the level of funding requested necessitates a total staff level of 12 in 2008, 13 in 2009 and about 21 in 2010. Currently the Companies have 4 staff members spending about 60% of their time on Energy Efficiency and Conservation Activity. Hiring and training these additional staff will also increase the number of skilled energy efficiency practitioners in British Columbia. More detail on staffing levels included in this Application can be found in Section 6.11, "Staffing".

8. Conclusion

The Terasen Utilities have been actively, though modestly engaged in EEC activities since 1997 with considerable success. Since the time that these funding levels were established, the socio-economic landscape in which the Companies operate has changed significantly. Natural gas commodity prices have increased, the number of energy options from which customers can choose has increased, the average use of natural gas per account has decreased, and government and the public policy initiatives are placing a higher level of importance on environmental and energy use issues. Existing programming has provided cost-effective DSM activity for customers; however, the opportunity exists for the Terasen Utilities to expand cost-effective EEC. The Companies' believe that this Application addresses customer interests and government's policy objectives through appropriate EEC programs and funding levels, while ensuring that investors are able to achieve appropriate returns for these services. The funding sought in this Application would bring the Companies' EEC expenditure and program offerings to customers more into line with other large utilities.

The programs contemplated in this EEC Application are expected to provide the following outcomes:

- Provide customers access to a wider variety of energy efficiency and conservation incentive programs, assisting them to reduce energy consumption, thereby lowering customer energy bills and reducing the individual and societal impacts associated with energy use.
- Expand the range of customers for whom energy efficiency and conservation programs are available. For example, the commercial program portfolio is proposal is a significant expansion over the Companies' current efforts, and in the residential sector, funding is contemplated specifically for DSM for Affordable Housing, as outlined in the Section 6.6.
- Provide education for customers and the public at large about energy and conservation issues, leading to customers making more informed choices about energy equipment and actions, as outlined in the proposal received from Wasserman and Partners, attached as Appendix 8.

- Recognize the need to maintain a competitive cost for using natural gas an energy source, thus maintaining the energy balance in the province, and ensuring that customers have a wide variety of cost-competitive energy sources to choose from.
- Support BC Hydro and FortisBC in achieving their conservation goals, through both incidental electrical savings from such items as efficient motors in efficient natural gas appliances, and through the residential fuel switching measures proposed herein, thus helping to minimize the need for the customers of the electric utilities to invest in additional generation and transmission infrastructure.
- Recognize the continued value in adding efficient cost-effective customers to the Terasen Utilities distribution system, keeping the use of natural gas and other energy forms competitive for all customers.
- Recognize that individual metering technologies can help to inform customers as to their individual consumption, which is shown to lead to reduced overall consumption of up to 30%[49], as noted in Section 7.3.
- Encourage the utilization of new and alternative technologies that have not to date enjoyed strong market penetration in British Columbia.
- Support the development and training of skilled tradespeople that are fluent in the merits of conservation and efficient technology.

It is for these reasons that the Companies respectfully submit that this Application should be approved.

[49] Article, "The installation of meters leads to permanent changes in customer behaviour", Lars Gullev and Michael Poulson, "News from DBDH", March 2006

Glossary of Terms

TGI – Terasen Gas Inc.

TGVI – Terasen Gas (Vancouver Island) Inc.

TGW – Terasen Gas (Whistler) Inc.

The Companies – Terasen Gas Inc. and Terasen Gas (Vancouver Island) Inc.

The Terasen Utilities – Terasen Gas Inc., and Terasen Gas (Vancouver Island) Inc.

DSM – Demand Side Management

EEC – Energy Efficiency and Conservation

Residential Customers - Terasen Gas Inc. Rate 1 Customers; and Terasen Gas (Vancouver Island) Inc. RGS Customers

Commercial Customers – Terasen Gas Inc. Rates 2, 3, 4. 5, 6, 23 and 25 Customers; and Terasen Gas (Vancouver Island) Inc. Rates SCS1, SCS2, LCS1, LCS2, AGS, LCS3, HLF and ILF Customers

GJs - GigaJoules

CPR – Conservation Potential Review

GHG – Greenhouse Gases

CO2e – Carbon Dioxide equivalent

TRC – Total Resource Cost test – represents the benefits/costs to the economy as a whole of a DSM program

RIM – Ratepayer Impact Measure test – represents the benefits/costs to all ratepayers of a DSM program, regardless of whether or not they participate in a DSM program

Participant – Participant test – represents the benefits/costs to a Participant from participating in a DSM program

Utility Cost – Utility Cost test – represents the benefits/costs to a Utility from participating in a DSM program

Appendix 1

TERASEN GAS
CONSERVATION POTENTIAL REVIEW

Residential Sector Report

–Final Report–

Submitted to:
Terasen Gas

Prepared by:
Marbek Resource Consultants

In Association with

Habart & Associates, and
Innes Hood Consulting

April 2006

Marbek Resource Consultants
300-222 Somerset Street West
Ottawa, Ontario K2P 2G3
Tel: 613.523.0784 ⬩ Fax: 613.523.0717 ⬩ www.marbek.ca

EXECUTIVE SUMMARY

❑ Background and Objectives

This Conservation Potential Review (CPR) provides Terasen Gas with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long range energy efficiency and fuel choice strategy
- Design and implement energy efficiency and fuel choice programs
- Assess the impact of energy efficiency and fuel choice programs on both peak and annual loads
- Set annual energy efficiency and fuel choice targets and budgets.

❑ Scope

This study was designed to coincide as much as possible with the structure and approach of the BC Hydro CPR, which was completed in 2003. The intent was to ensure that: this study would benefit from the substantial body of information and modelling work prepared for BC Hydro as part of its Conservation Potential Review – Update 2002; and, the results of this study would enable the assessment of not only energy efficiency opportunities, but also opportunities where natural gas could cost effectively replace electricity in selected markets.

Sector Coverage: The study addresses three sectors: residential (Rate 1, plus Rate 2 and 3 multi-unit buildings), commercial/institutional (Rate 2, 3 and 23 – non process loads) and manufacturing (Rate 5, 25 and Rate 3 and 23 process loads). Terasen's 300 largest manufacturing accounts (Rate 7 and 22) are outside the scope of this study.

Geographical Coverage: The study results are presented for the total Terasen Gas service region and for the three service areas of: Lower Mainland, Interior and Vancouver Island.

Study Period: The base year for this study is fiscal year FY 2003/04. The time period covered by this study is to FY 2015/16, with milestones at the intervening years of FY 2005/06 and FY 2010/11.

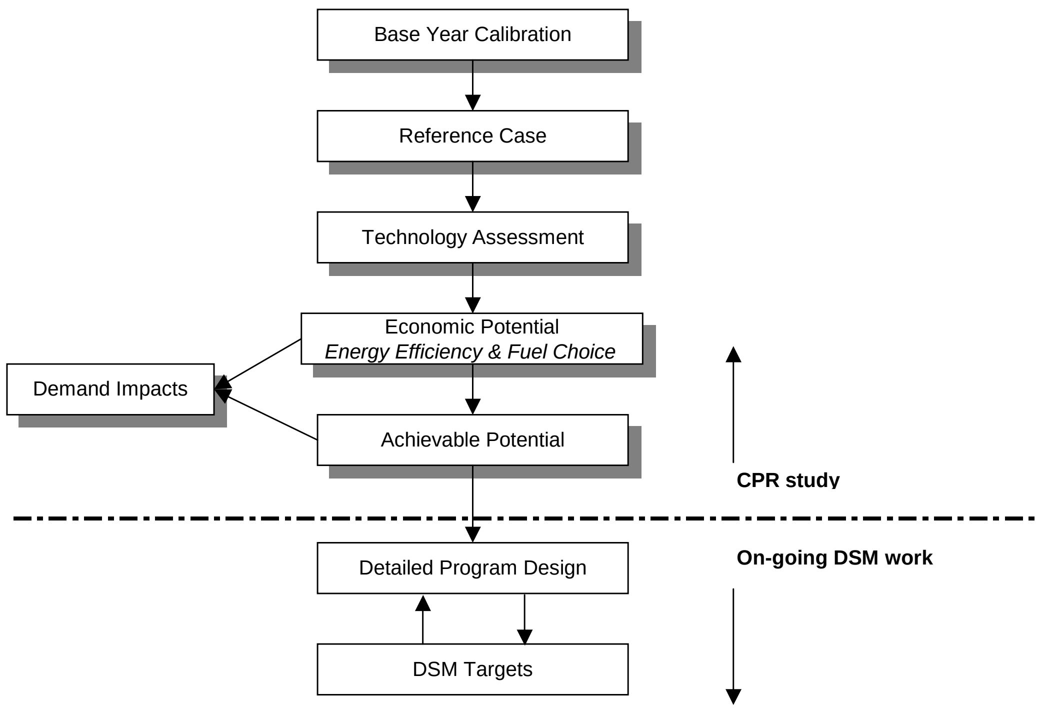
Technologies: The study addresses both energy efficiency and fuel choice options.

❑ Approach

The detailed end use analysis of energy efficiency and fuel choice opportunities in the Residential Sector employed two linked modelling platforms, specifically: HOT-2000, a commercially supported, residential building energy-use simulation software; 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 E1 and are discussed in the following paragraphs. 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.

Exhibit E1
Study Approach
Major Analytical Steps



❑ Major Analytic Steps and Definitions

This study employs numerous terms that are unique to analyses such as this one; 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. Building energy use simulations were undertaken for each building segment.

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, and, finally an estimation of "natural" changes affecting energy consumption over the study period.

Technology Assessment

Energy efficiency and fuel choice 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 base line 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 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 8%.

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 Terasen Gas's perspective using life-cycle costing, against the long-run avoided cost of new natural gas supply. All the energy efficiency and fuel choice options included in the technology assessment that had a positive measure TRC were incorporated into the Economic Potential Forecasts.

Two economic potential forecasts were prepared: energy efficiency and fuel choice.

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 practically difficult to induce customers to purchase and install all the energy efficiency or fuel choice options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as “Most Likely” and “Upper”.

Estimates provided were developed in a workshop involving Terasen Gas and BC Hydro energy efficiency program personnel, trade allies, selected external experts and the consulting team.

Peak Day Load Impacts

Load factors provided by Terasen Gas were used to derive peak day load impacts from the energy consumption values contained in each of the potential estimates noted above.

❑ Results and Findings – Base Year and Reference Case Forecast

Base Year Natural Gas Use

In the base year of 2003/04, Terasen Gas's residential customers consumed approximately 96,700,000 GJ. Exhibits E2 and E3, respectively, provide additional details on the major end uses and sub sectors where residential sector natural gas consumption occurs.

Exhibit E2 shows that space heating accounts for approximately 61% of the total residential natural gas use. Domestic hot water heating is the next largest residential end use, accounting for approximately 21% of total residential natural gas use, followed by fireplaces (13%). Cooking, swimming pool heaters, and clothes dryers, combined, account for about 3% of residential natural gas use. The "Other" end use includes a variety of residential uses such as gas barbecues, spa/hot tub heaters, outdoor fireplaces, garage or patio heaters, and outdoor lights. Combined, these end uses account for the remaining 2% of residential natural gas use.

Exhibit E3 shows that single family dwellings (SFD) and duplexes account for about 68% of residential natural gas consumption followed by low-rise (15%) and row (5%) houses. High-rise and mobile/other dwellings account for the remaining residential natural gas use.

Exhibit E2
Graphic of Base Year Residential Natural Gas Consumption
Distribution of Use by End Use

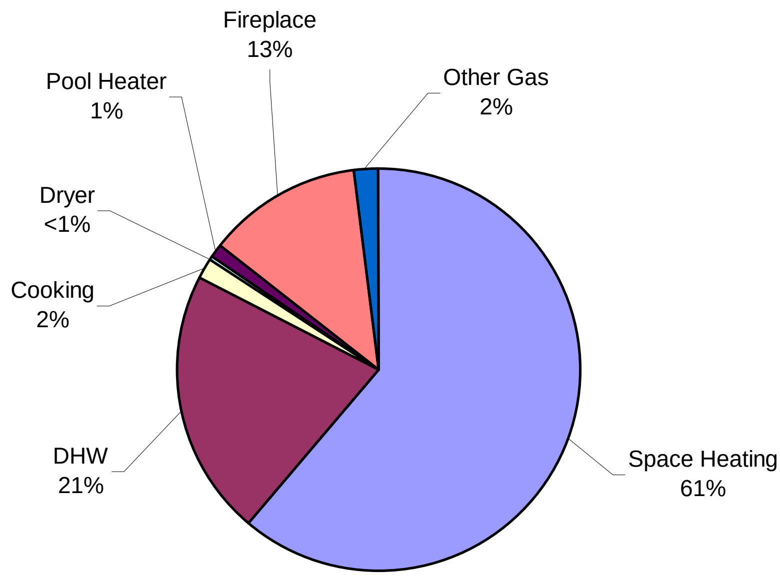
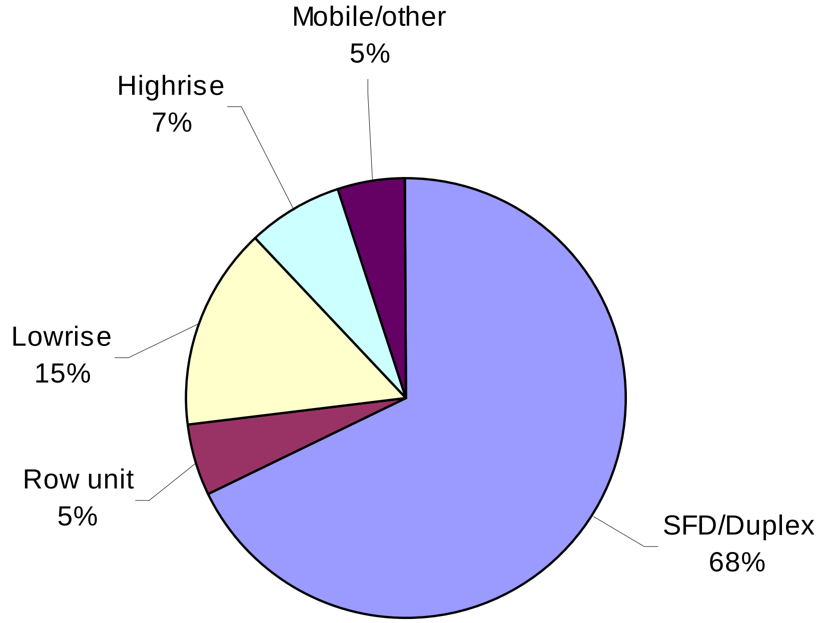


Exhibit E3
Graphic of Base Year Residential Natural Gas Consumption
Distribution of Use by Building Segment



Reference Case

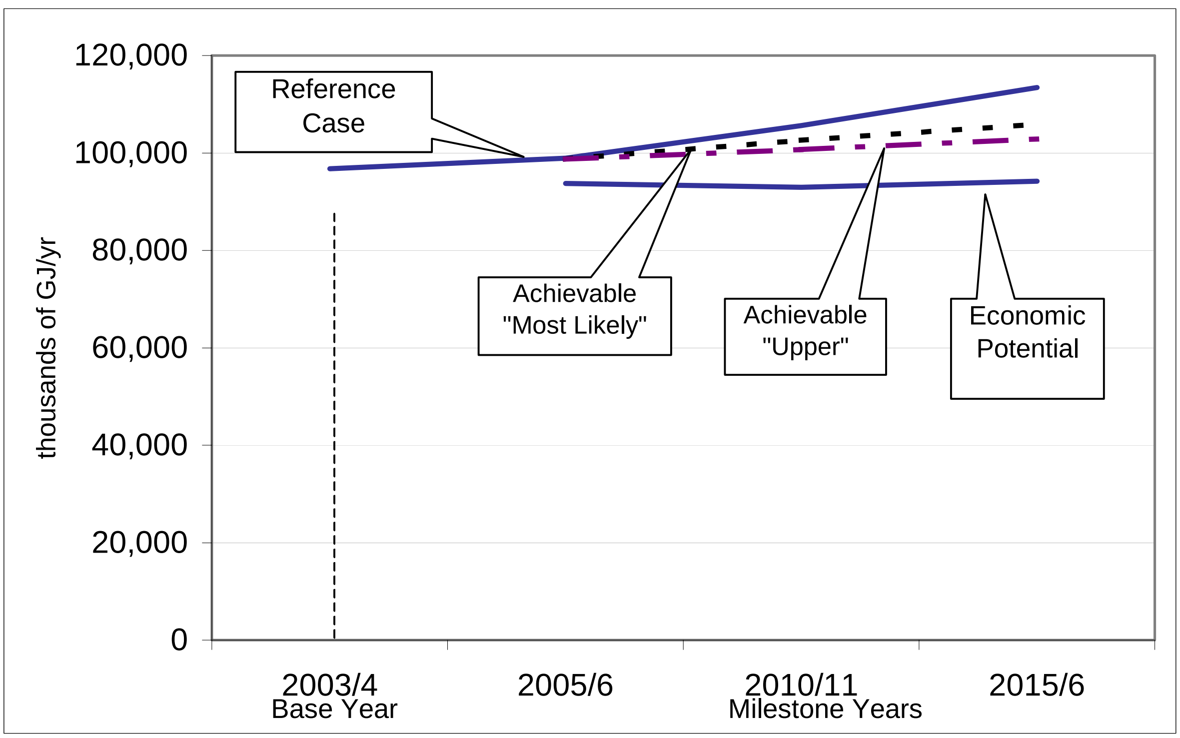
In the absence of continued demand side management (DSM) initiatives, the study estimates that natural gas consumption in the residential sector will grow from the base year (FY 2003/04) consumption of approximately 96,700,000 GJ/yr. to 105,600,000 GJ/yr. by FY 2010/11 and 113,400,000 GJ/yr. by FY 2015/16. This represents an overall growth of about 17% in the period.

❑ Results and Findings – Energy Efficiency

A summary of the levels of annual natural gas consumption contained in each of the energy efficiency forecasts, by milestone year, is presented in Exhibit E4 and discussed briefly in the paragraphs below.

Exhibit E4
Summary of Forecast Results (thousand GJ/yr.)
– Energy Efficiency –

Annual consumption (thousand of GJ/yr) Residential Sector						Potential Annual Savings (thousand of GJ/yr)		
	Base Year	Reference Case	Economic	Achievable		Economic	Achievable	
				Most Likely	Upper		Most Likely	Upper
2003/04	96,723	96,723						
2005/06		98,904	93,755	98,705	98,705	5,149	199	199
2010/11		105,596	92,953	102,570	100,661	12,643	3,025	4,935
2015/16		113,401	94,216	105,888	102,886	19,185	7,513	10,515



Economic Potential Forecast – Energy Efficiency Scenario[1]

Under the conditions of the Economic Potential Forecast – Energy Efficiency Scenario, the study estimated that consumption in the residential sector would decline to about 94,200,000 GJ/yr. by FY 2015/16. Annual savings relative to the Reference Case are about 19,200,000 GJ/yr. or about 17%. The Economic Potential annual savings are about 12,600,000 GJ/yr. in FY 2010/11.

Achievable Potential – Energy Efficiency Scenario

The natural gas savings opportunities identified in the Economic Potential Forecast were "bundled", by end use, into a set of "Actions" reflecting a way in which initiatives may be undertaken. A brief profile was developed for each of the identified Actions. The Action Profiles provided a "high-level" logic framework that guided participant discussions in a full-day workshop. The results are presented in Exhibit E5 by Action and by milestone year.

Consistent with the results in the Economic Potential Forecast, the most significant Achievable savings opportunities were in the Actions that addressed furnaces and appliances.

Exhibit E5
Summary of Achievable Savings – Energy Efficiency
For Total Terasen Gas Service Area
by Action and Milestone Year

Service Region / Action	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
R1 - Furnaces	949	1,752	2,439	3,277	32%
R2 - Fireplaces	137	520	941	1,642	13%
R3 - Efficient DHW Eqpt	8	48	52	200	1%
R4 - DHW Load Reduc	148	296	274	548	4%
R5 - DHW Heat Rec & Traps	24	37	23	35	0%
R6 - Appliances	1,254	1,600	2,482	2,949	33%
R7 - Efficient Windows	402	483	972	1,296	13%
R8 - Air Sealing	46	96	183	287	2%
R9 - Integrated Design	26	53	108	217	1%
R10 - Building Operations	30	51	39	65	1%
Total TG Service Region	**3,025**	**4,935**	**7,513**	**10,515**	**100%**

[1] Energy markets in Canada and worldwide have experienced a number of extraordinary events in the recent past. As a result, natural gas costs have risen substantially since the start of this CPR. As current natural gas costs are higher than those used in this analysis, the benefits of efficiency measures may be understated while the benefits of fuel choice measures may be overstated. Within the limits of the time and resources available, this CPR has attempted to accommodate the increasing natural gas prices by applying a "high level" price sensitivity analysis to the measures screening process. Efficiency measures that were close but did not initially pass the measures TRC test have been included in the Economic Potential scenario. This approach recognizes that the measures will be subject to further economic screening during the detailed program design stage, which will provide a further opportunity to decide whether the measures should continue to be included in Terasen's program portfolio.

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 Terasen Gas. The results are summarized in Exhibit E6. As illustrated, the Achievable peak day savings in 2015/16 range from a decrease of about 65,000 GJ/day ("Most Likely" scenario) to a decrease of approximately 91,000 GJ/day ("Upper" scenario) for the total Terasen Gas service region.

Exhibit E6
Summary of Peak Day Load Impacts – Energy Efficiency
For Total Terasen Gas Service Area
by Scenario and Milestone Year

Service Region & Scenario	**Peak Day Saving by Milestone Year & Scenario (GJ)**	
	2010/11	**2015/16**
Total Terasen Gas		
Achievable- Most Likely	26,255	65,220
Achievable- Upper	42,827	91,278

Electricity Impacts – Energy Efficiency Scenarios

The natural gas savings associated with each of the achievable energy efficiency scenarios shown in Exhibit E5 would also result in "collateral" electricity savings as some efficiency measures affect both energy sources. The study estimated that in FY 2015/16 the natural gas efficiency measures contained in the "Upper" and "Most Likely" Achievable Potential scenarios would result in additional electrical savings of 47 GWh/yr. and 62 GWh/yr., respectively.

Greenhouse Gas Impacts – Energy Efficiency Scenarios

The natural gas savings associated with each of the achievable energy efficiency scenarios shown in Exhibit E5 would result in significant greenhouse gas reductions. The study estimated that in FY 2015/16 the natural gas efficiency measures contained in the "Upper" and "Most Likely" Achievable Potential scenarios would reduce greenhouse gas emissions by, respectively, 380,000 and 533,000 of CO_2e/yr., depending on scenario. The electricity savings associated with the natural gas efficiency measures would result in additional GHG reductions, which have not been included in this calculation.

❑ Results and Findings – Fuel Choice

A summary of the levels of annual natural gas consumption contained in each of the fuel choice forecasts, by milestone year, is presented in Exhibit E7 and discussed briefly in the paragraphs below.

Exhibit E7
Summary of Forecast Results (thousand GJ/yr.)
- Fuel Choice -

Annual consumption (thousand of GJ/yr) Residential Sector						Potential Annual Increase (thousand of GJ/yr)		
	Base Year	Reference Case	Economic	Achievable		Economic	Achievable	
				Most Likely	Upper		Most Likely	Upper
2003/4	96,723	96,723						
2005/6		98,904						
2010/11		105,596	111,101	106,266	107,329	5,505	670	1,734
2015/6		113,401	122,796	114,854	117,002	9,395	1,453	3,601

Economic Potential Forecast – Fuel Choice Scenario

Under the Fuel Choice Scenario, natural gas consumption in the residential sector grows to approximately 122,800,000 GJ/yr. by FY 2015/16, an increase of about 9,400,000 GJ/yr., or 8% relative to the Reference Case. This growth in natural gas consumption would be offset by a decrease of about 1,730 GWh/yr. in electricity use.

The net energy avoided costs for the province-as-a-whole under this Fuel Choice scenario would be a savings of approximately $53.4 million dollars per year by the milestone year FY 2015/16.

Achievable Potential – Fuel Choice Scenario

The natural gas fuel choice opportunities identified in the Economic Potential Forecast were treated in the same manner as the energy efficiency opportunities. That is, they were “bundled”, by end use, into a set of “Actions” reflecting a way in which initiatives may be undertaken. The results are presented in Exhibit E8, by Action and by milestone year.

Exhibit E8
Summary of Achievable Natural Gas Impacts – Fuel Choice
For Total Terasen Gas Service Area
by Action and Milestone Year

Action	Annual Gas Increase (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
RFC1 - Heating	491	1,375	868	2,432	60%
RFC3 - Range	62	124	195	391	13%
RFC4 - Dryer	117	234	389	778	27%
Total TG Service Region	**670**	**1,734**	**1,453**	**3,601**	**100%**

Peak Day Load Impacts – Fuel Choice Scenarios

The peak day load impacts associated with the preceding achievable fuel choice scenarios are summarized in Exhibit E9. As illustrated, the Achievable peak day load impact in 2015/16 ranges from an increase of about 12,000 GJ/day (Most Likely scenario) to an increase of approximately 30,000 GJ/day (Upper scenario) for the total Terasen Gas service region.

Exhibit E9
Summary of Peak Day Load Impacts – Fuel Choice
For Total Terasen Gas Service Area
by Scenario and Milestone Year

Service Region & Scenario	Peak Day Increase by Milestone Year & Scenario (GJ)	
	2010/11	2015/16
Total Terasen Gas		
Achievable- Most Likely	5,552	12,116
Achievable- Upper	14,359	30,026

Electricity Impacts – Fuel Choice Scenarios

The increased consumption of natural gas associated with each of the achievable fuel choice scenarios would be offset by a decrease in electricity consumption. As illustrated in Exhibit E10, electricity savings in FY 2015/16 associated with the achievable fuel choice scenarios range from 300 GWh/yr. to about 750 GWh/yr. for, respectively, the Most Likely and Upper scenarios.

Exhibit E10
Summary of Achievable Electricity Impacts – Fuel Choice
For Total Terasen Gas Service Area
by Action and Milestone Year

Action	Electricity Decrease (GWh/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
RFC1 - Heating	103	287	186	521	62%
RFC3 - Range	7	14	22	43	7%
RFC4 - Dryer	28	55	92	184	31%
Total TG Service Region	**137**	**356**	**300**	**748**	**100%**

Greenhouse Gas Impacts – Fuel Choice Scenarios[2]

The increased consumption of natural gas that would occur under each of the preceding fuel choice achievable scenarios would result in increased greenhouse gas emissions, but would be partially offset by a decrease in greenhouse emissions from reduced electricity generation. The study estimated that the net increase in greenhouse gas emissions in FY 2015/16 would range from about 65,000 tonnes/yr. to 161,000 tonnes/yr. for, respectively, the Most Likely and Upper scenarios.

❑ Summary of Findings

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in British Columbia's residential sector. In the Most Likely and Upper achievable scenarios those energy efficiency improvements would provide between 7,500,000 and 10,500,000 GJ/yr. of savings in FY 2015/16 as well as peak day load reductions of approximately 65,000 to 91,000 GJ.

The study also identified substantial opportunities for the increased use of natural gas instead of electricity for space heating in new homes and for cooking and clothes drying.

In addition, the study noted that measures such as advanced housing thermal performance, high performance heat recovery ventilators, and on demand water heaters provide additional energy efficiency opportunities. While these measures did not fully pass the economic thresholds set in this study, future energy price increases combined with reduced technology costs are expected to make them economically attractive in the future.

❑ Interpretation of Results

The study findings outlined above could have significant implications for Terasen Gas. If the cost effective DSM measures identified in this study are pursued by Terasen Gas, then:

- **A significant increase in annual DSM investment in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels.** This increased level of DSM investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario.

- **Interactions between Terasen Gas and its customers would increase very significantly.** For example:
    - Furnace and fireplace actions combined, could affect up to 25% of residential customers by 2015/16.
    - Appliance actions could affect up to 800,000 customer purchases by 2015/16.

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[2] Estimates are based on an assumed emissions rate of 50.7 kg CO_2e/GJ for natural gas and 29 tonnes/GWh for electricity, Emissions rates are from Environment Canada (PERRL). Electricity value represents the average emissions rate over an annual period. Actual values may vary depending on both time of day and month of year. However, estimation of emissions impacts at this more detailed level was beyond the scope of this study.

- **Annual GHG offsets from residential natural gas savings could reach 300 to 500 kilotonnes**. At the estimated price range of $10 to $15 per tonne, these offsets could have an annual market value in the range of $3 million to over $7 million.

The current Terasen Gas DSM incentive mechanism provides an allowable return of 5% of the Total Resource Cost (TRC). The DSM measures identified for this sector, when combined with those identified in the commercial and manufacturing sector reports, could result in a larger scale DSM effort that might have a TRC value of $30 million, or more. A TRC value of $30 million would provide a $1.5 million annual payment through the DSM incentive mechanism. If the utility was to apply for increased DSM funding levels, a larger DSM incentive mechanism or equivalent shared savings mechanism could also be considered.

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Appendices

Table of Exhibits

1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

This Conservation Potential Review (CPR) provides Terasen Gas with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long range energy efficiency and fuel choice strategy.
- Design and implement energy efficiency and fuel choice programs.
- Assess the impact of energy efficiency and fuel choice programs on both peak and annual load.
- Set annual energy efficiency and fuel choice targets and budgets.

This report provides the CPR results for the Residential Sector; the Commercial and Manufacturing sectors are presented in separate documents.

1.2 STUDY SCOPE

Sector Coverage: The study addresses three sectors: residential (Rates 1, plus Rate 2 and 3 multi-unit buildings), commercial/institutional (Rates 2, 3 and 23 – non process loads) and manufacturing (Rates 5, 25 and Rates 3 and 23 process loads). Terasen's 300 largest manufacturing accounts (Rates 7 and 22) are outside the scope of this study.

Geographical Coverage: The study results are presented for the total Terasen Gas service region and for the three service areas of: Lower Mainland, Interior and Vancouver Island.

Study Period: The base year for this study is fiscal year FY 2003/04. The time period covered by this study is to FY 2015/16, with milestones at the intervening years of FY 2005/06 and FY 2010/11.

Technologies: The study addresses both energy efficiency and fuel choice options.

Relation to BC Hydro CPR: This study builds on the substantial body of information and modelling work prepared for BC Hydro as part of its Conservation Potential Review – Update 2002. This means that, wherever possible, this study will build on the existing building and energy use data compiled for the BC Hydro study.

1.3 DEFINITIONS

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. Key terms include the following:

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. Building energy use simulations were undertaken for each building segment.

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, and, finally an estimation of "natural" changes affecting energy consumption over the study period.

Technology Assessment

Energy efficiency and fuel choice 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 base line 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 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 8%.

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 Terasen Gas's perspective, when using life-cycle costing with the long-run avoided cost of new natural gas supply. All the energy efficiency and fuel choice 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: energy efficiency and fuel choice.

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 practically difficult to induce customers to purchase and install all the energy efficiency or fuel choice options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as "Most Likely" and "Upper".

Estimates provided were developed in a workshop involving Terasen Gas and BC Hydro energy efficiency program personnel, trade allies, selected external experts and the consulting team.

Peak Day Load Impacts Load factors provided by Terasen Gas were used to derive peak day load impacts from the energy consumption values contained in each of the potential estimates noted above.

1.4 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. 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. A summary of the steps is presented below.

Step 1: **Develop Base Year Calibration Using Actual Terasen Gas 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 Terasen Gas 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.

Step 3: **Develop and Assess Energy Efficiency and Fuel Choice Options**

- Develop list of energy efficiency and fuel choice measures.
- Compile detailed cost and performance data for each measure.
- Identify the baseline technologies employed in the Reference Case.
- Develop energy efficiency and fuel choice options for each end use.
- Compile Terasen Gas 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 and fuel choice option.

Step 4: **Estimate Economic Energy Efficiency Potential**

- Screen the identified energy efficiency 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 Fuel Choice Potential**

- Screen the identified fuel choice options from Step 3 against the economic data.
- Identify the combinations of fuel choice options and building types where the measure TRC is positive.
- Apply the economically attractive fuel choice measures from Step 3 within the energy use simulation model developed previously for each building type.
- Compare the consumption levels when all economic fuel choice 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 and fuel choice 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 Terasen Gas and BC Hydro personnel, review preliminary estimates and reach general agreement on "Most Likely" and "Upper" 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/fuel choice scenarios were converted to average daily values based on annual load profile data provided by Terasen Gas.
- Load factors that correlate "average" to "peak" consumption were provided by Terasen Gas 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.

1.5 ANALYTICAL MODELS

The analysis of the residential sector employs two linked modelling platforms. They are:

- **HOT-2000,** 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.

HOT-2000 is used to define household heating, cooling and DHW energy use for each of the residential building archetypes. HOT 2000 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 domestic hot water systems (DHW).
- 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 HOT-2000 provide the space heating/cooling energy use intensity (EUI) inputs to the thermal Archetype module of RSEEM (see below).

RSEEM (Residential ***S***ector ***E***nergy ***E***nd Use ***M***odel) 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.

1.6 THIS REPORT

The remainder of this report is organized as follows:

- **Section 2** presents the results and the specific tasks involved in developing the base year calibration.

- **Section 3** presents the Residential Reference Case for the FY 2003/04 to FY 2015/16.

- **Section 4** identifies and assesses energy efficiency and fuel choice technology options within the Residential Sector.

- **Section 5** presents the Residential Sector Economic Potential Forecast – Energy Efficiency for the study period (FY 2003/04 to FY 2015/16).

- **Section 6** presents the Residential Sector Economic Potential Forecast – Fuel Choice for the study period (FY 2003/04 to FY 2015/16).

- **Section 7** estimates the proportion of energy savings or fuel choice opportunities 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.

2. BASE YEAR NATURAL GAS USE

2.1 INTRODUCTION

This section presents a description of natural gas use in British Columbia's residential sector in the base year of fiscal FY 2003/04. Drawing on the best available data, this section presents total natural gas consumption in British Columbia's residential sector, together with an estimate of how that consumption is distributed by service area, sub sector, end use and technology.

Consistent with the discussion presented in the preceding section, development of the base year calibration builds directly on the data collected during the BC Hydro Conservation Potential Review 2002. This is because much of the energy-related data on British Columbia's building stock (e.g., dwelling units, space heating loads, DHW loads, fuel shares) compiled for the BC Hydro study, and subsequently made publicly available, is directly applicable to this study.

The remainder of this section outlines the steps involved in preparing the base year calibration and presents a summary of the results. The discussion is organized into the following subsections:

- Segmentation of residential building stock
- Estimation of space heating loads
- Estimation of appliance energy consumption
- Estimation of appliance saturation
- Estimation of fuel share by end use
- Model results – base year energy use
- Comparison with Terasen Gas sales data.

2.2 SEGMENTATION OF RESIDENTIAL BUILDING STOCK

The first major task in developing the base year natural gas consumption involved the segmentation of the residential building stock on the basis of four factors:

- Dwelling type or building segment
- Vintage
- Heating category (natural gas, electric)
- Service area.

Consistent with the overall approach, this study employs the same segmentation as was used in the BC Hydro Study. The segmentation[3] is:

- Single-family detached/duplex (including all detached single-family dwellings and duplexes)
- Row (including all row houses and townhouses)
- Low-rise apartment (four storeys or less)

[3] The BC Hydro study did not include segmentation by vintage of gas-heated homes in the first two categories above, although electrically-heated homes were separated into pre-1976 and post-1976 homes. In this study, both gas-heated and electrically-heated homes are segmented by vintage in the same way.

- High-rise apartment (five storeys or more)
- Mobile/other.

Terasen Gas customer billing data, combined with BC Hydro data, were used to develop a composite breakdown of the residential sector by dwelling type. This information is summarized in Exhibit 2.1. Highlights from Exhibit 2.1 are presented below:

- There are about 1.5 million dwelling units in the regions served by Terasen Gas. Not all of the dwelling units in Exhibit 2.1 are Terasen Gas customers as the figures also include residential buildings that are not connected to the Terasen Gas system.

- On a regional basis, almost 55% of dwelling units are in the Lower Mainland region, with over 25% in the Interior region and under 20% in the Vancouver Island region.

- On the basis of dwelling type, 55% of the residential stock is single-family, and a further 22% of the residential stock is low-rise apartment.

- In terms of fuel share, 72% of the residential stock uses natural gas for the primary space heating fuel; however, in the Vancouver Island region, gas space heating serves only 17% of the stock.

Estimating the number of dwelling units was relatively straightforward for single, row and mobile homes, as the Terasen Gas customer account data correspond quite well with both the BC Hydro data and the number of dwelling units. However, estimating the number of apartment units was more difficult, as most apartment buildings are metered as whole buildings. This study drew heavily on the earlier work done for the BCH study to determine average numbers of suites in low-rise and high-rise buildings and to separate energy use into amounts used in suites and amounts used in common areas.

Exhibit 2.1: Existing Residential Units for Total Terasen Service Area by Segment, Vintage and Primary Heating Source, 2004

Segment	Units			
	Lower Mainland	Interior	Vancouver Island	Total
SFD/Duplex Gas - pre 1976	88,168	62,535	5,106	155,809
SFD/Duplex Gas - post 1976	296,417	130,264	20,472	447,153
SFD/Duplex NonGas - pre 1976	6,625	18,704	29,784	55,112
SFD/Duplex NonGas - post 1976	22,272	38,961	118,515	179,747
Row unit Gas - pre 1976	2,924	3,105	694	6,723
Row unit Gas - post 1976	50,767	5,779	1,600	58,146
Row unit NonGas - pre 1976	1,755	2,302	3,954	8,011
Row unit NonGas - post 1976	27,996	3,673	7,755	39,424
Lowrise suite <=4 floors gas	165,711	53,493	8,614	227,817
Lowrise suite <=4 floors elec/other	48,023	12,511	47,019	107,553
Highrise suite >4 floors gas	82,747	14,790	3,324	100,862
Highrise suite >4 floors elec/other	24,543	6,196	9,271	40,010
Mobile w gas heat	19,940	59,990	4,264	84,194
Mobile w/o gas heat	4,346	8,623	10,719	23,688
Subtotal	842,233	420,925	271,091	1,534,248

2.3 ESTIMATION OF NET SPACE HEATING LOADS

The net space heating loads[4] for single, row and mobile units were developed based on two data sources:

- Terasen Gas sales data that shows "typical" as well as "high" and "low" consumption per residential customer.

- HOT-2000 simulations of archetypal buildings that were originally developed for the BC Hydro study.[5] These building archetypes were originally developed using a 2,800-building database developed from the EnerGuide for Houses program. The British Columbia EnerGuide database provides detailed descriptions of building areas and volume, airtightness and thermal characteristics of floors, windows, doors, ceilings and walls. In this study, the original simulation results were further refined in light of more recent information, including up-to-date information on saturations and fuel shares for specific end uses available from Terasen Gas's most recent Residential End Use Survey.

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.[6]

2.3.1 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.

2.3.2 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 Terasen Gas had already established for customer accounts. In general, the coastal climate corresponds to British Columbia's

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[4] 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.

[5] Due to the greater complexity of low- and high-rise apartments, their net space heat loads were modelled using Marbek's commercial building energy simulation model.

[6] For reader convenience, the following sub sections are repeated from the earlier BC Hydro study, with minor modifications as applicable.

Lower Mainland and Vancouver Island regions. The cold interior climate corresponds to the Northern Region and Southern Interior. For modelling purposes, weather data from Vancouver, Victoria and Kamloops were used to create thermal simulations of the Lower Mainland, Vancouver Island and Interior regions, respectively.

2.3.3 Floor Area and Shape

Exhibit 2.2 presents the typical floor area by region and vintage for single-family houses. As can be seen, there has been a general increase in floor area over time, and houses in the Lower Mainland are generally larger than those in the Vancouver Island and Interior regions. The biggest changes in housing size have occurred since the mid-1980s, when changing demographics and growing affluence resulted in larger floor areas for new houses.

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 is increasing even faster than floor area. Finally, due to the improved performance of newer windows, the area of glazing has increased by about 15%.

Exhibit 2.2: Typical Floor Areas for Single-family Detached Dwellings by Vintage and Region, (sq. ft.)

Vintage	Floor Space including basement area, (sq. ft.)		
	Lower Mainland	**Vancouver Island**	**Interior**
Pre-1965	2335	2400	2335
1966–1985	2540	2280	2520
1986–2000	3260	2700	2850
NUMBER IN SAMPLE	1,470 dwellings	466 dwellings	876 dwellings

Source: British Columbia EnerGuide for Houses database.

2.3.4 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 heating than, say, a crawlspace, where ceiling heights are typically 4 ft. or less.

An analysis of basement detachment styles was completed using the EnerGuide for Houses database and the results are shown in Exhibit 2.3. As illustrated, single-family dwellings in all regions of British Columbia typically combine more than one basement style.

Exhibit 2.3: Type of Basement for Single-family Detached Dwellings by Region

Region	Incidence of Basement Styles/Dwelling (%)				Avg. Styles per Dwelling
	Exposed/Crawl	Slab	Shallow	Full	
Lower Mainland	61	63	83	44	2.49
Vancouver Island	63	63	85	34	2.45
Interior	55	61	75	77	2.65

Source: British Columbia EnerGuide for Houses database.

2.3.5 Airtightness

Air test data for single-family houses were measured as part of the EnerGuide for Houses program, and Exhibit 2.4 summarizes the results by vintage and region. As demonstrated, there has been a continued improvement in the airtightness of buildings in all regions, with the most airtight houses located in the Interior region.

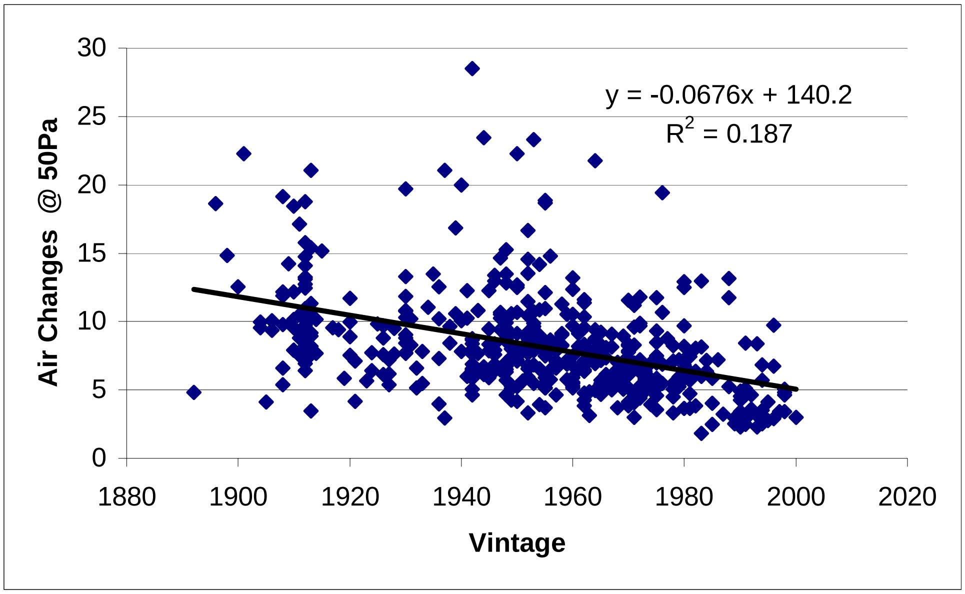
Exhibit 2.4: Average Air Changes per Hour in Single-family Detached Dwellings by Vintage and Region, (ACH @ 50 Pa)

Vintage	Lower Mainland (ACH)	Vancouver Island (ACH)	Interior (ACH)
Pre-1965	10.5	9.27	6.81
1966–1985	8.55	6.80	5.24
1986–2000	5.58	4.59	4.07
Number in sample	1470 dwellings	466 dwellings	876 dwellings

Source: BC EnerGuide for Houses database.

Exhibit 2.5 is a scatter plot showing improvement in the airtightness of building envelopes for single-family houses located on Vancouver Island. As demonstrated, there has been a continued improvement in the performance of air barriers over time.

Exhibit 2.5: Average Air Changes per Hour for Single-family Detached Dwellings by Vintage on Vancouver Island, (ACH @ 50 Pa)



Source: BC EnerGuide for Houses database.

2.3.6 Net Space Heating Load

Exhibit 2.6 summarizes the net space heating load by type of detachment, vintage and location. These estimates refer to the load that the space heating system must meet.

For ease of interpretation, the total apartment space heating load has been disaggregated to distinguish the heating load for suites from the heating load for common areas, such as corridors and lobbies. For presentation purposes, the net space heat loads shown in Exhibit 2.6 for apartment corridors/common areas relate to the whole building.

Exhibit 2.6: Existing Residential Units—Net Space Heating Loads[7] by Building Segment and Terasen Service Region, (MJ/yr.)

Segment	Tertiary Space Heating Load (MJ)		
	Lower Mainland	Interior	Vancouver Island
SFD/Duplex Gas - pre 1976	86,770	69,260	57,380
SFD/Duplex Gas - post 1976	71,180	59,580	48,060
SFD/Duplex NonGas - pre 1976	82,240	68,360	56,580
SFD/Duplex NonGas - post 1976	67,540	58,820	47,400
Row unit Gas - pre 1976	50,000	39,270	36,770
Row unit Gas - post 1976	41,820	35,530	31,240
Row unit NonGas - pre 1976	38,960	33,270	29,840
Row unit NonGas - post 1976	32,860	30,220	25,580
Lowrise suite <=4 floors gas	24,710	15,930	16,680
Lowrise <=4 flrs corridor gas	236,250	74,020	79,900
Lowrise suite <=4 floors elec/other	24,710	15,930	16,680
Lowrise <=4 flrs corridor elec/other	236,250	74,020	79,900
Highrise suite >4 floors gas	24,060	15,150	15,830
Highrise >4 flrs corridor gas	1,351,460	419,010	452,340
Highrise suite >4 floors elec/other	24,060	15,150	15,830
Highrise >4 floors corridor elec/other	1,351,460	518,750	560,010
Mobile w gas heat	46,600	42,800	35,800
Mobile w/o gas heat	46,610	42,730	35,800

2.3.7 Space Heating Efficiency

Natural gas furnaces are generally categorized into high, mid-, and standard efficiency levels. Exhibit 2.7 shows the percentage distributions of existing furnaces in these efficiency categories, for the Lower Mainland and Interior regions, as well as for the total former BC Gas territory.

Exhibit 2.7: Existing Natural Gas Furnace Distribution, by Efficiency Level

Region	Lower Mainland		Interior		BC Gas Total	
Current %	Of houses	Of furnaces	Of houses	Of furnaces	Of houses	Of furnaces
High	7.4%	12.9%	13.7%	20.2%	9.4%	15.5%
Mid	14.2%	24.7%	21.9%	32.3%	16.6%	27.3%
Standard	35.9%	62.4%	32.2%	47.5%	34.8%	57.2%

Source: Terasen Gas Residential End Use Survey, 2003.

[7] Net space heating load is the space heating load of a building that must be met by the space heating system over a full year. This is equal to the total heat loss through the building envelope minus solar and internal gains. These values are updated for the Terasen Gas study and are therefore in MJ/yr. The figures in this exhibit for multi-family space heating loads, adjusted for average efficiency of the space heating equipment, compare well against an energy audit database of 372 multi-family residential buildings provided by Terasen Gas.

2.3.8 Supplemental Heating

The use of supplemental heating in residential dwellings is a dynamic process shaped by a number of factors. During the 1970s and '80s, 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 '50s 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 crawl space 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 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.[8]

In addition to fuel conversions and substitutions, there is 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-1960's and growing in proportion to the rapidly increasing rates of renovation and addition-building in the 1970's and '80's.

The results of BC Hydro's Residential End Use Survey (REUS) show the incidence of supplemental heating equipment in both non-electrically heated and electrically heated dwellings, as illustrated in Exhibits 2.8 and 2.9. As demonstrated, the existence of electric supplemental heating equipment ranges from 21% to 63% for non-electrically heated dwellings (principally natural gas). Similarly, in electrically heated dwellings, as much as 76% of the stock has non-electric supplemental heating equipment, including natural gas fireplaces. 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 further in Section 2.6, which discusses fuel shares.)

[8] Personal communications with major British Columbia home improvement retail outlets.

Exhibit 2.8: Supplemental Electric Heating Equipment in Non-Electrically Heated Dwellings, (%)

Segment	Incidence of Supplemental Electric Heating Equipment (%)		
	Lower Mainland	Vancouver Island	Interior
Single-family	38	52	37
Duplex	32	36	26
Row	39	63	29
Apartment	23	31	21
Mobile/Other	38	31	35

Source: BC Hydro

Exhibit 2.9: Supplemental Non-Electric Space Heating Equipment in Electrically Heated Dwellings, (%)

Segment	Incidence of Supplemental Non-electric Space Heating Equipment (%)		
	Lower Mainland	Vancouver Island	Interior
Single-family	70	65	76
Duplex	46	29	35
Row	39	13	27
Apartment	32	14	17
Mobile/Other	33	44	50

Source: BC Hydro

2.4 ANNUAL APPLIANCE ENERGY USE

Exhibit 2.10 summarizes the estimated average annual “unit energy consumption” (UEC) for major natural gas end use appliances for the Lower Mainland region.

The values shown in Exhibit 2.10 apply to the current “stock mix” in the Lower Mainland. UECs vary slightly by service region, in some cases because of differences in occupancy rates. A brief discussion is provided below for each end use appliance shown in Exhibit 2.10. Appendix A provides the UECs for the other service regions.

Exhibit 2.10: Annual Appliance Natural Gas Use (UEC) for the Lower Mainland in Base Year (FY 2003/04) (MJ/yr.)

Segment	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas
	MJ/yr.	MJ/yr.	MJ/yr.	MJ/yr.	MJ/yr.	MJ/yr.
SFD/Duplex Gas - pre 1976	23,358	9,489	4,438	52,517	16,304	1,450
SFD/Duplex Gas - post 1976	23,358	9,489	4,438	52,517	16,304	1,450
SFD/Duplex NonGas - pre 1976	23,358	9,489	4,438	52,517	16,304	1,450
SFD/Duplex NonGas - post 1976	23,358	9,489	4,438	52,517	16,304	1,450
Row unit Gas - pre 1976	18,567	7,360	3,466	52,517	16,304	1,153
Row unit Gas - post 1976	18,567	7,360	3,466	52,517	16,304	1,153
Row unit NonGas - pre 1976	18,567	7,360	3,466	52,517	16,304	1,153
Row unit NonGas - post 1976	18,567	7,360	3,466	52,517	16,304	1,153
Lowrise suite <=4 floors gas	14,463	5,122	2,492	-	16,305	898
Lowrise <=4 flrs corridor gas	-	-	-	52,517	-	-
Lowrise suite <=4 floors elec/other	14,463	5,122	2,492	-	16,305	898
Lowrise <=4 flrs corridor elec/other	-	-	-	52,517	-	-
Highrise suite >4 floors gas	14,463	5,122	2,492	-	16,305	898
Highrise >4 flrs corridor gas	-	-	-	52,517	-	-
Highrise suite >4 floors elec/other	14,463	5,122	2,492	-	16,305	898
Highrise >4 floors corridor elec/other	-	-	-	52,517	-	-
Mobile w gas heat	18,189	7,190	3,386	52,517	16,304	1,129
Mobile w/o gas heat	18,189	7,190	3,386	52,517	16,304	1,129

Occupancy

Occupancy rates for each dwelling type were developed from BC Hydro's REUS data. 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 2.11 summarizes the occupancy rates.

Exhibit 2.11: Occupancy Rates by Detachment

Detachment	Number of Occupants		
	Lower Mainland	Vancouver Island	Interior
Single-family	3.14	2.7	2.59
Duplex	2.74	2.53	2.44
Row	2.55	2.33	2.1
Apartment	1.75	1.68	1.54
Mobile/Other	2.38	2.44	2.05

Source: BC Hydro

Domestic Hot Water

UEC estimates for DHW assume a per capita hot water consumption of 45 litres per person per day, a temperature rise of 45°C and the occupancy rates shown in Exhibit 2.11. Exhibit 2.12 shows the estimated distribution of DHW load by major end use.

Exhibit 2.12: Distribution of DHW Energy Use by End Use in Existing Stock

End Use	%
Personal Use	35
Dishwashing	23
Clothes Washing	27
Standby Losses	15
Total	**100**

To assess further the validity of the DHW consumption values shown in Exhibit 2.12, a review of estimated DHW consumption trends was completed for the major DHW end uses. In addition to the increased stock penetration of low-flow showerheads and faucets, the review found that there has been a 36% decrease in hot water use in clothes washers and a 41% decrease in hot water use in dishwashers (NRCan 2001).

Cooking

UEC estimates for existing stock of this group of food preparation appliances were obtained from The End Use Energy Data Handbook (NRCan, 2002). Energy consumption was adjusted for occupancy rates.

Dryer

Appliance UEC data was obtained from The End Use Energy Data Handbook (NRCan, 2002) and adjusted for occupancy rates.

Pool Heater

The Terasen Gas Residential End Use Survey identified the percentage of customers in the Lower Mainland and Interior regions with pool heaters. 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. Figures from a Terasen Gas conditional demand analysis showed 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 Terasen service territory. The resulting average figure was adjusted for climate differences between the regions.

Fireplaces

The average gas fireplace uses approximately 20% as much energy as a primary gas heating appliance.[9] The Terasen Gas REUS contains more detailed consumption data on two types of gas fireplace: heater-type fireplaces and decorative fireplaces. The consumption of the two types differs by less than 10%, although the decorative fireplaces essentially make no contribution to heating the home. The split between the two types is approximately equal, so the UEC used in the model is an average of the two.

Other

A variety of other gas end uses are found in the homes of Terasen Gas 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 Terasen Gas'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.

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 that are presented in Section 4.

[9] Personal communication, Skip Hayden, Group Leader - Integrated Energy Systems and Flaring, NRCan.

2.5 APPLIANCE SATURATION

Exhibit 2.13 summarizes the saturation levels assumed for the present analysis. The values shown are for the Lower Mainland. Saturation percentages combine the percentage of homes that contain a given appliance with the average number of such appliances found. Hence, some saturations exceed 100%. Saturation levels vary slightly by service region; those for Vancouver Island and the Interior are provided in Appendix A. In each case, the assumed saturation levels are developed from the most recent Terasen Gas Residential End Use Survey (REUS).

Exhibit 2.13: Appliance Saturation Levels for the Lower Mainland in Base Year (FY 2003/04) (%)

Segment	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas
	%	%	%	%	%	%
SFD/Duplex Gas - pre 1976	100%	100%	94%	5%	119%	100%
SFD/Duplex Gas - post 1976	100%	100%	94%	5%	119%	100%
SFD/Duplex NonGas - pre 1976	100%	100%	88%	2%	44%	100%
SFD/Duplex NonGas - post 1976	100%	100%	88%	2%	44%	100%
Row unit Gas - pre 1976	100%	100%	98%	1%	95%	100%
Row unit Gas - post 1976	100%	100%	98%	1%	95%	100%
Row unit NonGas - pre 1976	100%	100%	95%		35%	100%
Row unit NonGas - post 1976	100%	100%	95%		35%	100%
Lowrise suite <=4 floors gas	100%	100%	45%		60%	100%
Lowrise suite <=4 floors elec/other	100%	100%	45%		22%	100%
Highrise suite >4 floors gas	100%	100%	45%		60%	100%
Highrise suite >4 floors elec/other	100%	100%	45%		22%	100%
Mobile w gas heat	100%	100%	92%	1%	95%	100%
Mobile w/o gas heat	100%	100%	83%		35%	100%

2.6 NATURAL GAS FUEL SHARE

Exhibit 2.14 summarizes the natural gas fuel shares assumed for each of the end uses included in the present analysis. As in the preceding discussions, the values shown are for the Lower Mainland. Appendix A provides values for the remaining service regions.

In most cases, fuel shares are taken from the most recent Terasen Gas REUS. Most of the housing segments that do not use natural gas for space heating are not connected to the natural gas supply. For those segments, fuel shares were taken from the BC Hydro REUS used in the BC Hydro study. For several appliances, subtracting the natural gas share from 100% does not yield the electric share, because of significant use of other fuels such as oil or wood.

The BC Hydro REUS and NRCan data indicate that natural gas (67%) and electricity (27%) are the primary space heating fuels in the Lower Mainland. 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:[10]

- Electricity in non-electrically heated dwellings (primarily natural gas)
- Non-electric sources in electrically heated dwellings.

The space heating fuel shares presented in Exhibit 2.14 have been selected on the basis that they provide a reasonable "fit" with:

- General market description (i.e., known distribution of heating appliances by fuel)
- Conditional demand analysis of customer billing data
- Results of a database query of the British Columbia Energuide home energy audit database.

[10] 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 2.14: Natural Gas Fuel Shares for the Lower Mainland in Base Year (FY 2003/04) (%)

Segment	Space heating	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas
	%	%	%	%	%	%	%
SFD/Duplex Gas - pre 1976	95%	86%	18%	6%	58%	69%	100%
SFD/Duplex Gas - post 1976	95%	86%	18%	6%	58%	69%	100%
SFD/Duplex NonGas - pre 1976	25%	39%	15%	1%	58%	69%	100%
SFD/Duplex NonGas - post 1976	25%	39%	15%	1%	58%	69%	100%
Row unit Gas - pre 1976	90%	86%	18%	6%	58%	69%	100%
Row unit Gas - post 1976	90%	86%	18%	6%	58%	69%	100%
Row unit NonGas - pre 1976	35%	28%	4%	1%	58%	69%	100%
Row unit NonGas - post 1976	35%	28%	4%	1%	58%	69%	100%
Lowrise suite <=4 floors gas	87%	95%	6%	3%	100%	69%	100%
Lowrise <=4 flrs corridor gas	99%				58%	100%	100%
Lowrise suite <=4 floors elec/other	25%	75%	6%	1%	100%	69%	100%
Lowrise <=4 flrs corridor elec/other	1%				58%	100%	100%
Highrise suite >4 floors gas	90%	95%	6%	3%	100%	69%	100%
Highrise >4 flrs corridor gas	99%				58%	100%	100%
Highrise suite >4 floors elec/other	25%	75%	6%	1%	100%	69%	100%
Highrise >4 floors corridor elec/other	1%				58%	100%	100%
Mobile w gas heat	80%	86%	18%	6%	58%	69%	100%
Mobile w/o gas heat	20%	25%	0%	1%	58%	69%	100%

2.7 AVERAGE NATURAL GAS ENERGY CONSUMPTION PER DWELLING UNIT

Exhibit 2.15 combines the efficiency, saturation and fuel share data presented in the preceding exhibits and shows the resulting energy use, by end use, for each dwelling type in Lower Mainland. The following example shows how the data from the previous exhibits are combined to provide the estimates shown in Exhibit 2.15.

Sample Calculation of Annual DHW Natural Gas Use for a SFD/Duplex, Gas-heated – pre-1976 home In Lower Mainland Region

• UEC, from Exhibit 2.10	23,358 MJ/yr
• Saturation, from Exhibit 2.13	100%
• Natural Gas Fuel Share, from Exhibit 2.14	86%

Annual DHW Natural Gas Use = 23,358 x 100% x 86% = 20,088 MJ/yr (as shown in Exhibit 2.15.)

Appendix A presents average energy use data for the remaining service regions.

Exhibit 2.15: Average Natural Gas Use per Dwelling Unit for the Lower Mainland in Base Year (FY 2003/04) (MJ/yr.)

Segment	Space Heating MJ/yr.	DHW MJ/yr.	Cooking MJ/yr.	Dryer MJ/yr.	Pool Heater MJ/yr.	Fireplace MJ/yr.	Other Gas MJ/yr.	TOTAL MJ/yr.
SFD/Duplex Gas - pre 1976	95,285	20,088	1,708	253	1,522	13,471	1,450	132,326
SFD/Duplex Gas - post 1976	76,760	20,088	1,708	253	1,522	13,471	1,450	113,801
SFD/Duplex NonGas - pre 1976	23,650	9,110	1,423	39	560	4,953	1,450	39,734
SFD/Duplex NonGas - post 1976	19,075	9,110	1,423	39	560	4,953	1,450	35,159
Row unit Gas - pre 1976	48,870	15,967	1,325	205	303	10,717	1,153	77,387
Row unit Gas - post 1976	39,690	15,967	1,325	205	303	10,717	1,153	68,207
Row unit NonGas - pre 1976	14,175	5,199	294	33		3,940	1,153	23,642
Row unit NonGas - post 1976	11,515	5,199	294	33		3,940	1,153	20,982
Lowrise suite <=4 floors gas	19,749	13,740	307	34		6,785	898	40,615
Lowrise <=4 flrs corridor gas	292,347							292,347
Lowrise suite <=4 floors elec/other	5,675	10,848	307	11		2,495	898	19,336
Lowrise <=4 flrs corridor elec/other	2,953							2,953
Highrise suite >4 floors gas	19,710	13,740	307	34		6,785	898	40,576
Highrise >4 flrs corridor gas	1,672,407							1,672,407
Highrise suite >4 floors elec/other	5,475	10,848	307	11		2,495	898	19,136
Highrise >4 floors corridor elec/other	16,893							16,893
Mobile w gas heat	40,080	15,643	1,294	188	303	10,717	1,129	68,226
Mobile w/o gas heat	40,080	13,642	7,190	2,782		1,737	1,129	65,432

2.8 SUMMARY OF MODEL RESULTS

This section presents the results of the model runs for the base year FY 2003/04. They are presented in four separate exhibits:

- Exhibit 2.16 presents the model results for the total Terasen Gas service area. The results are broken out by building segment and end use. Exhibit 2.16 also includes a pie chart showing gas consumption by end use.

- Exhibits 2.17 to 2.19, inclusive, present the same results, broken out by segment and end use for each of the three service regions defined for this study.

Exhibit 2.16: Natural Gas Consumption for the Total Terasen Gas Service Area, Modelled by End Use and Segment in the Base Year (FY 2003/04), (1000 GJ/yr.)

Segment	Heat	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas	Totals
SFD/Duplex	41,343	12,361	1,243	151	1,008	8,129	1,215	65,450
Row unit	2,903	1,198	96	14	20	819	129	5,180
Lowrise	8,369	3,983	80	8	20	1,674	316	14,451
Highrise	4,096	1,753	36	4	2	746	131	6,768
Mobile/other	2,488	1,307	97	15	27	820	122	4,874
Total	**59,199**	**20,602**	**1,553**	**192**	**1,077**	**12,188**	**1,913**	**96,723**

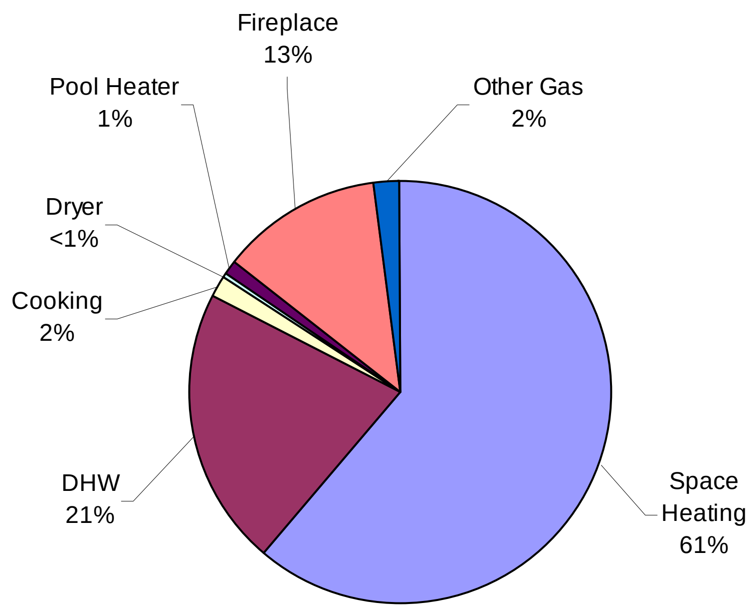


Exhibit 2.17: Natural Gas Consumption for the Lower Mainland, Modelled by End Use and Segment in the Base Year (FY 2003/04), (1000 GJ/yr.)

Segment	Heat	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas	Totals
SFD/Duplex	31,612	7,981	697	98	601	5,324	600	46,913
Row unit	2,572	1,010	80	12	16	693	96	4,479
Lowrise	6,826	2,794	66	6	11	1,244	192	11,139
Highrise	3,671	1,401	33	3	1	623	96	5,828
Mobile/other	834	331	26	4	6	231	27	1,459
Total	**45,515**	**13,517**	**901**	**123**	**636**	**8,114**	**1,012**	**69,818**

Exhibit 2.18: Natural Gas Consumption for Vancouver Island, Modelled by End Use and Segment in the Base Year (FY 2003/04), (1000 GJ/yr.)

Segment	Heat	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas	Totals
SFD/Duplex	1,339	988	209	11	60	580	252	3,439
Row unit	76	60	6	1	1	39	16	198
Lowrise	399	389	11	1	3	123	55	981
Highrise	123	98	3	0	0	36	12	272
Mobile/other	100	121	5	1	1	54	17	300
Total	**2,038**	**1,656**	**233**	**13**	**64**	**832**	**353**	**5,189**

Exhibit 2.19: Natural Gas Consumption for the Interior, Modelled by End Use and Segment in the Base Year (FY 2003/04), (1000 GJ/yr.)

Segment	Heat	DHW	Cooking	Dryer	Pool Heater	Fireplace	Other Gas	Totals
SFD/Duplex	8,392	3,392	337	42	347	2,225	363	15,099
Row unit	255	129	11	2	3	87	17	504
Lowrise	1,145	800	3	2	6	307	69	2,332
Highrise	302	254	1	0	0	88	22	667
Mobile/other	1,553	854	67	10	19	535	77	3,115
Total	**11,646**	**5,429**	**419**	**56**	**376**	**3,242**	**548**	**21,716**

2.9 COMPARISON WITH TERASEN GAS BILLING DATA

The final step in developing the base year profile of natural gas use involved a comparison of the model results with the sales data provided by Terasen Gas for fiscal year FY 2003/04. Two steps were required to compile this comparison:

- Terasen Gas sales data were segmented into the sectors and sub sectors employed in this study.
- Minor differences in customer base between BC Hydro and Terasen were reconciled in the Marbek energy model.

2.9.1 Segmentation of Terasen Gas Sales Data

In consultation with Terasen Gas personnel, the following steps were applied:[11]

- Rate 1 sales were allocated 100% to the Residential Sector.

- Rates 2 and 3 sales were allocated on the basis of NAICs codes. However, there are variations in the availability of the NAICs codes among the three service areas:

  - In the Lower Mainland, approximately 80% of the Rates 2 and 3 customers have NAICs codes, which were used to allocate sales. The remaining 20% of sales were allocated using the same proportions as for the NAICs-coded customers.
  - In the Interior, sales were allocated among sectors on the basis of a sample of approximately 1,500 Interior customers that did have NAICs codes.
  - In Vancouver Island, sales were allocated among sectors on the basis of recommendations provided by Terasen's Vancouver Island staff.

- Rates 5, 25, 23, 7, 22, 27, which have NAICs coding, were sorted into their applicable sub sectors. Rates 7, 22 and 27 are outside the scope of this study.

- The natural gas sales that were allocated from, respectively, residential and commercial, were distributed among the sub sectors based on the relative model shares of each.

The results of this segmentation are presented in Exhibit 2.20.

[11] Rate classes for Vancouver Island differ from those in the Lower Mainland and Interior regions; in each case, the equivalent Vancouver Island rate classes were used.

Exhibit 2.20: Allocation of Terasen Gas Sales Data, by Sector

Service Area:		***Lower Mainland***		**Sector Allocation (GJ) FY 2003/04**			
Rate Class	***% of Sales***	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
1	44%	494,843	52,844,936	52,844,936	0	0	0
2	14%	51,841	16,667,241	5,266,848	9,366,990	2,033,403	0
3	12%	4,079	14,234,817	7,387,870	5,053,360	1,793,587	0
23	3%	732	3,352,708	855,352	1,586,477	885,995	24,884
5	3%	372	3,646,499	2,251,633	785,252	609,614	0
25	7%	469	8,761,471	1,188,612	2,226,146	5,346,713	0
7	0%	4	63,619				63,619
22	12%	32	14,692,785				14,692,785
27	4%	90	4,856,841				4,856,841
Total GJ		552,462	119,120,916	69,795,251	19,018,225	10,669,312	19,638,129
% Total		100%	100%	59%	16%	9%	16%

Service Area:		***Vancouver Island***		**Sector Allocation (GJ) FY 2003/04**			
Rate Class	***% of Sales***	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
Equiv. to 1	11%	71,413	3,939,513	3,939,513	0	0	0
Equiv. to 2 & 3	20%	9,022	6,758,601	1,250,289	4,958,312	550,000	0
Transportation	69%	9	23,568,066	0	0	0	23,568,066
Total GJ		80,444	34,266,180	5,189,802	4,958,312	550,000	23,568,066
% Total		100%	100%	15%	14%	2%	69%

Service Area:		***Interior***		**Sector Allocation (GJ) FY 2003/04**			
Rate Class	***% of Sales***	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
1	30%	213,032	18,714,253	18,714,253	0	0	0
2	10%	21,703	6,431,661	1,865,182	3,858,996	707,483	0
3	5%	819	2,893,920	1,030,235	1,446,960	416,724	0
23	1%	130	699,445	15,822	430,280	247,314	6,029
5	1%	50	774,046	48,911	441,992	283,143	0
25	11%	165	6,563,106	43,820	864,233	5,655,054	0
7	0%	2	21,384				21,384
22	40%	27	25,019,059				25,019,059
27	1%	9	778,860				778,860
Total GJ		235,937	61,895,733	21,718,223	7,042,461	7,309,718	25,825,332
% Total		100%	100%	35%	11%	12%	42%
Grand Total		868,843	215,282,830	96,703,276	31,018,998	18,529,031	69,031,527
%		100%	100%	45%	14%	9%	32%

2.9.2 Reconciliation of BC Hydro and Terasen Gas Customer Bases

Two adjustments were made to the Marbek British Columbia energy model to accommodate differences between the BC Hydro and Terasen Gas customer bases in each service region. They were:

- **Exclusion of Whistler.** The BC Hydro study (and model results) includes the village of Whistler; however, Whistler is not currently served by natural gas and is not included within the scope of this study.[12]

- **Addition of West Kootenay Area.** Fortis provides electricity to the West Kootenay region of interior British Columbia This service area was excluded from the BC Hydro study (and model results); however, Terasen Gas does serve this area.

- **Other Adjustments.** Other minor adjustments were made to account for minor differences in the BC Hydro and Terasen Gas service areas such as the exclusion of the Pacific Northern Gas service area.

To accommodate each of the above situations, the existing stock of dwellings contained in Marbek's British Columbia energy model was adjusted. A brief description is provided below.

- **Exclusion of Whistler**

As noted above, Whistler was included in the BC Hydro study (and model results) but is outside the scope of this study. There have been a number of recent energy studies of the Whistler region, including those that provide data on dwelling units. The Whistler service area exclusion was accommodated within the energy model by reducing the number of units within the affected building segments.

- **Addition of Fortis Electricity Sales**

Fortis provides electricity to Terasen Gas customers in the southern interior of British Columbia As for the preceding adjustments, the inclusion of the Fortis service area was accommodated within the energy model by adjusting the dwelling units in Marbek's British Columbia energy model. In contrast to the preceding situation, this adjustment required an increase in dwelling units.

The Fortis sales data is presented in Exhibit 2.21. The "Residential" and "Industrial" rate categories could be assigned to the residential and industrial segments, respectively. However, the "General" and "Wholesale" categories contain sales to all sectors. To adjust for this discrepancy, the relative percentages of sales in the BC Hydro-supplied portion of the Interior region were used to disaggregate the "General" and "Industrial" sales. The Fortis service territory has proportionately more residential sales than the portion of the Interior region serviced by BC Hydro (36% versus 21%). Several large

[12] Terasen Gas and RMOW are currently collaborating on a parallel end use study for Whistler village.

industrial customers in the Fortis area generate their own electricity, tilting the bulk of sales towards residential. Exhibit 2.21 also presents the estimated segmentation that is used in this study.[13]

Exhibit 2.21: Fortis Sales Data (2003)[14]

Rate Category	Number of Customers	Fortis Reported Sales (GWh/yr)	Sales Allocation used in this Study (GWH/yr)
Residential	82,174	1,013	1,504
Commercial/Institutional	Not reported	Not reported	244
General	9,433	520	
Wholesale	8	907	
Industrial	38	337	1,029
Total	**n/a**	**2,777**	**2,777**

2.9.2 Comparison Results

Exhibit 2.22 compares the modelled results with actual billing data for total Terasen Gas sales as well as for each of the service regions.

Exhibit 2.22: Comparison of Model Results with Actual Terasen Gas Billing Data, (thousand of GJ/yr.)

Segment	Lower Mainland			Interior			Vancouver Island			Total		
	TG	Model	%	TG	Model	%	TG	Model	%	TG	Model	%
SFD/Duplex		46,913			15,099			3,439			65,450	
Row unit		4,479			504			198			5,180	
Lowrise		11,139			2,332			981			14,451	
Highrise		5,828			667			272			6,768	
Mobile/other		1,459			3,115			300			4,874	
Subtotal	**69,795**	**69,818**	**0%**	**21,718**	**21,716**	**0%**	**5,190**	**5,189**	**0%**	**96,703**	**96,723**	**0%**

As illustrated in Exhibit 2.22, there is a good match between the model results and the actual billing data.

13 Fortis BC, *2005 Load and Customer Forecast*, 26 November 2004.

14 Irrigation and street lighting loads were omitted, as these are not in either the BC Hydro or Terasen studies.

3. REFERENCE CASE

3.1 INTRODUCTION

This section presents the Residential Sector Reference Case for the study period (FY 2003/04 to FY 2015/16). 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 remaining economically attractive energy efficiency and fuel choice opportunities.

The discussion is presented within the following subsections:

- Estimation of net space heating loads—new dwellings
- Stock growth
- “Natural” changes to space heating loads—existing dwellings
- “Natural” changes to appliance and space heating energy use
- Fuel shares and saturation levels
- End use model results.

3.2 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 HOT-2000 simulations of archetypal buildings originally developed for the BC Hydro study. Two major data sources were referenced:

- The EnerGuide for Houses database
- The BC Building Code.

The EnerGuide database was queried for homes constructed after 1998 (those corresponding to the current version of the Building Code). The database outputs were then referenced in developing physical descriptions, such as floor area, window area and air leakage rates for new single-family, duplex, row and mobile dwellings.

Insulation levels for new single-family, duplex and row houses were obtained from the current version of the BC Building Code. Exhibit 3.1 presents a summary.

Exhibit 3.1: Minimum Thermal Resistance of Insulation (RSI) for Residential Buildings, ($W/m^2 \cdot °C$)

Assembly	Thermal Resistance (RSI)* Required	
	< 4,500 C Degree Days	> 4,500 C Degree Days
Attic Spaces	7.0	7.7
Roof Joists	4.9	4.9
Frame Wall	3.5	3.85
Suspended Floors:		
• Framed	4.9	4.9
• Concrete	2.1	2.1
Foundation Walls	2.1	2.1
Unheated Slabs	1.8	2.1

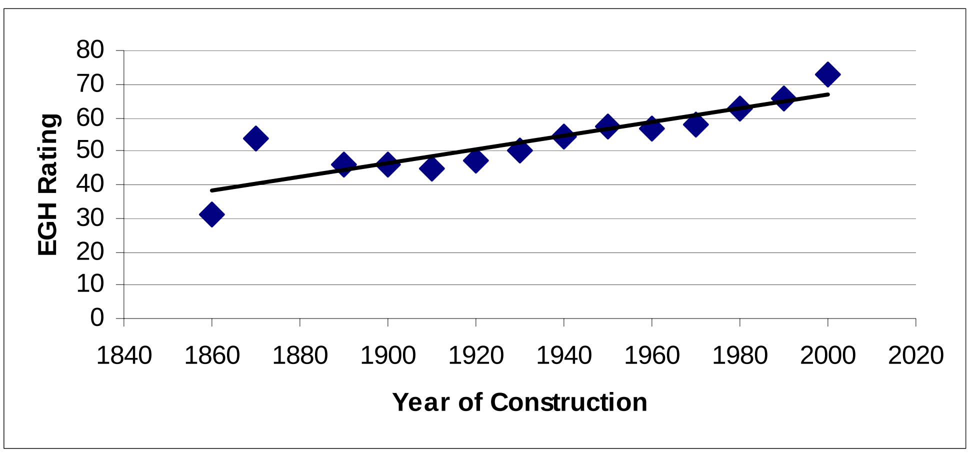
* RSI x 5.68 = R-Value

Note: In areas of 3,500 celsius degree days and where the building is heated by natural gas not supplied by the Vancouver Island natural gas pipeline, the minimum insulation required for frame walls may be reduced to RSI 2.45.

3.2.1 Trends in British Columbia Residential Space Heating Loads

Exhibit 3.2 provides a summary of trends in the thermal performance of British Columbia dwellings based on the results of 1300 EnerGuide for Houses audits.

Exhibit 3.2: Trends in B.C. Housing Efficiency Rating



As illustrated in Exhibit 3.2, the thermal performance of British Columbia housing stock has been improving steadily with each new generation of construction. Related trends that underlie the data shown in Exhibit 3.2 include:

- As in the base year, overall space heating loads for the Lower Mainland will continue to be larger than for the other two regions, for the following reasons: houses and apartment buildings will continue to be larger, on average, than in the other two regions, and; overall building shell insulation levels will continue to be lower in the Lower Mainland than in the Interior.

- 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 same trend towards larger buildings was not evident in the data for the Vancouver Island Region.

- 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 BC 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.

3.2.2 Additional Considerations

Discussions with provincial government staff indicated that a number of changes to residential buildings are under consideration that could affect the thermal performance of British Columbia's new housing over the study period. These include:

- The British Columbia Ministry of Energy and Mines has established targets for the performance of new construction, including: An EnerGuide 80 rating for all new residential buildings by 2010; and all commercial buildings (including apartments) will achieve energy performance levels equivalent to 25% below the Model National Energy Code for Buildings (MNECB).

- A range of strategies are under discussion to achieve improved thermal performance in related residential equipment and products, including regulations for high efficiency furnaces, efficiency regulations for natural gas fireplaces, and increased thermal performance of windows.[15]

- In addition to increased stringency of regulations, there is speculation that the next version of the British Columbia Building Code will include requirements for a heat recovery ventilator instead of the current requirements for a principle exhaust fan.

No attempt has been made to incorporate the above considerations into this Reference Case, as their outcome remains uncertain at this time. These considerations will,

[15] Ref. Personal Communication, Andrew Pape Salmon. BC Ministry Energy Mines.

however, be addressed as part of the Achievable Potential presented in later sections of this report.

3.2.3 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 is presented in Exhibit 3.3, by region and segment.

Exhibit 3.3: New Residential Units—Net Space Heating Loads[16] by Building Segment and Terasen Gas Service Region, (MJ/yr.)

Segment	Net Space Heating Load		
	Lower Mainland	**Vancouver Island**	**Interior**
Single Family/Duplex Dwelling Gas Heating	65,560	43,670	53,580
Single Family/Duplex Dwelling Non-gas Heating	62,220	43,090	53,000
Row - Gas Heating	51,500	36,170	41,650
Row – Non-gas Heating	40,080	29,380	35,280
Low Rise Apartment Units Gas Heating	22,730	15,590	16,360
Low Rise Apartment – Gas Heating – Whole Building Corridor	210,480	71,310	66,750
Low Rise Apartment Units Non-gas Heating	22,730	15,590	16,360
Low Rise Apartment – Non-gas Heating – Whole Building Corridor	210,480	71,310	66,750
High Rise Apartment Units Gas Heating	22,730	14,830	14,000
High Rise Apartment – Gas Heating - Whole Building Corridor	1,204,050	403,680	377,870
High Rise Apartment Units Non-gas Heating	22,730	14,830	14,000
High Rise Apartment - Non-gas Heating - Whole Building Corridor	1,204,050	499,770	467,820
Mobile Gas Heating	35,970	28,070	32,910
Mobile Non-gas Heating	35,970	28,070	32,910

16 Net space heating load is the space heating load of a building that must be met by the space heating system over a full year. This is equal to the total heat loss through the building envelope minus solar and internal gains. Values shown for electrically heating dwellings are shown in megajoules for format consistency.

3.3 STOCK GROWTH

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 employed were based originally on data provided by BC Hydro.[17] These original growth rates were used for overall growth by housing type, but newer data from a recent Terasen Gas study on New Construction Fuel Choice[18] were used to allocate fuel shares within the new housing units.

Exhibit 3.4 presents a summary of the growth rates employed in this Reference Case, by region, dwelling type and primary space heating fuel.

Exhibit 3.4: Annual Growth Rates in Period by Building Segment and Terasen Gas Service Region, (%)

	Non Electric Accounts				Electric Accounts			
	Single	Row	Apt.	Mobile/ Other	Single	Row	Apt.	Mobile/ Other
Lower Mainland								
2004-2006	1.8%	2.5%	1.0%	1.3%	3.6%	2.8%	6.8%	1.9%
2006-2011	1.8%	2.7%	1.0%	1.3%	3.5%	3.0%	6.1%	2.6%
2011-2016	1.8%	2.7%	1.1%	1.3%	3.3%	2.9%	5.1%	2.5%
Vancouver Island								
2004-2006	4.2%	4.0%	0.2%	1.4%	1.4%	0.7%	0.7%	1.6%
2006-2011	5.5%	5.1%	0.3%	1.6%	2.1%	1.0%	1.3%	2.4%
2011-2016	4.7%	5.2%	0.4%	1.5%	2.0%	1.3%	1.3%	2.3%
Interior								
2004-2006	2.6%	3.1%	1.5%	1.7%	2.0%	1.9%	4.0%	1.8%
2006-2011	2.8%	2.6%	1.3%	1.7%	1.6%	1.6%	3.4%	1.9%
2011-2016	2.7%	2.4%	1.4%	1.7%	1.6%	1.6%	3.2%	1.8%

*Source: BC Hydro Load Forecast; and, Habart & Associates; New Construction Fuel Choice Interim Report; prepared for Terasen Gas, May 2005.

3.3.1 Demolition Rates

In addition to new construction activity, the demolition of older residential buildings was also reviewed. The review examined demolition statistics from the Greater Vancouver Regional District (GVRD, 2001) and Statistics Canada (Statistics Canada, 2002). The results showed that in the Lower Mainland, the demolition rate for single-family dwellings has remained relatively constant over the last 10 years at an annual rate of 0.5%. The review also concluded that demolition rates in the other regions were negligible and, consequently, a demolition rate was applied only to the Lower Mainland.

[17] Personal Communication: Larry Meyer.

[18] *New Construction Fuel Choice: Interim Report*, prepared by Habart & Associates for Terasen Gas, May 2005.

3.3.2 Net Change In Residential Stock

The resulting (net) number of residential units is summarized in Exhibit 3.5, by year and dwelling type.

Exhibit 3.5: Residential Stock, FY 2003/04 and FY 2015/16, (Number of Units)

	FY 2003/04 base year			FY 2015/16 forecast		
	Lower Mainland	Vancouver Island	Interior	Lower Mainland	Vancouver Island	Interior
Single Family/Duplex Dwelling Gas Heating, Pre-1976	88,168	5,106	62,535	83,677	5,106	62,535
Single Family/Duplex Dwelling – Gas Heating, 1976-2004	296,417	20,472	130,264	282,304	20,472	130,264
Single Family/Duplex Dwelling Gas Heating, Post-2004	--	--	--	109,551	19,049	70,641
Single Family/Duplex Dwelling – Non-gas Heating, Pre-1976	6,625	29,784	18,704	6,287	29,784	18,704
Single Family/Duplex Dwelling – Non-gas Heating, 1976-2004	22,272	118,515	38,961	21,235	118,515	38,961
Single Family/Duplex Dwelling Non-gas Heating, Post-2004	--	--	--	16,059	46,916	16,484
Row – Gas Heating, Pre-1976	2,924	694	3,105	2,924	694	3,105
Row – Gas Heating, 1976-2004	50,767	1,600	5,779	50,767	1,600	5,779
Row – Gas Heating, Post-2004	--	--	--	25,822	2,083	4,199
Row – Non-gas Heating, Pre-1976	1,755	3,954	2,302	1,755	3,954	2,302
Row – Non-gas Heating, 1976-2004	27,996	7,755	3,673	27,996	7,755	3,673
Row – Non-gas Heating, Post-2004	--	--	--	13,284	1,841	1,440
Low Rise Apartment Units Gas Heating, All Vintages	165,711	8,614	53,493	187,758	8,986	62,939
Low Rise Apartment – Gas Heating – Whole Building Corridor, All	11,349	746	6,094	12,879	780	7,169
Low Rise Apartment Units Non-gas Heating, All Vintages	48,023	47,019	12,511	94,873	54,100	19,637
Low Rise Apartment – Non-gas Heating – Whole Building Corridor, All	3,520	4,397	1,418	6,771	5,045	2,229
High Rise Apartment Units Gas Heating, All Vintages	82,747	3,324	14,790	93,805	3,419	17,553
High Rise Apartment – Gas Heating - Whole Building Corridor, All	1,150	57	277	1,300	60	328
High Rise Apartment Units Non-gas Heating, All Vintages	24,543	9,271	6,196	48,040	11,065	8,280
High Rise Apartment – Non-gas Heating - Whole Building Corridor, All	301	317	93	620	364	132
Mobile/Other Non-Electric Heating, All Vintages	19,940	4,264	59,990	23,271	5,110	73,377
Mobile/Other Electric Heating, All Vintages	4,346	10,719	8,623	5,810	13,947	10,724
Sub-total	842,233	271,091	420,925	1,095,219	354,397	550,596
Total			1,534,248			2,000,212

Note: Whole Building Corridors refers to total number of buildings.

3.4 "NATURAL" CHANGES TO SPACE HEATING LOADS—EXISTING DWELLINGS

In addition to the construction of new buildings, the Reference Case also assumes that a portion of the existing building stock is subject to energy retrofits in each period. To provide a reasonable representation of the impact of these "naturally" occurring retrofit activities on the net heating loads, it was necessary to:

- Define a bundle of upgrade measures associated with a "typical" retrofit within each building segment.
- Estimate the rate at which this bundle of measures is introduced into the existing stock of buildings.
- Estimate the impact of these upgrades.

To estimate the naturally occurring changes to the net heating loads for existing buildings, results of the 1995 Home Energy Retrofit Survey (NRCan 2000) were reviewed in conjunction with the EnerGuide for Houses database. Exhibit 3.6 summarizes the Home Energy Retrofit Survey results.

Exhibit 3.6: Annual Retrofit Activity by Assembly and Detachment, (%)

Assembly	Single	Row	Apartment	Mobile/Other
Insulation Improvements	4.20	2.40	2.30	4.10
Exterior Doors	5.40	5.90	2.80	5.30
Window Replacements	6.70	7.00	4.10	6.60
Fireplace Improvements	2.90	1.60	1.20	2.70
Heating System Conversions	0.90	0.40	0.10	0.90
Energy Source Conversions	0.90	0.80	0.10	0.90
Equipment Replacements	2.90	2.10	1.00	2.90
Averages	3.41	2.89	1.66	3.34

Sources: 1995 Home Energy Retrofit Survey—Statistical Report (NRCan 2000) and BC EnerGuide for Houses database.

In addition to the above data sources, it is possible to further calibrate the overall rate of envelope renovations using window installations as a proxy, because window replacement is the most common element in a typical envelope renovation. Data from NRCan[19] indicates that the number of windows sold for replacement in existing homes is approximately equal to the number used in new home construction. Data from the Siding and Window Dealers Association of Canada[20] indicates that a typical window replacement project involves half as many windows as a new home. Therefore, the rate of renovation is likely to be approximately twice the rate of new home construction.

[19] *"Technical Analyses of Canadian Energy Star Options",* Anil Parekh, NRCan Office of Energy Efficiency, Ottawa, 2002.

[20] Personal communication, Ene Saksniit, 29 October, 2004.

While the above sources provide useful references, neither source provides adequate data to allow for an accurate estimate of the overall impact. For example, the EnerGuide for Houses database only contains 20 applicable samples. Similarly, the Home Energy Retrofit Survey data show activity rates but do not link them to energy impact. Moreover, previous studies have clearly shown that a significant portion of energy retrofit activity is linked to home renovation activities, which often include the addition of new living spaces.

Trial energy simulation runs were undertaken in HOT-2000, assuming a variety of combinations of the above retrofit activities. As expected, the results varied widely, from about 2% to 15% reduction in heat load, depending on assumptions related to the number of windows or doors replaced, etc. In the absence of more comprehensive data, this analysis employs the insulation activity rates presented in Exhibit 3.6 and assumes that each renovation project includes replacement of half the windows in the home as well as one insulation measure, for a net average heat load reduction of 7%.

3.5 "NATURAL" CHANGES TO APPLIANCE AND HEATING ENERGY USE

3.5.1 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.

Data available from Natural Resources Canada (NRCan)[21] 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. Consequently, this Reference Case assumes that, in the absence of new initiatives, further improvements in the efficiency of new appliances will be relatively minor over the forecast period. However, the energy consumption of the stock of natural gas appliances and heating equipment will continue to lower as the existing stock is replaced over the study period.

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.

[21] Natural Resource Canada; *Energy Use Data Handbook, 2005. Pg 38-39*

Furnaces

Program evaluation work undertaken by Terasen Gas shows that there is a trend towards the use of more efficient furnaces in both new construction and replacement markets, but the market share is much smaller than it is elsewhere in Canada.[22] High efficiency furnaces account for approximately 20% of installations in new homes and approximately 50% of the replacement market. The remainder are mid-efficiency models. The installation of standard efficiency furnaces is no longer permitted in the British Columbia marketplace.

Discussions with industry personnel indicate that mid-efficiency models are still being installed in a large number of new homes and in furnace replacement projects, even with the existence of the current incentives. Consequently, this Reference Case assumes that the trend towards increased market share of high efficiency furnaces continues over the study period, but at a moderate rate. This latter assumption recognizes that, by definition, this Reference Case does not include future Terasen Gas DSM programs.

Domestic Hot Water

Exhibit 3.7 summarizes DHW percentage consumption by end use for new dwellings. A comparison with the values presented previously for existing dwellings (see Section 2) shows significant reductions for hot water use in dishwashing and clothes washing; however, slightly more modest changes have been assumed for personal consumption. This may result in a modest over-estimation of personal consumption, as the 1998 British Columbia Building Code has set requirements for flow rates on showerheads and faucets. However, there are also a number of uses in this category that are increasing, such as whirlpools and spas. Given that the net impact of these trends remains unknown, no reduction for personal consumption was included.

DHW energy consumption for new and existing appliances is improving steadily as a result of energy efficiency regulations. The minimum efficiency factor has risen from 0.52 for a 200 litre tank as of 1995 to 0.57 for a 200 litre tank as of 2003. (OEE Regulations Bulletin, Sept 2004). Over the study period, the natural turnover of water heaters will result in an improvement of approximately 2% as failing water heaters are replaced by new ones that meet the new standard. The UEC for DHW in new buildings is assumed to be constant.

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[22] In other jurisdictions, home builders have found that high efficiency furnaces offer savings in venting costs that significantly offset their higher capital costs.

Exhibit 3.7: Distribution of DHW Use by End Use in New Stock, (%)

End Use	%
Personal Use	35
Dishwashing	23
Clothes Washing	27
Standby Losses	15
Total	**100%**

Cooking Ranges

A UEC of 9.5 GJ/yr. is assumed in the base year (for single family homes in the Lower Mainland region), adjusted for occupancy in other housing types and regions. This value is based on residential end use data compiled by Terasen Gas.[23]

As outlined in the overview to this section, 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. Therefore, this Reference Case assumes that the current gas cooking UEC declines (in a straight line) by 3% to 9.2 GJ/yr. by the final milestone year.

Clothes Dryer

A UEC of 4.4 GJ/yr. is assumed in the base year (for single family homes in the Lower Mainland region), adjusted for occupancy in other housing types and regions. This value is based on residential end use data compiled by Terasen Gas.

As in the case of cooking ranges, the primary contribution to reduced natural gas consumption in gas clothes dryers will come from the gradual penetration of new, more efficient models into the stock of new and existing residences. Therefore, this Reference Case assumes that the current clothes dryer UEC declines (in a straight line) by 2% to 4.3 GJ/yr. by the final milestone year.

Fireplaces

Fireplaces currently have a very wide range of efficiencies, and the average efficiency of units currently sold has not been extensively studied. The study team and industry personnel[24] estimated that the base case efficiency of current fireplace unit sales is approximately 35-40%. In the absence of any new initiatives, the average UEC was not assumed to change during the study period.

[23] Data from Natural Resources Canada reported in *Energy Use Data Handbook, 2005,* show a lower national UEC for gas ranges. The Terasen Gas end use data values were used because they are specific to the service territory under study

[24] Information provided during the Residential Sector Achievable Workshop.

Pool Heaters

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.

3.6 APPLIANCE SATURATION TRENDS

To develop estimates of the future saturation of residential equipment, references from Natural Resources Canada (NRCan, 1998) and the BC Hydro CPR study (2002) were reviewed. The saturation of most end use appliances has remained relatively constant over the last 10 years, suggesting that further changes to saturations are unlikely within the study period. The two exceptions are: computers and dishwashers. However, these changes do not directly impact natural gas consumption and therefore are not considered further in this analysis.

3.7 FUEL SHARE

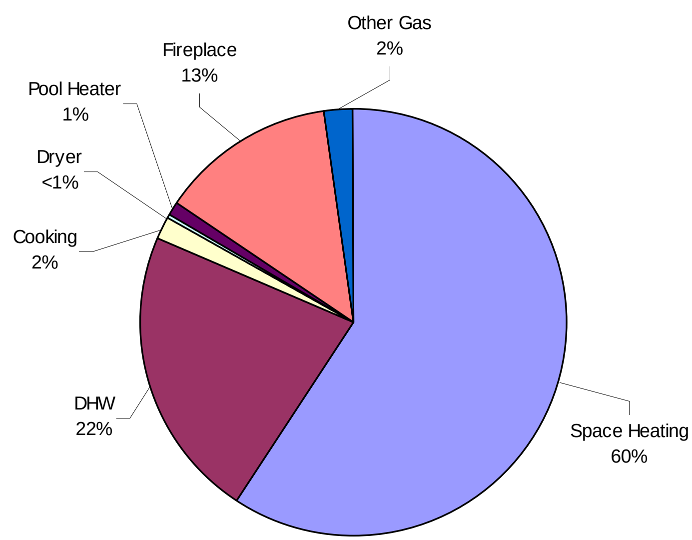
Fuel share data are taken directly from the recently completed study for Terasen Gas, entitled, New Construction Fuel Choice, prepared by Habart & Associates, May 2005.

3.8 END USE MODEL RESULTS

Exhibit 3.8 presents the results—broken out by dwelling type and milestone year—of the Reference Case for the total Terasen Gas service area. The Exhibit also includes a pie chart showing gas consumption by end use, based on projected consumption at the end of the study period (FY 2015/16).

Exhibit 3.8: Reference Case Model Results, (thousand of GJ/yr.)

	Lower Mainland				Vancouver Island				Interior				Total			
	FY 03/04	**FY 05/06**	**FY 10/11**	**FY 15/16**	**FY 03/04**	**FY 05/06**	**FY 10/11**	**FY 15/16**	**FY 03/04**	**FY 05/06**	**FY 10/11**	**FY 15/16**	**FY 03/04**	**FY 05/06**	**FY 10/11**	**FY 15/16**
SFD/Duplex Existing	44,756	43,899	41,997	40,372	3,261	3,245	3,201	3,155	14,225	14,139	13,921	13,703	62,242	61,283	59,119	57,230
SFD/Duplex New	2,156	3,728	7,896	12,405	179	331	933	1,564	873	1,453	3,105	4,915	3,208	5,512	11,934	18,884
Row Existing	3,996	3,965	3,894	3,824	184	183	181	179	452	449	443	437	4,632	4,598	4,518	4,440
Row New	483	747	1,516	2,398	14	23	57	101	52	82	154	228	548	852	1,727	2,727
Low Rise Apt Units Existing	10,393	10,323	10,163	9,994	939	935	924	912	2,141	2,131	2,106	2,078	13,473	13,388	13,193	12,983
Low Rise Apt Units New	746	1,061	1,944	2,926	42	50	98	148	191	269	454	656	979	1,381	2,496	3,730
High Rise Apt Units Existing	5,435	5,397	5,312	5,222	260	258	255	252	617	614	607	599	6,311	6,269	6,174	6,073
High Rise Apt Units New	394	556	1,011	1,518	12	15	28	41	50	71	122	179	457	643	1,162	1,738
Mobile/Other Existing	1,410	1,400	1,377	1,353	288	287	283	280	2,981	2,965	2,923	2,879	4,679	4,652	4,583	4,512
Mobile/Other New	49	82	172	268	12	20	48	78	134	224	470	737	195	326	690	1,084
Total Existing	65,990	64,984	62,742	60,766	4,931	4,908	4,845	4,777	20,416	20,299	20,000	19,696	91,337	90,191	87,587	85,239
Total New	3,828	6,174	12,539	19,516	258	440	1,164	1,932	1,301	2,100	4,305	6,715	5,386	8,713	18,008	28,163
GRAND TOTAL	**69,818**	**71,158**	**75,282**	**80,282**	**5,189**	**5,348**	**6,009**	**6,709**	**21,716**	**22,398**	**24,305**	**26,410**	**96,723**	**98,904**	**105,596**	**113,401**



4. ENERGY EFFICIENCY AND FUEL CHOICE MEASURES

4.1 INTRODUCTION

This section identifies and assesses the financial and economic attractiveness of the selected energy efficiency and fuel choice measures for the residential sector. The discussion is organized and presented as follows:

- Methodology
- Summary of energy efficiency results
- Summary of fuel choice results
- Description of energy efficiency technologies and measures
- Description of fuel choice technologies and measures.

4.2 METHODOLOGY

The following steps were employed to assess the energy efficiency and fuel choice measures:

- Select candidate energy efficiency and fuel choice 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 Terasen Gas personnel based on a combination of a literature review and the previous experience of both the consultants and Terasen Gas 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 fuel choice 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 (2005) 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."[25] 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 8%.

[25] 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.

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 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, it is not included in subsequent stages of the analysis.

4.2.1 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 Terasen Gas. The data provided were segmented on the basis of future year (over a 25 year period), end use or load shape and service area. Exhibit 4.1, provides a summary of the avoided natural gas supply costs for each combination of year, load shape and service area. To make the data more manageable, the annual values were averaged for each of the time periods shown in Exhibit 4.1. The distinction between high load factor (flat) and low load factor (peaky) load shapes reflects the difference in costs to supply each load type. Similarly, the cost data shown in Exhibit 4.1 reflect the modest differences in the cost of serving different service areas within the province.

Exhibit 4.1: Natural Gas – Avoided Supply Costs

Natural Gas	Load Shape							
	Low Load Factor (e.g., space heat)				High Load Factor (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	5.756	5.685	5.716	5.782	5.102	5.041	5.031	4.978
Lower Mainland	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782
Interior	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782

1 kWh =3.6 MJ; 1GJ = 1000 MJ

- ### Avoided Supply Cost of Electricity

The avoided supply costs of electricity used in this analysis are shown in Exhibit 4.2. As illustrated, the electricity values have been organized symmetrically with the natural gas prices on the basis of measure life, load shape and service region.

The electricity supply costs shown in Exhibit 4.2 are estimated values based on the avoided cost of $0.06/kWh that was used in the earlier BC Hydro study. This value was an average value and reflected the cost of delivering an incremental kWh of new electricity supply to a lower mainland busbar.

Although the BC Hydro study used a single avoided cost value for all end uses, BC Hydro is also confronted with higher supply costs for end uses such as space heating that have peaky requirements. Detailed electricity supply costs were not available to this study for each of the defined load types. Consequently, based on discussions with the study team personnel, it was decided to assume that peaky loads such as space heating cost, on average, 10% more to supply than for relatively flat loads, such as hot water. BC Hydro personnel confirmed that this value was generally consistent with recent values estimated by the utility. To accommodate this 10% cost spread and to also adhere to the same average avoided cost of $0.06/kWh, peaky load values were adjusted upwards by 5% from the average BC Hydro values and flat load values were adjusted downwards by 5%.

The values shown in Exhibit 4.2 have also been adjusted to account for the delivery destination. The Terasen Gas values are for delivery to the customer. As the BC Hydro values are at a distribution busbar, the values were adjusted upwards by 7% (3% area transmission and 4% distribution)[26] to account for losses between the busbar and the customer.

As the same electricity avoided cost value was used for all three service regions in the BC Hydro study, no attempt was made to generate distinct service region values in this study.

[26] This approach omits bulk transmission losses of 5%; however, this is consistent with the approach that was applied in the BC Hydro CPR. It is also consistent with the general assumption that the Most Likely future electricity supply options will be developed closer to the load rather that at remote sites, such as the historical large-scale hydroelectric developments.

Exhibit 4.2: Electricity – Avoided Supply Costs

Electricity	Load Shape							
	Low Load Factor (e.g., space heat)				High Load Factor (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Lower Mainland	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Interior	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94

1 kWh =3.6 MJ; 1GJ = 1000 MJ

- **Customer Energy Prices**

The customer energy prices used in this analysis are presented in Exhibit 4.3. These values are used in the calculation of customer payback periods that are presented in later sections of this report. In the case of both electricity and natural gas, the prices shown are based on February 2005 rate schedules and, in the case of electricity incorporate both energy and 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.

Exhibit 4.3: Customer Energy Prices

Customer Energy Prices	Residential		Commercial		Manufacturing	
	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0132	$0.0169	$0.0113	$0.0135	$0.0094	$0.0135
Lower Mainland	$0.0105	$0.0169	$0.0099	$0.0135	$0.0087	$0.0135
Interior	$0.0104	$0.0169	$0.0098	$0.0135	$0.0086	$0.0135

1kWh=3.6 MJ; 1 GJ=1000 MJ

4.3 SUMMARY OF ENERGY EFFICIENCY SCREENING RESULTS

A summary of the screening results for the energy efficiency options is presented Exhibit 4.4a, 4.4b and 4.4c below. Due to the number of measures assessed, the following exhibits only show results for those options that pass the screen. Those options that did not pass the screen are contained in Appendix B.

Highlights are summarized below.

- The space heating measures that fail the economic screen include all the building envelope measures, the boiler efficiency upgrade, high efficiency HRVs, and gas-fired heat pumps. The upfront cost of these measures is too high relative to the value of their energy savings.

- Space heating measures that pass in certain markets include: high performance windows, which pass in new single detached/duplex home construction in all regions but in row housing only in the Lower Mainland; furnace efficiency upgrades, which pass in new and existing homes in the Lower Mainland, in both new and existing single detached/duplex archetype and in new row houses in the Interior, and in new single detached/duplex only in Vancouver Island; and, integrated heating and DHW, which passé in new and existing single detached/duplex and row in the Lower Mainland and Interior, but only in new single detached/duplex in Vancouver Island.

- Measures such as the furnace efficiency upgrade pass in more housing types in the Lower Mainland and the Interior than in Vancouver Island, due to the lower space heating loads in that region. Vancouver Island not only has a lower tertiary space heating load, but also has significant supplementary space heating from both fireplaces and baseboard electric. Baseline space heating natural gas consumption of at least 70 GJ/yr is required before the furnace efficiency upgrade becomes economically attractive.

- DHW measures that fail the economic screen include the condensing water heater, the instantaneous water heater, waste water heat recovery, and solar water heating. All these measures have upfront costs too high relative to the value of their energy savings.

- For dishwashers and clothes washers, in each case there is an Energy Star product with a modest (or zero) incremental cost. These machines pass the economic screen. The more expensive “best available dishwasher” and the front loading washers both have too great an incremental cost to pass the screening test.

- High efficiency pool heaters and fail the economic screen, due to high upfront cost.

Exhibit 4.4a: Summary of TRC Measure Screening Results Residential Sector Energy Efficiency Options – Lower Mainland

Measure #	Measure Name	Target Market: Service Area(s)	Target Market: Sub Sector(s)	Target Market: Vintage	Target Market: Full/Incr	Simple Payback (Yrs)	Measure TRC	B/C Ratio
1	Air Sealing	LM	SD/Dupl	Existing	Full	6.9	$48.69	1.1
			SD/Dupl	New	Incr.	7.1	$28.87	1.0
7	High Performance Windows	LM	SD/Dupl	New	Incr.	6.1	$309.24	1.3
			Row	New	Incr.	8.1	-$61.25	0.9
11	Furnace Efficiency Upgrade	LM	SD/Dupl	Existing	Incr.	3.8	$379.35	1.6
			Row	Existing	Incr.	6.9	-$69.43	0.9
			SD/Dupl	New	Incr.	5.2	$110.59	1.2
			Row	New	Incr.	6.8	-$58.59	0.9
14	Integrated Heating and DHW	LM	SD/Dupl	Existing	Incr.	3.0	$568.97	2.1
			Row	Existing	Incr.	5.1	$138.17	1.3
			SD/Dupl	New	Incr.	3.7	$392.52	1.8
			Row	New	Incr.	5.0	$149.96	1.3
16	Low-Flow Showerheads and Faucets	LM	SD/Dupl	Existing	Full	1.0	$81.94	4.3
			Row	Existing	Full	1.2	$60.01	3.4
17	DHW Heat Trap	LM	SD/Dupl	Existing	Full	2.7	$48.66	1.7
			Row	Existing	Full	3.3	$25.35	1.4
			SD/Dupl	New	Full	2.7	$46.39	1.7
			Row	New	Full	3.4	$23.54	1.4
19	DHW Pipe Insulation	LM	SD/Dupl	Existing	Full	0.5	$14.74	4.7
			Row	Existing	Full	0.7	$10.90	3.7
			SD/Dupl	New	Full	0.6	$14.37	4.6
			Row	New	Full	0.7	$10.60	3.7
23	Energy Star Dishwasher	LM	SD/Dupl	Existing	Incr.	0.0	$67.31	N/A
			Row	Existing	Incr.	0.0	$53.29	N/A
			SD/Dupl	New	Incr.	0.0	$64.58	N/A
			Row	New	Incr.	0.0	$51.16	N/A
25	Energy Star Clothes Washer	LM	SD/Dupl	Existing	Incr.	2.6	$84.72	1.8
			Row	Existing	Incr.	3.3	$44.92	1.4
			SD/Dupl	New	Incr.	2.7	$78.92	1.8
			Row	New	Incr.	3.4	$40.45	1.4
27	Insulating Pool Cover	LM	SD/Dupl	Existing	Full	1.6	$465.58	2.3
			SD/Dupl	New	Full	1.6	$465.58	2.3
30	Energy Efficient Fireplace	LM	SD/Dupl	Existing	Incr.	2.9	$88.00	1.6
			Row	Existing	Incr.	2.9	$88.00	1.6
			SD/Dupl	New	Incr.	2.9	$88.00	1.6
			Row	New	Incr.	2.9	$88.00	1.6

Exhibit 4.4b: Summary of TRC Measure Screening Results Residential Sector Energy Efficiency Options – Vancouver Island

Measure #	Measure Name	Target Market: Service Area(s)	Target Market: Sub Sector(s)	Target Market: Vintage	Target Market: Full/Incr	Simple Payback (Yrs)	Measure TRC	B/C Ratio
7	High Performance Windows	VI	SD/Dupl	New	Incr.	9.3	-$163.58	0.9
11	Furnace Efficiency Upgrade	VI	SD/Dupl	Existing	Incr.	4.7	-$84.87	0.9
14	Integrated Heating and DHW	VI	SD/Dupl	Existing	Incr.	3.8	-$31.02	0.9
16	Low-Flow Showerheads and Faucets	VI	SD/Dupl	Existing	Full	0.9	$52.31	3.1
			Row	Existing	Full	1.1	$39.59	2.6
17	DHW Heat Trap	VI	SD/Dupl	Existing	Full	2.6	$17.63	1.3
			Row	Existing	Full	3.1	$4.04	1.1
			SD/Dupl	New	Full	2.6	$16.07	1.2
			Row	New	Full	3.1	$2.74	1.0
19	DHW Pipe Insulation	VI	SD/Dupl	Existing	Full	0.5	$9.55	3.4
			Row	Existing	Full	0.6	$7.32	2.8
			SD/Dupl	New	Full	0.5	$9.30	3.3
			Row	New	Full	0.6	$7.11	2.8
23	Energy Star Dishwasher	VI	SD/Dupl	Existing	Incr.	0.0	$51.33	N/A
			Row	Existing	Incr.	0.0	$42.28	N/A
			SD/Dupl	New	Incr.	0.0	$48.97	N/A
			Row	New	Incr.	0.0	$40.41	N/A
25	Energy Star Clothes Washer	VI	SD/Dupl	Existing	Incr.	2.5	$41.95	1.4
			Row	Existing	Incr.	3.0	$15.08	1.2
			SD/Dupl	New	Incr.	2.5	$37.01	1.4
			Row	New	Incr.	3.1	$11.21	1.1
27	Insulating Pool Cover	VI	SD/Dupl	Existing	Full	1.4	$277.66	1.8
			SD/Dupl	New	Full	1.4	$277.66	1.8
30	Energy Efficient Fireplace	VI	SD/Dupl	Existing	Incr.	2.3	$61.04	1.4
			Row	Existing	Incr.	2.3	$61.04	1.4
			SD/Dupl	New	Incr.	2.3	$61.04	1.4
			Row	New	Incr.	2.3	$61.04	1.4

Exhibit 4.4c: Summary of TRC Measure Screening Results Residential Sector Energy Efficiency Options – Interior

Measure #	Measure Name	Target Market: Service Area(s)	Target Market: Sub Sector(s)	Target Market: Vintage	Target Market: Full/Incr	Simple Payback (Yrs)	Measure TRC	B/C Ratio
1	Air Sealing	Int	SD/Dupl	Existing	Full	8.8	-$147.04	0.8
			SD/Dupl	New	Incr.	8.9	-$104.95	0.9
7	High Performance Windows	Int	SD/Dupl	New	Incr.	7.5	$50.50	1.0
11	Furnace Efficiency Upgrade	Int	SD/Dupl	Existing	Incr.	4.8	$165.62	1.3
			SD/Dupl	New	Incr.	6.6	-$33.54	0.9
13	Integrated Heating and DHW	Int	SD/Dupl	Existing	Incr.	4.1	$262.11	1.5
			Row	Existing	Incr.	7.2	-$62.20	0.9
			SD/Dupl	New	Incr.	5.2	$106.26	1.2
			Row	New	Incr.	6.8	-$41.19	0.9
15	Low-Flow Showerheads and Faucets	Int	SD/Dupl	Existing	Full	1.2	$62.68	3.5
			Row	Existing	Full	1.5	$44.19	2.8
16	DHW Heat Trap	Int	SD/Dupl	Existing	Full	3.3	$28.19	1.4
			Row	Existing	Full	4.1	$8.53	1.1
			SD/Dupl	New	Full	3.3	$26.43	1.4
			Row	New	Full	4.2	$7.15	1.1
18	DHW Pipe Insulation	Int	SD/Dupl	Existing	Full	0.7	$11.37	3.8
			Row	Existing	Full	0.9	$8.13	3.0
			SD/Dupl	New	Full	0.7	$11.08	3.8
			Row	New	Full	0.9	$7.90	3.0
22	Energy Star Dishwasher	Int	SD/Dupl	Existing	Incr.	0.0	$56.92	N/A
			Row	Existing	Incr.	0.0	$44.76	N/A
			SD/Dupl	New	Incr.	0.0	$54.45	N/A
			Row	New	Incr.	0.0	$42.84	N/A
24	Energy Star Clothes Washer	Int	SD/Dupl	Existing	Incr.	3.1	$55.62	1.6
			Row	Existing	Incr.	4.1	$19.65	1.2
			SD/Dupl	New	Incr.	3.2	$50.44	1.5
			Row	New	Incr.	4.2	$15.70	1.2
26	Insulating Pool Cover	Int	SD/Dupl	Existing	Full	1.5	$520.11	2.5
			SD/Dupl	New	Full	1.5	$520.11	2.5
29	Energy Efficient Fireplace	Int	SD/Dupl	Existing	Incr.	3.0	$88.00	1.6
			Row	Existing	Incr.	3.0	$88.00	1.6
			SD/Dupl	New	Incr.	3.0	$88.00	1.6
			Row	New	Incr.	3.0	$88.00	1.6

4.4 SUMMARY OF FUEL CHOICE SCREENING RESULTS

A summary of the screening results for the fuel choice options is presented Exhibit 4.5 below. Highlights of the results shown in Exhibit 4.5 are summarized in the text that follows and the detailed calculations are provided in Appendix C.

Exhibit 4.5a: Summary of TRC Measure Screening Results For Residential Sector Fuel Choice Options – Lower Mainland

Measure		Target Market				Simple Payback (Yrs)	Measure TRC	B/C Ratio
#	Name	Service Area(s)	Sub Sector(s)	Vintage	Full/Incr			
1	Furnace Fuel Choice	LM	SD/Dupl	Existing	Incr.	-0.7	$9,902.41	2.8
			Row	Existing	Incr.	-1.3	$5,548.02	2.9
			SD/Dupl	New	Incr.	5.1	$4,930.54	1.8
			Row	New	Incr.	6.6	$3,268.62	1.6
2	DHW Fuel Choice	LM	SD/Dupl	New	Incr.	-13.2	$192.50	1.2
			Row	New	Incr.	-16.5	$81.22	1.1
3	Range Fuel Choice	LM	SD/Dupl	New	Incr.	0.0	$55.54	1.1
			Row	New	Incr.	0.0	$43.08	1.1
4	Dryer Fuel Choice	LM	SD/Dupl	Existing	Incr.	16.3	$141.99	1.3
			Row	Existing	Incr.	20.9	$78.04	1.2
			SD/Dupl	New	Incr.	0.0	$287.35	2.0
			Row	New	Incr.	0.0	$224.42	2.0

Note:
- For the furnace fuel choice measure in existing homes, simple payback is negative because the natural gas option is less expensive than the base case electric option. A negative incremental cost with positive savings produces a negative simple payback.
- For the DHW fuel choice measure, simple payback is negative because at current retail rates for electricity and gas, the electric water heater is less expensive to operate. The measure nonetheless has a positive TRC, using current avoided cost values.

Exhibit 4.5b: Summary of TRC Measure Screening Results For Residential Sector Fuel Choice Options – Vancouver Island

Measure		Target Market				Simple Payback (Yrs)	Measure TRC	B/C Ratio
#	Name	Service Area(s)	Sub Sector(s)	Vintage	Full/Incr			
1	Furnace Fuel Choice	VI	SD/Dupl	Existing	Incr.	-2.0	$7,010.93	3.4
			Row	Existing	Incr.	-3.3	$4,332.26	3.5
			SD/Dupl	New	Incr.	14.0	$2,774.25	1.7
			Row	New	Incr.	17.6	$1,800.42	1.5
2	DHW Fuel Choice	VI	SD/Dupl	New	Incr.	-4.8	$181.55	1.2
			Row	New	Incr.	-5.7	$94.10	1.1
3	Range Fuel Choice	VI	SD/Dupl	New	Incr.	0.0	$128.53	1.3
			Row	New	Incr.	0.0	$104.63	1.3
4	Dryer Fuel Choice	VI	SD/Dupl	Existing	Incr.	-57.6	$142.74	1.4
			Row	Existing	Incr.	-71.7	$85.24	1.3
			SD/Dupl	New	Incr.	0.0	$288.10	2.4
			Row	New	Incr.	0.0	$231.51	2.4

Note:
- For the furnace fuel choice measure in existing homes, simple payback is negative because the natural gas option is less expensive than the base case electric option. A negative incremental cost with positive savings produces a negative simple payback.
- For the DHW fuel choice measure, simple payback is negative because at current retail rates for electricity and gas, the electric water heater is less expensive to operate. The measure nonetheless has a positive TRC, using current avoided cost values.

Exhibit 4.5c: Summary of TRC Measure Screening Results For Residential Sector Fuel Choice Options – Interior

Measure #	Measure Name	Target Market: Service Area(s)	Target Market: Sub Sector(s)	Target Market: Vintage	Target Market: Full/Incr	Simple Payback (Yrs)	Measure TRC	B/C Ratio
1	Furnace Fuel Choice	Int	SD/Dupl	Existing	Incr.	-0.9	$7,828.58	2.8
			Row	Existing	Incr.	-1.7	$4,278.04	2.9
			SD/Dupl	New	Incr.	6.2	$3,514.72	1.7
			Row	New	Incr.	8.4	$2,103.92	1.5
2	DHW Fuel Choice	Int	SD/Dupl	New	Incr.	-17.6	$95.31	1.1
			Row	New	Incr.	-22.4	$1.39	1.0
3	Range Fuel Choice	Int	SD/Dupl	New	Incr.	0.0	$45.57	1.1
			Row	New	Incr.	0.0	$35.03	1.1
4	Dryer Fuel Choice	Int	SD/Dupl	Existing	Incr.	18.8	$90.99	1.2
			Row	Existing	Incr.	25.1	$30.74	1.1
			SD/Dupl	New	Incr.	0.0	$237.16	2.0
			Row	New	Incr.	0.0	$177.87	2.0

Note:

- For the furnace fuel choice measure in existing homes, simple payback is negative because the natural gas option is less expensive than the base case electric option. A negative incremental cost with positive savings produces a negative simple payback.
- For the DHW fuel choice measure, simple payback is negative because at current retail rates for electricity and gas, the electric water heater is less expensive to operate. The measure nonetheless has a positive TRC, using current avoided cost values.

4.5 DESCRIPTION OF ENERGY EFFICIENCY TECHNOLOGIES AND MEASURES

This sub section provides a brief description of each of the energy efficiency technologies and measures that are included in this study, as listed in Exhibit 4.6.

Exhibit 4.6: Energy Efficiency Technologies and Measures - Residential Sector

Air Leakage Sealing
Attic Insulation
Wall Insulation
Foundation Insulation
Crawl-space insulation
Vacuum Panel Insulation
High- & Super High-Performance Windows
Integrated Design & Multiple Envelope Measures
Condensing Furnaces
Condensing Boilers
High-Efficiency Heat Recovery Ventilators (HRV)
Integrated Heating & DHW (e.g., eKOCOMFORT)
Gas-fired Heat Pumps

EnerGuide Natural Gas Fireplaces
Low-Flow Showerheads & Faucets
DHW Heat Trap
DHW Temperature Reduction
Condensing Water Heaters
Hot Water Pipe Insulation
In-line (Instantaneous) Gas-Fired DHW
DHW Savings from Efficient Dishwashers
DHW Savings from Efficient Clothes Washers
Insulated Swimming Pool Covers
High-Efficiency Pool Heaters
Solar Pool Heating

Also:
High efficiency gas range (no improvements)
High efficiency gas dryers (no improvements

The discussion is organized and presented in the following subsections:

- Existing building envelope
- New building design
- Space heating equipment
- Domestic hot water
- Pool heaters
- Major appliances
- Fireplaces.

Each option is discussed below, with a brief description of the technology, savings relative to the baseline, typical installed costs, applicability and co-benefits. Detailed cost and performance data are provided in Appendix B

4.5.1 Existing Building Envelope

"Building envelope" measures improve the thermal performance of the building's walls, roof and/or windows. These measures also provide significant co-benefits, such as increased occupant comfort, improved resale value, etc. Seven energy efficiency upgrade options were identified and assessed for this end use. They are:

- High-performance and super high-performance windows
- Air leakage sealing
- Attic insulation
- Wall insulation
- Foundation insulation
- Crawl space insulation
- Vacuum panel insulation.

- **High- & Super High-Performance Windows**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$2,400 incremental cost in existing $1,100 incremental cost in new
Savings	6% of space heating energy in existing 22% of space heating energy in new
Useful Life	30 years

High-performance[27] windows are double glazed with a ½-inch air space; they incorporate a number of additional energy-saving features including low E (soft coating), insulating spacers, argon fill and vinyl frames (a mix of hinged and picture). The more efficient windows reduce heat loss through the window by 25% or more, compared to the average low- or mid-efficiency replacement window. High performance windows have a U-Value of 1.8 or lower (R-3.2). High-performance windows also provide occupant co-benefits, such as reduced interior noise, reduced air leakage, greater thermal comfort and fewer condensation problems.

This analysis employs an incremental cost of $2,400 to renovate a single-family house to high-performance windows; the corresponding savings are approximately 6% of space heating and a similar percentage of air conditioning and ventilation fan energy.

If the upgrade is chosen as part of a new construction, the incremental cost is approximately $1,100 and the potential savings are approximately 22%. Savings are higher in new housing, because the windows currently being installed include a much higher proportion of low efficiency products than in the replacement market, and because new homes tend to have more and larger windows. These larger absolute savings are an even larger percentage of overall heating, cooling, and ventilating energy, because the other components of the building envelope have improved faster than windows have. The product lifetime for windows is approximately 30 years.[28]

[27] Super High performance windows incorporate additional features such as triple glazing or fibreglass frames as well as the low E coating, argon fill and insulating spacers, giving them a U-Value of 1.4 or lower (R-4). These windows are much more costly relative to the high performance windows – incremental costs would be approximately $5,000 per house. This analysis focused on the high efficiency windows instead. G

[28] Marbek Resource Consultants: *Ontario Low-Rise Residential Windows Market Study*, prepared for Enbridge Gas, 2004.

- **Air Leakage Sealing**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$900 incremental cost in existing $700 incremental cost in new
Savings	12% of space heating energy
Useful Life	25Years

Air 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, through electrical and plumbing penetrations and at the top of foundation walls. Installation of sealant is a generally accepted method for reducing air leakage in buildings.

Air sealing also provides important co-benefits, including reduced drafts, increased occupant comfort, and greater control over ventilation capability. In addition, reduced air leakage around windows and attic penetrations eliminates one of the key contributors to water ingress into exterior envelope assemblies.

According to a study conducted by the Greater Vancouver Regional District, air leakage in existing dwellings can be reduced by as much as 33%, which results in space heating savings of 12%. Electricity savings from air conditioning, if applicable, and ventilation fans would be approximately the same percentage. The cost of leakage control is approximately $900 per existing single-family dwelling if undertaken by an air-sealing contractor who can perform an air test as part of the work. If homeowners undertake the air sealing work, significant cost savings can be achieved, but the resulting energy would be substantially reduced as well.

The incremental cost of improved air sealing in a new construction project used in this analysis is $700. As in existing dwellings, 12% savings of space heating energy is assumed for enhanced air leakage sealing of new dwellings. The life of this measure is approximately 25 years.[29]

[29] Energy impacts are from Hot 2000 simulations; cost data are based on discussions with installation contractors. Data were originally developed and used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study.

❑ Attic Insulation

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$1,000 incremental cost
Savings	6% of space heating energy
Useful Life	30 Years

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, then add an additional layer of unfaced fibreglass batt insulation across the joists.

This analysis estimates the cost of this measure to be $1000, with a resulting savings of approximately 6% of the space heating costs. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. The life of this measure is approximately 30 years.[30]

❑ Wall Insulation

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing
Costs	$2,500 incremental cost in existing
Savings	13% of space heating energy
Useful Life	30 Years

Wall insulation is usually challenging to retrofit in an existing house, because the inside surfaces of the exterior walls are already finished and in place. Adding insulation is only possible by blowing insulating materials into the wall cavity if sufficient space exists or by adding insulation to the exterior of the building under the siding.

The cost of adding the exterior insulation (as not all walls have sufficient space for blown-in insulation) used in this analysis is $2,500 for a typical single family home (assuming siding is already being replaced). Savings are estimated to be 13% of space heating costs. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. The life of this measure is approximately 30 years.[31]

[30] Energy impacts are from Hot 2000 simulations; cost data are based on discussions with installation contractors. Data were originally developed and used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study.

[31] Ibid.

❑ Foundation Insulation

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$4,700 full cost in existing
Savings	11% of space heating energy in existing and new
Useful Life	30 Years

In older homes the basement is often under insulated or even left un-insulated. Increasing the insulation level in basements can be achieved in a number of ways including: constructing a new insulated frame wall or 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. For purposes of this report, increased basement insulation was assumed to be either moving an existing frame wall or constructing a new frame wall with an upgrade to R-24 insulation.

Co-benefits of improved basement insulation include improved thermal comfort, fewer drafts, more usable living space and less condensation.

The cost of adding insulation to the foundation, including labour and finishing, is approximately $\$40/m^2$ of basement wall area, or $4,700 for a typical single-family dwelling. Adding this insulation reduces space heating energy by 11%. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. This measure has a life of approximately 30 years.[32]

❑ Crawl Space Insulation

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing
Costs	$1,125 incremental cost in existing
Savings	1% of space heating energy
Useful Life	30 Years

Insulation levels remain below code in many homes that include crawl space as part of the basement design. Co-benefits of improved crawl space insulation include improved thermal comfort, fewer drafts and less condensation.

The addition of crawl space insulation in existing houses to bring the thermal resistance values up to existing code levels of R 12 (RSI 2.1) provides annual energy savings of approximately $0.06 GJ/yr./m^2$.[33] Typical installed costs are approximately $\$75/m^2$. For the

[32] Energy impacts are from Hot 2000 simulations; cost data are based on discussions with installation contractors. Data were originally developed and used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study.

[33] In some cases, it is possible to place insulation in the floor substructure to improve R values to 30 (RSI 4.8).

purposes of estimating benefits and costs, an average house was assumed to have 15 m^2 of crawlspace area. Savings amount to approximately 1% of total space heating energy for the home. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. This measure has a life of approximately 30 years.[34]

- **Vacuum Panel Insulation**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$9,000 incremental cost in new
Savings	25% of space heating energy in new
Useful Life	30 Years

Vacuum Panel Insulation (VPI) can achieve thermal resistance levels that are three to seven times those provided by conventional insulation materials, such as rigid foam boards and fiberglass. The technology consists of a core panel enclosed in an airtight, vacuum-sealed envelope. Such panels can attain thermal resistances of approximately R20/in. Although targeted primarily to refrigerators and specialized containers, VPI can be manufactured in any size and thus has potential for buildings.

A wall component with a thermal resistance of R40 can reduce space heating loads by 25%. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. The price for this technology is approximately \$40/m^2 of insulation. For the housing archetypes used to estimate costs and benefits, this would amount to a total capital cost of approximately $9,000. This measure has a life of approximately 30 years.[35]

4.5.2 New Building Design

"New building design" integrates advances in both building envelope and space/water conditioning technologies. Construction of new homes according to the R2000 standard was identified as one energy efficiency upgrade option for this end use. The EnerGuide rating system for new homes is emerging as the key metric for energy performance in Canada. R2000 is one method of achieving an EnerGuide rating of 80, but there are other combinations of features that could achieve this performance level. Accordingly, a second upgrade option is identified, that of building an EnerGuide 80 home without specifying that it must also meet the R2000 standard.

[34] Energy impacts are from Hot 2000 simulations; cost data are based on discussions with installation contractors. Data were originally developed and used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study.

[35] Cost, savings and life based on estimates from ESource Heating Technology Atlas.

❑ R2000 for New Dwellings

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	New
Costs	$6,500 incremental cost
Savings	30% of space heating energy
Useful Life	30 Years

R2000 homes are required to achieve a stringent energy budget that is determined by a combination of factors related to heating fuel, house size and climatic data. In addition, R2000 homes are required to achieve an air tightness level of 1.5 ACH at 50 Pa. A number of co-benefits are associated with R2000 construction. These include improved occupant comfort, improved air quality due to the mandatory use of heat recovery ventilators, higher re-sale value and reduced environmental impact.

This analysis estimates that annual space heating savings are 30% relative to standard, non-electrically heated new houses. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. Typical incremental construction costs for an R2000 home are assumed to be $6,500.[36]

❑ EGH80 for New Dwellings

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	New
Costs	$3,800 incremental cost
Savings	30% of space heating energy
Useful Life	30 Years

An EnerGuide for Houses rating is a standard measure of a home's energy performance, calculated by a professional EnerGuide for Houses 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. A blower door test measures air leakage when the air pressure within the house is lowered a specified amount below the air pressure outside. EnerGuide ratings for new houses fall within the following ranges:

- Typical new houses: 66 to 74 (a house built to code would typically receive a rating of 68)
- Energy efficient new houses: 75 to 79
- R-2000 houses: 80
- Highly energy-efficient new houses: 80 to 90
- Advanced houses using little or no purchased energy: 91 to 100.

[36] Energy impacts are from Hot 2000 simulations; cost data are based on discussions with installation contractors. Data were originally developed and used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study.

The key difference between the R-2000 standard and a more flexible requirement to meet the EnerGuide 80 rating is that builders would not necessarily need to install a heat recovery ventilator to achieve a rating of 80. This substantially reduces the cost of the measure.

This analysis estimates that annual space heating savings are 30% relative to standard, non-electrically heated new houses. Electricity savings from air conditioning and ventilation fans, if applicable, would be approximately the same percentage. Typical incremental construction costs for an EGH80 home are assumed to be $3,800.[37]

4.5.3 Space Heating Equipment

Space heating refers to the equipment and controls used to heat residential dwellings. Seven energy efficiency upgrade options were identified and assessed for this end use. They are:

- Condensing furnace
- Condensing boiler
- High efficiency HRV
- Electronic thermostats
- Gas-fired heat pumps
- Integrated heating & DHW
- Ecoheating.

- ❑ **Condensing Furnaces**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$600 incremental cost in existing and new
Savings	18% of space heating energy in existing
Useful Life	18 Years

High efficiency condensing furnaces feature advanced heat exchanger designs that extract more heat from the flue gases before they are exhausted. In fact, so much heat is extracted that the flue gases condense and must be discharged as a condensate rather than a gas.

This analysis assumes that a condensing furnace has an incremental cost of roughly $600 over a mid-efficiency furnace. Non-condensing mid-efficiency furnaces have AFUEs ranging from 78-84% while condensing high-efficiency units have AFUEs in the range of 90-98%. A typical condensing unit is assumed to average 94%, compared to an average mid-efficiency furnace of approximately 80%. Therefore, the condensing unit would reduce gas use by an average of 18% compared to a non-condensing unit. Some furnaces also feature variable speed fan motors that can save up 600-700 kWh/year of the

[37] Cost is based on R2000 incremental cost, less the cost of installing an HRV.

electrical energy use, at an additional incremental cost, but this feature is not assumed to be part of this measure. The typical life of a furnace is 18 years.[38]

❑ Condensing Boilers

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$3,200 incremental cost
Savings	12.5 % of space heating energy
Useful Life	18 Years

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.

This analysis employs an incremental cost of $3,200 for a residential condensing boiler compared to the price of a mid-efficiency boiler. Non-condensing mid-efficiency boilers have AFUEs ranging from 80-87% while condensing high-efficiency units have AFUEs in the range of 88-97%. An efficient condensing unit can reduce gas use by 12.5% compared to a non-condensing unit. A high efficiency boiler also saves up to 50 kWh/yr in electrical energy savings from the pump motor. The typical life of a boiler is 18 years.[39]

❑ High-Efficiency Heat Recovery Ventilators (HRV)

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	New
Costs	$650 incremental cost
Savings	7% of space heating energy
Useful Life	15 Years

Many new homes now have heat recovery ventilators installed to recover wasted heat energy from centralized exhausts. This analysis assumes that a standard heat recovery ventilator costs approximately $2,500 and results in a 13% reduction in space heating costs.

This analysis estimates that, in contrast to the standard HRV model, new, high-efficiency HRV units recover approximately 50% more of the energy escaping in ventilation air, which results in an additional 7% reduction in space heating costs. The incremental cost

[38] Efficiency ranges and costs are from manufacturer's estimates. Estimated life is from ASHRAE.

[39] Efficiency ranges and costs are from manufacturer's estimates. Estimated life is from ACEEE (ASHRAE estimates life of a steel boiler at 25 years, and a cast iron boiler at 35 years.)

of this more efficient HRV compared to the standard model, is approximately $650. This technology has an estimated life of 15 years.[40]

- **Gas-fired Heat Pumps**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$5,000 incremental cost in existing and new
Savings	30% of space heating energy in existing
Useful Life	18 Years

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 heat pump using generator-absorber heat exchange (GAX) is currently being developed in the U.S. with support from the U.S. Department of Energy (DOE) and some gas utilities.

The technology is still at the prototype stage, but the manufacturer estimates that these units will consume 1/3 less gas than a comparably sized condensing furnace. The manufacturer hopes that the final price of these units will be in the range of $7,500, approximately $5,000 more than a condensing furnace. GAX heat pumps are estimated to have a COP between 1.25 to 1.5. The life of this measure is assumed to be 18 years.[41]

As this technology is not commercially available, it was not considered further in this analysis.

- **Integrated Heating & DHW (e.g., eKOCOMFORT, condensing water heater-based combo systems)**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$500 incremental cost in existing and new
Savings	12% of space heating energy in existing
Useful Life	18 Years

eKOCOMFORT is a specification developed by several HVAC companies and research facilities that brings together the most efficient technology for residential space heating, water heating and ventilation. Primary benefits of the integrated unit are:

[40] ESource Heating Technology Atlas. Data used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study.

[41] "Emerging Technologies for a Second Generation of Gas Demand-Side Management", 2004, submitted by David Nichols for EGDI.

- Compact construction.
- Lower cost of installation (only one set of gas, water and ventilation connections are required).
- The price for the integrated system is expected to be lower than the total price for comparable individual systems for heating air and water, once the technology is mature.
- Higher efficiency at lower installation and maintenance costs.

This analysis estimates that eKOCOMFORT units operate at a seasonal efficiency of approximately 94%. The estimated installed costs are approximately $500 more than for a conventional system. Reductions in gas use are approximately 12% per year. The life of the eKOCOMFORT system is 18 years.[42]

It should, however, be noted that if the eKOCOMFORT system is not widely commercialized until late in the study period, the marketplace may have largely transformed to condensing furnaces by that time. If the baseline is a condensing furnace, only the DHW savings of the eKOCOMFORT system will remain, making it less economically attractive.

- **EcoHeating**

The EcoHeating system is a speculative technology with a long time to commercialization. It is a compact vented forced air heating unit with very low air emissions and a potentially low installed cost. The unit uses a continuously rotating ceramic core to transport heat and moisture from the combusted gas to the forced air stream entering the space to be heated. It provides humidification and air cleaning as well as air heating.

The inventors claim that the thermal efficiency of the prototype unit is over 99%, and that the cost to manufacture the unit would be extremely inexpensive, less than $75 (US). The simple design suggests a lifetime that may be greater than that of conventional furnaces.[43]

As this technology is not commercially available, it was not considered further in this analysis.

4.5.4 Domestic Hot Water (DHW)

Domestic hot water (DHW) refers to the heated water used for showers and baths, hand washing or clothes and dishwashing. Eight energy efficiency upgrade options were identified and assessed for this end use as follows:

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[42] Sources: 1)Nichols, David; “Emerging Technologies for a Second Generation of Gas Demand-Side Management” prepared for Enbridge Gas Distribution Inc. (EGDI), 2004.

EGDI, 2) ESource Technology Profile on eKOCOMFORT 3) eKOCOMFORT website, www.ekocomfort.com.

[43] Nichols, David; “Emerging Technologies for a Second Generation of Gas Demand-Side Management”, prepared for Enbridge Gas Distribution Inc. (EGDI), 2004.

- Low-flow showers and faucets
- Heat trap
- Condensing water heater
- Instantaneous water heater
- Waste water heat recovery
- Hot water pipe insulation.

❑ Low-flow Showers and Faucets

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing
Costs	$25 incremental cost
Savings	11% of DHW energy in existing
Useful Life	12 Years

Energy efficient showers and faucets have aerators and flow restrictors to reduce water use. DHW used for general use (showers and faucets) is assumed to account for approximately 35% of total DHW energy.

This analysis estimates that reductions in hot water usage are in the range of 30 percent relative to traditional models, or 11% of total DHW use. Installed costs are approximately $25 for a single-family dwelling. This measure has an expected life of 12 years.[44]

❑ Heat Trap

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing
Costs	$65 incremental cost
Savings	10% of DHW energy
Useful Life	15 Years

Heat traps are installed on the exit side of the hot water tank to reduce thermal siphoning and related stand-by losses.

This analysis estimates that in a typical application, total hot water consumption is reduced by about 10 percent. Typical installed costs are assumed to be $65. The life of this measure is assumed to be 15 years.[45]

[44] Data used in 2002 BC Hydro Conservation Potential Review and updated in 2003 Manitoba Hydro DSM Study. Similar assumptions are used in ACEEE and EERE "Consumer Tip Sheets".

[45] Cost and savings data based on earlier analysis conducted for Enbridge Gas Distribution Inc.

❑ Condensing Water Heaters

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$1,250 incremental cost
Savings	30% of DHW energy
Useful Life	10 Years

Condensing boilers capture almost all of the heat value of the condensing flue gas water vapour to liquid (about 10% for natural gas), resulting in an overall efficiency of over 90%. In addition, their forced draft burners eliminate off-cycle heat transfer to the flue.

The incremental cost of a condensing water heater is estimated to be $1,250 relative to a conventional unit. Incremental DHW savings relative to a conventional water heater are assumed to be 30%. Condensing water heaters are assumed to have a life of 10 years.[46]

❑ In-line (Instantaneous) Gas-Fired Water Heaters

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$700 incremental cost
Savings	28% of DHW energy
Useful Life	20 Years

In-line tankless water heaters heat water on demand, eliminating hot water storage. The efficiency of tankless water heaters depends on the water heater's characteristics and on the temperature of the water being heated. Operating efficiencies can be as high as 90% but are more typically in the 75% to 80% range. The absence of hot water storage reduces standby heat losses. One concern with promoting the uptake of on demand water heaters is that they have a very high energy demand, ranging from 2 to 4 times the maximum demand of a standard water heater. Prices have dropped significantly in the recent past as the technology has matured; however, a significant price gap continues to exist between this technology and the standard tank system.

An incremental price of $700 is used in this analysis for a tankless water heater relative to a standard tank system. The seasonal efficiency of an instantaneous water heater is estimated to be 80%, which results in a DHW savings of 28% relative to a tank system. Due to the high quality materials used in tankless water heaters, their useful life is assumed to be 20 years.[47]

[46] Sources: 1) Nichols, David op cit; 2) "Emerging Energy-Saving Technologies and Practices for the Buildings Sector: 2004", ACEEE, 3) "A comparative Study of High-Efficiency Residential Natural Gas Water Heating", 2002, ACEEE.

[47] Sources: 1) "Emerging Energy-Saving Technologies and Practices for the Buildings Sector: 2004", ACEEE, 2) "A comparative Study of High-Efficiency Residential Natural Gas Water Heating", 2002, ACEEE.

❑ Waste Water Heat Recovery

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$625 incremental cost
Savings	16 % of DHW energy
Useful Life	18 Years

Residential waste water heat recovery systems transfer the waste heat from drains to pre-heat make-up water. The system works well only for DHW uses in which the hot water use and the draining of waste water are simultaneous. In a home, therefore, application to anything other than showers is difficult. One example of this technology is the GFX system which was originally developed with a grant from the US Department of Energy and is currently manufactured by Doucette Industries. The GFX system incorporates a shell-and-tube heat exchanger that typically has efficiencies in the range of 30 to 50%. The cost of these systems varies according to the application and the installation difficulty.

This analysis estimates that the incremental costs are $625 and the savings are approximately 45% of DHW used for showers, which is approximately 90% of the personal use DHW, which in turn is approximately 35% of overall DHW energy use. Thus, the savings potential is approximately 16% of total DHW energy use. The life of this measure is approximately 18 years.

❑ Hot Water Pipe Insulation

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$4 incremental cost
Savings	3% of DHW energy
Useful Life	6 Years

Hot water pipe insulation reduces the distribution losses for domestic hot water, which account for approximately 5-10% of the total natural gas consumption in a water heater.

This analysis estimates that hot water pipe insulation reduces total DHW energy consumption by 3%. The materials cost an average of $4 per house and are assumed to be installed by the homeowner. The measure has an expected life of 6 years.

4.5.5 Pool Heaters

Pool heaters refer to natural gas heaters for swimming pools, usually outdoors. The saturation of heated pools in British Columbia is relatively low, but where they are present, pool heaters often use as much natural gas as the home's primary space heating appliance. Two energy efficiency upgrade options were identified and assessed.

- Insulating pool covers
- High efficiency pool heater.

❑ Insulating Swimming Pool Covers

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$1,200 full cost
Savings	40 % of pool heating energy
Useful Life	10 Years

About 70% 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. In an indoor pool, the evaporation not only adds to the cost of heating the pool itself but must also be removed from the pool room by a ventilation system, further increasing the cost. Evaporation also increases the quantity of chemicals that must be added to the pool.

This analysis assumes that the installation and regular use of a swimming pool cover will save 40% of the energy used for heating the swimming pool. The reduction in pool chemicals is an additional benefit that is not included in the cost savings. For a 50 m^2 pool, a cover with a manual reel, is assumed to cost $900-1,500. It is assumed that a swimming pool cover has a life of approximately 10 years.[48]

❑ High-Efficiency Pool Heaters

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$2,900 incremental cost
Savings	14% of pool heating energy
Useful Life	20 Years

High efficiency pool heaters incorporate advanced heat exchangers, forced draft combustion systems, pilot-less ignitions and innovations in hydraulics, which results in performance efficiencies that range between 89 and 95%, compared to efficiencies of

[48] Marbek Resource Consultants; "Tuning Up Multi-Unit Residential Buildings"; prepared for CMHC, 2003..

80% to 85% for standard models. If a pool heater is 5-10 years old, it is likely only 65-75% efficient.

This analysis assumes that the incremental cost of a high efficiency pool heater is $2,900 and energy savings are 14%[49] relative to a standard efficiency model.

4.5.6 Major Appliances

"Major appliances" include washing machines, dishwashers, ranges, and dryers. Two energy efficiency upgrade options were identified and assessed for this end use as follows:

- DHW savings from efficient dishwashers
- DHW and dryer savings from efficient clothes washers.

❑ **DHW Savings from Efficient Dishwashers**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$0
Savings	5 % of DHW energy
Useful Life	13 Years

Energy Star Dishwasher

Energy Star dishwashers save energy by using improved technology for the primary wash cycle and by using less hot water to clean. Construction includes more effective washing action, energy-efficient motors and other advanced technologies, such as 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.

Compared to a standard dishwasher, an Energy Star dishwasher will save 5% of DHW energy and 20% of dishwasher electricity with no additional cost.[50] The estimated life of a dishwasher is 13 years.

Best Available Dishwasher

The best available dishwashers have additional energy savings features such as soil sensing technology that allows the machine to vary the amount of water that it uses.

[49] Personal Communications with Jandy pool heater manufacturers.

[50] Savings and Life information obtained from EnergyStar website. Cost information obtained from www.consumerreports.org.

This analysis assumes that these machines save 9% of total DHW energy use compared to a standard dishwasher as well as approximately 35% of appliance electrical energy use. An incremental cost of $600 is assumed.[51]

- **DHW and Dryer Savings from Efficient Clothes Washers**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$500
Savings	14 % of DHW
Useful Life	14 Years

Energy Star Top-Loading (Vertical Axis) Clothes Washer

Energy Star clothes washers use 35 to 50 percent less hot water and 50 percent less mechanical energy per load than standard models. Because Energy Star clothes washers spin faster, there are additional savings in dryer energy.

This analysis estimates that relative to a standard model, these appliances save 8% of DHW energy, 35% of dryer energy and 50% of clothes washer electricity. Typical incremental costs are about $100 more than for the standard model. The estimated life of a clothes washer is 14 years.[52]

Front-Loading (Horizontal Axis) Clothes Washer

Compared to standard models, front-loading (horizontal axis) washing machines reduce hot water use by 60% to 80%, or about 14% of total DHW use. Mechanical energy use is also reduced by about 50% and, due to their faster spin speed, they also reduce dryer energy by about 35%.

This analysis assumes the energy savings outlined above. Incremental costs are assumed to be about $500 more than a standard vertical axis machine.[53] (Some high-end models have incremental costs of about $1000). Horizontal axis clothes washer designs also result in less wear and tear on and fewer wrinkles in clothes. They are assumed to have a life of 14 years.

[51] Savings data obtained from “EnerGuide for Equipment, EnerGuide Appliance Directory 2002”. Cost obtained from www.consumerreports.org and www.sears.ca.

[52] Savings and product life data obtained from EnergyStar website; cost information obtained from www.consumerreports.org.

[53] Savings data obtained from “EnerGuide for Equipment, EnerGuide Appliance Directory 2002”. Cost data obtained from www.consumerreports.org and www.sears.ca and the Sage Report- “Pilot Test Comparison of Energy Star VS Standard Efficiency Appliances”.

4.5.7 Fireplaces

"Fireplaces" include gas-fired indoor fireplaces. The upgrade option identified and assessed for this end use is a more efficient fireplace as measured by the EnerGuide rating system.

- **Efficient Natural Gas Fireplaces**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing and new
Costs	$150 incremental cost
Savings	30% of fireplace energy
Useful Life	15 Years

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. Fireplace efficiency ranges from about 20% to 77%. EnerGuide recommends Direct Vented fireplaces as the safest and most energy efficient type of fireplace. EnerGuide does not set a minimum efficiency level, so savings are possible by using the EnerGuide label to choose the more efficient unit. The price of natural gas fireplaces has more to do with "add-ons" (e.g., mantles, etched glass, etc.) than with efficiency. However, at present it is difficult to purchase an efficient fireplace without also purchasing some of the additional features. Today, this typically adds between $300 and $500; however this price increment is expected to decline to about $150 in the near future, as sales volumes increase.

The efficient natural gas upgrade option would consist of installing a fireplace that meets a minimum efficiency level set by Terasen Gas. 55% is the proposed threshold efficiency. This threshold was selected so that fireplace inserts would not be excluded from consideration – more than one model of fireplace insert exceeds the 55% efficiency level.

British Columbia industry personnel estimate that heater style fireplaces account for about 80% of gas fireplace sales in the province. For the purposes of this study, the efficiency of the average heater fireplace being sold in BC is assumed to be 38%.

This analysis uses an energy savings of 30% for fireplace consumption and incremental cost of $150. Installing a Direct Vented fireplace also reduces the heating load on the main heating appliance in the home (because a regular fireplace acts like a large hole in the house envelope). To be conservative, these additional savings have not been included in this analysis. The expected useful life is 15 years.

4.6 DESCRIPTION OF FUEL CHOICE MEASURES

This sub section provides a brief description of each of the fuel choice technologies and measures that are included in this study, as listed in Exhibit 4.7.

Exhibit 4.7: Fuel Choice Technologies and Measures Residential Sector

New Dwellings	Existing Dwellings
Electric DHW to natural gas	Electric DHW to natural gas
Electric space heating to natural gas	Electric space heating to natural gas
Electric cooking to natural gas	Electric cooking to natural gas
Electric dryers to natural gas	Electric dryers to natural gas

Each of the technologies and measures shown in Exhibit 4.7 are briefly described in the text that follows. In each case, the text provides the following:

- The current baseline technology
- A brief description of the upgrade technology
- Information on the technologies energy performance and cost relative to the baseline technology
- The target sub sectors and building vintage(s) (new vs existing) where the technology can be practically applied
- The expected useful life of the technology.

4.6.1 Space Heating

There are two main scenarios under which the choice between electric and natural gas space heating would likely be exercised: in an existing home with electric forced air heating (so that new ductwork is not required) and in a new home.

❑ **Electric to Natural Gas Space Heating in Existing Homes**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing
Costs	Approximately $900 less than a comparable electric system
Useful Life	18 Years

Electricity is used as the main heating fuel in approximately 9% of the Terasen customers in the Lower Mainland and approximately 4% of those in the Interior region. Ductless heating methods, such as electric baseboards or radiant electric cables, account for under 5% of the Terasen customers in the Lower Mainland and under 3% of those in the Interior region. Most of the remaining electrically-heated homes in the Terasen Gas service territory use forced-air electric furnaces.

The natural gas fuel choice option would consist of installing a high efficiency natural gas furnace to replace the existing electric forced air furnace, in the event that the electric furnace requires replacement. It is assumed that no new ductwork would be required. The base case for this upgrade is not, however, a new electric furnace to replace the old one. Based on interviews with British Columbia contractors, homeowners are choosing air source heat pumps instead of electric furnaces so consistently that they were unable to provide recent pricing on electric forced air furnaces. A heat pump provides not just heating but air conditioning as well. Therefore, to compare the base case to the upgrade on a fair basis, the natural gas furnace option also includes installation of a central air conditioner.

This analysis assumes consumer behaviour (thermostat setpoints, hours of operation, etc.) would remain the same. An air source heat pump costs approximately $8,000 installed, whereas the combination of gas furnace and central air conditioner costs only about $7,100 installed. The measure is evaluated based on a negative cost increment relative to replacing the electric furnace with a heat pump: the upgrade costs about $900 less. The expected useful life is 18 years.

- **Electric to Natural Gas Space Heating in New Homes**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	New
Costs	$6,350 incremental cost
Useful Life	18 Years

Electricity is selected as the primary heating fuel choice in approximately 34% of new homes in the Terasen Gas service territory.[54] In the majority of these homes, the electric heating is supplied through baseboards.

The natural gas fuel choice option would consist of installing a high efficiency natural gas furnace instead of an electric baseboard system in a new home. It is assumed that the additional cost of installing ductwork is part of the incremental cost of the measure. A side benefit of the measure is that a central air conditioning becomes a relatively inexpensive add-on feature.

This analysis assumes consumer behaviour (thermostat setpoints, hours of operation, etc.) would remain the same. The measure is evaluated based on the cost increment relative to installing the electric baseboard system, $7,600 (including ducts) versus $1,250, or an increment of $6,350. The expected useful life is 18 years.

[54] *New Construction Fuel Choice: Interim Report*, prepared for Terasen Gas and BC Hydro by Habart & Associates, May 2005.

4.6.2 DHW

There are two main scenarios under which the choice between electric and natural gas DHW would likely be exercised: in an existing home and in a new home.

- **Electric to Natural Gas DHW in Existing Homes**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	Existing
Costs	$1,250 incremental cost
Useful Life	15 Years

Electricity is used as the water heating fuel by approximately 14% of Terasen customers. The natural gas fuel choice option would consist of installing a natural gas water heater to replace the existing electric water heater, in the event that the electric water heater requires replacement. It is assumed that venting for the water heater is not present and is part of the incremental cost.

The cost increment to replace an electric water heater with a natural gas unit is $1,250. This is based on an installed cost of $2,000 for the gas water heater, assuming appropriate venting is not present and must be included in the installation cost, and that the replacement electric water heater costs $750 installed. The expected useful life is 15 years.

- **Electric to Natural Gas DHW in New Homes**

Assumptions used for Analysis	
Target Segments	Single detached and attached
Vintage	New
Costs	$700 incremental cost
Useful Life	15 Years

Electricity is selected as the water heating fuel in approximately 24% of new homes in the Terasen Gas service territory. The natural gas fuel choice option would consist of installing a natural gas water heater instead of an electric water heater. It is assumed that venting for the water heater is part of the incremental cost.

The cost increment of installing a natural gas water heater instead of an electric one is $350. Builder costs for the natural gas and electric water heaters are similar, except that the cost of venting for the natural gas water heater is approximately $350 more expensive than the cost of wiring for the electric water heater. The expected useful life is 15 years.

4.6.3 Cooking

There are two main scenarios under which the choice between electric and natural gas ranges would likely be exercised: in an existing home and in a new home.

- **Electric to Natural Gas Ranges in Existing Homes**

Assumptions used for Analysis	
Target Segments	All
Vintage	Existing
Costs	$150 incremental cost
Useful Life	18 Years

Electricity is used as the range fuel by over 80% of Terasen customers. The natural gas fuel choice option would consist of installing a natural gas range to replace the existing range, in the event that the range requires replacement. It is assumed that venting for the range is adequate and is not part of the incremental cost. The incremental cost is primarily gas piping.

The cost increment to replace an electric range with a natural gas range is $150. The expected useful life is 18 years.

- **Electric to Natural Gas Ranges in New Homes**

Assumptions used for Analysis	
Target Segments	All
Vintage	New
Costs	$0 incremental cost
Useful Life	18 Years

Electricity is selected as the range fuel in over 70% of new homes in the Terasen Gas service territory. The natural gas fuel choice option would consist of installing a natural gas range instead of an electric range. It is assumed that venting costs would be similar for both ranges, and that gas piping cost is similar to the cost of running 220 V supply to the range location.

The measure is evaluated based on an incremental cost of zero. The expected useful life is 18 years.

4.6.4 Clothes Drying

There are two main scenarios under which the choice between electric and natural gas dryers would likely be exercised: in an existing home and in a new home.

❑ Electric to Natural Gas Dryers in Existing Homes

Assumptions used for Analysis	
Target Segments	All non-apartments
Vintage	Existing
Costs	$150 incremental cost
Useful Life	18 Years

Electricity is used as the dryer fuel by over 90% of Terasen customers. The natural gas fuel choice option would consist of installing a natural gas dryer to replace the existing dryer, in the event that the dryer requires replacement. It is assumed that venting for the dryer is adequate and is not part of the incremental cost. The incremental cost is primarily gas piping.

The measure is evaluated based on the cost increment relative to replacing the electric dryer with an identical one, that is, $150. The expected useful life is 18 years.

❑ Electric to Natural Gas Dryers in New Homes

Assumptions used for Analysis	
Target Segments	All non-apartments
Vintage	New
Costs	$0 incremental cost
Useful Life	18 Years

Electricity is selected as the dryer fuel in over 90% of new homes in the Terasen Gas service territory. The natural gas fuel choice option would consist of installing a natural gas dryer instead of an electric dryer. It is assumed that venting costs would be similar for both dryers, and that gas piping cost is similar to the cost of running 220 V supply to the dryer location.

The measure is evaluated based on an incremental cost of zero. The expected useful life is 18 years.

4.6.5 Other Fuel Choice Options

In addition to the four options detailed above, there are other potential fuel choice options. They include:

- Space heating fuel choice from oil or propane to natural gas
- DHW heating fuel choice from oil or propane to natural gas
- Fireplace or stove heating fuel choice from wood to natural gas
- Barbecue fuel choice from propane to natural gas.

In each of these cases, the base case fuel is in the "other" category and represents a relatively small share of overall energy use within the sector. These fuels are not individually tracked in this study; consequently, these measures were not analyzed.

5. ECONOMIC POTENTIAL FORECAST – ENERGY EFFICIENCY SCENARIO

5.1 INTRODUCTION

This section presents the Residential Sector Economic Potential Forecast – Energy Efficiency for the study period (FY 2003/04 to FY 2015/16). The Economic Potential Forecast estimates the level of energy consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost-effective. In this study, "cost-effective" means that the technology upgrade passes the measure Total Resource Cost (TRC) test, as discussed previously in Section 4.2.[55]

The discussion in this section is organized into the following subsections:

- Major modelling tasks
- Technologies included in economic potential forecast – energy efficiency scenario
- Presentation of results
- Interpretation of results.

5.2 MAJOR MODELLING TASKS

By comparing the results of the Residential Sector Economic Potential Forecast – Energy Efficiency Scenario with the Reference Case, it is possible to determine the aggregate level of potential natural gas savings within the Residential Sector, as well as identify which specific building segments and end uses provide the most significant opportunities for savings.

To develop the Residential Sector Economic Potential Forecast – Energy Efficiency Scenario the following tasks were completed:

- The measure TRC results for each of the energy-efficiency upgrades presented previously in Exhibit 4.4 were reviewed.

- Technology upgrades that had positive measure TRC results were selected for inclusion in the Energy Efficiency Scenario, 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, which in this study was set at 75% of the equipment's rated life expectancy.

[55] Energy markets in Canada and worldwide have experienced a number of extraordinary events in the recent past. As a result, natural gas costs have risen substantially since the start of this CPR. As current natural gas costs are higher than those used in this analysis, the benefits of efficiency measures may be understated while the benefits of fuel choice measures may be overstated. Within the limits of the time and resources available, this CPR has attempted to accommodate the increasing natural gas prices by applying a "high level" price sensitivity analysis to the measures screening process. Efficiency measures that were close but did not initially pass the measures TRC test have been included in the Economic Potential scenario. This approach recognizes that the measures will be subject to further economic screening during the detailed program design stage, which will provide a further opportunity to decide whether the measures should continue to be included in Terasen's program portfolio.

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 building segments 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 forecast 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., low-flow showerheads and more efficient dishwashers) would be applied before a high efficiency water heater. Similarly, the cost effectiveness of the high efficiency water heater was tested at the new, lower annual load and included only if it continued to pass the measure TRC test.

5.3 TECHNOLOGIES INCLUDED IN ECONOMIC POTENTIAL FORECAST – ENERGY EFFICIENCY SCENARIO

Exhibit 5.1 provides a listing of the technologies selected for inclusion in this 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 5.1: Technologies Included in Economic Potential Forecast – Energy Efficiency Scenario

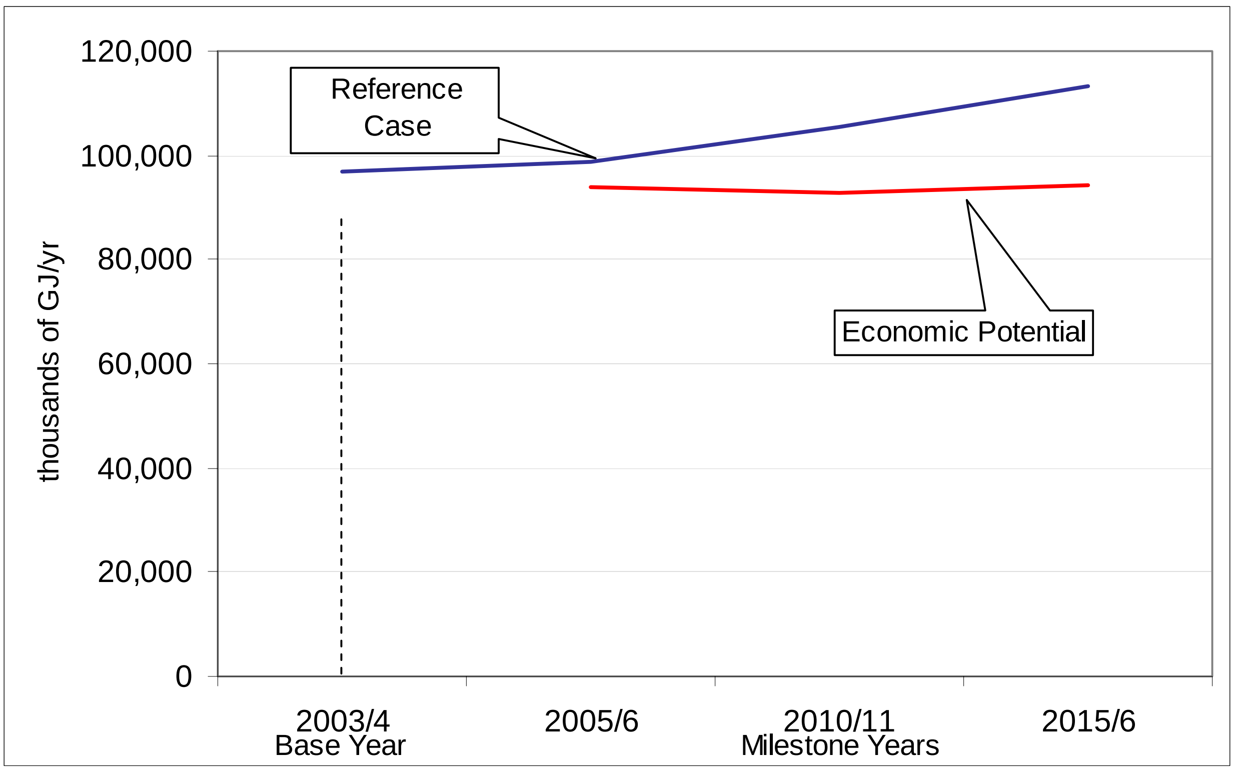
End Use	Upgrade Option	Applicability of Upgrade Options by Dwelling Type	Rate of Stock Introduction
Space Heating	High-performance glazing	• SFD/Duplex, new only • Lower Mainland and Interior only	• New construction, immediate
	Condensing furnace	• SFD/Duplex • Existing and new homes • L. Mainland and Int. only	• New construction, immediate • Existing homes, at rate of furnace replacement
	Integrated heating & DHW[56]	• SFD/Duplex • Existing and new homes • L. Mainland and Int. only	• New construction, immediate • Existing homes, at rate of furnace replacement
	New Building Construction 60% Below Current Energy Consumption	• New high rise apartments	• New construction, immediate
	Improved Building Operations	• Existing apartments	• Existing buildings, immediate
	High Efficiency Boilers	• Existing apartments	• Existing buildings, at rate of boiler replacement
DHW	Savings from new washers and dishwashers	• All	• See below for appliances
	Aerators and low-flow showerheads	• All	• Immediate introduction • 60% current penetration assumed for LM and VI, 65% for Interior
	DHW Heat Trap	• All existing homes with older DHW tanks	• Immediate introduction • Opportunity ends as tanks are replaced
	DHW pipe insulation	• All	• Immediate introduction to both new and existing homes • Initial penetration of 25% assumed
	New Building Construction 60% Below Current Energy Consumption	• New high rise apartments	• New construction, immediate
	Condensing DHW Boilers	• Existing high rise apartments	• At rate of boiler replacement
	Condensing DHW Heaters	• Existing apartments	• At rate of heater replacement
	Drainwater heat recovery	• High rise apartments	• New construction, immediate • Existing construction, where feasible, immediate
Appliances	Energy Star dishwasher	• All	• Existing stock, at turnover, full penetration by 2016 • New stock, immediate
	Energy Star clothes washer	• All	• Existing stock, at turnover, full penetration by 2016 • New stock, immediate
Pools	Insulating pool cover	• All homes with pools	• Immediate introduction • Initial penetration 73% in LM and VI, 90% Interior
Fireplace	Efficient fireplace	• All existing or new homes with fireplaces	• As replaced or installed in new construction • Full penetration by 2016

[56] Though cost-effective compared to the base case standard furnace and water heater, this technology is not competitive against a condensing furnace and water heater, because space heating savings are eliminated. Savings in DHW energy are not enough to justify the incremental cost.

5.4 PRESENTATION OF RESULTS[57]

Exhibit 5.2 compares the Reference Case and Economic Potential Forecast – Energy Efficiency Scenario levels of residential energy consumption. As illustrated, under the Reference Case residential natural gas consumption would grow from the base year level of approximately 96,700,000 GJ/yr. to 113,400,000 GJ/yr. by FY 2015/16. This contrasts with the Economic Potential Forecast – Energy Efficiency Scenario in which natural gas consumption would decline initially and then rise slowly to approximately 94,200,000 GJ/yr. This is a difference of approximately 19,200,000 GJ/yr.

Exhibit 5.2: Reference Case versus Economic Potential (Energy Efficiency Scenario) Gas Consumption in Residential Sector, (GJ/yr.)



5.4.1 Energy Savings

Further detail on the total potential energy savings provided by the Economic Potential Forecast – Energy Efficiency Scenario is provided in the following exhibits:

- Exhibit 5.3 presents the results by service region and milestone year
- Exhibit 5.4 presents the results by building segment and milestone year
- Exhibit 5.5 presents the results by end use and milestone year
- Exhibit 5.6 provides a further disaggregation of the savings by end use, technology, milestone year and cost.

[57] All results are reported at the customer's point of use.

Exhibit 5.3: Total Potential Natural Gas Savings by Service Region and Milestone Year, (thousand GJ/yr.)

Milestone Year	Lower Mainland	Vancouver Island	Interior	Total	% Savings 2015/16 Re: Ref Case
	thousand GJ				
2005/06	3,538	295	1,316	5,149	5%
2010/11	8,922	639	3,082	12,643	12%
2015/16	13,530	943	4,712	19,185	17%
% Savings 2015/16 Re: Reference Case	17%	14%	18%	17%	

Exhibit 5.4: Total Potential Natural Gas Savings by Building Segment and Milestone Year, (thousand GJ/yr.)

Dwelling Type	Milestone Year			% Savings 2015/6	
	2005/6	2010/11	2015/6	Re: Ref Case	Re: Total
	thousand GJ				
Detached/Duplex	4,090	9,705	14,587	19%	76%
Row unit	342	817	1,267	18%	7%
Lowrise	195	740	1,234	7%	6%
Highrise	177	643	1,028	13%	5%
Mobile/other	344	736	1,070	19%	6%
Total	5,149	12,643	19,185	17%	100%

Exhibit 5.5: Total Potential Natural Gas Savings by End Use and Milestone Year, (thousand GJ/yr.)

End Use	Milestone Year			% Savings 2015/6	
	2005/6	2010/11	2015/6	Re: Ref Case	Re: Total
	thousand GJ				
Heating	1,420	5,084	8,548	13%	45%
DHW	3,033	5,336	6,840	27%	36%
Dryer	3	9	12	5%	0%
Pool Heaters	108	147	160	12%	1%
Fireplaces	585	2,067	3,625	24%	19%
Total	5,149	12,643	19,185	17%	100%

DHW savings include savings from reduced DHW consumption by efficient clothes washers and dishwashers.

Exhibit 5.6: Potential Natural Gas Savings by End Use, Technology, Segment and Milestone Year (thousand GJ/yr.)

End Use	Technology	Economic Potential (thousands of GJ)			B/C Ratio
		2005/06	2010/11	2015/16	
DHW	DHW Savings of Dishwasher	179	330	372	N/A
Fireplace	Efficient Fireplace	585	2,067	3,625	N/A
Heating	New Bldg Constr 60% Below Current	51	239	476	4.88
DHW	New Bldg Constr 60% Below Current	2	25	66	4.58
DHW	DHW Pipe Wrap	307	323	340	4.22
DHW	Low-Flow Showerheads and Faucets	581	552	517	3.90
Pool	Insulating Pool Covers	108	147	160	2.31
DHW	Condensing DHW Heaters	33	171	261	2.08
DHW	Condensing DHW Boiler	6	31	57	1.98
DHW	Integrated Heating & DHW	-	772	2,051	1.88
DHW	DHW Savings of Washer	651	2,426	3,351	1.70
Dryer	Dryer Savings from Washer	3	9	12	1.68
DHW	DHW Heat Trap	1,271	1,207	1,132	1.59
Heating	Condensing Furnace	794	2,418	3,722	1.39
DHW	Drainwater Heat Recovery	3	14	25	1.22
Heating	High Performance Windows - New	236	805	1,296	1.17
Heating	Improved Building Operations	54	202	261	1.11
Heating	Air Sealing	262	823	1,334	0.99
Heating	High Efficiency Boilers (Existing)	22	81	127	0.95
TOTAL		5,149	12,643	19,185	

5.5 ELECTRICITY SAVINGS

Implementation of the measures contained in the economic potential (Energy Efficiency Scenario) would also result in collateral 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 and dishwashers use less electricity as well as less hot water. In this economic potential scenario, electricity savings were estimated to be approximately 100 GWh/yr. by FY 2015/16. Single detached homes and duplexes accounted for approximately 75% of the savings; the savings were divided among three end uses: ventilation (68%) followed by clothes washers (26%) and dishwashers (6%).

5.6 INTERPRETATION OF RESULTS

Highlights of the results presented in the preceding exhibits are summarized below:

- **Savings by Service region**
  Lower Mainland service region represents more than 2/3 of the identified savings. This is to be expected given the large number of customers in this service region. On the other hand, the Vancouver Island service region offers a proportionally smaller share of savings due to both the lower heating loads and the relatively smaller natural gas market share in this region.

- **Savings by Milestone Year**
  Savings levels increase from milestone to milestone at a relatively even pace, indicating that most measures are implemented as equipment is replaced at the end of its life. Most

of these measures are not cost effective at full cost, i.e., it is not economically attractive to replace the inefficient equipment before end of its useful life.

- **Savings by Segment**
  Single-family dwellings and duplexes account for over three-quarters of the potential savings; this reflects their larger market share and their generally higher level of energy intensity per dwelling. Conversely, low rise apartments offer somewhat less savings potential on a percentage basis than the other segments.

- **Savings by End Use**
  Space heating accounts for approximately 45% of the total energy savings in the Economic Potential Forecast – Energy Efficiency Scenario. The major contributors include condensing furnaces, integrated heating and DHW appliances (provided they can be commercialized quickly enough), high performance windows, improved construction for new apartment buildings, improved building operations for existing apartment buildings, and high efficiency boilers for apartment buildings.

  DHW accounts for approximately 36% of the total energy savings in the Economic Potential Forecast – Energy Efficiency Scenario. There are several significant DHW energy-saving measures that are economically attractive, including clothes washers and dishwashers, heat traps, low flow fixtures, DHW pipe insulation, and condensing DHW boilers for apartment buildings, along with some more modest DHW measures.

  Fireplaces account for just under 20% of the savings in the Economic Potential Forecast – Energy Efficiency Scenario. The savings measure is a fireplace (or insert) with an efficiency level of at least 55% as measured by EnerGuide.

  Swimming pool heaters account for approximately 1% of the total savings in the Economic Potential Forecast – Energy Efficiency Scenario. The efficiency measure is an insulating pool cover.

  Clothes dryers account for under 1% of the total savings in the Economic Potential Forecast – Energy Efficiency Scenario. These savings result from the faster spin cycles of efficient clothes washers.

5.5.1 Caveats on Interpretation of Results

A systems approach, consistent with that employed in the BC Hydro CPR, 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, a condensing furnace reduces space heating natural gas use, as does the installation of new energy-efficient windows. On their own, each measure will reduce overall space heating energy use. However, the two savings are not additive. 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 those individual measures shown in Exhibit 5.6 are reduced. For example, if the condensing furnace measure was implemented in the absence of any other space heating measures, its savings would be greater than those shown in Exhibit 5.6. As appropriate, this issue is addressed in the Achievable Potential section of this report.

6. ECONOMIC POTENTIAL FORECAST – FUEL CHOICE SCENARIO

6.1 INTRODUCTION

This section presents the Residential Sector Economic Potential Forecast – Fuel Choice Scenario for the study period (FY 2003/04 to FY 2015/16). The Economic Potential Forecast – Fuel Choice Scenario estimates the level of natural gas consumption that would occur if natural gas was the "fuel of choice" to meet the loads in all new facilities or retrofit applications, where natural gas is cost-effective relative to electricity.

In this study, "cost-effective" means that the option passes the measure Total Resource Cost (TRC) test, as discussed previously in Section 4.2.

The discussion in this section is organized into the following subsections:

- Major modelling tasks
- Technologies included in economic potential forecast – fuel choice scenario
- Presentation of results
- Interpretation of results.

6.2 MAJOR MODELLING TASKS

To develop the Fuel Choice Scenario, the following tasks were undertaken:

- The measure TRC results for each of the fuel choice options presented previously in Exhibit 4.4 were reviewed. Those fuel choice options that had positive measure TRC results were selected for inclusion in this Fuel Choice Scenario. If more than one cost effective natural gas option existed, the study selected the most energy efficient one.

- In new buildings, the Fuel Choice Scenario assumes that natural gas is the fuel of choice for all new space and domestic hot water applications where natural gas is cost effective relative to electricity. In addition, natural gas is the fuel of choice for new dryers and ranges where the dwelling will have gas service.

- For existing stock, cost effective fuel choice options were introduced as the existing stock approached the end of its useful life, which in this study was set at 75% of the equipment's rated life expectancy.

- The scenario was modeled using the same end use model as was used in the previous scenarios.

6.3 TECHNOLOGIES INCLUDED IN ECONOMIC POTENTIAL FORECAST – FUEL CHOICE SCENARIO

Exhibit 6.1 provides a listing of the technologies selected for inclusion in this forecast. In each case, the exhibit shows the following:

- End use affected
- Fuel choice option selected
- Building segments to which the fuel choice options were applied
- Rate at which the fuel choice options were introduced into the stock.

Exhibit 6.1: Technologies Included in Economic Potential Forecast – Fuel Choice

End Use	Fuel Choice Option	Applicability of Fuel Choice Options by building Segment	Rate of Stock Introduction
Space Heating[58]	High Efficiency Furnace and Conventional Central A/C instead of Heat Pump	• Existing non-apartment dwellings with forced air heating systems	• When current forced air electric system reaches 75% of its rated life expectancy
	High Efficiency Furnace instead of Baseboard Electric Heat	• New non-apartment dwellings	• At rate of new construction
DHW	Gas DHW instead of Electric DHW	• New non-apartment dwellings	• At rate of new construction
Cooking	Gas Range instead of Electric Range	• New dwellings that will have gas service for another end use	• At rate of new construction
Clothes Drying	Gas Dryer instead of Electric Dryer	• Non-apartment dwellings[59], both new and existing, that have (or will have) gas service for another major use	• Existing dwellings, when current dryer reaches 75% of its rated life expectancy • New dwellings, at rate of new construction

6.4 PRESENTATION OF RESULTS

Under the Reference Case that was presented previously in Chapter 3, residential natural gas use is forecast to grow from base year levels of approximately 96,700,000 GJ/yr. to approximately 105,600,000 GJ/yr. by the FY 2010/11 and approximately 113,400,000 GJ/yr. by the FY 2015/16.

[58] Hydronic heating for apartment buildings did not pass the TRC test and was not included in this scenario. However, continued technology improvements and future price changes may provide added opportunities for his technology in the future.

[59] Note: The original CPR analysis did not include gas dryers for apartment buildings. At the time, it was thought that venting requirements could pose practical challenges. However, subsequent analysis confirmed that venting challenges are the same for gas and electric dryers. Time constraints precluded re-doing the full analysis; however, as a “rough indicator” of impact, the study team estimated that the inclusion of apartment units would increase the dryer fuel choice results presented in this and the subsequent chapter by about 8 to 12%.

Under the Fuel Choice Scenario, natural gas consumption grows to 122,800,000 GJ/yr. by FY 2015/16, an increase of approximately 8% relative to the Reference Case.

As is discussed further in the following sub sections, the increase in natural gas consumption of 9,400,000 GJ/yr. in FY 2015/16 would be offset by a decrease of about 1,730 GWh/yr. in electricity use. The net energy avoided costs for the province as a whole under this Fuel Choice scenario would be approximately $53,400,000/yr. by FY 2015/16.

The following exhibits provide further detail on the total change in energy use within the Economic Potential Forecast – Fuel Choice Scenario and the resulting economic impacts that would result:

- Exhibits 6.2a and b present the results by service region and milestone year, expressed in, respectively, gigajoules/yr. and gigawatts/yr.
- Exhibits 6.3a & b present the results by building segment and milestone year, expressed in, respectively, gigajoules/yr. and gigawatts/yr.
- Exhibits 6.4a & b present the results by end use and milestone year and also includes a pie chart expressed in, respectively, gigajoules/yr. and gigawatts/yr.
- Exhibit 6.5 presents an estimate of the net avoided energy costs for British Columbia from the Fuel Choice Scenario.

Exhibit 6.2a: Change in Energy Use Relative to Reference Case (thousand GJ/yr), by Service Area and Milestone Year

Milestone Year	Lower Mainland			Vancouver Island			Interior			Total Service Region		
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change
2005/06	947	570	377	353	255	98	523	262	261	1,823	1,087	736
2010/11	2,607	1,684	923	1,455	1,070	385	1,443	835	608	5,505	3,588	1,917
2015/16	4,383	2,869	1,514	2,625	1,945	680	2,387	1,411	976	9,395	6,224	3,170
% Natural Gas Increase 2015/16	47%			28%			25%			100%		

Exhibit 6.2b: Change in Energy Use Relative to Reference Case (GWh/yr), by Service Area and Milestone Year

Milestone Year	Lower Mainland			Vancouver Island			Interior			Total Service Region		
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change
2005/06	263	158	105	98	71	27	145	73	72	506	302	204
2010/11	724	468	256	404	297	107	401	232	169	1,529	997	532
2015/16	1,218	797	421	729	540	189	663	392	271	2,610	1,729	881
% Natural Gas Increase 2015/16	47%			28%			25%			100%		

Exhibit 6.3a: Change in Energy Use Relative to Reference Case (thousand GJ/yr), by Segment and Milestone Year

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Detached/Duplex	4,372	2,910	1,462	7,505	5,066	2,439	80%
Row unit	577	384	193	1,003	673	329	11%
Lowrise	157	63	94	223	89	134	2%
Highrise	69	27	41	98	39	59	1%
Mobile/other	330	204	125	567	357	210	6%
Total	5,505	3,588	1,917	9,395	6,224	3,170	100%

Exhibit 6.3b: Change in Energy Use Relative to Reference Case (GWh/yr), by Segment and Milestone Year

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Detached/Duplex	1,215	808	406	2,085	1,407	677	80%
Row unit	160	107	54	279	187	92	11%
Lowrise	44	17	26	62	25	37	2%
Highrise	19	8	11	27	11	16	1%
Mobile/other	92	57	35	157	99	58	6%
Total	1,529	997	532	2,610	1,729	881	100%

Exhibit 6.4a: Change in Energy Use Relative to Reference Case, by End Use and Milestone Year (thousand GJ/yr)

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Space Heating	1,965	1,478	487	3,474	2,680	793	37%
DHW	1,011	517	493	1,833	948	885	20%
Cooking	1,239	496	743	1,954	781	1,172	21%
Dryer	1,291	1,097	194	2,134	1,814	320	23%
Total	5,505	3,588	1,917	9,395	6,224	3,170	100%

Exhibit 6.4b: Change in Energy Use Relative to Reference Case, by End Use and Milestone Year (GWh/yr)

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Space Heating	546	411	135	965	745	220	37%
DHW	281	144	137	509	263	246	20%
Cooking	344	138	207	543	217	326	21%
Dryer	358	305	54	593	504	89	23%
Total	1,529	997	532	2,610	1,729	881	100%

Exhibit 6.5: Residential Fuel Choice – Avoided Energy Costs (thousand $/yr.)

Milestone Year	Lower Mainland			Vancouver Island			Interior			Total Service Region		
	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost
2005/06	-$5,891	$10,036	$4,144	-$1,889	$4,489	$2,600	-$3,254	$4,610	$1,357	-$11,034	$19,135	$8,101
2010/11	-$16,223	$29,637	$13,413	-$7,777	$18,829	$11,053	-$8,980	$14,690	$5,710	-$32,980	$63,156	$30,176
2015/16	-$27,278	$50,503	$23,225	-$14,030	$34,228	$20,198	-$14,852	$24,828	$9,976	-$56,160	$109,558	$53,399

6.5 INTERPRETATION OF RESULTS

Highlights of the results presented in the preceding exhibits are summarized below:

- **Energy Impacts by Service Region**
  Lower Mainland service region represents more than 47% of the identified fuel choice opportunity. This is to be expected given the large number of customers in this service region. The Vancouver Island service region offers a disproportionate share of the opportunity. This is because it currently has a relatively smaller natural gas market share than in other regions; consequently, the scope for expansion is relatively larger.

- **Energy Impacts by Milestone Year**

  Fuel choice opportunities increase from milestone to milestone at a relatively even pace, indicating that most measures are implemented as equipment is replaced towards the end of its life or as new dwellings are built. None of the fuel choice measures are cost effective at full cost, i.e., it is not economically attractive to replace the existing equipment before the end of its useful life.

- **Energy Impacts by Segment**

  Single-family dwellings and duplexes account for approximately 80% of the potential savings; this reflects their larger market share and their generally higher level of energy intensity per dwelling. In apartments, only the gas range measure is likely to be broadly applicable, so the potential opportunity in apartments is disproportionately small.

- **Energy Impacts by End Use**

  Space heating accounts for over one-third of the total fuel choice opportunity. The major contributor is the switch from baseboard electric heating to high efficiency furnaces in new dwellings. The switch from heat pumps to the furnace/conventional AC combination in existing homes with a forced-air electric system near end of life is a much smaller component of the opportunity, largely because dwellings with forced-air electric heating systems are relatively rare.

  Clothes dryers account for just over 20% of the total fuel choice opportunity. Approximately 60% of this potential is in existing, gas heated dwellings, replacing dryers near the end of their life. The remainder is in new dwellings.

  Cooking also accounts for just over 20% of the total fuel choice opportunity. All of this potential consists of installing gas ranges instead of electric ranges in new dwellings.

  DHW accounts for approximately 20% of the total fuel choice opportunity. All of this potential consists of installing gas water heaters instead of electric water heaters in new dwellings.

- **Net Energy Avoided Costs**

  Overall, the net energy avoided costs for the province as a whole under this Fuel Choice Scenario would be approximately $30 million per year by FY 2010/11, increasing to about $53.4 million per year by FY 2015/16.

7. ACHIEVABLE POTENTIAL

7.1 INTRODUCTION

This section presents the Residential Sector Achievable Potential for the study period (FY 2003/04 to FY 2015/16). The Achievable Potential is defined as the proportion of the energy efficiency and fuel choice opportunities identified in the Economic Potential Forecasts 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 efficiency
- Results – fuel choice.

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 or fuel choice opportunities 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:

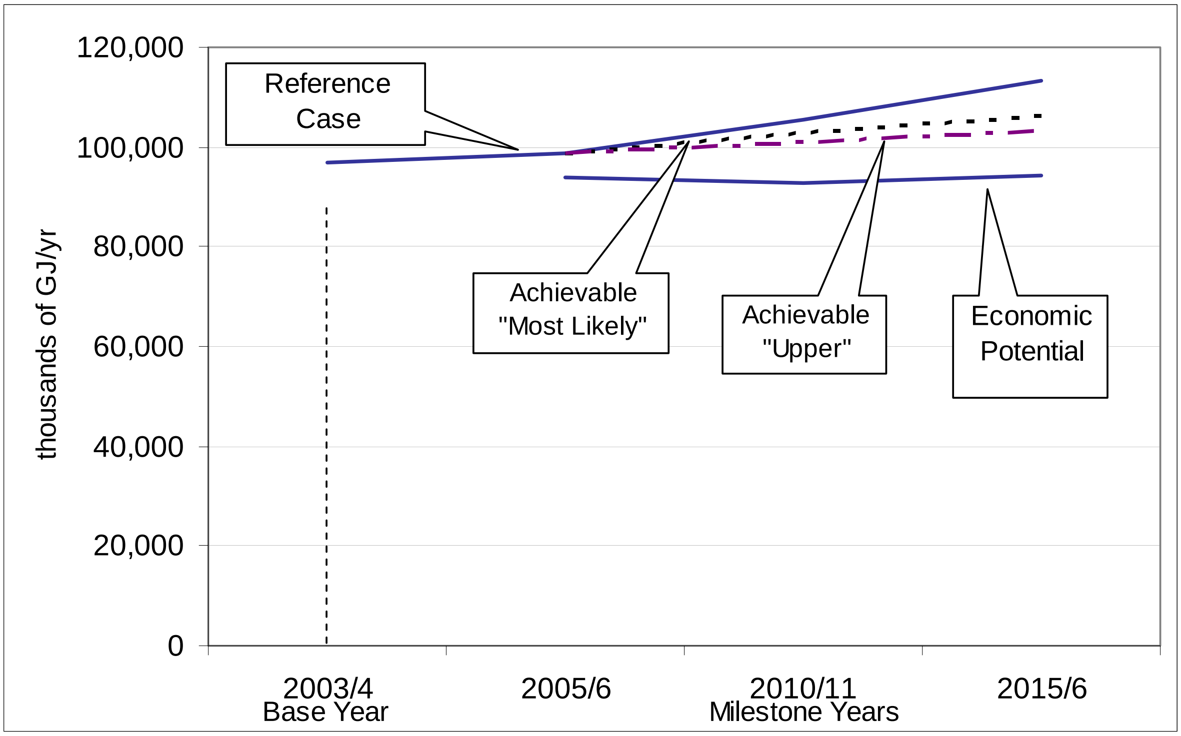
- Higher first cost of efficient product(s)
- Need to recover investment costs in a short period (payback)
- Lack of product performance information
- Lack of product availability.

The rate at which customers accept and purchase energy-efficiency and fuel choice products will be influenced by the level of financial incentives, information and other measures put in place by Terasen Gas, BC Hydro, governments and the private sector to remove barriers such as those noted above.

Exhibit 7.1 (overleaf) presents the levels of natural gas consumption that are estimated in the Achievable Potential – Energy Efficiency 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 7.1 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 7.1 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 7.1: Annual Natural Gas Consumption—Energy Efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Residential Sector, (thousand GJ/yr.)



As also illustrated in Exhibit 7.1, 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 10-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: “Most Likely” and “Upper”.

- The “**Most Likely” Achievable Potential** assumes British Columbia market conditions that are similar to those contained in the Reference Case. That is, the customers’ awareness of energy efficiency or fuel choice 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 Terasen Gas’s ability to influence customers’ decisions towards increased investments in energy efficiency or fuel choice options remain “roughly” in line with previous company DSM experience.

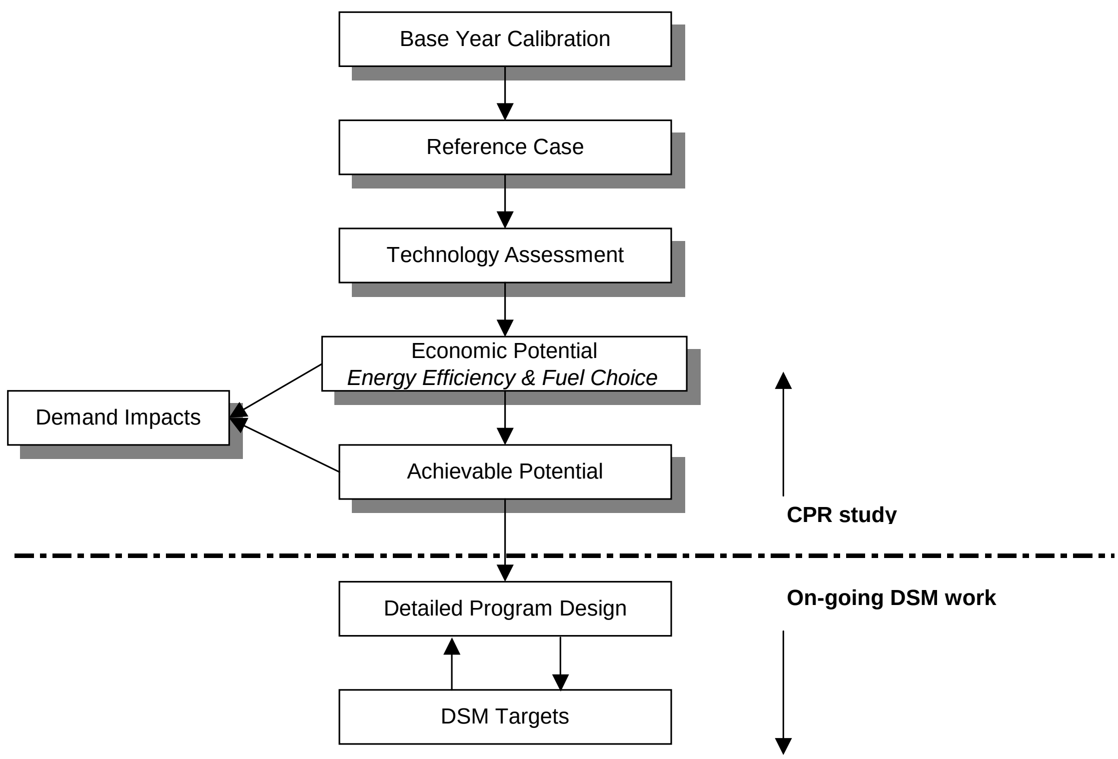
- The **“Upper” Achievable Potential** assumes that British Columbia market conditions become more supportive of investing in energy efficiency. For example, this scenario assumes that: real energy prices continue to increase over the study period; it also assumes that federal and provincial government actions to mitigate climate change result in increased levels of complementary energy efficiency initiatives. Upper 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 7.2 illustrates the relationship between Achievable Potential and the more detailed program design.

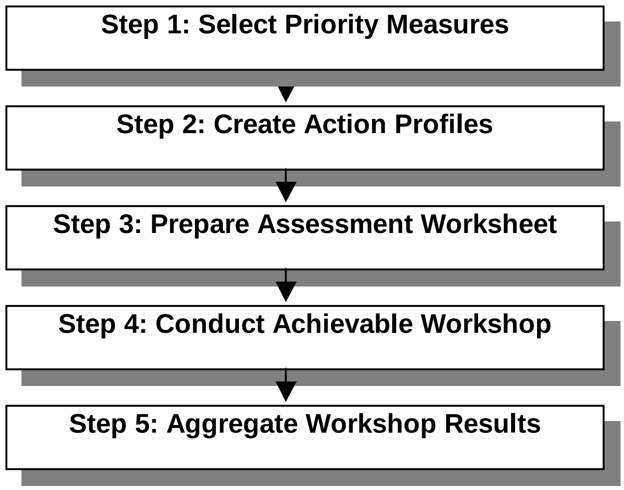
Exhibit 7.2: Achievable Potential versus Detailed Program Design



7.3 APPROACH TO THE ESTIMATION OF ACHIEVABLE POTENTIAL

Achievable Potential was estimated in a five-step approach. A schematic showing the major steps is shown in Exhibit 7.3 and each step is discussed below.

Exhibit 7.3: Flow Chart Estimating Achievable Potential



7.3.1 Step 1: Select Priority Measures

The first step in developing the Achievable Potential estimates required that the energy saving and fuel choice opportunities identified in the Economic Potential Forecasts be "bundled" into a set of Actions that would facilitate the subsequent assessment of their potential market penetration.

A summary of the selected energy efficiency and fuel choice Actions is provided in, respectively Exhibits 7.4 and 7.5. As illustrated, the Actions have been bundled by end use and, for each, Exhibits 7.4 and 7.5 show the Action name and the approximate percentage that it represents of the total residential potential contained in the Economic Potential Forecasts.

Exhibit 7.4: Residential Sector Actions – Energy Efficiency

Action Profile #	Title	Approximate % of Economic Savings Potential
R1	High Efficiency Furnaces	19
R2	Efficient Heater Fireplaces	19
R3	High Efficiency DHW Equipment for High Rise Apartments and Integrated Heating and DHW for Non-Apartments	12
R4	Hot Water Load Reduction	4
R5	DHW Heat Recovery & Heat Traps	6
R6	Energy Star Appliances	19
R7	Energy Star Windows	7
R8	Air Sealing	7
R9	Ultra Efficient New High Rise Apartments	3
R10	Recommissioning/Next Generation BAS in High Rise Apartments	1

Exhibit 7.5: Residential Sector Actions – Fuel Choice

Action Profile #	Title	Approximate % of Economic Savings Potential
RFC1	Space Heating Conversion	37
RFC2	Domestic Hot Water Conversion	20
RFC3	Cooking Conversion	21
RFC4	Clothes Dryer Conversion	23

7.3.2 Step 2: Create Action Profiles

The next step involved the development of brief profiles for each of the Actions noted above in Exhibits 7.4 and 7.5. A sample profile for Action R1 (Residential High Efficiency Furnaces) is presented in Exhibit 7.6. (For profiles for the remaining Actions see Appendix D.)

The purpose of the Action 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 Exhibit 7.6, each Action Profile addresses the following areas:

- ***Overview*** – provides a summary statement of the broad goal and rationale for the Action.

Exhibit 7.6: Sample Residential Action Profile

Action Profile R 1 – High Efficiency Furnaces

Overview:

This action will encourage the installation of high efficiency condensing furnaces and boilers in both new and existing residential dwellings. The broad strategy for this Action consists of:

- Strong up-front promotional and education efforts directed towards customers, vendors and trade allies; in the existing market, this will include promotion of early replacement.
- Enhanced financial incentives.
- A Terasen exit strategy built around collaboration with NRCan and the provincial government to establish HE furnaces as the minimum energy performance.

For new construction, the strategy will include support to the MEMPR EGNH80 initiative (Built Green), which intends to legislate energy efficiency levels for new construction that will require a condensing furnace. Target date for the legislation is 2010. In the interim, the existing incentive program will be continued to build awareness and acceptance by developers.

For the replacement market, the periodic incentive program (September to December) has been expanded and made available throughout the year. This is intended to raise consumer awareness, reduce the cost premium for the technology, and to reduce price premiums in the distribution chain.

Target Technologies and Sub Segments:

- Condensing furnaces that meet the Energy Star rating (92% AFUE or higher). Furnaces may have a PSC or ECM motor.
- This technology applies to SFD/Duplexes and row housing in all 3 service regions.
- Early replacement assumes that existing furnaces become candidates for retrofit at 75% of rated life span (i.e., after 15 years)

It should be noted that under the initial avoided cost assumptions used in this analysis, this measure did not quite pass the measure TRC test for row houses or for Vancouver Island. However, given the general natural gas price increases that have occurred since the start of this CPR, it was decided to include these measures in this next stage of the analysis.

Target Stakeholder Group:

- Program developers for new construction.
- People planning to purchase or build a new house.
- Homeowners who are anticipating furnace replacement. However some groups are especially hard to involve:
  - Rental property
  - Low income groups & Housing authorities
  - Homeowners planning to move in the near future.

Key Barriers and Interventions:

Experience indicates that the most significant barriers affecting this opportunity are:

- Retrofit
  Technical barriers such as lack of a condensate drain and / or difficulty in venting the furnace.
  Rental properties, people intending to sell and low income groups are less interested or willing to pay the additional costs.
- New Construction
  Split incentive, developers do not believe that there is sufficient interest from purchasers to allow them to recover their costs.

This Action will address these barriers by combining the following interventions:

- Retrofit
  - Continuation of the current Terasen incentive program which provides incentives throughout the year.
  - Support of MEMPR initiative to include EGNH rating in real estate listings.
  - Consider lower-income program delivery in collaboration with NRCan's recently announced low-income Energy Retrofits
- New Construction
  - Support of the Built Green program, leading to EGNH 80 based legislation in 2010, which will require ES furnaces to meet the code.
  - Work with Housing Agencies to consider operating cost in heating system selection for new construction.
  - Support of MEMPR initiative to include EGH rating in Real Estate listings and build public awareness of energy efficiency and impact on operating costs.

Time Frame:

Current incentive programs to be extended, and possibly enhanced, through to 2010, when new minimum efficiency regulations will come into effect.

Additional Information:

- Current incentives for this technology are approximately $625 in total. Terasen Gas contribution is $100. EGH provides approx. $550 for furnace upgrade to EE furnace in existing homes.

- ***Target Technologies and Sub Segments—***highlights the major technologies and the sub segments where the most significant opportunities have been identified in the Economic Potential Forecast.

- ***Target Stakeholder Groups***—identifies key market players that would be expected to be involved in the actual delivery of services. The list of stakeholders shown is intended to be "indicative" and is by no means comprehensive.

- ***Key Barriers and Interventions—***identifies key market barriers that are currently constraining the increased penetration of energy-efficient technologies or measures. Interventions for addressing the identified barriers are noted. Again, it is recognized that the interventions are not necessarily comprehensive; rather, their primary purpose was to help guide the workshop discussions.

- ***Time Frame—***identifies the potential timing of activities with the intent of assisting workshop participants to envision possible customer participation rates.

- ***Additional Information—***identifies information or possible synergies with other Actions that may affect workshop participant views on possible customer participation rates

7.3.3 Step 3: Prepare Draft Action Assessment Worksheets

A draft Assessment Worksheet was prepared for each Action Profile in advance of the Achievable Workshop. The Assessment Worksheets complemented the information contained in the Action Profiles by providing quantitative data on the potential energy savings or fuel choice for each Action 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.

A sample Assessment Worksheet for Action R1—High Efficiency Furnaces is presented in Exhibit 7.7. (For worksheets for the remaining Actions see Appendix E.) As illustrated in Exhibit 7.7, each Action Assessment Worksheet addresses the following areas:

- ***Approximate % of Action Savings***—shows the contribution of individual sub sectors to the total energy impacts represented by each Action. For example, the previous Exhibit 7.6 showed that condensing furnaces account for about 23% of the residential energy savings contained in the Economic Potential Forecast – Energy Efficiency Scenario. The first entry in Exhibit 7.7 shows that single-family detached and duplex dwellings account for about 86% of those potential savings.

- ***Economic Savings to FY 2015/16—***shows the total economic impacts on natural gas use, by milestone period, for the measures included in the Action. As applicable, the savings are further broken out by technology and/or end use.

- ***Participant Definition—***provides the definition of "participant" that is used in subsequent portions of the worksheet to calculate electricity savings. The definition of "participant" may vary depending on the specific Action.

- ***Total Applicable (Participants)—***shows the total population of potential participants that could theoretically take part in the Action. Numbers shown are from the eligible populations used in the Economic Potential Forecasts.

- ***Prime Target—***identifies, as appropriate, any portion of the applicable participants that offer particularly good opportunities for electricity savings under the Action.

- ***Major Technologies and Contribution to Economic Savings—***provides additional detail on the composition of the economic savings for the Action. It was particularly intended to assist workshop participants in their discussions of potential participation rates.

- ***Approximate Savings per Participant—***indicates the annual natural gas savings (GJ/yr.) for a "typical" participant within each sub sector. The purpose of this entry was to invoke a more informed discussion among workshop participants vis-à-vis the level of savings assumed in the Economic Potential Forecast and whether any adjustments were needed to account for practical considerations.

- ***Savings Adjustment Factor—***provides a record of any decisions to de-rate the "optimized" savings contained in the Economic Potential Forecast to levels that better account for practical customer considerations. This entry was completed during the workshop, or in subsequent discussions with workshop participants.[60]

- ***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 Terasen Gas'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 Action. This information provided an indication of the level of attractiveness that the Action measures 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 Action's attractiveness to customers without making the measures economically unattractive to Terasen Gas.

[60] It was not possible to discuss all the Action Profiles during the one-day workshop. Consequently, selected follow up discussions were held with Terasen Gas personnel after the workshop.

Exhibit 7.7: Sample Worksheet: Action Profile R1—Residential Furnace Efficiency

Sub Sector	Existing Detached			Existing Attached			Existing Low Rise			Existing High Rise			Existing Other		
Approx % of Action Savings	86%			6%			0%			0%			9%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	555	1,592	2,370	26	94	158	-	-	-	-	-	-	42	144	239
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	38	110	164	3	12	19	0	0	0	0	0	0	3	10	17
Annual Applicable Dwellings ('000s)	19	14	11	2	2	2	0	0	0	0	0	0	1	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Condensing Furnace	100%		Condensing Furnace	100%		N/A	100%		N/A	100%		Condensing Furnace	100%	
Approx Svgs/ Dwelling (GJ/yr)	14			8			0			0			14		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.5			0.9			0.0			0.0			1.5		
Approx. Customer Payback (yrs)	4.0			7.1			0.0			0.0			4.2		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*25*	*33*	*58*	*25*	*25*	*44*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*25*	*44*
Upper	*25*	*67*	*83*	*25*	*50*	*63*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*50*	*63*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*139*	*669*	*1521*	*6*	*30*	*76*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*46*	*115*
Upper	*139*	*1200*	*2114*	*6*	*54*	*105*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*82*	*160*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*623*	*1,830*	*2,767*
Most Likely	*156*	*746*	*1,712*
Upper	*156*	*1,336*	*2,379*

- ***Participation Rates—***show the percentage of economic savings that workshop participants concluded could be achievable in each milestone period. As noted in the introduction to this section, two achievable levels are shown: "Most Likely" and "Upper". For example, Exhibit 7.7 shows a participation rate of 58% (most likely) for condensing furnaces in existing single-family dwellings/duplexes by the year FY 2015/16. This means that by FY 2015/16, 58% of the potential savings contained in the Economic Potential forecast will be achieved.

- ***Action Savings by Year—***shows the calculated electricity savings in each milestone period based on the savings and participation rates presented in the preceding rows of the Worksheet.

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 November 1, 2005. Workshop participants consisted of core members of the consultant team, DSM program and technical personnel from both Terasen Gas and BC Hydro, 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 twofold:

- To promote discussion regarding the technical and market conditions confronting the identified energy efficiency and fuel choice opportunities.

- To compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

The discussion of each Action 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 Action Profile and accompanying Worksheet.

Following discussion of the broad market and intervention conditions affecting the Action, workshop participant views were recorded on "Most Likely" and "Upper" customer participation rates. General agreement was sought on rates to be carried forward into the analysis; estimates were rounded down for "Most Likely" and rounded up for "Upper" estimates.

As noted earlier, it was not possible to fully address all Actions in the one-day workshop. Consequently, the workshop focused on the "big ticket" Actions and follow up discussions were held with Terasen Gas program personnel after the workshop. The values shown in the attached appendices and in the following summary tables incorporate the results of the two sets of inputs.

7.3.5 Step 5: Aggregate Action Results

The final step involved aggregating the results of the individual Actions to provide a view of the potential achievable savings for the total residential sector.

7.4 RESULTS – ENERGY EFFICIENCY

A summary of the "Most Likely" and "Upper" Achievable Potential results for the energy efficiency actions is presented in this section. These results include the following:

- Natural gas consumption savings
- Electricity savings
- Peak day load impacts
- Greenhouse gas emission reductions.

7.4.1 Natural Gas Consumption Savings – Energy Efficiency Scenarios

The following exhibits present the reductions in natural gas consumption under the two Achievable Potential scenarios. In each case the results shown are relative to the Reference Case.

- Exhibit 7.8 (Energy Efficiency, by Action, Milestone Year and Service Region)
- Exhibit 7.9 (Energy Efficiency, by Segment, Milestone Year and Service Region).

In Exhibits 7.8 and 7.9, the results represent the total annual cumulative natural gas savings at the end of each milestone year. For example, Exhibit 7.8 shows that Action R1— Condensing Furnaces will achieve an annual saving of 950,000 GJ/yr. by FY 2010/11 under the "Most Likely" scenario. This annual savings increases to 2,400,000 GJ/yr. by FY 2015/16, again under the "Most Likely" scenario.

Selected highlights related to the participation rates used to calculate the energy efficiency impacts shown in Exhibits 7.8 and 7.9 are provided below. Detailed results showing the estimated participation rates and calculation of related energy impacts are provided in Appendix E.

7.4.1.1 Action R1 – High Efficiency Furnaces

Workshop participants concluded that, under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 100% in new single detached/duplex homes and 83% in existing single detached/duplex homes could be achieved by FY 2015/16. Participation rates in other segments would be lower.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates of approximately 80% in new single detached/duplex homes and 58% for furnace replacement in existing single detached/duplex homes could be achieved by FY 2015/16.

Selected highlights from the discussion of this Action are listed below:

- Participants estimated that the current market share of condensing furnaces in new homes is only 20% in the Terasen Gas service territory; the sales share in the furnace replacement market is currently about 40%.
- The lower rate in new homes is influenced by British Columbia contractors who still regard this technology as an unfamiliar, comparatively new product; they are particularly concerned about potential call backs.
- Decreases in the incremental cost of condensing furnaces may be coming from use of cheaper materials, which may shorten product life. This is an issue that could threaten future participation rates.
- Participants estimated that 5-10% of existing homes cannot be converted to condensing furnaces because of technical constraints.
- Rental and low-income housing account for about 10% of stock, and are a difficult market to approach.
- About 30% of homes are at risk of converting to electric heat.

Exhibit 7.8: Summary of Achievable Natural Gas Savings, by Action—"Most Likely" & "Upper" Scenarios

Service Region / Action	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
R1 - Furnaces	949	1,752	2,439	3,277	32%
R2 - Fireplaces	137	520	941	1,642	13%
R3 - Efficient DHW Eqpt	8	48	52	200	1%
R4 - DHW Load Reduc	148	296	274	548	4%
R5 - DHW Heat Rec & Traps	24	37	23	35	0%
R6 - Appliances	1,254	1,600	2,482	2,949	33%
R7 - Efficient Windows	402	483	972	1,296	13%
R8 - Air Sealing	46	96	183	287	2%
R9 - Integrated Design	26	53	108	217	1%
R10 - Building Operations	30	51	39	65	1%
Total TG Service Region	**3,025**	**4,935**	**7,513**	**10,515**	**100%**
Lower Mainland Region	**Annual Gas Savings (thousand GJ/yr), by Milestone Year**				**% of Total 2015/16**
	2010/11		**2015/16**		
	Most Likely	**Upper**	**Most Likely**	**Upper**	
R1 - Furnaces	728	1,344	1,868	2,517	35%
R2 - Fireplaces	88	336	597	1,045	11%
R3 - Efficient DHW Eqpt	5	31	34	130	1%
R4 - DHW Load Reduc	96	193	178	358	3%
R5 - DHW Heat Rec & Traps	16	24	15	23	0%
R6 - Appliances	816	1,040	1,615	1,925	30%
R7 - Efficient Windows	309	370	745	996	14%
R8 - Air Sealing	35	74	140	220	3%
R9 - Integrated Design	19	37	78	155	1%
R10 - Building Operations	21	36	28	47	1%
Lower Mainland Region	**2,135**	**3,485**	**5,298**	**7,417**	**100%**
Vancouver Island Region	**Annual Gas Savings (thousand GJ/yr), by Milestone Year**				**% of Total 2015/16**
	2010/11		**2015/16**		
	Most Likely	**Upper**	**Most Likely**	**Upper**	
R1 - Furnaces	16	30	43	56	12%
R2 - Fireplaces	11	43	78	134	21%
R3 - Efficient DHW Eqpt	1	4	4	15	1%
R4 - DHW Load Reduc	12	24	21	42	6%
R5 - DHW Heat Rec & Traps	2	3	2	3	0%
R6 - Appliances	100	130	194	227	53%
R7 - Efficient Windows	7	8	17	22	5%
R8 - Air Sealing	1	2	3	5	1%
R9 - Integrated Design	1	3	5	9	1%
R10 - Building Operations	1	3	2	3	0%
Vancouver Island Region	**152**	**249**	**369**	**517**	**100%**
Interior Region	**Annual Gas Savings (thousand GJ/yr), by Milestone Year**				**% of Total 2015/16**
	2010/11		**2015/16**		
	Most Likely	**Upper**	**Most Likely**	**Upper**	
R1 - Furnaces	204	378	528	703	29%
R2 - Fireplaces	37	141	266	463	14%
R3 - Efficient DHW Eqpt	2	13	14	54	1%
R4 - DHW Load Reduc	40	80	74	148	4%
R5 - DHW Heat Rec & Traps	7	10	6	9	0%
R6 - Appliances	338	430	672	797	36%
R7 - Efficient Windows	87	104	211	278	11%
R8 - Air Sealing	10	21	40	62	2%
R9 - Integrated Design	6	13	26	52	1%
R10 - Building Operations	7	12	9	16	1%
Interior Region	**738**	**1,202**	**1,847**	**2,582**	**100%**

Exhibit 7.9: Summary of Achievable Natural Gas Savings, by Segment—"Most Likely" & "Upper" Scenarios

Service Region / Action	Annual Gas Savings (thousand GJ/yr), by Milestone Year						% of Total 2015/16
	2005/06		2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	Most Likely	Upper	
Detached	174	174	2,475	3,997	6,131	8,361	82%
Attached	11	11	219	336	580	783	8%
Low Rise	0	0	78	168	174	391	2%
High Rise	0	0	71	140	164	348	2%
Mobile and Other	13	13	181	295	464	633	6%
Total TG Service Region	**199**	**199**	**3,025**	**4,935**	**7,513**	**10,515**	**100%**
Lower Mainland Region	**Annual Gas Savings (thousand GJ/yr), by Milestone Year**						**% of Total 2015/16**
	2005/06		**2010/11**		**2015/16**		
	Most Likely	**Upper**	**Most Likely**	**Upper**	**Most Likely**	**Upper**	
Detached	120	120	1,747	2,822	4,323	5,897	82%
Attached	8	8	155	237	409	552	8%
Low Rise	0	0	55	119	123	276	2%
High Rise	0	0	50	99	116	245	2%
Mobile and Other	9	9	128	208	327	446	6%
Lower Mainland Region	**137**	**137**	**2,135**	**3,485**	**5,298**	**7,417**	**100%**
Vancouver Island Region	**Annual Gas Savings (thousand GJ/yr), by Milestone Year**						**% of Total 2015/16**
	2005/06		**2010/11**		**2015/16**		
	Most Likely	**Upper**	**Most Likely**	**Upper**	**Most Likely**	**Upper**	
Detached	10	10	125	202	301	411	82%
Attached	1	1	11	17	28	38	8%
Low Rise	0	0	4	8	9	19	2%
High Rise	0	0	4	7	8	17	2%
Mobile and Other	1	1	9	15	23	31	6%
Vancouver Island Region	**12**	**12**	**152**	**249**	**369**	**517**	**100%**
Interior Region	**Annual Gas Savings (thousand GJ/yr), by Milestone Year**						**% of Total 2015/16**
	2005/06		**2010/11**		**2015/16**		
	Most Likely	**Upper**	**Most Likely**	**Upper**	**Most Likely**	**Upper**	
Detached	44	44	604	973	1,507	2,053	82%
Attached	3	3	53	82	143	192	8%
Low Rise	0	0	19	41	43	96	2%
High Rise	0	0	17	34	40	85	2%
Mobile and Other	3	3	44	72	114	155	6%
Interior Region	**50**	**50**	**738**	**1,202**	**1,847**	**2,582**	**100%**

7.4.1.2 Action R2 –Efficient Fireplaces

Workshop participants concluded that under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 50% by FY 2015/16 could be achieved.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates of approximately 30% could be achieved by FY 2015/16.

Selected highlights from the discussion of this Action are listed below:

- The share of decorative fireplaces, which consume close to the same natural gas as heater style units but contribute no net heat to the home, has fallen to about 20% of new sales.

- Earlier analysis had assumed no price increment for efficiency. However, participants noted that efficiency is usually packaged with other features, and it is those other features that usually determine model selection. Consequently, a price increment of $150 was assumed for the discussion of participation rates (see below).

- Participants indicated that the price increment for more efficient (Energuide rating of at least 55%) is currently $300-500, but is expected to decline to $150 for new or retrofit situations within 3 to 5 years, as sales volumes increase. The total cost of a retrofit is $2,000 to $4,000, so a $150 increment is modest in this context. On the other hand, the cost of a fireplace in a new dwelling is only $1,000 to $2,000, so $150 appears larger in that context.

- Participants also noted that there is a significant risk that the market share in new dwellings will move towards electric fireplaces – as much as 45%. Fuel switching to electricity in retrofit situations is less likely.

7.4.1.3 Action R3 –Efficient DHW Equipment

Workshop participants concluded under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 50% by FY 2015/16 could be achieved.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates of approximately 10% by FY 2015/16 could be achieved.

Selected highlights from the discussion of this Action are listed below:

- Participation rates in apartment buildings would be similar to those in commercial buildings.

- A low participation rate of 1-2% was set for this Action in the non-apartment dwellings. This is because the applicable technology is an integrated heating and DHW unit. These combination units offer significant savings when compared against a conventional furnace and water heater. When compared against a condensing furnace and conventional water heater, however, the space heating savings are eliminated and the resulting financial attractiveness is greatly reduced, or eliminated.

7.4.1.4 Action R4 –DHW Load Reduction

This action was not discussed during the workshop. Participation rates were estimated based on previous Marbek project work, in consultation with the client. Under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 60% by FY 2015/16 were estimated for existing dwellings.

In new dwellings, some elements of the action, namely low-flow showerheads and faucets, are not applicable because they are required by code. The DHW pipe insulation, however, could be adopted at a participation rate up to 100%.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates of approximately 30% for existing dwellings and 50% for new dwellings by FY 2015/16 were estimated.

7.4.1.5 Action R5 –DHW Heat Recovery and Heat Traps

This action was not discussed during the workshop. Participation rates were estimated based on previous Marbek project work, in consultation with the client. Under ideal conditions represented by the Upper Achievable scenario, participation rates up to 3% by FY 2015/16 were estimated.

Heat traps on existing DHW tank heaters require installation by a plumber, and are only cost-effective when the plumber is already visiting the home for some other purpose. They are also a shrinking opportunity, because most new DHW tank heaters already include the heat trap feature.

The wastewater heat recovery option was cost-effective only in apartment buildings. It is usually challenging to retrofit, so the potential participation for this element of the measure was also deemed to be very low.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates of approximately 2% by FY 2015/16 were estimated.

7.4.1.6 Action R6 –Efficient Appliances

Workshop participants concluded that under the ideal conditions represented by the Upper Achievable scenario, participation rates up to about 80% by FY 2015/16 could be achieved. This participation rate reflects a blending of the estimated participation rate for efficient clothes washers and that for efficient dishwashers.

Under the more modest market conditions represented by the Most Likely Achievable scenario, a blended participation rate of approximately 68% by FY 2015/16 was estimated.

Selected highlights from the discussion of this Action are listed below:

- 75% of current sales of dishwashers are Energy Star models.

- 35% of current sales of clothes washers are Energy Star, including the horizontal axis units.

- Although the horizontal axis units did not pass the measure TRC test due to their higher incremental cost, consumers have shown that they are willing to buy them because of their other attractive features.

7.4.1.7 Action R7 –Efficient Windows

Workshop participants concluded that under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 100% by FY 2015/16 could be achieved.

Under the more modest market conditions represented by the Most Likely Achievable scenario, a blended participation rate of approximately 75% by FY 2015/16 was estimated.

Selected highlights from the discussion of this Action are listed below:

- Only 10-20% of current sales of windows in new homes are Energy Star
- Almost 100% of custom homes are built using Energy Star windows.

7.4.1.8 Action R8 –Air Sealing

This action was not discussed during the workshop. Participation rates were estimated based on previous Marbek project work, in consultation with the client. Under ideal conditions represented by the Upper Achievable scenario participation rates up to 50% for new dwellings and 15% for existing dwellings by FY 2015/16 were estimated.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates of approximately 30% for new dwellings and 10% for existing dwellings by FY 2015/16 were estimated.

7.4.1.9 Action R9 – Integrated Design of New Buildings

This action was not discussed during the residential workshop. The action is very similar to the integrated design action in commercial buildings. Participation rates were therefore estimated based on rates estimated during the commercial achievable workshop.

7.4.1.10 Action R10 – Improved Building Operations

This action was not discussed during the residential workshop. The action is very similar to the recommissioning action in commercial buildings. Participation rates were therefore estimated based on rates estimated during the commercial achievable workshop.

7.4.2 Electricity Savings – Energy Efficiency Scenarios

Implementation of the natural gas efficiency measures contained in the preceding achievable potential (Most Likely and Upper) scenarios would also result in collateral electricity savings. For example, measures that improve the building envelope (such as efficient windows) reduce furnace runtime, thereby saving ventilation fan energy. Similarly, Energy Star clothes washers and dishwashers use less electricity as well as less hot water. A summary of the electricity savings associated with the applicable natural gas efficiency Actions is presented in Exhibit 7.10. As illustrated, by FY 2015/16 the electricity savings are estimated to range between 47 and 62/GWh/yr. for, respectively, the Most Likely and Upper Achievable scenarios.

Exhibit 7.10: Summary of Achievable Electricity Savings, by Action—"Most Likely" & "Upper" Scenarios

Service Region / Action	Annual Electricity Savings (GWh/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
R6 - Appliances, Existing	10	13	16	19	34%
R6 - Appliances, New	2	2	5	6	11%
R7 - Efficient Windows	8	10	19	26	41%
R8 - Air Sealing, Existing	1	1	2	3	5%
R8 - Air Sealing, New	0	0	1	2	3%
R9 - Integrated Design	1	1	2	4	5%
R10 - Building Operations	1	1	1	1	2%
Total TG Service Region	**22**	**29**	**47**	**62**	**100%**

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.).

- Terasen Gas provided load factors that correlate the relationship between “average” and “peak day” consumption levels for each rate class and service region. These rate based load factors were converted to sector based values using the same rate class to sector mapping as outlined previously in Exhibit 2.20. For example, the residential sector defined in this CPR primarily includes customers from rate class 1, but also includes multi-unit residential buildings primarily from classes 2, 3, and 23. Exhibit 7.11 shows a Lower Mainland residential sector load factor rate of 0.316. This is a sales-weighted value based on the relative share of residential sector sales in the Lower Mainland represented by each of the Terasen Gas rate classes.

- Finally, peak day load impacts were calculated by dividing the average daily consumption by the appropriate sector and service region load factors, as presented below in Exhibit 7.11.

Exhibit 7.11: 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 (incl High-Rise)	.316	.382	.304
Commercial & Institutional	.340	.491	.360
Manufacturing	.369	.509	.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	.308	.354	.304
2	.293	.473	.296
3	.366	.509	.347
5	.433	.51	.511

#Source: Terasen Gas

Exhibit 7.12 presents a summary of 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 65,000 to 91,000 GJ by FY 2015/16, depending on scenario.

Exhibit 7.12: Peak Day Capacity Impacts – Energy Efficiency Achievable Potential, by Scenario, Service Region and Milestone Year

Service Region & Scenario	Peak Day Saving by Milestone Year & Scenario (GJ)	
	2010/11	2015/16
Total Terasen Gas		
Achievable- Most Likely	26,255	65,220
Achievable- Upper	42,827	91,278
Lower Mainland		
Achievable- Most Likely	18,509	45,933
Achievable- Upper	30,211	64,305
Vancouver Island		
Achievable- Most Likely	1,093	2,646
Achievable- Upper	1,786	3,707
Interior		
Achievable- Most Likely	6,652	16,641
Achievable- Upper	10,829	23,266

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 significant reduction of greenhouse gas (GHG) emissions.[61] As illustrated in Exhibit 7.13, by FY 2015/16 the GHG reductions are estimated to be in the range of 381,000 to 533,000 tonnes/year, depending on scenario.

Exhibit 7.13: Estimated GHG Emission Reductions – Achievable Potential, By Scenario and Milestone Year

Service Region & Scenario	Annual Natural Gas Savings (GJ/yr.)		Annual GHG Savings (tonnes/yr.)	
	2010/11	2015/16	2010/11	2015/16
Total Terasen Gas				
Achievable - Most Likely	3,025,440	7,513,319	153,390	380,925
Achievable- Upper	4,935,270	10,515,357	250,218	533,129

7.5 RESULTS – FUEL CHOICE

This section presents a summary of the Most Likely and Upper Achievable Potential results for each of the fuel choice Actions. The results include the following:

- Natural gas consumption impact
- Electricity savings
- Peak day load impacts
- Greenhouse gas impacts.

[61] GHG impacts are estimated based on an emissions factor of 50.7 kg of $CO_{2\ equiv.}$ per GJ of natural gas. This is the value currently employed by Natural Resources Canada.

7.5.1 Natural Gas Consumption Impact – Fuel Choice Scenarios

A summary of the Most Likely and Upper Achievable Potential natural gas consumption impacts for the fuel choice actions is presented in Exhibit 7.14. The results shown are relative to the Reference Case and represent the total annual cumulative increase in natural gas use at the end of each milestone year. For example, Exhibit 7.14 shows that Action RFC1 — space heating conversion (Vancouver Island) in new single detached homes will achieve an annual increase of 491 GJ/yr. by FY 2010/11 under the Most Likely scenario. This annual increase grows to 868 GJ/yr. by FY 2015/16, again under the Most Likely scenario.

Exhibit 7.14: Summary of Fuel Choice Natural Gas Impacts, by Action and Segment

Action	Annual Gas Increase (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
RFC1 - Heating	491	1,375	868	2,432	60%
RFC3 - Range	62	124	195	391	13%
RFC4 - Dryer	117	234	389	778	27%
Total TG Service Region	**670**	**1,734**	**1,453**	**3,601**	**100%**

Selected highlights related to the participation rates used to calculate the fuel choice impacts shown in Exhibit 7.12 are provided below. Detailed results showing the estimated participation rates and calculation of related energy impacts are provided in Appendix E.

7.5.1.1 Action RFC1 – Space Heating Fuel Choice

Workshop participants concluded that under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 70% by FY 2015/16 could be achieved.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates were estimated to be approximately 25% by FY 2015/16.

Selected highlights from the discussion of this Action are listed below:

- The only market considered by the workshop was new single detached homes on Vancouver Island, as it was judged to provide the primary opportunity.
- Under an aggressive program during the mid to late 1990s, the natural gas space heating share reached 70% in new homes. This 70% participation rate was, therefore, used to define the likely "Upper" participation rate.

- More recently, in 2003, the natural gas space heating fuel share in new homes was estimated to be 36%, with a $1000 incentive. This 36% participation rate was used as a reference point to define the "Most Likely" participation rate. In light of the recent natural gas price increases, the 2003 rate was reduced to 25% for Most Likely.

- Participants noted there is potential for an increase in natural gas prices after 2012. This is the expiry date of an earlier price agreement implemented at the time of the gas pipeline construction. Participants indicated that customers who are aware of this situation may be more cautious about committing to gas.

- Hook-up fees currently provide an unintended incentive to use electric heat (because they drop for larger service connections). BCH is currently examining changes to hook-up fees to eliminate this unintended effect. If trend goes heavily towards electric heat, it will strain transmission capacity to the Island, and BCH will be forced to address it in some way: through rates perhaps.

- The space heating fuel choice measure is also economically attractive for existing homes, at the time of equipment replacement. However, it was not explicitly discussed in the achievable potential workshop because the potential market in existing homes is very small. Less than 5% of existing electrically heated homes have forced air systems. In the absence of specific data, the participation rates for the new home action were used for the existing space heating fuel choice action as well.

7.5.1.2 Action RFC2 –DHW Fuel Choice

The DHW heating fuel choice measure, although it passes the TRC test, has a negative customer payback in existing homes because operating cost with the natural gas technology would actually be higher than for the competing electric technology. Participation by customers would require not only an upfront incentive, but also a tariff that is lower than that paid by existing customers in the same rate class. This is not likely to be a viable option, so the participation rates were set to zero.

7.5.1.3 Action RFC3 –Cooking Fuel Choice

This action was not discussed during the workshop. Participation rates were estimated based on previous Marbek project work, in consultation with the client. (Note: this action applies only to homes that already have natural gas supply serving another end use.)

Under the ideal conditions represented by the Upper Achievable scenario, participation rates up to 20% by FY 2015/16 were estimated. Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates were estimated to be approximately 10% by FY 2015/16. This "Most Likely" participation rate translates into an increase in market share from the current approximately 25% to 35%.

7.5.1.4 Action RFC4 –Dryer Fuel Choice

This action was not discussed during the workshop. Participation rates were estimated based on previous Marbek project work, in consultation with the client. Note: this action applies only to homes that already have natural gas supply serving another end use.

Under the ideal conditions represented by the Upper Achievable scenario participation rates were estimated to be 42% for existing dwellings and 28% for new dwellings by FY 2015/16.

Under the more modest market conditions represented by the Most Likely Achievable scenario, participation rates were estimated to be approximately 21% for existing dwellings and 14% for new dwellings could be expected by FY 2015/16. These participation rates translate into a shift from the current market share of 5% in new dwellings and 6% in existing dwellings to a market share of 15% in both by FY 2015/16.

7.5.2 Electricity Savings – Fuel Choice Scenarios

Implementation of the fuel choice measures contained in the preceding achievable potential (Most Likely and Upper) scenarios would result in a corresponding decrease in electricity consumption. Further details are provided in the following exhibits.

- Exhibit 7.15 shows the electricity decrease by Action, milestone year and scenario for the total Terasen Gas service area.
- Exhibit 7.16 shows the avoided cost impacts of the Achievable Potential Fuel Choice Scenario.

Exhibit 7.15: Summary of Fuel Choice Electricity Impacts, by Action

Action	Electricity Decrease (GWh/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
RFC1 - Heating	103	287	186	521	62%
RFC3 - Range	7	14	22	43	7%
RFC4 - Dryer	28	55	92	184	31%
Total TG Service Region	**137**	**356**	**300**	**748**	**100%**

Exhibit 7.16: Residential Fuel Choice – Avoided Energy Costs (thousand $/yr.)

Milestone Year	Most Likely Scenario			Upper Scenario		
	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost
2005/06	$0	$0	$0	$0	$0	$0
2010/11	-$4,171	$8,693	$4,522	-$9,266	$22,589	$13,323
2015/16	-$9,042	$18,994	$9,952	-$19,248	$47,425	$28,177

7.5.3 Peak Day Load Impacts – Fuel Choice Scenarios

This sub section estimates the peak day load impact that would occur as a result of the achievable potential fuel choice 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 methodology used to estimate the peak day load impact is the same as that presented in 7.4.3 above.

Exhibit 7.17 presents a summary of 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 increase of approximately 12,000 to 30,000 GJ by FY 2015/16, depending on scenario.

Exhibit 7.17: Peak Day Capacity Impacts – Fuel Choice Achievable Potential, By Scenario, Service Region and Milestone Year

Service Region & Scenario	Peak Day Increase by Milestone Year & Scenario (GJ)	
	2010/11	**2015/16**
Total Terasen Gas		
Achievable- Most Likely	5,552	12,116
Achievable- Upper	14,359	30,026
Lower Mainland		
Achievable- Most Likely	3,094	5,878
Achievable- Upper	8,002	14,566
Vancouver Island		
Achievable- Most Likely	1,428	2,912
Achievable- Upper	3,694	7,215
Interior		
Achievable- Most Likely	1,030	3,327
Achievable- Upper	2,663	8,244

7.5.4 Greenhouse Gas Emission Impact – Fuel Choice Scenarios[62]

The increased consumption of natural gas that would occur under each of the preceding fuel choice achievable scenarios would result in increased greenhouse gas emissions, but would be partially offset by a decrease in greenhouse emissions from reduced electricity generation.

As illustrated in Exhibit 7.18, the net increase in greenhouse gas emissions in FY 2015/16 would range from about 65,000 tonnes/yr. to 161,000 tonnes/yr. for, respectively, the Most Likely and Upper scenarios.

Exhibit 7.18: Net Impact on GHG Emissions – Fuel Choice Achievable Potential, By Scenario and Milestone Year

Service Region & Scenario	Annual GHG Net Increase (tonnes/yr.)	
	2010/11	2015/16
Total Terasen Gas		
Achievable - Most Likely	30,005	64,977
Achievable- Upper	77,551	160,859

62 Based on an assumed emissions rate of 50.7 kg CO_2e/GJ of natural gas and 29 tonnes/GWh of electricity. Emissions rates are from Environment Canada (PERRL). Electricity value represents the average emissions rate over an annual period. Actual values may vary depending on both time of day and month of year. However, estimation of emissions impacts at this more detailed level was beyond the scope of this study.

8. STUDY CONCLUSIONS

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in British Columbia’s residential sector. In the “Most Likely” and “Upper” achievable scenarios those energy efficiency improvements would provide between 7,500,000 and 10,500,000 GJ/yr. of savings in FY 2015/16 as well as peak day load reductions of approximately 65,000 to 91,000 GJ.

In addition, the study noted that measures such as advanced housing thermal performance, high performance heat recovery ventilators and on demand water heaters provide additional energy efficiency opportunities. While these measures did not fully pass the economic thresholds set in this study, future energy price increases combined with reduced technology costs are expected to make them economically attractive in the future.

The study findings also confirm the existence of fuel choice options that provide potential for cost-effective use of natural gas instead of electricity for selected space heating and appliance applications within British Columbia’s residential sector. In the Most Likely and Upper achievable scenarios those options increase natural gas use by between 1,450,000 and 3,600,000 GJ/yr. in FY 2015/16 and reduce electricity consumption by 300 GWh/yr. to 750 GWh/yr. (1,080,000 to 2,700,000 GJ/yr.). At these levels of natural gas substitution for electricity, the net avoided energy avoided cost would range from about $10 million to $28 million per year in FY 2015/16.

❑ Interpretation of Results

The study findings outlined above could have significant implications for Terasen Gas. If the cost effective DSM measures identified in this study are pursued by Terasen Gas, then:

- **A significant increase in annual DSM investment in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels.** This increased level of DSM investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario.

- **Interactions between Terasen Gas and its customers would increase very significantly.** For example:
  - Furnace and fireplace actions combined, could affect up to 25% of residential customers by 2015/16.
  - Appliance actions could affect up to 800,000 customer purchases by 2015/16.

- **Annual GHG offsets from residential natural gas savings could reach 300 to 500 kilotonnes**. At the estimated price range of $10 to $15 per tonne, these offsets could have an annual market value in the range of $3 million to over $7 million.

The current Terasen Gas DSM incentive mechanism provides an allowable return of 5% of the Total Resource Cost (TRC). The DSM measures identified for this sector, when combined with those identified in the commercial and manufacturing sector reports, could result in a larger scale

DSM effort that might have a TRC value of $30 million, or more. A TRC value of $30 million would provide a $1.5 million annual payment through the DSM incentive mechanism. If the utility was to apply for increased DSM funding levels, a larger DSM incentive mechanism or equivalent shared savings mechanism could also be considered.

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APPENDIX A

Energy Use Data for Vancouver Island and the Interior

Segments

Segment
SFD/Duplex Gas - pre 1976
SFD/Duplex Gas - post 1976
SFD/Duplex NonGas - pre 1976
SFD/Duplex NonGas - post 1976
Row unit Gas - pre 1976
Row unit Gas - post 1976
Row unit NonGas - pre 1976
Row unit NonGas - post 1976
Lowrise suite <=4 floors gas
Lowrise suite <=4 floors elec/other
Highrise suite >4 floors gas
Highrise suite >4 floors elec/other
Mobile w gas heat
Mobile w/o gas heat
Subtotal

UEC 2.10a Int

Segment	DHW	Cook	Dryer	Pool	Fireplace	Other Gas
	MJ/yr.	MJ/yr.	MJ/yr.	MJ/yr.	MJ/yr.	MJ/yr.
SFD/Duplex Gas - pre 1976	19,150	7,786	3,663	56,028	16,304	1,450
SFD/Duplex Gas - post 1976	19,150	7,786	3,663	56,028	16,304	1,450
SFD/Duplex NonGas - pre 1976	19,150	7,786	3,663	56,028	16,304	1,450
SFD/Duplex NonGas - post 1976	19,150	7,786	3,663	56,028	16,304	1,450
Row unit Gas - pre 1976	15,112	5,985	2,747	56,028	16,304	1,153
Row unit Gas - post 1976	15,112	5,985	2,747	56,028	16,304	1,153
Row unit NonGas - pre 1976	15,112	5,985	2,747	56,028	16,304	1,153
Row unit NonGas - post 1976	15,112	5,985	2,747	56,028	16,304	1,153
Lowrise suite <=4 floors gas	13,729	4,648	2,177	-	16,305	1,040
Lowrise <=4 flrs corridor gas	-	-	-	56,028	-	-
Lowrise suite <=4 floors elec/other	13,729	4,648	2,177	-	16,305	1,040
Lowrise <=4 flrs corridor elec/other	-	-	-	56,028	-	-
Highrise suite >4 floors gas	14,463	4,648	2,177	-	16,305	1,040
Highrise >4 flrs corridor gas	-	-	-	56,028	-	-
Highrise suite >4 floors elec/other	14,463	4,648	2,177	-	16,305	1,040
Highrise >4 floors corridor elec/other	-	-	-	56,028	-	-
Mobile w gas heat	15,581	6,180	2,896	56,028	16,304	1,129
Mobile w/o gas heat	15,581	6,180	2,896	56,028	16,304	1,129

UEC 2.10a VI

Segment	DHW MJ/yr.	Cook MJ/yr.	Dryer MJ/yr.	Pool MJ/yr.	Fireplace MJ/yr.	Other Gas MJ/yr.
SFD/Duplex Gas - pre 1976	19,150	7,786	3,816	45,835	16,304	1,450
SFD/Duplex Gas - post 1976	19,150	7,786	3,816	45,835	16,304	1,450
SFD/Duplex NonGas - pre 1976	19,150	7,786	3,816	45,835	16,304	1,450
SFD/Duplex NonGas - post 1976	19,150	7,786	3,816	45,835	16,304	1,450
Row unit Gas - pre 1976	16,000	6,338	3,067	45,835	16,304	1,153
Row unit Gas - post 1976	16,000	6,338	3,067	45,835	16,304	1,153
Row unit NonGas - pre 1976	16,000	6,338	3,067	45,835	16,304	1,153
Row unit NonGas - post 1976	16,000	6,338	3,067	45,835	16,304	1,153
Lowrise suite <=4 floors gas	13,075	3,417	2,155	-	16,305	990
Lowrise <=4 flrs corridor gas	-	-	-	45,835	-	-
Lowrise suite <=4 floors elec/other	13,075	3,417	2,155	-	16,305	990
Lowrise <=4 flrs corridor elec/other	-	-	-	45,835	-	-
Highrise suite >4 floors gas	13,775	3,417	2,155	-	16,305	990
Highrise >4 flrs corridor gas	-	-	-	45,835	-	-
Highrise suite >4 floors elec/other	13,775	3,417	2,155	-	16,305	990
Highrise >4 floors corridor elec/other	-	-	-	45,835	-	-
Mobile w gas heat	15,650	6,180	3,446	45,835	16,304	1,129
Mobile w/o gas heat	15,650	6,180	3,446	45,835	16,304	1,129

Sat 2.15 Int

Segment	DHW	Cook	Dryer	Pool	Fireplace	Other Gas
	%	%	%	%	%	%
SFD/Duplex Gas - pre 1976	100%	100%	94%	5%	92%	100%
SFD/Duplex Gas - post 1976	100%	100%	94%	5%	92%	100%
SFD/Duplex NonGas - pre 1976	100%	100%	88%	2%	19%	100%
SFD/Duplex NonGas - post 1976	100%	100%	88%	2%	19%	100%
Row unit Gas - pre 1976	100%	100%	98%	1%	74%	100%
Row unit Gas - post 1976	100%	100%	98%	1%	74%	100%
Row unit NonGas - pre 1976	100%	100%	95%		15%	100%
Row unit NonGas - post 1976	100%	100%	95%		15%	100%
Lowrise suite <=4 floors gas	100%	100%	44%		47%	100%
Lowrise suite <=4 floors elec/other	100%	100%	44%		9%	100%
Highrise suite >4 floors gas	100%	100%	44%		47%	100%
Highrise suite >4 floors elec/other	100%	100%	44%		9%	100%
Mobile w gas heat	100%	100%	92%	1%	74%	100%
Mobile w/o gas heat	100%	100%	83%		15%	100%

Sat 2.15 VI

Segment	DHW	Cook	Dryer	Pool	Fireplace	Other Gas
	%	%	%	%	%	%
SFD/Duplex Gas - pre 1976	100%	100%	94%	3%	92%	100%
SFD/Duplex Gas - post 1976	100%	100%	94%	3%	92%	100%
SFD/Duplex NonGas - pre 1976	100%	100%	88%	1%	17%	100%
SFD/Duplex NonGas - post 1976	100%	100%	88%	1%	17%	100%
Row unit Gas - pre 1976	100%	100%	98%	1%	74%	100%
Row unit Gas - post 1976	100%	100%	98%	1%	74%	100%
Row unit NonGas - pre 1976	100%	100%	95%		14%	100%
Row unit NonGas - post 1976	100%	100%	95%		14%	100%
Lowrise suite <=4 floors gas	100%	100%	44%		60%	100%
Lowrise suite <=4 floors elec/other	100%	100%	44%		11%	100%
Highrise suite >4 floors gas	100%	100%	44%		60%	100%
Highrise suite >4 floors elec/other	100%	100%	44%		11%	100%
Mobile w gas heat	100%	100%	92%	1%	74%	100%
Mobile w/o gas heat	100%	100%	83%		14%	100%

Segment	Space heating %	DHW %	Cook %	Dryer %	Pool %	Fireplace %	Other Gas %
SFD/Duplex Gas - pre 1976	55%	86%	18%	6%	58%	72%	100%
SFD/Duplex Gas - post 1976	55%	86%	18%	6%	58%	72%	100%
SFD/Duplex NonGas - pre 1976	25%	20%	15%	1%	58%	72%	100%
SFD/Duplex NonGas - post 1976	25%	20%	15%	1%	58%	72%	100%
Row unit Gas - pre 1976	55%	86%	18%	6%	58%	72%	100%
Row unit Gas - post 1976	55%	86%	18%	6%	58%	72%	100%
Row unit NonGas - pre 1976	35%	15%	4%	1%	58%	72%	100%
Row unit NonGas - post 1976	35%	15%	4%	1%	58%	72%	100%
Lowrise suite <=4 floors gas	87%	97%	1%	3%	100%	72%	100%
Lowrise <=4 flrs corridor gas	99%				58%	100%	100%
Lowrise suite <=4 floors elec/other	25%	52%	1%	1%	100%	72%	100%
Lowrise <=4 flrs corridor elec/other	1%	100%	100%	100%	58%	100%	100%
Highrise suite >4 floors gas	90%	97%	1%	3%	100%	72%	100%
Highrise >4 flrs corridor gas	99%	100%	100%	100%	58%	100%	100%
Highrise suite >4 floors elec/other	25%	52%	1%	1%	100%	72%	100%
Highrise >4 floors corridor elec/other	1%	100%	100%	100%	58%	100%	100%
Mobile w gas heat	55%	86%	18%	6%	58%	72%	100%
Mobile w/o gas heat	20%	38%	0%	1%	58%	72%	100%

Fuels 2.16 VI

Segment	Space heating	DHW	Cook	Dryer	Pool	Fireplace	Other Gas
	%	%	%	%	%	%	%
SFD/Duplex Gas - pre 1976	40%	86%	18%	6%	58%	72%	100%
SFD/Duplex Gas - post 1976	40%	86%	18%	6%	58%	72%	100%
SFD/Duplex NonGas - pre 1976	10%	20%	15%	1%	58%	72%	100%
SFD/Duplex NonGas - post 1976	10%	20%	15%	1%	58%	72%	100%
Row unit Gas - pre 1976	40%	86%	18%	6%	58%	72%	100%
Row unit Gas - post 1976	40%	86%	18%	6%	58%	72%	100%
Row unit NonGas - pre 1976	15%	15%	4%	1%	58%	72%	100%
Row unit NonGas - post 1976	15%	15%	4%	1%	58%	72%	100%
Lowrise suite <=4 floors gas	95%	78%	6%	3%	100%	72%	100%
Lowrise <=4 flrs corridor gas	99%				58%	100%	100%
Lowrise suite <=4 floors elec/other	30%	49%	6%	1%	100%	72%	100%
Lowrise <=4 flrs corridor elec/other	10%				58%	100%	100%
Highrise suite >4 floors gas	95%	78%	6%	3%	100%	72%	100%
Highrise >4 flrs corridor gas	99%				58%	100%	100%
Highrise suite >4 floors elec/other	30%	49%	6%	1%	100%	72%	100%
Highrise >4 floors corridor elec/other	10%				58%	100%	100%
Mobile w gas heat	40%	86%	18%	6%	58%	72%	100%
Mobile w/o gas heat	10%	38%	0%	1%	58%	72%	100%

Per House Use Int

Segment	Space Heating m³/yr.	DHW m³/yr.	Cook m³/yr.	Dryer m³/yr.	Pool m³/yr.	Fireplace m³/yr.	Other Gas m³/yr.	TOTAL m³/yr.
SFD/Duplex Gas - pre 1976	43,120	16,469	1,401	209	1,624	10,885	1,450	73,708
SFD/Duplex Gas - post 1976	36,465	16,469	1,401	209	1,624	10,885	1,450	67,053
SFD/Duplex NonGas - pre 1976	19,375	3,830	1,168	32	597	2,188	1,450	27,190
SFD/Duplex NonGas - post 1976	16,375	3,830	1,168	32	597	2,188	1,450	24,190
Row unit Gas - pre 1976	22,495	12,996	1,077	162	323	8,661	1,153	45,714
Row unit Gas - post 1976	19,965	12,996	1,077	162	323	8,661	1,153	43,184
Row unit NonGas - pre 1976	11,725	2,267	239	26		1,741	1,153	15,998
Row unit NonGas - post 1976	10,395	2,267	239	26		1,741	1,153	14,668
Lowrise suite <=4 floors gas	10,266	13,317	46	29		5,483	1,040	29,141
Lowrise <=4 flrs corridor gas	91,872							91,872
Lowrise suite <=4 floors elec/other	2,950	7,139	46	10		1,102	1,040	11,247
Lowrise <=4 flrs corridor elec/other	928							928
Highrise suite >4 floors gas	9,720	14,030	46	29		5,483	1,040	29,308
Highrise >4 flrs corridor gas	517,775							517,775
Highrise suite >4 floors elec/other	2,700	7,521	46	10		1,102	1,040	11,379
Highrise >4 floors corridor elec/other	6,506							6,506
Mobile w gas heat	24,915	13,400	1,112	161	323	8,661	1,129	48,572
Mobile w/o gas heat	9,080	9,660	6,180	2,380		1,741	1,129	29,041

Per House Use VI

Segment	Space Heating m³/yr.	DHW m³/yr.	Cook m³/yr.	Dryer m³/yr.	Pool m³/yr.	Fireplace m³/yr.	Other Gas m³/yr.	TOTAL m³/yr.
SFD/Duplex Gas - pre 1976	25,440	16,469	1,401	218	793	10,885	1,450	55,207
SFD/Duplex Gas - post 1976	20,760	16,469	1,401	218	793	10,885	1,450	50,527
SFD/Duplex NonGas - pre 1976	6,260	3,830	1,168	34	264	2,036	1,450	13,592
SFD/Duplex NonGas - post 1976	5,110	3,830	1,168	34	264	2,036	1,450	12,442
Row unit Gas - pre 1976	15,120	13,760	1,141	181	264	8,661	1,153	39,127
Row unit Gas - post 1976	12,360	13,760	1,141	181	264	8,661	1,153	36,367
Row unit NonGas - pre 1976	4,365	2,400	254	29		1,620	1,153	8,667
Row unit NonGas - post 1976	3,570	2,400	254	29		1,620	1,153	7,872
Lowrise suite <=4 floors gas	12,065	10,199	205	28		7,059	990	29,556
Lowrise <=4 flrs corridor gas	99,000							99,000
Lowrise suite <=4 floors elec/other	3,810	6,407	205	9		1,320	990	11,752
Lowrise <=4 flrs corridor elec/other	10,000							10,000
Highrise suite >4 floors gas	11,115	10,744	205	28		7,059	990	29,152
Highrise >4 flrs corridor gas	560,736							560,736
Highrise suite >4 floors elec/other	3,510	6,750	205	9		1,320	990	11,794
Highrise >4 floors corridor elec/other	70,120							70,120
Mobile w gas heat	14,640	13,459	1,112	191	264	8,661	1,129	38,328
Mobile w/o gas heat	3,660	9,703	6,180	2,831		624	1,129	22,998

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APPENDIX B

Technology Screening of Energy Efficiency Measures

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Air Sealing

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	63,573	2,160	55,945	1,901	F	$900	$0	25	7,629	259	7,888	$105.08	8.6	-$377	0.6
2	**Existing Pre-76 Attached Home -** Baseline: No action	37,814	1,440	33,276	1,267	F	$900	$0	25	4,538	173	4,711	$62.82	14.3	-$585	0.3
3	**New Single Detached Home -** Baseline: Standard construction	46,442	2,880	40,869	2,534	I	$700	$0	25	5,573	346	5,919	$79.40	8.8	-$287	0.6
4	**New Attached Home** - Baseline: Standard construction	37,067	1,440	32,619	1,267	I	$700	$0	25	4,448	173	4,621	$61.63	11.4	-$391	0.4

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Air Sealing

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	100,309	2,160	88,272	1,901	F	$900	$0	25	12,037	259	12,296	$130.56	6.9	$49	1.1
2	**Existing Pre-76 Attached Home -** Baseline: No action	54,343	1,440	47,822	1,267	F	$900	$0	25	6,521	173	6,694	$71.28	12.6	-$380	0.6
3	**New Single Detached Home -** Baseline: Standard construction	73,792	2,880	64,937	2,534	I	$700	$0	25	8,855	346	9,201	$98.67	7.1	$29	1.0
4	**New Attached Home** - Baseline: Standard construction	56,224	1,440	49,477	1,267	I	$700	$0	25	6,747	173	6,920	$73.65	9.5	-$163	0.8

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Air Sealing

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	78,417	2,160	69,007	1,901	F	$900	$0	25	9,410	259	9,669	$102.02	8.8	-$147	0.8
2	**Existing Pre-76 Attached Home -** Baseline: No action	40,937	1,440	36,025	1,267	F	$900	$0	25	4,912	173	5,085	$53.89	16.7	-$499	0.4
3	**New Single Detached Home -** Baseline: Standard construction	58,825	2,880	51,766	2,534	I	$700	$0	25	7,059	346	7,405	$79.09	8.9	-$105	0.9
4	**New Attached Home** - Baseline: Standard construction	43,912	1,440	38,642	1,267	I	$700	$0	25	5,269	173	5,442	$57.60	12.2	-$273	0.6

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Attic 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	**Existing Pre-76 Single Detached Home -** Baseline: Average attic insulation levels	63,573	2,160	59,759	2,030	F	$1,000	$0	30	3,814	130	3,944	$52.54	19.0	-$724	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Average attic insulation levels	37,814	1,440	35,545	1,354	F	$1,000	$0	30	2,269	86	2,355	$31.41	31.8	-$834	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Attic 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	**Existing Pre-76 Single Detached Home -** Baseline: Average attic insulation levels	100,309	2,160	94,291	2,030	F	$1,000	$0	30	6,019	130	6,148	$65.28	15.3	-$990	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average attic insulation levels	54,343	1,440	51,083	1,354	F	$1,000	$0	30	3,261	86	3,347	$35.64	28.1	-$993	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Attic 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	**Existing Pre-76 Single Detached Home -** Baseline: Average attic insulation levels	78,417	2,160	73,712	2,030	F	$1,000	$0	30	4,705	130	4,835	$51.01	19.6	-$603	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Average attic insulation levels	40,937	1,440	38,481	1,354	F	$1,000	$0	30	2,456	86	2,543	$26.95	37.1	-$789	0.2

** *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:

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Wall Insulation

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average wall insulation levels	63,573	2,160	55,309	1,879	F	$2,500	$0	30	8,265	281	8,545	$113.84	22.0	-$1,903	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Average wall insulation levels	37,814	1,440	32,898	1,253	F	$2,500	$0	30	4,916	187	5,103	$68.05	36.7	-$2,141	0.1

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Wall Insulation

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average wall insulation levels	100,309	2,160	87,269	1,879	F	$2,500	$0	30	13,040	281	13,321	$141.45	17.7	-$2,478	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average wall insulation levels	54,343	1,440	47,279	1,253	F	$2,500	$0	30	7,065	187	7,252	$77.22	32.4	-$2,485	0.0

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Wall Insulation

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average wall insulation levels	78,417	2,160	68,223	1,879	F	$2,500	$0	30	10,194	281	10,475	$110.52	22.6	-$1,640	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Average wall insulation levels	40,937	1,440	35,615	1,253	F	$2,500	$0	30	5,322	187	5,509	$58.39	42.8	-$2,042	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Foundation Insulation

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Average foundation insulation levels	63,573	2,160	56,580	1,922	F	$4,700	$0	30	6,993	238	7,231	$96.32	48.8	-$4,195	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Average foundation insulation levels	37,814	1,440	33,655	1,282	F	$4,700	$0	30	4,160	158	4,318	$57.58	81.6	-$4,396	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Foundation Insulation

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Average foundation insulation levels	100,309	2,160	89,275	1,922	F	$2,500	$0	30	11,034	238	11,272	$119.68	20.9	-$2,481	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average foundation insulation levels	54,343	1,440	48,366	1,282	F	$2,500	$0	30	5,978	158	6,136	$65.34	38.3	-$2,488	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Foundation Insulation

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Average foundation insulation levels	78,417	2,160	69,792	1,922	F	$2,500	$0	30	8,626	238	8,864	$93.52	26.7	-$1,772	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Average foundation insulation levels	40,937	1,440	36,434	1,282	F	$2,500	$0	30	4,503	158	4,662	$49.40	50.6	-$2,113	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Crawl-space Upgrade

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average crawl-space insulation levels	63,573	2,160	63,001	2,141	F	$1,100	$0	30	572	19	592	$7.88	139.6	-$1,059	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average crawl-space insulation levels	37,814	1,440	37,474	1,427	F	$1,100	$0	30	340	13	353	$4.71	233.5	-$1,075	0.0

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Crawl-space Upgrade

	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		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Average crawl-space insulation levels	100,309	2,160	99,406	2,141	F	$1,100	$0	30	903	19	922	$9.79	112.3	-$1,098	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average crawl-space insulation levels	54,343	1,440	53,854	1,427	F	$1,100	$0	30	489	13	502	$5.35	205.8	-$1,099	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Crawl-space Upgrade

	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		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Average crawl-space insulation levels	78,417	2,160	77,712	2,141	F	$1,100	$0	30	706	19	725	$7.65	143.8	-$1,040	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Average crawl-space insulation levels	40,937	1,440	40,569	1,427	F	$1,100	$0	30	368	13	381	$4.04	272.1	-$1,068	0.0

** *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*

Assumptions:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Vacuum Panel Insulation

#	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	F/I	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard wall insulation	63,573	2,160	47,680	1,620	F	$9,300	$0	30	15,893	540	16,433	$218.92	42.5	-$8,152	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Standard wall insulation	37,814	1,440	28,361	1,080	F	$9,300	$0	30	9,454	360	9,814	$130.87	71.1	-$8,609	0.1
3	**New Single Detached Home -** Baseline: Standard construction and wall insulation	46,442	2,880	34,831	2,160	I	$9,300	$0	30	11,610	720	12,330	$165.42	56.2	-$8,392	0.1
4	**New Attached Home -** Baseline: Standard construction and wall insulation	37,067	1,440	27,800	1,080	I	$9,300	$0	30	9,267	360	9,627	$128.40	72.4	-$8,621	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Vacuum Panel Insulation

1

#	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	F/I	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard wall insulation	100,309	2,160	75,232	1,620	F	$9,300	$0	30	25,077	540	25,617	$272.01	34.2	-$7,216	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard wall insulation	54,343	1,440	40,758	1,080	F	$9,300	$0	30	13,586	360	13,946	$148.51	62.6	-$8,157	0.1
3	**New Single Detached Home -** Baseline: Standard construction and wall insulation	73,792	2,880	55,344	2,160	I	$9,300	$0	30	18,448	720	19,168	$205.57	45.2	-$7,699	0.2
4	**New Attached Home -** Baseline: Standard construction and wall insulation	56,224	1,440	42,168	1,080	I	$9,300	$0	30	14,056	360	14,416	$153.43	60.6	-$8,120	0.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Vacuum Panel Insulation

#	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	F/I	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard wall insulation	78,417	2,160	58,813	1,620	F	$9,300	$0	30	19,604	540	20,144	$212.55	43.8	-$7,646	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard wall insulation	40,937	1,440	30,703	1,080	F	$9,300	$0	30	10,234	360	10,594	$112.28	82.8	-$8,420	0.1
3	**New Single Detached Home -** Baseline: Standard construction and wall insulation	58,825	2,880	44,119	2,160	I	$9,300	$0	30	14,706	720	15,426	$164.78	56.4	-$7,993	0.1
4	**New Attached Home -** Baseline: Standard construction and wall insulation	43,912	1,440	32,934	1,080	I	$9,300	$0	30	10,978	360	11,338	$120.00	77.5	-$8,361	0.1

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

	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	**Existing Pre-76 Single Detached Home -** Baseline 1: Current average installed windows	63,573	2,160	59,759	2,030	I	$2,400	$0	30	3,814	130	3,944	$52.54	45.7	-$2,124	0.1
2	**Existing Pre-76 Attached Home -** Baseline 1: Current average installed windows	37,814	1,440	35,545	1,354	I	$2,400	$0	30	2,269	86	2,355	$31.41	76.4	-$2,234	0.1
3	**New Single Detached Home -** Baseline 1: Low Efficiency	46,442	2,880	36,224	2,246	I	$1,100	$0	30	10,217	634	10,851	$117.83	9.3	-$164	0.9
4	**New Attached Home -** Baseline 1: Low Efficiency	37,067	1,440	28,912	1,123	I	$1,100	$0	30	8,155	317	8,471	$90.85	12.1	-$392	0.6

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	100,309	2,160	94,291	2,030	I	$2,400	$0	30	6,019	130	6,148	$65.28	36.8	-$1,900	0.2
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	54,343	1,440	51,083	1,354	I	$2,400	$0	30	3,261	86	3,347	$35.64	67.3	-$2,126	0.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	73,792	2,880	57,558	2,246	I	$1,100	$0	30	16,234	634	16,868	$180.90	6.1	$309	1.3
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	56,224	1,440	43,854	1,123	I	$1,100	$0	30	12,369	317	12,686	$135.02	8.1	-$61	0.9

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	78,417	2,160	73,712	2,030	I	$2,400	$0	30	4,705	130	4,835	$51.01	47.0	-$2,003	0.2
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	40,937	1,440	38,481	1,354	I	$2,400	$0	30	2,456	86	2,543	$26.95	89.1	-$2,189	0.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	58,825	2,880	45,884	2,246	I	$1,100	$0	30	12,942	634	13,575	$146.39	7.5	$51	1.0
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	43,912	1,440	34,251	1,123	I	$1,100	$0	30	9,661	317	9,977	$106.63	10.3	-$274	0.8

** *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:

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline 1: Current average installed windows	63,573	2,160	57,216	1,944	I	$5,000	$0	30	6,357	216	6,573	$87.57	57.1	-$4,541	0.1
2	**Existing Pre-76 Attached Home -** Baseline 1: Current average installed windows	37,814	1,440	34,033	1,296	I	$5,000	$0	30	3,781	144	3,925	$52.35	95.5	-$4,724	0.1
3	**New Single Detached Home -** Baseline 1: Low Efficiency	46,442	2,880	32,509	2,016	I	$5,000	$0	30	13,932	864	14,796	$160.68	31.1	-$3,723	0.3
4	**New Attached Home -** Baseline 1: Low Efficiency	37,067	1,440	25,947	1,008	I	$5,000	$0	30	11,120	432	11,552	$123.88	40.4	-$4,035	0.2

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	100,309	2,160	90,278	1,944	I	$5,000	$0	30	10,031	216	10,247	$108.80	46.0	-$4,166	0.2
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	54,343	1,440	48,909	1,296	I	$5,000	$0	30	5,434	144	5,578	$59.40	84.2	-$4,543	0.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	73,792	2,880	51,654	2,016	I	$5,000	$0	30	22,138	864	23,002	$246.69	20.3	-$3,078	0.4
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	56,224	1,440	39,357	1,008	I	$5,000	$0	30	16,867	432	17,299	$184.12	27.2	-$3,584	0.3

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	78,417	2,160	70,576	1,944	I	$5,000	$0	30	7,842	216	8,058	$85.02	58.8	-$4,338	0.1
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	40,937	1,440	36,844	1,296	I	$5,000	$0	30	4,094	144	4,238	$44.91	111.3	-$4,648	0.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	58,825	2,880	41,178	2,016	I	$5,000	$0	30	17,648	864	18,512	$199.62	25.0	-$3,431	0.3
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	43,912	1,440	30,738	1,008	I	$5,000	$0	30	13,173	432	13,605	$145.40	34.4	-$3,874	0.2

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: R2000 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	46,442	2,880	32,509	2,016	I	$6,500	$0	30	13,932	864	14,796	$198.51	32.7	-$5,411	0.2
2	**New Attached Home -** Baseline: Current Average House Construction	37,067	1,440	25,947	1,008	I	$6,500	$0	30	11,120	432	11,552	$154.09	42.2	-$5,685	0.1

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: R2000 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	73,792	2,880	51,654	2,016	I	$6,500	$0	30	22,138	864	23,002	$246.69	26.3	-$6,432	0.0
2	**New Attached Home -** Baseline: Current Average House Construction	56,224	1,440	39,357	1,008	I	$6,500	$0	30	16,867	432	17,299	$184.12	35.3	-$6,466	0.0

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: R2000 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	58,825	2,880	41,178	2,016	I	$6,500	$0	30	17,648	864	18,512	$197.73	32.9	-$4,931	0.2
2	**New Attached Home -** Baseline: Current Average House Construction	43,912	1,440	30,738	1,008	I	$6,500	$0	30	13,173	432	13,605	$143.99	45.1	-$5,374	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energuide 80 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	46,442	2,880	32,509	2,016	I	$3,800	$0	30	13,932	864	14,796	$198.51	19.1	-$2,711	0.3
2	**New Attached Home -** Baseline: Current Average House Construction	37,067	1,440	25,947	1,008	I	$3,800	$0	30	11,120	432	11,552	$154.09	24.7	-$2,985	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energuide 80 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	73,792	2,880	51,654	2,016	I	$3,800	$0	30	22,138	864	23,002	$246.69	15.4	-$3,732	0.0
2	**New Attached Home -** Baseline: Current Average House Construction	56,224	1,440	39,357	1,008	I	$3,800	$0	30	16,867	432	17,299	$184.12	20.6	-$3,766	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energuide 80 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	58,825	2,880	41,178	2,016	I	$3,800	$0	30	17,648	864	18,512	$197.73	19.2	-$2,231	0.4
2	**New Attached Home -** Baseline: Current Average House Construction	43,912	1,440	30,738	1,008	I	$3,800	$0	30	13,173	432	13,605	$143.99	26.4	-$2,674	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	63,573	2,160	53,905	2,160	I	$600	$0	18	9,668	0	9,668	$127.62	4.7	-$85	0.9
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	37,814	1,440	32,063	1,440	I	$600	$0	18	5,751	0	5,751	$75.91	7.9	-$294	0.5
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	46,442	2,880	39,475	2,880	I	$600	$0	18	6,966	0	6,966	$91.95	6.5	-$229	0.6
4	**New Attached Home -** Baseline: Mid-efficiency furnace	37,067	1,440	31,507	1,440	I	$600	$0	18	5,560	0	5,560	$73.39	8.2	-$304	0.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	100,309	2,160	85,054	2,160	I	$600	$0	18	15,255	0	15,255	$159.91	3.8	$379	1.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	54,343	1,440	46,079	1,440	I	$600	$0	18	8,265	0	8,265	$86.63	6.9	-$69	0.9
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	73,792	2,880	62,723	2,880	I	$600	$0	18	11,069	0	11,069	$116.02	5.2	$111	1.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	56,224	1,440	47,790	1,440	I	$600	$0	18	8,434	0	8,434	$88.40	6.8	-$59	0.9

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	78,417	2,160	66,491	2,160	I	$600	$0	18	11,926	0	11,926	$123.73	4.8	$166	1.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	40,937	1,440	34,711	1,440	I	$600	$0	18	6,226	0	6,226	$64.59	9.3	-$200	0.7
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	58,825	2,880	50,001	2,880	I	$600	$0	18	8,824	0	8,824	$91.55	6.6	-$34	0.9
4	**New Attached Home -** Baseline: Mid-efficiency furnace	43,912	1,440	37,325	1,440	I	$600	$0	18	6,587	0	6,587	$68.34	8.8	-$177	0.7

** *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:

Vancouver Island

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Boiler Efficiency Upgrade

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency boiler	63,573	2,160	55,627	2,145	I	$3,200	$0	18	7,947	15	7,962	$105.15	30.4	-$2,774	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency boiler	37,814	1,440	33,087	1,430	I	$3,200	$0	18	4,727	10	4,737	$62.56	51.1	-$2,946	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency boiler	46,442	2,880	40,636	2,860	I	$3,200	$0	18	5,805	20	5,825	$76.97	41.6	-$2,887	0.1
4	**New Attached Home -** Baseline: Mid-efficiency boiler	37,067	1,440	32,433	1,430	I	$3,200	$0	18	4,633	10	4,643	$61.33	52.2	-$2,951	0.1

Lower Mainland

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Boiler Efficiency Upgrade

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency boiler	100,309	2,160	87,771	2,145	I	$3,200	$0	18	12,539	15	12,554	$131.69	24.3	-$2,392	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency boiler	54,343	1,440	47,550	1,430	I	$3,200	$0	18	6,793	10	6,803	$71.37	44.8	-$2,762	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency boiler	73,792	2,880	64,568	2,860	I	$3,200	$0	18	9,224	20	9,244	$97.03	33.0	-$2,604	0.2
4	**New Attached Home -** Baseline: Mid-efficiency boiler	56,224	1,440	49,196	1,430	I	$3,200	$0	18	7,028	10	7,038	$73.84	43.3	-$2,747	0.1

Interior

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Boiler Efficiency Upgrade

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency boiler	78,417	2,160	68,615	2,145	I	$3,200	$0	18	9,802	15	9,817	$101.95	31.4	-$2,568	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency boiler	40,937	1,440	35,820	1,430	I	$3,200	$0	18	5,117	10	5,127	$53.26	60.1	-$2,870	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency boiler	58,825	2,880	51,472	2,860	I	$3,200	$0	18	7,353	20	7,373	$76.63	41.8	-$2,724	0.1
4	**New Attached Home -** Baseline: Mid-efficiency boiler	43,912	1,440	38,423	1,430	I	$3,200	$0	18	5,489	10	5,499	$57.12	56.0	-$2,846	0.1

** *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:

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Heat Recovery Ventilator

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: standard	63,573	2,160	59,441	2,160	I	$650	$0	15	4,132	0	4,132	$54.55	11.9	-$449	0.3
2	**Existing Pre-76 Attached Home -** Baseline: standard	37,814	1,440	35,356	1,440	I	$650	$0	15	2,458	0	2,458	$32.44	20.0	-$530	0.2
3	**New Single Detached Home -** Baseline: standard	46,442	2,880	43,423	2,880	I	$650	$0	15	3,019	0	3,019	$39.85	16.3	-$503	0.2
4	**New Attached Home** - Baseline: standard	37,067	1,440	34,657	1,440	I	$650	$0	15	2,409	0	2,409	$31.80	20.4	-$533	0.2

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Heat Recovery Ventilator

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: standard	100,309	2,160	93,789	2,160	I	$650	$0	15	6,520	0	6,520	$68.34	9.5	-$268	0.6
2	**Existing Pre-76 Attached Home -** Baseline: standard	54,343	1,440	50,811	1,440	I	$650	$0	15	3,532	0	3,532	$37.03	17.6	-$443	0.3
3	**New Single Detached Home -** Baseline: standard	73,792	2,880	68,996	2,880	I	$650	$0	15	4,796	0	4,796	$50.28	12.9	-$369	0.4
4	**New Attached Home** - Baseline: standard	56,224	1,440	52,569	1,440	I	$650	$0	15	3,655	0	3,655	$38.31	17.0	-$436	0.3

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Heat Recovery Ventilator

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: standard	78,417	2,160	73,320	2,160	I	$650	$0	15	5,097	0	5,097	$52.88	12.3	-$351	0.5
2	**Existing Pre-76 Attached Home -** Baseline: standard	40,937	1,440	38,276	1,440	I	$650	$0	15	2,661	0	2,661	$27.61	23.5	-$494	0.2
3	**New Single Detached Home -** Baseline: standard	58,825	2,880	55,002	2,880	I	$650	$0	15	3,824	0	3,824	$39.67	16.4	-$426	0.3
4	**New Attached Home** - Baseline: standard	43,912	1,440	41,057	1,440	I	$650	$0	15	2,854	0	2,854	$29.61	21.9	-$483	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Integrated Heating and DHW

	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	**Existing Pre-76 Single Detached Home -** Baseline: mid-efficiency furnace	82,724	2,160	72,797	2,160	I	$500	$0	18	9,927	0	9,927	$131.03	3.8	-$31	0.9
2	**Existing Pre-76 Attached Home -** Baseline: mid-efficiency furnace	53,814	1,440	47,356	1,440	I	$500	$0	18	6,458	0	6,458	$85.24	5.9	-$195	0.6
3	**New Single Detached Home -** Baseline: mid-efficiency furnace	65,231	2,880	57,404	2,880	I	$500	$0	18	7,828	0	7,828	$103.33	4.8	-$130	0.7
4	**New Attached Home -** Baseline: mid-efficiency furnace	52,765	1,440	46,433	1,440	I	$500	$0	18	6,332	0	6,332	$83.58	6.0	-$201	0.6

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Integrated Heating and DHW

	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	**Existing Pre-76 Single Detached Home -** Baseline: mid-efficiency furnace	123,667	2,160	108,827	1,620	I	$500	$0	30	14,840	540	15,380	$164.70	3.0	$569	2.1
2	**Existing Pre-76 Attached Home -** Baseline: mid-efficiency furnace	72,910	1,440	64,161	1,080	I	$500	$0	30	8,749	360	9,109	$97.81	5.1	$138	1.3
3	**New Single Detached Home -** Baseline: mid-efficiency furnace	96,683	2,880	85,081	2,160	I	$500	$0	30	11,602	720	12,322	$133.81	3.7	$393	1.8
4	**New Attached Home -** Baseline: mid-efficiency furnace	74,419	1,440	65,489	1,080	I	$500	$0	30	8,930	360	9,290	$99.71	5.0	$150	1.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Integrated Heating and DHW

	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	**Existing Pre-76 Single Detached Home -** Baseline: mid-efficiency furnace	97,568	2,160	85,860	2,160	I	$500	$0	30	11,708	0	11,708	$121.47	4.1	$262	1.5
2	**Existing Pre-76 Attached Home -** Baseline: mid-efficiency furnace	56,049	1,440	49,323	1,440	I	$500	$0	30	6,726	0	6,726	$69.78	7.2	-$62	0.9
3	**New Single Detached Home -** Baseline: mid-efficiency furnace	77,615	2,880	68,301	2,880	I	$500	$0	30	9,314	0	9,314	$96.63	5.2	$106	1.2
4	**New Attached Home -** Baseline: mid-efficiency furnace	58,739	1,440	51,690	1,440	I	$500	$0	30	7,049	0	7,049	$73.13	6.8	-$41	0.9

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Gas-fired Heat Pump

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	63,573	2,160	42,594	2,160	I	$5,000	$0	18	20,979	0	20,979	$276.93	18.1	-$3,882	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	37,814	1,440	25,336	1,440	I	$5,000	$0	18	12,479	0	12,479	$164.72	30.4	-$4,335	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	46,442	2,880	31,116	2,880	I	$5,000	$0	18	15,326	0	15,326	$202.30	24.7	-$4,183	0.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	37,067	1,440	24,835	1,440	I	$5,000	$0	18	12,232	0	12,232	$161.46	31.0	-$4,348	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Gas-fired Heat Pump

1

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	100,309	2,160	67,207	2,160	I	$5,000	$0	18	33,102	0	33,102	$346.98	14.4	-$2,875	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	54,343	1,440	36,410	1,440	I	$5,000	$0	18	17,933	0	17,933	$187.98	26.6	-$3,849	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	73,792	2,880	49,441	2,880	I	$5,000	$0	18	24,351	0	24,351	$255.25	19.6	-$3,437	0.3
4	**New Attached Home -** Baseline: Mid-efficiency furnace	56,224	1,440	37,670	1,440	I	$5,000	$0	18	18,554	0	18,554	$194.48	25.7	-$3,809	0.2

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Gas-fired Heat Pump

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	78,417	2,160	52,540	2,160	I	$5,000	$0	18	25,878	0	25,878	$268.48	18.6	-$3,339	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	40,937	1,440	27,428	1,440	I	$5,000	$0	18	13,509	0	13,509	$140.16	35.7	-$4,133	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	58,825	2,880	39,413	2,880	I	$5,000	$0	18	19,412	0	19,412	$201.40	24.8	-$3,754	0.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	43,912	1,440	29,421	1,440	I	$5,000	$0	18	14,491	0	14,491	$150.34	33.3	-$4,070	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Low-Flow Showerheads and Faucets

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	17,140	0	F	$25	$0	12	2,011	0	2,011	$26.54	0.9	$52	3.1
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	14,320	0	F	$25	$0	12	1,680	0	1,680	$22.18	1.1	$40	2.6

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Low-Flow Showerheads and Faucets

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	20,905	0	F	$25	$0	12	2,453	0	2,453	$25.71	1.0	$82	4.3
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	16,617	0	F	$25	$0	12	1,950	0	1,950	$20.43	1.2	$60	3.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Low-Flow Showerheads and Faucets

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	17,140	0	F	$25	$0	12	2,011	0	2,011	$20.86	1.2	$63	3.5
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	13,525	0	F	$25	$0	12	1,587	0	1,587	$16.46	1.5	$44	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:

Vancouver Island

	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Heat Trap

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	17,235	0	F	$65	$0	15	1,915	0	1,915	$25.28	2.6	$18	1.3
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	14,400	0	F	$65	$0	15	1,600	0	1,600	$21.12	3.1	$4	1.1
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	16,911	0	F	$65	$0	15	1,879	0	1,879	$24.80	2.6	$16	1.2
4	**New Attached Home -** Baseline: standard construction	15,699	-	14,129	0	F	$65	$0	15	1,570	0	1,570	$20.72	3.1	$3	1.0

Lower Mainland

	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Heat Trap

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	21,022	0	F	$65	$0	15	2,336	0	2,336	$24.48	2.7	$49	1.7
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	16,710	0	F	$65	$0	15	1,857	0	1,857	$19.46	3.3	$25	1.4
3	**New Single Detached Home -** Baseline: standard construction	22,891	-	20,602	0	F	$65	$0	15	2,289	0	2,289	$23.99	2.7	$46	1.7
4	**New Attached Home -** Baseline: standard construction	18,196	-	16,376	0	F	$65	$0	15	1,820	0	1,820	$19.07	3.4	$24	1.4

Interior

	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Heat Trap

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	17,235	0	F	$65	$0	15	1,915	0	1,915	$19.87	3.3	$28	1.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	13,600	0	F	$65	$0	15	1,511	0	1,511	$15.68	4.1	$9	1.1
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	16,911	0	F	$65	$0	15	1,879	0	1,879	$19.49	3.3	$26	1.4
4	**New Attached Home -** Baseline: standard construction	14,827	-	13,344	0	F	$65	$0	15	1,483	0	1,483	$15.38	4.2	$7	1.1

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Condensing Water Heater

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,405	0	I	$1,250	$0	10	5,745	0	5,745	$75.84	16.5	-$1,053	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	16,000	-	11,200	0	I	$1,250	$0	10	4,800	0	4,800	$63.36	19.7	-$1,086	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,153	0	I	$1,250	$0	10	5,637	0	5,637	$74.41	16.8	-$1,057	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	-	10,989	0	I	$1,250	$0	10	4,710	0	4,710	$62.17	20.1	-$1,089	0.1

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Condensing Water Heater

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	23,358	-	16,350	0	I	$1,250	$0	10	7,007	0	7,007	$73.45	17.0	-$978	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	18,567	-	12,997	0	I	$1,250	$0	10	5,570	0	5,570	$58.39	21.4	-$1,034	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	-	16,023	0	I	$1,250	$0	10	6,867	0	6,867	$71.98	17.4	-$983	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	-	12,737	0	I	$1,250	$0	10	5,459	0	5,459	$57.22	21.8	-$1,038	0.2

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Condensing Water Heater

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,405	0	I	$1,250	$0	10	5,745	0	5,745	$59.61	21.0	-$1,027	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	15,112	-	10,578	0	I	$1,250	$0	10	4,533	0	4,533	$47.03	26.6	-$1,074	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,153	0	I	$1,250	$0	10	5,637	0	5,637	$58.48	21.4	-$1,031	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	-	10,379	0	I	$1,250	$0	10	4,448	0	4,448	$46.15	27.1	-$1,077	0.1

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW 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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	18,576	0	F	$4	$0	6	575	0	575	$7.58	0.5	$10	3.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	15,520	0	F	$4	$0	6	480	0	480	$6.34	0.6	$7	2.8
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	18,226	0	F	$4	$0	6	564	0	564	$7.44	0.5	$9	3.3
4	**New Attached Home -** Baseline: standard construction	15,699	-	15,228	0	F	$4	$0	6	471	0	471	$6.22	0.6	$7	2.8

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW 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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	22,657	0	F	$4	$0	6	701	0	701	$7.35	0.5	$15	4.7
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	18,010	0	F	$4	$0	6	557	0	557	$5.84	0.7	$11	3.7
3	**New Single Detached Home -** Baseline: standard construction	22,891	-	22,204	0	F	$4	$0	6	687	0	687	$7.20	0.6	$14	4.6
4	**New Attached Home -** Baseline: standard construction	18,196	-	17,650	0	F	$4	$0	6	546	0	546	$5.72	0.7	$11	3.7

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW 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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	18,576	0	F	$4	$0	6	575	0	575	$5.96	0.7	$11	3.8
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	14,658	0	F	$4	$0	6	453	0	453	$4.70	0.9	$8	3.0
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	18,226	0	F	$4	$0	6	564	0	564	$5.85	0.7	$11	3.8
4	**New Attached Home -** Baseline: standard construction	14,827	-	14,382	0	F	$4	$0	6	445	0	445	$4.61	0.9	$8	3.0

** *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*

Assumptions:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous (in-line) Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,788	0	I	$700	$0	20	5,362	0	5,362	$70.78	9.9	-$435	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	16,000	-	11,520	0	I	$700	$0	20	4,480	0	4,480	$59.14	11.8	-$479	0.3
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,529	0	I	$700	$0	20	5,261	0	5,261	$69.45	10.1	-$440	0.4
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	-	11,303	0	I	$700	$0	20	4,396	0	4,396	$58.02	12.1	-$483	0.3

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous (in-line) Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	23,358	-	16,818	0	I	$700	$0	20	6,540	0	6,540	$68.55	10.2	-$333	0.5
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	18,567	-	13,368	0	I	$700	$0	20	5,199	0	5,199	$54.49	12.8	-$408	0.4
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	-	16,481	0	I	$700	$0	20	6,409	0	6,409	$67.18	10.4	-$340	0.5
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	-	13,101	0	I	$700	$0	20	5,095	0	5,095	$53.40	13.1	-$414	0.4

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous (in-line) Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,788	0	I	$700	$0	20	5,362	0	5,362	$55.63	12.6	-$399	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	15,112	-	10,880	0	I	$700	$0	20	4,231	0	4,231	$43.90	15.9	-$463	0.3
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,529	0	I	$700	$0	20	5,261	0	5,261	$54.58	12.8	-$405	0.4
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	-	10,676	0	I	$700	$0	20	4,152	0	4,152	$43.07	16.3	-$467	0.3

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Waste Water Heat Recovery

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	16,134	0	F	$625	$0	18	3,016	0	3,016	$39.81	15.7	-$483	0.2
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	13,480	0	F	$625	$0	18	2,520	0	2,520	$33.26	18.8	-$506	0.2
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	15,830	0	F	$625	$0	18	2,959	0	2,959	$39.06	16.0	-$485	0.2
4	**New Attached Home -** Baseline: standard construction	15,699	-	13,226	0	F	$625	$0	18	2,473	0	2,473	$32.64	19.1	-$508	0.2

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Waste Water Heat Recovery

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	19,679	0	F	$625	$0	18	3,679	0	3,679	$38.56	16.2	-$429	0.3
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	15,643	0	F	$625	$0	18	2,924	0	2,924	$30.65	20.4	-$469	0.2
3	**New Single Detached Home -** Baseline: standard construction	22,891	-	19,285	0	F	$625	$0	18	3,605	0	3,605	$37.79	16.5	-$433	0.3
4	**New Attached Home -** Baseline: standard construction	18,196	-	15,330	0	F	$625	$0	18	2,866	0	2,866	$30.04	20.8	-$472	0.2

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Waste Water Heat Recovery

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	16,134	0	F	$625	$0	18	3,016	0	3,016	$31.29	20.0	-$464	0.3
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	12,731	0	F	$625	$0	18	2,380	0	2,380	$24.69	25.3	-$498	0.2
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	15,830	0	F	$625	$0	18	2,959	0	2,959	$30.70	20.4	-$467	0.3
4	**New Attached Home -** Baseline: standard construction	14,827	-	12,492	0	F	$625	$0	18	2,335	0	2,335	$24.23	25.8	-$501	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Orphans Program

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	11,490	0	F	$500	$0	10	7,660	0	7,660	$101.11	4.9	-$238	0.5
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	16,000	-	9,600	0	F	$500	$0	10	6,400	0	6,400	$84.48	5.9	-$281	0.4

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Orphans Program

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	23,358	-	14,015	0	F	$500	$0	10	9,343	0	9,343	$97.93	5.1	-$137	0.7
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	18,567	-	11,140	0	F	$500	$0	10	7,427	0	7,427	$77.85	6.4	-$212	0.6

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Orphans Program

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	11,490	0	F	$500	$0	10	7,660	0	7,660	$79.47	6.3	-$203	0.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	15,112	-	9,067	0	F	$500	$0	10	6,045	0	6,045	$62.71	8.0	-$265	0.5

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	18,116	288	I	$0	$0	13	1,034	72	1,106	$14.87	0.0	$51	N/A
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	16,000	278	15,136	222	I	$0	$0	13	864	56	920	$12.34	0.0	$42	N/A
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	17,775	241	I	$0	$0	13	1,015	60	1,075	$14.41	0.0	$49	N/A
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	233	14,851	186	I	$0	$0	13	848	47	894	$11.98	0.0	$40	N/A

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	23,358	359	22,097	288	I	$0	$0	13	1,261	72	1,333	$14.44	0.0	$67	N/A
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	18,567	278	17,564	222	I	$0	$0	13	1,003	56	1,058	$11.45	0.0	$53	N/A
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	301	21,655	241	I	$0	$0	13	1,236	60	1,296	$13.98	0.0	$65	N/A
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	233	17,213	186	I	$0	$0	13	983	47	1,029	$11.09	0.0	$51	N/A

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	18,116	288	I	$0	$0	13	1,034	72	1,106	$11.95	0.0	$57	N/A
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	15,112	278	14,296	222	I	$0	$0	13	816	56	872	$9.41	0.0	$45	N/A
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	17,775	241	I	$0	$0	13	1,015	60	1,075	$11.55	0.0	$54	N/A
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	233	14,026	186	I	$0	$0	13	801	47	847	$9.09	0.0	$43	N/A

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Best Available Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	17,341	234	I	$600	$0	13	1,810	126	1,936	$26.01	23.1	-$510	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	16,000	278	14,488	181	I	$600	$0	13	1,512	97	1,609	$21.60	27.8	-$526	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	17,014	195	I	$600	$0	13	1,776	105	1,881	$25.22	23.8	-$514	0.1
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	233	14,215	151	I	$600	$0	13	1,484	81	1,565	$20.96	28.6	-$529	0.1

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Best Available Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	23,358	359	21,151	234	I	$600	$0	13	2,207	126	2,333	$25.27	23.7	-$482	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	18,567	278	16,812	181	I	$600	$0	13	1,755	97	1,852	$20.04	29.9	-$507	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	301	20,728	195	I	$600	$0	13	2,163	105	2,268	$24.46	24.5	-$487	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	233	16,476	151	I	$600	$0	13	1,719	81	1,801	$19.40	30.9	-$510	0.1

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Best Available Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	17,341	234	I	$600	$0	13	1,810	126	1,936	$20.91	28.7	-$500	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	15,112	278	13,684	181	I	$600	$0	13	1,428	97	1,525	$16.46	36.4	-$522	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	17,014	195	I	$600	$0	13	1,776	105	1,881	$20.21	29.7	-$505	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	233	13,426	151	I	$600	$0	13	1,401	81	1,483	$15.92	37.7	-$525	0.1

*** 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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Clothes Washer

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Clotheswasher	22,967	300	20,089	150	I	$100	$0	14	2,877	150	3,027	$40.51	2.5	$42	1.4
2	**Existing Pre-76 Attached Home -** Baseline: Standard Clotheswasher	19,066	226	16,705	113	I	$100	$0	14	2,361	113	2,474	$33.08	3.0	$15	1.2
3	**New Single Detached Home -** Baseline: Standard Clotheswasher	22,546	259	19,719	130	I	$100	$0	14	2,827	130	2,957	$39.51	2.5	$37	1.4
4	**New Attached Home -** Baseline: Standard Clotheswasher	18,717	195	16,397	98	I	$100	$0	14	2,320	98	2,418	$32.27	3.1	$11	1.1

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,796	300	24,362	150	I	$100	$0	14	3,434	150	3,584	$38.53	2.6	$85	1.8
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	22,033	226	19,325	113	I	$100	$0	14	2,708	113	2,821	$30.29	3.3	$45	1.4
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,258	259	23,887	130	I	$100	$0	14	3,371	130	3,501	$37.53	2.7	$79	1.8
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	21,607	195	18,948	98	I	$100	$0	14	2,659	98	2,756	$29.52	3.4	$40	1.4

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,813	300	19,990	150	I	$100	$0	14	2,824	150	2,973	$31.83	3.1	$56	1.6
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,859	226	15,681	113	I	$100	$0	14	2,178	113	2,291	$24.51	4.1	$20	1.2
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,395	259	19,620	130	I	$100	$0	14	2,774	130	2,904	$30.98	3.2	$50	1.5
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,531	195	15,391	98	I	$100	$0	14	2,140	98	2,237	$23.85	4.2	$16	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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Horizontal Axis Clothes Washer

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Clotheswasher	22,967	300	18,988	150	I	$500	$0	14	3,978	150	4,128	$55.05	9.1	-$312	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Standard Clotheswasher	19,066	226	15,785	113	I	$500	$0	14	3,281	113	3,394	$45.22	11.1	-$346	0.3
3	**New Single Detached Home -** Baseline: Standard Clotheswasher	22,546	259	18,638	130	I	$500	$0	14	3,908	130	4,037	$53.77	9.3	-$318	0.4
4	**New Attached Home -** Baseline: Standard Clotheswasher	18,717	195	15,494	98	I	$500	$0	14	3,223	98	3,320	$44.19	11.3	-$351	0.3

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Horizontal Axis Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,796	300	23,019	150	I	$500	$0	14	4,777	150	4,927	$52.61	9.5	-$251	0.5
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	22,033	226	18,258	113	I	$500	$0	14	3,775	113	3,888	$41.49	12.1	-$304	0.4
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,258	259	22,571	130	I	$500	$0	14	4,688	130	4,817	$51.33	9.7	-$258	0.5
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	21,607	195	17,902	98	I	$500	$0	14	3,705	98	3,802	$40.49	12.3	-$310	0.4

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Horizontal Axis Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,813	300	18,889	150	I	$500	$0	14	3,925	150	4,075	$43.26	11.6	-$292	0.4
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,859	226	14,812	113	I	$500	$0	14	3,047	113	3,160	$33.52	14.9	-$339	0.3
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,395	259	18,540	130	I	$500	$0	14	3,855	130	3,984	$42.19	11.9	-$298	0.4
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,531	195	14,538	98	I	$500	$0	14	2,992	98	3,090	$32.70	15.3	-$344	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Insulating Pool Cover

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	27,501	0	F	$350	$0	10	18,334	0	18,334	$242.01	1.4	$278	1.8
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	27,501	0	F	$350	$0	10	18,334	0	18,334	$242.01	1.4	$278	1.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Insulating Pool Cover

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	31,510	0	F	$350	$0	10	21,007	0	21,007	$220.19	1.6	$466	2.3
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	31,510	0	F	$350	$0	10	21,007	0	21,007	$220.19	1.6	$466	2.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Insulating Pool Cover

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	33,617	0	F	$350	$0	10	22,411	0	22,411	$232.52	1.5	$520	2.5
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	33,617	0	F	$350	$0	10	22,411	0	22,411	$232.52	1.5	$520	2.5

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	39,563	0	I	$2,900	$0	15	6,272	0	6,272	$82.79	35.0	-$2,629	0.1
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	39,563	0	I	$2,900	$0	15	6,272	0	6,272	$82.79	35.0	-$2,629	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	45,331	0	I	$2,900	$0	15	7,187	0	7,187	$75.33	38.5	-$2,550	0.1
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	45,331	0	I	$2,900	$0	15	7,187	0	7,187	$75.33	38.5	-$2,550	0.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	48,361	0	I	$2,900	$0	15	7,667	0	7,667	$79.55	36.5	-$2,527	0.1
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	48,361	0	I	$2,900	$0	15	7,667	0	7,667	$79.55	36.5	-$2,527	0.1

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Pool Heater

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 **Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	22,918	0	I	$3,500	$0	10	22,918	0	22,918	$302.51	11.6	-$2,715	0.2
2 **New Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	22,918	0	I	$3,500	$0	10	22,918	0	22,918	$302.51	11.6	-$2,715	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Pool Heater

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 **Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	26,259	0	I	$3,500	$0	10	26,259	0	26,259	$275.24	12.7	-$2,481	0.3
2 **New Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	26,259	0	I	$3,500	$0	10	26,259	0	26,259	$275.24	12.7	-$2,481	0.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Pool Heater

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 **Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	28,014	0	I	$3,500	$0	10	28,014	0	28,014	$290.65	12.0	-$2,412	0.3
2 **New Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	28,014	0	I	$3,500	$0	10	28,014	0	28,014	$290.65	12.0	-$2,412	0.3

** *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:

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Efficient Fireplace

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$64.56	2.3	$61	1.4
2	**Existing Pre-76 Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$64.56	2.3	$61	1.4
3	**New Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$64.56	2.3	$61	1.4
4	**New Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$64.56	2.3	$61	1.4

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Efficient Fireplace

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$51.27	2.9	$88	1.6
2	**Existing Pre-76 Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$51.27	2.9	$88	1.6
3	**New Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$51.27	2.9	$88	1.6
4	**New Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$51.27	2.9	$88	1.6

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Efficient Fireplace

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$50.75	3.0	$88	1.6
2	**Existing Pre-76 Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$50.75	3.0	$88	1.6
3	**New Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$50.75	3.0	$88	1.6
4	**New Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$150	$0	15	4,891	0	4,891	$50.75	3.0	$88	1.6

** *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:

MARBEK
Resource Consultants Ltd.

APPENDIX C

Technology Screening of Fuel Choice Measures

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Fuel Choice

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	56,197	53,905	2,160	I	-$400	$0	18	-53,905	54,037	132	$201.69	-2.0	$7,011	3.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	33,582	32,063	1,440	I	-$400	$0	18	-32,063	32,142	79	$119.97	-3.3	$4,332	3.5
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	42,355	39,475	2,880	I	$2,050	$0	18	-39,475	39,475	0	$146.06	14.0	$2,774	1.7
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	32,947	31,507	1,440	I	$2,050	$0	18	-31,507	31,507	0	$116.57	17.6	$1,800	1.5

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Fuel Choice

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	87,423	85,054	2,160	I	-$400	$0	18	-85,054	85,263	209	$553.20	-0.7	$9,902	2.8
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	47,632	46,079	1,440	I	-$400	$0	18	-46,079	46,192	113	$299.70	-1.3	$5,548	2.9
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	65,603	62,723	2,880	I	$2,050	$0	18	-62,723	62,723	0	$405.35	5.1	$4,931	1.8
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	49,230	47,790	1,440	I	$2,050	$0	18	-47,790	47,790	0	$308.84	6.6	$3,269	1.6

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Fuel Choice

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	68,815	66,491	2,160	I	-$400	$0	18	-66,491	66,655	163	$439.58	-0.9	$7,829	2.8
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	36,237	34,711	1,440	I	-$400	$0	18	-34,711	34,797	85	$229.48	-1.7	$4,278	2.9
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	52,881	50,001	2,880	I	$2,050	$0	18	-50,001	50,001	0	$328.48	6.2	$3,515	1.7
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	38,765	37,325	1,440	I	$2,050	$0	18	-37,325	37,325	0	$245.20	8.4	$2,104	1.5

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.005	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,533	19,150	0	I	$1,250	$0	10	-19,150	10,533	-8,618	-$74.78	-16.7	-$708	0.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	-	8,800	16,000	0	I	$1,250	$0	10	-16,000	8,800	-7,200	-$62.48	-20.0	-$797	0.6
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,334	18,790	0	I	$350	$0	10	-18,790	10,334	-8,455	-$73.37	-4.8	$182	1.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	-	8,634	15,699	0	I	$350	$0	10	-15,699	8,634	-7,064	-$61.30	-5.7	$94	1.1

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	-	12,847	23,358	0	I	$1,250	$0	10	-23,358	12,847	-10,511	-$27.15	-46.0	-$696	0.7
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	-	10,212	18,567	0	I	$1,250	$0	10	-18,567	10,212	-8,355	-$21.58	-57.9	-$810	0.6
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	-	12,590	22,891	0	I	$350	$0	10	-22,891	12,590	-10,301	-$26.61	-13.2	$192	1.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	-	10,008	18,196	0	I	$350	$0	10	-18,196	10,008	-8,188	-$21.15	-16.5	$81	1.1

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.017
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,533	19,150	0	I	$1,250	$0	10	-19,150	10,533	-8,618	-$20.21	-61.8	-$796	0.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	-	8,311	15,112	0	I	$1,250	$0	10	-15,112	8,311	-6,800	-$15.95	-78.4	-$892	0.5
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,334	18,790	0	I	$350	$0	10	-18,790	10,334	-8,455	-$19.83	-17.6	$95	1.1
4	**New Attached Home -** Baseline: Mid-efficiency water heater	-	8,155	14,827	0	I	$350	$0	10	-14,827	8,155	-6,672	-$15.65	-22.4	$1	1.0

** *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*

Assumptions:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Range Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,114	7,786	0	I	$150	$0	18	-7,786	3,114	-4,672	-$50.14	-3.0	-$18	1.0
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,535	6,338	0	I	$150	$0	18	-6,338	2,535	-3,803	-$40.82	-3.7	-$43	0.9
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,039	7,598	0	I	$0	$0	18	-7,598	3,039	-4,559	-$48.93	0.0	$129	1.3
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,474	6,185	0	I	$0	$0	18	-6,185	2,474	-3,711	-$39.83	0.0	$105	1.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Range Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,796	9,489	0	I	$150	$0	18	-9,489	3,796	-5,693	-$35.15	-4.3	-$93	0.9
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,944	7,360	0	I	$150	$0	18	-7,360	2,944	-4,416	-$27.26	-5.5	-$106	0.8
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,704	9,260	0	I	$0	$0	18	-9,260	3,704	-5,556	-$34.30	0.0	$56	1.1
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,873	7,182	0	I	$0	$0	18	-7,182	2,873	-4,309	-$26.61	0.0	$43	1.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Range Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,114	7,786	0	I	$150	$0	18	-7,786	3,114	-4,672	-$28.01	-5.4	-$103	0.8
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,394	5,985	0	I	$150	$0	18	-5,985	2,394	-3,591	-$21.53	-7.0	-$114	0.8
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,039	7,598	0	I	$0	$0	18	-7,598	3,039	-4,559	-$27.33	0.0	$46	1.1
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,336	5,841	0	I	$0	$0	18	-5,841	2,336	-3,505	-$21.01	0.0	$35	1.1

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.006	$0.013
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Dryer Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,244	3,816	417	I	$150	$0	18	-3,816	2,827	-990	-$2.60	-57.6	$143	1.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,607	3,067	335	I	$150	$0	18	-3,067	2,272	-795	-$2.09	-71.7	$85	1.3
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,192	3,756	410	I	$0	$0	18	-3,756	2,782	-974	-$2.56	0.0	$288	2.4
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,565	3,018	330	I	$0	$0	18	-3,018	2,236	-783	-$2.06	0.0	$232	2.4

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Dryer Fuel Choice

	Measure Description	Baseline Energy Use (MJ/yr)		Upgrade Energy Use (MJ/yr)		Measure Capital & Installation Cost F = full I=Incremental		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,772	4,438	485	I	$150	$0	18	-4,438	3,287	-1,151	$9.18	16.3	$142	1.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,946	3,466	379	I	$150	$0	18	-3,466	2,567	-899	$7.17	20.9	$78	1.2
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,713	4,368	477	I	$0	$0	18	-4,368	3,235	-1,133	$9.04	0.0	$287	2.0
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,900	3,411	373	I	$0	$0	18	-3,411	2,527	-884	$7.06	0.0	$224	2.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.017
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Dryer Fuel Choice

	Measure Description	Baseline Energy Use (MJ/yr)		Upgrade Energy Use (MJ/yr)		Measure Capital & Installation Cost F = full I=Incremental		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,114	3,663	400	I	$150	$0	18	-3,663	2,713	-950	$7.97	18.8	$91	1.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,335	2,747	300	I	$150	$0	18	-2,747	2,035	-712	$5.98	25.1	$31	1.1
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,064	3,605	394	I	$0	$0	18	-3,605	2,670	-935	$7.84	0.0	$237	2.0
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,298	2,704	295	I	$0	$0	18	-2,704	2,003	-701	$5.88	0.0	$178	2.0

** *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*

Assumptions:

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APPENDIX D

Action Profiles and Workshop Background

Terasen Gas
Conservation Potential Review (CPR)

–Residential Sector–

Background Materials
for
Workshop
on
Achievable Potential

November 1, 2005

Marbek Resource Consultants Ltd
300-222 Somerset Street West, Ottawa, ON K2P 2G3
Tel: (613) 523.0784 Fax: (613) 523.0717 www.marbek.ca

1. INTRODUCTION

This document provides a "straw dog" set of Actions for the residential sector. The specific Actions build directly from the Economic Potential savings, as contained in Section 5 of the draft Report presented in September 2005.

The attached Action Profiles provide a framework for the workshop discussions to be held on November 1. They are intended to provide a logic framework that defines an overall rationale and direction without getting into the much greater detail required of program design (which is beyond the scope of this project).

1.1 WORKSHOP GOAL AND OUTCOME

Workshop participants are all involved is some aspect of the technologies and/or markets affecting energy efficiency and fuel choice opportunities affecting British Columbia's residential sector. The goal of this workshop is to make maximum advantage of the participant's experience and knowledge by promoting active discussion of each Action Profile related, in particular, to the following factors:

- Review of expected energy savings per participant
- Best estimate of "Most likely" and "Upper" customer participation rates
- As applicable, expected levels of incentives or other conditions necessary to achieve the customer participation rates.

It is hoped that the outcome of this workshop will be general agreement on the above factors, which will enable the Terasen Gas Conservation Potential Review to complete the development of a "high level" estimate of achievable potential for the residential sector.

1.2 CONTENTS

This document contains the following background information:

- Exhibit 1: Summary of Action Profiles
- Exhibit 2: Generalized Barriers – for reference and/or refinement when reviewing the Action Profiles
- Exhibit 3: Generalized Interventions - for reference and/or refinement when reviewing the Action Profiles
- 10 Energy Efficiency Action Profiles and 2 Fuel Choice Action Profiles (in the order shown below in Exhibit 1). Each Action Profile is presented on two pages. The first page provides a "high level" description of the Action; the second page outlines the quantitative information to be discussed during the workshop. As illustrated, the consultants will provide the initial technical and cost information that has been developed as part of the Conservation Potential Review work to date.

Exhibit 1A
Summary of Energy Efficiency Action Profiles

Action Profile #	Title	Approximate % of Economic Savings Potential
R1	High Efficiency Furnaces	22
R2	Efficient Heater Fireplaces	17
R3	High Efficiency DHW Equipment for High Rise Apartments	11
R4	Hot Water Load Reduction	4
R5	DHW Heat Recovery & Heat Traps	5
R6	Energy Star Appliances	26
R7	Energy Star Windows	4
R8	Air Sealing	6
R9	Ultra Efficient New High Rise Apartments	3
R10	Recommissioning/Next Generation BAS in High Rise Apartments	1

Exhibit 1B
Summary of Fuel Choice Action Profiles

Action Profile #	Title	Approximate % of Economic Savings Potential
R1	Space Heating Conversion	62
R2		38

Exhibit 2
Generalized Barriers

Customer EE Awareness	• Awareness that EE opportunities & products exist • Awareness of benefits – cost and co-benefit • Customers' technical ability to assess the options.
Product and Service Availability	• Local or national product availability. • Existence of a viable infrastructure of trade allies. • Vendor or trade ally awareness of the efficiency options and their understanding of the technical issues.
Financing	• Access to appropriate financing • Size of required EE investment vs asset base • Payback Ratio – Actual vs Required
Transaction Costs	• Level of effort/hassle required to become informed, select products, choose contractor(s) and install
Perceived Risk/Reward	• Level of perceived risk that the EE product may not perform as promised • Level of positive external/personal recognition for "doing the right thing" by installing the EE measure(s)
Split Incentive/Motivation	• Level to which the incentives of the agent charged with purchasing the EE are aligned with those of the person(s) that would benefit.
Regulatory	• Codes or standards that prohibit implementation of innovative EE technologies • Level of EE performance that is required in codes or standards

(Source: BC Hydro Conservation Potential Review 2002)

Exhibit 3
Generalized Interventions

Ref	Name	Sample Descriptions
A	Information & Promotion	• Passive provision of information to market participants re: EE opportunities and benefits. • Product or building EE labelling • Employee EE awareness programs
B	Technical services to customers	• Energy audits (walk-through, pre-feasibility, investment grade) • Web based self analysis • Metering • Design assistance • Energy performance benchmarking • Commissioning and recommissioning • Direct management of third party utilities • Third party verification • Post installation technical support re: EE equipment.
C	Specialized customer support	• Provide solutions to sub sector specific EE constraints e.g., Assist property managers/owners to establish language in lease agreements enabling cost recovery of EE capital investments. • Provide market recognition for customer EE achievements
D	Vendor and Customer Links	• Providing customer contacts to contractors • Providing contractor contacts to customers • Contractor certification • Providing sales, marketing and/or technical training about products or services to individuals responsible for selling it. • Vertical integration of market between upstream and downstream market actors (i.e., forming a relationship between contractors and suppliers).
E	Trade Ally Training	• Providing training to trade-allies so that they better understand new or existing practices or procedures • O&M training • Recommissioning and commissioning training
F	Financial incentives	• Product rebates to customer • Product rebates to vendor • Performance incentives ($/GJ/year) • Below market interest rate loans with repayment through energy bills • Revolving fund for feasibility studies • Direct audit incentives • Subsidize industrial process improvements
G	Rates	• Time of use rates • Curtailable and interruptible energy rates. • Emission credits- perhaps considering GHG credit purchase for customer DSM.
H	EE Procurement	• Utility bulk purchases target product to bring price down and establish agreement with trade allies to sell the product. • Development of EE procurement guidelines for Municipal, C/I sectors
I	Standards and Regulations	• Product energy test standards and energy performance rating • Standardized protocols for installation and operation of energy equipment • Regulations prescribing minimum energy efficiency performance levels
J	Emerging technology accelerated market adoption	• Providing demonstration of the use/performance of energy efficient technologies to market actors • Bulk purchase • Take equity position in companies developing technologies

Residential Energy Efficiency Action Profiles

Action Profile R 1 – High Efficiency Furnaces

Overview:

This action will encourage the installation of high efficiency condensing furnaces and boilers in both new and existing residential dwellings. The broad strategy for this Action consists of:

- Strong up-front promotional and education efforts directed towards customers, vendors and trade allies; in the existing market, this will include promotion of early replacement.
- Enhanced financial incentives.
- A Terasen exit strategy built around collaboration with NRCan and the provincial government to establish HE furnaces as the minimum energy performance.

For new construction, the strategy will include support to the MEMPR EGNH80 initiative (Built Green), which intends to legislate energy efficiency levels for new construction that will require a condensing furnace. Target date for the legislation is 2010. In the interim, the existing incentive program will be continued to build awareness and acceptance by developers.

For the replacement market, the periodic incentive program (September to December) has been expanded and made available throughout the year. This is intended to raise consumer awareness, reduce the cost premium for the technology, and to reduce price premiums in the distribution chain.

Target Technologies and Sub Segments:

- Condensing furnaces that meet the Energy Star rating (92% AFUE or higher). Furnaces may have a PSC or ECM motor.
- This technology applies to SFD/Duplexes and row housing in all 3 service regions.
- Early replacement assumes that existing furnaces become candidates for retrofit at 75% of rated life span (i.e., after 15 years)

It should be noted that under the initial avoided cost assumptions used in this analysis, this measure did not quite pass the measure TRC test for row houses or for Vancouver Island. However, given the general natural gas price increases that have occurred since the start of this CPR, it was decided to include these measures in this next stage of the analysis.

Target Stakeholder Group:

- Program developers for new construction.
- People planning to purchase or build a new house.
- Homeowners who are anticipating furnace replacement. However some groups are especially hard to involve:
  - Rental property
  - Low income groups & Housing authorities
  - Homeowners planning to move in the near future.

Key Barriers and Interventions:

Experience indicates that the most significant barriers affecting this opportunity are:

- Retrofit
  Technical barriers such as lack of a condensate drain and / or difficulty in venting the furnace.
  Rental properties, people intending to sell and low income groups are less interested or willing to pay the additional costs.
- New Construction
  Split incentive, developers do not believe that there is sufficient interest from purchasers to allow them to recover their costs.

This Action will address these barriers by combining the following interventions:

- *Retrofit*
  - Continuation of the current Terasen incentive program which provides incentives throughout the year.
  - Support of MEMPR initiative to include EGNH rating in real estate listings.
  - Consider lower-income program delivery in collaboration with NRCan's recently announced low-income Energy Retrofits
- *New Construction*
  - Support of the Built Green program, leading to EGNH 80 based legislation in 2010, which will require ES furnaces to meet the code.
  - Work with Housing Agencies to consider operating cost in heating system selection for new construction.
  - Support of MEMPR initiative to include EGH rating in Real Estate listings and build public awareness of energy efficiency and impact on operating costs.

Time Frame:

Current incentive programs to be extended, and possibly enhanced, through to 2010, when new minimum efficiency regulations will come into effect.

Additional Information:

- Current incentives for this technology are approximately $625 in total. Terasen Gas contribution is $100. EGH provides approx. $550 for furnace upgrade to EE furnace in existing homes.

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	*The approach shown for single family detached will be applied to the remaining sub-sectors.*			
Economic Savings Potential in Period ***(GJ/year)***	*05/06*: ✓ *10/11*: ✓ *15/16*: ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓	✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Approximate Svgs per Participant e.g., Dwelling ***(GJ/year)***	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate ***(% of Applicable Dwellings in Period)*** **Most Likely**	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Upper	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Action Savings, by Milestone Year (GJ/year) **Most Likely**	*05/06* / *10/11* / *15/16* *Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R 2 – Efficient Heater Fireplaces

Overview:

This action will encourage the purchase of Efficient Heater Fireplaces in new homes and the retrofit of inefficient gas fireplaces in existing homes. All vented fireplaces sold in Canada, which are transported across provincial boarders, must be tested and labelled. However, there is currently no minimum energy efficiency standard for fireplaces. This study has defined "Efficient Heater Fireplace" as one having an EnerGuide rated efficiency of 55%, or more.

The broad strategy for this Action consists of:

- Strong up-front promotional and education efforts directed towards customers, vendors and trade allies. This will include support to the Built Green / MEMPR initiatives for EGNH 80 legislation as efficient fireplaces will help builders meet this standard.
- Financial incentives to both new construction and retrofit markets for an interim period. This should encourage manufacturers to label and increase the efficiency of their products while raising awareness of both homeowners and the distribution chain of the availability and benefits of the efficient products.
- A Terasen Gas exit strategy that includes collaboration with NRCan and the provincial government accelerate the establishment of minimum energy performance regulations for heater-style fireplaces.

Note: the intent of this Action is to encourage adoption of efficient heater-style fireplaces, not to eliminate legitimate uses for gas log-sets or to encourage the sale of more fireplaces.

Target Technologies and Sub Segments:

- Fireplaces, including inserts, zero clearance and freestanding units that meet an EnerGuide rating of 55%.
- This technology applies to SFD/Duplex and Row Houses in all 3 service regions.
- Existing fireplaces are replaced at the end of useful life.

Target Stakeholder Group:

- Developers and builders of new housing
- Fireplace venders and installers
- Renovation contractors who put additions on houses which require additional heat
- Strata councils of MURBs with electric heating and centrally provided natural gas for fireplaces.
- Home owners who are renovating or upgrading their dwellings

Key Barriers and Interventions:

- Appearance is more important than efficiency in the purchase decision.
- *New Construction*
  - Units that are manufactured and sold in BC are not required to undergo testing and labelling. Many fireplaces used in new construction fall into this category.
- *Retrofit:*
  - Units are expensive (though the incremental cost of efficient vs inefficient is zero) and typically are a discretionary purchase.

  Lack of consumer awareness.

Time Frame:

Start-up promotion in 2006 with mail-in rebate/incentives to 2010 when new minimum efficiency regulations will come into effect.

Additional Information:

- Promotion of this Action could be combined with the High Efficiency Furnace Action (R1).
- There are no current incentives for this technology; however, one is being considered for 2006. A 3-month pilot initiative in 2004 that provided a $300 incentive attracted only 500 participants but generated considerable interest. The $2,500 to $3,000 dollar capital cost appeared to be a serious barrier for most homeowners and the short time frame (3 months) was not sufficient to attract the participation of Stratos.

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ The consultant will provide data in an updated version of this worksheet to be presented out at the workshop ✗ To be discussed during the workshop			
Economic Savings Potential in Period *(GJ/year)*	*05/06*: ✓ *10/11*: ✓ *15/16*: ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓				
Approximate Svgs per Participant e.g., Dwelling *(GJ/year)*	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate *(% of Applicable Dwellings in Period)* **Most Likely**	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Upper	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Action Savings, by Milestone Year (GJ/year)	*05/06* / *10/11* / *15/16*				
Most Likely	*Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R 3 – High Efficiency DHW Equipment for High Rise Apartments

Overview:

This action will encourage the adoption of condensing water heaters and boilers in new and retrofit applications. The broad strategy for this Action consists of:

- Strong up-front promotional and education efforts directed towards customers, vendors and trade allies; ; in the existing market, this will include promotion of early replacement.
- Financial incentives
- A Terasen exit strategy that includes collaboration with NRCan and the provincial government to accelerate the establishment of minimum energy performance regulations that would require condensing water heaters and boilers.

Target Technologies and Sub Segments:

- Condensing (commercial) boilers in new and existing high-rise apartments.

Target Stakeholder Group:

- Building developers
- Plumbers
- Homeowners

Key Barriers and Interventions:

They key barriers are the lack of information about the benefits of these measures, and the willingness of customers to pay the additional costs.

- New Construction.
- Plumbing is done on a low bid basis. This means that the target measures will have to be included in the specifications for the job. Developers/builders will likely assume that they cannot recover the increased cost in the price of the dwelling, so that an incentive will be required to offset the additional cost.
- Replacement
- Direct contact with the Strata is difficult as most high rises have a property manager that receives the bill
- Requires a large capital investment and therefore decision making periods are often long.

Time Frame:

Start-up promotion in 2006 with mail-in rebate/incentives to 2010 when new minimum efficiency regulations will come into effect.

Additional Information:

- Terasen gas is currently offering the Efficient Boiler Program to the commercial market. Average incentive amount is $12,000 for condensing or near-condensing boilers. The program expects about 130 participants over two years from all sub sectors.

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period ***(GJ/year)***	*05/06* ✓ · *10/11* ✓ · *15/16* ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓				
Approximate Svgs per Participant e.g., Dwelling ***(GJ/year)***	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate particip ant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate ***(% of Applicable Dwellings in Period)*** **Most Likely**	*05/06* ✗ · *10/11* ✗ · *15/16* ✗				
Upper	✗ · ✗ · ✗				
Action Savings, by Milestone Year (GJ/year)	*05/06* · *10/11* · *15/16*				
Most Likely	*Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R 4 – Hot Water Load Reduction

Overview:

This Action will encourage the adoption of a number of technologies that reduce the energy required to meet the DHW needs of customers. The objective is to have these measures installed as part of new construction, and to be installed on replacement hot water tanks, as applicable.

The broad strategy envisions the use of education, promotion and, for a limited time, incentives to raise awareness of these technologies and their benefits. The intent is to have them become "standard practices" in new construction and when hot water tanks are retrofitted.

Target Technologies and Sub Segments:

- Low Flow Showerheads and Faucets for existing dwellings
- DHW pipe insulation for both new and existing dwellings

Target Stakeholder Group:

- Building developers
- Plumbers
- Homeowners

Key Barriers and Interventions:

They key barriers are the lack of information about the benefits of these measures, and the willingness of customers to pay the additional costs.

- New Construction.
- Plumbing is done on a low bid basis. This means that the target measures will have to be included in the specifications for the job. Developers/builders will likely assume that they cannot recover the increased cost in the price of the dwelling, so that an incentive will be required to offset the additional cost.
- These measures could be included in the Built Green program as checklist items to encourage their adoption.
- Replacement
- Point of purchase (POP) material for the homeowner
- Training for the plumbing community. The incentive program would be used in the early years to encourage plumbers to adopt these practices.

Time Frame:

Start in 2006, with incentives ending in 2008.

Additional Information:

These measures can be installed by the homeowner.

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period *(GJ/year)*	*05/06* ✓ · *10/11* ✓ · *15/16* ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓				
Approximate Svgs per Participant e.g., Dwelling *(GJ/year)*	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate *(% of Applicable Dwellings in Period)* **Most Likely**	*05/06* ✗ · *10/11* ✗ · *15/16* ✗				
Upper	✗ · ✗ · ✗				
Action Savings, by Milestone Year (GJ/year)	*05/06* · *10/11* · *15/16*				
Most Likely	*Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R 5 – DHW Heat Recovery & Heat Traps

Overview:

This action will encourage certified contractors to install heat recovery devices in the main plumbing lines of new high-rise apartments and to install DHW heat trap on existing, household water heating tanks.

The broad strategy envisions the use of education, promotion and, for a limited time, incentives to raise awareness of these technologies and their benefits

Target Technologies and Sub Segments:

- Heat trap for all existing residential hot water heaters
- Drainwater heat recovery in all new high-rise apartments

Target Stakeholder Group:

- Building developers
- Plumbers
- Homeowners

Key Barriers and Interventions:

They key barriers are the lack of information about the benefits of these measures, and the willingness of customers to pay the additional costs.

- New Construction.
- Plumbing is done on a low bid basis. This means that the target measures will have to be included in the specifications for the job. Developers/builders will likely assume that they cannot recover the increased cost in the price of the dwelling, so that an incentive will be required to offset the additional cost.
- These measures could be included in the Built Green program as checklist items to encourage their adoption.
- Replacement
- Point of purchase (POP) material for the homeowner
- Training for the plumbing community. The incentive program would be used in the early years to encourage plumbers to adopt these practices.

Time Frame:

Start in 2006, with incentives ending in 2008.

Additional Information:

New hot water tanks are typically equipped with heat traps; consequently, this measure is assumed to be applicable to existing tanks only.

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period *(GJ/year)*	*05/06*: ✓ *10/11*: ✓ *15/16*: ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓				
Approximate Svgs per Participant e.g., Dwelling *(GJ/year)*	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate *(% of Applicable Dwellings in Period)* **Most Likely**	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Upper	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Action Savings, by Milestone Year (GJ/year) **Most Likely**	*05/06* *10/11* *15/16* *Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R 6 - Energy Star Appliances

Overview:

This Action will encourage the purchase of Energy Star compliant home dishwashers and clothes washers. These two home appliances as well as other heating/air conditioning equipment are already promoted through the Energy Star brand. It is assumed that there is significant opportunity for leveraging complementary federal government and BC Hydro initiatives in this area.

The broad strategy envisioned for this Action consists of:

- Strong up-front promotional efforts directed towards customers, vendors and trade allies, including in-store promotions.
- Support of the Built Green program, which includes dishwashers and clothes washers.
- Financial incentives in conjunction with Power Smart targeted to both customers and vendors for the first 5 years to boost market momentum.
- A Terasen exit strategy that includes collaboration with NRCan and the provincial government to accelerate the establishment of minimum energy performance regulations for these products that would require Energy Star levels.

Target Technologies and Sub Segments:

- Energy Star dishwashers and clothes washers – all segments

Target Stakeholder Group:

Building owners, occupants and maintenance personnel, including:

- New home developers and Built Green program, especially for multi family units where appliances are typically provided by the developer.
- Homeowners who need to replace appliances
- Homeowners who are contemplating a renovation on their home
- Building owners who pay for operating expenditures
- Housing authorities that subsidize operating costs of building occupants
- Vendors and trade allies

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- lack of consumer awareness and information,
- higher first cost of products

This Action will address these barriers by combining the following interventions:

- Information and promotion – e.g., energy and cost savings; appliance labelling - an energy star rating in conjunction with an EnerGuide label will provide a performance metric and a benchmark to improve consumer knowledge of product energy efficiency
- Financing – e.g., mail in rebates to customers plus vendor incentive for promotion and handling
- Standards and regulations – e.g., appliance standards increased to Energy Star levels

Time Frame:

Start up promotions in 2006; mail in rebates and vendor incentives to 2010; increased product performance standards and regulations post 2010.

Additional Information:

- BCH incentive amounts for these technologies are currently under discussion.
- Current sales share of these Energy Star compliant products across Canada are estimated to be 35% for cloths washers (up from 25% in the previous year), and 75% for dishwashers (up from 50% the previous year).

Sub Sector	Single Family Detached			Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓						
Economic Savings Potential in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	E.g., dwellings ✓ ✗						
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗						
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗						
Major Technologies & Contribution to Economic Savings	*Technology*	*% of Eco Svg*					
	Tech 1 ✓	✓					
	Tech 2 ✓	✓					
Approximate Svgs per Participant e.g., Dwelling *(GJ/year)*	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate *(% of Applicable Dwellings in Period)*	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

The approach shown for single family detached will be applied to the remaining sub-sectors.

✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**

✗ **To be discussed during the workshop**

Action Profile R 7 - Energy Star Windows

Overview:

This Action will complement Action R6 and will encourage the purchase of Energy Star compliant windows for Terasen Gas customers in new dwellings. It is assumed that there is significant opportunity for leveraging complementary federal government initiatives in this area.

The broad strategy envisioned for this Action consists of:

- Support of the Built Green program, which includes ES windows.
- Strong up-front promotional efforts directed towards customers, vendors and trade allies, including in-store promotions and technical information for retrofit and non-Built Green new construction.
- Financial incentives in conjunction with Power Smart targeted to both customers and vendors for the first 5 years to boost market momentum.
-

Target Technologies and Sub Segments:

- Energy Star windows – all low rise segments – new construction only

Target Stakeholder Group:

Building owners, occupants and maintenance personnel, including:

- New home developers and Built Green program
- Homeowners who are contemplating a renovation on their home
- Building owners who pay for operating expenditures
- Housing authorities that subsidize operating costs of building occupants
- Vendors and trade allies

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- lack of consumer awareness and information,
- higher first cost of products

This Action will address these barriers by combining the following interventions:

- Information and promotion – e.g., energy and cost savings; appliance labelling - an energy star rating in conjunction with an EnerGuide label will provide a performance metric and a benchmark to improve consumer knowledge of product energy efficiency
- Financing – e.g., mail in rebates to customers plus vendor incentive for promotion and handling
- Standards and regulations – e.g., appliance standards increased to Energy Star levels

Time Frame:

Start up promotions in 2006; mail in rebates and vendor incentives to 2010; increased product performance standards and regulations post 2010.

Additional Information:

- Current incentives for this technology are approximately $1 per sq ft of glass, which covers most of the incremental cost. Incentive may be reduced in future years as the incremental cost is expected to decrease.
- In electrically heated houses, it is estimated that less than 10% of the houses (representing about 7% of total window area) have double pane low-e glass.

Sub Sector	**Single Family Detached**			**Attached**	**Low Rise Apartment**	**High Rise Apartment**	**Mobile/Other**
Approx % of Action Svgs	✓			***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period ***(GJ/year)***	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	E.g., dwellings ✓ ✗						
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗						
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗						
Major Technologies & Contribution to Economic Savings	*Technology*	*% of Eco Svg*					
	Tech 1 ✓	✓					
	Tech 2 ✓	✓					
Approximate Svgs per Participant e.g., Dwelling ***(GJ/year)***	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate ***(% of Applicable Dwellings in Period)***	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

Action Profile R8 – Air Sealing

Overview:

This Action will promote the application of air sealing measures in existing Terasen Gas customer homes. Industry experts indicate that there is a need for qualified contractors to service those homeowners who do not want to do air sealing work themselves. The strategy for this Action consists of:

- Promotional efforts directed towards customers.
- Educational efforts directed towards residential contractors. Terasen will work with existing associations such as the Heating, Refrigeration and Air Conditioning Institute to provide support residential contractors. The intent is to enhance industry air sealing skills and to promote "best practices" among residential contractors.
- Financial incentives delivered in collaboration with the Energuide for Houses program; customers will receive a grant if they successfully go through the pre- and post-EnerGuide evaluation. The EnerGuide initiative is currently slated to terminate in March 2007.

Target Technologies and Sub Segments:

Air 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, through electrical and plumbing penetrations and at the top of foundation walls. Installation of sealant is a generally accepted method for reducing air leakage in buildings.

The program will target all existing low rise residential customers in all 3 service regions.

Target Stakeholders:

- Building owners who pay for operating expenditures
- Housing authorities that subsidize operating costs of building occupants

Time Frame:

Start in 2006, with incentives ending in 2008.

Additional Information:

- This Action complements activities envisioned under Actions R1, R2 and R3. This Action could be "piggybacked" to the retrofit installation of condensing furnaces, water heaters or high efficiency heater fireplaces in existing homes.

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.***			
Economic Savings Potential in Period *(GJ/year)*	*05/06*: ✓ *10/11*: ✓ *15/16*: ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗	✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**			
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓	✗ **To be discussed during the workshop**			
Approximate Svgs per Participant e.g., Dwelling *(GJ/year)*	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate ***(% of Applicable Dwellings in Period)*** **Most Likely**	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Upper	✗ ✗ ✗				
Action Savings, by Milestone Year (GJ/year) **Most Likely**	*05/06* / *10/11* / *15/16* *Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R9 – Ultra Efficient New High Rise Apartments

Overview:

This Action will promote high performance new construction through the application of an integrated design approach (IDA) in all new high rise apartment buildings. The goal is to design large buildings that on average use 60% less energy than the Model New Energy Code Building (MNECB).

The broad strategy for this Action assumes that the current BC Hydro roll out provides good opportunity for collaboration; one that will enable builders to address total energy options (not just electricity) and will provide opportunities for program administrative efficiencies. It will include:

- Promotional efforts in collaboration with Power Smart High Performance Buildings program.
- Efforts to facilitate a team approach to designing buildings (Engineers, architects, LEED consultants, contractors)
- Customized incentives.

Implementation of this Action would be co-ordinated with the Commercial Sector Action (C1), which targets the same opportunity within large and medium commercial buildings. Although the changes required to the design process within the IDA are economic, they represent a significant departure from today's conventional practices. Consequently, it is assumed that short-term market penetration of this Action will be limited.

Target Technologies and Sub Segments:

- Integrated design approach –new high rise apartment buildings

Ultra low energy designs attain high performance levels through application of IDA coupled with a high degree of weather integration via passive cooling, natural or hybrid ventilation designs and use of renewable technologies. A common element of these ultra low energy designs is the use of a displacement ventilation (DV) system with radiant cooling.

Target Stakeholder Group:

- Design community including architects and M&E's
- Owners, developers, facility managers, BOMA members

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers to the design of high performance commercial buildings through the application of IDA is:

- IDA service availability – true IDA is difficult to implement and designers are uncomfortable with the notion of optimizing (i.e.: reducing) equipment to take advantage of the trade-offs. If the building systems fail to provide the necessary comfort to occupants the costs of upgrading systems is significant.
- Split incentive. For spec buildings, additional construction costs may be hard to pass on to purchasers. The ability to pass on the electricity costs to tenants reduces the incentive to developers and owners.
- Transaction costs for the additional studies of the systems
- Financing for the incremental upfront cost
- Risk that the energy savings will not occur as expected.

This action will address the above barriers by combining the following interventions:

- Information and promotion – e.g.,: make owners/developers aware of the benefits of IDA
- Specialized customer support – e.g.,: provide training on lease agreement language to BOMA members
- Vendor & customer links – e.g.,: contractor/customer links; contractor certification (e.g., LEEDS)
- Technical services to customers – e.g.,: design assistance
- Trade ally training e.g.,: training of architects and designers
- Financing or developer and trade ally incentives, passed on performance achievements.
- Support of pilot developments accompanied by case studies and other promotion of successful results.

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period ***(GJ/year)***	*05/06*: ✓ *10/11*: ✓ *15/16*: ✓				
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗				
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Economic Savings	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓				
Approximate Svgs per Participant e.g., Dwelling ***(GJ/year)***	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate ***(% of Applicable Dwellings in Period)*** **Most Likely**	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Upper	*05/06*: ✗ *10/11*: ✗ *15/16*: ✗				
Action Savings, by Milestone Year (GJ/year) **Most Likely**	*05/06* / *10/11* / *15/16* *Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

Action Profile R10 – Recommissioning/Next Generation BAS in High Rise Apartments

Overview:

This Action will encourage operators of existing high rise apartment buildings to reduce space heating and electrical energy use through building HVAC and Building Automation System (BAS) recommissioning.

The broad strategy for this Action includes:

- Promotional efforts in collaboration with BC Hydro's Power Smart Partners program.
- Customized incentives
- Training and capacity development for building operators, ESCOs and service providers in the commercial sector

Implementation of this Action would be co-ordinated with the Commercial Sector Actions that target the same opportunity within large and medium commercial buildings.

Target Technologies and Sub Segments:

This Action targets HVAC equipment and BAS/FMS controls through equipment recommissioning, maintenance, and owner/operator training. The action targets all existing high rise apartments.

Key Barriers and Interventions:

- Lack of customer awareness
- Split incentive, including leasing arrangements
- Transaction cost to do the necessary audits and analysis
- Financing of the retrofits
- Perceived risk that the retrofits will not perform as promised

The Action will address the above barriers by combining the following interventions

- Information and promotion
- Financing or incentives (need to understand how the current Terasen boiler program fits into this).
- Pilot projects and case studies to address perceived risk of these technologies

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Sub Sector	Single Family Detached			Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Svgs	✓			***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	E.g., dwellings ✓ ✗						
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗						
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗						
Major Technologies & Contribution to Economic Savings	*Technology*	*% of Eco Svg*					
	Tech 1 ✓	✓					
	Tech 2 ✓	✓					
Approximate Svgs per Participant e.g., Dwelling *(GJ/year)*	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate ***(% of Applicable Dwellings in Period)***	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

Residential
Fuel Choice
Action Profiles

Action Profile RFC 1 – Space Heating Conversion

Overview:

This Action will encourage residential customers to choose natural gas to meet their space heating needs. For existing electrically heated homes, this will mean choosing a high efficiency natural gas furnace instead of forced air electric furnace at the time of replacement. For new construction, the target population will be the 20% to 30% of new residential construction that is currently choosing electric space heating.

The broad strategy for this Action will be very similar to that outlined previously in Action R1– High Efficiency Furnaces. It includes:

- Strong up-front promotional and education efforts directed towards customers, vendors and trade allies; in the existing market, this will include promotion of early replacement.
- Enhanced financial incentives.

Target Technologies and Sub Segments:

- Condensing furnaces that meet the Energy Star rating (92% AFUE or higher). Furnaces may have a PSC or ECM motor.
- This technology applies to SFD/Duplexes and row housing in all 3 service regions.
- Early replacement assumes that existing furnaces become candidates for retrofit at 75% of rated life span (i.e., after 15 years)

It is recognized that many existing electric forced-air furnaces are being replaced by electric heat pumps that also provide air conditioning.

Target Stakeholder Group:

- Program developers for new construction.
- People planning to purchase or build a new house.
- Heating contractors who sell into the replacement market.
- Homeowners with electric furnaces who have access to gas, especially if it is a recent main extension.

Key Barriers and Interventions:

Experience indicates that the most significant barriers affecting this opportunity are:

- Retrofit
  - Technical barriers such as lack of a condensate drain and / or difficulty in venting the furnace.
  - Small duct work in older homes may make retrofit difficult (requires high airflow with associated noise)
- New Construction
  - Split incentive, developers do not believe that there is sufficient interest from purchasers to allow them to recover their costs.
  - Architectural limitations for ductwork or heating system installation.

This Action will address these barriers by combining the following interventions:

- *Retrofit*
- Advertising and promotion to raise awareness of the alternatives and benefits of natural gas.
- Terasen incentive program.

- *New Construction*
  - Advertising and promotion to raise awareness of the alternatives and benefits of natural gas
  - Work with Housing Agencies to consider operating cost in heating system selection for new construction.

Time Frame:

Current incentive programs to be extended, and possibly enhanced, through to 2010.

Additional Information:

- Available information indicates that about 65% of Terasen customers use natural gas as the primary space heating fuel (75% SFD, 62% Row Housing, 32% Apt).
- The share of existing electrically heated homes that have forced air systems is estimated to be < 5%.

Sub Sector	**Single Family Detached**			**Attached**	**Low Rise Apartment**	**High Rise Apartment**	**Mobile/Other**
Approx % of Action Impacts	✓			***The approach shown for single family detached will be applied to the remaining sub-sectors.*** ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Potential Natural Gas Increase in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	E.g., dwellings ✓ ✗						
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗						
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗						
Major Technologies & Contribution to Increased Natural Gas Use	*Technology*	*% of Eco Svg*					
	Tech 1 ✓	✓					
	Tech 2 ✓	✓					
Approximate Increase in Gas Use per Participant e.g., Dwelling *(GJ/year)*	✓						
Gas Use Adjustment Factor, if applicable	✗ *Comments re: above approximate gas use levels.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate *(% of Applicable Dwellings in Period)*	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Impacts, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

Action Profile RFC 2 – DHW Conversion

Overview:

This Action will encourage the choice of natural gas water heating in those new homes with natural gas service that would otherwise select electric DHW. It is also directed towards those homes that choose to participant in the preceding Action RFC-1, Space Heating Conversion.

The broad strategy for this Action will be very similar to that outlined previously in Action R1– High Efficiency Furnaces. It includes:

- Strong up-front promotional and education efforts directed towards customers, vendors and trade allies
- Financial incentives.

Target Technologies and Sub Segments:

- Natural gas DHW storage tanks and instantaneous water heaters
- This technology applies primarily to new SFD/Duplex and Row Houses, gas and electric heated homes, in all 3 service regions.

Target Stakeholder Group:

- Developers and builders of new housing
- Plumbing contractors and dealers
- Home improvement / building supply stores.

Key Barriers and Interventions:

- Requirement for a flue, if a natural gas furnace is not installed.

This Action will address the barriers by combining the following interventions

- Advertising and promotion to raise awareness of the alternatives and benefits of natural gas
- Work with Housing Agencies to consider operating cost in heating system selection for new construction.

Time Frame:

Start-up promotion in 2006 with promotion to 2010.

Additional Information:

- Promotion of this Action could be combined with the Space Heating Conversion Action (RFC1).
- Available information indicates that about 75% of new construction uses natural gas DHW. (SFD 80%, Row Houses & Apt. 70%)

Sub Sector	Single Family Detached	Attached	Low Rise Apartment	High Rise Apartment	Mobile/Other
Approx % of Action Impacts	✓				
Potential Natural Gas Increase in Period *(GJ/year)*	*05/06* ✓ *10/11* ✓ *15/16* ✓	***The approach shown for single family detached will be applied to the remaining sub-sectors.***			
Participant Definition	E.g., dwellings ✓ ✗				
Total Applicable Dwellings in Period	E.g., dwellings ✓ ✗	✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**			
Prime Target	E.g., existing dwelling, pre 1976 ✓ ✗				
Major Technologies & Contribution to Increased Natural Gas Use	*Technology* / *% of Eco Svg* Tech 1 ✓ / ✓ Tech 2 ✓ / ✓	✗ **To be discussed during the workshop**			
Approximate Increase in Gas Use per Participant e.g., Dwelling *(GJ/year)*	✓				
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate gas use levels.*				
Approximate Measure B/C Ratio	✓				
Approx Customer Payback (yrs)	✓				
Participation Rate *(% of Applicable Dwellings in Period)* **Most Likely**	*05/06* ✗ *10/11* ✗ *15/16* ✗				
Upper	✗ ✗ ✗				
Action Impacts, by Milestone Year (GJ/year) **Most Likely**	*05/06* *10/11* *15/16* *Calculated based on above inputs*				
Upper	*Calculated based on above inputs*				

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APPENDIX E

Achievable Action Worksheets

Residential Sector Achievable Action Worksheet: R1 - High Efficiency Furnaces, Existing

Sub Sector	Existing Detached			Existing Attached			Existing Low Rise			Existing High Rise			Existing Other		
Approx % of Action Savings	86%			6%			0%			0%			9%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	555	1,592	2,370	26	94	158	-	-	-	-	-	-	42	144	239
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	38	110	164	3	12	19	0	0	0	0	0	0	3	10	17
Annual Applicable Dwellings ('000s)	19	14	11	2	2	2	0	0	0	0	0	0	1	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Condensing Furnace	100%		Condensing Furnace	100%		N/A	100%		N/A	100%		Condensing Furnace	100%	
Approx Svgs/ Dwelling (GJ/yr)	14			8			0			0			14		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.5			0.9			0.0			0.0			1.5		
Approx. Customer Payback (yrs)	4.0			7.1			0.0			0.0			4.2		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*25*	*33*	*58*	*25*	*25*	*44*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*25*	*44*
Upper	*25*	*67*	*83*	*25*	*50*	*63*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*50*	*63*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*139*	*669*	*1521*	*6*	*30*	*76*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*46*	*115*
Upper	*139*	*1200*	*2114*	*6*	*54*	*105*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*82*	*160*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*623*	*1,830*	*2,767*
Most Likely	*156*	*746*	*1,712*
Upper	*156*	*1,336*	*2,379*

Residential Sector Achievable Action Worksheet: R1 - High Efficiency Furnaces, New

Sub Sector	New Detached			New Attached			New Low Rise			New High Rise			New Other		
Approx % of Action Savings	79%			13%			0%			0%			8%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	142	478	754	18	68	123	-	-	-	-	-	-	11	43	78
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	14	46	73	2	8	15	0	0	0	0	0	0	1	4	8
Annual Applicable Dwellings ('000s)	7	7	5	1	1	1	0	0	0	0	0	0	1	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Furnace w/o ECM Motor	100%		Furnace w/o ECM Motor	100%		N/A	100%		N/A	100%		Furnace w/o ECM Motor	100%	
Approx Svgs/ Dwelling (GJ/yr)	10			8			0			0			10		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.1			0.9			0.0			0.0			1.1		
Approx. Customer Payback (yrs)	5.6			6.9			0.0			0.0			5.8		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*25*	*30*	*80*	*25*	*15*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*15*	*40*
Upper	*25*	*70*	*100*	*25*	*35*	*50*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*35*	*50*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*36*	*179*	*639*	*4*	*15*	*54*	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*9*	*34*
Upper	*36*	*370*	*790*	*4*	*28*	*66*	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*18*	*42*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*171*	*589*	*956*
Most Likely	*43*	*203*	*727*
Upper	*43*	*416*	*898*

Residential Sector Achievable Action Worksheet: R2 - Efficient Fireplaces, Existing

Sub Sector	Existing Detached			Existing Attached			Existing Low Rise			Existing High Rise			Existing Other		
Approx % of Action Savings	66%			7%			14%			6%			7%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	315	1,085	1,838	31	107	184	64	224	384	29	100	171	32	113	193
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	64	222	376	6	22	38	13	46	79	6	20	35	7	23	40
Annual Applicable Dwellings ('000s)	32	32	31	3	3	3	7	7	7	3	3	3	3	3	3
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Fireplace	100%		Fireplace	100%		Fireplace	100%		Fireplace	100%		Fireplace	100%	
Approx Svgs/ Dwelling (GJ/yr)	5			5			5			5			5		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	N/A			N/A			N/A			N/A			N/A		
Approx. Customer Payback (yrs)	2.9			2.9			0.0			0.0			2.9		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*5*	*30*	*0*	*5*	*30*	*0*	*10*	*10*	*0*	*10*	*10*	*0*	*5*	*30*
Upper	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*30*	*30*	*0*	*30*	*30*	*0*	*25*	*50*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*54*	*551*	*0*	*5*	*55*	*0*	*22*	*38*	*0*	*10*	*17*	*0*	*6*	*58*
Upper	*0*	*271*	*919*	*0*	*27*	*92*	*0*	*67*	*115*	*0*	*30*	*51*	*0*	*28*	*97*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*470*	*1,629*	*2,770*
Most Likely	*0*	*98*	*720*
Upper	*0*	*424*	*1,274*

Residential Sector Achievable Action Worksheet: R2 - Efficient Fireplaces, New

Sub Sector	New Detached			New Attached			New Low Rise			New High Rise			New Other		
Approx % of Action Savings	69%			9%			11%			5%			6%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	79	305	592	11	42	80	12	46	92	6	21	40	6	24	50
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	16	62	121	2	9	16	3	9	19	1	4	8	1	5	10
Annual Applicable Dwellings ('000s)	8	9	12	1	1	2	1	1	2	1	1	1	1	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Fireplace	100%		Fireplace	100%		Fireplace	100%		Fireplace	100%		Fireplace	100%	
Approx Svgs/ Dwelling (GJ/yr)	5			5			5			5			5		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	N/A			N/A			N/A			N/A			N/A		
Approx. Customer Payback (yrs)	2.9			2.9			0.0			0.0			2.9		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*10*	*30*	*0*	*10*	*30*	*0*	*3*	*3*	*0*	*3*	*3*	*0*	*10*	*30*
Upper	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*5*	*5*	*0*	*5*	*5*	*0*	*25*	*50*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*31*	*178*	*0*	*4*	*24*	*0*	*1*	*3*	*0*	*1*	*1*	*0*	*2*	*15*
Upper	*0*	*76*	*296*	*0*	*10*	*40*	*0*	*2*	*5*	*0*	*1*	*2*	*0*	*6*	*25*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*114*	*438*	*854*
Most Likely	*0*	*39*	*221*
Upper	*0*	*96*	*368*

Residential Sector Achievable Action Worksheet: R3 - Efficient DHW Eqpt, Existing

Sub Sector	Existing Detached			Existing Attached			Existing Low Rise			Existing High Rise			Existing Other		
Approx % of Action Savings	80%			3%			9%			8%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	-	639	1,508	-	20	49	21	107	168	18	95	150	-	0	0
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	0	46	108	0	2	6	32	111	168	13	46	70	0	0	0
Annual Applicable Dwellings ('000s)	0	9	12	0	0	1	16	16	11	7	7	5	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Integrated Htg & DHW	100%		Integrated Htg & DHW	100%		DHW Boilers	18%		DHW Boilers	18%		Integrated Htg & DHW	100%	
							DHW Heaters	82%		DHW Heaters	82%				
Approx Svgs/ Dwelling (GJ/yr)	14			8			1			2			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.0			1.2			2.1			2.1			0.0		
Approx. Customer Payback (yrs)	3.3			5.5			2.1			2.1			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*4*	*10*	*0*	*4*	*10*	*0*	*0*	*0*
Upper	*0*	*1*	*2*	*0*	*1*	*2*	*0*	*20*	*50*	*0*	*20*	*50*	*0*	*0*	*0*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*15*	*0*	*0*	*0*	*0*	*4*	*17*	*0*	*4*	*15*	*0*	*0*	*0*
Upper	*0*	*6*	*30*	*0*	*0*	*1*	*0*	*21*	*84*	*0*	*19*	*75*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*39*	*860*	*1,874*
Most Likely	*0*	*8*	*47*
Upper	*0*	*47*	*190*

Residential Sector Achievable Action Worksheet: R3 - Efficient DHW Eqpt, New

Sub Sector	New Detached			New Attached			New Low Rise			New High Rise			New Other		
Approx % of Action Savings	95%			5%			0%			0%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	-	109	471	-	5	23	-	-	-	-	-	-	-	0	0
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	0	11	47	0	1	3	0	0	0	0	0	0	0	0	0
Annual Applicable Dwellings ('000s)	0	2	7	0	0	0	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Integrated Htg & DHW	100%		Integrated Htg & DHW	100%		DHW Boilers	0%		DHW Boilers	0%		Integrated Htg & DHW	100%	
							DHW Heaters	0%		DHW Heaters	0%				
Approx Svgs/ Dwelling (GJ/yr)	10			9			0			0			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.6			1.2			0.0			0.0			0.0		
Approx. Customer Payback (yrs)	4.2			5.4			0.0			0.0			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*10*	*14*	*0*	*10*	*14*	*0*	*0*	*0*
Upper	*0*	*1*	*2*	*0*	*1*	*2*	*0*	*12*	*16*	*0*	*12*	*16*	*0*	*0*	*0*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*5*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*1*	*9*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*0*	*114*	*494*
Most Likely	*0*	*0*	*5*
Upper	*0*	*1*	*10*

Residential Sector Achievable Action Worksheet: R4 - DHW Load Reduction, Existing

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Savings	79%			8%			2%			2%			10%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	714	660	608	68	63	59	10	15	16	9	14	15	74	74	74
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	412	380	350	47	44	41	15	22	23	13	19	21	44	43	43
Annual Applicable Dwellings ('000s)	206	0	0	23	0	0	7	1	0	7	1	0	22	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Low Flow	66%		Low Flow	66%		Low Flow	100%		Low Flow	100%		Low Flow	65%	
	Pipe Wrap	34%		Pipe Wrap	34%		Pipe Wrap	0%		Pipe Wrap	0%		Pipe Wrap	35%	
Approx Svgs/ Dwelling (GJ/yr)	2			1			1			1			2		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	4.1			3.4			1.7			1.7			4.0		
Approx. Customer Payback (yrs)	0.9			1.1			2.2			2.2			0.9		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*15*	*30*	*0*	*15*	*30*	*0*	*15*	*30*	*0*	*15*	*30*	*0*	*15*	*30*
Upper	*0*	*30*	*60*	*0*	*30*	*60*	*0*	*30*	*60*	*0*	*30*	*60*	*0*	*30*	*60*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*99*	*182*	*0*	*10*	*18*	*0*	*2*	*5*	*0*	*2*	*4*	*0*	*11*	*22*
Upper	*0*	*198*	*365*	*0*	*19*	*36*	*0*	*5*	*10*	*0*	*4*	*9*	*0*	*22*	*44*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*876*	*826*	*772*
Most Likely	*0*	*124*	*232*
Upper	*0*	*248*	*463*

Residential Sector Achievable Action Worksheet: R4 - DHW Load Reduction, New

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Savings	81%			11%			0%			0%			8%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	11	40	69	1	5	9	-	-	-	-	-	-	1	4	7
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	17	63	108	2	10	17	0	0	0	0	0	0	1	6	11
Annual Applicable Dwellings ('000s)	9	9	9	1	1	2	0	0	0	0	0	0	1	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Pipe Wrap	100%		Pipe Wrap	100%								Pipe Wrap	100%	
Approx Svgs/ Dwelling (GJ/yr)	1			1			0			0			1		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	4.2			3.5			2.6			2.6			4.1		
Approx. Customer Payback (yrs)	0.6			0.7			0.0			0.0			0.6		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*50*	*50*	*0*	*50*	*50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*50*	*50*
Upper	*0*	*100*	*100*	*0*	*100*	*100*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*100*	*100*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*20*	*34*	*0*	*3*	*5*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*3*
Upper	*0*	*40*	*69*	*0*	*5*	*9*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*7*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*13*	*48*	*85*
Most Likely	*0*	*24*	*42*
Upper	*0*	*48*	*85*

Residential Sector Achievable Action Worksheet: R5 - DHW Heat Recovery and Heat Traps, Existing

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Savings	75%			7%			4%			4%			9%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	1,023	945	872	96	90	84	24	40	49	21	36	44	110	109	109
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	469	433	399	53	50	46	5	8	10	4	7	9	51	51	51
Annual Applicable Dwellings ('000s)	234	0	0	26	0	0	2	1	0	2	1	0	26	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Heat Trap	100%		Heat Trap	100%		Heat Recovery	27%		Heat Recovery	27%		Heat Trap	100%	
							Heat Trap	73%		Heat Trap	73%				
Approx Svgs/ Dwelling (GJ/yr)	2			2			5			5			2		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.6			1.3			1.1			1.1			1.6		
Approx. Customer Payback (yrs)	2.8			3.4			4.4			4.4			2.9		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*2*	*2*	*0*	*2*	*2*	*0*	*2*	*2*	*0*	*2*	*2*	*0*	*2*	*2*
Upper	*0*	*3*	*3*	*0*	*3*	*3*	*0*	*3*	*3*	*0*	*3*	*3*	*0*	*3*	*3*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*19*	*17*	*0*	*2*	*2*	*0*	*1*	*1*	*0*	*1*	*1*	*0*	*2*	*2*
Upper	*0*	*28*	*26*	*0*	*3*	*3*	*0*	*1*	*1*	*0*	*1*	*1*	*0*	*3*	*3*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*1,273*	*1,221*	*1,157*
Most Likely	*0*	*24*	*23*
Upper	*0*	*37*	*35*

Residential Sector Achievable Action Worksheet: R6 - Efficient Appliances, Existing

Sub Sector	Existing Detached			Existing Attached			Existing Low Rise			Existing High Rise			Existing Other		
Approx % of Action Savings	77%			8%			3%			3%			9%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	646	1,858	2,186	63	184	219	14	66	91	13	60	82	63	197	252
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	212	611	719	25	74	89	8	39	53	8	36	49	21	66	84
Annual Applicable Dwellings ('000s)	106	80	22	13	10	3	4	6	3	4	6	3	11	9	4
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Washer	90%		Washer	90%		Washer	90%		Washer	90%		Washer	90%	
	Dishwasher	10%		Dishwasher	10%		Dishwasher	10%		Dishwasher	10%		Dishwasher	10%	
Approx Svgs/ Dwelling (GJ/yr)	3			2			2			2			3		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.6			1.3			0.9			0.9			1.5		
Approx. Customer Payback (yrs)	2.4			3.0			4.4			4.4			2.5		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*46*	*68*	*0*	*46*	*68*	*0*	*33*	*44*	*0*	*33*	*44*	*0*	*46*	*68*
Upper	*0*	*59*	*81*	*0*	*59*	*81*	*0*	*39*	*52*	*0*	*39*	*52*	*0*	*59*	*81*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*855*	*1480*	*0*	*85*	*149*	*0*	*22*	*40*	*0*	*20*	*36*	*0*	*91*	*170*
Upper	*0*	*1093*	*1760*	*0*	*108*	*177*	*0*	*26*	*47*	*0*	*24*	*43*	*0*	*116*	*203*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*799*	*2,366*	*2,830*
Most Likely	*0*	*1,071*	*1,876*
Upper	*0*	*1,366*	*2,228*

Residential Sector Achievable Action Worksheet: R6 - Efficient Appliances, New

Sub Sector	New Detached			New Attached			New Low Rise			New High Rise			New Other		
Approx % of Action Savings	79%			11%			2%			1%			7%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	29	322	712	4	43	101	0	4	14	0	4	13	2	26	65
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	10	109	241	1	18	42	0	3	9	0	2	8	1	9	23
Annual Applicable Dwellings ('000s)	5	20	26	1	3	5	0	1	1	0	0	1	0	2	3
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Washer	90%		Washer	90%		Washer	90%		Washer	90%		Washer	90%	
	Dishwasher	10%		Dishwasher	10%		Dishwasher	10%		Dishwasher	10%		Dishwasher	10%	
Approx Svgs/ Dwelling (GJ/yr)	3			2			2			2			3		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.5			1.2			0.8			0.8			1.5		
Approx. Customer Payback (yrs)	2.5			3.1			4.6			4.6			2.6		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*46*	*68*	*0*	*46*	*68*	*0*	*33*	*44*	*0*	*33*	*44*	*0*	*46*	*68*
Upper	*0*	*59*	*81*	*0*	*59*	*81*	*0*	*39*	*52*	*0*	*39*	*52*	*0*	*59*	*81*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*148*	*482*	*0*	*20*	*68*	*0*	*1*	*6*	*0*	*1*	*6*	*0*	*12*	*44*
Upper	*0*	*190*	*573*	*0*	*26*	*81*	*0*	*2*	*7*	*0*	*1*	*7*	*0*	*15*	*52*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*35*	*400*	*904*
Most Likely	*0*	*183*	*606*
Upper	*0*	*234*	*720*

Residential Sector Achievable Action Worksheet: R7 - Efficient Windows

Sub Sector	New Detached			New Attached			New Low Rise			New High Rise			New Other		
Approx % of Action Savings	87%			13%			0%			0%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	212	711	1,123	24	94	173	-	-	-	-	-	-	-	0	0
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	14	47	74	3	11	21	0	0	0	0	0	0	0	0	0
Annual Applicable Dwellings ('000s)	7	7	5	1	2	2	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Windows	100%		Windows	100%		N/A	100%		N/A	100%		Windows	100%	
Approx Svgs/ Dwelling (GJ/yr)	15			8			0			0			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			0.9			0.0			0.0			0.0		
Approx. Customer Payback (yrs)	6.6			8.1			0.0			0.0			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*50*	*75*	*0*	*50*	*75*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*50*	*75*
Upper	*0*	*60*	*100*	*0*	*60*	*100*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*60*	*100*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*356*	*842*	*0*	*47*	*130*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*427*	*1123*	*0*	*56*	*173*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*236*	*805*	*1,296*
Most Likely	*0*	*402*	*972*
Upper	*0*	*483*	*1,296*

Residential Sector Achievable Action Worksheet: R8 - Air Sealing, Existing

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Savings	100%			0%			0%			0%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	254	729	1,085	-	-	-	-	-	-	-	-	-	-	0	0
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	22	64	95	0	0	0	0	0	0	0	0	0	0	0	0
Annual Applicable Dwellings ('000s)	11	8	6	0	0	0	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*
Contribution to Economic Savings	Air Sealing		100%	Air Sealing		100%	N/A		100%	N/A		100%	Air Sealing		100%
Approx Svgs/ Dwelling (GJ/yr)	11			0			0			0			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.0			0.0			0.0			0.0			0.0		
Approx. Customer Payback (yrs)	7.3			0.0			0.0			0.0			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*5*	*10*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*10*	*15*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*36*	*109*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*73*	*163*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*254*	*729*	*1,085*
Most Likely	*0*	*36*	*109*
Upper	*0*	*73*	*163*

Residential Sector Achievable Action Worksheet: R8 - Air Sealing, New

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Savings	100%			0%			0%			0%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	8	94	248	-	-	-	-	-	-	-	-	-	-	0	0
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	1	11	28	0	0	0	0	0	0	0	0	0	0	0	0
Annual Applicable Dwellings ('000s)	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	Air Sealing	100%		Air Sealing	100%		N/A	100%		N/A	100%		Air Sealing	100%	
Approx Svgs/ Dwelling (GJ/yr)	9			0			0			0			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.0			0.0			0.0			0.0			0.0		
Approx. Customer Payback (yrs)	7.1			0.0			0.0			0.0			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*10*	*30*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*25*	*50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*9*	*74*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*23*	*124*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*8*	*94*	*248*
Most Likely	*0*	*9*	*74*
Upper	*0*	*23*	*124*

Residential Sector Achievable Action Worksheet: R9 - Integrated Design of New Buildings

Sub Sector	**Detached**			**Attached**			**Low Rise**			**High Rise**			**Other**		
Approx % of Action Savings	0%			0%			42%			58%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	-	-	-	-	-	-	10	96	227	42	169	316	-	-	-
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	0	0	0	0	0	0	5	14	15	2	6	6	0	0	0
Annual Applicable Dwellings ('000s)	0	0	0	0	0	0	3	2	0	1	1	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	N/A	100%		N/A	100%		Heating	84%		Heating	90%		N/A	100%	
							DHW	16%		DHW	10%				
Approx Svgs/ Dwelling (GJ/yr)	0			0			15			50			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	0.0			0.0			1.2			1.2			0.0		
Approx. Customer Payback (yrs)	0.0			0.0			4.1			4.1			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*20*	*0*	*10*	*20*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*20*	*40*	*0*	*20*	*40*	*0*	*0*	*0*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*45*	*0*	*17*	*63*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*19*	*91*	*0*	*34*	*126*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*53*	*264*	*542*
Most Likely	*0*	*26*	*108*
Upper	*0*	*53*	*217*

Residential Sector Achievable Action Worksheet: R10 - Building Operations

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Savings	0%			0%			48%			52%			0%		
Eco Savings (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	-	-	-	-	-	-	26	97	125	28	105	135	-	0	0
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	0	0	0	0	0	0	33	115	164	16	54	78	0	0	0
Annual Applicable Dwellings ('000s)	0	0	0	0	0	0	16	16	10	8	8	5	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Savings	N/A	100%		N/A	100%		Building Operations	100%		Building Operations	100%		N/A	100%	
Approx Svgs/ Dwelling (GJ/yr)	0			0			1			2			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	0.0			0.0			1.1			1.1			0.0		
Approx. Customer Payback (yrs)	0.0			0.0			4.5			4.5			0.0		
Participation Rate (% of Eco svgs)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*15*	*15*	*0*	*15*	*15*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*25*	*0*	*25*	*25*	*0*	*0*	*0*
Action Savings, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*15*	*19*	*0*	*16*	*20*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*24*	*31*	*0*	*26*	*34*	*0*	*0*	*0*

Total Savings, by Year (thousand GJ/yr)	2006	2011	2016
Economic Savings	*54*	*202*	*261*
Most Likely	*0*	*30*	*39*
Upper	*0*	*51*	*65*

Residential Sector Achievable Action Worksheet: RFC1 - Space Heating Fuel Choice, Existing

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Gas Increase	86%			7%			0%			0%			7%		
Natural Gas Increase (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	152	514	853	13	44	73	-	-	-	-	-	-	12	40	67
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	2	8	14	0	1	2	0	0	0	0	0	0	0	1	1
Annual Applicable Dwellings ('000s)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Gas Increase	Heating	100%		Heating	100%		N/A			N/A			Heating	100%	
Approx Increase/ Dwelling (GJ/yr)	63			40			0			0			60		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	3.1			3.0			0.0			0.0			3.1		
Approx. Customer Payback (yrs)	-1.4			-1.8			0.0			0.0			-1.4		
Participation Rate (% of Eco increase)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*25*	*25*	*0*	*25*	*25*	*0*	*25*	*25*	*0*	*25*	*25*	*0*	*25*	*25*
Upper	*0*	*70*	*70*	*0*	*70*	*70*	*0*	*70*	*70*	*0*	*70*	*70*	*0*	*70*	*70*
Action Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*129*	*213*	*0*	*11*	*18*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*17*
Upper	*0*	*360*	*597*	*0*	*31*	*51*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*28*	*47*

Total Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016
Economic Increase	*177*	*598*	*993*
Most Likely	*0*	*150*	*248*
Upper	*0*	*419*	*695*

Residential Sector Achievable Action Worksheet: RFC1 - Space Heating Fuel Choice, New

Sub Sector	**Detached**			**Attached**			**Low Rise**			**High Rise**			**Other**		
Approx % of Action Gas Increase	85%			12%			0%			0%			3%		
Natural Gas Increase (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	306	1,165	2,109	42	158	288	-	-	-	-	-	-	10	43	84
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	6	24	44	1	3	6	0	0	0	0	0	0	0	1	2
Annual Applicable Dwellings ('000s)	3	4	4	0	1	1	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Gas Increase	Heating	100%		Heating	100%		N/A			N/A			Heating	100%	
Approx Increase/ Dwelling (GJ/yr)	48			46			0			0			48		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.7			1.6			0.0			0.0			1.7		
Approx. Customer Payback (yrs)	10.4			7.5			0.0			0.0			10.0		
Participation Rate (% of Eco increase)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*25*	*25*	*0*	*25*	*25*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*25*
Upper	*0*	*70*	*70*	*0*	*70*	*70*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*70*	*70*
Action Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*291*	*527*	*0*	*40*	*72*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*11*	*21*
Upper	*0*	*816*	*1476*	*0*	*111*	*202*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*30*	*59*

Total Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016
Economic Increase	*357*	*1,367*	*2,481*
Most Likely	*0*	*342*	*620*
Upper	*0*	*957*	*1,737*

Residential Sector Achievable Action Worksheet: RFC2 - DHW Fuel Choice, New

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Gas Increase	80%			14%			0%			0%			6%		
Natural Gas Increase (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	201	810	1,463	36	140	261	-	-	-	-	-	-	14	60	109
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	10	40	73	2	8	15	0	0	0	0	0	0	1	3	6
Annual Applicable Dwellings ('000s)	5	6	6	1	1	1	0	0	0	0	0	0	0	0	0
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Gas Increase	Heating	100%		Heating	100%		N/A			N/A			Heating	100%	
Approx Increase/ Dwelling (GJ/yr)	20			18			0			0			20		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.1			0.0			0.0			1.1		
Approx. Customer Payback (yrs)	-10.6			-16.0			0.0			0.0			-11.5		
Participation Rate (% of Eco increase)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Total Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016
Economic Increase	*251*	*1,011*	*1,833*
Most Likely	*0*	*0*	*0*
Upper	*0*	*0*	*0*

Residential Sector Achievable Action Worksheet: RFC3 - Cooking Fuel Choice, New

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Gas Increase	69%			9%			11%			5%			5%		
Natural Gas Increase (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	361	836	1,351	53	110	176	98	157	223	43	69	98	30	67	106
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	42	97	157	8	16	25	14	23	32	6	10	14	4	8	13
Annual Applicable Dwellings ('000s)	21	11	12	4	2	2	7	2	2	3	1	1	2	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Gas Increase	Cooking	100%		Cooking	100%		Cooking	100%		Cooking	100%		Cooking	100%	
Approx Increase/ Dwelling (GJ/yr)	9			7			7			7			8		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.1			1.1			1.1			1.1			1.1		
Approx. Customer Payback (yrs)	0.0			0.0			0.0			0.0			0.0		
Participation Rate (% of Eco increase)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*5*	*10*	*0*	*5*	*10*	*0*	*5*	*10*	*0*	*5*	*10*	*0*	*5*	*10*
Upper	*0*	*10*	*20*	*0*	*10*	*20*	*0*	*10*	*20*	*0*	*10*	*20*	*0*	*10*	*20*
Action Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*42*	*135*	*0*	*6*	*18*	*0*	*8*	*22*	*0*	*3*	*10*	*0*	*3*	*11*
Upper	*0*	*84*	*270*	*0*	*11*	*35*	*0*	*16*	*45*	*0*	*7*	*20*	*0*	*7*	*21*

Total Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016
Economic Increase	*584*	*1,239*	*1,954*
Most Likely	*0*	*62*	*195*
Upper	*0*	*124*	*391*

Residential Sector Achievable Action Worksheet: RFC4 - Dryer Fuel Choice, Existing

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Gas Increase	80%			9%			0%			0%			11%		
Natural Gas Increase (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	179	615	1,034	19	65	111	-	-	-	-	-	-	25	86	147
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	43	146	246	5	19	33	0	0	0	0	0	0	6	21	36
Annual Applicable Dwellings ('000s)	21	21	20	3	3	3	0	0	0	0	0	0	3	3	3
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Gas Increase	Heating	100%		Heating	100%		N/A			N/A			Heating	100%	
Approx Increase/ Dwelling (GJ/yr)	4			3			0			0			4		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.3			1.2			0.0			0.0			1.3		
Approx. Customer Payback (yrs)	13.8			19.1			0.0			0.0			14.4		
Participation Rate (% of Eco increase)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*10.5*	*21*	*0*	*10.5*	*21*	*0*	*10.5*	*21*	*0*	*10.5*	*21*	*0*	*10.5*	*21*
Upper	*0*	*21*	*42*	*0*	*21*	*42*	*0*	*21*	*42*	*0*	*21*	*42*	*0*	*21*	*42*
Action Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*65*	*217*	*0*	*7*	*23*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*9*	*31*
Upper	*0*	*129*	*434*	*0*	*14*	*47*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*18*	*62*

Total Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016
Economic Increase	*223*	*767*	*1,292*
Most Likely	*0*	*80*	*271*
Upper	*0*	*161*	*543*

Residential Sector Achievable Action Worksheet: RFC4 - Dryer Fuel Choice, New

Sub Sector	Detached			Attached			Low Rise			High Rise			Other		
Approx % of Action Gas Increase	83%			11%			0%			0%			6%		
Natural Gas Increase (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	187	431	695	29	59	94	-	-	-	-	-	-	15	34	54
Participant Definition	Dwellings			Dwellings			Dwellings			Dwellings			Dwellings		
Total Applicable Dwellings ('000s)	46	106	171	9	18	28	0	0	0	0	0	0	4	9	14
Annual Applicable Dwellings ('000s)	23	12	13	4	2	2	0	0	0	0	0	0	2	1	1
Prime Target	All			All			All			All			All		
Major Technologies &	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
Contribution to Economic Gas Increase	Cooking	100%		Cooking	100%		Cooking	100%		Cooking	100%		Cooking	100%	
Approx Increase/ Dwelling (GJ/yr)	4			3			0			0			4		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.1			2.0			2.0			2.0			2.1		
Approx. Customer Payback (yrs)	0.0			0.0			0.0			0.0			0.0		
Participation Rate (% of Eco increase)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*7*	*14*	*0*	*7*	*14*	*0*	*7*	*14*	*0*	*7*	*14*	*0*	*7*	*14*
Upper	*0*	*14*	*28*	*0*	*14*	*28*	*0*	*14*	*28*	*0*	*14*	*28*	*0*	*14*	*28*
Action Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*30*	*97*	*0*	*4*	*13*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*8*
Upper	*0*	*60*	*195*	*0*	*8*	*26*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*5*	*15*

Total Gas Increase, by Year (thousand GJ/yr)	2006	2011	2016
Economic Increase	*231*	*524*	*843*
Most Likely	*0*	*37*	*118*
Upper	*0*	*73*	*236*

TERASEN GAS
CONSERVATION POTENTIAL REVIEW

Commercial Sector Report

–Final Report–

Submitted to:

Terasen Gas

Submitted by:

Marbek Resource Consultants

April 2006

Marbek Resource Consultants
300-222 Somerset Street West
Ottawa, Ontario K2P 2G3
Tel: 613.523.0784 • Fax: 613.523.0717 • www.marbek.ca

EXECUTIVE SUMMARY

❑ Background and Objectives

This Conservation Potential Review (CPR) provides Terasen Gas with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long range energy efficiency and fuel choice strategy
- Design and implement energy efficiency and fuel choice programs
- Assess the impact of energy efficiency and fuel choice programs on both peak and annual load
- Set annual energy efficiency and fuel choice targets and budgets.

❑ Scope

The scope of this study was designed to coincide as much as possible with the structure and approach of the BC Hydro CPR, which was completed in 2003. The intent was to ensure that: this study would benefit from the substantial body of information and modelling work prepared for BC Hydro as part of its Conservation Potential Review – Update 2002; and, the results of this study would enable the assessment of not only energy efficiency opportunities, but also opportunities where natural gas could cost effectively replace electricity in selected markets.

Sector Coverage: The study addresses three sectors: residential (Rate 1, plus Rate 2 and 3 multi-unit buildings), commercial/institutional (Rate 2, 3 and 23 – non process loads) and manufacturing (Rate 5, 25, and Rate 3 and 23 – process loads). Terasen's 300 largest manufacturing accounts (Rate 7, 22 and 27) are outside the scope of this study.

Geographical Coverage: The study results are presented for the total Terasen Gas service region and for the three service areas of: Lower Mainland, Interior and Vancouver Island.

Study Period: The base year for this study is fiscal year FY 2003/04. The time period covered by this study is to FY 2015/16, with milestones at the intervening years of FY 2005/06 and FY 2010/11.

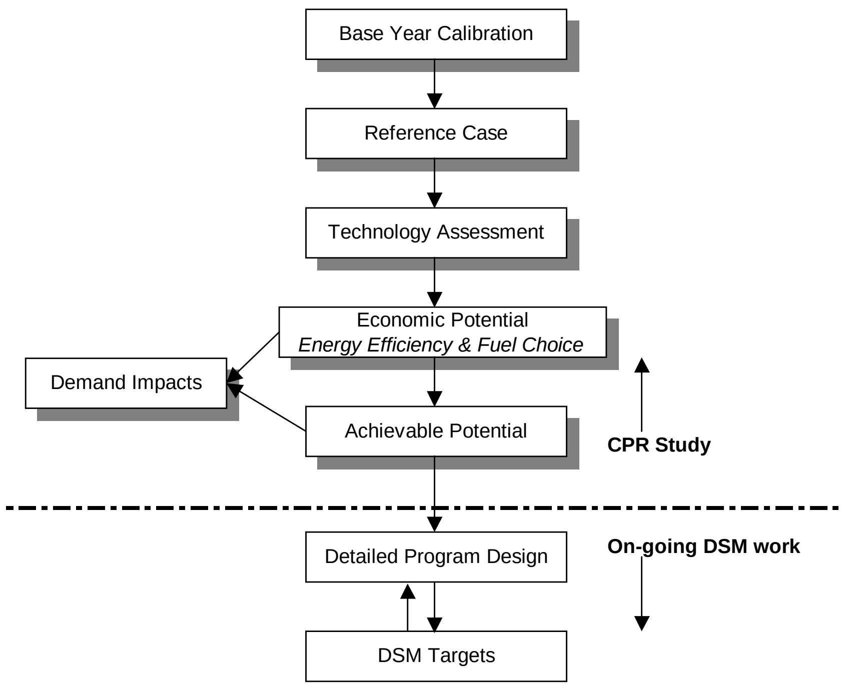
Technologies: The study addresses both energy efficiency and fuel choice options.

❑ Approach

The detailed end use analysis of the commercial sector was conducted using two linked modelling platforms: ***CEEAM*** (***C***ommercial ***E***nergy and ***E***missions ***A***nalysis ***M***odel), an in-house, simulation model, developed in conjunction with Natural Resources Canada for modelling energy use in commercial-institutional building stock; and, ***CSEEM*** (***C***ommercial ***S***ector ***E***nergy ***E***nd use ***M***odel), an in-house spreadsheet-based macro model.

The major steps involved in the analysis are shown in Exhibit E1 and are discussed in the following paragraphs. 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.

Exhibit E1
Study Approach
Major Analytical Steps



❑ Major Analytic Steps and Definitions

This study employs numerous terms that are unique to analyses such as this one; 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 of 15 large and medium building segments. Small commercial and the "Recreational and Other" segments were derived from the results of the modelled segments.

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, and, finally an estimation of "natural" changes affecting energy consumption over the study period.

Technology Assessment

Energy efficiency and fuel choice 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 base line 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 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 8%.

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 Terasen Gas's perspective, when using life-cycle costing with the long-run avoided cost of new natural gas supply. All the energy efficiency and fuel choice 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: energy efficiency and fuel choice.

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 practically difficult to induce customers to purchase and install all the energy efficiency or fuel choice options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as "Most Likely" and " Upper".

Estimates provided were developed in a workshop involving Terasen Gas and BC Hydro energy efficiency program personnel, trade allies, selected external experts and the consulting team.

Peak Day Load Impacts

Load factors provided by Terasen Gas were used to derive peak-day load impacts from the energy consumption values contained in each of the potential estimates noted above.

❑ Results and Findings – Base Year and Reference Case Forecast

Base Year Natural Gas Use

In the base year of 2003/04, Terasen Gas's commercial sector customers consumed about 31,000,000 GJ of natural gas. Exhibits E2 and E3, respectively, provide additional information on the major end uses and building segments where commercial sector natural gas consumption occurs.

Exhibit E2 shows that space heating accounts for approximately 76% of the total commercial sector natural gas use. Domestic hot water heating (14%) followed by commercial cooking (10%) account for the remaining commercial natural gas use. A small amount of natural gas (<1%) is used in miscellaneous applications such as equipment sterilization in hospitals and outdoor swimming pool heating.

Exhibit E3 shows that the small commercial segment together with the recreational and other segment account for just over 50% of commercial sector natural gas use. Among the large and medium building segments, universities and colleges, followed by large offices and large schools are the largest users.

Exhibit E2
Graphic of Base Year Natural Gas Consumption
Distribution of Use by End Use
Commercial Sector

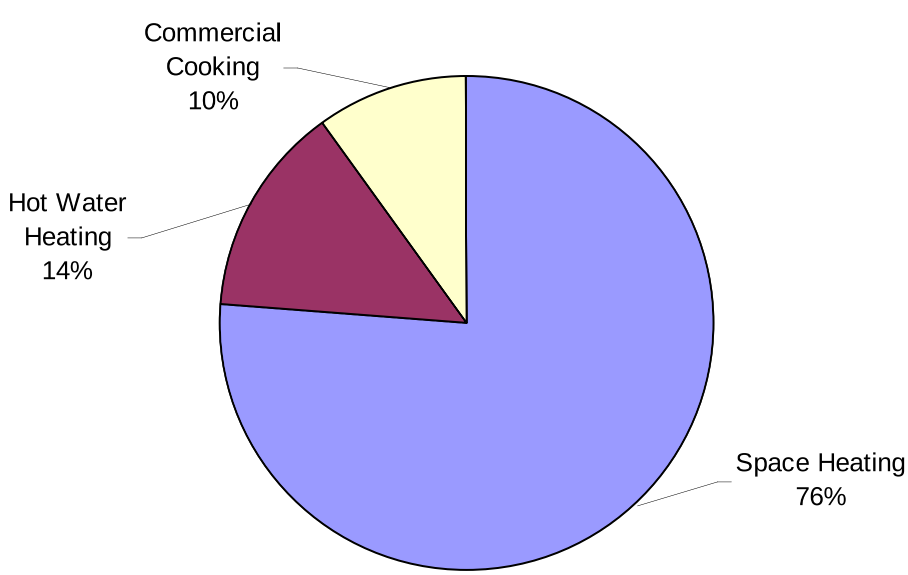
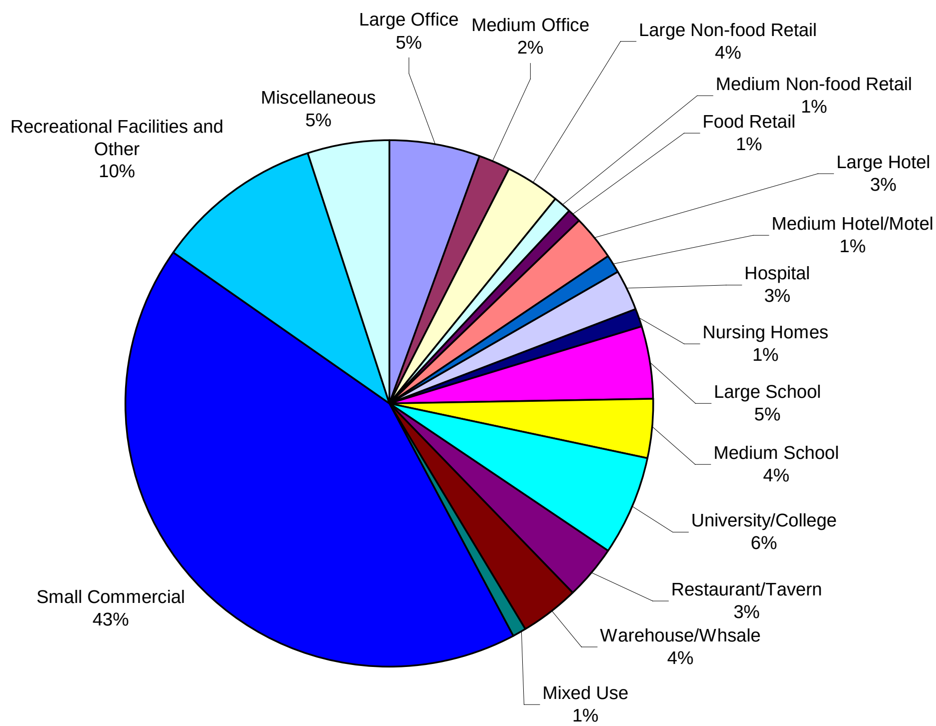


Exhibit E3
Graphic of Base Year Natural Gas Consumption
Distribution of Use by Building Segment
Commercial Sector



Reference Case

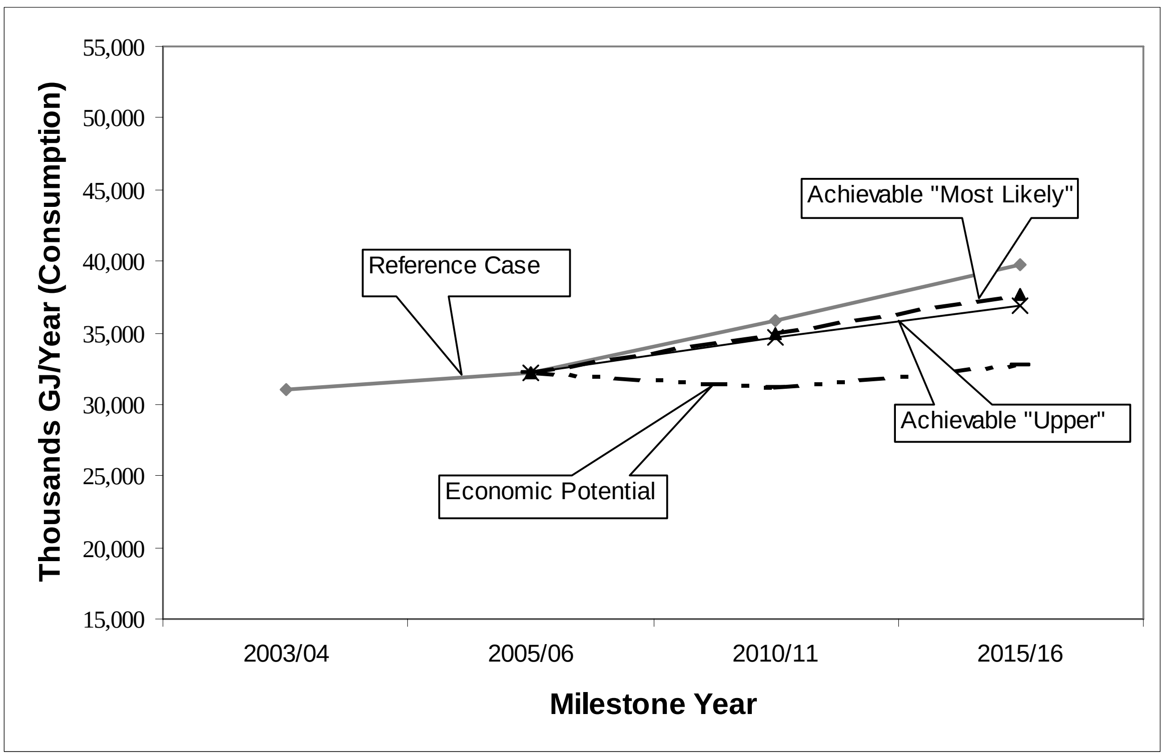
In the absence of continued demand side management (DSM) initiatives, the study estimates that natural gas consumption in the Commercial Sector will grow from the base year (FY 2003/04) consumption of approximately 31,000,000 GJ/yr. to about 36,000,000 GJ/yr. by FY 2010/11 and 39,800,00 GJ/yr. by FY 2015/16. This represents an overall growth of about 17% in the period.

❑ Results and Findings – Energy Efficiency

A summary of the levels of annual natural gas consumption contained in each of the energy efficiency forecasts, by milestone year, is presented in Exhibit E4 and discussed briefly in the paragraphs below.

Exhibit E4
Summary of Forecast Results (thousand GJ/yr.)
- Energy Efficiency-

Annual Consumption (thousands of GJ/yr.) Commercial Sector				Potential Annual Savings (thousands of GJ/yr.)		
	Base Year	Reference Case	Economic	Economic	Achievable: Most Likely	Achievable: Upper
2003/4	31,011	31,011				
2005/6		32,238				
2010/11		35,898	31,158	4,739	1,010	1,276
2015/6		39,820	32,767	7,053	2,211	2,897



Economic Potential Forecast – Energy Efficiency Scenario

Under the conditions of the Economic Potential Forecast – Energy Efficiency Scenario, the study estimated that consumption in the commercial sector would decline to about 32,800,000 GJ/yr. by FY 2015/16. Annual savings relative to the Reference Case are about 7,053,000 GJ/yr. or about 18 %. The Economic Potential annual savings are about 4,739,000 GJ/yr. in FY 2010/11.

Achievable Potential – Energy Efficiency Scenario

The natural gas savings opportunities identified in the Economic Potential Forecast were "bundled", by end use, into a set of "Actions" reflecting a way in which initiatives may be undertaken. A brief profile was developed for each of the identified Actions. The Action Profiles provided a "high-level" logic framework that guided participant discussions in a full-day workshop. The results are presented in Exhibit E5 by Action and by milestone year.

The most significant Achievable Savings opportunities were in the Actions that addressed energy efficient new construction and the replacement of standard efficiency boilers with condensing models in existing buildings.

Exhibit E5
Summary of Achievable Savings – Energy Efficiency
For Total Terasen Gas Service Area by Action and Milestone Year

Service Region / Action	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
C1 - Energy Eff. New Construction	196	288	505	764	23%
C2 - Improved Boilers, New	135	139	203	165	9%
C3 - Improved Boilers, Existing	316	339	585	665	26%
C4 - Next Gen. BAS, Existing	41	68	82	136	4%
C5 - Recommissioning, Existing	50	83	100	166	5%
C6 - EE Food Prep, New	4	5	13	19	1%
C6 - EE Food Prep, Existing	8	13	67	97	3%
C7 - Hot Water Reduction for Food Prep, Existing	23	41	45	82	2%
C8 - Small Commercial Efficiency Initiative	187	238	492	649	22%
C9 - Recreational and Other Efficiency Initiative	50	63	117	154	5%
Total TG Service Region	**1,010**	**1,276**	**2,211**	**2,897**	**100%**

Peak Day Load Impact – Achievable Energy Efficiency Scenarios

As illustrated in Exhibit E6, the peak day savings in FY 2015/16 associated with the preceding achievable energy efficiency scenarios range from a decrease of about 13,200 GJ/day (Achievable – Most Likely) to a decrease of approximately 17,300 GJ/day (Achievable - Upper) for the total Terasen Gas service region.

Exhibit E6
Summary of Peak Day Load Impacts – Energy Efficiency
For Total Terasen Gas Service Area
by Scenario and Milestone Year

Service Region & Scenario	Peak Day Saving by Milestone Year & Scenario (GJ)	
	2010/11	2015/16
Total Terasen Gas		
Achievable – Most Likely	7,634	13,216
Achievable – Upper	9,659	17,279

Greenhouse Gas Emission Reduction

The natural gas savings associated with each of the achievable potential scenarios would also result in a significant reduction of greenhouse gas emissions. Under the Most Likely scenario, the GHG reductions are estimated to be approximately 51,200 tonnes/year in FY 2010/11, increasing to approximately 112,100 tonnes/year by FY 2015/16.

❑ Results and Findings – Fuel Choice

A summary of the levels of annual natural gas consumption contained in each of the fuel choice forecasts, by milestone year, is presented in Exhibit E7 and discussed briefly in the paragraphs below.

Exhibit E7
Summary of Forecast Results (thousand GJ/yr.)
– Fuel Choice –

Annual Consumption (thousands/yr.) Commercial Sector				Potential Annual Increase (thousand GJ/yr.)		
Milestone Year	Base Year	Reference Case	Economic	Economic	Achievable	
					Most Likely	Upper
2003/04	31,011	31,011				
2005/06		32,238				
2010/11		35,898	37,047	1,150	0	0
2015/16		39,820	41,849	2,029	0	0

Economic Potential Forecast – Fuel Choice Scenario

Under the Fuel Choice Scenario, natural gas consumption grows to 41,800,000 GJ/yr. by FY 2015/16, an increase of approximately 2,000,000 GJ/yr., or about 5% relative to the Reference Case. This growth in natural gas consumption would be offset by a decrease of about 360 GWh/yr. in electricity use.

At the avoided supply costs for natural gas and electricity, the economic impact for British Columbia would be a net energy avoided cost of approximately $10.7 million dollars per year by the milestone year FY 2015/16.

Achievable Potential – Fuel Choice Scenario

Participants at the one-day Achievable Potential workshop concluded that none of the fuel choice opportunities identified in the Economic Potential Forecast is achievable. This conclusion recognized that natural gas already has a large share of the applicable space and water heating loads in this sector and, that the associated technical and financial constraints in the remaining sub markets precluded further increases in natural gas market share.

❑ Summary of Findings

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in B.C.'s commercial sector. In the "Most Likely" and "Upper" achievable scenarios those energy efficiency improvements would provide between 2,200,000 and 2,900,000 GJ/yr. of savings in FY 2015/16 as well as peak day load reductions of approximately 13,000 to 17,000 GJ/day.

The study notes that the majority of the energy savings opportunities identified for this sector involve two measures:

- Integrated designs for new construction
- Condensing space and water heating systems in both new and existing buildings.

The study concludes that if these measures are to realize their full market potential, then there is need for better training and on-going support to building owners and operators as well as building developers and design professionals.

❑ Interpretation of Results

The study findings outlined above could have significant implications for Terasen Gas. If the cost effective DSM measures identified in this study are pursued by Tersasen Gas, then:

- **A significant increase in annual DSM investment in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels.** This increased level of DSM investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario.

- **Interactions between Terasen Gas and its customers would increase very significantly.** For example, under the most likely achievable scenario, over 2000 Terasen Gas commercial customers would participate by FY 2015/16.

- **Annual GHG offsets from commercial sector natural gas savings could reach 50 to 65 kilotonnes**. At the estimated price range of $10 to $15 per tonne, these offsets could have an annual market value in the range of $0.5 million to about $1 million.

The current Terasen Gas DSM incentive mechanism provides an allowable return of 5% of the Total Resource Cost (TRC). The DSM measures identified for this sector, when combined with those identified in the residential and manufacturing sector reports, could result in a larger scale DSM effort that might have a TRC value of $30 million, or more. A TRC value of $30 million would provide a $1.5 million annual payment through the DSM incentive mechanism. If the utility was to apply for increased DSM funding levels, a larger DSM incentive mechanism or equivalent shared savings mechanism could also be considered.

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1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

The purpose of this study is to provide Terasen Gas 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.

This report provides the CPR results for the Commercial Sector; the Residential and Manufacturing sectors are presented in separate documents.

1.2 STUDY SCOPE

Sector Coverage: The study addresses three sectors: residential (Rate 1), commercial/ institutional (Rates 2, 3 and 23 – non process loads) and manufacturing (Rates 5, 25, and Rates 3 and 23 – process loads). Terasen's 300 largest manufacturing accounts (Rates 7, 22 and 27) are outside the scope of this study.

Geographical Coverage: The study results are presented for the total Terasen Gas service region and for the three service areas of: Lower Mainland, Interior and Vancouver Island.

Study Period: The base year for this study is fiscal year FY 2003/04. The time period covered by this study is to FY 2015/16, with milestones at the intervening years of FY 2005/06 and FY 2010/11.

Technologies: The study addresses both energy efficiency and fuel choice options.

Relation to BC Hydro CPR: This study builds on the substantial body of information and modelling work prepared for BC Hydro as part of its Conservation Potential Review – Update 2002. This means that, wherever possible, this study will build on the existing building and energy use data compiled for the BC Hydro study.

Combining both BC Hydro and Terasen Gas customer energy-related data into a dual-fuel model provides the opportunity for additional insight and data confidence. To maximize this opportunity, symmetry of analytic structure and data between the two studies was maintained as much as possible.

1.3 DEFINITIONS

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. Key terms include the following:

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 of 15 large and medium building segments. "Small Commercial" and the "Recreational and Other" segments were derived from the results of the modelled segments.
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, and, finally an estimation of "natural" changes affecting energy consumption over the study period.
Technology Assessment	Energy efficiency and fuel choice 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 base line 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 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 8%.
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 Terasen Gas's perspective, when using life-cycle costing with the long-run avoided cost of new natural gas supply. All the energy efficiency and fuel choice 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: energy efficiency and fuel choice.

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 practically difficult to induce customers to purchase and install all the energy efficiency or fuel choice options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as "Most Likely" and "Upper".

Estimates provided were developed in a workshop involving Terasen Gas and BC Hydro energy efficiency program personnel, trade allies, selected external experts and the consulting team.

Peak Day Load Impacts Load factors provided by Terasen Gas were used to derive peak day load impacts from the energy consumption values contained in each of the potential estimates noted above.

1.4 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. At the completion of each step, the client[1] reviewed the results and, as applicable, revisions were identified and incorporated into the interim results. The study then progressed to the next step. A summary of the steps is presented below.

Step 1: Develop Base Year Calibration Using Actual Terasen Gas Billing Data

- Compile and analyze available data on B.C.'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 Terasen Gas 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.

Step 3: Develop and Assess Energy Efficiency and Fuel Choice Options

- Develop list of energy efficiency and fuel choice measures.
- Compile detailed cost and performance data for each measure.
- Identify the baseline technologies employed in the Reference Case.

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[1] Members of the External Review Panel also read and commented on draft reports, and participated in aspects of the study.

- Develop energy efficiency and fuel choice options for each end use.
- Compile Terasen Gas 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 and fuel choice option.

Step 4: ***Estimate Economic Energy Efficiency Potential***

- Screen the identified energy efficiency and fuel choice options from Step 3 against the economic data.
- Identify the combinations of energy efficiency options 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.

Step 5: ***Estimate Economic Fuel Choice Potential***

- Screen the identified fuel choice options from Step 3 against the economic data.
- Identify the combinations of fuel choice options and building types where the measure TRC is positive.
- Apply the economically attractive fuel choice measures from Step 3 within the energy use simulation model developed previously for each building type.
- 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 6: ***Estimate Achievable Savings Potential***

- "Bundle" the energy efficiency and fuel choice 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 Terasen Gas and BC Hydro personnel, review preliminary estimates and reach general agreement on "Most Likely" and "Upper" range of achievable potential.

Step 7: ***Estimate Peak Day Load Impacts of Economic and Achievable Savings Potential***

- Convert annual energy decreases/increases contained in each of the energy efficiency/fuel choice scenarios to average daily values based on annual load profile data provided by Terasen Gas.
- Calculate peak day load impacts for each of the energy efficiency and fuel choice scenario results by applying load factors that correlate "average" to

"peak" consumption, as provided by Terasen Gas for each rate class and service region.

1.5 ANALYTICAL MODELS

The detailed end use analysis of the commercial sector was conducted using two linked modelling platforms as follows:

- ***CEEAM*** (***C***ommercial ***E***nergy and ***E***missions ***A***nalysis ***M***odel), an in-house, simulation model, developed in conjunction with Natural Resources Canada for modelling energy use in commercial-institutional building stock.
- ***CSEEM*** (***C***ommercial ***S***ector ***E***nergy ***E***nd use ***M***odel), 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. Developed in conjunction with Natural Resources Canada (NRCan), CEEAM has been successfully employed in numerous recent assignments for NRCan, Consumers Gas, BC Hydro and international DSM projects, including the extensive national climate change analysis conducted for the federal Buildings Table. CEEAM is a robust modelling platform and its results have been verified against actual end use metered data for the cities of Ottawa and Toronto and against DOE-2.1E.

CEEAM has been developed specifically for applications such as this study. One of CEEAM's 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 and combinations that are not possible in other simulation software, such as DOE 2.

CEEAM simulates the energy consumption and peak demand for all electricity and natural gas end uses present in a given commercial building segment. CEEAM calculates energy use and emissions by end use and reports them in $MJ/m^2/yr.$ (or, $kWh/m^2/yr.$) and kg eCO_2/m^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 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 Marbek's in-house ***C***ommercial ***S***ector ***E***nergy ***E***nd use ***M***odel (CSEEM). **CSEEM,** as noted above**,** is a spreadsheet-based macro model. It consists of two modules:

- A General Parameters module that contains general sector data (e.g., number of dwellings, growth rates, etc.);
- A Building Profile module that contains the EUI data for each of the selected building segments.

CSEEM combines the data from each of the modules and provides total energy use by service region, building segment and end use.

1.6 THIS REPORT

The remainder of this report is organized as follows:

- **Section 2** presents results and the specific tasks involved in developing the base year calibration.
- **Section 3** presents the Commercial Reference Case for the FY 2003/04 to FY 2015/16.
- **Section 4** identifies and assesses energy efficiency and fuel choice options within the Commercial Sector.
- **Section 5** presents the Commercial Sector Economic Potential Forecast – Energy Efficiency for the study period (FY 2003/04 to FY 2015/16).
- **Section 6** presents the Commercial Sector Economic Potential Forecast – Fuel Choice for the study period (FY 2003/04 to FY 2015/16).
- **Section 7** estimates the proportion of energy savings or fuel choice opportunities identified in the Economic Potential Forecast that can realistically be achieved within the study period. Peak day load impacts are also presented.
- **Section 8** summarizes the key study findings and identifies areas that warrant further consideration.
- **Section 9** lists sources and references.

2. BASE YEAR NATURAL GAS USE

2.1 INTRODUCTION

This section presents a description of natural gas use in British Columbia's commercial and institutional sectors in the base year of fiscal year 2003/04.[2] Drawing on the best available data, this section presents the total natural gas consumption in B.C.'s commercial sector, together with an estimate of how that consumption is distributed by service area, sub sector and end use.

Consistent with the discussion presented in the preceding section, development of the base year calibration builds directly on the data collected during the BC Hydro Conservation Potential Review 2002. This is because much of the energy-related data on B.C.'s building stock (e.g., space heating loads, DHW loads, fuel shares, floorspace) compiled for the BC Hydro study, and subsequently made publicly available, is directly applicable to this study.

The remainder of this section outlines the steps involved in preparing the base year calibration and presents a summary of the results. The discussion is organized into the following subsections:

- Segmentation of commercial and institutional building stock
- Development of detailed technical profiles for existing buildings
- Derivation of saturation and fuel share data
- Segmentation of Terasen Gas sales data
- Reconciliation of BC Hydro and Terasen Gas sales, and
- Summary of base year energy use.

2.2 SEGMENTATION OF COMMERCIAL AND INSTITUTIONAL BUILDING STOCK

The first step in the base year calibration required that the total stock of commercial and institutional buildings be segmented into sub sectors. In order to take full advantage of the BC Hydro study, as mentioned above, the building stock in the commercial and institutional sector was segmented using the same categories as in the BC Hydro study. Exhibit 2.1 presents a summary of the commercial sub sectors used in this study.

Most of the sub sectors shown in Exhibit 2.1 are self-explanatory, with the exception of the following:

- Mixed Use Buildings
- Small Commercial
- Recreational Facilities and Other Commercial Buildings
- Miscellaneous.

[2] Throughout this study, use of the term "commercial" also includes institutional buildings unless otherwise noted.

Exhibit 2.1: Commercial Sector Segmentation

- Large Office
- Medium Office
- Large Non-food Retail
- Medium Non-food Retail
- Food Retail
- Large Hotel
- Medium Hotel/Motel
- Hospital
- Nursing Home
- Large School
- Medium School
- University/College
- Restaurant/Tavern
- Warehouse/Wholesale
- Mixed Use
- Small Commercial
- Recreational Facilities and Other Commercial Buildings
- Miscellaneous

2.2.1 Mixed Use Buildings

This sub sector refers to buildings that contain both retail space (usually on the first floor or two) and apartments.

2.2.2 Small Commercial

This sub sector is a mirror image of the large and medium sub sectors listed in Exhibit 2.1, except that the buildings in this grouping have, on average, less than 3,500 to 4,500 m^2 of floor space.[3] This approach is consistent with the BC Hydro study. At the time, the rationale was that the annual energy expenditures of medium and large buildings were 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 on mass market approaches. This same rationale is applicable to the current study.

2.2.3 Recreational Facilities and Other Commercial Buildings

This sub sector consists of commercial and institutional buildings that in the BC Hydro study did 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 presented two conditions that precluded their inclusion as a separate sub sector:

- The total floor area represented by the individual building type was too small relative to the other primary sub sectors,[4] and/or

[3] Actual floor space thresholds differ slightly by sub sector and are identified in the Building Profiles contained in Appendix A.

[4] For example, energy use within a recreational building can be significant; however in the BC Hydro study, when the total electricity use within all recreational facilities was combined, it represented less than 1% of total provincial electricity use.

- The energy use patterns within the building type were too varied to allow a realistic depiction of “typical” energy use patterns.

In the BC Hydro Study, this sub sector was addressed as a whole, based on the results calculated for those sub sectors that were subjected to detailed energy use simulation modelling. This study treats the “Recreational Facilities and Other Commercial Buildings” sub sector in a similar manner.

2.2.4 Miscellaneous

This sub sector includes facilities that were called “Other Non-building” in the BC Hydro study. It contains a wide variety of facilities that, for the BC Hydro study, shared the common feature that electricity use in each was dominated by the equipment within the buildings. As this electrical equipment represented specialized applications, no attempt was made to model potential electricity savings. Examples include: telephone exchange buildings; television and radio broadcasting centers; communication and relay stations etc.

Consistent with the approach in the BC Hydro study, no attempt has been made to model natural gas use within this sub sector. However, it is recognized that some of these facilities require space conditioning and some share of that space heating will be provided by natural gas. However, there are no data available to quantify the actual amounts. Consequently, for the purposes of this study, nominal natural gas to electricity consumption ratios of either 20:80 (Lower Mainland and Vancouver Island) or 30:70 (Interior) have been assumed. Both of these are conservative estimates: in most buildings with natural gas space heating, natural gas would account for 40 to 60% of the total energy consumed.

2.3 DEVELOPMENT OF DETAILED TECHNICAL PROFILES FOR EXISTING BUILDINGS

The next step involved the construction of building profiles for each of the major existing commercial building segments described above.[5] Each profile contains detailed technical data on: building specifications; domestic hot water (DHW) equipment; heating, cooling and ventilation (HVAC) equipment; lighting fixtures; and cooking, plug and miscellaneous loads. The building profile is the platform from which the CEEAM model is populated and run to generate the bottom-up profile of energy use in the targeted segments.

Consistent with the overall approach outlined above, the starting point for each profile was the corresponding building profile developed previously for the BC Hydro study. 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 B.C. building design practitioners.

[5] The exception is “Small Commercial” which is modelled as a composite of the large and medium building segments.

Separate building profiles were developed for each combination of sub sector and weather region. Two weather regions were used:

- The Lower Mainland and the Vancouver Island service areas (using Vancouver weather data)
- The Interior service areas (using blended weather data from Summerland and Prince George.)

A sample building profile summary for existing large offices in the Lower Mainland is presented in Exhibit 2.2. A complete set of detailed profiles for existing buildings is presented in Appendix A (Lower Mainland and Vancouver Island) and Appendix B (Interior).

Exhibit 2.2: Sample Building Profile Summary – Existing Large Office

Building Type: Large Office

Location: Lower Mainland

Description: This archetype is based on 58 large office buildings with a combined published "rentable" floor area of 15,600,000 ft². The buildings range in size from 100,000 to 600,000 ft² constructed between 1910 and 2000.
- Electrical energy intensities (electrical bepi) ranges from 11 kWh/ft².yr to 34 kWh/ft².yr.
- This sample represents approximately 70% of the total 18,000,000 ft² of published rentable floor area in the Lower Mainland.

The Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 230,000 ft²
- average footprint 12,100 ft² assumes a 110 ' x 110 ' footprint
- 19 stories

BUILDING SPECIFICATIONS

roof construction:	0.7 W/m².°C		
wall construction:	0.95 W/m².°C		
windows:	5.7 W/m².°C	Mixed, assumes 80% single glazing and 20% double glazing	
shading coefficient	0.65		
window to wall ratio	0.4		

General Lighting & LPD: 660 Lux, 18.8 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	50%	10%	40%	

Architectural Lighting & LPD: 500 Lux, 30.1 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	25%	15%	30%	0%	30%	

Overall LPD: 17.9 W/m²

Plug Loads (office equipment) EPD: 7.7 W/m²

Ventilation

System Type	CAV	VAV	DD	IU	100%OA	Other
	50%	50%	0%	0%	0%	

System air Flow	5.4 L/s.m²	1.07 CFM/ft²
Fan Power	12.3 W/m²	1.14 W/ft²

Cooling Plant

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	85%	0%	15%	0%	0%	

Calculated Capacity: 113 W/m², 336 ft²/Ton

Cooling Plant Auxiliaires

Circulating Pumps	1.2 W/m²	0.1 W/ft²
Condenser Pumps	1.1 W/m²	0.1 W/ft²
Condenser Fan Size	2.3 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m^2.yr	**kWh/ft².yr**	**MJ/m^2.yr**	**kWh/ft².yr**
General Lighting	335	8.7		
Architectural Lighting	45	1.2		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	175	4.5		
Space Heating	9	0.2	325.7	8.4
Space Cooling	56	1.4	0.0	8.4
HVAC Equipment	302	7.8		
DHW	8	0.2	27.6	0.7
Refrigeration Equipment	4	0.1		
Food Service Equuipment	1	0.0	4.2	0.1
Miscellaneous	160	4.1		
Total	**1094**	**28.2**	**357.4**	**18**

2.3.1 Space Heating Equipment

Model assumptions related to the distribution of natural gas space heating equipment by type are summarized in Exhibit 2.3.

Exhibit 2.3: Space Heating Equipment Type - % of Natural Gas Heated Floor Area (m^2)

Sub-Sector	Boilers	Rooftop Units & Other
Large Office	98%	2%
Medium Office	20%	80%
Large Retail	50%	50%
Medium Retail	10%	90%
Food Retail	10%	90%
Large Hotel	98%	2%
Medium Hotel	20%	80%
Hospital	98%	2%
Nursing Homes	50%	50%
Large Schools	98%	2%
Medium Schools	98%	2%
University College	98%	2%
Restaurant	10%	90%
Warehouse	10%	90%
Mixed Use	50%	50%
Small Commercial	10%	90%
Rec and Other	50%	50%

The profiles were, however, revised to more explicitly address natural gas cooking and domestic hot water use (DHW). The "Miscellaneous" end use was handled outside of the detailed model. A summary of the cooking and DHW revisions is provided below, along with a discussion of the "Miscellaneous" end use.

2.3.2 Natural Gas Cooking

Gas cooking end use energy intensities are based on previous Marbek work in this area, which included an extensive literature search[6] of gas cooking EUI values. The values used in this study are shown in Exhibit 2.4.

[6] For example, see: Pacific Gas and Electric Company, *California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study* (Study ID #SW061), 14 May 2003.

Exhibit 2.4: Gas Cooking EUIs

Sub sector	Gas Commercial Cooking EUI (MJ/m^2-yr)
Office (Large and Medium)	5
Large Non-food Retail	40
Medium Non-food Retail	10
Food Retail	125
Large Hotel	140
Medium Hotel/Motel	100
Hospital	120
Nursing Home	140
School (Large and Medium)	5
University/College	20
Restaurant/Tavern	800
Warehouse/Whsale	0
Mixed Use	0
Small Commercial	70
Recreational and Other	55-70[7]

2.3.3 Domestic Hot Water (DHW)

Exhibit 2.5 shows the base year distribution of domestic hot water equipment between boilers and tank heaters that has been assumed in this study. The distributions are shown by sub sector; data were not available to further differentiate by service region.

[7] Value varies by region because it is weighted by sub sector floorspace.

Exhibit 2.5: Existing Gas DHW Equipment Distribution (% of Floor Space)

Sub sector	Tank Heaters (%)	Boilers (%)
Large Office	75	25
Medium Office	95	5
Large Non-food Retail	95	5
Medium Non-food Retail	99	1
Food Retail	99	1
Large Hotel	10	90
Medium Hotel/Motel	10	90
Hospital	5	95
Nursing Home	5	95
Large School	50	50
Medium School	75	25
University/College	50	50
Restaurant/Tavern	99	1
Warehouse/Whsale	99	1
Mixed Use	75	25
Small Commercial	99	1
Recreational and Other	75	25

2.3.4 Miscellaneous

For most building types, natural gas use will be used primarily for space heating, domestic hot water heating and in cooking. Other natural gas uses will be very small. However, for three building types: "Hospital," "University/College" and "Recreational and Other", the Miscellaneous end use was judged to be significant enough to include in the calculations. In hospitals, natural gas will be used in sterilization processes. Universities and colleges will have gas use in labs and research facilities. Recreational facilities will use natural gas in pool heating. Approximate percentages of total natural gas use in existing buildings are presented in Exhibit 2.6. EUI's, also given in Exhibit 2.6, were calculated from the estimated percentages for use in the models and vary by region.

Exhibit 2.6: Miscellaneous % of Total Natural Gas Use and EUIs

Sub sector	Misc. % of Total Natural Gas Use	Miscellaneous EUI (MJ/m^2-yr)
Hospital	0.5	7.5 to 8
University/College	0.25	1.5 to 2.5
Recreational and Other	0.5	2.0 to 2.5

Because the "Small Commercial" sub sector is a weighted blend of the sub sectors modelled individually, it, too, has some "Miscellaneous" gas use.

2.4 DERIVATION OF FUEL SHARE DATA

The space heating and DHW fuel share data developed during the BC Hydro study were retained for this study. These values were developed through an analysis of BC Hydro's detailed monthly billing data.

Cooking fuel shares were not calculated during the BC Hydro study; consequently we used an average value of 83% developed during a recent study by the Canadian Gas Research Institute[8].

The fuel shares for "Miscellaneous" in hospitals and "Recreation and Other" building types were set to 100% because the EUI's displayed in Table 2.6, above, were calculated on that basis.

A summary of the fuel share data for each end use, sub sector and service regions is provided in Exhibit 2.7.

[8] The cooking fuel share value of 83% is from a recent confidential report prepared for the Canadian Gas Research Institute. The CGI value is for the commercial sector as a whole. It is recognized that actual fuel shares are likely to very at the sub sector level; however data are not available at that level of disaggregation.

Exhibit 2.7: Estimated Gas Fuel Share by Building Segment and Service Region (%)

Sub Sector	Lower Mainland				Vancouver Island				Interior			
	Space Heat %	**DHW** %	**Cooking**** %	**Misc** %	**Space Heat** %	**DHW** %	**Cooking**** %	**Misc** %	**Space Heat** %	**DHW** %	**Cooking**** %	**Misc** %
Large Office	95	70	83	*	78	70	83	*	90	75	83	*
Medium Office	90	70	83	*	80	70	83	*	80	70	83	*
Large Non-Food Retail	95	50	83	*	91	50	83	*	95	60	83	*
Medium Non-Food Retail	95	50	83	*	94	50	83	*	88	50	83	*
Food Retail	90	80	83	*	88	80	83	*	90	80	83	*
Large Hotel	90	95	83	*	81	81	83	*	10	10	83	*
Medium Hotel/Motel	80	80	83	*	59	59	83	*	90	85	83	*
Hospital	99	98	83	100	98	98	83	100	99	98	83	100
Nursing Homes	85	90	83	*	90	90	83	*	99	95	83	*
Large School	90	90	83	*	85	87	83	*	90	90	83	*
Medium School	95	90	83	*	87	87	83	*	93	90	83	*
University/College	97	90	83	100	94	90	83	100	95	90	83	100
Restaurant/Tavern	99	90	83	*	85	85	83	*	98	90	83	*
Warehouse/Whsale	99	90	83	*	98	95	83	*	90	90	83	*
Mixed Use	90	90	83	*	87	87	83	*	90	90	83	*
Small Commercial	88	85	83	*	75	75	83	*	80	90	83	*
Recreational Facilities and Other Buildings	91	81	83%	100	80	76	83	100	83	86	83	100

*"Miscellaneous" end use was judged to be negligible for this building type.

2.5 SEGMENTATION OF TERASEN SALES DATA

Once the above revisions to Marbek's B.C. energy model had been completed, the next step was to segment the Terasen Gas sales data into the same sector and sub sector combinations as contained in the model.

Terasen Gas provided sales data for fiscal year 2003/04. However, much of Terasen Gas' customer sales data (Rates 1, 2 and 3) is coded on the basis of rate class only; consequently, it was not possible to directly correlate all of Terasen Gas' customer sales to the sub sectors used in this study. However, customer sales data in the remaining rate classes are identified by a NAICs code[9] and consequently could be sorted into their appropriate sub sector.

[9] NAICs is North American Industrial Classification. This was formerly referred to as "SIC codes".

In consultation with Terasen Gas personnel, the following steps were applied:[10]

- Rate 1 sales were allocated 100% to the Residential Sector (further detail is provided in the residential sector report).

- Rate 2 and 3 sales were allocated on the basis of NAICs codes. However, there are variations in the availability of the NAICs codes among the three service areas:

    - In the Lower Mainland, approximately 80% of the Rate 2 and 3 customers have NAICs codes, which were used to allocate sales. The remaining 20% of sales were allocated using the same proportions as for the NAICs-coded customers.
    - In the Interior, sales were allocated among sectors on the basis of a sample of approximately 1,500 Interior customers that did have NAICs codes.
    - In Vancouver Island, sales were allocated among sectors on the basis of recommendations provided by Terasen's Vancouver Island staff

- Rates 5, 25, 23, 7, 22, 27, which have NAICs coding, were sorted into their applicable sub sector. Rates 7, 22 and 27 are outside the scope of this study.

The results of this segmentation are presented in Exhibit 2.8.

[10] Rate classes for Vancouver Island differ from those in the Lower Mainland and Interior regions; in each case, the equivalent Vancouver Island rate classes were used.

Exhibit 2.8: Allocation of Terasen Gas Sales Data, by Sector

Service Area:		*Lower Mainland*		Sector Allocation (GJ) FY 2003/04			
Rate Class	*% of Sales*	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
1	44%	494,843	52,844,936	52,844,936	0	0	0
2	14%	51,841	16,667,241	5,266,848	9,366,990	2,033,403	0
3	12%	4,079	14,234,817	7,387,870	5,053,360	1,793,587	0
23	3%	732	3,352,708	855,352	1,586,477	885,995	24,884
5	3%	372	3,646,499	2,251,633	785,252	609,614	0
25	7%	469	8,761,471	1,188,612	2,226,146	5,346,713	0
7	0%	4	63,619				63,619
22	12%	32	14,692,785				14,692,785
27	4%	90	4,856,841				4,856,841
Total GJ		552,462	119,120,916	69,795,251	19,018,225	10,669,312	19,638,129
% Total		100%	100%	59%	16%	9%	16%

Service Area:		*Vancouver Island*		Sector Allocation (GJ) FY 2003/04			
Rate Class	*% of Sales*	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
Equiv. to 1	11%	71,413	3,939,513	3,939,513	0	0	0
Equiv. to 2 & 3	20%	9,022	6,758,601	1,250,289	4,958,312	550,000	0
Transportation	69%	9	23,568,066	0	0	0	23,568,066
Total GJ		80,444	34,266,180	5,189,802	4,958,312	550,000	23,568,066
% Total		100%	100%	15%	14%	2%	69%

Service Area:		*Interior*		Sector Allocation (GJ) FY 2003/04			
Rate Class	*% of Sales*	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
1	30%	213,032	18,714,253	18,714,253	0	0	0
2	10%	21,703	6,431,661	1,865,182	3,858,996	707,483	0
3	5%	819	2,893,920	1,030,235	1,446,960	416,724	0
23	1%	130	699,445	15,822	430,280	247,314	6,029
5	1%	50	774,046	48,911	441,992	283,143	0
25	11%	165	6,563,106	43,820	864,233	5,655,054	0
7	0%	2	21,384				21,384
22	40%	27	25,019,059				25,019,059
27	1%	9	778,860				778,860
Total GJ		235,937	61,895,733	21,718,223	7,042,461	7,309,718	25,825,332
% Total		100%	100%	35%	11%	12%	42%
Grand Total		868,843	215,282,830	96,703,276	31,018,998	18,529,031	69,031,527
%		100%	100%	45%	14%	9%	32%

2.6 RECONCILIATION OF BC HYDRO AND TERASEN GAS SALES

The final step in developing the base year profile of natural gas use required that adjustments be made to the Marbek B.C. energy model to accommodate differences between the BC Hydro and Terasen Gas customer bases in each service region. The major adjustments were:

- **Exclusion of Rate 7, 22 and 27 customers**. Rate 7, 22 and 27 are outside the scope of this study; however, they were included in the BC Hydro study (and model results). This group includes a central heating plant that serves a number of office, retail and high-rise apartment buildings in downtown Vancouver as well as a number of large facilities such as universities, hospitals and hotels.

- **Exclusion of Whistler.** The BC Hydro study (and model results) includes the village of Whistler; however, Whistler is not currently served by natural gas and is not included within the scope of this study.[11]

- **Addition of West Kootenay Area.** Fortis provides electricity to the West Kootenay region of interior B.C. This service area was excluded from the B.C. Hydro study (and model results); however, Terasen Gas does serve this area.

- **Other Adjustments.** Other minor adjustments were made to account for minor differences in the BC Hydro and Terasen Gas service areas such as the exclusion of the Pacific Northern Gas service area.

To accommodate each of the above situations, the existing floorspace data in Marbek's B.C. energy model was adjusted to provide an approximation of the expected energy consumption impact.[12]

2.6.1 Exclusion of Rate 7, 22 and 27 customers

The data provided by Terasen Gas for these rate classes is NAICs coded, which enabled the study team to sort the data and establish the number of buildings and the amount of affected natural gas consumption in each sub sector. The floorspace data within the model were then adjusted to account for the reduction in the number of buildings in the sub sector.

2.6.2 Exclusion of Whistler

As noted above, Whistler was included in the BC Hydro study (and model results) but is outside the scope of this study. There have been a number of recent energy studies of the Whistler region, including those that provide floorspace estimates for each of the major sub sectors. As in the preceding adjustment, the Whistler service area exclusion was accommodated within the energy model by reducing floorspace within the affected sub

[11] Terasen Gas and RMOW are currently collaborating on a parallel end use study for Whistler village.

[12] It is recognized that there are other small differences in customer bases; however, the total impact of these additional differences is within the accuracy range of the overall calibration exercise.

sectors. In this case, the principle sub sectors affected were the hotel/motel and retail sub sectors.

2.6.3 Addition of Fortis Electricity Sales and Floorspace

Fortis provides electricity to Terasen Gas customers in the southern interior of B.C. As for the preceding adjustments, the inclusion of the Fortis service area was accommodated within the energy model by adjusting the commercial floorspace numbers in Marbek's B.C. energy model. In contrast to the preceding situations, this adjustment required an increase in floorspace.

The Fortis sales data is presented in Exhibit 2.9. The "Residential" and "Industrial" rate categories could be assigned to the residential and industrial segments, respectively. However, the "General" and "Wholesale" categories contain sales to all sectors. To adjust for this discrepancy, the relative percentages of commercial/institutional and industrial sales in the BC Hydro-supplied portion of the Interior region were used to disaggregate the "General" and "Industrial" sales. Exhibit 2.9 also presents the estimated segmentation that is used in this study.[13]

Exhibit 2.9: 2003 Fortis Sales Data[14]

Rate Category	Number of Customers	Fortis Reported Sales (GWh/yr)	Sales Allocation used in this Study (GWH/yr)
Residential	82,174	1,013	1,504
Commercial/Institutional	Not reported	Not reported	244
General	9,433	520	
Wholesale	8	907	
Industrial	38	337	1,029
Total	**n/a**	**2,777**	**2,777**

To calculate the amount of floorspace adjustment, Fortis electricity sales for 2003 were first segmented by sector. As a detailed sub sector breakdown was not available for Fortis, the study assumed that the commercial sector shares among the sub sectors was the same in the Fortis service area as in the other interior regions served by BC Hydro.

2.6.4 Revised Floor Space Estimates

A summary of the resulting floor area estimates used in this study in presented in Exhibit 2.10.

The original floor area estimates contained in the BC Hydro study were derived by dividing the actual sales data for each building segment by the applicable fuel share and saturation-weighted, whole-building electricity use intensity (EUI). At the time, floor

[13] Fortis BC, *2005 Load and Customer Forecast*, 26 November 2004.

[14] Irrigation and street lighting loads were omitted, as these are not in either the BC Hydro or Terasen studies.

area estimates were compared with available data from the Building Owners and Managers Association (British Columbia) and were found to provide a good match.

Exhibit 2.10: Estimated Floor Area (FY 2003/04) for Terasen Gas Study by Sub Sector (m^2)[15]

Sub Sector	Floor Area (m^2)			
	Lower Mainland	Vancouver Island	Interior	Total
Large Office	3,724,135	523,747	177,789	4,425,671
Medium Office	1,095,633	232,666	179,978	1,508,277
Large Non-Food Retail	2,752,570	555,068	613,751	3,921,389
Medium Non-Food Retail	797,418	249,883	243,278	1,290,579
Food Retail	367,402	170,638	155,211	693,251
Large Hotel	895,219	110,520	96,959	1,102,698
Medium Hotel/Motel	399,645	122,256	141,143	663,044
Hospital	68,352	293,130	141,117	502,600
Nursing Homes	161,929	89,858	28,056	279,843
Large School	2,329,972	496,287	871,569	3,697,828
Medium School	1,224,463	456,098	716,358	2,396,919
University/College	1,831,920	378,524	208,938	2,419,382
Restaurant/Tavern	604,066	158,411	132,144	894,622
Warehouse/Whsale	2,147,113	208,267	142,280	2,497,659
Mixed Use	3,724,135	523,747	177,789	4,425,671
Small Commercial	18,023,919	5,621,230	7,892,349	31,537,498
Recreational Other Buildings	5,388,854	876,963	983,471	7,249,288

2.7 SUMMARY OF BASE YEAR ENERGY USE

The summary of Base Year 2003/04 model results are presented in four separate Exhibits:

- Exhibit 2.11 presents the model results for all of the Terasen Gas customers that are within the scope of this study. The results are broken out by sub sector and service region, and are compared with the actual Terasen Gas sales data in each region.
- Exhibits 2.12 to 2.14 inclusive present the same results, broken out by sub sector and end use for each of the three service areas defined for this study.

[15] Note: these values are for the Terasen Gas services areas and are (moderately) different than for the province as a whole or for the total BC Hydro service region.

Exhibit 2.11: Base Year (FY 2003/04) Natural Gas Consumption for Terasen Gas Model Results versus Actual Sales (GJ/yr)

Segment	Lower Mainland			Vancouver Island			Interior			Total		
	Model	Sales	diff.%	Model	Sales	diff.%	Model	Sales	diff.%	Model	Sales	diff.%
Large Office	1,454,465			172,574			66,878			1,693,918		
Medium Office	430,564			88,778			68,437			587,778		
Large Non-food Retail	721,435			168,412			195,794			1,085,641		
Medium Non-food Retail	193,777			85,129			78,114			357,020		
Food Retail	152,747			77,497			71,665			301,909		
Large Hotel	689,126			86,423			19,199			794,748		
Medium Hotel/Motel	218,779			56,429			90,507			365,715		
Hospital	100,075			456,815			222,729			779,619		
Nursing Homes	163,316			120,362			40,538			324,216		
Large School	803,206			208,743			389,518			1,401,468		
Medium School	547,234			225,974			382,505			1,155,712		
University/College	1,336,906			343,473			187,816			1,868,195		
Restaurant/Tavern	694,167			172,875			150,493			1,017,535		
Warehouse/Whsale	950,122			100,832			61,842			1,112,796		
Mixed Use	231,538			22,235			18,430			272,203		
Large & Medium Commercial	8,687,456			2,386,552			2,044,465			13,118,473		
										0		
Small Commercial	7,392,301			2,298,295			3,474,642			13,165,239		
										0		
Recreational Facilities and Other	2,317,964			415,128			459,788			3,192,881		
										0		
Miscellaneous	890,638			126,963			516,516			1,534,117		
Total	**19,288,360**	**19,018,225**	**-1%**	**5,226,939**	**4,958,312**	**-5%**	**6,495,411**	**7,042,461**	**8%**	**31,010,709**	**31,018,998**	**0%**
	62%			17%			21%					

Exhibit 2.12: Base Year (FY 2003/04) Modelled Annual Gas Consumption for Lower Mainland by Segment and End Use (GJ/yr)

End-use / Segment	End-uses				
	Commercial Cooking	**Domestic Hot Water**	**Space Heating**	**Misc.**	**Totals**
Large Office	15,455	101,333	1,337,678		**1,454,465**
Medium Office	4,547	32,830	393,187		**430,564**
Large Non-food Retail	91,385	58,925	571,125		**721,435**
Medium Non-food Retail	6,619	13,083	174,075		**193,777**
Food Retail	38,118	25,447	89,182		**152,747**
Large Hotel	104,024	275,249	309,852		**689,126**
Medium Hotel/Motel	33,171	105,420	80,188		**218,779**
Hospital	6,808	10,699	82,060	508	**100,075**
Nursing Homes	18,816	27,199	117,300		**163,316**
Large School	9,669	56,618	736,919		**803,206**
Medium School	5,082	32,989	509,163		**547,234**
University/College	30,410	58,822	1,244,216	3,458	**1,336,906**
Restaurant/Tavern	401,100	145,131	147,936		**694,167**
Warehouse/Whsale		71,059	879,063		**950,122**
Mixed Use		76,238	155,300		**231,538**
Small Commercial	1,019,840	1,312,920	5,058,500	1,042	**7,392,301**
Recreational Facilities and Other	259,654	321,294	1,725,243	11,773	**2,317,964**
Miscellaneous			890,638		**890,638**
Total	**2,044,698**	**2,725,257**	**14,501,623**	**16,782**	**19,288,360**

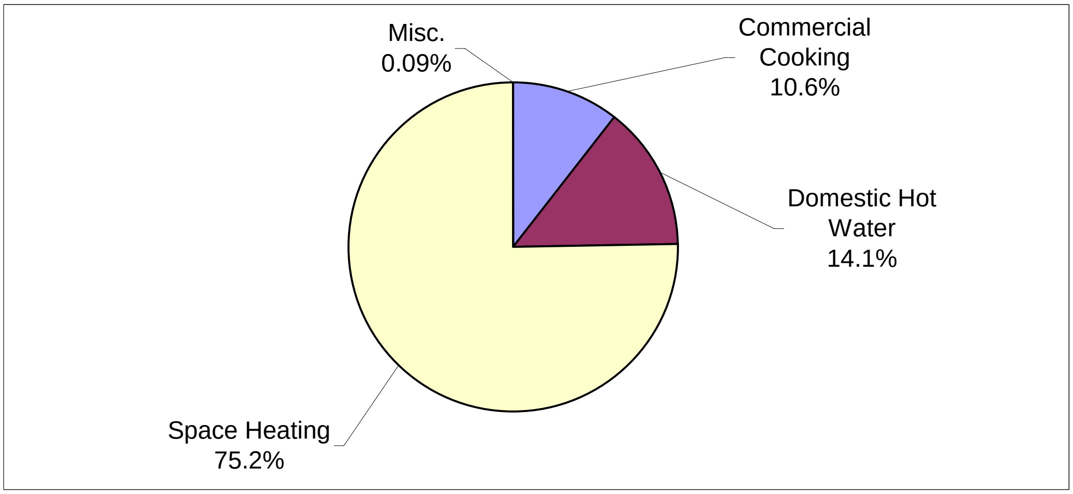


Exhibit 2.13: Base Year (FY 2003/04) Modelled Annual Gas Consumption for Vancouver Island by Segment and End Use (GJ/yr Base Year)

End-use / Segment	End-uses: Commercial Cooking	Domestic Hot Water	Space Heating	Misc.	Totals
Large Office	2,174	14,230	156,170		**172,574**
Medium Office	966	6,973	80,839		**88,778**
Large Non-food Retail	18,428	11,882	138,102		**168,412**
Medium Non-food Retail	2,074	4,100	78,955		**85,129**
Food Retail	17,704	11,844	47,949		**77,497**
Large Hotel	12,842	29,036	44,544		**86,423**
Medium Hotel/Motel	10,147	23,396	22,886		**56,429**
Hospital	29,196	54,515	370,773	2,331	**456,815**
Nursing Homes	10,442	14,980	94,940		**120,362**
Large School	2,060	11,658	195,026		**208,743**
Medium School	1,893	11,902	212,179		**225,974**
University/College	6,283	12,254	324,075	861	**343,473**
Restaurant/Tavern	105,185	35,967	31,723		**172,875**
Warehouse/Whsale		6,902	93,930		**100,832**
Mixed Use		7,321	14,914		**22,235**
Small Commercial	318,064	362,993	1,616,886	352	**2,298,295**
Recreational Facilities and Other	48,232	55,024	309,768	2,105	**415,128**
Miscellaneous			126,963		**126,963**
Total	**585,688**	**674,978**	**3,960,624**	**5,648**	**5,226,939**

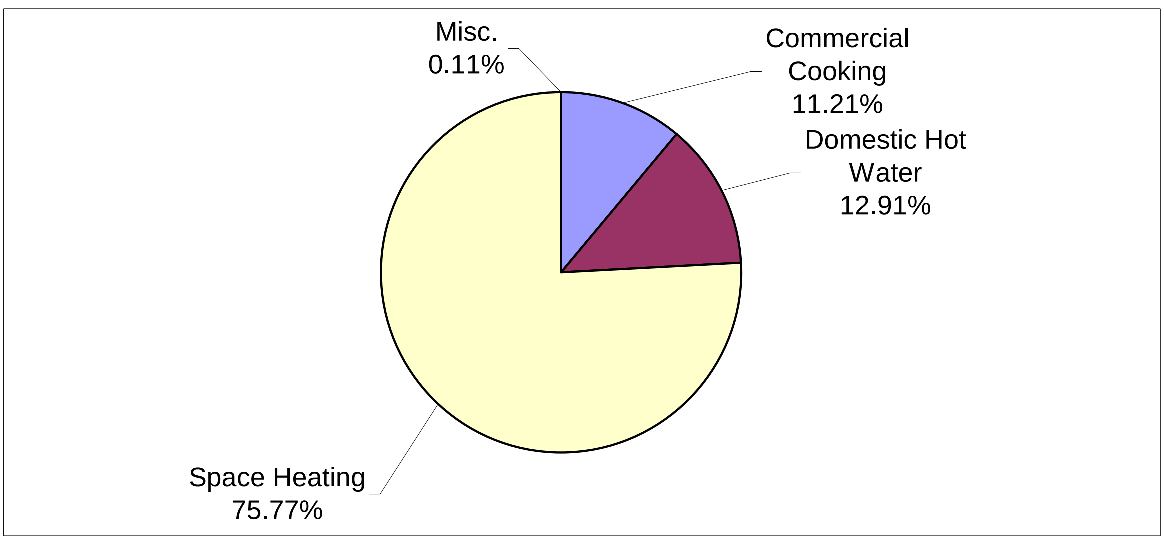
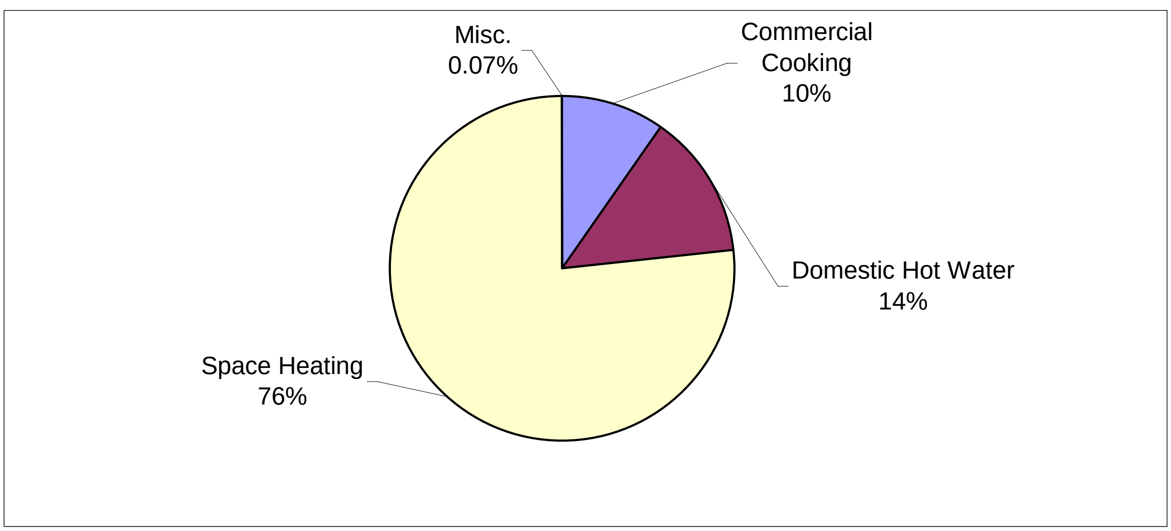


Exhibit 2.14: Base Year (FY2003/04) Modelled Annual Gas Consumption for Interior by Segment and End Use (GJ/yr)

End-use / Segment	End-uses				
	Commercial Cooking	Domestic Hot Water	Space Heating	Misc.	Totals
Large Office	738	5,171	60,969		**66,878**
Medium Office	747	5,390	62,300		**68,437**
Large Non-food Retail	20,377	15,771	159,647		**195,794**
Medium Non-food Retail	2,019	3,993	72,102		**78,114**
Food Retail	16,103	10,768	44,794		**71,665**
Large Hotel	11,267	3,141	4,792		**19,199**
Medium Hotel/Motel	11,715	38,863	39,929		**90,507**
Hospital	14,055	26,824	180,715	1,134	**222,729**
Nursing Homes	3,260	4,943	32,335		**40,538**
Large School	3,617	21,179	364,722		**389,518**
Medium School	2,973	19,306	360,227		**382,505**
University/College	3,468	6,717	177,150	480	**187,816**
Restaurant/Tavern	87,744	31,729	31,020		**150,493**
Warehouse/Whsale		4,463	57,379		**61,842**
Mixed Use		6,068	12,362		**18,430**
Small Commercial	446,569	611,278	2,416,295	499	**3,474,642**
Recreational Facilities and Other	52,007	68,352	337,102	2,327	**459,788**
Miscellaneous			516,516		**516,516**
Total	**624,652**	**883,957**	**4,930,355**	**4,440**	**6,495,411**



3. REFERENCE CASE

3.1 INTRODUCTION

This section presents the Commercial Sector Reference Case for the study period (FY 2003/04 to FY 2015/16). 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 remaining economically attractive savings opportunities.

The discussion is presented within the following subsections:

- Development of detailed profiles—new buildings
- Expected growth in building stock
- "Natural" changes affecting natural gas consumption
- End use model results.

3.2 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, lighting equipment and "plug load" electrical use for the "new" buildings in each of the commercial building segments. 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 3.1. 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 D (Lower Mainland and Vancouver Island) and Appendix E (Interior)

Exhibit 3.1: Sample New Building Profile Summary – New Large Office

Building Type: New Large Office	**Location:** Lower Mainland
Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program. and NRCan's CBIP program.	**The Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 230,000 ft² - average footprint 12,100 ft² assumes a 110 ' x 110 ' footprint - 19 stories

Building Specifications:						
roof construction:	0.24 W/m².°C					
wall construction:	0.71 W/m².°C					
windows:	2.8 W/m².°C					
shading coefficient	0.45					
window to wall ratio	0.6					
General Lighting & LPD	440 Lux		11.4 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	0%	0%	100%	
Architectural Lighting & LPD	300 Lux		13.0 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	30%	0%	0%	60%	
Overall LPD	10.8 W/m²					
Plug Loads (office equipment) EPD	7.8 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	10%	90%	0%	0%	0%	
System air Flow	5.5 L/s.m²		1.08 CFM/ft²			
Fan Power	9.3 W/m²		0.86 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	75%	25%	0%	0%	
Calculated Capacity	102 W/m²		371 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	1.1 W/m²		0.1 W/ft²			
Condenser Pumps	1.0 W/m²		0.1 W/ft²			
Condenser Fan Size	2.0 W/m²		0.2 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	164	4.2		
Architectural Lighting	19	0.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	176	4.5		
Space Heating	6	0.1	209.4	5.4
Space Cooling	49	1.3	0.0	5.4
HVAC Equipment	151	3.9		
DHW	8	0.2	25.6	0.7
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	160	4.1		
Total	**737**	**19.0**	**239.2**	**12**

Exhibit 3.2 highlights the resulting whole-building natural gas EUIs for each new commercial building segment. For the purposes of reference, it also shows whole-building EUIs for each of the existing building segments. In general, EUIs declined. General factors that have reduced the EUIs for new buildings include the following:

- Improved thermal characteristics with insulation levels of R16 for roofs and R8 to R12 for walls
- Double pane with thermal break window glazing (no single-pane glazing)
- Lower infiltration rates due to tighter shells
- Increased use of variable-air-volume (VAV) ventilation systems.

However, in some cases, specifically retail food and schools, the natural gas new building EUIs have increased. Reasons for these increases are noted below in Exhibit 3.2.

Exhibit 3.2: Comparison of Whole Building Gas EUIs – Lower Mainland (MJ/m²/Yr)

Segment	Existing Buildings	New Buildings	Comments (if any)
Large Office	357	239	
Medium Office	404	232	
Large Non-Food Retail	281	212	
Medium Non-Food Retail	250	144	
Food Retail	330	507	Although building shells are improving, ventilation rates in new supermarkets are considerably higher than in existing supermarkets.
Large Hotel	779	694	
Medium Hotel/Motel	552	463	
Hospital	1491	1153	Ventilation rates in new hospitals are higher than in existing hospitals, however more new hospitals use VAV systems, minimizing the impact of this change.
Nursing Homes	1030	804	
Large School	350	521	Although building shells are improving, higher ventilation rates result in higher heating loads.
Medium School	423	786	Similar to large schools.
University/College	755	356	
Restaurant	1150	1138	
Warehouse/Wholesale	449	256	
Mixed Use	438	401	

3.3 EXPECTED GROWTH IN BUILDING STOCK

The next step in developing the Reference Case involved the development and application of estimated levels of floor space growth in each building segment and service region over the study period. The growth rates used in this study are identical to those provided by the Load Forecasting Group for use in the BC Hydro study. Exhibit 3.3 summarizes these growth rates.

Exhibit 3.3: Annual Growth Rates in Period by Building Segment and Service Region (%/Yr)

Commercial Segment	Lower Mainland			Vancouver Island			Interior Region		
	Period 2003/05 %	Period 2005/10 %	Period 2010/15 %	Period 2003/05 %	Period 2005/10 %	Period 2010/15 %	Period 2003/05 %	Period 2005/10 %	Period 2010/15 %
Large Office	2.2%	2.7%	2.2%	2.1%	2.0%	2.2%	2.5%	2.5%	2.2%
Medium Office	2.2%	2.7%	2.2%	2.1%	2.0%	2.2%	2.5%	2.5%	2.2%
Large Non-food Retail	3.2%	3.4%	2.6%	3.2%	3.5%	2.6%	3.0%	2.8%	2.6%
Medium Non-food Retail	3.2%	3.4%	2.6%	3.2%	3.5%	2.6%	3.0%	2.8%	2.6%
Food Retail	2.9%	2.7%	2.4%	1.6%	1.7%	2.4%	1.9%	2.4%	2.4%
Large Hotel	3.6%	3.5%	2.5%	1.7%	2.1%	2.5%	2.8%	2.9%	2.5%
Medium Hotel/Motel	3.6%	3.5%	2.5%	1.7%	2.1%	2.5%	2.8%	2.9%	2.5%
Hospital	2.4%	2.2%	1.8%	3.0%	2.9%	1.8%	2.7%	2.7%	1.8%
Nursing Homes	3.4%	3.7%	2.4%	1.3%	2.3%	2.4%	2.6%	3.4%	2.4%
Large School	2.2%	2.3%	2.2%	0.2%	0.6%	2.2%	1.9%	2.2%	2.2%
Medium School	2.2%	2.3%	2.2%	0.2%	0.6%	2.2%	1.9%	2.2%	2.2%
University/Colleges	2.2%	2.3%	2.2%	0.2%	0.6%	2.2%	1.9%	2.2%	2.2%
Restaurant/Tavern	2.4%	2.5%	2.2%	2.1%	2.1%	2.2%	2.7%	2.6%	2.2%
Warehouse/Whsale	2.8%	3.0%	2.3%	2.0%	3.2%	2.3%	2.5%	2.5%	2.3%
Mixed Use	2.3%	2.5%	2.4%	2.3%	2.5%	2.4%	2.3%	2.5%	2.4%
Small Commercial	2.7%	2.8%	2.8%	2.0%	2.1%	2.3%	2.3%	2.3%	2.0%
Recreational and Other	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%
Other Non-buildings	1.7%	2.0%	2.0%	1.7%	2.0%	2.0%	1.7%	2.0%	2.0%

3.4 "NATURAL" CHANGES AFFECTING NATURAL GAS CONSUMPTION

The next task involved estimation of expected "natural" changes in natural gas consumption patterns over the study period with consideration of two major factors:

- "Naturally occurring" improvements in equipment efficiency
- Expected stock penetration by more efficient equipment.

Other considerations, such as operating hours, fuel share, etc., may also affect future natural gas demand. For the BC Hydro study, the values used for existing and new stock were assumed to remain constant over the study period based on information provided by the BC Hydro Load Forecasting Group. These values were treated in the same way in this study.

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. Major "natural" change in electrical use are also discussed.

3.4.1 Commercial Cooking

Commercial cooking energy use intensities 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.

3.4.2 Domestic Hot Water

Gas DHW equipment was assumed to be distributed in new buildings as shown in Exhibit 3.4. The efficiencies of the equipment types are displayed in Exhibit 3.5. These tables show an increase in efficiency compared to equipment installed in existing buildings.

Both type and efficiency of DHW equipment installed in new buildings were assumed to be constant through the study period.

Exhibit 3.4: Gas DHW Equipment Distribution in New Buildings (% of Floor Space)

Sub sector	Standard Eff. Tank (%)	Power Vent Tank (%)	Condensing Tank (%)	Standard Eff. Boiler (%)	Condensing Eff. Boiler (%)
Large Office	50	20		28	2
Medium Office	75	25			
Large Non-food Retail	80	20			
Medium Non-food Retail	80	20			
Food Retail	90	10			
Large Hotel				95	5
Medium Hotel/Motel				95	5
Hospital				95	5
Nursing Home	15	5		78	2
Large School	37	37	2	19	5
Medium School	50	42	2		6
University/College	5	5		85	5
Restaurant/Tavern	90	10			
Warehouse/Whsale	90	10			
Mixed Use	65	5		30	

Exhibit 3.5: Gas DHW Equipment Efficiencies in New Buildings

Sub sector	Efficiencies/Thermal Factor
Standard Efficiency Tank	0.55
Power Vent Tank	0.6
Condensing Tank	0.9
Standard Efficiency Boiler	75%
Condensing Efficiency Boiler	90%

3.4.3 Space Heating

Gas boilers being installed in new buildings are assumed to be a mix of standard, near condensing and condensing boilers. A weighted efficiency, shown in Exhibit 3.6, was used in the building profile models.

Both type and efficiency of DHW equipment installed in new buildings were assumed to be constant through the study period.

Exhibit 3.6: Gas Space Heating in New Buildings Stock Weighted, Seasonal Boiler Efficiency

Sub sector	Boiler Efficiency (%)
Large Office	83
Medium Office	75
Large Non-food Retail	75
Medium Non-food Retail	69
Food Retail	80
Large Hotel	75
Medium Hotel/Motel	83
Hospital	75
Nursing Home	77
Large School	83
Medium School	83
University/College	83
Restaurant/Tavern	69
Warehouse/Whsale	83
Mixed Use	83

3.4.4 Miscellaneous

Because of the relatively small size of the "miscellaneous" end use, the EUI was assumed to be the same in new buildings as in old buildings. The EUI was also assumed to be constant throughout the course of the study.

3.4.5 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; and
- Plug loads.

3.4.5.1 Lighting

The replacement of T12 fluorescent lighting and electromagnetic ballasts with T8 fluorescent lamps and electronic ballasts is occurring because of decreasing prices, increasing public recognition of the savings, and changing ballast codes.

When lighting loads decrease, winter heating loads will tend to increase.

3.4.5.2 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. The BC Hydro work, which was followed for this project, assumed a low- to intermediate-growth scenario.

The increase in plug loads will tend to decrease heating loads.

3.4.6 Additional Considerations

Discussions with provincial government staff indicated that a proposal is under discussion that would set the following targets by the year 2010:

- To achieve energy performance of 25% better than the Model National Energy Code for Buildings for new industrial, commercial, institutional, and multi-unit residential buildings.
- To retrofit 20% of existing industrial, commercial, and institutional buildings to realize an average savings of 14% per building.
- To retrofit 16% of existing multi-unit residential buildings to realize an average savings of 9% per building.

No attempt has been made to incorporate the above considerations into this Reference Case, as the outcome of the proposal discussion is currently uncertain. However, these considerations are addressed as part of the Achievable Potential presented in later sections of this report.

3.5 END USE MODEL RESULTS

The Reference Case results are presented in four separate exhibits:

Exhibit 3.8 presents the model results for the total Terasen Gas service area, with the results being broken out by building segment and milestone year.

Exhibits 3.9 to 3.11 inclusive present the same results for each of the three service regions.

Exhibit 3.8: Reference Case for Annual Natural Gas Consumption for Terasen Gas Service Region (GJ/yr.)

Segment	FY 2003/04	FY 2005/06	FY 2010/11	FY 2015/16
Large Office	1,693,918	1,739,996	1,893,302	2,039,255
Medium Office	587,778	603,685	654,999	704,808
Large Non-Food Retail	1,085,641	1,137,243	1,295,246	1,439,418
Medium Non-Food Retail	357,020	371,203	414,473	454,173
Food Retail	301,909	318,916	367,877	423,617
Large Hotel	794,748	841,312	977,446	1,095,411
Medium Hotel/Motel	365,715	387,127	447,952	493,591
Hospital	779,619	813,349	907,375	976,420
Nursing Homes	324,216	337,161	384,041	424,265
Large School	1,401,468	1,470,467	1,680,752	1,927,919
Medium School	1,155,712	1,215,266	1,399,061	1,621,670
University/College	1,868,195	1,902,016	2,005,992	2,136,136
Restaurant/Tavern	1,017,535	1,064,311	1,199,048	1,335,161
Warehouse/Whsale	1,112,796	1,147,977	1,259,528	1,357,584
Mixed Use	272,203	283,446	317,490	354,501
Small Commercial	13,165,239	13,676,134	15,166,104	16,827,190
Recreational and Other	3,192,881	3,343,134	3,776,488	4,276,430
Miscellaneous	1,534,117	1,585,377	1,750,384	1,932,565
Total	31,010,709	32,238,117	35,897,557	39,820,113

Exhibit 3.9: Reference Case for Annual Natural Gas Consumption in the Lower Mainland, (GJ/yr.)

Segment	FY 2003/04	FY 2005/06	FY 2010/11	FY 2015/16
Large Office	1,454,465	1,492,758	1,625,066	1,747,008
Medium Office	430,564	441,452	479,074	513,749
Large Non-Food Retail	721,435	755,509	861,880	956,499
Medium Non-Food Retail	193,777	201,047	223,743	243,931
Food Retail	152,747	163,226	191,254	219,546
Large Hotel	689,126	732,161	856,743	960,340
Medium Hotel/Motel	218,779	232,903	273,793	297,679
Hospital	100,075	103,755	113,213	121,772
Nursing Homes	163,316	171,961	199,927	220,293
Large School	803,206	855,305	1,007,427	1,170,130
Medium School	547,234	588,654	709,597	838,952
University/College	1,336,906	1,365,478	1,448,905	1,538,135
Restaurant/Tavern	694,167	726,215	820,370	913,555
Warehouse/Whsale	950,122	981,111	1,076,792	1,160,648
Mixed Use	231,538	241,101	270,011	301,506
Small Commercial	7,392,301	7,699,507	8,611,273	9,658,038
Recreational and Other	2,317,964	2,425,986	2,737,535	3,096,956
Miscellaneous	890,638	920,397	1,016,193	1,121,959
Total	19,288,360	20,098,526	22,522,796	25,080,697

Exhibit 3.10: Reference Case for Annual Natural Gas Consumption in Vancouver Island, (GJ/yr.)

Segment	FY 2003/04	FY 2005/06	FY 2010/11	FY 2015/16
Large Office	172,574	177,907	191,968	209,112
Medium Office	88,778	91,395	98,297	106,713
Large Non-Food Retail	168,412	176,791	203,772	227,152
Medium Non-Food Retail	85,129	88,841	100,794	111,151
Food Retail	77,497	80,614	89,597	103,587
Large Hotel	86,423	88,967	97,582	109,053
Medium Hotel/Motel	56,429	58,431	64,477	72,527
Hospital	456,815	477,693	536,065	576,955
Nursing Homes	120,362	122,942	135,358	149,903
Large School	208,743	209,665	216,706	244,170
Medium School	225,974	227,063	235,382	267,834
University/College	343,473	344,319	350,781	375,987
Restaurant/Tavern	172,875	179,881	199,313	221,945
Warehouse/Whsale	100,832	103,201	113,920	122,778
Mixed Use	22,235	23,154	25,961	28,954
Small Commercial	2,298,295	2,372,700	2,588,771	2,852,387
Recreational and Other	415,128	434,907	491,953	557,763
Miscellaneous	126,963	131,206	144,861	159,939
Total	5,226,939	5,389,677	5,885,558	6,497,910

Exhibit 3.11: Reference Case for Annual Natural Gas Consumption in the Interior (GJ/yr.)

Segment	FY 2003/04	FY 2005/06	FY 2010/11	FY 2015/16
Large Office	66,878	69,331	76,268	83,134
Medium Office	68,437	70,837	77,627	84,347
Large Non-Food Retail	195,794	204,943	229,593	255,767
Medium Non-Food Retail	78,114	81,315	89,936	99,091
Food Retail	71,665	75,075	87,027	100,483
Large Hotel	19,199	20,185	23,121	26,017
Medium Hotel/Motel	90,507	95,792	109,682	123,385
Hospital	222,729	231,900	258,097	277,693
Nursing Homes	40,538	42,258	48,756	54,069
Large School	389,518	405,497	456,619	513,618
Medium School	382,505	399,549	454,082	514,884
University/College	187,816	192,219	206,306	222,013
Restaurant/Tavern	150,493	158,214	179,364	199,661
Warehouse/Whsale	61,842	63,664	68,817	74,159
Mixed Use	18,430	19,191	21,518	24,040
Small Commercial	3,474,642	3,603,927	3,966,059	4,316,764
Recreational and Other	459,788	482,241	547,001	621,711
Miscellaneous	516,516	533,774	589,330	650,668
Total	6,495,411	6,749,914	7,489,203	8,241,506

4. ENERGY EFFICIENCY AND FUEL CHOICE MEASURES

4.1 INTRODUCTION

This section identifies and assesses the financial and economic attractiveness of selected energy efficiency and fuel choice technologies and measures for the commercial sector. The discussion is organized and presented as follows:

- Methodology
- Summary of energy efficiency screening results
- Summary of fuel choice screening results
- Description of energy efficiency technologies and measures
- Description of fuel choice technologies and measures.

4.2 METHODOLOGY

The following steps were employed to assess the energy efficiency and fuel choice technologies and measures:

- Select candidate energy efficiency and fuel choice options
- Establish technical performance for each option within a range of applicable load sizes and/or service region conditions (e.g., degree days, fuel costs etc)
- 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 Technologies and Measure

The candidate technologies and measures were selected, in close collaboration with Terasen Gas personnel, based on a combination of a literature review and the previous experience of both the consultants and Terasen Gas personnel. The selected technologies and 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 technical option 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 technical options are reported for both natural gas and electricity.

Step 3 Establish Capital, Installation and Operating Costs for Each Option

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 cost and full cost of each option were estimated.

The incremental cost is applicable when a technology 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 fuel choice 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 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 (2005) 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."[16] 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 ($)
CostBase	= initial capital cost of the baseline technology ($)
AnnUpgr	= ongoing operating cost of the upgrade ($/year)
AnnBase	= ongoing operating cost of the baseline technology ($/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 8%.

[16] 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.

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 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, it is not included in subsequent stages of the analysis.

4.2.1 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 Terasen Gas. The data provided were segmented on the basis of future year (over a 25 year period), end use or load shape and service area. Exhibit 4.1 provides a summary of the avoided natural gas supply costs for each combination of year, load shape and service area. To make the data more manageable, the annual values were averaged for each of the time periods shown in Exhibit 4.1. The distinction between high load factor (flat) and low load factor (peaky) load shapes reflects the difference in costs to supply each load type. Similarly, the cost data shown in Exhibit 4.1 reflect the modest differences in the cost of serving different service areas within the province

Exhibit 4.1: Natural Gas – Avoided Supply Costs

Natural Gas	Load Shape							
	Low Load Factor (e.g., space heat)				High Load Factor (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	5.756	5.685	5.716	5.782	5.102	5.041	5.031	4.978
Lower Mainland	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782
Interior	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782

1 kWh =3.6 MJ; 1GJ = 1000 MJ

- **Avoided Supply Cost of Electricity**

The avoided supply costs of electricity used in this analysis are shown in Exhibit 4.2. As illustrated, the electricity values have been organized symmetrically with the natural gas prices on the basis of measure life, load shape and service region.

The electricity supply costs shown in Exhibit 4.2 are estimated values based on the avoided cost of $0.06/kWh that was used in the earlier BC Hydro study. This value was an average value and reflected the cost of delivering an incremental kWh of new electricity supply to a lower mainland busbar.

Although the BC Hydro study used a single avoided cost value for all end uses, BC Hydro is also confronted with higher supply costs for end uses such as space heating that have peaky requirements. Detailed electricity supply costs were not available to this study for each of the defined load types. Consequently, based on discussions with the study team personnel, it was decided to assume that end uses with low load factors, such as space heating, cost, on average, 10% more to supply than end uses that have relatively high load factors, such as hot water. BC Hydro personnel confirmed that this value was generally consistent with recent values estimated by the utility. To accommodate this 10% cost spread and to also adhere to the same average avoided cost of $0.06/kWh, low load factor values were adjusted upwards by 5% from the average BC Hydro values and high load factor values were adjusted downwards by 5%.

The values shown in Exhibit 4.2 have also been adjusted to account for the delivery destination. The Terasen Gas values are for delivery to the customer. As the BC Hydro values are at a distribution busbar, the values were adjusted upwards by 7% (3% area transmission and 4% distribution)[17] to account for losses between the busbar and the customer.

As the same electricity avoided cost value was used for all three service regions in the BC Hydro study, no attempt was made to generate distinct service region values in this study.

[17] This approach omits bulk transmission losses of 5%; however, this is consistent with the approach that was applied in the BC Hydro CPR. It is also consistent with the general assumption that the most likely future electricity supply options will be developed closer to the load rather that at remote sites, such as the historical large-scale hydroelectric developments.

Exhibit 4.2: Electricity – Avoided Supply Costs

Electricity	Load Shape							
	Low Load Factor (e.g., space heat)				High Load Factor (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Lower Mainland	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Interior	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94

1 kWh =3.6 MJ; 1GJ = 1000 MJ

- **Customer Energy Prices**

The customer energy prices used in this analysis are presented in Exhibit 4.3. These values are used in the calculation of customer payback periods that are presented in later sections of this report. In the case of both electricity and natural gas, In the case of both electricity and natural gas, the prices shown are based on February 2005 rate schedules and, in the case of electricity incorporate both energy and 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.

Exhibit 4.3: Customer Energy Prices

Customer Energy Prices	Residential		Commercial		Manufacturing	
	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0132	$0.0169	$0.0113	$0.0135	$0.0094	$0.0135
Lower Mainland	$0.0105	$0.0169	$0.0099	$0.0135	$0.0087	$0.0135
Interior	$0.0104	$0.0169	$0.0098	$0.0135	$0.0086	$0.0135

4.3 SUMMARY OF ENERGY EFFICIENCY SCREENING RESULTS

A summary of the screening results for the energy efficiency options is presented Exhibit 4.4 below. The specific measures are taken from the results for Vancouver Island, unless otherwise noted; and are representative of all three regions. Highlights of the results shown in Exhibit 4.4 are summarized in the text that follows and the detailed calculations are provided in Appendix E.

Exhibit 4.4: Summary of Measure TRC Screening Results Commercial Sector Energy Efficiency Options

	Target Market				Simple Payback (Yrs)	Measure TRC [$]	B/C Ratio
Name	Service Area(s)	Sub Sector(s)	Vintage	Full/Incr			
DHW - Pre-Rinse Spray Valve (new)	All	small, medium & large	new	I	0.2	939	15.4
DHW - Pre-Rinse Spray Valve (existing)	All	small, medium & large	existing	F	0.3	904	10.0
Commercial Food Preparation - Gas Broilers	All	small, medium & large	existing & new	I	0.3	1,726	9.6
Ultra Efficient Building Design to 60% Below Current Practice (large)	All	large	new	I	1.4	1,609,017	9.0
High Efficiency Boilers (Existing) - Near-Condensing	All	medium & large	existing	I	1.1	48,158	5.0
DHW - High Efficiency Condensing DHW Boiler	All	large	existing & new	I	1.4	2,165	4.5
High Efficiency Boilers (New) - Near-Condensing	All	medium & large	new	I	1.4	29,532	4.0
Commercial Food Preparation - Gas Ranges	All	small, medium & large	existing & new	I	0.9	1,951	3.4
Demand Controlled Ventilation (large)	Interior	large	existing	F	1.3	19,942	3.3
DHW - High Efficiency Condensing DHW Heaters	All	medium & large	existing & new	I	1.6	2,165	2.1
Energy Efficient Building Design to 30% Below Current Practice (large)	All	large	new	I	5.9	238,752	1.9
Energy Efficient Building Design to 30% Below Current Practice (medium)	All	small and medium	new	I	6.0	80,657	1.9
Improved Building Operations - "Next Generation" BAS	All	large	existing	F	4.9	40,596	1.5
DHW - Instantaneous Hot Water Heaters	All	restaurants & med hotels	existing & new	I	2.5	1,058	1.5
High Efficiency Boilers (Existing) - Condensing	All	medium & large	existing	I	4.2	21,630	1.3
DHW - Drainwater Heat Recovery (New)	All	rest, large hotels, nursing homes, hospitals	new	I	3.6	3,885	1.2
Improved Building Operations - Building Recommissioning	All	medium & large	existing	F	6.1	20,596	1.2
High Efficiency Boilers (New) - Condensing	All	medium & large	new	I	4.6	10,352	1.2
DHW - Drainwater Heat Recovery (Existing)	All	rest, large hotels, nursing homes, hospitals	existing	F	4.2	885	1.0
High-Performance Glazings (New) - HIT Windows	All	large	new	I	11.7	(4,339)	1.0
Demand Controlled Ventilation (medium)	Interior	medium	existing	F	6.3	(1,439)	0.9
Commercial Food Preparation - Gas Fryers	All	small, medium & large	existing & new	I	5.1	(526)	0.6
High Efficiency Rooftop Units - Modulating	All	small & medium	existing	I	13.1	(29,959)	0.4
High-Performance Glazings (Existing) - Energy Star Windows	All	large	existing	I	19.5	(71,926)	0.3
High-Performance Building Envelopes - Gas-Filled Wall Panels	All	large	new	I	24.9	(93,645)	0.2
Increased Roof Insulation for Flat Roofs	All	small & medium low-rise	existing	I	25.1	(43,804)	0.2
High-Performance Glazings (Existing) - HIT Windows	All	large	existing	I	29.1	(259,842)	0.2
High-Performance Building Envelopes - Vacuum Panel Insulation	All	large	new	I	103.6	(568,374)	0.1

4.4 DESCRIPTION OF ENERGY EFFICIENCY TECHNOLOGIES AND MEASURES

The energy efficiency technologies and measures that were selected for inclusion in this study are listed below in Exhibit 4.5.

Exhibit 4.5: Energy Efficiency Technologies and Measures -- Commercial Sector

- Increased Insulation for Flat Roofs
- Energy Star Windows
- HIT Windows
- Aerogel Glazings
- Vacuum Panel Insulation
- Gas-Filled Wall Panels
- Energy Efficient Building Design
- Ultra-Efficient Building Design
- High Efficiency Boilers – Condensing
- High Efficiency Boilers – Non-Condensing
- Recommissioning
- "Next Generation" Building Automation Systems
- Demand-Controlled Ventilation
- High-Efficiency Rooftop HVAC Units
- Condensing DHW Boilers
- Condensing DHW Heaters
- Pre-Rinse Spray Valves
- On demand (Tankless) Water Heaters
- Drainwater Heat Recovery
- Commercial Food Equipment Technologies

Each of the technologies and measures shown in Exhibit 4.5 is briefly described in the text that follows. In each case, the text provides the following:[18]

- The current baseline technology
- A brief description of the upgrade technology
- The target sub sectors and building vintage(s) (new or existing) where the technology can be practically applied
- Information on the technology's energy performance and cost relative to the baseline technology
- The expected useful life of the technology.

Further detail is provided in Appendix E.

4.4.1 Increased Insulation for Flat Roofs

The current practice for re-roofing low-rise commercial flat built-up roofs results in an approximate thermal performance of R20. The application of an additional 2 inches (50 mm) of rigid foam insulation increases insulation values from R20 to R28.

The target sub sectors for this measure are all existing small and medium low-rise buildings. Energy simulation modelling of this measure shows that the resulting energy

[18] Energy and cost data are presented in imperial units as this continues to be the industry norm.

savings are between 5 to 10% of the total space heating energy use.[19] If this measure is applied at the time of roof replacement, the applicable costs are limited to the additional rigid foam insulation, which is approximately $0.40/ft^2$.inch.[20] Consequently, the total incremental cost of an additional 2 inches of insulation for a "typical" low-rise, medium building with a roof area of 70,000 ft^2 is $56,000.

The service life of this measure is estimated to be 25 years.

4.4.2 High Performance Glazings (R Value >4)

This study reviewed three glazing upgrade options. They are: Energy Star, HIT windows and Aerogel glazings. The target market is typically both existing and new large commercial buildings with high window-to-wall ratios (WWR). For existing buildings, the technology is applicable at the time of window replacement. In each case, this study assumes that the current practice is a standard double-glazed window. Each upgrade option is briefly discussed below.

- **Energy Star Windows**

Energy Star windows incorporate double-glazing, low-e (soft coating), argon fill, and high-performance spacers. When combined, these features produce windows with U-values of 1.87, or lower. Energy savings for this technology are estimated to be equal to 7% of the total space-heating requirement. The incremental price for this upgrade is approximately $3/ft^2$ of window area, or about 15%. For this technology, the target market is only existing large commercial building with high window-to-wall ratios.

The service life of this technology is estimated to be 25 years.

- **HIT Windows**

High Insulation Technology (HIT) windows achieve further insulation values through the use of low-e films suspended between the traditional two panes of glass to create two or more inter-pane air spaces. HIT windows achieve performance levels that are superior to triple pane windows, yet weigh the same as double pane windows.

In existing buildings, the incremental cost of HIT windows ranges from $8 to $13/ft^2$ of window area[21] (or, about $1.60/ft^2$ of floor area).[22] In new construction, the cost is assumed to be $0.80/ ft^2$ of floor area. The lower cost for new construction recognizes that HIT windows will be used in very high performance building designs that employ an Integrated Design Process (IDP). IDP provides equipment cost trade-offs as a result of equipment downsizing. Experience to date has shown that the cost savings from

[19] Energy savings based on CEEAM simulations of small low rise office and retail buildings.

[20] R.S Means.

[21] Personal communications, Visionwall Technologies.

[22] The cost per unit of window area has been converted to a cost per unit floor area assuming a WWR ratio of 0.38.

equipment downsizing equals approximately 50% of the incremental costs of the more efficient equipment and windows.[23]

Savings due to this measure are estimated to be in the range of 15% of the space heating energy used; the building's electrical energy consumption is also reduced by about 5% as a result of reduced air conditioning and ventilation fan loads.[24]

The service life of this technology is estimated to be 25 years.

- **Aerogel Glazings**

Aerogel glazings represent a third upgrade option that is currently under development. Aerogel is a transparent material that looks like glass, insulates better than mineral wool and is more heat resistant than aluminum. The combination of these features makes it suitable for use in many potential applications, including as a double pane window fill. Aerogel is one of the few existing materials that are both transparent and porous. It can be formed into almost any useful shape and can be inexpensively manufactured.

Silica aerogel, as a double pane window fill, performs to R-20 in a 90% vacuum, in contrast with today's best performance of around R-6.[25] In the commercial sector, the higher thermal performance provided by the aerogel glazings would result in significantly lower heating and cooling loads with consequent reductions in heating and cooling energy use.

There are a number of companies in the US currently working on developing this technology for different applications. They include Nanopore, Aspen Systems, Ocellus, Cabot Corp., and the TASSI Company. Use of aerogel for windows will not be possible until researchers find a way to clear their slightly hazy blue appearance.

Aerogel technology is still in the research and development stage and is not expected to reach commercialization for a number of years. Consequently, aerogels are not considered further in this study.

4.4.3 High Performance Building Envelopes

This study assumes that the current practice for envelope insulation is use of conventional materials, such as rigid foam boards and fibreglass. Two upgrade options were reviewed for improving the energy performance of building envelopes. They are: gas-filled wall panels and vacuum panel insulation. Each upgrade option is briefly discussed below. In both cases, the target market is new, large commercial buildings.

[23] *Integrated Designs and HVAC Equipment Sizing*, ASHRAE Journal, Sept. 2004.

[24] Energy savings based on CEEAM simulations of large commercial buildings.

[25] '*Aerogel: Energy Efficient Material for Buildings'*, Center for Building Science News, LBL, 1995.

- **Gas-filled Wall Panels**

Gas-filled Wall Panels (GFP) are constructed with sealed bags encased in a honeycombed baffle within a wall panel that is filled with a low-conducting gas, such as argon or krypton. GFPs have a thermal performance of R7/inch of wall thickness when filled with argon gas and R12.5/inch when filled with krypton gas.

Using this technology, an insulation performance of R30 can be attained with no increase in wall thickness. Energy savings of 8-14% in space heating have been calculated based on energy use simulation modelling in B.C. commercial buildings.[26] Gas-filled wall panels cost approximately $1/ft^2 per inch of insulation.

The service life of this technology is estimated to be 25 years.

- **Vacuum Panel Insulation**

Vacuum Panel Insulation (VPI) provides even greater insulation values than GFPs. The technology consists of a core panel enclosed in an airtight, vacuum-sealed envelope. These panels can achieve thermal resistance values of approximately R20/inch. Although targeted primarily to refrigerators and specialized containers, VPI can be manufactured in any size and thus has potential for building applications.

A wall component with a thermal resistance of R40 would result in energy savings of approximately 10%-16% of the total space-heating load. The price for this technology is approximately $10/ft^2 of insulation.

This service life of this technology is estimated to be 25 years.[27]

4.4.4 Integrated Building Design

This study considered two new building design upgrade options. They are: energy efficient building design to 30% below current practice and "Ultra-efficient" building design to 60% below current practice. Each upgrade option is briefly discussed below.

- **Energy Efficient Building Design to 30% Below Current Practice**

Over the past 10 years, significant experience has been gained throughout North America with the concept of whole building or integrated design process (IDP) to produce high performance buildings. IDP refers to an iterative process that seeks to optimize the building's design through minimization of heating, cooling, lighting, fan and pumping loads; the reduced loads are then met with the "best available" equipment and technologies such as air-to-air heat recovery, condensing boilers and high performance

[26] *BC Hydro Conservation Potential Review 2002*, prepared by Marbek for BC Hydro, May 2003. Energy savings are based on CEEAM simulations.

[27] Cost, and life based on estimates from ESource Heating Technology Atlas. Energy savings are based on CEEAM simulations.

building envelopes, etc. The iterative process allows the design team to take advantage of synergies that exist between building shell, HVAC equipment and lighting systems. The application of IDP magnifies the potential energy savings and helps offset the incremental cost of the energy efficient (EE) components. An important element of the IDP is the use of a Design Assistance Professional (DAP) who has extensive knowledge of EE technologies, can identify valid applications of the technologies and is able to test their application using a variety of analytical tools. These tools range from energy simulation models such as DOE 2.1E to computational fluid dynamic (CFD) models that can assess thermal performance and natural ventilation effectiveness.

Experience in Canada has shown that an IDP typically achieves energy savings of 25% to 35% compared to a building constructed in accordance with Canada's Model National Energy Code for Buildings (MNECB). Experience has also shown that incremental costs range from nothing to approximately 2% of total construction costs. This study assumes an incremental cost of $\$1.3/ft^2$ for both large and medium office buildings.

Energy efficient building design (30% below standard) is applicable to new, small, medium and large commercial buildings, and is assumed to have a service life of 25 years.

- **Ultra-Efficient Building Design to 60% Below Current Practice**

Programs such as the federal government's C-2000 Program and the Commercial Building Incentive Program (CBIP) as well as BC Hydro's Design Assistance Program have achieved energy savings of 25% to 50% over standard design practice[28]. Current research efforts are directed towards higher performance levels through the application of IDP coupled with a higher degree of weather integration via passive cooling, natural or hybrid ventilation designs and use of renewable technologies. A common element of these ultra low energy designs is the use of displacement ventilation (DV) systems with radiant cooling, which are better suited for hybrid and natural ventilation designs than other approaches.

There is limited information on the performance of ultra low energy designs. Available data indicates that energy savings are in the range of 50% to 70% relative to conventional construction. Construction costs can be similar, or lower than, conventional buildings due to the design optimization that tends to reduce HVAC equipment sizes. This is consistent with the findings from high performance programs such as Canada's C-2000 program, which has seen a number of projects achieve the same construction cost as the base case design.

The incremental cost of an ultra-efficient building is estimated to be equal to 1% of total construction costs, or approximately $\$1/ft^2$. The incremental costs for an ultra-efficient building (60% below standard) is actually lower than the incremental costs for energy efficient building (30% below standard) because of the "tunneling through the cost

[28] Standard design practice often exceeds the Model National Energy Code for Buildings (MNECB).

barrier" effect that occurs with equipment downsizing trade-offs that are present with very high performance designs.

Ultra-efficient building design (60% below standard) is applicable to new, large commercial buildings and is assumed to have a service life of 25 years.

4.4.5 High Efficiency Boilers

Two boiler efficiency upgrade options were considered: High efficiency, Near-Condensing Boilers and High Efficiency Condensing Boilers. For both options, the base case is a standard efficiency atmospheric boiler with a steady-state efficiency (Et) of 80% (seasonal efficiency of 68%),[29] a cost of $7/kBtu,[30] and an estimated service life of 25 to 30 years.[31] In both cases, the target market is new and existing medium and large commercial buildings. Each upgrade option is briefly discussed below.

- **High Efficiency Near-Condensing Boilers**

This study defines high efficiency near-condensing boilers as those models that exceed the minimum steady state efficiency (Et) of 80%, as outlined in ASHRAE Standard 90.1-2000. Commercial boilers that meet this standard typically have efficiencies in the range of 82% up to 88%.[32] Within this product group, individual models vary widely in design, cost and quality with the most efficient models generally being the most expensive. These types of boilers range from cast iron sectional boiler designs to large scotch marine and others.

This study uses an average steady state efficiency of 85% (seasonal efficiency of 80%) for high-efficiency near-condensing boilers and a cost of $10/kBtu.

- **High Efficiency Condensing Boilers**

The most efficient boilers available on the market are condensing boilers, which condense the water vapour in the flue gas to recover more useful heat energy. Unfortunately, due to the corrosive nature of this condensate, condensing boilers must be made from expensive corrosion-resistant materials, such as stainless steel.

When condensing boilers replace existing systems, it is often necessary to make modifications to the perimeter radiation system because the lower water temperatures inherent to condensing units require increased flow and a greater radiator surface area. In new construction, the radiation systems are designed for these requirements.

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[29] Source: Terasen Gas.

[30] Source: Terasen Gas.

[31] Efficiency ranges and costs are from manufacturer's estimates. Estimated life is from ACEEE (ASHRAE estimates life of a steel boiler at 25 years, and a cast iron boiler at 35 years).

[32] Boilers with efficiencies above 88% are discussed under the "High Efficiency Condensing Boiler category.

In this study, condensing boilers are estimated to have a steady state efficiency of 94% and a seasonal efficiency of 89% to 92% depending on the application. The design and use of expensive materials give these units a large incremental cost over standard units. The cost of a high-efficiency condensing boiler is estimated to be $24/kBtu.[33]

4.4.6 Improved Building Operations

Two improved building operations options were considered in this study: Building Recommissioning and "Next Generation" Building Automation Systems (BAS). Each option is briefly discussed below.

- **Building Recommissioning**

"Recommissioning" is a process of optimizing the operation of an existing building through low-cost and no-cost repairs and operational changes.[34] It includes the following tasks:

- Optimize system operations to improve comfort and reduce energy costs
- Solve existing comfort or indoor air quality problems
- Undertake air and water rebalancing
- Review and update equipment control sequences to ensure optimum operation during occupied periods and shutdown during unoccupied periods
- Ensure ongoing optimal operation through involvement and training of building staff
- Make recommendations for system improvements and retrofits.

In contrast to the conventional audit and retrofit process, recommissioning involves a greater investment in monitoring and simulation of building systems to gain a thorough understanding of current operation and possibilities for optimization. Because the measures recommended tend to be inexpensive, the overall cost is typically one-third that of the audit/retrofit process. Overall costs range from $0.40 to $0.60/ft^2 and are primarily for labour.

Recommissioning typically results in energy savings of 5 to 10% of space heating consumption. The savings come mostly from repairs to equipment, such as valves, controllers or thermostats, and from optimization of duct pressures, hot and cold air temperatures, variable air volume settings and pump control. Paybacks are typically achieved over 1 to 2 years. Electrical energy savings of 5 to 10% from reduced and optimized operation of HVAC equipment are also commonly achieved.

Because of the significant initial investment in monitoring and simulation, the target market is medium and large commercial buildings.

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[33] Source: Terasen Gas.

[34] Marbek, "Recommissioning Options Discussion Paper," prepared for Public Works and Government Services Canada, March 2002.

This study uses a recommissioning cost of 50 cents/ft^2 and a corresponding energy savings of 7.5%. The service life is estimated to be 10 years.

- **"Next Generation" Building Automation Systems**

The majority of large commercial buildings have Building Automation Systems (BAS). However, only a small number of these systems are maintained on a continuous basis. Similarly, few have had their software revised or control algorithms updated. The latest generation of BAS is able to automatically detect anomalies in building operations and can automate building diagnostics as well. These systems typically take data on the performance of a building's energy systems, analyze them using logic and physical modelling to detect deviations from expected performance, and use built-in logic to suggest the cause of the deviation.[35]

In addition, the newer generations of BAS have improved predictive, self-tuning control algorithms that help to minimize the need for by-pass or override of the BAS.

Energy savings of 5 to 10% can be achieved from the installation of a "next generation" BAS or from a system upgrade that incorporates a new front-end, automated diagnostics, and control strategies. These savings result from re-instituting equipment scheduling, expanding control strategies (e.g., lighting) and improving self-tuning control strategies. In addition, electrical energy savings of approximately 5 to 10% are also common due to reduced HVAC equipment operation.

This study uses a BAS cost of 40 cents/ft^2 and a corresponding savings of 7.5% of the total building energy use. The target market for "next generation" BAS is large commercial buildings. The service life is estimated to be 10 years.

4.4.7 Demand Controlled Ventilation

Demand Controlled Ventilation (DCV) uses CO_2 sensors to supply outdoor air (OA) based on the actual building occupancy, while preserving indoor air quality. Energy is saved because lower volumes of OA are introduced when occupancy levels are reduced. In practice, volumes of OA can often be reduced by as much as 50%. For commercial buildings such as a large office, this reduction in OA can reduce the space heating energy use for conditioning OA by up to 5 to 10%. Similarly, in medium commercial buildings that utilize packaged rooftop heating-cooling units, the overall reduction in space heating energy use is also 5 to 10%.

DCV can be installed as an add-on, as part of a building retrofit or during the construction of a new building. If DCV is installed in an application that already has an automated control system, then the incremental cost is $800 to $1,000 per zone. If the application is an add-on to an air handling systems system that does not have an

[35] "Automated Building Diagnostics: Improving Energy Performance and Occupant Comfort," *E Source E News*, ER-01 (18 Nov 2001).

automated control system, then the cost is approximately $1,200 per zone. The majority of new HVAC systems (approximately 75% of new systems) are installed with automated controls.

In this study, the target market for DCV is existing medium and large commercial buildings. For this study, the cost of implementing DCV is estimated to be $1,000 per zone in a large commercial building with a BAS, and $1,200 per rooftop unit in medium commercial buildings. Annual energy savings are estimated to be 7.5% in both medium and large commercial buildings. The service life of this measure is estimated to be 15 years.

4.4.8 High Efficiency Rooftop Units

Typical commercial gas-fired rooftop air conditioning units have a fixed heating capacity or a "low-high," two-stage heating capacity control. Seasonal efficiencies are typically about 70%. This study considered two rooftop upgrade options: Modulating Rooftop, Heat-Cool Units; and Condensing Rooftop, Heat-Cool Units.

- **High-Efficiency Modulating Rooftop Heat-Cool Units (RTUs)**

Modulating rooftop HVAC units increase energy efficiency by modulating the burner and combustion air flows. This approach allows for greater temperature control and eliminates much of the cycling losses. The net result is higher seasonal efficiencies.

Modulating units, such as the Trane Intellipak and units manufactured by Engineered Air, are able to maintain their steady state efficiencies by avoiding "on-off" cycling. These units operate their heating sections continuously and modulate the heating output to match the space heating requirements. As a result the units attain seasonal efficiencies of 83-86%. These units also have higher efficiency A/C sections. Typical units have an EER of about 10.5; this compares with an EER of 9.5 for baseline equipment.

The incremental cost of modulating units over standard units is roughly $150 to $500/ton.[36] The average life of these units ranges from 15 to 25 years.

For this study, this technology is applicable to existing small and medium commercial buildings that replace their RTUs at the end of the equipment life. The seasonal efficiency of a modulating unit is 80% compared to 70% for a standard unit. The incremental cost is estimated to be $300/ton; and therefore incremental cost for a typical medium commercial building is $54,000.

The service life is estimated to be 20 years.

[36] Cost and savings information from *Emerging Energy-Saving Technologies and Practices for the Building Sector: 2004*, ACEEE and personal communication with Engineered Air.

- **High-Efficiency Condensing Rooftop Heat-Cool Units (RTUs)**

The only known available condensing RTUs are from Custom Mechanical Equipment (CME) a division of Lennox Industries that offers custom-order high efficiency packaged multizone RTUs. These multizone RTUs are extremely expensive and rarely used in typical commercial applications. As a result of the limited product availability and highly site-specific costs of each unit, this technology was not assessed any further.

4.4.9 Domestic Hot Water

This study considered five DHW upgrade options: On demand Hot Water Heaters, HE Condensing DHW boilers, HE Condensing DHW Heaters, Pre-Rinse Spray Valve, and Drain Water Heat Recovery. For each option, the base case is either a standard gas-fired tank water heater with an energy factor in the range of 0.52 to 0.6, an installed cost of approximately $1,700 and a service life of 10 to 12 years;[37] or, a standard DHW boiler with an efficiency of approximately 75%, a cost approximately $7/kBtu, and a service life of 25 to 30 years. Each DHW upgrade option is briefly discussed below.

- **On demand Hot Water Heaters**

In-line tankless water heaters heat water on demand, eliminating hot water storage. The efficiency of tankless water heaters depends on the water heater's characteristics and on the temperature of the water being heated. Operating efficiencies can be as high as 95% but are more typically in the 75% to 80% range. The absence of hot water storage reduces standby heat losses. One concern with promoting the uptake of on demand water heaters is that they have a higher natural gas capacity than a standard water heater (2 to 4 times) for the same application. The absence of a storage tank requires that an on demand heater be sized for the peak coincident DHW load. The potential impact of the use of on demand water heaters on gas supply and distribution should be considered when evaluating this technology.

For this study, the target market is existing and new small and medium commercial buildings that have high DHW needs such as restaurants and hotels. The installed cost of a 4 USGPM on demand commercial water heater is $3,800 as compared to $1,700 for an equivalent standard 85 USG tank heater. The seasonal efficiency of an on demand water heater is estimated to be 80% and, due to the high quality materials used in tankless water heaters, their useful life is 20 years.

- **High Efficiency Condensing DHW Boilers**

Condensing boilers used to generate domestic hot water are available in capacities of over 100 gallons, can operate at thermal efficiencies as high as 95% and have low

[37] Sources: 1) "Emerging Energy-Saving Technologies and Practices for the Buildings Sector: 2004", ACEEE, 2) "A comparative Study of High-Efficiency Residential Natural Gas Water Heating", 2002, ACEEE. 3) www.tanklesswaterheaters.ca

standby energy losses.[38] Condensing boilers can cost three times more than standard non-condensing boilers. This target market for this technology is both new and existing large commercial buildings with large DHW requirements.

For this study, the high-efficiency condensing boiler is estimated to have a cost of $24/kBtu, a seasonal efficiency of 90%, and a service life of 25 years.

- **High Efficiency Condensing DHW Heaters**

Condensing water heaters can capture over 90% of the input energy, but their high cost has limited their market penetration to date. These units capture almost all of the heat value of condensing flue gas water vapour to liquid (about 10% for natural gas). More importantly, their forced draft burners eliminate off-cycle heat transfer to the flue.

For this study, the target market for his condensing water heaters is new and existing medium and large commercial buildings; the cost is $2,000 more than a conventional power vent water heater; the efficiency is 95%; and the service life is 10 years.

- **Pre-Rinse Spray Valves**

Pre-rinse spray valves (also called a spray nozzle or spray head) are used by restaurant and cafeteria and kitchen staff to remove food from plates and other dishes prior to loading them in the dishwasher. New energy and water efficient valves utilize a “knife-edge” spray rather than a traditional “shower-type” spray to better focus the available energy and remove the food particles more efficiently. A traditional spray valve uses 10 to 20 litres per minute (Lpm) of hot water, while a new efficient model uses 6 Lpm or less.

The target market for energy and water efficient spray valves is new and existing small, medium and large commercial buildings with commercial food preparation equipment. For this study, the valve is estimated to be used 1 hour per day, cost $65 and have an expected service life of 5 years.

- **Drainwater Heat Recovery**

Drainwater heat recovery systems transfer the waste heat from drains to pre-heat make-up water. One example of this technology is the GFX system, which was originally developed with a grant from the US Department of Energy and is currently manufactured by Doucette Industries. The GFX system incorporates a shell-and-tube heat exchanger that typically has efficiencies in the range of 30 to 50%. The cost of these systems varies according to the application and the complexity of the installation. Specific applications include commercial laundries and dishwashers.

[38] Nichols, D; “Emerging Technologies for a Second Generation of Gas Demand-Side Management”, 2004.

The target market for this technology is quite specialized and includes restaurants, nursing homes, and hospitals, and large hotels in both existing and new buildings. The installed cost is estimated to be $8,000 for a new building; and for existing buildings, the cost is estimated to be $12,000 due to the need to modify the existing sanitary pipe layout. Energy savings are estimated to be 20% of DHW energy use for the specific appliance, and the service life is estimated to be 20 years.

4.4.10 Commercial Food Preparation

Three gas appliances, ranges, fryers and broilers, together account for an estimated 70% of commercial kitchen primary cooking energy use in Canada.[39] The target market for these technologies is small, medium, and large commercial buildings. A brief outline of efficiency improvement opportunities in these appliances is presented below.

- **Gas Ranges**

The commercial range-top is the most widely used piece of commercial cooking equipment. Standard gas ranges have efficiencies in the range of 25 to 30% and use about 160,000 kBtu per year per range.[40] Efficient gas ranges use advanced technologies such as power burners, sealed combustion, infrared burners and halogen range tops. The use of these new technologies improves range efficiency into the range of 45 to 60%.[41]

This study used the following estimates: an energy efficient range has an efficiency of 52%; and costs approximately $3,300, or about $800[42] more than a standard efficiency model that has an efficiency of 27%. The service life of a range is assumed to be 10 years, but this number is highly dependent on maintenance and operation practices.

- **Gas Fryers**

Standard gas fryers have efficiencies in the range of 25 to 50% and use approximately 74,900 kBtu per year per fryer.[43] Various new technologies, such as infrared burners, powered burners, recirculation tubes, and fry pot insulation have been developed that improve fryer efficiency to roughly 50 to 65%.

Infrared (IR) burners employ a fine honeycomb matrix to evenly disperse the fuel/air mixture across the burner surface. Combustion takes place close to the burner surface,

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[39] Technology Review of Commercial Food Service Equipment, Prepared for NRCan and Consumers Gas by Don Fisher and CGRI, 1996. The actual breakdown is 31.8% for ranges, 19.24% for broilers and 17.5% for fryers.

[40] *Commercial Cooking Appliance Technology Assessment*, Prepared for the Food Service Technology Center by Don Fisher, 2002.

[41] Ibid.

[42] Incremental cost from *Natural Gas Efficiency and Conservation Measure Resource Assessment,* Prepared for the Energy Trust of Oregon by Ecotope, 2003.

[43] *Commercial Cooking Appliance Technology Assessment*, Prepared for the Food Service Technology Center by Don Fisher, 2002.

causing it to become red-hot and emit infrared radiation to the surrounding heat-transfer-tube walls. IR burners currently represent 5-10% of the gas fryers in the marketplace.[44]

This study used the following estimates: an infrared fryer has an efficiency of 57%; and cost about $2,500 or about $1,300 more than a standard efficiency fryer[45] that has an efficiency of 37%. The service life of a fryer is 10 years.

- **Gas Broilers**

Depending on type, broilers use approximately 115,000-210,000 kBtu per year per unit and have efficiency levels that range from 15% to 30%.[46] Past broiler efficiency strategies have dealt with methods of reducing the input energy when the broiler is idle; however, none have proven to be commercially successful. Similarly, the flavour and appearance of broiled food is distinctive, and is often the selling point on the menu; consequently, switching to other, more efficient cooking methods is typically not a viable option.

Commercial broilers cost approximately $7,000. In general, broiler prices vary based on non-energy features and are not directly related to the unit's energy efficiency. This study, therefore, assumes the most efficient units (30% efficiency) have a small incremental cost ($200) over the baseline models that have an efficiency of 20%. The service life of a commercial broiler is estimated to be 10 years.

4.5 SUMMARY OF FUEL CHOICE SCREENING RESULTS

A summary of the screening results for the fuel choice upgrade options is presented Exhibit 4.6 below. The specific measures are taken from the results for Vancouver Island, and are representative of all three regions. Highlights of the results shown in Exhibit 4.6 are summarized in the text that follows and the detailed calculations are provided in Appendix F.

[44] Ibid.

[45] *Natural Gas Efficiency and Conservation Measure Resource Assessment,* Prepared for the Energy Trust of Oregon by Ecotope, 2003. (Energy Star assumes $1,000 (US) incremental price.)

[46] *Commercial Cooking Appliance Technology Assessment*, Prepared for the Food Service Technology Center by Don Fisher, 2002.

Exhibit 4.6: Summary of TRC Measure Screening Results–Commercial Sector Fuel Choice Options

Name	Target Market				Measure TRC [$]	B/C Ratio
	Service Area(s)	Sub Sector(s)	Vintage	Full/Incr		
Electric DHW to Gas (New) - Natural Gas Water Heater	All	small, medium & large	New	I	11,307	2.1
Electric DHW to Gas (Existing) - Natural Gas Water Heater	All	small, medium & large	Existing	I	9,999	2.1
Electric DHW to Gas (New) - Multiple Natural Gas Water Heaters	All	small, medium & large	New	I	10,322	2.0
Electric DHW to Gas (Existing) - Multiple Natural Gas Water Heaters	All	small, medium & large	Existing	I	8,979	2.0
Electric DHW to Gas (Existing) - On Demand Natural Gas Water Heater	All	small, medium & large	Existing	I	2,873	1.6
Electric DHW to Gas (New) - Instantaneous Natural Gas Water Heater	All	small, medium & large	New	I	1,066	1.2
Electric Heating to Gas (New) - Forced Air Heating Application	All	small, medium & large	New	I	10,176	1.2
Electric Heating to Gas (Existing) - Forced Air Heating Application	All	small, medium & large	Existing	I	5,411	1.2
Electric Heating to Gas (New) - Hydronic Heating Application	All	small, medium & large	New	I	-238,698	0.4
Electric Heating to Gas (Existing) - Hydronic Heating Application	All	small, medium & large	Existing	I	-251,735	0.4

4.6 DESCRIPTION OF FUEL CHOICE MEASURES

This sub section provides a brief description of each of the fuel choice technologies and measures that are included in this study, as listed in Exhibit 4.7.

Exhibit 4.7: Fuel Choice Technologies and Measures– Commercial Sector

- Electric DHW to natural gas – new buildings
- Electric space heating to natural gas – new buildings
- Electric DHW to natural gas – existing buildings
- Electric space heating to natural gas – existing buildings
- Electric cooling to natural gas cooling for large commercial

Each of the technologies and measures shown in Exhibit 4.7 are briefly described in the text that follows. In each case, the text provides the following:

- The current baseline technology
- A brief description of the upgrade technology
- Information on the technology's energy performance and cost relative to the baseline technology
- The target sub sectors and building vintage(s) (new or existing) where the technology can be practically applied
- The expected useful life of the technology.

4.6.1 Electric DHW To Natural Gas

The evaluation of domestic hot water fuel choice options involved a study of gas-fired domestic hot water heaters and gas-fired on demand water heaters for both new and existing commercial buildings. The results show that buildings with large DHW loads such as restaurants and nursing homes demonstrate the best economic potential for fuel choice options. Furthermore, DHW heaters located in single storey buildings, penthouses, and in close proximity to the building perimeter represent the best conditions for venting gas appliances.

An overview of the three fuel choice upgrade options considered in this study is presented below.

- **Natural Gas DHW Heater – Central DHW Application**

The baseline for this option is a single commercial electric water heater that forms part of a centralized DHW system consisting of a heater, circulation pump and piping distribution system. For this application, a “medium office” building was selected to test and demonstrate the feasibility of the upgrade. The baseline electric water heater has a storage capacity of 85 USG; an energy factor (EF) of 0.91; a 1^{st} hour rating of 290 USG; a 45 kW electric heating element; an estimated installed cost of $1,500 (adapted from Means); and an expected service life of 10 to 12 years.

The upgrade option is the installation of a standard natural gas fired DHW heater equipped with a power-vent for the products of combustion. The heater has an EF of 0.6, a storage capacity of 90 USG, a 1st hour rating of 300 USG, an installed cost of $1,700 (adapted from Means), and an expected service life of 10 to 12 years.

For this application, the target market for gas-fire DHW heaters is both new and existing small, medium and large commercial buildings equipped with a central commercial-sized electric DHW heater.

- **Multiple Natural Gas DHW Heaters – Distributed DHW Application**

The baseline for this option is four electric water heaters that form part of a distributed DHW system consisting of four independent DHW systems located within a commercial building. For this application, a “medium office” building was selected to test and demonstrate the feasibility of the upgrade. The baseline electric water heaters each have a storage capacity of 50 USG; an EF of 0.91; a 1st hour rating of 90 USG; a 9 kW electric heating element; an estimated installed cost of $700 (adapted from Means); and an expected service life of 10 to 12 years.

The upgrade option is the installation of four standard natural gas fired DHW heaters equipped with power-vents. The heaters each have a storage capacity of 50 USG; and EF of 0.6; a 1^{st} hour rating of 90 USG, an installed cost of $900 (adapted from Means), and an expected service life of 10 to 12 years.

For this application, the target market for gas-fire DHW heaters is both new and existing small, medium and large commercial buildings equipped with distributed electric DHW heaters.

- **Natural Gas On demand Heater – On-demand DHW Application**

The baseline for this option is a commercial electric water heater that forms part of an on-demand DHW system consisting of a heater and a piping distribution system. For this application, a “food retail” building was selected to test and demonstrate the feasibility of the upgrade. The baseline electric water heater has a storage capacity of 85 USG; an energy factor (EF) of 0.91; a 1st hour rating of 290 USG; a 45 kW electric heating element; an estimated installed cost of $1,500 (adapted from Means); and an expected service life of 10 to 12 years.

The upgrade option is the installation of a commercial-grade on demand natural gas fired DHW heater. The heater has an EF of 0.81; a capacity of 4 USGPM at 90 deg. F delta T; an installed cost of $3,800 (as per supplier quotation); and an expected service life of 20 years.

The target market for natural gas on demand water heaters is both new and existing small, medium and large commercial buildings equipped with an on-demand electric DHW heating system.

4.6.2 Electric Space Heating to Natural Gas

The evaluation of space heating fuel choice options involved a study of gas-fired hydronic heating systems, and gas-fired packaged rooftop units for both new and existing commercial buildings.

An overview of the two fuel choice upgrade options considered in this study is presented below.

- **Natural Gas-Fired Space Heating – Perimeter Hydronic Application**

The baseline for this option is a commercial building equipped with perimeter electric heating, either electric baseboard heaters, fan coils, or PTACs, with an estimated conversion efficiency of 98% and an estimated service life of 25 years. For this application, a “medium hotel” was selected to test and demonstrate the feasibility of the upgrade.

The upgrade option is the installation of a gas-fired high efficiency boiler with an estimated seasonal efficiency of 80%, a perimeter hydronic heating system, and a gas-fired ventilation system. The upgrade an estimated installation cost of $5 to $6 per square foot (adapted from Means), and an expected service life of 25 years.

For this application, the target market for gas-fired DHW heaters is both new and existing small, medium and large commercial buildings equipped with perimeter electric heating.

- **Natural Gas-Fired Space Heating – Forced Air Application**

The baseline for this option is a commercial building equipped with multiple electric rooftop units for heating and cooling. For this application, a “food retail” building was selected to test and demonstrate the feasibility of the upgrade. More specifically, the baseline consists of three 10 ton packaged rooftop units equipped with electric resistance heating; an estimated conversion efficiency of 98%; an installed cost of $7,225 each (as per Means); and an expected service life of 15 years.

The upgrade option is the installation of equivalent 10 ton gas-fired rooftop units with an estimated seasonal heating efficiency of 78%. The upgrade an estimated installation cost of $14,500 each (as per Means), and an expected service life of 15 years.

For this application, the target market for gas-fired rooftop units is both new and existing small, medium and large commercial buildings equipped with electric rooftop units.

5. ECONOMIC POTENTIAL FORECAST – ENERGY EFFICIENCY SCENARIO

5.1 INTRODUCTION

This section presents the Commercial Sector Economic Potential Forecast – Energy Efficiency Scenario for the study period (FY 2003/04 to FY 2015/16). The Economic Potential Forecast – Energy Efficiency Scenario estimates the level of natural gas consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost-effective. In this study, "cost-effective" means that the technology upgrade passes the measure Total Resource Cost (TRC) test, as discussed previously in Section 4.2.[47]

The discussion in this section is presented in the following subsections:

- Major modelling tasks
- Technologies included in the economic potential forecast – energy efficiency scenario
- Presentation of results
- Interpretation of results.

5.2 MAJOR MODELLING TASKS

To develop the Commercial Sector Economic Potential Forecast – Energy Efficiency Scenario, the following steps were undertaken:

- The measure TRC results for each of the energy-efficiency upgrades presented previously in Exhibit 4.4 were reviewed.

- Technology upgrades that had positive TRC results were selected for inclusion in the economic potential scenario, either on a "full cost" or "incremental" basis. Technical upgrades passing the TRC test on a "full cost" basis were implemented in the first forecast year. Those upgrades that only passed the TRC test on an "incremental" basis were introduced as the existing stock approached the end of its useful life, which in this study was agreed to be 75% of the equipment's rated life expectancy.

- Energy use within each of the building segments 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 forecast were replaced with the most efficient "technology upgrade option" that passed the TRC test. If

[47] Energy markets in Canada and worldwide have experienced a number of extraordinary events in the recent past. As a result, natural gas costs have risen substantially since the start of this CPR. As current natural gas costs are higher than those used in this analysis, the benefits of efficiency measures may be understated while the benefits of fuel choice measures may be overstated. Within the limits of the time and resources available, this CPR has attempted to accommodate the increasing natural gas prices by applying a "high level" price sensitivity analysis to the measures screening process. Efficiency measures that were close but did not initially pass the measures TRC test have been included in the Economic Potential scenario. This approach recognizes that the measures will be subject to further economic screening during the detailed program design stage, which will provide a further opportunity to decide whether the measures should continue to be included in Terasen's program portfolio.

more than one cost effective measure existed for the same end use application, the study selected the most energy efficient one.

When more than one upgrade option was applied to a given end use, the first measure selected was the one that reduced the end use load. For example, for the domestic hot water (DHW) end use, pre-rinse spray valves are applied first (where applicable) to reduce load. Building automation systems are applied next, to optimize performance of the system through better controls. Drainwater heat recovery (where applicable) is applied next, to further reduce load. Finally, the measures to replace DHW boilers and water heaters are applied, to improve the efficiency of the equipment itself.

5.3 TECHNOLOGIES INCLUDED IN ECONOMIC POTENTIAL FORECAST

Exhibit 5.1 provides a listing of the technologies selected for inclusion in this forecast. In each case, the exhibit shows the following:

- End use affected
- Upgrade option(s) selected
- Building segments[48] to which the upgrade options were applied
- Rate at which the upgrade options were introduced into the stock.

[48] Measures selected for the small commercial segment were extrapolated from the modelling results for the large and medium buildings as small buildings were not specifically modelled in Section 4. This is consistent with the approach applied in the BC Hydro CPR.

Exhibit 5.1: Technologies Included in Economic Potential Forecast – Energy Efficiency Scenario

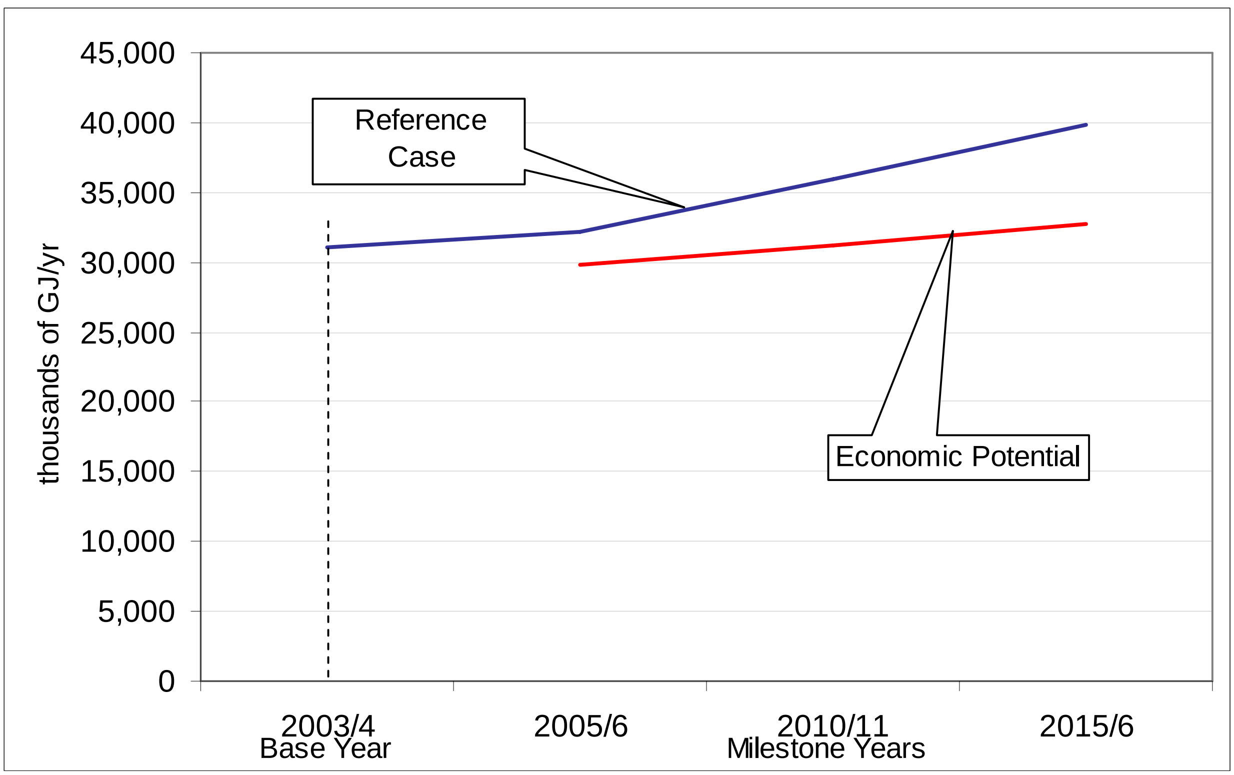
End Use	Upgrade Option	Applicability of Upgrade Options by building Segment	Rate of Stock Introduction
Space Heating	Non-condensing boilers	• Large and medium buildings	• Existing buildings, at rate of boiler replacement • New buildings, included in the Improved Construction measures (below)
	Building Automation Systems	• Large buildings	• Existing buildings, immediate • New buildings, included in the Improved Construction measures (below)
	Commissioning	• Medium and large buildings	• Existing buildings, immediate • New buildings, included in the Improved Construction measures (below)
	New Building Construction 60% Below Current Energy Consumption	• Large Buildings	• New buildings, immediate
	New Building Construction 30% Below Current Energy Consumption	• Medium and small buildings	• New buildings, immediate
DHW	Condensing DHW Boilers	• Large buildings	• Existing buildings, at rate of boiler replacement • In new buildings, included in the Improved Construction measures (below)
	Condensing DHW Heaters	• Large and medium buildings	• Existing buildings, at rate of water heater replacement • In new buildings, included in the Improved Construction measures (below)
	Building Automation Systems	• Large buildings	• Existing buildings, immediate • New buildings, included in the Improved Construction measures (below)
	DHW Drainwater Heat Recovery	• Restaurants, hospitals, nursing homes and large and medium hotels	• Existing hotels, immediate • In new hotels, included in the Improved Construction measures (below)
	Pre-rinse Spray Valve	• All	• Immediate introduction in existing buildings • In new buildings, included in the Improved Construction measures (below)
	New Building Construction 60% Below Current Energy Consumption	• Large Buildings	• New buildings, immediate
	New Building Construction 30% Below Current Energy Consumption	• Medium and small buildings	• New buildings, immediate
Commercial Food Preparation	Efficient Gas Range	• All	• Existing buildings, at turnover, full penetration by 2016 • New buildings, immediate

End Use	Upgrade Option	Applicability of Upgrade Options by building Segment	Rate of Stock Introduction
	Efficient Gas Broiler	• All	• Existing buildings, at turnover, full penetration by 2016 • New buildings, immediate

5.4 PRESENTATION OF RESULTS

Exhibit 5.2 compares levels of commercial Energy Efficiency Scenario, natural gas consumption for the Reference Case and the Economic Potential Forecast. As illustrated, under the Reference Case, commercial natural gas use would grow from base year levels of approximately 31.0 million GJ/yr. to approximately 39.8 million GJ/yr. by the FY 2015/16. This contrasts with the Economic Potential Forecast – Energy Efficiency Scenario in which natural gas use grows to 32.8 million GJ/yr. over the same period, a reduction of approximately 7.1 million GJ/yr., or about 18%.

Exhibit 5.2: Reference Case versus Economic Potential Forecast Energy Efficiency Scenario for the Commercial Sector, (thousand GJ/yr.)



5.4.1 Energy Savings

The following exhibits provide further detail on the total potential natural gas savings within the Economic Potential Forecast – Energy Efficiency Scenario:

- Exhibit 5.3 presents the results by service region and milestone year
- Exhibit 5.4 presents the results by building segment and milestone year
- Exhibit 5.5 presents the results by end use and milestone year and also includes a pie chart
- Exhibit 5.6 provides a further disaggregation of the savings by end use, technology, milestone year and cost.

Exhibit 5.3: Natural Gas Savings by Service Region and Milestone Year, (thousand GJ/yr)

Milestone Year	Annual Savings (thousands GJ/yr.)				% Savings in 2015/16 Re: Reference Case
	Lower Mainland	Vancouver Island	Interior	Total	
2005/06	1,583	411	466	2,460	8%
2010/11	3,071	760	909	4,739	13%
2015/16	4,560	1,149	1,344	7,053	18%
% Savings 2015/16 Re: Reference Case	18%	18%	16%	18%	
% of Total Savings in 2015/16	65%	16%	19%		

Exhibit 5.4: Natural Gas Savings by Building Segment and Milestone Year, (thousand GJ/yr)

Segment	Milestone Year			% Savings 2015/6	
	2005/6	2010/11	2015/6	Re: Ref Case	Re: Total
	thousand GJ				
Large Office	287	456	620	30%	9%
Medium Office	48	74	99	14%	1%
Large Non-Food Retail	171	286	393	27%	6%
Medium Non-Food Retail	29	44	58	13%	1%
Food Retail	23	44	66	16%	1%
Large Hotel	131	233	325	30%	5%
Medium Hotel/Motel	27	56	82	17%	1%
Hospital	141	230	305	31%	4%
Nursing Homes	52	87	117	28%	2%
Large School	261	448	657	34%	9%
Medium School	116	231	357	22%	5%
University/College	309	456	616	29%	9%
Restaurant/Tavern	119	210	301	23%	4%
Warehouse/Whsale	88	127	159	12%	2%
Mixed Use	19	37	55	16%	1%
Small Commercial	387	1,230	2,094	12%	30%
Recreational and Other	253	491	748	17%	11%
Miscellaneous	0	0	0	0%	<1%
Total	2,460	4,739	7,053	18%	100%

Exhibit 5.5: Natural Gas Savings by End Use and Milestone Year, (thousand GJ/yr)

End Use	Milestone Year			% Savings 2015/6	
	2005/6	2010/11	2015/6	Re: Ref Case	Re: Total
	thousand GJ				
Space Heating	1,863	3,251	4,700	17%	67%
DHW	451	959	1,434	25%	20%
Food Prep	147	529	919	21%	13%
Total	2,460	4,739	7,053	18%	100%

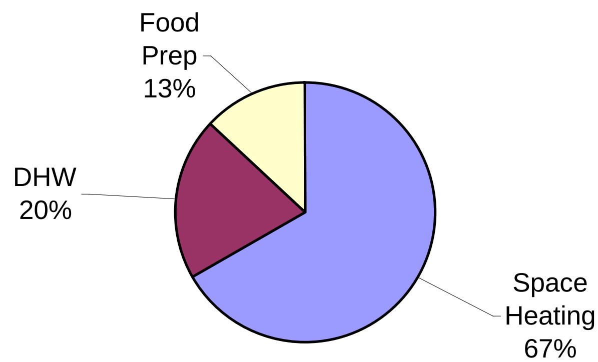


Exhibit 5.6: Natural Gas Savings by End use, Technology, Segment, Milestone Year and Benefit/Cost Ratio

End Use	Technology	Economic Potential (thousand of GJ)			B/C Ratio
		2005/06	2010/11	2015/16	
DHW	DHW Spray Valve	154	154	154	10.04
Comm Food Prep	Efficient Gas Broiler	55	197	342	9.63
Htg and DHW	Savings from 60% Better Construction	224	907	1,604	9.05
DHW	DHW Condensing Boiler	7	23	36	4.49
Comm Food Prep	Efficient Gas Range	92	332	577	3.44
Heating	DCV	60	60	60	2.75
DHW	DHW Condensing Heater	132	403	640	2.08
Htg and DHW	Savings from 30% Better Construction	159	628	1,146	1.92
Heating	Commissioning	892	892	892	1.51
Heating	Condensing Boilers	183	641	1,100	1.30
Htg and DHW	BAS	471	471	471	1.21
DHW	DHW Heat Recovery	30	30	30	1.04
TOTAL		2,460	4,739	7,053	

5.5 INTERPRETATION OF RESULTS

Highlights of the results presented in the preceding exhibits are summarized below:

- **Savings by Service Region**

Exhibit 5.3 shows that the overall savings are distributed among the three service regions in "rough" approximation to the distribution of total annual natural gas sales.

- **Savings by Milestone Year**

Exhibit 5.3 also shows that savings occur somewhat disproportionately in the first milestone period; this is because several measures are economic on a full-cost basis and, in this forecast, they are all installed by the first milestone year. These full-cost measures include: commissioning, BAS systems, pre-rinse spray valves, and drainwater heat recovery. In subsequent milestone years, the savings increase at a relatively even pace, indicating that most other measures are implemented as equipment reaches the end of its life.

- **Savings by Building Segment**

Exhibit 5.4 shows that the small commercial segment, which consists of the many small customers within each of the modelled building segments (e.g., office, hospital etc.), represents approximately 30% of the total savings potential. Although savings per square metre of small commercial floor space are generally smaller than in the larger buildings, overall savings potential remains significant. This is due to the large number of customers (and floor space) within this building segment.

Recreational and other buildings provide the next largest share of the potential savings in this forecast (approximately 11%); followed by large office, large school and universities and colleges (all at 9%); and large non-food retail (6%). These segments offer large potential savings due to the fact that almost all technologies are applicable, and because the new construction measure, which provides 60% improved energy performance, is applicable in large buildings.

- **Savings by End use and Technology**

Exhibits 5.5 and 5.6 show that space heating technologies account for approximately 67% of the total economic potential savings. The technologies that achieve the reduction include:

- Heating savings from 60% better construction in new large buildings
- Heating savings from 30% better construction in new medium and small buildings
- Commissioning
- Heating savings from building automation systems (BAS)
- Non-condensing (85% efficient) boilers.

DHW savings account for a further 20% of the total economic potential savings. The most significant contribution to these savings are from:

- Condensing water heaters in medium and small buildings
- DHW savings from 60% better construction in new large buildings
- DHW savings from 30% better construction in new medium and small buildings
- DHW savings from building automation systems
- Condensing DHW boilers in large buildings.

The final 13% of savings are from food preparation, through the implementation of more energy efficient cooking equipment.

Modest additional savings may be applicable to the miscellaneous end use. However, due the relatively small size of this end use and the generally more application-specific technologies involved (e.g., equipment sterilization in hospitals), no measures applicable to this end use were assessed.

5.5.1 Caveats on Interpretation of Results

A systems approach, consistent with that employed in the BC Hydro CPR, 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, a condensing boiler reduces 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 additive. 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., a window upgrade that reduce the space heating load) and then to introduce measures that meet the remaining load more efficiently (e.g., a mid-efficiency boiler).

The above approach means that where there is interaction between measures that affect the same end use, the savings for those individual measures shown in Exhibit 5.6 are reduced. For example, if the condensing furnace measure was implemented in the absence of any other space heating measures, its savings would be greater than those shown in Exhibit 5.6. As appropriate, this issue will be further addressed during the Achievable Potential section of this report.

6. ECONOMIC POTENTIAL FORECAST – FUEL CHOICE SCENARIO

6.1 INTRODUCTION

This section presents the Commercial Sector Economic Potential Forecast – Fuel Choice Scenario for the study period (FY 2003/04 to FY 2015/16). The Economic Potential Forecast – Fuel Choice Scenario estimates the level of natural gas consumption that would occur if natural gas is the "fuel of choice" to meet the loads in all new facilities or retrofit applications, where natural gas is cost-effective relative to electricity.

In this study, "cost-effective" means that the natural gas fuel choice option passes the measure Total Resource Cost (TRC) test, as discussed previously in Section 4.

The discussion in this section is presented in the following subsections:

- Major modelling tasks
- Technologies included in economic potential forecast—fuel choice scenario
- Presentation of results
- Interpretation of results.

6.2 MAJOR MODELLING TASKS

To develop the Fuel Choice Scenario, the following tasks were undertaken:

- The measure TRC results for each of the fuel choice options presented in Exhibit 4.6 were reviewed. Those fuel choice options that had positive TRC results were selected for inclusion in this Fuel Choice Scenario. If more than one cost-effective natural gas option existed, the study selected the most energy-efficient one.

- In new buildings, it was assumed that natural gas is the fuel of choice for all new space and domestic hot water applications where natural gas is cost effective relative to electricity.

- For existing stock, it was assumed that cost effective fuel choice options are introduced as the existing stock approaches the end of its useful life, which in this study was set at 75% of the equipment's rated life expectancy.

- The scenario was modelled using the same end use model as was used in the previous scenarios. The model results calculated the changes in both electricity (reduced consumption) and natural gas (increased consumption) that resulted from this scenario.

- The final task in this scenario was the calculation of the net avoided energy costs that would result from the changes in electricity and natural gas use over the study period. The calculation of avoided energy costs used the same electricity and natural gas avoided supply costs as presented previously in Section 4 of this report, including application of the specific avoided supply cost values for each combination of end use (i.e., load factor), service area, energy source (natural gas and electricity) and measure life.

6.3 TECHNOLOGIES INCLUDED IN ECONOMIC POTENTIAL FORECAST

Exhibit 6.1 provides a listing of the technologies selected for inclusion in this forecast. In each case, the exhibit shows the following:

- End use affected
- Fuel choice option selected
- Building segments to which the fuel choice options were applied
- Rate at which the fuel choice options were introduced into the stock.

Exhibit 6.1: Technologies Included in Economic Potential Forecast – Fuel Choice

End Use	Fuel Choice Option[49]	Applicability of Fuel Choice Options by Building Segment	Rate of Stock Introduction
Space Heating	Electric Heating to Gas – Forced Air Applications	• Small commercial buildings with electric rooftop units and furnaces • Medium buildings equipped with electric rooftop units	• Existing buildings, when current electric forced air heating unit[50] reaches 75% of its rated life expectancy • New buildings, at rate of new construction
DHW	Electric DHW to Gas – Centralized DHW Applications	• Large and medium buildings with central commercial-sized electric DHW heater	• Existing buildings, when current electric DHW unit reaches 75% of its rated life expectancy • New buildings, at rate of new construction
	Electric DHW to Gas – Multiple Water Heaters	• Large and medium buildings with electric distributed DHW heaters	• Existing buildings, when current electric DHW unit reaches 75% of its rated life expectancy • New buildings, at rate of new construction

49 As noted previously, if more than one cost effective measure is applicable to a given application, this scenario employs the most energy efficient choice.

50 In the absence of more detailed data, this fuel choice scenario assumes that the electric space heating share in existing buildings is 50% electric forced air (rooftop and furnace) and 50% electric baseboard, wall mounted heaters, etc. The fuel choice option is applied only to the forced air share.

6.4 PRESENTATION OF RESULTS

Under the Reference Case that was presented previously in Section 3, commercial sector natural gas use is forecast to grow from base year levels of approximately 31.0 million GJ/yr. to approximately 35.9 million GJ/yr. by the FY 2010/11 and approximately 39.8 million GJ/yr. by the FY 2015/16.

Under the Fuel Choice Scenario, natural gas consumption grows to approximately 42.0 million GJ/yr. by FY 2015/16, an increase of about 5% relative to the Reference Case. As is discussed further in the following sub sections, the increase in natural gas consumption of 2,029,000 GJ/yr. in FY 2015/16 would be offset by a decrease of 1,286,000 GJ/yr. in electricity use.

The following exhibits provide further detail on the total changes in energy use within the Economic Potential Forecast – Fuel Choice Scenario:

- Exhibits 6.2A and B present the results by service region and milestone year, expressed in, respectively, gigajoules and gigawatts.
- Exhibits 6.3A & B present the results by building segment and milestone year, expressed in, respectively, gigajoules and gigawatts.
- Exhibits 6.4A & B present the results by end use and milestone year, expressed in, respectively, gigajoules and gigawatts.
- Exhibit 6.5 presents an estimate of the net impact on provincial energy supply costs associated with this Fuel Choice Scenario.

Exhibit 6.2A: Change in Energy Use Relative to Reference Case (thousand GJ/yr) By Service Area and Milestone Year

Milestone Year	Lower Mainland			Vancouver Island			Interior			Total Service Region		
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change
2005/06	136	85	50	106	63	43	70	50	21	312	198	114
2010/11	513	319	195	379	229	150	257	181	76	1,150	729	421
2015/16	917	566	351	668	408	261	444	312	132	2,029	1,286	743
% Natural Gas Increase 2015/16	45%			33%			22%			100%		

Exhibit 6.2B: Change in Energy Use Relative to Reference Case (GWh/yr) By Service Area and Milestone Year

Milestone Year	Lower Mainland			Vancouver Island			Interior			Total Service Region		
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change
2005/06	38	24	14	29	18	12	20	14	6	87	55	32
2010/11	143	88	54	105	64	42	72	50	21	319	202	117
2015/16	255	157	97	186	113	72	123	87	37	564	357	207
% Natural Gas Increase 2015/16	45%			33%			22%			100%		

Exhibit 6.3A: Change in Energy Use Relative to Reference Case (thousand GJ/yr) By Segment and Milestone Year

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Large Office	49	34	15	85	58	27	4%
Medium Office	26	21	6	45	36	10	2%
Large Non-Food Retail	48	36	12	84	62	22	4%
Medium Non-Food Retail	15	11	4	27	19	8	1%
Food Retail	12	10	2	22	17	4	1%
Large Hotel	47	36	12	80	61	20	4%
Medium Hotel/Motel	29	23	6	61	47	14	3%
Hospital	4	2	2	6	3	3	0%
Nursing Homes	11	9	3	20	15	5	1%
Large School	50	33	18	91	60	31	4%
Medium School	28	17	11	52	31	22	3%
University/College	18	12	5	32	22	10	2%
Restaurant/Tavern	10	8	3	19	13	5	1%
Warehouse/Whsale	3	3	1	5	4	1	0%
Mixed Use	10	9	1	17	15	2	1%
Small Commercial	656	467	189	1,150	822	327	57%
Recreational and Other	132	0	132	233	0	233	11%
Miscellaneous	0	0	0	0	0	0	0%
Total	**1,150**	**729**	**421**	**2,029**	**1,286**	**743**	**100%**

Exhibit 6.3B: Change in Energy Use Relative to Reference Case (GWh/yr) By Segment and Milestone Year

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Large Office	14	9	4	24	16	7	4%
Medium Office	7	6	2	13	10	3	2%
Large Non-Food Retail	13	10	3	23	17	6	4%
Medium Non-Food Retail	4	3	1	7	5	2	1%
Food Retail	3	3	1	6	5	1	1%
Large Hotel	13	10	3	22	17	5	4%
Medium Hotel/Motel	8	6	2	17	13	4	3%
Hospital	1	1	1	2	1	1	<1%
Nursing Homes	3	2	1	6	4	1	1%
Large School	14	9	5	25	17	9	4%
Medium School	8	5	3	15	9	6	3%
University/College	5	3	1	9	6	3	2%
Restaurant/Tavern	3	2	1	5	4	1	1%
Warehouse/Whsale	1	1	0	2	1	0	<1%
Mixed Use	3	2	0	5	4	1	1%
Small Commercial	182	130	52	319	228	91	57%
Recreational and Other	37	0	37	65	0	65	11%
Miscellaneous	0	0	0	0	0	0	<1%
Total	**319**	**202**	**117**	**564**	**357**	**207**	**100%**

Exhibit 6.4A: Change in Energy Use Relative to Reference Case By End Use and Milestone Year (thousand GJ/yr)

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Space Heating	810	543	267	1,415	955	461	70%
DHW	340	186	154	614	331	283	30%
Total	**1,150**	**729**	**421**	**2,029**	**1,286**	**743**	**100%**

Exhibit 6.4B: Change in Energy Use Relative to Reference Case By End Use and Milestone Year (GWh/yr)

Segment	Milestone Year						% Natural Gas Increase 2015/16
	2010/11			2015/16			
	Natural Gas Increase	Electricity Decrease	Net Change	Natural Gas Increase	Electricity Decrease	Net Change	
Space Heating	225	151	74	393	265	128	70%
DHW	94	52	43	170	92	79	30%
Total	**319**	**202**	**117**	**564**	**357**	**207**	**100%**

Exhibit 6.5: Commercial Fuel Choice - Avoided Energy Costs (thousand $)

Milestone Year	Lower Mainland			Vancouver Island			Interior			Total Service Region		
	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost	Natural Gas Avoided Cost	Electricity Avoided Cost	Net Energy Avoided Cost
2005/06	-$904	$1,560	$655	-$593	$1,155	$562	-$470	$906	$436	-$1,967	$3,620	$1,653
2010/11	-$3,424	$5,825	$2,401	-$2,122	$4,184	$2,063	-$1,718	$3,311	$1,593	-$7,263	$13,320	$6,056
2015/16	-$6,118	$10,347	$4,230	-$3,740	$7,453	$3,713	-$2,962	$5,706	$2,744	-$12,820	$23,506	$10,686

6.5 INTERPRETATION OF RESULTS

Highlights of the results presented in the preceding exhibits are summarized below:

- **Energy Impacts by Service Region**

The Lower Mainland represents approximately 45% of the identified fuel choice opportunity, which is consistent with the large share of customers in this service area. The Vancouver Island service region accounts for about 33% of identified fuel choice opportunity. This is a disproportionately large share relative to its customer base and is due primarily to the current relatively smaller natural gas market share in this service region.

- **Energy Impacts by Milestone Year**

Fuel choice opportunities increase within each milestone period at a relatively even pace because the measures are implemented as equipment is replaced towards the end of its life or as new buildings are built. None of the fuel choice measures are cost effective at full cost, i.e., it is not economically attractive to replace the existing equipment before failure.

- **Energy Impacts by Building Segment**

The small commercial segment, which consists of the many smaller buildings within each of the modelled building segments (e.g., office, hospital etc.), represents the largest (57%) share of the total fuel choice opportunity.

The small commercial segment accounts for 48% of the floor space in the commercial sector, which means that the natural gas increase is disproportionately high in this segment. This is because the small commercial sector has a higher percentage of forced-air heating systems than the large and medium buildings and, it is only these forced-air systems that pass the measure TRC test. As discussed previously in Chapter 4, hydronic systems, which are more common in larger buildings, do not have a positive measure TRC and are not included in the fuel choice scenario.

"Recreational and other buildings" provide the second largest share (11%) of the fuel choice opportunity. This is proportional to the floor space represented by this segment.

- **Energy Impacts by End use and Technology**

Space heating accounts for approximately 70% of the total fuel choice opportunity. As noted above, the major contributor is the switch to gas fired rooftop units in the small and medium commercial buildings. DHW savings account for the remaining 30% of the fuel choice opportunity.

- **Net Energy Avoided Costs**

Overall, the net energy avoided costs for the province as a whole under this Fuel Choice Scenario would be approximately $6.0 million per year by FY 2010/11, increasing to approximately $10.7 million per year by FY 2015/16.

7. ACHIEVABLE POTENTIAL FORECAST

7.1 INTRODUCTION

This section presents the Commercial Sector Achievable Potential for the study period (FY 2003/04 to FY 2015/16). The Achievable Potential is defined as the proportion of the energy efficiency and fuel choice opportunities identified in the Economic Potential Forecasts 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 efficiency
- Results – fuel choice.

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 or fuel choice measures 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:

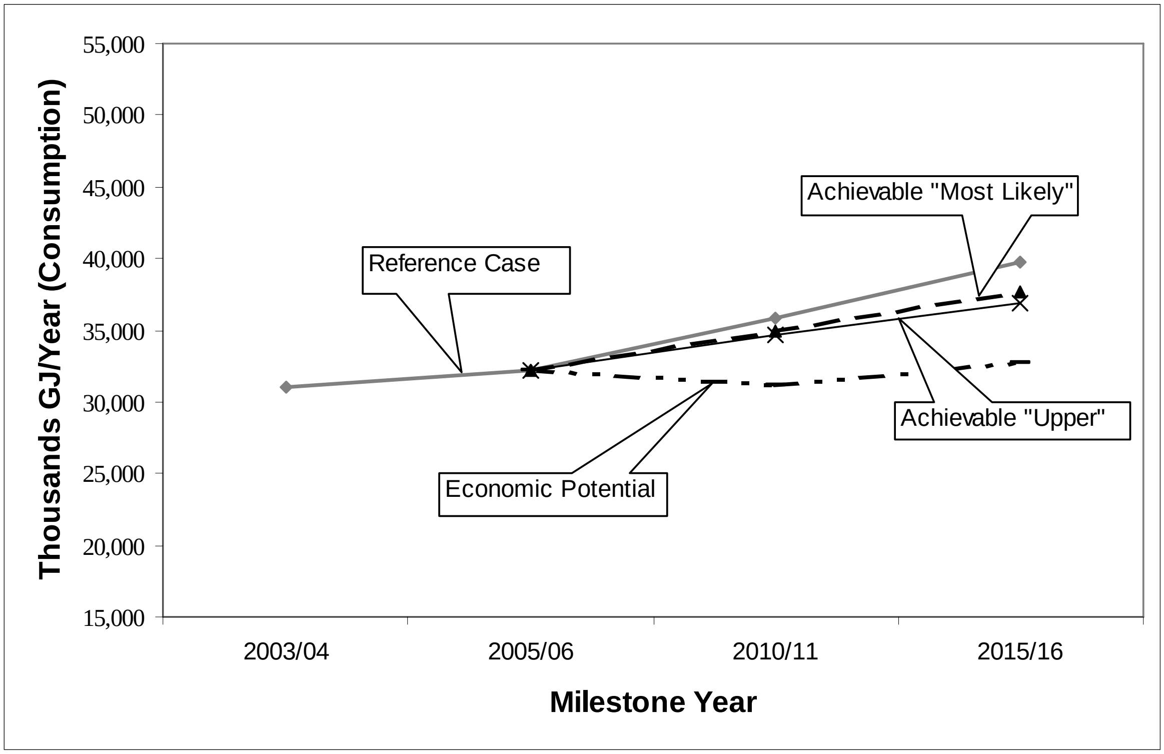
- Higher first cost of efficient product(s)
- Need to recover investment costs in a short period (payback)
- Lack of product performance information
- Lack of product availability.

The rate at which customers accept and purchase energy-efficiency and fuel choice products will be influenced by the level of financial incentives, information and other measures put in place by Terasen Gas, BC Hydro, governments and the private sector to remove barriers such as those noted above.

Exhibit 7.1 (overleaf) presents the levels of natural gas consumption that are estimated in the Achievable Potential – Energy Efficiency 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.

Exhibit 7.1 also shows that 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 7.1 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 7.1: Annual Natural Gas Consumption—Energy Efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Commercial Sector, (thousand GJ/yr.)



As also illustrated in Exhibit 7.1, 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 10-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: “Most Likely” and “Upper”.

- 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 or fuel choice 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 Terasen Gas’s ability to influence customers’ decisions towards increased investments in energy efficiency or fuel choice options remain “roughly” in line with previous company DSM experience.

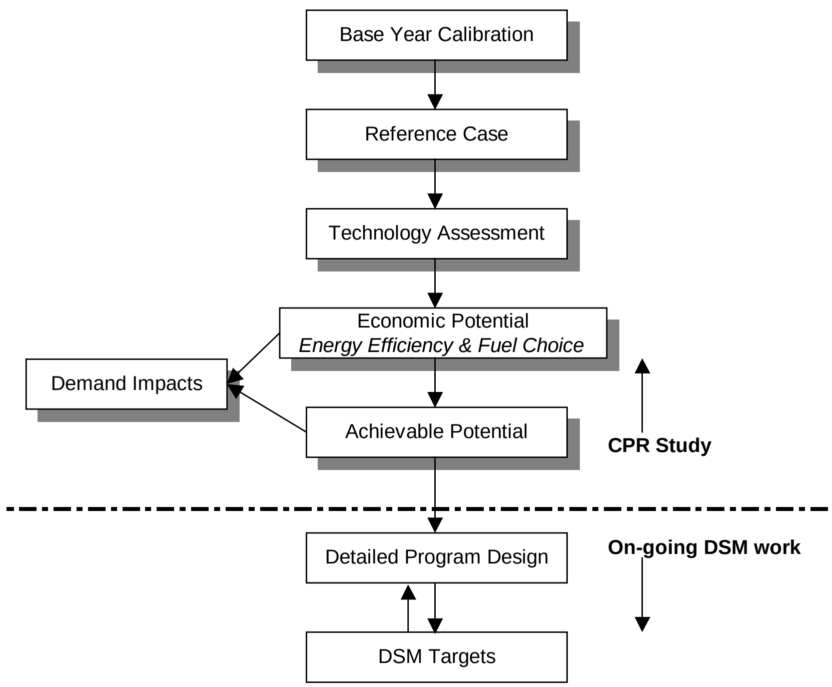
- The **“Upper” Achievable Potential** assumes that B.C. market conditions become more supportive of investing in energy efficiency. For example, this scenario assumes that real energy prices continue to increase over the study period; it also assumes that federal and provincial government actions to mitigate climate change result in increased levels of complementary energy efficiency initiatives. In most applications, “Upper” achievable potential will not reach economic potential levels; this recognizes that there will be some portion of the market that is 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 7.2 illustrates the relationship between Achievable Potential and the more detailed program design.

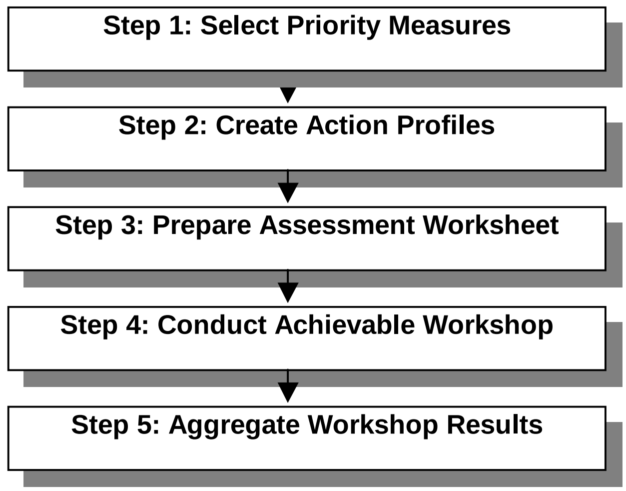
Exhibit 7.2: Achievable Potential versus Detailed Program Design



7.3 APPROACH TO THE ESTIMATION OF ACHIEVABLE POTENTIAL

Achievable Potential was estimated in a five-step approach. A schematic showing the major steps is shown in Exhibit 7.3 and each step is discussed below.

Exhibit 7.3: Flow Chart Estimating Achievable Potential



7.3.1 Step 1: Select Priority Measures

The first step in developing the Achievable Potential estimates required that the energy saving and fuel choice opportunities identified in the Economic Potential Forecasts be “bundled” into a set of Actions that would facilitate the subsequent assessment of their potential market penetration.

A summary of the selected energy efficiency and fuel choice Actions is provided in, respectively Exhibits 7.4 and 7.5. As illustrated, the Actions have been bundled by end use and, for each, Exhibits 7.4 and 7.5 show the Action name and the approximate percentage that it represents of the total commercial sector potential contained in the Economic Potential Forecasts.

Exhibit 7.4: Commercial Sector Actions – Energy Efficiency

Action Profile #	Title	Approximate % of Economic Savings Potential
C1	Ultra High Efficiency New Construction	27
C2	New Construction –High Efficiency Space & Water Heating	In above
C3	Existing Commercial: High Efficiency Space & Water Heating Retrofit	26
C4	Existing Commercial: Next Generation BAS	6
C5	Existing Commercial: Recommissioning	5
C6	EE Food Preparation Equipment	17
C7	Commercial Hot Water Reduction for Food Preparation	1
C8	Small Commercial Efficiency Initiative	21
C9	Recreation and “Other” Building Efficiency Initiative	8

Exhibit 7.5: Commercial Sector Actions – Fuel Choice

Action Profile #	Title	Approximate % of Economic Savings Potential
CFC1	Space Heating Conversion	75
CFC2	Water Heating Conversion	25

7.3.2 Step 2: Create Action Profiles

The next step involved the development of brief profiles for each of the Actions noted above in Exhibits 7.4 and 7.5. A sample profile for Action C1- Ultra High Efficiency New Construction is presented in Exhibit 7.6 (profiles for the remaining Actions are presented in Appendix G).

The purpose of the Action Profiles was to provide a “high-level” logic framework that would serve as a guide for participant discussions in the Achievable Workshop (see 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 Exhibit 7.6, each Action Profile addresses the following areas:

- ***Overview–***provides a summary statement of the broad goal and rationale for the Action.
- ***Target Technologies and Sub Segments—***highlights the major technologies and the sub segments where the most significant opportunities have been identified in the Economic Potential Forecast.

Exhibit 7.6: Sample Commercial Sector Action Profile

Action Profile C 1 – Ultra High Efficiency New Construction
Overview: This Action will promote high performance new construction through the application of an integrated design process (IDP) in all new small, medium, and large commercial buildings. The goal is to design commercial buildings that use between 30 to 60 percent less energy than the Model National Energy Code Buildings (MNECB). Energy efficient designs attain high performance levels through the application of IDP coupled with a high degree of integration and the use of energy efficient equipment and renewable technologies. BC Hydro is currently in the process of rolling out their High Performance Buildings Program. The BC Hydro Program provides funding assistance for an initial "design options" study and, based on the study results, a separate MOU is signed with the builder that provides an incentive for incorporation of the agreed high performance design options. The broad strategy for this Action assumes that the current BC Hydro roll out of a similar initiative provides good opportunity for collaboration; one that will enable builders to address total energy options (not just electricity) and will provide opportunities for program administrative efficiencies. It will include: • Promotional efforts in collaboration with Power Smart High Performance Buildings program. • Efforts to facilitate a team approach to designing buildings (Engineers, architects, LEED consultants, contractors) • Customized incentives. Although the changes required to the design process within the IDP are economic, they represent a significant departure from today's conventional practices. Consequently, it is assumed that short-term market penetration of this Action will be limited. Therefore a complementary Action Profile C2 is outlined separately that will encourage the adoption of some of the individual technologies that contribute to the savings in Action C1.
Target Technologies and Sub Segments: • Ultra Efficient Building Design to 60% Below Current Practice for large commercial buildings • Energy Efficient Building Design to 30% Below Current Practice for small, medium and large commercial buildings
Target Stakeholder Group: • Design community including architect, engineers, and LEED accredited professionals • Owners, developers, facility managers, BOMA members
Key Barriers and Interventions: Experience to date indicates that the most significant barriers to the design of high performance commercial buildings through the application of IDP is: • IDP has only been adopted by a small fraction of the owners, developers and engineering practitioners for various reasons including perceived risks, time constraints, costs, and a lack of understanding of the benefits as elaborated below. • Split incentive. For spec buildings, additional construction costs may be hard to pass on to purchasers; and in the case of lease agreements, the inability to pass on the electricity costs to tenants reduces the incentive to developers and owners. • Transaction costs for the additional studies of the systems • Financing for the incremental upfront cost • Risk that the energy savings will not occur as expected. This action will address the above barriers by combining the following interventions: • Information and promotion – e.g., make owners/developers aware of the benefits of IDP • Specialized customer support – e.g., provide training on lease agreement language to BOMA members • Vendor & customer links – e.g., contractor/customer links; contractor certification • Technical services to customers – e.g., design assistance • Trade ally training e.g., training of architects and engineers • Financing or developer and trade ally incentives, passed on performance achievements. • Support of pilot developments accompanied by case studies and other promotion of successful results.
Time Frame: Promotional efforts begin in 2006. Incentives provided until 2010.
Additional Information: Links directly with BCH program, which is targeted to the same building population and trade allies.

- ***Target Stakeholder Groups***—identifies key market players that would be expected to be involved in the actual delivery of services. The list of stakeholders shown is intended to be "indicative" and is by no means comprehensive.

- ***Key Barriers and Interventions—***identifies key market barriers that are currently constraining the increased penetration of energy-efficient technologies or measures. Interventions for addressing the identified barriers are noted. Again, it is recognized that the interventions are not necessarily comprehensive; rather, their primary purpose was to help guide the workshop discussions.

- ***Time Frame—***identifies the potential timing of activities with the intent of assisting workshop participants to envision possible customer participation rates.

- ***Additional Information—***identifies information or possible synergies with other Actions that may affect workshop participant views on possible customer participation rates.

7.3.3 Step 3: Prepare Draft Action Assessment Worksheets

A draft Assessment Worksheet was prepared for each Action Profile in advance of the Achievable Workshop. The Assessment Worksheets complemented the information contained in the Action Profiles by providing quantitative data on the potential energy savings or fuel choice for each Action 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.

A sample Assessment Worksheet for ***Action C1—Ultra High Efficiency New Construction*** is presented in Exhibit 7.7. (Worksheets for the remaining Actions are presented in Appendix H.) As illustrated in Exhibit 7.7, each Action Assessment Worksheet addresses the following areas:

- ***Approximate % of Action Savings***—shows the contribution of individual sub sectors to the total energy impacts represented by each Action. For example, the first entry in Exhibit 7.7 shows that large offices account for about 13% of the total energy savings for this Action.

- ***Economic Savings to FY 2015/16—***shows the total economic impacts on natural gas use, by milestone period, for the measures included in the Action. As applicable, the savings are further broken out by technology and/or end use.

- ***Participant Definition***—provides the definition of "participant" that is used in subsequent portions of the worksheet to calculate energy savings. The definition of "participant" may vary depending on the specific Action.

- ***Total Applicable (Participants)—***shows the total population of potential participants that could theoretically take part in the Action. Numbers shown are from the eligible populations used in the Economic Potential Forecasts.

- ***Prime Target—***identifies, as appropriate, any portion of the applicable participants that offer particularly good opportunities for energy savings under the Action.

- ***Major Technologies and Contribution to Economic Savings—***provides additional detail on the composition of the economic savings for the Action. It was particularly intended to assist workshop participants in their discussions of potential participation rates.

- ***Approximate Savings per Participant—***indicates the annual natural gas savings (GJ/yr.) for a "typical" participant within each sub sector. The purpose of this entry was to invoke a more informed discussion among workshop participants vis-à-vis the level of savings assumed in the Economic Potential Forecast and whether any adjustments were needed to account for practical considerations.

- ***Savings Adjustment Factor—***provides a record of any decisions to de-rate the "optimized" savings contained in the Economic Potential Forecast to levels that better account for practical customer considerations. This entry was completed during the workshop, or in subsequent discussions with workshop participants.

- ***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 Terasen Gas'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 Action. This information provided an indication of the level of attractiveness that the Action measures 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 Action's attractiveness to customers without making the measures economically unattractive to Terasen Gas.

Exhibit 7.7: Sample Worksheet: Action Profile C1—Ultra High Efficiency New Construction

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	13%			2%			12%			2%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	27	118	204	5	20	35	26	106	179	4	16	28	4	16	29
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	177	769	1,329	57	244	423	227	924	1,558	74	301	507	29	110	202
Annual Applicable Participants (‘000s of m2)	88	118	112	29	37	36	114	139	127	37	45	41	14	16	18
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.153			0.082			0.115			0.055			0.146		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	9.0			1.9			9.0			1.9			1.9		
Approx. Customer Payback (yrs)	1.4			6.0			1.4			6.0			6.0		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*22*	*28*	*0*	*21*	*42*	*0*	*18*	*36*	*0*	*18*	*36*	*0*	*18*	*36*
Upper	*0*	*28*	*56*	*0*	*42*	*84*	*0*	*36*	*73*	*0*	*36*	*73*	*0*	*36*	*73*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*26*	*51*	*0*	*4*	*11*	*0*	*19*	*49*	*0*	*3*	*8*	*0*	*3*	*8*
Upper	*0*	*33*	*86*	*0*	*8*	*22*	*0*	*39*	*98*	*0*	*6*	*15*	*0*	*6*	*16*

- ***Participation Rates—***show the percentage of economic savings that workshop participants concluded could be achievable in each milestone period. As noted in the introduction to this section, two achievable levels are shown: “Most Likely” and “Upper”. For example, Exhibit 7.7 shows a participation rate of 28% (Most Likely) for Ultra High Efficiency New Construction in large offices by the year FY 2015/16. This means that by FY 2015/16, 28% of the potential savings contained in the Economic Potential forecast will be achieved.

- ***Action Savings by Year—***shows the calculated energy savings in each milestone period based on the savings and participation rates presented in the preceding rows of the Worksheet.

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 October 31, 2005. Workshop participants consisted of core members of the consultant team, DSM program and technical personnel from both Terasen Gas and BC Hydro, 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 B.C.

The purpose of this workshop was twofold:

- To promote discussion regarding the technical and market conditions confronting the identified energy efficiency and fuel choice opportunities.

- To compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

The discussion of each Action 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 Action Profile and accompanying Worksheet.

Following discussion of the broad market and intervention conditions affecting the Action, workshop participant views were recorded on “Most Likely” and “Upper” customer participation rates. General agreement was sought on rates to be carried forward into the analysis; estimates were rounded down for “Most Likely” and rounded up for “Upper” estimates.

As noted earlier, it was not possible to fully address all Actions in the one-day workshop. Consequently, the workshop focussed on the “big ticket” Actions and follow up discussions were held with Terasen Gas program personnel after the workshop. The values shown in the attached appendices incorporate the results of the two sets of inputs.

7.3.5 Step 5: Aggregate Action Results

The final step involved aggregating the results of the individual Actions to provide a view of the potential achievable savings for the total commercial sector.

7.4 RESULTS – ENERGY EFFICIENCY

A summary of the "Most Likely" and "Upper" Achievable Potential results is presented in the following exhibits. In each case the results shown are relative to the Reference Case.

- Exhibit 7.8 (Energy Efficiency, by Action, Milestone Year and Service Region)
- Exhibit 7.9 (Energy Efficiency, by Segment and Milestone Year).

In Exhibits 7.8 and 7.9, the results represent the total annual cumulative natural gas savings at the end of each milestone year. For example, Exhibit 7.8 shows that Action C1— Ultra High Efficiency New Construction will achieve an annual saving of 196 GJ/yr. by FY 2010/11 under the "Most Likely" scenario. This annual savings increases to 505 GJ/yr. by FY 2015/16, again under the "Most Likely" scenario.

Selected highlights related to the results shown in Exhibits 7.8 and 7.9 are provided below. Detailed results showing the estimated participation rates and calculation of related energy impacts are provided in Appendix H.

Exhibit 7.8: Summary of Achievable Savings, by Action—"Most Likely" & "Upper" Scenarios

Service Region / Action	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
C1 - Energy Eff. New Construction	196	288	505	764	23%
C2 - Improved Boilers, New	135	139	203	165	9%
C3 - Improved Boilers, Existing	316	339	585	665	26%
C4 - Next Gen. BAS, Existing	41	68	82	136	4%
C5 - Recommissioning, Existing	50	83	100	166	5%
C6 - EE Food Prep, New	4	5	13	19	1%
C6 - EE Food Prep, Existing	8	13	67	97	3%
C7 - Hot Water Reduction for Food Prep, Existing	23	41	45	82	2%
C8 - Small Commercial Efficiency Initiative	187	238	492	649	22%
C9 - Recreational and Other Efficiency Initiative	50	63	117	154	5%
Total TG Service Region	**1,010**	**1,276**	**2,211**	**2,897**	**100%**

Lower Mainland Region	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
C1 - Energy Eff. New Construction	125	190	312	492	22%
C2 - Improved Boilers, New	87	90	132	107	9%
C3 - Improved Boilers, Existing	205	220	379	431	27%
C4 - Next Gen. BAS, Existing	26	45	51	87	4%
C5 - Recommissioning, Existing	32	55	62	107	4%
C6 - EE Food Prep, New	2	3	8	12	1%
C6 - EE Food Prep, Existing	5	8	42	61	3%
C7 - Hot Water Reduction for Food Prep, Existing	15	27	30	54	2%
C8 - Small Commercial Efficiency Initiative	112	142	295	389	21%
C9 - Recreational and Other Efficiency Initiative	36	46	85	112	6%
Lower Mainland Region	**645**	**825**	**1,396**	**1,850**	**100%**

Vancouver Island Region	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
C1 - Energy Eff. New Construction	36	51	105	150	27%
C2 - Improved Boilers, New	22	23	34	27	9%
C3 - Improved Boilers, Existing	52	56	98	111	25%
C4 - Next Gen. BAS, Existing	7	12	17	27	4%
C5 - Recommissioning, Existing	9	15	21	33	5%
C6 - EE Food Prep, New	1	1	2	3	1%
C6 - EE Food Prep, Existing	1	2	12	17	3%
C7 - Hot Water Reduction for Food Prep, Existing	3	6	6	11	2%
C8 - Small Commercial Efficiency Initiative	27	35	74	98	19%
C9 - Recreational and Other Efficiency Initiative	7	8	15	20	4%
Vancouver Island Region	**165**	**208**	**385**	**497**	**100%**

Interior Region	Annual Gas Savings (thousand GJ/yr), by Milestone Year				% of Total 2015/16
	2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	
C1 - Energy Eff. New Construction	35	47	88	123	20%
C2 - Improved Boilers, New	25	26	38	31	9%
C3 - Improved Boilers, Existing	59	63	108	123	25%
C4 - Next Gen. BAS, Existing	7	11	14	22	3%
C5 - Recommissioning, Existing	9	14	18	27	4%
C6 - EE Food Prep, New	1	1	3	4	1%
C6 - EE Food Prep, Existing	2	3	13	19	3%
C7 - Hot Water Reduction for Food Prep, Existing	5	8	9	17	2%
C8 - Small Commercial Efficiency Initiative	49	62	123	162	28%
C9 - Recreational and Other Efficiency Initiative	7	9	17	23	4%
Interior Region	**199**	**244**	**431**	**550**	**100%**

Exhibit 7.9: Summary of Achievable Savings, by Segment–"Most Likely" & "Upper" Scenarios

Service Region / Segment	Annual Gas Savings (thousand GJ/yr), by Milestone Year						% of Total 2015/16
	2005/6		2010/11		2015/16		
	Most Likely	Upper	Most Likely	Upper	Most Likely	Upper	
Large Office	0	0	138	183	265	380	12%
Medium Office	0	0	11	18	24	39	1%
Large Non-Food Retail	0	0	53	86	122	194	5%
Medium Non-Food Retail	0	0	5	9	12	20	1%
Food Retail	0	0	6	10	18	30	1%
Large Hotel	0	0	38	58	81	129	4%
Medium Hotel/Motel	0	0	6	10	15	26	1%
Hospital	0	0	66	82	140	173	6%
Nursing Homes	0	0	22	28	50	64	2%
Large School	0	0	136	150	264	300	12%
Medium School	0	0	105	109	202	214	9%
University/College	0	0	153	175	312	366	14%
Restaurant/Tavern	0	0	23	41	76	124	3%
Warehouse/Whsale	0	0	6	8	12	17	1%
Mixed Use	0	0	5	7	10	16	0%
Small Commercial	0	0	187	238	492	649	22%
Recreational and Other	0	0	50	63	117	154	5%
Total TG Service Region	**0**	**0**	**1,010**	**1,276**	**2,211**	**2,897**	**100%**

7.4.1 Action C1 – Ultra High Efficiency New Construction

The focus of this Action was the application of an integrated design process (IDP) to the construction of new commercial and institutional buildings. Savings of 60% relative to new building constructed to performance levels contained in the Model National Energy Code for Buildings (MNECB) were applied to the large building segments and 30% savings were applied medium building segments.

As illustrated in Exhibit 7.8, workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, natural gas savings of about 288,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 764,000 GJ/yr. by FY 2015/16.

Selected highlights from the discussion of this Action are listed below:

- Many IDP buildings constructed to date have a poor operating record, with many systems not working as designed. The need for better training and support to building owners and operators as well as building developers and design professionals was identified as being essential to increased market penetration of IDP. If a resource can be established that is capable of providing consistent support, and a critical mass of working examples can be compiled, then participation rates can be expected to grow significantly in the second milestone period (FY 2010/11 to FY 2015/16).

- Ownership and occupancy patterns are a critical determinant of participation in IDP. The institutional sector has accounted for virtually all of the IDP activity in B.C. to date; this pattern was expected to continue into the future as well. Private sector participation is currently very low. The Large Office segment was discussed in detail; participants estimated that about 25% of this segment was subject to long term ownership and occupancy. The expressed view was that this 25% share of the Large Office segment was the primary target for IDP. The remaining share of the Large Office segment would remain focused on cheapest first cost, unless compelled by new regulations to incorporate higher energy efficiency levels.

- Participation rates were estimated for each of the remaining building segments by applying a similar assessment of ownership and occupancy patterns to each. Higher participant rates were applied to institutional buildings such as schools, hospital and universities. The warehouse building segment was identified as having the lowest participation rate.

7.4.2 Action C2 – New Construction – High Efficiency Space and Water Heating

The Action focuses on the same new construction market as Action C1. Buildings that did not participate in Action C1 represent the target market for this Action. The discussion was conducted in two stages. The first stage estimated the portion of the remaining new market that could be encouraged to implement condensing space and water heating equipment. The second stage estimated the portion the market remaining after the condensing equipment discussion that could be expected to adopt near-condensing equipment.

As illustrated in Exhibit 7.8, workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, natural gas savings of about 139,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 165,000 GJ/yr. by FY 2015/16.[51]

Selected highlights from the discussion of this Action are listed below:

- Workshop participants indicated that there has been some bad experience related to the performance of condensing boilers. One contributor is that some manufacturers have sought to lower the price on condensing heating equipment by using poorer quality materials, which corrode quickly. As a result, maintenance costs have been higher than projected and overall performance lower.

- Similar to the IDP discussion, workshop participants identified a need to undo the poor reputation that had developed in some markets if condensing equipment is to gain a large market share. Participants also cited the need for a design guideline for low temperature design as well as operator training. Assuming that these issues can be addressed within the first milestone period, participants concluded that virtually all

[51] The “Upper” savings shown in FY 2015/16 for Action C2 is lower than the “most likely” value. This apparent contradictory result occurs because Actions C1 and C2 address the same new construction market. In the “Upper” achievable scenario of Action C1 a greater share of the new construction market implements IDP, thus leaving a smaller remaining share to implement the measures contained in Action C2. Conversely, because in the “most likely, achievable scenario of Action C1 a smaller share of the new construction market implements IDP, there is a larger remaining market to implement the measures contained in Action C2.

of the large building segments with long term ownership/occupancy could be expected to adopt condensing heating equipment in the second milestone period.

- During the second milestone period, approximately 80 - 90% of the remaining market could be encouraged to adopt near-condensing equipment. The remaining 10-20% of the market was considered to be so price sensitive that it would continue to install standard efficiency models, unless compelled by new regulations to incorporate higher energy efficiency levels.

7.4.3 Action C3 – Existing Commercial – High Efficiency Space and Water Heating Retrofit

The Action focuses on existing buildings. Similar to the approach for Action C2, this Action was also discussed in two stages. The first stage estimated the portion of the existing market that could be encouraged to implement condensing space and water heating equipment. The second stage estimated the portion of the market remaining after the condensing equipment discussion that could be expected to adopt near-condensing equipment.

As illustrated in Exhibit 7.8, workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, natural gas savings of about 339,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 665,000 GJ/yr. by FY 2015/16.

Selected highlights from the discussion of this Action are listed below:

- Space heating participation rates for condensing and near-condensing follow the same general trends as for new construction. That is, participation rates are highest in institutional segments and commercial segments subject to long term ownership/occupancy.

- As in the case of new buildings, workshop participants indicated that by the second milestone period, it is reasonable to expect that up to about 80% of the overall market could be encouraged to install condensing or near-condensing space heating equipment. About 10 to 20% of the overall market remains so price sensitive that it will continue to install standard efficiency models, unless compelled by new regulations to incorporate higher energy efficiency levels.

- In building segments having large DHW loads, workshop participants concluded that the participation rate for condensing DHW equipment would be approximately the same as the participation rates for the combination of IDP and condensing space heat boilers in the new construction market (Actions C1 and C2).

- Participation rates were assumed to be nil for segments with small DHW loads such as office buildings etc.

7.4.4 Action C4 – Existing Commercial – Next Generation Building Automation Systems (BAS)

The Action focuses on existing large buildings. As illustrated in Exhibit 7.8, workshop participants concluded that under ideal the conditions represented by the Upper Achievable Forecast, natural gas savings of about 68,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 136,000 GJ/yr. by FY 2015/16.

Workshop participants concurred that there was a large potential for this Action; however, they indicated that there had been quite a bit of activity in this area in the recent past, particularly among the large institutional building segments, such as hospitals.

7.4.5 Action C5 – Existing Commercial - Recommissioning

The Action focuses on existing large and medium buildings. As illustrated in Exhibit 7.8, workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, natural gas savings of about 83,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 166,000 GJ/yr. by FY 2015/16.

In general, workshop participants concluded that participation rates for recomissioning should be the same as for Action C5 (BAS) in large buildings. Participation rates in medium buildings were estimated to be 1/3 of those in the large building segments.

7.4.6 Action C6 – Energy Efficient Food Preparation Equipment

The Action focuses on efficient gas-fired cooking ranges and broilers in new and existing buildings. As illustrated in Exhibit 7.8, workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, natural gas savings of about 18,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 116,000 GJ/yr. by FY 2015/16.

Selected highlights from the discussion of this Action are listed below:

- Participation rates are based on similar analysis in other Canadian jurisdictions and are the same for both new and existing facilities.
- Universities and large hotels have higher participation rates due to both higher awareness levels and recognition that the required capital investment represents a much smaller portion of their annual operating budgets than smaller facilities.

7.4.7 Action C7 – Commercial DHW Reduction

This Action focuses on DHW savings in commercial kitchens through the use of a pre-rinse spray valve. This is a relatively inexpensive measure that, in selected other jurisdictions, has been treated as a free promotional "give away". Consequently, high participation rates were assumed for the building segments having substantial food preparation loads.

As illustrated in Exhibit 7.8,workshop participants concluded that under the ideal the conditions represented by the Upper Achievable Forecast, natural gas savings of about 41,000 GJ/yr. could be achieved by the first milestone year of FY 2010/11, increasing to about 82,000 GJ/yr. by FY 2015/16.

7.4.8 Action C8 – Small Commercial Efficiency Initiative

This Action was not discussed during the workshop, nor was this building segment specifically modeled in this analysis. Rather, consistent with the agreed approach to small commercial buildings, savings and participation rates in these buildings were pro-rated to those for the medium buildings in the same building segment. That is, space heating savings for small offices were set at 75% of the rates applied to the medium offices. The same approach and percentage was applied to each of the end uses across all of the building segments.

7.4.9 Action C9 – Recreational and "Other" Commercial

This Action was not discussed during the workshop, nor was this building segment specifically modeled in this analysis. Rather, consistent with the agreed approach savings and participation rates in these buildings were pro-rated to those for the commercial buildings as a whole. In this case, the achievable savings for this building segment were set at 50% of the levels estimated for the modeled medium building segments.

7.5 RESULTS – FUEL CHOICE

The two fuel choice Actions noted in Exhibit 7.4 were briefly discussed during the workshop. Workshop participants concluded that neither Action was likely to attract any significant participants. Consequently, these Actions were not considered further in this analysis.

7.6 PEAK DAY LOAD IMPACT

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.).

- Terasen Gas provided load factors that correlate the relationship between "average" and "peak day" consumption levels for each rate class and service region. These rate based load factors were converted to sector based values using the same rate class to sector mapping as outlined previously in Exhibit 2.9. For example, the commercial sector defined in this CPR includes customers from rate classes 2, 3, 23, 5 and 25. Exhibit 7.10 shows a Lower Mainland commercial sector load factor rate of 0.340. This is a sales-weighted value based on the relative share of commercial sector sales in the Lower Mainland represented by each of the Terasen Gas rate classes.

- Finally, peak day load impacts were calculated by dividing the average daily consumption by the appropriate sector and service region load factors, as presented below in Exhibit 7.10

Exhibit 7.10: 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 (incl High-Rise)	.316	.382	.304
Commercial & Institutional	.340	.491	.360
Manufacturing	.369	.509	.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	.308	.354	.304
2	.293	.473	.296
3	.366	.509	.347
5	.433	.51	.511

[#]Source: Terasen Gas

7.6.1 Results

Exhibit 7.11 presents a summary of 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 13,200 to 17,300 GJ by FY 2015/16, depending on scenario.

Exhibit 7.11: Peak Day Capacity Impacts – Achievable Potential, By Scenario, Service Region and Milestone Year

Service Region & Scenario	Peak Day Saving by Milestone Year & Scenario (GJ)	
	2010/11	2015/16
Total Terasen Gas		
Achievable - Most Likely	7,634	13,216
Achievable- Upper	9,659	17,279
Lower Mainland		
Achievable - Most Likely	5,200	7,787
Achievable- Upper	6,646	10,324
Vancouver Island		
Achievable - Most Likely	922	2,147
Achievable- Upper	1,159	2,773
Interior		
Achievable - Most Likely	1,512	3,282
Achievable- Upper	1,854	4,182

7.7 GREENHOUSE GAS EMISSION IMPACT

The natural gas savings associated with each of the achievable potential scenarios would also result in a significant reduction of greenhouse gas (GHG) emissions.[52] As illustrated in Exhibit 7.12, by FY 2015/16 the GHG reductions are estimated to be in the range of 112,100 to 146,900 tonnes/year, depending on scenario.

Exhibit 7.12: Estimated GHG Emission Reductions – Achievable Potential, By Scenario and Milestone Year

Service Region & Scenario	Annual Natural Gas Savings (GJ/yr.)		Annual GHG Savings (tonnes/yr.)	
	2010/11	2015/16	2010/11	2015/16
Total Terasen Gas				
Achievable - Most Likely	1,009,317	2,211,626	51,172	112,129
Achievable- Upper	1,276,102	2,896,686	64,698	146,862

[52] GHG impacts are estimated based on an emissions factor of 50.7 kg of $CO_{2\ equiv.}$ per GJ of natural gas. This is the value currently employed by Natural Resources Canada.

8. STUDY CONCLUSIONS

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in B.C.'s commercial sector. In the "Most Likely" and "Upper" achievable scenarios those energy efficiency improvements would provide between 2,200,000 and 2,900,000 GJ/yr. of savings in FY 2015/16 as well as peak day load reductions of in range of 13,200 to 17,300 GJ. The associated GHG reductions are estimated to be in the range of 112,100 to 146,900 tonnes/year, depending on scenario.

The majority of the energy savings opportunities identified for this sector involve two measures:

- Integrated design process (IDP) for new construction
- Condensing space and water heating systems in both new and existing buildings.

The discussions held during the study's one-day Achievable Potential Workshop noted that if the above measures are to realize their full market potential, there is need for better training and on-going support to building owners/operators as well as building developers and design professionals.

The study also identified opportunities for the cost effective use of natural gas instead of electricity in selected space and water heating applications. However, participants in the Achievable Potential workshop concluded that none of these fuel choice opportunities is likely to attract significant participation rates.

❑ Interpretation of Results

The study findings outlined above could have significant implications for Terasen Gas. If the cost effective DSM measures identified in this study are pursued by Tersasen Gas, then:

- **A significant increase in annual DSM investment in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels.** This increased level of DSM investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario.

- **Interactions between Terasen Gas and its customers would increase very significantly.** For example, under the most likely achievable scenario, over 2000 Terasen Gas commercial customers would participate by FY 2015/16.

- **Annual GHG offsets from commercial sector natural gas savings could reach 50 to 65 kilotonnes**. At the estimated price range of $10 to $15 per tonne, these offsets could have an annual market value in the range of $0.5 million to about $1 million.

The current Terasen Gas DSM incentive mechanism provides an allowable return of 5% of the Total Resource Cost (TRC). The DSM measures identified for this sector, when combined with those identified in the residential and manufacturing sector reports, could result in a larger scale DSM effort that might have a TRC value of $30 million, or more. A TRC value of $30 million would provide a $1.5 million annual payment through the DSM incentive mechanism. If the utility was to apply for increased DSM funding levels, a larger DSM incentive mechanism or equivalent shared savings mechanism could also be considered.

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APPENDIX A

Existing Building Profiles – Lower Mainland and Vancouver Island

Note: **Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island.**

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Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island. Blank specification boxes in the profiles indicate that no data were used.

Summary Building Profile

Building Type: Large Office	**Location:** Lower Mainland
Description: This archetype is based on 58 large office buildings with a combined published "rentable" floor area of 15,600,000 ft²). The buildings range in size from 100,000 to 600,000 ft² constructed between 1910 and 2000. - Electrical energy intensities (electrical beep) ranges from 11 kWh/ft².yr to 34 kWh/ft².yr. - This sample represents approximately 70% of the total 18,000,000 ft² of published rentable floor area in the Lower Mainland.	**The Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 230,000 ft² - average footprint 12,100 ft² assumes a 110 ' x 110 ' footprint - 19 stories

Building Specifications:

roof construction:	0.7 W/m².°C
wall construction:	0.95 W/m².°C
windows:	5.7 W/m².°C
shading coefficient	0.65
window to wall ratio	0.4

General Lighting & LPD 660 Lux 18.8 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	50%	10%	40%	

Architectural Lighting & LPD 500 Lux 30.1 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
25%	15%	30%	0%	30%	

Overall LPD 17.9 W/m²

Plug Loads (office equipment) EPD 7.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
50%	50%	0%	0%	0%	

System air Flow	5.4 L/s.m²	1.07 CFM/ft²
Fan Power	12.3 W/m²	1.14 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
85%	0%	15%	0%	0%	

Calculated Capacity 113 W/m² 336 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.2 W/m²	0.1 W/ft²
Condenser Pumps	1.1 W/m²	0.1 W/ft²
Condenser Fan Size	2.3 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m^2.yr	**kWh/ft².yr**	**MJ/m^2.yr**	**kWh/ft².yr**
General Lighting	335	8.7		
Architectural Lighting	45	1.2		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	175	4.5		
Space Heating	9	0.2	325.7	8.4
Space Cooling	56	1.4	0.0	8.4
HVAC Equipment	302	7.8		
DHW	8	0.2	27.6	0.7
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	160	4.1		
Total	**1094**	**28.2**	**357.4**	**18**

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)	0.95	W/m².°C	0.17	Btu/hr.ft² .°F	
Roof U value (W/m².°C)	0.70	W/m².°C	0.12	Btu/hr.ft² .°F	
Glazing U value (W/m².°C)	5.70	W/m².°C	1.00	Btu/hr.ft² .°F	
Window/Wall Ratio (WIWAR) (%)	0.40				
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 (%)	50%				50%				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				
Fresh Air Requirements or Outside Air	25	L/s.person	53	CFM/person

%OA 18.10%

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	1.35			
Total Air Circulation or Design Air Flow	5.42	L/s.m²	1.07	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 CFM/ft²
Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22.5	°C	72.5	°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)**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	660	Lux	61.3	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	18.8	W/m²	1.7	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	95%
Usage During Unoccupied Period	42%
Fixture Cleaning:	
Incidence of Practice	
Interval	years

Light Level (Lux)	300	500	700	1000			Total
% Distribution		20%	80%				100%
Weighted Average							**660**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50%	10%	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	0.80	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	8.7
	MJ/m².yr	335

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	30.1	W/m²	2.8	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

Light Level (Lux)	300	500	700	1000			Total
% Distribution		100%					100%
Weighted Average							**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	15%	30%		30%		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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.2
	MJ/m².yr	45

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)				
Connected Load	14.0	W/m²	1.3	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

Light Level (Lux)	300	500	700	1000			Total
% Distribution	100%						100%
Weighted Average							**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)		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	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	
	MJ/m².yr	

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	10
	MJ/m².yr	380

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	69	72	50	200	50	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.1	
Connected Load	2.4 W/m²	2.5 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2 W/m²
	0.2 W/ft²	0.2 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	60%	60%	50%	20%	20%	60%
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)	7.7 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	4.5 W/m²	0.4 W/ft²

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EUI	kWh/ft².yr	4.5
	MJ/m².yr	175

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	4.1
	MJ/m².yr	160

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

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%				3%		2%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	85.9	W/m²	27.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	257	MJ/m².yr	6.6	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% Gas Fuel Share 95.0% Oil Fuel Share

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
Natural Gas EUI	kWh/ft².yr	8.9
	MJ/m².yr	343
Market Composite EUI	kWh/ft².yr	8.6
	MJ/m².yr	335

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	85.0%			15.0%				100.0%
COP	4.7	5.4	4.4	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	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	113	W/m²	36	Btu/hr.ft²	336	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	145.6	MJ/m².yr	3.8	kWh/ft².yr		
Sizing Factor	1.00					
A/C Saturation (Incidence of A/C)	90.0%					

Electric Fuel Share 100.0% Gas Fuel Share

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 Maintenar

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	
	MJ/m².yr	
Market Composite EUI	kWh/ft².yr	1.6
	MJ/m².yr	62

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	52.50%				17.50%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.58		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

All Electric EUI	kWh/ft².yr	0.6
	MJ/m².yr	25
Natural Gas EUI	kWh/ft².yr	1.0
	MJ/m².yr	39
Market Composite EUI	kWh/ft².yr	0.9
	MJ/m².yr	35.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Office Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Lower Mainland

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.4	L/s.m²	1.07	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	12.3	W/m²	1.14	W/ft²
Fan Design Load VAV	12.3	W/m²	1.14	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	75%	25%		100%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m²	0.04	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	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)	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	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.15	W/m²	0.11	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	1.2	W/m²	0.12	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	70.5	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	2.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	8.5	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	7.8
	MJ/m².yr	301.8

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:**	**28.2** kWh/ft².yr	**1,093.5** MJ/m².yr	**Gas:**	**9.2** kWh/ft².yr	**357.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	8.7	335.2
ARCHITECTURAL LIGHTING	1.2	44.6
OTHER (HIGH BAY) LIGHTING		
OFFICE EQUIPMENT & PLUG LOAI	4.5	174.9
HVAC ELECTRICITY	7.8	301.8
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	4.1	160.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	9.1	8.4	325.7
SPACE COOLING	1.4	55.7		
SERVICE HOT WATER	0.2	7.5	0.7	27.6
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

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)	0.95	W/m².°C	0.17	Btu/hr.ft² .°F
Roof U value (W/m².°C)	0.70	W/m².°C	0.12	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	5.70	W/m².°C	1.00	Btu/hr.ft² .°F
Window/Wall Ratio (WIWAR) (%)	0.30			
Shading Coefficient (SC)	0.65			

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 (%)	70%		0%		30%		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	25	L/s.person	53	CFM/person

%OA 18.33%

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.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	5.35	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	

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	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 HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Incidence of Annual Room Controls Maintenance

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		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	650	Lux	60.4	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	19.0	W/m²	1.8	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	95%
Usage During Unoccupied Period	40%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**650**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	65%	10%	25%	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	8.6
	MJ/m².yr	331

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	21.8	W/m²	2.0	W/ft²

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	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	20%	15%	35%	0%	30%	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	0.8
	MJ/m².yr	32

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	9
	MJ/m².yr	364

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.8	0.8	0.15	0.1	0.1	
Connected Load	1.7 W/m²	2.7 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2 W/m²
	0.2 W/ft²	0.2 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	6.9 W/m²	0.6 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²

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EUI		
	kWh/ft².yr	2.7
	MJ/m².yr	104

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% — Electricity Fuel Share: 17.0%

	Natural Gas EUI		All Electric EUI	
EUI	kWh/ft².yr	0.1	kWh/ft².yr	0.1
	MJ/m².yr	5.0	MJ/m².yr	4.0

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI		
	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	100

EXISTING BUILDINGS: Medium Office, Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	90%	0%	0%	0%	5%	0%	5%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	96.0 W/m²	30.5 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%	Gas Fuel Share 90.0%	Oil Fuel Share 0.0%

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%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	6.0	231
Natural Gas EUI	10.6	411
Market Composite EUI	10.1	393

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	15.0%	0.0%	0.0%	65.0%	20.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	114 W/m²	36 Btu/hr.ft²	332 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	131.6 MJ/m².yr	3.4 kWh/ft².yr	
Sizing Factor	1.00		
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		

	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.7	66
Natural Gas EUI	0.0	0
Market Composite EUI	1.7	66

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	66.50%				3.50%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.53		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	1.1	43
Market Composite EUI	1.0	37.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Office** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.05	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	8.8	W/m²	0.81	W/ft²
Fan Design Load VAV	12.9	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	70%	30%	100%	
Operation	Continuous	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 area	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.07	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	0.006	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	0.68	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	56.6	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	1.7	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.5	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	6.4
	MJ/m².yr	247.8

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:		Value	Unit	Value	Unit
	Electricity:	23.5	kWh/ft².yr	909.9	MJ/m².yr
	Gas:	10.4	kWh/ft².yr	403.8	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	8.6	331.3
ARCHITECTURAL LIGHTING	0.8	32.2
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.7	104.0
HVAC ELECTRICITY	6.4	247.8
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	2.6	100.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	23.1	9.5	369.7
SPACE COOLING	1.5	59.3	0.0	0.0
SERVICE HOT WATER	0.2	7.5	0.8	30.0
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

Summary Building Profile

Building Type: Large Retail	**Location:** Lower Mainland
Description: This archetype is based on Building Check-up data including 11 sites and BOMA data including 15 of the largest malls. The BOMA malls average nearly 700,000 sq.ft.. The archetype uses a floor area of 50,000 m^2 (538,000 ft²), on one level. Electrical energy intensity (electrical beep) based on these buildings is 22.9 kWh/ft².yr. Detailed modeling indicates that energy intensities for the HVAC, heating and cooling end uses is lower than expected for this type of building.	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 538,000 ft² - average footprint 430,000 ft^2 assumes a 290' x 1,450' footprint - mainly one storey

Building Specifications:

roof construction:	0.35 W/m².°C
wall construction:	0.7116 W/m².°C
windows:	4.48 W/m².°C
shading coefficient	0.8
window to wall ratio	0.05

General Lighting & LPD 620 Lux 33.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
20%	5%	40%	0%	20%	15%

Common Area, Atria Lighting & LPD 500 Lux 31.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
20%	0%	15%	0%	5%	60%

Overall LPD 26.9 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
90%	10%	0%	0%	0%	

System air Flow	5.1 L/s.m²	0.99 CFM/ft²
Fan Power	10.5 W/m²	0.98 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
50%	0%	0%	20%	30%	0%	

Calculated Capacity 98 W/m² 388 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8 W/m²	0.1 W/ft²
Condenser Pumps	0.0 W/m²	0.0 W/ft²
Condenser Fan Size	2.6 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	$MJ/m^2.yr$	**kWh/ft².yr**	**$MJ/m^2.yr$**	**kWh/ft².yr**
General Lighting	487	12.6		
Architectural Lighting	146	3.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	69	1.8		
Space Heating	7	0.2	213.4	5.5
Space Cooling	62	1.6	0.0	5.5
HVAC Equipment	134	3.5		
DHW	5	0.1	34.2	0.9
Refrigeration Equipment	10	0.3		
Food Service Equipment	2	0.0	33.2	0.0
Miscellaneous	45	1.2		
Total	**968**	**25.0**	**280.8**	**12**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	4.48	W/m².°C	0.79	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) (%)	0.05								
Shading Coefficient (SC)	0.80				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 (%)	90%		0%		10%		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	17.59%
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:	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	5.05	L/s.m²	0.99	CFM/ft²				
					Separate Make-up air unit (100% OA)	0 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	

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	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:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	620 Lux	57.6	ft-candles
Floor Fraction (GLFF)	0.80		
Connected Load	33.6 W/m²	3.1	W/ft²

Occ. Period(Hrs./yr.)	4100	Light Level (Lux)	300	500	700	1000				Total	
Unocc. Period(Hrs./yr.)	4660	% Distribution	0%	40%	60%	0%				100%	
Usage During Occupied Period	100%	Weighted Average								**620**	
Usage During Unoccupied Period	20%										
			INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL	
Fixture Cleaning:		System Present (%)	20%	5%	40%	0%	20%	15%	0%	100.0%	
Incidence of Practice		CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6		
Interval	years	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	Group / Spot										
of Practice										EUI kWh/ft².yr	12.6
										MJ/m².yr	487

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	31.6 W/m²	2.9	W/ft²

Occ. Period(Hrs./yr.)	4100	Light Level (Lux)	300	500	700	1000				Total	
Unocc. Period(Hrs./yr.)	4660	% Distribution	0%	100%	0%	0%				100%	
Usage During Occupied Period	100%	Weighted Average								**500**	
Usage During Unoccupied Period	50%										
			INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL	
Fixture Cleaning:		System Present (%)	20%	0%	15%	0%	5%	60%	0%	100.0%	
Incidence of Practice		CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6		
Interval	years	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	Group / Spot										
of Practice										EUI kWh/ft².yr	3.8
		EUI = Load X Hrs. X SF X GLFF								MJ/m².yr	146

OTHER (HIGH BAY) LIGHTING

Light Level	0.00 Lux	0.0	ft-candles	Floor fraction check: should = 1.00	1.00
Floor Fraction (HBLFF)	0.00				
Connected Load	0.0 W/m²	0.0	W/ft²		

Occ. Period(Hrs./yr.)	4000	Light Level (Lux)	300	500	700	1000				Total	
Unocc. Period(Hrs./yr.)	4760	% Distribution	0%	0%	0%	0%				0%	
Usage During Occupied Period	0%	Weighted Average								**0**	
Usage During Unoccupied Period	100%										
			INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL	
Fixture Cleaning:		System Present (%)	0%	0%	0%	0%	0%	100%	0%	100.0%	
Incidence of Practice		CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6		
Interval	years	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	Group / Spot										
of Practice										EUI kWh/ft².yr	0.0
										MJ/m².yr	0

TOTAL LIGHTING	EUI TOTAL	kWh/ft².yr	16
		MJ/m².yr	634

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	100%	20%
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)	3.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	0.9 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	1.8
	MJ/m².yr	69

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share:	83.0%	Electricity Fuel Share:	17.0%	Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	1.2
	MJ/m².yr	45

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	2%	1%	0%	2%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	59.1 W/m²	18.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	168 MJ/m².yr	4.3 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Gas Fuel Share 95.0%	Oil Fuel Share 0.0%

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	3.6
MJ/m².yr	141

Natural Gas EUI	
kWh/ft².yr	5.8
MJ/m².yr	225

Market Composite EUI	
kWh/ft².yr	5.7
MJ/m².yr	220

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	HE	Screw Chillers	Reciprocating Chillers Open	DX	Absorption Chillers W. H.	CW	Total
System Present (%)	50.0%	0.0%	0.0%	20.0%	30.0%	0.0%	0.0%	100.0%
COP	4.8	5.4	4.4	3.7	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.27	0.37	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	98 W/m²	31 Btu/hr.ft²	388 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	152.7 MJ/m².yr	3.9 kWh/ft².yr	
Sizing Factor	1.00		
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	1.9
MJ/m².yr	73

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.9
MJ/m².yr	73

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	76.00%				4.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.53		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	25

Natural Gas EUI	
kWh/ft².yr	1.1
MJ/m².yr	43

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	39.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Lower Mainland
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	0.99	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	5.3	W/m²	0.49	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	90%	10%	100%	
Operation	Continuous	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 area	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)	2.63	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	0.006	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	28.9	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	1.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.8	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	3.5
	MJ/m².yr	134.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**25.0** kWh/ft².yr	**968.3** MJ/m².yr	**Gas:**	**7.2** kWh/ft².yr	**280.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	12.6	487.5
ARCHITECTURAL LIGHTING CORI	3.8	146.3
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.8	69.4
HVAC ELECTRICITY	3.5	134.3
REFRIGERATION EQUIPMENT	0.3	10.0
MISCELLANEOUS EQUIPMENT	1.2	45.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.0	5.5	213.4
SPACE COOLING	1.6	62.2	0.0	0.0
SERVICE HOT WATER	0.1	5.0	0.9	34.2
FOOD SERVICE EQUIPMENT	0.0	1.7	0.9	33.2

Summary Building Profile

Building Type: Medium Retail	**Location:** Lower Mainland
Description: This archetype is based on Building Check-up data that includes 11 sites. The size range covered is 50,000 - 100,000 ft². The archetype uses a floor area of 7,500 m² (80,700 ft²) on one level. Electrical energy intensity (electrical bepi) is based on the intensity developed for large retail, adjusted to the smaller floor area and expected differences in technology.	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 80,700 ft², with a footprint of 127' x 635' - one storey

Building Specifications:

roof construction:	0.55 W/m².°C
wall construction:	0.53 W/m².°C
windows:	5.4 W/m².°C
shading coefficient	0.78
window to wall ratio	0.1

General Lighting & LPD — 630 Lux — 26.5 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	0%	80%	5%	5%	

Architectural Lighting & LPD — 500 Lux — 24.9 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	15%	15%	60%	5%	5%	

Overall LPD — 25.1 W/m²

Plug Loads (office equipment) EPD — 5.1 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	3.6 L/s.m²	0.72 CFM/ft²
Fan Power	0.0 W/m²	0.00 W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	0%	100%	0%	0

Calculated Capacity	97 W/m²	389 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.0 W/m²	0.0 W/ft²
Condenser Pumps	0.0 W/m²	0.0 W/ft²
Condenser Fan Size	2.6 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	549	14.2		
Architectural Lighting	38	1.0		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	67	1.7		
Space Heating	8	0.2	228.1	5.9
Space Cooling	45	1.2	0.0	5.9
HVAC Equipment	109	2.8		
DHW	11	0.3	13.2	0.3
Refrigeration Equipment	9	0.2		
Food Service Equipment	2	0.0	8.3	0.2
Miscellaneous	43	1.1		
Total	**880**	**22.7**	**249.6**	**12**

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)	0.53	W/m².°C	0.09	Btu/hr.ft² .°F	Typical Building Size	7,500	m²	80,700	ft²
Roof U value (W/m².°C)	0.55	W/m².°C	0.10	Btu/hr.ft² .°F	Typical Footprint (m²)	7,500	m²	80,700	ft²
Glazing U value (W/m².°C)	5.40	W/m².°C	0.95	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)	0.78				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 22.01%
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			
Total Air Circulation or Design Air Flow	3.63	L/s.m²	0.72	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	

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: Medium Retail, Baseline | **SIZE:** 50,000 - 100,000 ft2 | **VINTAGE:** | **REGION:** Lower Mainland

LIGHTING

GENERAL LIGHTING

Light Level	630	Lux	58.6	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	26.5	W/m²	2.5	W/ft²
Occ. Period(Hrs./yr.)	5000			
Unocc. Period(Hrs./yr.)	3760			
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)	300	500	700	1000	Total
% Distribution	0%	35%	65%	0%	100%
Weighted Average					**630**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	0%	80%	5%	5%	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 14.2; MJ/m².yr 549

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	24.9	W/m²	2.3	W/ft²
Occ. Period(Hrs./yr.)	5500			
Unocc. Period(Hrs./yr.)	3260			
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	30%	40%	30%	0%	100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	15%	60%	5%	5%	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 1.0; MJ/m².yr 38

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 15; MJ/m².yr 587

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0.1	0.1	0.1	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.8 W/m²	0.2 W/m²	3 W/m²
	0.0 W/ft²	0.1 W/ft²	0.02 W/ft²	0.07 W/ft²	0.02 W/ft²	0.28 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	5.1 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	0.7 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.7; MJ/m².yr 67

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.3	0.2
MJ/m².yr	10.0	9.6

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.2; MJ/m².yr 8.6

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.1; MJ/m².yr 43

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Retail** **Baseline**

SIZE: **50,000 - 100,000 ft2**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	88%	0%	0%	1%	0%	0%	4%	93%
Eff./COP	69%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.45	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	52.3 W/m²	16.6 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	166 MJ/m².yr	4.3 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Gas Fuel Share 95.0%	Oil Fuel Share 0.0%

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%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	3.9	153
Natural Gas EUI	6.2	240
Market Composite EUI	5.7	219

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	3	5.4	4.4	3.6	2.4	0.9	1	
Performance (1 / COP) (kW/kW)	0.33	0.19	0.23	0.28	0.42	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	97 W/m²	31 Btu/hr.ft²	389 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	100.8 MJ/m².yr	2.6 kWh/ft².yr	
Sizing Factor	1.00		
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		

	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.3	50
Natural Gas EUI	0.0	0
Market Composite EUI	1.3	50

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	39.60%				0.40%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	40%		60%
Blended Efficiency	0.52		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 17.3

Wetting Use Percentage: 90%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.5	19
Natural Gas EUI	0.9	33
Market Composite EUI	0.6	24.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Retail** **Baseline**

SIZE: **50,000 - 100,000 ft2**

VINTAGE:

REGION: **Lower Mainland**

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.6	L/s.m²	0.72	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.4	W/m²	0.32	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	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	85%	15%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit area	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	0.027	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	0.000	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	0.006	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	5500	hrs./year
Supply Fan Unocc. Period	3260	hrs./year
Supply Fan Energy Consumption	28.5	kWh/m².yr
Exhaust Fan Occ. Period	5500	hrs./year
Exhaust Fan Unocc. Period	3260	hrs./year
Exhaust Fan Energy Consumption	1.1	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	7000	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	109.2

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:**	**22.7** kWh/ft².yr	**880.5** MJ/m².yr	**Gas:**	**6.4** kWh/ft².yr	**249.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	14.2	548.8
ARCHITECTURAL LIGHTING	1.0	37.8
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.7	67.0
HVAC ELECTRICITY	2.8	109.2
REFRIGERATION EQUIPMENT	0.2	8.6
MISCELLANEOUS EQUIPMENT	1.1	43.3

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.6	5.9	228.1
SPACE COOLING	1.2	45.2	0.0	0.0
SERVICE HOT WATER	0.3	11.4	0.3	13.2
FOOD SERVICE EQUIPMENT	0.0	1.6	0.2	8.3

Summary Building Profile

Building Type: Food Retail | **Location:** Lower Mainland

Description: This archetype is based on the prototype eReview benchmarks based on the relatively small amount of Building Check-up data. Additional data from an hourly calibrated Best Food Store and the Commercial Refrigeration System Tech Report for Hydro Quebec and CEA have been used to supplement the eReview prototype.

The BCU database contains 13 building samples, 6 of which are less than 2,000 ft². The average size of the sample is 13,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 13,000 ft²
- single storey

Building Specifications:

roof construction:	0.35	W/m².°C
wall construction:	0.7116	W/m².°C
windows:	4.48	W/m².°C
shading coefficient	0.8	
window to wall ratio	0.1	

General Lighting & LPD 640 Lux 26.8 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
5%	0%	10%	0%	5%	80%

Architectural Lighting & LPD 500 Lux 16.3 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
0%	0%	50%	0%	30%	20%

Overall LPD 24.1 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	6.0	L/s.m²	1.18	CFM/ft²
Fan Power	12.5	W/m²	1.16	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
0%	0%	0%	10%	90%	0%	

Calculated Capacity 82 W/m² 463 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.7	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.2	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	619	16.0		
Architectural Lighting	51	1.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	78	2.0	156.1	4.0
Space Cooling	49	1.3	0.0	4.0
HVAC Equipment	149	3.8		
DHW	10	0.3	69.7	1.8
Refrigeration Equipment	1200	31.0		
Food Service Equipment	3	0.1	103.8	0.0
Miscellaneous	60	1.5		
Total	**2335**	**60.3**	**329.5**	**10**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Food Retail** **Baseline** | **SIZE:** **0** | **VINTAGE:** | **REGION:** **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F	Typical Building Size	1,225	m²	13,181	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	1,225	m²	13,181	ft²
Glazing U value (W/m².°C)	4.48	W/m².°C	0.79	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) (%)	0.10								
Shading Coefficient (SC)	0.80				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 9.30%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	0%				
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: 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	5.98	L/s.m²	1.18	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	

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	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	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**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	26.8	W/m²	2.5	W/ft²

Occ. Period(Hrs./yr.)	4100
Unocc. Period(Hrs./yr.)	4660
Usage During Occupied Period	100%
Usage During Unoccupied Period	65%
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	0%	10%	0%	5%	80%	0%	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	16.0
	MJ/m².yr	619

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	16.3	W/m²	1.5	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	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	50%	0%	30%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	51

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	17
	MJ/m².yr	670

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0.01		0.01		0.01		0.01		0.05			
Connected Load	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.1	W/m²	4	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.00	W/ft²	0.01	W/ft²	0.37	W/ft²
Diversity Occupied Period	75%		75%		90%		90%		100%		90%	
Diversity Unoccupied Period	25%		25%		50%		10%		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)	3.7	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	3.7	W/m²	0.3	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI		
	kWh/ft².yr	3.0
	MJ/m².yr	116

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	3.2	EUI	kWh/ft².yr	0.5
	MJ/m².yr	125.0		MJ/m².yr	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI		
	kWh/ft².yr	31.0
	MJ/m².yr	1200.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	1.5
	MJ/m².yr	60

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Food Retail Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	60%	0%	0%	10%	0%	0%	30%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	75.8	W/m²	24.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	195	MJ/m².yr	5.0	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 40.0% Gas Fuel Share 60.0% Oil Fuel Share 0.0%

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	195

Natural Gas EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Market Composite EUI	
kWh/ft².yr	6.0
MJ/m².yr	234

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	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	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	82	W/m²	26	Btu/hr.ft²	463	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	117.5	MJ/m².yr	3.0	kWh/ft².yr		

Sizing Factor 1.00

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	79.20%				0.80%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.52		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 45.5

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	50

Natural Gas EUI	
kWh/ft².yr	2.2
MJ/m².yr	87

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	79.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	6.0	L/s.m²	1.18	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	6.2	W/m²	0.58	W/ft²
Fan Design Load VAV	12.5	W/m²	1.16	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	0.2	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.21	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	0.004	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	0.005	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	33.8	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	7000	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	3.8
	MJ/m².yr	148.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**60.3** kWh/ft².yr	**2,334.9** MJ/m².yr	**Gas:**	**8.5** kWh/ft².yr	**329.5** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	16.0	618.5					
ARCHITECTURAL LIGHTING CORF	1.3	51.3	SPACE HEATING	2.0	77.9	4.0	156.1
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	1.3	48.9	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	3.0	116.3	SERVICE HOT WATER	0.3	10.0	1.8	69.7
HVAC ELECTRICITY	3.8	148.6	FOOD SERVICE EQUIPMENT	0.1	3.4	2.7	103.8
REFRIGERATION EQUIPMENT	31.0	1,200.0					
MISCELLANEOUS EQUIPMENT	1.5	60.0					

Summary Building Profile

Building Type: Large Hotel

Location: Lower Mainland

Description: This archetype is based on the Building Check-up Database for large hotel which exceeded 50,000 ft². The BCU database contains 37 hotels 21 of which meets the criteria of a large hotel. A total of 17 hotels are in the lower mainland and the remaining 4 in the interior. The hotels in the database range in size from 57,000 ft² to 600,000 ft² constructed between 1910 and 1996. The average size for the sample is 220,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 200,000 ft²
- 10 stories

Building Specifications:

roof construction:	0.43 W/m².°C
wall construction:	0.64008 W/m².°C
windows:	4.045 W/m².°C
shading coefficient	0.65
window to wall ratio	0.3

GENERAL LIGHTING (SUITES) 125 Lux 13.0 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
60%	30%	10%	0%	0%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 23.5 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
40%	15%	30%	0%	15%	

Overall LPD 9.8 W/m²

Plug Loads (office equipment) EPD 3.0 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Fan Coils
66%	0%	0%	0%	0%	34%

System air Flow 3.6 L/s.m² 0.71 CFM/ft²
Fan Power 9.4 W/m² 0.88 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
40%	0%	20%	40%	0%	0

Calculated Capacity 92 W/m² 410 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8 W/m²	0.1 W/ft²
Condenser Pumps	0.5 W/m²	0.1 W/ft²
Condenser Fan Size	2.5 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	147	3.8		
Lobby, Ballrooms, Corridors, Back-of-house	145	3.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	95	2.5		
Space Heating	24	0.6	353.5	9.1
Space Cooling	36	0.9	0.0	9.1
HVAC Equipment	120	3.1		
DHW	13	0.3	309.2	8.0
Refrigeration Equipment	30	0.8		
Food Service Equipment	1	0.0	116.2	3.0
Miscellaneous	60	1.5		
Total	**671**	**17.3**	**778.9**	**29**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Hotel Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Lower Mainland

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.43	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	4.05	W/m².°C	0.71	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	FCoils	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 34.71%
Occupancy Schedule Occ. Period	45%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	75	L/s.person	159	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	3.60	L/s.m²	0.71	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	

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	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)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	13.0	W/m²	1.2	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	40%
Usage During Unoccupied Period	50%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	75%	25%	0%	100%
Weighted Average					**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	60%	30%	10%	0%	0%	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 147

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	23.5	W/m²	2.2	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	85%
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	40%	15%	30%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 3.8; MJ/m².yr 145

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 8; MJ/m².yr 292

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	4.3 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.40 W/ft²
Diversity Occupied Period	0%	0%	0%	0%	0%	70%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	70%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	3.0 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	3.0 W/m²	0.3 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 2.5; MJ/m².yr 95

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.6	0.1
MJ/m².yr	140.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 1.5; MJ/m².yr 60

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Large Hotel **0** **Lower Mainland**
Baseline

SPACE HEATING

Heating Plant Type

	Hot Water System							Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller		Resistance	Total
System Present (%)	90%	0%	0%	3%	2%	0%		5%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50		1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22		1.00	

Peak Heating Load	49.2 W/m²	15.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	295 MJ/m².yr	7.6	kWh/ft².yr
Sizing Factor	1.00		

Electric Fuel Share 10.0% Gas Fuel Share 90.0% Oil Fuel Share 0.0%

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
Natural Gas EUI	kWh/ft².yr	10.1
	MJ/m².yr	393
Market Composite EUI	kWh/ft².yr	9.7
	MJ/m².yr	378

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	40.0%	0.0%	0.0%	20.0%	40.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	92 W/m²	29 Btu/hr.ft²	410 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	94.9 MJ/m².yr	2.5 kWh/ft².yr	

Sizing Factor 0.90

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank			Boiler
System Present (%)	9.50%			85.50%
Eff./COP	0.520			0.750

	Fossil		Elec. Res.
Fuel Share	95%		5%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.7	8.4	8.3
MJ/m².yr	260	325	322.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.6	L/s.m²	0.71	CFM/ft²
System Static Pressure CAV	375	Pa	1.5	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	3.2	W/m²	0.30	W/ft²
Fan Design Load VAV	9.4	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	100%	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.49	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	0.55	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.006	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	23.7	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	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	3.1
	MJ/m².yr	120.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**17.3**	kWh/ft².yr	**670.6**	MJ/m².yr		
	Gas:	**20.1**	kWh/ft².yr	**778.9**	MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr	END USE:	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING (SUITES)	3.8	146.6					
LOBBY, BALLROOMS, CORRIDORS	3.8	145.3	SPACE HEATING	0.6	24.0	9.1	353.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	0.9	36.0	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.5	94.9	SERVICE HOT WATER	0.3	13.0	8.0	309.2
HVAC ELECTRICITY	3.1	120.1	FOOD SERVICE EQUIPMENT	0.0	0.7	3.0	116.2
REFRIGERATION EQUIPMENT	0.8	30.0					
MISCELLANEOUS EQUIPMENT	1.5	60.0					

Summary Building Profile

Building Type: Medium Hotel	**Location:** Lower Mainland
Description: No available sample data.	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 64,560 ft² - 4 stories

Building Specifications:

roof construction:	0.43	W/m².°C
wall construction:	0.64008	W/m².°C
windows:	4.045	W/m².°C
shading coefficient	0.57	
window to wall ratio	0.3	

GENERAL LIGHTING (SUITES) 125 Lux 13.0 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
60%	30%	10%	0%	0%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 20.0 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
30%	15%	40%	0%	15%	

Overall LPD 9.8 W/m²

Plug Loads (office equipment) EPD 3.2 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	F.coils/Ptac
66%	0%	0%	0%	0%	34%

System air Flow	3.6	L/s.m²	0.71	CFM/ft²
Fan Power	12.5	W/m²	1.17	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	15%	85%	0%	0%

Calculated Capacity 69 W/m² 550 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.6	W/m²	0.1	W/ft²
Condenser Pumps	0.4	W/m²	0.0	W/ft²
Condenser Fan Size	1.9	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	147	3.8		
Lobby, Ballrooms, Corridors, Back-of-house	124	3.2		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	93	2.4		
Space Heating	38	1.0	208.7	5.4
Space Cooling	16	0.4	0.0	5.4
HVAC Equipment	107	2.8		
DHW	52	1.3	260.4	6.7
Refrigeration Equipment	30	0.8		
Food Service Equipment	1	0.0	83.0	2.1
Miscellaneous	60	1.5		
Total	**667**	**17.2**	**552.1**	**20**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	6,000	m²	64,560	ft²
Roof U value (W/m².°C)	0.43	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Footprint (m²)	1,500	m²	16,140	ft²
Glazing U value (W/m².°C)	4.05	W/m².°C	0.71	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) (%)	0.30								
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	FCoils	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 22.27%

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	3.59	L/s.m²	0.71	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	

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 (SUITES)

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	13.0	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	2100			
Unocc. Period(Hrs./yr.)	6660			
Usage During Occupied Period	40%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	75%	25%	0%				100%
Weighted Average								**125**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	60%	30%	10%	0%	0%	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	147

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	20.0	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	30%	15%	40%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	3.2
	MJ/m².yr	124

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	7
	MJ/m².yr	270

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0		0		0		0		0			
Connected Load	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	4	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.00	W/ft²	0.00	W/ft²	0.37	W/ft²
Diversity Occupied Period	0%		0%		0%		0%		0%		80%	
Diversity Unoccupied Period	0%		0%		0%		0%		0%		70%	
Operation Occ. Period (hrs./year)	0		0		0		0		0		3000	
Operation Unocc. Period (hrs./year)	8760		8760		8760		8760		8760		5760	

Total end-use load (occupied period)	3.2	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	2.8	W/m²	0.3	W/ft²

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EUI	kWh/ft².yr	2.4
	MJ/m².yr	93

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Kitchen services

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.1
	MJ/m².yr	100.0		MJ/m².yr	4.0

REFRIGERATION EQUIPMENT

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffett cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

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

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	80%	0%	0%	10%	0%	0%	10%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 64.2 W/m² — 20.4 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 196 MJ/m².yr — 5.1 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 20.0% — Gas Fuel Share: 80.0% — Oil Fuel Share: 0.0%

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	4.9	192
Natural Gas EUI	6.7	261
Market Composite EUI	6.4	247

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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: 69 W/m² — 22 Btu/hr.ft² — 550 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 85.9 MJ/m².yr — 2.2 kWh/ft².yr

Sizing Factor: 0.85

A/C Saturation (Incidence of A/C): 40.0%

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	1.0	40
Natural Gas EUI	0.0	0
Market Composite EUI	1.0	40

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	8.00%				72.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 236.6

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	6.7	260
Natural Gas EUI	8.4	325
Market Composite EUI	8.1	312.4

EXISTING BUILDINGS: Medium Hotel, Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Lower Mainland

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.6	L/s.m²	0.71	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	2.9	W/m²	0.26	W/ft²
Fan Design Load VAV	12.5	W/m²	1.17	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	Continuous	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 area	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)	1.86	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	0.41	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.004	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	21.8	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	0.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	2.8
	MJ/m².yr	107.1

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:**	**17.2** kWh/ft².yr	**667.1** MJ/m².yr		**Gas:**	**14.3** kWh/ft².yr	**552.1** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING (SUITES)	3.8	146.6					
LOBBY, BALLROOMS, CORRIDORS	3.2	123.9	SPACE HEATING	1.0	38.3	5.4	208.7
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	0.4	15.9	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.4	92.6	SERVICE HOT WATER	1.3	52.0	6.7	260.4
HVAC ELECTRICITY	2.8	107.1	FOOD SERVICE EQUIPMENT	0.0	0.7	2.1	83.0
REFRIGERATION EQUIPMENT	0.8	30.0					
MISCELLANEOUS EQUIPMENT	1.5	60.0					

Summary Building Profile

Building Type: Hospital	**Location:** Lower Mainland
Description: This archetype is based on the Building Check-up Database for large hospitals. The BCU database contains 12 hospitals with 10 in the Interior, 2 in Vancouver Island and none in the Lower Mainland. The facilities in the database range in size from 18,000 to 120,000 ft² constructed between 1959 and 1961. The average size of the sample is 67,000 ft². This sample was augmented with data from four additional facilities ranging in size from 237,000 to 685,000 ft².	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 150,000 ft² - 10 stories

Building Specifications:

roof construction:	0.41	W/m².°C
wall construction:	0.43	W/m².°C
windows:	3.702	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.15	

PATIENT ROOMS 250 Lux 7.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	90%	0%	10%	

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY 700 Lux 20.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	80%	0%	20%	

Overall LPD 2.3 W/m²

Plug Loads (office equipment) EPD 6.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Fcoils
20%	50%	0%	0%	0%	30%

System air Flow	4.3	L/s.m²	0.84	CFM/ft²
Fan Power	10.6	W/m²	0.98	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
80%	0%	15%	5%	0%	0

Calculated Capacity 95 W/m² 400 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8	W/m²	0.1	W/ft²
Condenser Pumps	1.3	W/m²	0.1	W/ft²
Condenser Fan Size	1.2	W/m²	0.1	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Patient Rooms	22	0.6		
Nursing Stations, Examination, Laboratories	108	2.8		
Corridors, Other	100	2.6		
Plug Loads & Office Equipment	147	3.8		
Space Heating	0	0.0	1223.9	31.6
Space Cooling	40	1.0	0.0	31.6
HVAC Equipment	248	6.4		
DHW	0	0.0	160.2	4.1
Refrigeration Equipment	15	0.4		
Food Service Equipment	1	0.0	99.6	0.0
Miscellaneous	30	0.8		
Total	**711**	**18.4**	**1483.7**	**67**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Hospital** **Baseline** — **SIZE:** — **VINTAGE:** — **REGION:** **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.43	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.41	W/m².°C	0.07	Btu/hr.ft² .°F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	3.70	W/m².°C	0.65	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	10			
					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	FCoils	IU	100% O.A	TOTAL
System Present (%)	20%				50%	30%			100%
Min. Air Flow (%)					70%				

(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	60	L/s.person	127	CFM/person

%OA 47.02%

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: 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	4.25	L/s.m²	0.84	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 CFM/ft²
Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

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	24	°C	75.2	°F	16.5	°C	61.7	°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	24	°C	75.2	°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

PATIENT ROOMS

Light Level	250 Lux	23.2	ft-candles
Floor Fraction (GLFF)	0.30		
Connected Load	7.6 W/m²	0.7	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	50%
Usage During Unoccupied Period	25%

Light Level (Lux)	50	100	200	300				Total
% Distribution			50%	50%				100%
Weighted Average								**250**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			90%		10%		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	0.6
	MJ/m².yr	22

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY

Light Level	700 Lux	65.1	ft-candles
Floor Fraction (ALFF)	0.35		
Connected Load	20.9 W/m²	1.9	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	60%
Usage During Unoccupied Period	40%

Light Level (Lux)	300	500	700	1000				Total
% Distribution			100%					100%
Weighted Average								**700**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	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	0.80	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.8
	MJ/m².yr	108

CORRIDORS, OTHER

Light Level	250.00 Lux	23.2	ft-candles
Floor Fraction (HBLFF)	0.35		
Connected Load	9.1 W/m²	0.8	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	100%
Usage During Unoccupied Period	100%

Light Level (Lux)	200	300	500	700				Total
% Distribution	50%	50%						100%
Weighted Average								**250**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	70%		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	0.80	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	2.6
	MJ/m².yr	100

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	6
	MJ/m².yr	231

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0.05		0.05									
Connected Load	0.1	W/m²	0.1	W/m²		W/m²		W/m²		W/m²	10	W/m²
	0.0	W/ft²	0.0	W/ft²		W/ft²		W/ft²		W/ft²	0.93	W/ft²
Diversity Occupied Period	90%		90%								65%	
Diversity Unoccupied Period	40%		40%								40%	
Operation Occ. Period (hrs./year)											2000	
Operation Unocc. Period (hrs./year)	8760		8760		8760		8760		8760		6760	

Total end-use load (occupied period)	6.7 W/m²	0.6 W/ft²
Total end-use load (unocc. period)	4.1 W/m²	0.4 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	3.8
	MJ/m².yr	147

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food services

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	3.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	120.0		MJ/m².yr	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Hospital — **Lower Mainland**
Baseline

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	100%							100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	53.2 W/m²	16.9 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	918 MJ/m².yr	23.7 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share		Gas Fuel Share 100.0%	Oil Fuel Share

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		
Natural Gas EUI	31.6	1224
Market Composite EUI	31.6	1224

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	80.0%			15.0%	5.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	95 W/m²	30 Btu/hr.ft²	400 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	95.3 MJ/m².yr	2.5 kWh/ft².yr	
Sizing Factor	0.65		
A/C Saturation (Incidence of A/C)	85.0%		
Electric Fuel Share	100.0%	Gas Fuel Share	

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 Maintenar

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	1.2	47
Natural Gas EUI		
Market Composite EUI	1.2	47

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	5.00%				95.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	100%		
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 118.3

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	3.4	130
Natural Gas EUI	4.1	160
Market Composite EUI	4.1	160.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hospital Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.3	L/s.m²	0.84	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	9.6	W/m²	0.89	W/ft²
Fan Design Load VAV	10.6	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	50%	50%	100%	

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)	1.23	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	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	1.25	W/m²	0.12	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.006	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	52.2	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	3.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.7	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	6.4
	MJ/m².yr	247.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hospital Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.4** kWh/ft².yr	**710.9** MJ/m².yr	**Gas:**	**38.3** kWh/ft².yr	**1,483.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
PATIENT ROOMS	0.6	22.3					
NURSING STATIONS, EXAMINATIO	2.8	108.1	SPACE HEATING			31.6	1,223.9
CORRIDORS, OTHER	2.6	100.2	SPACE COOLING	1.0	40.1		
OFFICE EQUIPMENT & PLUG LOAI	3.8	147.1	SERVICE HOT WATER			4.1	160.2
HVAC ELECTRICITY	6.4	247.6	FOOD SERVICE EQUIPMENT	0.0	0.7	2.6	99.6
REFRIGERATION EQUIPMENT	0.4	15.0					
MISCELLANEOUS EQUIPMENT	0.8	30.0					

Summary Building Profile

Building Type:	Nursing Home	**Location:**	Lower Mainland

Description: This archetype is based on the Building Check-up Database for extended care buildings. The BCU database contains 23 extended care facilities with 12 in the Lower Mainland, 1 in Vancouver Island and the remaining 10 in the Interior. The facilities in the database range in size from 12,000 ft² to 150,000 ft² constructed between 1960 and 1993. The average size for the sample is 56,000 ft².

This sample was augmented with data from two extended care facilities ranging in size from 45,000 ft² to 175,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 60,000 ft²
- 2 stories

Building Specifications:

roof construction:	0.28	W/m².°C
wall construction:	0.61624	W/m².°C
windows:	4.045	W/m².°C
shading coefficient	0.6	
window to wall ratio	0.28	

GENERAL LIGHTING (SUITES) 200 Lux 10.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
20%	10%	55%	0%	15%	

SERVICES, KITCHEN, OFFICES, DINING, RECREATION 300 Lux 14.7 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	5%	60%	0%	15%	

Overall LPD 8.2 W/m²

Plug Loads (office equipment) EPD 2.5 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	2.5	L/s.m²	0.48	CFM/ft²
Fan Power	0.0	W/m²	0.00	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	15%	85%	0%	0

Calculated Capacity 92 W/m² 412 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.7	W/m²	0.1	W/ft²
Condenser Pumps	0.5	W/m²	0.0	W/ft²
Condenser Fan Size	2.5	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	118	3.0		
Services, Kitchen, Offices, Dining, Recreation	89	2.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	87	2.2	747.0	19.3
Space Cooling	11	0.3	0.0	19.3
HVAC Equipment	125	3.2		
DHW	15	0.4	166.4	4.3
Refrigeration Equipment	30	0.8		
Food Service Equipment	1	0.0	116.2	3.0
Miscellaneous	40	1.0		
Total	**573**	**14.8**	**1029.5**	**46**

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)	0.62	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	5,600	m²	60,256	ft²
Roof U value (W/m².°C)	0.28	W/m².°C	0.05	Btu/hr.ft² .°F	Typical Footprint (m²)	2,800	m²	30,128	ft²
Glazing U value (W/m².°C)	4.05	W/m².°C	0.71	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	FCoils	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%	0%	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	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	38	L/s.person	81	CFM/person

%OA 51.57%

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			
Total Air Circulation or Design Air Flow	2.46	L/s.m²	0.48	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	

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	24	°C	75.2	°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 (SUITES)

Light Level	200	Lux	18.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	10.9	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	70%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	0%	100%	0%				100%
Weighted Average								**200**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	20%	10%	55%	0%	15%	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 3.0; MJ/m².yr 118

SERVICES, KITCHEN, OFFICES, DINING, RECREATION

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	14.7	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	70%			
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	5%	60%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.3; MJ/m².yr 89

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 5; MJ/m².yr 206

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0		0		0		0		0			
Connected Load	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	3.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.00	W/ft²	0.00	W/ft²	0.33	W/ft²
Diversity Occupied Period	0%		0%		0%		0%		0%		70%	
Diversity Unoccupied Period	0%		0%		0%		0%		0%		45%	
Operation Occ. Period (hrs./year)	0		0		0		0		0		3000	
Operation Unocc. Period (hrs./year)	8760		8760		8760		8760		8760		5760	

Total end-use load (occupied period)	2.5	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	1.6	W/m²	0.1	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.5; MJ/m².yr 59

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation equipment

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.6	0.1
MJ/m².yr	140.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 1.0; MJ/m².yr 40

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	85%	0%	0%	5%	0%	0%	10%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	55.0 W/m²	17.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	659 MJ/m².yr	17.0 kWh/ft².yr
Sizing Factor	1.00	

Electric Fuel Share 15.0% Gas Fuel Share 85.0% Oil Fuel Share 0.0%

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	14.9
MJ/m².yr	578

Natural Gas EUI	
kWh/ft².yr	22.7
MJ/m².yr	879

Market Composite EUI	
kWh/ft².yr	21.5
MJ/m².yr	834

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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)	88.8 MJ/m².yr	2.3 kWh/ft².yr	
Sizing Factor	0.85		
A/C Saturation (Incidence of A/C)	25.0%		

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	4.50%				85.50%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 136.5

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	3.9
MJ/m².yr	150

Natural Gas EUI	
kWh/ft².yr	4.8
MJ/m².yr	185

Market Composite EUI	
kWh/ft².yr	4.7
MJ/m².yr	181.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	2.5	L/s.m²	0.48	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	3.1	W/m²	0.29	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	65%	35%	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.48	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	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.50	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.006	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	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	6.7	kWh/m².yr
Condenser Pump Energy Consumption	1.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	4.5	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	3.2
	MJ/m².yr	124.6

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:**	**14.8** kWh/ft².yr	**573.3** MJ/m².yr	**Gas:**	**26.6** kWh/ft².yr	**1,029.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	3.0	117.5
SERVICES, KITCHEN, OFFICES, DII	2.3	88.9
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.1
HVAC ELECTRICITY	3.2	124.6
REFRIGERATION EQUIPMENT	0.8	30.0
MISCELLANEOUS EQUIPMENT	1.0	40.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	2.2	86.6	19.3	747.0
SPACE COOLING	0.3	10.9	0.0	0.0
SERVICE HOT WATER	0.4	15.0	4.3	166.4
FOOD SERVICE EQUIPMENT	0.0	0.7	3.0	116.2

Summary Building Profile

Building Type: Large Schools	Location: Lower Mainland
Description: This archetype is based on Building Check-up data including 26 secondary and 2 elementary schools of at least 50,000 sq ft. Size range was from 50,600 to 250,000 sq. ft., with an average of 99,000 sq ft. The archetype uses a floor area of 9,300 m2 (100,000 ft2), on two levels. Electrical energy intensity (electrical bepi) based on these buildings is 8.5 kWh/ft².yr. Detailed modelling indicates that energy intensities from the Check-up data for the ventilation and heating end uses is lower than expected for this type of building.	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 100,000 ft² - average footprint 50,000 ft² assumes a 100' x 500' footprint - mainly one storey

Building Specifications:						
roof construction:	0.44 W/m².°C					
wall construction:	0.61 W/m².°C					
windows:	4.1 W/m².°C					
shading coefficient	0.89					
window to wall ratio	0.13					
General Lighting & LPD	440 Lux		12.3 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	40%	10%	50%	
Architectural Lighting & LPD	400 Lux		13.8 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	5%	5%	30%	10%	50%	
Overall LPD	10.5 W/m²					
Plug Loads (office equipment) EPD	1.9 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	90%	10%	0%	0%	0%	
System air Flow	2.9 L/s.m²		0.57 CFM/ft²			
Fan Power	2.7 W/m²		0.25 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	5%	0%	15%	80%	0%	0
Calculated Capacity	88 W/m²		429 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	0.8 W/m²		0.1 W/ft²			
Condenser Pumps	0.5 W/m²		0.0 W/ft²			
Condenser Fan Size	2.4 W/m²		0.2 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	161	4.2		
Architectural Lighting	17	0.4		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	31	0.8		
Space Heating	9	0.2	321.0	8.3
Space Cooling	2	0.1	0.0	8.3
HVAC Equipment	89	2.3		
DHW	2	0.0	24.5	0.6
Refrigeration Equipment	2	0.1		
Food Service Equipment	0	0.0	4.2	0.0
Miscellaneous	12	0.3		
Total	**340**	**8.8**	**349.7**	**17**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Schools** **Baseline**
SIZE: **> 50,000 ft2**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	9,300	m²	100,068	ft²
Roof U value (W/m².°C)	0.44	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Footprint (m²)	4,650	m²	50,034	ft²
Glazing U value (W/m².°C)	4.10	W/m².°C	0.72	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)	0.89				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	31.11%
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	1.3			
Total Air Circulation or Design Air Flow	2.89	L/s.m²	0.57	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	

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)	0.85		
Connected Load	12.3 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	30%		
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 (%)	0%	0%	40%	10%	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 4.2
MJ/m².yr 161

ARCHITECTURAL LIGHTING

Light Level	400 Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	13.8 W/m²	1.3	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	30%	10%	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 17

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.4
MJ/m².yr 15

TOTAL LIGHTING EUI TOTAL kWh/ft².yr 5
MJ/m².yr 194

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.08	0.08	0.03	0.02	0.02	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.4 W/m²	0.1 W/m²	0.4 W/m²
	0.0 W/ft²	0.1 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.04 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	1.9 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	0.5 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 0.8
MJ/m².yr 31

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

	Natural Gas EUI		All Electric EUI	
EUI	kWh/ft².yr	0.1	kWh/ft².yr	0.1
	MJ/m².yr	5.0	MJ/m².yr	2.1

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.1
MJ/m².yr 2.1

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 0.3
MJ/m².yr 12

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Schools Baseline | **SIZE:** > 50,000 ft2 | **VINTAGE:** | **REGION:** Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	3%	0%	0%	2%	100%
Eff./COP	73%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	42.0	W/m²	13.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	247	MJ/m².yr	6.4	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% | Gas Fuel Share 95.0% | Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	4.4	8.7	8.5
MJ/m².yr	171	338	330

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	5.0%	0.0%	0.0%	15.0%	80.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.37	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	429	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	77.9	MJ/m².yr	2.0	kWh/ft².yr		

Sizing Factor 1.00

A/C Saturation (Incidence of A/C) 5.0%

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	1.0	0.0	1.0
MJ/m².yr	40	0	40

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	45.00%				45.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.64		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 17.3

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.7	0.7
MJ/m².yr	19	27	26.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Schools** **Baseline** | **SIZE:** **> 50,000 ft2** | **VINTAGE:** | **REGION:** **Lower Mainland**

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	2.9	L/s.m²	0.57	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	2.7	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	90%	10%	100%	
Operation	Continuous	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 area	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)	2.38	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	0.007	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	0.006	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	4000	hrs./year
Supply Fan Unocc. Period	4760	hrs./year
Supply Fan Energy Consumption	18.5	kWh/m².yr
Exhaust Fan Occ. Period	4000	hrs./year
Exhaust Fan Unocc. Period	4760	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	4000	hrs./year
Circulating Pump Energy Consumption	3.0	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	2.3
	MJ/m².yr	88.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:				
Electricity:	**8.8** kWh/ft².yr	**339.8** MJ/m².yr		
Gas:	**9.0** kWh/ft².yr	**349.7** MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	161.1
ARCHITECTURAL LIGHTING	0.4	17.4
OTHER (HIGH BAY) LIGHTING	0.4	15.1
OFFICE EQUIPMENT & PLUG LOAI	0.8	30.5
HVAC ELECTRICITY	2.3	88.6
REFRIGERATION EQUIPMENT	0.1	2.1
MISCELLANEOUS EQUIPMENT	0.3	12.2

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	8.5	8.3	321.0
SPACE COOLING	0.1	2.0	0.0	0.0
SERVICE HOT WATER	0.0	1.9	0.6	24.5
FOOD SERVICE EQUIPMENT	0.0	0.4	0.1	4.2

Summary Building Profile

Building Type:	Medium Schools	**Location:**	Lower Mainland

Description: This archetype is initially based on the large schools archetype, which was in turn based on 28 schools from the Building Check-up Database. Adjustments were made for the different operating hours, construction standards, and types of equipment prevalent in primary schools.
Size range is up to 50,000 sq.ft. The archetype uses a floor area of 2,300 m2 (24,700 ft2), on one level.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 24,700 ft²
- average footprint 24,700 ft² assumes a 70' x 350' footprint
- one storey

Building Specifications:

roof construction:	0.5	W/m².°C
wall construction:	0.8	W/m².°C
windows:	4.1	W/m².°C
shading coefficient	0.89	
window to wall ratio	0.13	

General Lighting & LPD 400 Lux 11.2 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	40%	10%	50%	

Architectural Lighting & LPD 300 Lux 10.3 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
5%	5%	30%	10%	50%	

Overall LPD 9.5 W/m²

Plug Loads (office equipment) EPD 1.4 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	3.7	L/s.m²	0.73	CFM/ft²
Fan Power	1.8	W/m²	0.16	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	100%	0%	0

Calculated Capacity 102 W/m² 369 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	0.6	W/m²	0.1	W/ft²
Condenser Fan Size	2.8	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	135	3.5		
Architectural Lighting	13	0.3		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	23	0.6		
Space Heating	12	0.3	392.3	10.1
Space Cooling	2	0.0	0.0	10.1
HVAC Equipment	64	1.7		
DHW	2	0.0	26.9	0.7
Refrigeration Equipment	1	0.0		
Food Service Equipment	0	0.0	4.2	0.7
Miscellaneous	6	0.2		
Total	**273**	**7.1**	**423.4**	**22**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.80	W/m².°C	0.14	Btu/hr.ft² .°F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.50	W/m².°C	0.09	Btu/hr.ft² .°F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	4.10	W/m².°C	0.72	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)	0.89				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	26.84%
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
(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	3.73	L/s.m²	0.73	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	

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 HVAC Controls Maintenance:

Incidence of Annual Room 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)	0.85		
Connected Load	11.2 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	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	40%	10%	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	3.5
	MJ/m².yr	135

ARCHITECTURAL LIGHTING

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	10.3 W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400		
Unocc. Period(Hrs./yr.)	6360		
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	30%	10%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.4
	MJ/m².yr	15

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	4
	MJ/m².yr	163

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.05	0.05	0.02	0.02	0.02	
Connected Load	0.3 W/m²	0.4 W/m²	0.1 W/m²	0.4 W/m²	0.1 W/m²	0.3 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.03 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	1.4 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	0.4 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	0.6
	MJ/m².yr	23

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI		
EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0

All Electric EUI		
EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	0.2
	MJ/m².yr	6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Schools** **Baseline**
SIZE: **< 50,000 ft2**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	90%	0%	0%	2%	0%	0%	3%	95%
Eff./COP	73%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load: 71.5 W/m² — 22.7 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 301 MJ/m².yr — 7.8 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% — Gas Fuel Share: 95.0% — Oil Fuel Share: 0.0%

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	6.4	247
Natural Gas EUI	10.7	413
Market Composite EUI	9.9	384

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.37	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: 102 W/m² — 32 Btu/hr.ft² — 369 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 80.7 MJ/m².yr — 2.1 kWh/ft².yr

Sizing Factor: 1.00

A/C Saturation (Incidence of A/C): 5.0%

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	1.0	38
Natural Gas EUI	0.0	0
Market Composite EUI	1.0	38

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	67.50%				22.50%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.58		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 17.3

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.5	19
Natural Gas EUI	0.8	30
Market Composite EUI	0.7	28.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Schools** **Baseline**

SIZE: **< 50,000 ft2**

VINTAGE:

REGION: **Lower Mainland**

HVAC ELECTRICITY

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	100%	0%	100%	
Operation	Continuous	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 area	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)	2.77	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	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.61	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.006	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	3000	hrs./year
Supply Fan Unocc. Period	5760	hrs./year
Supply Fan Energy Consumption	11.9	kWh/m².yr
Exhaust Fan Occ. Period	3000	hrs./year
Exhaust Fan Unocc. Period	5760	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	0.7	kWh/m².yr
Circulating Pump Yearly Operation	3000	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	1.7
	MJ/m².yr	64.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**7.1**	kWh/ft².yr	**273.1**	MJ/m².yr	**Gas:**	**10.9**	kWh/ft².yr	**423.4**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.5	135.2
ARCHITECTURAL LIGHTING	0.3	12.9
OTHER (HIGH BAY) LIGHTING	0.4	15.1
OFFICE EQUIPMENT & PLUG LOAI	0.6	22.5
HVAC ELECTRICITY	1.7	64.1
REFRIGERATION EQUIPMENT	0.0	1.1
MISCELLANEOUS EQUIPMENT	0.2	6.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.3	10.1	392.3
SPACE COOLING	0.0	1.9	0.0	0.0
SERVICE HOT WATER	0.0	1.9	0.7	26.9
FOOD SERVICE EQUIPMENT	0.0	0.2	0.1	4.2

Summary Building Profile

Building Type: University-Colleges **Location:** Lower Mainland

Description: This archetype is based on approximately 150 buildings as follows
-BCIT walk-through audits of 47 buildings
-BCIT detailed lighting audits of 47 buildings
-UBC detailed lighting audit of 37 buildings
-Royal Roads University walk-through audit of 10 buildings
-UVIC walk-through audit of 38 buildings.
The combined floor area is estimated to be approximately 2.2 million ft². The buildings range in size from 10,000 to 200,000 ft². The average building size is 96,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 90,000 ft²
- average footprint 45,000 ft² with a 7:1 length to aspect ratio
- 2 stories

Building Specifications:

roof construction:	0.35 W/m².°C
wall construction:	0.95 W/m².°C
windows:	5.7 W/m².°C
shading coefficient	0.65
window to wall ratio	0.3

General Lighting & LPD 640 Lux 19.3 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
0%	0%	80%	0%	15%	5%

Architectural Lighting & LPD 300 Lux 14.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	5%	65%	0%	15%	

Overall LPD 17.4 W/m²

Plug Loads (office equipment) EPD 4.1 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
70%	30%	0%	0%	0%	

System air Flow 3.5 L/s.m² 0.69 CFM/ft²
Fan Power 7.3 W/m² 0.67 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
25%	0%	0%	0%	75%	0%	

Calculated Capacity 117 W/m² 324 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0 W/m²	0.1 W/ft²
Condenser Pumps	0.0 W/m²	0.0 W/ft²
Condenser Fan Size	3.2 W/m²	0.3 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	289	7.5		
Architectural Lighting	46	1.2		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	12	0.3	704.1	18.2
Space Cooling	3	0.1	0.0	18.2
HVAC Equipment	170	4.4		
DHW	3	0.1	32.2	0.8
Refrigeration Equipment	20	0.5		
Food Service Equipment	3	0.1	16.6	0.0
Miscellaneous	75	1.9		
Total	**680**	**17.6**	**752.9**	**37**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.95	W/m².°C	0.17	Btu/hr.ft² .°F	Typical Building Size	9,000 m²	96,840	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	4,500 m²	48,420	ft²
Glazing U value (W/m².°C)	5.70	W/m².°C	1.00	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	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 (%)	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	34.86%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	17	L/s.person	36	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	1.1			
Total Air Circulation or Design Air Flow	3.48	L/s.m²	0.69	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	

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	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	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	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	640 Lux	59.5	ft-candles
Floor Fraction (GLFF)	0.90		
Connected Load	19.3 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	

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	30%	70%	0%	100%
Weighted Average					**640**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	80%	0%	15%	5%	0%	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	7.5
	MJ/m².yr	289

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.10		
Connected Load	14.4 W/m²	1.3	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	5%	65%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	1.2
	MJ/m².yr	46

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	9
	MJ/m².yr	334

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.1	0.1	0.15	0.05	0.05	
Connected Load	0.4 W/m²	0.6 W/m²	0.5 W/m²	0.7 W/m²	0.2 W/m²	2 W/m²
	0.0 W/ft²	0.1 W/ft²	0.05 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	4.1 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	1.2 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI		
	kWh/ft².yr	1.5
	MJ/m².yr	59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.5	0.5
MJ/m².yr	20.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI		
	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	1.9
	MJ/m².yr	75

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: University-Colleges Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	97%	0%	0%	0%	0%	1%	2%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 80.2 W/m² — 25.4 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 544 MJ/m².yr — 14.1 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 3.0% — Gas Fuel Share: 97.0% — Oil Fuel Share: 0.0%

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	10.6	410
Natural Gas EUI	18.7	726
Market Composite EUI	18.5	716

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	25.0%	0.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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: 117 W/m² — 37 Btu/hr.ft² — 324 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 120.5 MJ/m².yr — 3.1 kWh/ft².yr

Sizing Factor: 1.00

A/C Saturation (Incidence of A/C): 5.0%

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 Maintenar

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	1.6	62
Natural Gas EUI	0.0	0
Market Composite EUI	1.6	62

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank			Boiler
System Present (%)	45.00%			45.00%
Eff./COP	0.520			0.750

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.64	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	0.9	36
Market Composite EUI	0.9	34.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Lower Mainland
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.5	L/s.m²	0.69	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	7.3	W/m²	0.67	W/ft²
Fan Design Load VAV	7.3	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	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	0.0	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)	3.15	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	0.006	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	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	37.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.7	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	7000	hrs./year
Circulating Pump Energy Consumption	6.9	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	4.4
	MJ/m².yr	170.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **17.6** kWh/ft².yr **680.4** MJ/m².yr **Gas:** **19.4** kWh/ft².yr **752.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	7.5	288.8
ARCHITECTURAL LIGHTING CORF	1.2	45.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.3
HVAC ELECTRICITY	4.4	170.5
REFRIGERATION EQUIPMENT	0.5	20.0
MISCELLANEOUS EQUIPMENT	1.9	75.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.3	18.2	704.1
SPACE COOLING	0.1	3.1	0.0	0.0
SERVICE HOT WATER	0.1	2.5	0.8	32.2
FOOD SERVICE EQUIPMENT	0.1	3.4	0.4	16.6

Summary Building Profile

Building Type: Restaurant	**Location:** Lower Mainland
Description: This archetype is based on data from the Building Check-up database. The BCU database contains 4 buildings ranging in size from 7,000 ft² constructed between 1940 and 1996. The average size of the sample is 8,400 ft². Only end-use energy intensities available. No detailed specifications available to develop a full archetype.	**Average Building:**

Building Specifications:

roof construction:	W/m².°C	
wall construction:	W/m².°C	
windows:	W/m².°C	
shading coefficient		
window to wall ratio		
General Lighting & LPD	Lux	W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Architectural Lighting & LPD	Lux	W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Overall LPD	W/m²
Plug Loads (office equipment) EPD	W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other

System air Flow	L/s.m²	CFM/ft²
Fan Power	W/m²	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other

Calculated Capacity	W/m²	ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	W/m²	W/ft²
Condenser Pumps	W/m²	W/ft²
Condenser Fan Size	W/m²	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	619	16.0		
Architectural Lighting	51	1.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	78	2.0	156.1	4.0
Space Cooling	42	1.1	0.0	4.0
HVAC Equipment	149	3.8		
DHW	10	0.3	69.5	1.8
Refrigeration Equipment	1200	31.0		
Food Service Equipment	3	0.1	664.0	0.0
Miscellaneous	60	1.5		
Total	**2328**	**60.1**	**889.6**	**10**

Note that this profile is not fully "live"--only some of the summary values come from "profile"

Summary Building Profile

Building Type:	Warehouse/Whsale	**Location:**	Lower Mainland

Description: This archetype is based on the Building Check-up database for Warehouse/Whsale buildings. The BCU database contains 20 buildings ranging in size from 5,000 to 140,000 ft² constructed between 1940 and 1993. the average size of the sample is 34,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 34,000 ft²

Building Specifications:

roof construction:	0.35	W/m².°C
wall construction:	0.85464	W/m².°C
windows:	4.48	W/m².°C
shading coefficient	0.8	
window to wall ratio	0.05	

High Bay Lighting & LPD 460 Lux 16.6 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH	HPS
	0%	0%	10%	0%	5%	75%	10%

Other Office Lighting & LPD 500 Lux 21.3 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	5%	75%	0%	10%	

Overall LPD 15.7 W/m²

Plug Loads (office equipment) EPD 4.5 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	4.1	L/s.m²	0.80	CFM/ft²
Fan Power	8.5	W/m²	0.79	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	0%	0%	10%	90%	0%	

Calculated Capacity 46 W/m² 818 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.2	W/m²	0.0	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	1.2	W/m²	0.1	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
High Bay Lighting	273	7.0		
Other Office Lighting	22	0.6		
Other Lighting	0	0.0		
Plug Loads & Office Equipment	96	2.5		
Space Heating	0	0.0	424.8	11.0
Space Cooling	9	0.2	0.0	11.0
HVAC Equipment	63	1.6		
DHW	6	0.2	24.4	0.6
Refrigeration Equipment	50	1.3		
Food Service Equipment	0	0.0	0.0	0.0
Miscellaneous	40	1.0		
Total	**558**	**14.4**	**449.2**	**23**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Warehouse/Whsale** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.85	W/m².°C	0.15	Btu/hr.ft² .°F	Typical Building Size	3,200	m²	34,432	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	3,200	m²	34,432	ft²
Glazing U value (W/m².°C)	4.48	W/m².°C	0.79	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	4.90%
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: 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	4.08	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	

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	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:
Warehouse/Whsale	0		Lower Mainland
Baseline			

LIGHTING

HIGH BAY LIGHTING

Light Level	460	Lux	42.8	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	16.6	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

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%	10%	0%	5%	75%	10%	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	7.0
	MJ/m².yr	273

OTHER, OFFICE LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	21.3	W/m²	2.0	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	5%	75%	0%	10%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

OTHER 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%				0%
Weighted Average								**0**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	0%	0%	0%	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

EUI TOTAL	kWh/ft².yr	7.6
	MJ/m².yr	294

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.46 W/ft²
Diversity Occupied Period	0%	0%	0%	90%	100%	90%
Diversity Unoccupied Period	0%	0%	0%	10%	100%	40%
Operation Occ. Period (hrs./year)	0	0	0	2600	2600	3500
Operation Unocc. Period (hrs./year)	8760	8760	8760	6160	6160	5260

Total end-use load (occupied period)	4.5	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.0	W/m²	0.2	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	2.5
	MJ/m².yr	96

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 0.0% | Electricity Fuel Share: 100.0%

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	0.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	0.0		MJ/m².yr	0.0

REFRIGERATION EQUIPMENT

Provide description below:

Large refrigeration storage

EUI	kWh/ft².yr	1.3
	MJ/m².yr	50.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	1.0
	MJ/m².yr	40

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Warehouse/Whsale** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	100%	0%	0%	0%	0%	0%	0%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	94.2 W/m²	29.9 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	319 MJ/m².yr	8.2 kWh/ft².yr
Sizing Factor	1.00	

Electric Fuel Share 0.0% Gas Fuel Share 100.0% Oil Fuel Share 0.0%

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	0.0
	MJ/m².yr	0
Natural Gas EUI	kWh/ft².yr	11.0
	MJ/m².yr	425
Market Composite EUI	kWh/ft².yr	11.0
	MJ/m².yr	425

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	HE	Screw Chillers	Reciprocating Chillers Open	DX	Absorption Chillers W. H.	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	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	46 W/m²	15 Btu/hr.ft²	818 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	58.2 MJ/m².yr	1.5 kWh/ft².yr	
Sizing Factor	1.00		
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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	69.30%				0.70%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.52		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 18.2

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.9	0.8
MJ/m².yr	20	35	30.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Lower Mainland
Baseline			

HVAC ELECTRICITY

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	4.3	W/m²	0.40	W/ft²
Fan Design Load VAV	8.5	W/m²	0.79	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.25	W/m²	0.12	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	0.003	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	13.6	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	7000	hrs./year
Circulating Pump Energy Consumption	1.4	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	1.6
	MJ/m².yr	62.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.4** kWh/ft².yr	**557.8** MJ/m².yr	**Gas:**	**11.6** kWh/ft².yr	**449.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
HIGH BAY LIGHTING	7.0	272.6					
OTHER, OFFICE LIGHTING	0.6	21.6	SPACE HEATING	0.0	0.0	11.0	424.8
OTHER LIGHTING	0.0	0.0	SPACE COOLING	0.2	9.2	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.5	95.6	SERVICE HOT WATER	0.2	6.0	0.6	24.4
HVAC ELECTRICITY	1.6	62.8	FOOD SERVICE EQUIPMENT	0.0	0.0	0.0	0.0
REFRIGERATION EQUIPMENT	1.3	50.0					
MISCELLANEOUS EQUIPMENT	1.0	40.0					

Summary Building Profile

Building Type: Mixed Use

Location: Lower Mainland

Description: This archetype is based on data from the Building Check-up database, BC Hydro's High and LowiRise Apt. Bldgs. Audit and Simulation Study and end-use data supplied by Sheltair.

This profile assumes retail space in the first floor and apartments in all floors above.

Average Building: The average building characteristics used to define this building profile are as follows:
- average number of suites 89 at 750 ft²/suite
- average building size 80,000 ft² (assumes 20% additional floor space for corridors
- average footprint 8,100 ft² assumes 9 suites per floor (except first floor retail)
- 10 stories

Building Specifications:

roof construction:	0.32 W/m².°C
wall construction:	0.62 W/m².°C
windows:	3.748 W/m².°C
shading coefficient	0.65
window to wall ratio	0.25

General Lighting & LPD 97.5 Lux 12.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
82%	10%	8%	0%	0%	

Architectural Lighting & LPD 150 Lux 13.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
50%	30%	15%	0%	5%	

Overall LPD 9.9 W/m²

Plug Loads (office equipment) EPD 1.0 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	0.1 L/s.m²	0.02 CFM/ft²
Fan Power	0.0 W/m²	0.00 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
1%	0%	5%	94%	0%	0

Calculated Capacity 36 W/m² 1051 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.3 W/m²	0.0 W/ft²
Condenser Pumps	0.0 W/m²	0.0 W/ft²
Condenser Fan Size	0.0 W/m²	0.0 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Suite Lighting	32	0.8		
Corridor/Common Area Lighting	80	2.1		
High Bay Lighting	0	0.0		
Appliance, TV, Entertainment, Other	60	1.6		
Space Heating	156	4.0	0.0	0.0
Space Cooling	3	0.1	0.0	0.0
HVAC Equipment	4	0.1		
DHW	23	0.6	106.4	2.7
Residential Refrigerator	27	0.7		
Cooking Appliances (incl. Stove)	18	0.5	0.0	0.0
Miscellaneous	17	0.4		
Total	**420**	**10.8**	**106.4**	**3**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Mixed Use** **Baseline** — **SIZE:** **0** — **VINTAGE:** — **REGION:** **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	7,500 m²	80,700	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	750 m²	8,070	ft²
Glazing U value (W/m².°C)	3.75	W/m².°C	0.66	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	1.25		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	75%		
Window/Wall Ratio (WIWAR) (%)	0.25							
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 (%)	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 249.99%

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: 0.1 L/s.m² — 0.02 CFM/ft² — 75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.10	L/s.m²	0.02	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)	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	

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:
Mixed Use	0		Lower Mainland
Baseline			

LIGHTING

SUITE LIGHTING

Light Level	98	Lux	9.1	ft-candles
Floor Fraction (GLFF)	0.80			
Connected Load	12.4	W/m²	1.2	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	5%
Usage During Unoccupied Period	13%

Light Level (Lux)	50	200	300	500	Total
% Distribution	75%	15%	10%	0%	100%
Weighted Average					**97.5**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	82%	10%	8%	0%	0%	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	0.8
	MJ/m².yr	32

CORRIDORS/COMMON AREAS

Light Level	150	Lux	13.9	ft-candles
Floor Fraction (ALFF)	0.20			
Connected Load	13.9	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	70%	10%	20%	100%
Weighted Average					**150**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	50%	30%	15%	0%	5%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.1
	MJ/m².yr	80

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	3
	MJ/m².yr	113

APPLIANCES, TV ENTERTAINMENT, OTHER

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0	0	0	
Connected Load	0.3 W/m²	0.4 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	2.4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.22 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

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	1.6
	MJ/m².yr	60

COOKING APPLIANCES STOVE

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

Electric stove with an annual consumption of 340 kWh/unit

Natural Gas EUI		
EUI	kWh/ft².yr	0.0
	MJ/m².yr	0.0

All Electric EUI		
EUI	kWh/ft².yr	0.5
	MJ/m².yr	18.0

RESIDENTIAL REFRIGERATOR

Provide description below:

Residential refrigerator with an annual consumption of 636 kWh/unit

EUI	kWh/ft².yr	0.7
	MJ/m².yr	27.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	0.4
	MJ/m².yr	17

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Mixed Use** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	0%	0%	0%	0%	0%	100%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load 43.3 W/m² 13.7 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load) 156 MJ/m².yr 4.0 kWh/ft².yr
Sizing Factor 1.00

Electric Fuel Share 100.0% Gas Fuel Share 0.0% Oil Fuel Share 0.0%

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	4.0
	MJ/m².yr	156
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	4.0
	MJ/m².yr	156

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	1.0%	0.0%	0.0%	5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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 36 W/m² 11 Btu/hr.ft² 1051 ft²/Ton
Seasonal Cooling Load (Tertiary Load) 60.1 MJ/m².yr 1.6 kWh/ft².yr

Sizing Factor 1.00

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	56.25%				18.75%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.58	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 81.9

Wetting Use Percentage 80%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.3	3.7	3.3
MJ/m².yr	90	142	128.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Mixed Use Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Lower Mainland

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	0.1	L/s.m²	0.02	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	0.0	W/m²	0.00	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	100%	0%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	20	L/s.washroom	42	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	0.002	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	0.002	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	0.3	W/m²	0.03	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	0.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.6	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	0.0	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	0.1
	MJ/m².yr	3.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Mixed Use	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**10.8** kWh/ft².yr	**420.0** MJ/m².yr	**Gas:**	**2.7** kWh/ft².yr	**106.4** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
SUITE LIGHTING	0.8	32.3					
CORRIDORS/COMMON AREAS	2.1	80.3	SPACE HEATING	4.0	156.3	0.0	0.0
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	0.1	2.6	0.0	0.0
APPLIANCES, TV ENTERTAINMENT	1.6	60.1	SERVICE HOT WATER	0.6	22.5	2.7	106.4
HVAC ELECTRICITY	0.1	3.7	COOKING APPLIANCES STOV	0.5	18.0	0.0	0.0
RESIDENTIAL REFRIGERATOR	0.7	27.0					
MISCELLANEOUS EQUIPMENT	0.4	17.0					

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Resource Consultants Ltd.

APPENDIX B

Existing Building Profiles – Interior

Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island.

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Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island. Blank specification boxes in the profiles indicate that no data were used.

Summary Building Profile

Building Type:	Large Office	**Location:**	Interior

Description: This archetype is based on 58 large office buildings with a combined published "rentable" floor area of 15,600,000 ft². The buildings range in size from 100,000 to 600,000 ft² constructed between 1910 and 2000.
Electrical energy intensities (electrical beep) ranges from 11 kWh/ft².yr to 34 kWh/ft².yr.

The Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 230,000 ft²
- average footprint 12,100 ft² assumes a 110 ' x 110 ' footprint
- 19 stories

Building Specifications:

roof construction:	0.7 W/m².°C
wall construction:	0.95 W/m².°C
windows:	4.968 W/m².°C
shading coefficient	0.65
window to wall ratio	0.4

General Lighting & LPD 620 Lux 17.0 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	30%	10%	60%	

Architectural Lighting & LPD 500 Lux 29.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
25%	15%	10%	0%	50%	

Overall LPD 16.2 W/m²

Plug Loads (office equipment) EPD 8.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
50%	50%	0%	0%	0%	

System air Flow	5.1 L/s.m²	1.00 CFM/ft²
Fan Power	11.5 W/m²	1.07 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
65%	20%	15%	0%	0%	

Calculated Capacity 108 W/m² 351 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.2 W/m²	0.1 W/ft²
Condenser Pumps	1.1 W/m²	0.1 W/ft²
Condenser Fan Size	2.2 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	304	7.8		
Architectural Lighting	44	1.1		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	200	5.2		
Space Heating	4	0.1	SPACE COO	0.0
Space Cooling	160	4.1	SERVICE HO	0.0
HVAC Equipment	0	0.0		
DHW	0	0.0	HVAC ELEC	0.0
Refrigeration Equipment	0	0.0		
Food Service Equipment	0	0.0	0.0	0.0
Miscellaneous	0	0.0		
Total	**712**	**18.4**	**0.0**	**0**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Interior
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.95 W/m².°C	0.17 Btu/hr.ft² .°F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.70 W/m².°C	0.12 Btu/hr.ft² .°F	Typical Footprint (m²)	1,125	m²	12,100	ft²
Glazing U value (W/m².°C)	4.97 W/m².°C	0.87 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) (%)	0.40						
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 (%)	50%				50%				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	19.28%
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
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: 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	
Total Air Circulation or Design Air Flow	5.08 L/s.m²	1.00 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)	L/s.m²	CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

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)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Interior**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	620	Lux	57.6	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	17.0	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	42%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution		40%	60%					100%
Weighted Average								**620**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			30%	10%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	7.8
	MJ/m².yr	304

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	29.6	W/m²	2.8	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%						100%
Weighted Average								**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	15%	10%		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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.1
	MJ/m².yr	44

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)				
Connected Load	14.0	W/m²	1.3	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	100%							100%
Weighted Average								**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)		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	
	MJ/m².yr	

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	9
	MJ/m².yr	348

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	69	72	50	200	50	
Density (device/occupant)	1.05	1.05	0.15	0.1	0.1	
Connected Load	2.8 W/m²	3.0 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2.3 W/m²
	0.3 W/ft²	0.3 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.21 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	60%	60%	50%	20%	20%	60%
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)	8.7 W/m²	0.8 W/ft²
Total end-use load (unocc. period)	5.2 W/m²	0.5 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	5.2
	MJ/m².yr	200

FOOD SERVICE EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	4.1
	MJ/m².yr	160

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Office Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%				3%		2%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	76.4	W/m²	24.2	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	292	MJ/m².yr	7.5	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share: 5.0% | Gas Fuel Share: 95.0% | Oil Fuel Share:

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	5.2	10.1	9.8
MJ/m².yr	201	389	380

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	65.0%	20.0%		15.0%				100.0%
COP	4.7	6.1	4.4	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.16	0.23	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	108	W/m²	34	Btu/hr.ft²	351	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	246.2	MJ/m².yr	6.4	kWh/ft².yr		

Sizing Factor: 0.85

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% | Gas Fuel Share:

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	2.0		2.0
MJ/m².yr	78		78

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank					Boiler
System Present (%)	52.50%					17.50%
Eff./COP	0.520					0.750

	Fossil		Elec. Res.
Fuel Share	70%		30%
Eff.	0.58		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.6	1.0	0.9
MJ/m².yr	25	39	35.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Office** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Interior**

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.00	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	11.5	W/m²	1.07	W/ft²
Fan Design Load VAV	11.5	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	50%	50%	100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%		100%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit area	0.2	L/s.m²	0.04	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	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)	2.16	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	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.10	W/m²	0.10	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	1.2	W/m²	0.11	W/ft²		

Supply Fan Occ. Period	2700	hrs./year
Supply Fan Unocc. Period	6060	hrs./year
Supply Fan Energy Consumption	52.3	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	3.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	6.2
	MJ/m².yr	238.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **26.8** kWh/ft².yr **1,038.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	kWh/ft².yr	MJ/m².yr	END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	7.8	303.8	FOOD SERVICE EQUIPMENT	0.1032631	4	SPACE HEATING ELECTRIC	0.2590615	10.03501
ARCHITECTURAL LIGHTING	1.1	43.8	REFRIGERATION EQUIPMENT	0.1	4.0	SPACE COOLING	1.6058593	62.20456
OTHER (HIGH BAY) LIGHTING			MISCELLANEOUS EQUIPMEN	4.1	160.0	SERVICE HOT WATER	0.3050956	11.81818
OFFICE EQUIPMENT & PLUG LOAI	5.2	200.2				HVAC ELECTRICITY	6.1572666	238.5079

Summary Building Profile

Building Type:	Medium Office	**Location:**	Interior

Description: This archetype is based on 46 medium sized office buildings with a combined published "rentable" floor area of 310,000 ft² (3,335,000 ft²). The buildings range in size from 50,000 to 100,000 ft² constructed between 1910 and 1999.
Electrical energy intensities (electrical bepi) ranges from 11 kWh/ft².yr to 39 kWh/ft².yr.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 72,900 ft²
- average footprint 8,100 ft² assumes a 90' x 90' footprint
- 9 stories

Building Specifications:						
roof construction:	0.7 W/m².°C					
wall construction:	0.95 W/m².°C					
windows:	5.212 W/m².°C					
shading coefficient	0.65					
window to wall ratio	0.3					
General Lighting & LPD	650 Lux		19.0 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	65%	10%	25%	
Architectural Lighting & LPD	400 Lux		21.8 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	20%	15%	35%	0%	30%	
Overall LPD	18.0 W/m²					
Plug Loads (office equipment) EPD	6.9 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	70%	30%	0%	0%	0%	
System air Flow	5.5 L/s.m²		1.08 CFM/ft²			
Fan Power	11.4 W/m²		1.06 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	15%	0%	65%	20%	0%	0
Calculated Capacity	132 W/m²		286 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	0.9 W/m²		0.1 W/ft²			
Condenser Pumps	0.6 W/m²		0.1 W/ft²			
Condenser Fan Size	3.6 W/m²		0.3 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	331	8.6		
Architectural Lighting	32	0.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	104	2.7		
Space Heating	25	0.6	398.6	10.3
Space Cooling	92	2.4	0.0	10.3
HVAC Equipment	215	5.5		
DHW	8	0.2	30.0	0.8
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	100	2.6		
Total	**911**	**23.5**	**432.7**	**21**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Office** **Baseline**

SIZE: **50,000 to 100,000 ft²**

VINTAGE:

REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.95	W/m².°C	0.17	Btu/hr.ft² .°F	Typical Building Size	6,777 m²	72,921	ft²
Roof U value (W/m².°C)	0.70	W/m².°C	0.12	Btu/hr.ft² .°F	Typical Footprint (m²)	753 m²	8,102	ft²
Glazing U value (W/m².°C)	5.21	W/m².°C	0.92	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) (%)	0.30							
Shading Coefficient (SC)	0.65				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 (%)	70%		0%		30%		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	25	L/s.person	53	CFM/person

%OA 17.80%

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			
Total Air Circulation or Design Air Flow	5.51	L/s.m²	1.08	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	

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)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Interior**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	650 Lux	60.4	ft-candles
Floor Fraction (GLFF)	0.95		
Connected Load	19.0 W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	2900		
Unocc. Period(Hrs./yr.)	5860		
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)	300	500	700	1000	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**650**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	65%	10%	25%	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	8.6
	MJ/m².yr	331

ARCHITECTURAL LIGHTING

Light Level	400 Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	21.8 W/m²	2.0	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	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	20%	15%	35%	0%	30%	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 = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	0.8
	MJ/m².yr	32

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	9
	MJ/m².yr	364

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.8	0.8	0.15	0.1	0.1	
Connected Load	1.7 W/m²	2.7 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2 W/m²
	0.2 W/ft²	0.2 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	6.9 W/m²	0.6 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI		
	kWh/ft².yr	2.7
	MJ/m².yr	104

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Unknown

EUI		
	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	100

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Interior**
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	90%	0%	0%	0%	5%	0%	5%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	84.9	W/m²	26.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	332	MJ/m².yr	8.6	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 10.0% Gas Fuel Share 90.0% Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.3	11.4	10.9
MJ/m².yr	246	443	423

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	15.0%	0.0%	0.0%	65.0%	20.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	132	W/m²	42	Btu/hr.ft²	286	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	222.0	MJ/m².yr	5.7	kWh/ft².yr		

Sizing Factor 1.00

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.6	0.0	2.6
MJ/m².yr	102	0	102

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	66.50%				3.50%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.53	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.6	1.1	1.0
MJ/m².yr	25	43	37.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.08	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	8.5	W/m²	0.79	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	Continuous	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 area	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	0.027	kW/kW	0.09	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	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	60%			
Pump Motor Efficiency	82%			
Sizing Factor	1.0			
Pump Connected Load	0.64	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.008	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	82%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3000	hrs./year
Supply Fan Unocc. Period	5760	hrs./year
Supply Fan Energy Consumption	47.0	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	1.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.8	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.2	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	215.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**23.5** kWh/ft².yr	**911.2** MJ/m².yr	**Gas:**	**11.2** kWh/ft².yr	**432.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	8.6	331.3
ARCHITECTURAL LIGHTING	0.8	32.2
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.7	104.0
HVAC ELECTRICITY	5.5	215.0
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	2.6	100.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	24.6	10.3	398.6
SPACE COOLING	2.4	92.0	0.0	0.0
SERVICE HOT WATER	0.2	7.5	0.8	30.0
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

Summary Building Profile

Building Type:	Large Retail	Location:	Interior

Description: This archetype is based on the prototype eReview benchmarks. Additional data from the Building Check-up database and the BOMA database of the 15 largest malls was used to supplement the eReview prototype.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 250,000 ft²
- single storey

Building Specifications:

roof construction:	0.35 W/m².°C	
wall construction:	0.7116 W/m².°C	
windows:	4.48 W/m².°C	
shading coefficient	0.8	
window to wall ratio	0.05	
General Lighting & LPD	620 Lux	33.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
20%	5%	40%	0%	20%	15%

Architectural Lighting & LPD	500 Lux	30.8 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
20%	0%	25%	0%	5%	50%

Overall LPD	26.9 W/m²
Plug Loads (office equipment) EPD	3.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
90%	10%	0%	0%	0%	

System air Flow	6.2 L/s.m²	1.22 CFM/ft²
Fan Power	12.9 W/m²	1.20 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
50%	0%	0%	20%	30%	0%	

Calculated Capacity	108 W/m²	351 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9 W/m²	0.1 W/ft²
Condenser Pumps	0.0 W/m²	0.0 W/ft²
Condenser Fan Size	2.9 W/m²	0.3 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	487	12.6		
Architectural Lighting	143	3.7		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	69	1.8		
Space Heating	9	0.2	265.9	6.9
Space Cooling	69	1.8	0.0	6.9
HVAC Equipment	161	4.2		
DHW	5	0.1	34.2	0.9
Refrigeration Equipment	10	0.3		
Food Service Equipment	2	0.0	33.2	0.0
Miscellaneous	45	1.2		
Total	**1000**	**25.8**	**333.4**	**15**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Non-Food Retail	> 100,000 ft²		Interior
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	4.48	W/m².°C	0.79	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) (%)	0.05								
Shading Coefficient (SC)	0.80				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 (%)	90%		0%		10%		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	14.35%
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	1.5			
Total Air Circulation or Design Air Flow	6.19	L/s.m²	1.22	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	

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	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: Large Non-Food Retail Baseline | **SIZE:** > 100,000 ft² | **VINTAGE:** | **REGION:** Interior

LIGHTING

GENERAL LIGHTING

Light Level	620 Lux	57.6	ft-candles
Floor Fraction (GLFF)	0.80		
Connected Load	33.6 W/m²	3.1	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	

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	40%	60%	0%	100%
Weighted Average					**620**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	20%	5%	40%	0%	20%	15%	0%	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 12.6; MJ/m².yr 487

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	30.8 W/m²	2.9	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%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	20%	0%	25%	0%	5%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 3.7; MJ/m².yr 143

OTHER (HIGH BAY) 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%	0%
Weighted Average					**0**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 16; MJ/m².yr 630

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	100%	20%
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)	3.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	0.9 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.8; MJ/m².yr 69

FOOD SERVICE EQUIPMENT

Provide description below: | Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	1.0	0.3
MJ/m².yr	40.0	10.0

REFRIGERATION EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 0.3; MJ/m².yr 10.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.2; MJ/m².yr 45

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Non-Food Retail Baseline
SIZE: > 100,000 ft²
VINTAGE:
REGION: Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	2%	1%	0%	2%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	59.2	W/m²	18.8	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	210	MJ/m².yr	5.4	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% Gas Fuel Share 95.0% Oil Fuel Share 0.0%

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	4.5	174
Natural Gas EUI	7.2	280
Market Composite EUI	7.1	275

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	50.0%	0.0%	0.0%	20.0%	30.0%	0.0%	0.0%	100.0%
COP	4.8	5.4	4.4	3.7	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.27	0.37	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	108	W/m²	34	Btu/hr.ft²	351	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	179.4	MJ/m².yr	4.6	kWh/ft².yr		
Sizing Factor	1.00					
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		

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	2.1	81
Natural Gas EUI	0.0	0
Market Composite EUI	2.1	81

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	76.00%				4.00%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.53	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	1.1	43
Market Composite EUI	1.0	39.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Non-Food Retail Baseline
SIZE: > 100,000 ft²
VINTAGE:
REGION: Interior

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	6.2	L/s.m²	1.22	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	6.5	W/m²	0.60	W/ft²
Fan Design Load VAV	12.9	W/m²	1.20	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	Continuous	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 area	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)	2.91	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	0.008	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	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	35.7	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	1.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.4	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	4.2
	MJ/m².yr	161.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Non-Food Retail	**> 100,000 ft²**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**25.8** kWh/ft².yr	**1,000.0** MJ/m².yr	**Gas:**	**8.6** kWh/ft².yr	**333.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	12.6	487.5
ARCHITECTURAL LIGHTING CORF	3.7	142.6
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.8	69.4
HVAC ELECTRICITY	4.2	161.2
REFRIGERATION EQUIPMENT	0.3	10.0
MISCELLANEOUS EQUIPMENT	1.2	45.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	8.7	6.9	265.9
SPACE COOLING	1.8	68.9	0.0	0.0
SERVICE HOT WATER	0.1	5.0	0.9	34.2
FOOD SERVICE EQUIPMENT	0.0	1.7	0.9	33.2

Summary Building Profile

Building Type:	Medium Retail	Location:	Interior
Description: This archetype is based on Building Check-up data including 11 sites and the national archetype for strip malls developed for. The size range covered is 50,000 - 100,000 ft². The archetype uses a floor area of 7,500 m² (80,700 ft²) on one level. Electrical energy intensity (electrical bepi) is based on the intensity developed for large retail, adjusted to the smaller floor area and expected differences in technology.		**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 80,700 ft², with a footprint of 127' x 635' - one storey	

Building Specifications:

roof construction:	0.55	W/m².°C
wall construction:	0.53	W/m².°C
windows:	5.4	W/m².°C
shading coefficient	0.78	
window to wall ratio	0.1	

General Lighting & LPD 630 Lux 26.5 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	0%	80%	5%	5%	

Architectural Lighting & LPD 500 Lux 24.9 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	15%	15%	60%	5%	5%	

Overall LPD 25.1 W/m²

Plug Loads (office equipment) EPD 5.1 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	4.0	L/s.m²	0.78	CFM/ft²
Fan Power	0.0	W/m²	0.00	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	0%	100%	0%	

Calculated Capacity 115 W/m² 329 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.0	W/m²	0.0	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	3.1	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	549	14.2		
Architectural Lighting	38	1.0		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	67	1.7		
Space Heating	28	0.7	305.5	7.9
Space Cooling	68	1.7	0.0	7.9
HVAC Equipment	120	3.1		
DHW	11	0.3	13.2	0.3
Refrigeration Equipment	9	0.2		
Food Service Equipment	2	0.0	8.3	0.3
Miscellaneous	43	1.1		
Total	**934**	**24.1**	**327.0**	**16**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Retail** **Baseline**

SIZE: **50,000 - 100,000 ft2**

VINTAGE:

REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.53	W/m².°C	0.09	Btu/hr.ft² .°F	Typical Building Size	7,500	m²	80,700	ft²
Roof U value (W/m².°C)	0.55	W/m².°C	0.10	Btu/hr.ft² .°F	Typical Footprint (m²)	7,500	m²	80,700	ft²
Glazing U value (W/m².°C)	5.40	W/m².°C	0.95	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)	0.78				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	20.12%
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: 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	0.8			
Total Air Circulation or Design Air Flow	3.98	L/s.m²	0.78	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	

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: **Medium Retail** **Baseline**

SIZE: **50,000 - 100,000 ft2**

VINTAGE:

REGION: **Interior**

LIGHTING

GENERAL LIGHTING

Light Level	630 Lux	58.6	ft-candles
Floor Fraction (GLFF)	0.95		
Connected Load	26.5 W/m²	2.5	W/ft²
Occ. Period(Hrs./yr.)	5000		
Unocc. Period(Hrs./yr.)	3760		
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)	300	500	700	1000				Total
% Distribution	0%	35%	65%	0%				100%
Weighted Average								**630**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	0%	80%	5%	5%	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 14.2; MJ/m².yr 549

ARCHITECTURAL LIGHTING

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	24.9 W/m²	2.3	W/ft²
Occ. Period(Hrs./yr.)	5500		
Unocc. Period(Hrs./yr.)	3260		
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	30%	40%	30%	0%				100%
Weighted Average								**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	15%	60%	5%	5%	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 1.0; MJ/m².yr 38

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 15; MJ/m².yr 587

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0.1	0.1	0.1	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.8 W/m²	0.2 W/m²	3 W/m²
	0.0 W/ft²	0.1 W/ft²	0.02 W/ft²	0.07 W/ft²	0.02 W/ft²	0.28 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	5.1 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	0.7 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.7; MJ/m².yr 67

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.3	0.2
MJ/m².yr	10.0	9.6

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.2; MJ/m².yr 8.6

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.1; MJ/m².yr 43

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Retail Baseline | **SIZE:** 50,000 - 100,000 ft2 | **VINTAGE:** | **REGION:** Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	88%	0%	0%	1%	0%	0%	11%	100%
Eff./COP	69%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.45	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	52.3	W/m²	16.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	240	MJ/m².yr	6.2	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 12.0% | Gas Fuel Share 88.0% | Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	5.9	9.0	8.6
MJ/m².yr	230	347	333

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	3	5.4	4.4	3.6	2.4	0.9	1	
Performance (1 / COP) (kW/kW)	0.33	0.19	0.23	0.28	0.42	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	115	W/m²	36	Btu/hr.ft²	329	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	152.7	MJ/m².yr	3.9	kWh/ft².yr		

Sizing Factor 1.00

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	1.9	0.0	1.9
MJ/m².yr	75	0	75

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank					Boiler
System Present (%)	39.60%					0.40%
Eff./COP	0.520					0.750

	Fossil		Elec. Res.
Fuel Share	40%		60%
Blended Efficiency	0.52		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 17.3

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.9	0.6
MJ/m².yr	19	33	24.6

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.0	L/s.m²	0.78	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	0	Pa	0.0	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	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	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	85%	15%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit area	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.10	W/m²	0.29	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	0.007	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	5500	hrs./year
Supply Fan Unocc. Period	3260	hrs./year
Supply Fan Energy Consumption	31.1	kWh/m².yr
Exhaust Fan Occ. Period	5500	hrs./year
Exhaust Fan Unocc. Period	3260	hrs./year
Exhaust Fan Energy Consumption	1.1	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	7000	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	3.1
	MJ/m².yr	120.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**24.1** kWh/ft².yr	**933.9** MJ/m².yr	**Gas:**	**8.4** kWh/ft².yr	**327.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	14.2	548.8					
ARCHITECTURAL LIGHTING	1.0	37.8	SPACE HEATING	0.7	27.6	7.9	305.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	1.7	67.6	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.7	67.0	SERVICE HOT WATER	0.3	11.4	0.3	13.2
HVAC ELECTRICITY	3.1	120.2	FOOD SERVICE EQUIPMENT	0.0	1.6	0.2	8.3
REFRIGERATION EQUIPMENT	0.2	8.6					
MISCELLANEOUS EQUIPMENT	1.1	43.3					

Summary Building Profile

Building Type:	Food Retail	**Location:**	Interior

Description: This archetype is based on the prototype eReview benchmarks developed based on the relatively small amount of Building Check-up data. Additional data from an hourly calibrated Best Food Store and the Commercial Refrigeration System Tech Report for Hydro Quebec and CEA have been used to supplement the eReview prototype.

The BCU database contains 13 building samples, 6 of which are less than 2,000 ft². The average size of the sample is 13,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 13,000 ft²
- single storey

Building Specifications:

roof construction:	0.35 W/m².°C
wall construction:	0.7116 W/m².°C
windows:	4.48 W/m².°C
shading coefficient	0.8
window to wall ratio	0.1

General Lighting & LPD 640 Lux 26.8 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	5%	0%	10%	0%	5%	80%

Architectural Lighting & LPD 500 Lux 16.8 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	0%	0%	70%	0%	10%	20%

Overall LPD 24.1 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	5.8	L/s.m²	1.14	CFM/ft²
Fan Power	12.1	W/m²	1.12	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	0%	0%	10%	90%	0%	

Calculated Capacity 104 W/m² 365 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.8	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	619	16.0		
Architectural Lighting	53	1.4		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	23	0.6	281.0	7.3
Space Cooling	74	1.9	0.0	7.3
HVAC Equipment	156	4.0		
DHW	10	0.3	69.7	1.8
Refrigeration Equipment	1200	31.0		
Food Service Equipment	3	0.1	103.8	0.0
Miscellaneous	60	1.5		
Total	**2313**	**59.7**	**454.4**	**16**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Food Retail** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F	Typical Building Size	1,225	m²	13,181	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	1,225	m²	13,181	ft²
Glazing U value (W/m².°C)	4.48	W/m².°C	0.79	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) (%)	0.10								
Shading Coefficient (SC)	0.80				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	25	L/s.person	53	CFM/person

%OA 9.60%

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	1.1			
Total Air Circulation or Design Air Flow	5.79	L/s.m²	1.14	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	

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	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	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: Food Retail, Baseline
SIZE: 0
VINTAGE:
REGION: Interior

LIGHTING

GENERAL LIGHTING

Light Level	640 Lux	59.5	ft-candles
Floor Fraction (GLFF)	0.90		
Connected Load	26.8 W/m²	2.5	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	65%		
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	0%	10%	0%	5%	80%	0%	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 16.0; MJ/m².yr 619

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.10		
Connected Load	16.8 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	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%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	70%	0%	10%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 1.4; MJ/m².yr 53

OTHER (HIGH BAY) LIGHTING

Floor fraction check: should = 1.00 — 1.00

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 17; MJ/m².yr 671

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	3.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	3.7 W/m²	0.3 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 3.0; MJ/m².yr 116

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.2	0.5
MJ/m².yr	125.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:
Commercial refrigeration display cases

EUI kWh/ft².yr 31.0; MJ/m².yr 1200.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.5; MJ/m².yr 60

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Food Retail** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	85%	0%	0%	5%	0%	0%	5%	95%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 75.7 W/m² — 24.0 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 234 MJ/m².yr — 6.0 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Gas Fuel Share: 90.0% — Oil Fuel Share: 0.0%

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	5.9	228
Natural Gas EUI	8.1	312
Market Composite EUI	7.4	288

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	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	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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: 104 W/m² — 33 Btu/hr.ft² — 365 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 187.1 MJ/m².yr — 4.8 kWh/ft².yr

Sizing Factor: 1.00

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		

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	2.2	87
Natural Gas EUI	0.0	0
Market Composite EUI	2.2	87

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	79.20%				0.80%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.52	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 45.5

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.3	50
Natural Gas EUI	2.2	87
Market Composite EUI	2.1	79.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Food Retail, Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Interior

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.8	L/s.m²	1.14	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	6.0	W/m²	0.56	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	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	0.2	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.80	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	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	32.7	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	1.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.9	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	4.0
	MJ/m².yr	155.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **59.7** kWh/ft².yr **2,313.1** MJ/m².yr **Gas:** **11.7** kWh/ft².yr **454.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	16.0	618.5
ARCHITECTURAL LIGHTING CORF	1.4	52.8
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	3.0	116.3
HVAC ELECTRICITY	4.0	155.5
REFRIGERATION EQUIPMENT	31.0	1,200.0
MISCELLANEOUS EQUIPMENT	1.5	60.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.8	7.3	281.0
SPACE COOLING	1.9	73.7	0.0	0.0
SERVICE HOT WATER	0.3	10.0	1.8	69.7
FOOD SERVICE EQUIPMENT	0.1	3.4	2.7	103.8

Summary Building Profile

Building Type: Large Hotel	**Location:** Interior
Description: This archetype is based on the Building Check-up Database for large hotel which exceeded 50,000 ft². The BCU database contains 37 hotels 21 of which meet the criteria of a large hotel. A total of 17 hotels are in the lower mainland and the remaining 4 in the interior. The hotels in the database range in size from 57,000 ft² to 600,000 ft² constructed between 1910 and 1996. The average size for the sample is 220,000 ft².	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 200,000 ft² - 10 stories

Building Specifications:

roof construction:	0.43 W/m².°C
wall construction:	0.64008 W/m².°C
windows:	4.045 W/m².°C
shading coefficient	0.65
window to wall ratio	0.3

GENERAL LIGHTING (SUITES) 125 Lux 13.0 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
60%	30%	10%	0%	0%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 23.5 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
40%	15%	30%	0%	15%	

Overall LPD 9.8 W/m²

Plug Loads (office equipment) EPD 3.0 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	FCoils
66%	0%	0%	0%	0%	33%

System air Flow	4.5 L/s.m²	0.89 CFM/ft²
Fan Power	11.8 W/m²	1.10 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
40%	0%	20%	40%	0%	0

Calculated Capacity 107 W/m² 353 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9 W/m²	0.1 W/ft²
Condenser Pumps	0.6 W/m²	0.1 W/ft²
Condenser Fan Size	2.9 W/m²	0.3 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	147	3.8		
Lobby, Ballrooms, Corridors, Back-of-house	145	3.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	95	2.5		
Space Heating	127	3.3	301.5	7.8
Space Cooling	49	1.3	0.0	7.8
HVAC Equipment	146	3.8		
DHW	65	1.7	244.1	6.3
Refrigeration Equipment	30	0.8		
Food Service Equipment	1	0.0	116.2	0.0
Miscellaneous	60	1.5		
Total	**864**	**22.3**	**661.8**	**22**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Interior
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.43	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	4.05	W/m².°C	0.71	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	FCoils	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	33%	0%		99%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	60	m²/person	646	ft²/person	%OA 29.27%
Occupancy Schedule Occ. Period	45%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	79	L/s.person	167	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	4.50	L/s.m²	0.89	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	

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	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)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Interior
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125 Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75		
Connected Load	13.0 W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	2100		
Unocc. Period(Hrs./yr.)	6660		
Usage During Occupied Period	40%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval		years	
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	75%	25%	0%				100%
Weighted Average								**125**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	60%	30%	10%	0%	0%	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	147

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25		
Connected Load	23.5 W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	3000		
Unocc. Period(Hrs./yr.)	5760		
Usage During Occupied Period	85%		
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	40%	15%	30%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	3.8
	MJ/m².yr	145

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	8
	MJ/m².yr	292

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	4.3 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.40 W/ft²
Diversity Occupied Period	0%	0%	0%	0%	0%	70%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	70%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	3.0 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	3.0 W/m²	0.3 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	2.5
	MJ/m².yr	95

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	3.6	EUI	kWh/ft².yr	0.1
	MJ/m².yr	140.0		MJ/m².yr	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Hotel Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	60%	0%	0%	25%	0%	0%	15%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	49.2	W/m²	15.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	377	MJ/m².yr	9.7	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 40.0% | Gas Fuel Share 60.0% | Oil Fuel Share 0.0%

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%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	8.2	318
Natural Gas EUI	13.0	503
Market Composite EUI	11.1	429

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	40.0%	0.0%	0.0%	20.0%	40.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	107	W/m²	34	Btu/hr.ft²	353	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	160.5	MJ/m².yr	4.1	kWh/ft².yr		

Sizing Factor 0.90

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 Maintenar

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.8	70
Natural Gas EUI	0.0	0
Market Composite EUI	1.8	70

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank			Boiler
System Present (%)	7.50%			67.50%
Eff./COP	0.520			0.750

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	6.7	260
Natural Gas EUI	8.4	325
Market Composite EUI	8.0	309.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.5	L/s.m²	0.89	CFM/ft²
System Static Pressure CAV	375	Pa	1.5	wg
System Static Pressure VAV	1100	Pa	4.4	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	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	100%	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	0.027	kW/kW	0.09	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	0.006	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	0.64	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	3200	hrs./year
Supply Fan Unocc. Period	5560	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	2.3	kWh/m².yr
Condenser Pump Energy Consumption	1.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	3.8
	MJ/m².yr	145.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **22.3** kWh/ft².yr **864.3** MJ/m².yr **Gas:** **17.1** kWh/ft².yr **661.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	3.8	146.6
LOBBY, BALLROOMS, CORRIDORS	3.8	145.3
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.5	94.9
HVAC ELECTRICITY	3.8	145.7
REFRIGERATION EQUIPMENT	0.8	30.0
MISCELLANEOUS EQUIPMENT	1.5	60.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	3.3	127.2	7.8	301.5
SPACE COOLING	1.3	48.8	0.0	0.0
SERVICE HOT WATER	1.7	65.0	6.3	244.1
FOOD SERVICE EQUIPMENT	0.0	0.7	3.0	116.2

Summary Building Profile

Building Type:	Medium Hotel	**Location:**	Interior
Description:		**Average Building:**	

Building Specifications:

roof construction:	0.43 W/m².°C
wall construction:	0.64008 W/m².°C
windows:	4.045 W/m².°C
shading coefficient	0.57
window to wall ratio	0.3

GENERAL LIGHTING (SUITES) 125 Lux 13.0 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	60%	30%	10%	0%	0%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 20.0 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	30%	15%	40%	0%	15%	

Overall LPD 9.8 W/m²

Plug Loads (office equipment) EPD 3.2 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	FCoils
	66%	0%	0%	0%	0%	33%

System air Flow	4.7 L/s.m²	0.92 CFM/ft²
Fan Power	16.4 W/m²	1.52 W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	15%	85%	0%	0%

Calculated Capacity	84 W/m²	450 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.7 W/m²	0.1 W/ft²
Condenser Pumps	0.5 W/m²	0.0 W/ft²
Condenser Fan Size	2.3 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	147	3.8		
Lobby, Ballrooms, Corridors, Back-of-house	124	3.2		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	93	2.4		
Space Heating	23	0.6	290.2	7.5
Space Cooling	15	0.4	0.0	7.5
HVAC Equipment	139	3.6		
DHW	26	0.7	292.9	7.6
Refrigeration Equipment	30	0.8		
Food Service Equipment	1	0.0	83.0	2.1
Miscellaneous	60	1.5		
Total	**657**	**17.0**	**666.1**	**25**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Interior
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)	0.43	W/m².°C	0.08	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	4.05	W/m².°C	0.71	Btu/hr.ft² .°F
Window/Wall Ratio (WIWAR) (%)	0.30			
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	FCoils	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	33%	0%		99%
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 17.08%

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:	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	1.2			
Total Air Circulation or Design Air Flow	4.68	L/s.m²	0.92	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	

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	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: Medium Hotel, Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Interior

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125 Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75		
Connected Load	13.0 W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	2100		
Unocc. Period(Hrs./yr.)	6660		
Usage During Occupied Period	40%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	75%	25%	0%	100%
Weighted Average					**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	60%	30%	10%	0%	0%	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 147

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25		
Connected Load	20.0 W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3000		
Unocc. Period(Hrs./yr.)	5760		
Usage During Occupied Period	85%		
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	30%	15%	40%	0%	15%	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 3.2; MJ/m².yr 124

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 7; MJ/m².yr 270

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.37 W/ft²
Diversity Occupied Period	0%	0%	0%	0%	0%	80%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	70%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	3.2 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	2.8 W/m²	0.3 W/ft²

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EUI kWh/ft².yr 2.4; MJ/m².yr 93

FOOD SERVICE EQUIPMENT

Provide description below: Kitchen services

Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	2.6	0.1
MJ/m².yr	100.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 1.5; MJ/m².yr 60

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	90%	0%	0%	5%	0%	0%	5%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	64.2 W/m²	20.4 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	242 MJ/m².yr	6.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Gas Fuel Share 90.0%	Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	5.8	8.3	8.1
MJ/m².yr	226	322	313

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	84 W/m²	27 Btu/hr.ft²	450 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	171.7 MJ/m².yr	4.4 kWh/ft².yr	
Sizing Factor	0.85		
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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.0	0.0	2.0
MJ/m².yr	77	0	77

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	9.00%				81.00%
Eff./COP	0.520				0.750

	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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.7	8.4	8.2
MJ/m².yr	260	325	318.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Interior

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.92	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	3.7	W/m²	0.35	W/ft²
Fan Design Load VAV	16.4	W/m²	1.52	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	Continous	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 area	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)	2.27	W/m²	0.21	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Desgin Flow per unit floor area	0.004	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	0.50	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.005	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	28.4	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	1.4	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	3.6
	MJ/m².yr	139.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Interior
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	17.0 kWh/ft².yr	656.9 MJ/m².yr	Gas:	17.2 kWh/ft².yr	666.1 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	3.8	146.6
LOBBY, BALLROOMS, CORRIDORS	3.2	123.9
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.4	92.6
HVAC ELECTRICITY	3.6	139.2
REFRIGERATION EQUIPMENT	0.8	30.0
MISCELLANEOUS EQUIPMENT	1.5	60.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.6	7.5	290.2
SPACE COOLING	0.4	15.4	0.0	0.0
SERVICE HOT WATER	0.7	26.0	7.6	292.9
FOOD SERVICE EQUIPMENT	0.0	0.7	2.1	83.0

Summary Building Profile

Building Type: Hospital	Location: Interior
Description: This archetype is based on the Building Check-up Database for large hospitals. The BCU database contains 12 hospitals with 10 in the Interior, 2 in Vancouver and none in the Lower Mainland. The facilities in the database range in size from 18,000 to 120,000 ft² constructed between 1959 and 1961. The average size of the sample is 67,000 ft². This sample was augmented with data from four additional facilities ranging in size from 237,000 to 685,000 ft².	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 150,000 ft² - 10 stories

Building Specifications:

roof construction:	0.41 W/m².°C
wall construction:	0.43 W/m².°C
windows:	3.702 W/m².°C
shading coefficient	0.65
window to wall ratio	0.15

PATIENT ROOMS 250 Lux 7.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	90%	0%	10%	

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY 700 Lux 20.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	80%	0%	20%	

Overall LPD 2.3 W/m²

Plug Loads (office equipment) EPD 6.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
20%	50%	0%	0%	0%	

System air Flow	4.3 L/s.m²	0.86 CFM/ft²
Fan Power	10.4 W/m²	0.97 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	0%	0%	

Calculated Capacity 120 W/m² 315 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0 W/m²	0.1 W/ft²
Condenser Pumps	1.6 W/m²	0.1 W/ft²
Condenser Fan Size	1.6 W/m²	0.1 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Patient Rooms	22	0.6		
Nursing Stations, Examination, Laboratories	108	2.8		
Corridors, Other	100	2.6		
Plug Loads & Office Equipment	147	3.8		
Space Heating	10	0.3	1306.4	33.7
Space Cooling	38	1.0	0.0	33.7
HVAC Equipment	255	6.6		
DHW	0	0.0	160.2	4.1
Refrigeration Equipment	15	0.4		
Food Service Equipment	1	0.0	99.6	0.0
Miscellaneous	30	0.8		
Total	**726**	**18.7**	**1566.2**	**72**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Interior
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.43	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.41	W/m².°C	0.07	Btu/hr.ft² .°F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	3.70	W/m².°C	0.65	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	10			
					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	FCoils	IU	100% O.A	TOTAL
System Present (%)	20%		0%		50%	30%	0%		100%
Min. Air Flow (%)					70%				

(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	60	L/s.person	127	CFM/person

%OA 46.03%

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	1.35			
Total Air Circulation or Design Air Flow	4.35	L/s.m²	0.86	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	

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	24	°C	75.2	°F	16.5	°C	61.7	°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	24	°C	75.2	°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: Hospital Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Interior

LIGHTING

PATIENT ROOMS

Light Level	250 Lux	23.2	ft-candles
Floor Fraction (GLFF)	0.30		
Connected Load	7.6 W/m²	0.7	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	50%
Usage During Unoccupied Period	25%

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	0%	50%	50%	100%
Weighted Average					**250**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	90%	0%	10%	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 0.6; MJ/m².yr 22

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY

Light Level	700 Lux	65.1	ft-candles
Floor Fraction (ALFF)	0.35		
Connected Load	20.9 W/m²	1.9	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	60%
Usage During Unoccupied Period	40%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	0%	100%	0%	100%
Weighted Average					**700**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	80%	0%	20%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.8; MJ/m².yr 108

CORRIDORS, OTHER

Light Level	250.00 Lux	23.2	ft-candles
Floor Fraction (HBLFF)	0.35		
Connected Load	9.1 W/m²	0.8	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	100%
Usage During Unoccupied Period	100%

Light Level (Lux)	200	300	500	700	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**250**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	70%	0%	20%	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 2.6; MJ/m².yr 100

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 6; MJ/m².yr 231

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.05	0.05	0	0	0	
Connected Load	0.1 W/m²	0.1 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	10 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.93 W/ft²
Diversity Occupied Period	90%	90%	0%	0%	0%	65%
Diversity Unoccupied Period	40%	40%	0%	0%	0%	40%
Operation Occ. Period (hrs./year)	0	0	0	0	0	2000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	6760

Total end-use load (occupied period)	6.7 W/m²	0.6 W/ft²
Total end-use load (unocc. period)	4.1 W/m²	0.4 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 3.8; MJ/m².yr 147

FOOD SERVICE EQUIPMENT

Provide description below: Commercial food services

Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.1	0.1
MJ/m².yr	120.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 0.8; MJ/m².yr 30

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Interior**
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	99%	0%	0%	0%	0%	0%	1%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 53.2 W/m² — 16.9 Btu/hr.ft²

Seasonal Heating Load (Tertiary Load): 990 MJ/m².yr — 25.5 kWh/ft².yr

Sizing Factor: 1.00

Electric Fuel Share: 1.0% — Gas Fuel Share: 99.0% — Oil Fuel Share: 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	25.5	34.1	34.0
MJ/m².yr	990	1320	1316

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	80.0%	0.0%	0.0%	15.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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: 120 W/m² — 38 Btu/hr.ft² — 315 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 149.0 MJ/m².yr — 3.8 kWh/ft².yr

Sizing Factor: 0.75

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 Maintenar

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	1.6	0.0	1.6
MJ/m².yr	63	0	63

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	5.00%				95.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	100%		0%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 118.3

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	3.4	4.1	4.1
MJ/m².yr	130	160	160.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Interior**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.3	L/s.m²	0.86	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	54%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	9.5	W/m²	0.88	W/ft²
Fan Design Load VAV	10.4	W/m²	0.97	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)	0.5	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)	1.56	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	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	1.59	W/m²	0.15	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.008	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	51.8	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	3.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	7.2	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	6.6
	MJ/m².yr	255.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **18.7** kWh/ft².yr **726.1** MJ/m².yr **Gas:** **40.4** kWh/ft².yr **1,566.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
PATIENT ROOMS	0.6	22.3
NURSING STATIONS, EXAMINATIO	2.8	108.1
CORRIDORS, OTHER	2.6	100.2
OFFICE EQUIPMENT & PLUG LOAI	3.8	147.1
HVAC ELECTRICITY	6.6	255.1
REFRIGERATION EQUIPMENT	0.4	15.0
MISCELLANEOUS EQUIPMENT	0.8	30.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	9.9	33.7	1,306.4
SPACE COOLING	1.0	37.9	0.0	0.0
SERVICE HOT WATER	0.0	0.0	4.1	160.2
FOOD SERVICE EQUIPMENT	0.0	0.7	2.6	99.6

Summary Building Profile

Building Type:	Nursing Home	Location:	Interior

Description: This archetype is based on the Building Check-up Database for extended care buildings. The BCU database contains 23 extended care facilities with 12 in the Lower Mainland, 1 in Vancouver Island and the remaining 10 in the Interior. The facilities in the database range in size from 12,000 ft² to 150,000 ft² constructed between 1960 and 1993. The average size for the sample is 56,000 ft².

This sample was augmented with data from two extended care facilities ranging in size from 45,000 ft² to 175,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 60,000 ft²
- 2 stories

Building Specifications:

roof construction:	0.28 W/m².°C
wall construction:	0.61624 W/m².°C
windows:	4.045 W/m².°C
shading coefficient	0.6
window to wall ratio	0.28

GENERAL LIGHTING (SUITES) 200 Lux 9.3 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	5%	60%	0%	15%	

SERVICES, KITCHEN, OFFICES, DINNING, RECREATION 300 Lux 14.7 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	5%	60%	0%	15%	

Overall LPD 7.0 W/m²

Plug Loads (office equipment) EPD 2.8 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	2.4 L/s.m²	0.47 CFM/ft²
Fan Power	6.4 W/m²	0.59 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	0%	0%	

Calculated Capacity 105 W/m² 360 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9 W/m²	0.1 W/ft²
Condenser Pumps	0.6 W/m²	0.1 W/ft²
Condenser Fan Size	2.8 W/m²	0.3 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	89	2.3		
Services, Kitchen, Offices, Dining, Recreation	77	2.0		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	68	1.7		
Space Heating	15	0.4	1160.4	30.0
Space Cooling	14	0.4	0.0	30.0
HVAC Equipment	136	3.5		
DHW	8	0.2	175.6	4.5
Refrigeration Equipment	0	0.0		
Food Service Equipment	1	0.0	116.2	0.0
Miscellaneous	0	0.0		
Total	**407**	**10.5**	**1452.2**	**64**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Nursing Home** **Baseline** | **SIZE:** **50,000 to 100,000 ft²** | **VINTAGE:** | **REGION:** **Interior**

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)	0.28	W/m².°C	0.05	Btu/hr.ft² .°F	Typical Footprint (m²)	2,800	m²	30,128	ft²
Glazing U value (W/m².°C)	4.05	W/m².°C	0.71	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	FCoils	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%	0%	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	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	38	L/s.person	81	CFM/person

%OA 53.64%

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: 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	0.65			
Total Air Circulation or Design Air Flow	2.36	L/s.m²	0.47	CFM/ft²
Infiltration Rate	0.75	L/s.m²	0.15	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	

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	24	°C	75.2	°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		Interior
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	200 Lux	18.6	ft-candles
Floor Fraction (GLFF)	0.75		
Connected Load	9.3 W/m²	0.9	W/ft²

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	65%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	0%	100%	0%	100%
Weighted Average					**200**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	5%	60%	0%	15%	0%	0%	95.0%
CU	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 2.3; MJ/m².yr 89

SERVICES, KITCHEN, OFFICES, DINNING, RECREATION

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25		
Connected Load	14.7 W/m²	1.4	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	90%
Usage During Unoccupied Period	55%
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	5%	60%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.0; MJ/m².yr 77

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 4; MJ/m².yr 167

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.37 W/ft²
Diversity Occupied Period	0%	0%	0%	0%	0%	70%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	45%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	2.8 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.8 W/m²	0.2 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.7; MJ/m².yr 68

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation equipment

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.6	0.1
MJ/m².yr	140.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 1.0; MJ/m².yr 40

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Nursing Home** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	98%	0%	0%	1%	0%	0%	1%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	58.8	W/m²	18.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	888	MJ/m².yr	22.9	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share: 2.0% — Gas Fuel Share: 98.0% — Oil Fuel Share: 0.0%

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	18.8
	MJ/m².yr	729
Natural Gas EUI	kWh/ft².yr	30.6
	MJ/m².yr	1184
Market Composite EUI	kWh/ft².yr	30.3
	MJ/m².yr	1175

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	105	W/m²	33	Btu/hr.ft²	360	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	155.0	MJ/m².yr	4.0	kWh/ft².yr		

Sizing Factor: 0.85

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

`Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	4.75%				90.25%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	95%	5%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 136.5

Wetting Use Percentage: 90%

All Electric EUI	kWh/ft².yr	3.9
	MJ/m².yr	150
Natural Gas EUI	kWh/ft².yr	4.8
	MJ/m².yr	185
Market Composite EUI	kWh/ft².yr	4.7
	MJ/m².yr	183.1

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	2.4	L/s.m²	0.47	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	60%			
Fan Motor Efficiency	68%			
Sizing Factor	1.00			
Fan Design Load CAV	2.9	W/m²	0.27	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	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)	0.5	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	0.027	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	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.63	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	22.1	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	1.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.3	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	3.5
	MJ/m².yr	136.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**12.3** kWh/ft².yr	**477.5** MJ/m².yr	**Gas:**	**37.5** kWh/ft².yr	**1,452.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	2.3	89.3
SERVICES, KITCHEN, OFFICES, DII	2.0	77.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.7	67.6
HVAC ELECTRICITY	3.5	136.1
REFRIGERATION EQUIPMENT	0.8	30.0
MISCELLANEOUS EQUIPMENT	1.0	40.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	14.6	30.0	1,160.4
SPACE COOLING	0.4	14.2	0.0	0.0
SERVICE HOT WATER	0.2	7.5	4.5	175.6
FOOD SERVICE EQUIPMENT	0.0	0.7	3.0	116.2

Summary Building Profile

Building Type:	Large Schools	**Location:**	Interior

Description: This archetype is based on Building Check-up data including 26 secondary and 2 elementary schools of at least 50,000 sq ft. Size range was from 50,600 to 250,000 sq. ft., with an average of 99,000 sq ft. The archetype uses a floor area of 9,300 m2 (100,000 ft2), on two levels.

Electrical energy intensity (electrical bepi) based on these buildings is 8.5 kWh/ft².yr. Detailed modelling indicates that energy intensities from the Check-up data for the ventilation and heating end uses is lower than expected for this type of building.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 100,000 ft²
- average footprint 50,000 ft² assumes a 100' x 500' footprint
- two stories

Building Specifications:

roof construction:	0.57 W/m².°C
wall construction:	0.53 W/m².°C
windows:	4.4 W/m².°C
shading coefficient	0.89
window to wall ratio	0.16

General Lighting & LPD: 440 Lux, 12.3 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	40%	10%	50%	

Architectural Lighting & LPD: 400 Lux, 13.8 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	5%	5%	30%	10%	50%	

Overall LPD: 10.5 W/m²

Plug Loads (office equipment) EPD: 1.9 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	90%	10%	0%	0%	0%	

System air Flow	3.7 L/s.m²	0.72 CFM/ft²
Fan Power	3.5 W/m²	0.32 W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	2%	0%	3%	95%	0%	0

Calculated Capacity	113 W/m²	335 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0 W/m²	0.1 W/ft²
Condenser Pumps	0.7 W/m²	0.1 W/ft²
Condenser Fan Size	3.1 W/m²	0.3 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m^2.yr	**kWh/ft².yr**	**MJ/m^2.yr**	**kWh/ft².yr**
General Lighting	161	4.2		
Architectural Lighting	17	0.4		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	31	0.8		
Space Heating	25	0.6	415.8	10.7
Space Cooling	13	0.3	0.0	10.7
HVAC Equipment	113	2.9		
DHW	0	0.0	27.2	0.7
Refrigeration Equipment	2	0.1		
Food Service Equipment	0	0.0	4.2	0.0
Miscellaneous	12	0.3		
Total	**390**	**10.1**	**447.2**	**22**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.53	W/m².°C	0.09	Btu/hr.ft² .°F	Typical Building Size	9,300 m²	100,068	ft²
Roof U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² .°F	Typical Footprint (m²)	4,650 m²	50,034	ft²
Glazing U value (W/m².°C)	4.40	W/m².°C	0.77	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	5		
					Percent Conditioned Space	100%		
					Percent Conditioned Space	37%		
Window/Wall Ratio (WIWAR) (%)	0.16				Defined as Exterior Zone			
Shading Coefficient (SC)	0.89				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	27.36%
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
(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			
Total Air Circulation or Design Air Flow	3.66	L/s.m²	0.72	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	

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:
Large Schools	> 50,000 ft2		Interior
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.85			
Connected Load	12.3	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	30%			
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 (%)	0%	0%	40%	10%	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	4.2
	MJ/m².yr	161

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	13.8	W/m²	1.3	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	30%	10%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.4
	MJ/m².yr	17

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.4
	MJ/m².yr	15

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	194

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.08	0.08	0.03	0.02	0.02	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.4 W/m²	0.1 W/m²	0.4 W/m²
	0.0 W/ft²	0.1 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.04 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	1.9 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	0.5 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	0.8
	MJ/m².yr	31

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	2.1

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers		District	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High	Steam					
System Present (%)	90%	0%	0%	5%	0%	0%	5%	100%
Eff./COP	73%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	47.6	W/m²	15.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	337	MJ/m².yr	8.7	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 10.0% Gas Fuel Share 90.0% Oil Fuel Share 0.0%

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	250
Natural Gas EUI	kWh/ft².yr	11.9
	MJ/m².yr	462
Market Composite EUI	kWh/ft².yr	11.4
	MJ/m².yr	441

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	W. H.	CW	
System Present (%)	2.0%	0.0%	0.0%	3.0%	95.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.37	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	113	W/m²	36	Btu/hr.ft²	335	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	139.6	MJ/m².yr	3.6	kWh/ft².yr		
Sizing Factor	1.00					
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	1.7
	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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	50.00%				50.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	100%		0%
Blended Efficiency	0.64		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 17.3

Wetting Use Percentage 90%

All Electric EUI	kWh/ft².yr	0.5
	MJ/m².yr	19
Natural Gas EUI	kWh/ft².yr	0.7
	MJ/m².yr	27
Market Composite EUI	kWh/ft².yr	0.7
	MJ/m².yr	27.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Schools Baseline
SIZE: > 50,000 ft2
VINTAGE:
REGION: Interior

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.7	L/s.m²	0.72	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	3.5	W/m²	0.32	W/ft²
Fan Design Load VAV	3.5	W/m²	0.32	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	Continuous	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 area	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)	3.05	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	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.67	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	4000	hrs./year
Supply Fan Unocc. Period	4760	hrs./year
Supply Fan Energy Consumption	23.6	kWh/m².yr
Exhaust Fan Occ. Period	4000	hrs./year
Exhaust Fan Unocc. Period	4760	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	1.1	kWh/m².yr
Circulating Pump Yearly Operation	4000	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	2.9
	MJ/m².yr	113.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **10.1** kWh/ft².yr **390.1** MJ/m².yr **Gas:** **11.5** kWh/ft².yr **447.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	161.1
ARCHITECTURAL LIGHTING	0.4	17.4
OTHER (HIGH BAY) LIGHTING	0.4	15.1
OFFICE EQUIPMENT & PLUG LOAI	0.8	30.5
HVAC ELECTRICITY	2.9	113.1
REFRIGERATION EQUIPMENT	0.1	2.1
MISCELLANEOUS EQUIPMENT	0.3	12.2

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	25.0	10.7	415.8
SPACE COOLING	0.3	13.2	0.0	0.0
SERVICE HOT WATER	0.0	0.0	0.7	27.2
FOOD SERVICE EQUIPMENT	0.0	0.4	0.1	4.2

Summary Building Profile

Building Type:	Medium Schools	**Location:**	Interior

Description: This archetype is initially based on the one developed for large schools, which was in turn based on 28 schools from the Building Check-up Database. Adjustments were made for the different operating hours, construction standards, and types of equipment prevalent in primary schools. Size range is up to 50,000 sq.ft. The archetype uses a floor area of 2,300 m2 (24,700 ft2), on one level.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 24,700 ft²
- average footprint 24,700 ft² assumes a 70' x 350' footprint
- one storey

Building Specifications:						
roof construction:	0.65 W/m².°C					
wall construction:	0.8 W/m².°C					
windows:	4.4 W/m².°C					
shading coefficient	0.89					
window to wall ratio	0.16					
General Lighting & LPD	400 Lux		11.2 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	40%	10%	50%	
Architectural Lighting & LPD	300 Lux		10.3 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	5%	5%	30%	10%	50%	
Overall LPD	9.5 W/m²					
Plug Loads (office equipment) EPD	1.4 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	
System air Flow	4.8 L/s.m²		0.94 CFM/ft²			
Fan Power	2.3 W/m²		0.21 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	0%	100%	0%	0
Calculated Capacity	128 W/m²		296 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	1.1 W/m²		0.1 W/ft²			
Condenser Pumps	0.8 W/m²		0.1 W/ft²			
Condenser Fan Size	3.5 W/m²		0.3 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	135	3.5		
Architectural Lighting	13	0.3		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	23	0.6		
Space Heating	22	0.6	497.0	12.8
Space Cooling	4	0.1	0.0	12.8
HVAC Equipment	83	2.1		
DHW	1	0.0	28.4	0.7
Refrigeration Equipment	1	0.0		
Food Service Equipment	0	0.0	4.2	0.7
Miscellaneous	6	0.2		
Total	**302**	**7.8**	**529.6**	**27**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Schools** **Baseline**
SIZE: **< 50,000 ft2**
VINTAGE:
REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.80	W/m².°C	0.14	Btu/hr.ft² .°F	Typical Building Size	2,300 m²	24,748	ft²
Roof U value (W/m².°C)	0.65	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Footprint (m²)	2,300 m²	24,748	ft²
Glazing U value (W/m².°C)	4.40	W/m².°C	0.77	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) (%)	0.16							
Shading Coefficient (SC)	0.89				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	10	L/s.person	21	CFM/person

%OA 20.97%

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			
Total Air Circulation or Design Air Flow	4.77	L/s.m²	0.94	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	

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: Medium Schools, Baseline | **SIZE:** < 50,000 ft2 | **VINTAGE:** | **REGION:** Interior

LIGHTING

GENERAL LIGHTING

Light Level	400 Lux	37.2 ft-candles
Floor Fraction (GLFF)	0.85	
Connected Load	11.2 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	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	40%	10%	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 3.5; MJ/m².yr 135

ARCHITECTURAL LIGHTING

Light Level	300 Lux	27.9 ft-candles
Floor Fraction (ALFF)	0.05	
Connected Load	10.3 W/m²	1.0 W/ft²
Occ. Period(Hrs./yr.)	2400	
Unocc. Period(Hrs./yr.)	6360	
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	30%	10%	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 0.3; MJ/m².yr 13

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.4; MJ/m².yr 15

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 4; MJ/m².yr 163

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.05	0.05	0.02	0.02	0.02	
Connected Load	0.3 W/m²	0.4 W/m²	0.1 W/m²	0.4 W/m²	0.1 W/m²	0.3 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.03 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	1.4 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	0.4 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 0.6; MJ/m².yr 23

FOOD SERVICE EQUIPMENT

Provide description below: Cafeteria

Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.1	0.0
MJ/m².yr	5.0	1.1

REFRIGERATION EQUIPMENT

Provide description below: Unknown

EUI kWh/ft².yr 0.0; MJ/m².yr 1.1

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 0.2; MJ/m².yr 6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Schools, Baseline | **SIZE:** < 50,000 ft2 | **VINTAGE:** | **REGION:** Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	93%	0%	0%	3%	0%	0%	4%	100%
Eff./COP	73%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load: 84.3 W/m² | 26.7 Btu/hr.ft²

Seasonal Heating Load (Tertiary Load): 390 MJ/m².yr | 10.1 kWh/ft².yr

Sizing Factor: 1.00

Electric Fuel Share: 7.0% | Gas Fuel Share: 93.0% | Oil Fuel Share: 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	8.1	13.8	13.4
MJ/m².yr	312	534	519

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.37	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: 128 W/m² | 41 Btu/hr.ft² | 296 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 156.1 MJ/m².yr | 4.0 kWh/ft².yr

Sizing Factor: 1.00

A/C Saturation (Incidence of A/C): 5.0%

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	1.8	0.0	1.8
MJ/m².yr	72	0	72

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	71.25%				23.75%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	95%		5%
Blended Efficiency	0.58		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 17.3

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.8	0.8
MJ/m².yr	19	30	29.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Interior**
Baseline			

HVAC ELECTRICITY

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	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	2.3	W/m²	0.21	W/ft²
Fan Design Load VAV	2.3	W/m²	0.21	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	Continuous	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 area	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)	3.45	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	0.76	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.008	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	3000	hrs./year
Supply Fan Unocc. Period	5760	hrs./year
Supply Fan Energy Consumption	15.2	kWh/m².yr
Exhaust Fan Occ. Period	3000	hrs./year
Exhaust Fan Unocc. Period	5760	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	1.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	3000	hrs./year
Circulating Pump Energy Consumption	3.2	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	2.1
	MJ/m².yr	82.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**7.8** kWh/ft².yr	**302.0** MJ/m².yr	
	Gas:	**13.7** kWh/ft².yr	**529.6** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.5	135.2
ARCHITECTURAL LIGHTING	0.3	12.9
OTHER (HIGH BAY) LIGHTING	0.4	15.1
OFFICE EQUIPMENT & PLUG LOAI	0.6	22.5
HVAC ELECTRICITY	2.1	82.7
REFRIGERATION EQUIPMENT	0.0	1.1
MISCELLANEOUS EQUIPMENT	0.2	6.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	21.9	12.8	497.0
SPACE COOLING	0.1	3.6	0.0	0.0
SERVICE HOT WATER	0.0	1.0	0.7	28.4
FOOD SERVICE EQUIPMENT	0.0	0.2	0.1	4.2

Summary Building Profile

Building Type: University-Colleges **Location:** Interior

Description: This archetype is based on approximately 150 buildings as follows
-BCIT walk-through audits of 47 buildings
-BCIT detailed lighting audits of 47 buildings
-UBC detailed lighting audit of 37 buildings
-Royal Roads University walk-through audit of 10 buildings
-UVIC walk-through audit of 38 buildings.
The combined floor area is estimated to be approximately 2.2 million ft². The buildings range in size from 10,000 to 200,000 ft². The average building size is 96,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 90,000 ft²
- average footprint 45,000 ft² with a 7:1 length to aspect ratio
- 2 stories

Building Specifications:

roof construction:	0.35	W/m².°C
wall construction:	0.95	W/m².°C
windows:	4.968	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.3	

General Lighting & LPD 640 Lux 19.3 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
0%	0%	80%	0%	15%	5%

Architectural Lighting & LPD 300 Lux 14.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
15%	5%	65%	0%	15%	0%

Overall LPD 17.4 W/m²

Plug Loads (office equipment) EPD 4.1 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
70%	30%	0%	0%	0%	

System air Flow	3.5	L/s.m²	0.69	CFM/ft²
Fan Power	7.1	W/m²	0.66	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
25%	0%	0%	0%	75%	0%	

Calculated Capacity 106 W/m² 357 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.9	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	289	7.5		
Architectural Lighting	46	1.2		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	28	0.7	867.2	22.4
Space Cooling	5	0.1	0.0	22.4
HVAC Equipment	168	4.3		
DHW	3	0.1	32.2	0.8
Refrigeration Equipment	20	0.5		
Food Service Equipment	3	0.1	0.0	0.0
Miscellaneous	75	1.9		
Total	**695**	**17.9**	**899.4**	**46**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **University-Colleges** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.95	W/m².°C	0.17	Btu/hr.ft² .°F
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	4.97	W/m².°C	0.87	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)	4,500	m²	48,420	ft²
Footprint Aspect Ratio (L:W)	7			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
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 (%)	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	17	L/s.person	36	CFM/person

%OA 34.89%

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	0.8			
Total Air Circulation or Design Air Flow	3.48	L/s.m²	0.69	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	

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	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	0		Interior
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	19.3	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		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	80%	0%	15%	5%	0%	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 7.5; MJ/m².yr 289

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	14.4	W/m²	1.3	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	5%	65%	0%	15%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 1.2; MJ/m².yr 46

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 9; MJ/m².yr 334

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.1	0.1	0.15	0.05	0.05	
Connected Load	0.4 W/m²	0.6 W/m²	0.5 W/m²	0.7 W/m²	0.2 W/m²	2 W/m²
	0.0 W/ft²	0.1 W/ft²	0.05 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	4.1 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	1.2 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.5; MJ/m².yr 59

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 1-% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.5	0.5
MJ/m².yr	20.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.5; MJ/m².yr 20.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.9; MJ/m².yr 75

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Interior**
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	95%	0%	0%	1%	1%	0%	3%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	62.0	W/m²	19.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	685	MJ/m².yr	17.7	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% Gas Fuel Share 95.0% Oil Fuel Share 0.0%

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%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	14.3	553
Natural Gas EUI	23.6	913
Market Composite EUI	23.1	895

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	25.0%	0.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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)	203.8	MJ/m².yr	5.3	kWh/ft².yr		

Sizing Factor 0.80

A/C Saturation (Incidence of A/C) 5.0%

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		

	kWh/ft².yr	MJ/m².yr
All Electric EUI	2.4	93
Natural Gas EUI	0.0	0
Market Composite EUI	2.4	93

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	45.00%				45.00%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.64	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	0.9	36
Market Composite EUI	0.9	34.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Interior**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.5	L/s.m²	0.69	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	82%			
Sizing Factor	1.00			
Fan Design Load CAV	7.1	W/m²	0.66	W/ft²
Fan Design Load VAV	7.1	W/m²	0.66	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	0.0	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)	2.87	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	0.008	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	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	37.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.7	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.2	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	168.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**17.9** kWh/ft².yr	**695.0** MJ/m².yr	
	Gas:	**23.2** kWh/ft².yr	**899.4** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	7.5	288.8
ARCHITECTURAL LIGHTING CORF	1.2	45.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.3
HVAC ELECTRICITY	4.3	168.1
REFRIGERATION EQUIPMENT	0.5	20.0
MISCELLANEOUS EQUIPMENT	1.9	75.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	27.7	22.4	867.2
SPACE COOLING	0.1	4.6	0.0	0.0
SERVICE HOT WATER	0.1	2.5	0.8	32.2
FOOD SERVICE EQUIPMENT	0.1	3.4	0.0	0.0

Summary Building Profile

Building Type:	Restaurant	**Location:**	Interior

Description: This archetype is based on data from the Building Check-up database. The BCU database contains 4 buildings ranging in size from 7,000 ft² constructed between 1940 and 1996. The average size of the sample is 8,400 ft².

Only end-use energy intensities available. No detailed specifications available to develop a full archetype.

Average Building:

Building Specifications:

roof construction:	W/m².°C	
wall construction:	W/m².°C	
windows:	W/m².°C	
shading coefficient		
window to wall ratio		
General Lighting & LPD	Lux	W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Architectural Lighting & LPD — Lux — W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Overall LPD — W/m²

Plug Loads (office equipment) EPD — W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other

System air Flow	L/s.m²	CFM/ft²
Fan Power	W/m²	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other

Calculated Capacity	W/m²	ft²/Ton
Cooling Plant Auxiliaries		
Circulating Pumps	W/m²	W/ft²
Condenser Pumps	W/m²	W/ft²
Condenser Fan Size	W/m²	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	619	16.0		
Architectural Lighting	51	1.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	78	2.0	156.1	4.0
Space Cooling	42	1.1	0.0	4.0
HVAC Equipment	149	3.8		
DHW	10	0.3	69.7	1.8
Refrigeration Equipment	1200	31.0		
Food Service Equipment	3	0.1	664.0	0.0
Miscellaneous	60	1.5		
Total	**2328**	**60.1**	**889.8**	**10**

Note that this profile is not fully "live"--only some of the summary values come from "profile"

Summary Building Profile

Building Type:	Warehouse/Whsale	Location:	Interior

Description: This archetype is based on the Building Check-up database for Warehouse/Whsale buildings. The BCU database contains 20 buildings ranging in size from 5,000 to 140,000 ft² constructed between 1940 and 1993. the average size of the sample is 34,000 ft².

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 34,000 ft²

Building Specifications:		
roof construction:	0.35	W/m².°C
wall construction:	0.85464	W/m².°C
windows:	4.48	W/m².°C
shading coefficient	0.8	
window to wall ratio	0.05	

High Bay Lighting & LPD — 460 Lux, 16.6 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH	HPS
	0%	0%	10%	0%	5%	75%	10%

Other Office Lighting & LPD — 500 Lux, 21.3 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	5%	75%	0%	10%	

Overall LPD — 15.7 W/m²

Plug Loads (office equipment) EPD — 4.5 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	3.9	L/s.m²	0.77	CFM/ft²
Fan Power	8.2	W/m²	0.76	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	0%	0%	10%	90%	0%	

Calculated Capacity	65	W/m²	586	ft²/Ton
Cooling Plant Auxiliaries				
Circulating Pumps	0.3	W/m²	0.0	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	1.7	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
High Bay Lighting	273	7.0		
Other Office Lighting	22	0.6		
Other Lighting	0	0.0		
Plug Loads & Office Equipment	96	2.5		
Space Heating	35	0.9	416.4	10.7
Space Cooling	10	0.3	0.0	10.7
HVAC Equipment	63	1.6		
DHW	6	0.2	24.4	0.6
Refrigeration Equipment	50	1.3		
Food Service Equipment	0	0.0	0.0	0.0
Miscellaneous	40	1.0		
Total	**594**	**15.3**	**440.8**	**22**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Warehouse/Whsale** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.85	W/m².°C	0.15	Btu/hr.ft² .°F	Typical Building Size	3,200 m²	34,432	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	3,200 m²	34,432	ft²
Glazing U value (W/m².°C)	4.48	W/m².°C	0.79	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 5.09%
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: | 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	3.93	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	

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	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:
Warehouse/Whsale	0		Interior
Baseline			

LIGHTING

HIGH BAY LIGHTING

Light Level	460 Lux	42.8	ft-candles
Floor Fraction (GLFF)	0.95		
Connected Load	16.6 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	

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%	10%	0%	5%	75%	10%	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	7.0
	MJ/m².yr	273

OTHER, OFFICE LIGHTING

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	21.3 W/m²	2.0	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	5%	75%	0%	10%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

OTHER 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%				0%
Weighted Average								**0**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	0%	0%	0%	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

EUI TOTAL	kWh/ft².yr	7.6
	MJ/m².yr	294

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.46 W/ft²
Diversity Occupied Period	0%	0%	0%	90%	100%	90%
Diversity Unoccupied Period	0%	0%	0%	10%	100%	40%
Operation Occ. Period (hrs./year)	0	0	0	2600	2600	3500
Operation Unocc. Period (hrs./year)	8760	8760	8760	6160	6160	5260

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.0 W/m²	0.2 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	2.5
	MJ/m².yr	96

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

	Natural Gas EUI		All Electric EUI		
EUI	kWh/ft².yr	0.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	0.0		MJ/m².yr	0.0

REFRIGERATION EQUIPMENT

Provide description below:

Large refrigeration storage

EUI	kWh/ft².yr	1.3
	MJ/m².yr	50.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	1.0
	MJ/m².yr	40

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Warehouse/Whsale Baseline
SIZE: 0
VINTAGE:
REGION: Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	0%	0%	0%	10%	105%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	94.2 W/m²	29.9 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	347 MJ/m².yr	9.0 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Gas Fuel Share 90.0%	Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	9.0	11.9	12.2
MJ/m².yr	347	463	474

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	HE	Screw Chillers	Reciprocating Chillers Open	DX	Absorption Chillers W. H.	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	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	65 W/m²	20 Btu/hr.ft²	586 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	104.2 MJ/m².yr	2.7 kWh/ft².yr	
Sizing Factor	1.00		
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 Maintenar

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	1.3	0.0	1.3
MJ/m².yr	50	0	50

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	69.30%				0.70%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.52	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 18.2

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.9	0.8
MJ/m².yr	20	35	30.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Interior
Baseline			

HVAC ELECTRICITY

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	8.2	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	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.74	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	0.003	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	0.004	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	3200	hrs./year
Supply Fan Unocc. Period	5560	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	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	7000	hrs./year
Circulating Pump Energy Consumption	1.8	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	1.6
	MJ/m².yr	63.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**15.3** kWh/ft².yr	**593.9** MJ/m².yr	**Gas:**	**11.4** kWh/ft².yr	**440.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
HIGH BAY LIGHTING	7.0	272.6
OTHER, OFFICE LIGHTING	0.6	21.6
OTHER LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.5	95.6
HVAC ELECTRICITY	1.6	63.4
REFRIGERATION EQUIPMENT	1.3	50.0
MISCELLANEOUS EQUIPMENT	1.0	40.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.9	34.7	10.7	416.4
SPACE COOLING	0.3	10.0	0.0	0.0
SERVICE HOT WATER	0.2	6.0	0.6	24.4
FOOD SERVICE EQUIPMENT	0.0	0.0	0.0	0.0

Summary Building Profile

Building Type: Mixed Use	**Location:** Blended Interior
Description: This archetype is based on data from the Building Check-up database, BC Hydro's High and LowiRise Apt. Bldgs. Audit and Simulation Study and end-use data supplied by Sheltair. This profile assumes retail space in the first floor and apartments in all floors above. Electrical energy intensities range from 7.2 kWh/ft².yr to 11.4 kWh/ft².yr.	**Average Building:** The average building characteristics used to define this building profile are as follows: - average number of suites 62 at 750 ft²/suite - average building size 56,500 ft² (assumes 20% additional floor space for corridors - average footprint 8,100 ft² assumes 9 suites per floor (except first floor retail) - 7 stories

Building Specifications:						
roof construction:	0.32 W/m².°C					
wall construction:	0.62 W/m².°C					
windows:	5.212 W/m².°C					
shading coefficient	0.65					
window to wall ratio	0.29					
General Lighting & LPD	112.5 Lux		14.0 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	80%	10%	10%	0%	0%	
Architectural Lighting & LPD	150 Lux		13.9 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	50%	30%	15%	0%	5%	
Overall LPD	11.2 W/m²					
Plug Loads (office equipment) EPD	1.0 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	
System air Flow	0.0 L/s.m²		0.00 CFM/ft²			
Fan Power	0.0 W/m²		0.00 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	1%	0%	5%	94%	0%	0
Calculated Capacity	57 W/m²		658 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	0.5 W/m²		0.0 W/ft²			
Condenser Pumps	0.0 W/m²		0.0 W/ft²			
Condenser Fan Size	0.0 W/m²		0.0 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Suite Lighting	30	0.8		
Corridor/Common Area Lighting	80	2.1		
High Bay Lighting	0	0.0		
Appliance, TV, Entertainment, Other	60	1.6		
Space Heating	126	3.2	95.1	2.5
Space Cooling	1	0.0	0.0	2.5
HVAC Equipment	6	0.2		
DHW	23	0.6	106.4	2.7
Residential Refrigerator	27	0.7		
Cooking Appliances (incl. Stove)	18	0.5	0.0	0.0
Miscellaneous	17	0.4		
Total	**386**	**10.0**	**201.5**	**8**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Mixed Use** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Blended Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	5,250	m²	56,490	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	750	m²	8,070	ft²
Glazing U value (W/m².°C)	5.21	W/m².°C	0.92	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	1.25			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	75%			
Window/Wall Ratio (WIWAR) (%)	0.29								
Shading Coefficient (SC)	0.65				Typical # Stories	7			
					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 ########

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: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.001 L/s.m² 0.00 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.00	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)

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	

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:
Mixed Use	0		Blended Interior
Baseline			

LIGHTING

SUITE LIGHTING

Light Level	113	Lux	10.5	ft-candles
Floor Fraction (GLFF)	0.80			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	5%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	200	300	500	Total
% Distribution	65%	25%	10%	0%	100%
Weighted Average					**112.5**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	80%	10%	10%	0%	0%	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 30

CORRIDORS/COMMON AREAS

Light Level	150	Lux	13.9	ft-candles
Floor Fraction (ALFF)	0.20			
Connected Load	13.9	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	500	Total
% Distribution	70%	10%	20%	0%	100%
Weighted Average					**150**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	50%	30%	15%	0%	5%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.1
MJ/m².yr 80

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0
MJ/m².yr 0

TOTAL LIGHTING

EUI TOTAL kWh/ft².yr 3
MJ/m².yr 110

APPLIANCES, TV ENTERTAINMENT, OTHER

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0	0	0	
Connected Load	0.3 W/m²	0.4 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	2.4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.22 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

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.6
MJ/m².yr 60

COOKING APPLIANCES STOVE

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

Electric stove with an annual consumption of 340 kWh/unit

	Natural Gas EUI		All Electric EUI	
EUI	kWh/ft².yr	0.0	kWh/ft².yr	0.5
	MJ/m².yr	0.0	MJ/m².yr	18.0

RESIDENTIAL REFRIGERATOR

Provide description below:

Residential refrigerator with an annual consumption of 636 kWh/unit

EUI kWh/ft².yr 0.7
MJ/m².yr 27.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 0.4
MJ/m².yr 17

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Mixed Use	0		Blended Interior
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	0%	40%	0%	0%	0%	0%	60%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	61.9	W/m²	19.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	209	MJ/m².yr	5.4	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 60.0% | Gas Fuel Share 40.0% | Oil Fuel Share 0.0%

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	5.4	209
Natural Gas EUI	6.1	238
Market Composite EUI	5.7	221

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	1.0%	0.0%	0.0%	5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	658	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	150.1	MJ/m².yr	3.9	kWh/ft².yr		

Sizing Factor 1.00

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 Maintenar

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	0.2	7
Natural Gas EUI	0.0	0
Market Composite EUI	0.2	7

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	56.25%				18.75%
Eff./COP	0.520				0.750

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.58	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 81.9

Wetting Use Percentage 80%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	2.3	90
Natural Gas EUI	3.7	142
Market Composite EUI	3.3	128.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Mixed Use	**0**		**Blended Interior**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	0.0	L/s.m²	0.00	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	0.0	W/m²	0.00	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	100%	0%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	20	L/s.washroom	42	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	0.003	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	0.004	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	0.05	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	0.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.6	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	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	0.2
	MJ/m².yr	5.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Mixed Use	**0**		**Blended Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**10.0** kWh/ft².yr	**386.5** MJ/m².yr	**Gas:**	**5.2** kWh/ft².yr	**201.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
SUITE LIGHTING	0.8	29.5
CORRIDORS/COMMON AREAS	2.1	80.3
OTHER (HIGH BAY) LIGHTING	0.0	0.0
APPLIANCES, TV ENTERTAINMENT	1.6	60.1
HVAC ELECTRICITY	0.2	5.8
RESIDENTIAL REFRIGERATOR	0.7	27.0
MISCELLANEOUS EQUIPMENT	0.4	17.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	3.2	125.5	2.5	95.1
SPACE COOLING	0.0	0.7	0.0	0.0
SERVICE HOT WATER	0.6	22.5	2.7	106.4
COOKING APPLIANCES STOV	0.5	18.0	0.0	0.0

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Resource Consultants Ltd.

APPENDIX C

New Building Profiles – Lower Mainland and Vancouver Island

Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island.

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Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island. Blank specification boxes in the profiles indicate that no data were used.

Summary Building Profile

Building Type: New Large Office

Location: Lower Mainland

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program. and NRCan's CBIP program.

The Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 230,000 ft²
- average footprint 12,100 ft² assumes a 110 ' x 110 ' footprint
- 19 stories

Building Specifications:

roof construction:	0.24 W/m².°C
wall construction:	0.71 W/m².°C
windows:	2.8 W/m².°C
shading coefficient	0.45
window to wall ratio	0.6

General Lighting & LPD 440 Lux 11.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

Architectural Lighting & LPD 300 Lux 13.0 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
10%	30%	0%	0%	60%	

Overall LPD 10.8 W/m²

Plug Loads (office equipment) EPD 7.8 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
10%	90%	0%	0%	0%	

System air Flow	5.5 L/s.m²	1.08 CFM/ft²
Fan Power	9.3 W/m²	0.86 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	75%	25%	0%	0%	

Calculated Capacity 102 W/m² 371 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.1 W/m²	0.1 W/ft²
Condenser Pumps	1.0 W/m²	0.1 W/ft²
Condenser Fan Size	2.0 W/m²	0.2 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	164	4.2		
Architectural Lighting	19	0.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	176	4.5		
Space Heating	6	0.1	209.4	5.4
Space Cooling	49	1.3	0.0	5.4
HVAC Equipment	151	3.9		
DHW	8	0.2	25.6	0.7
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	160	4.1		
Total	**737**	**19.0**	**239.2**	**12**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Office** **Baseline**
SIZE: **> 9,300 m² (100,000 ft²)**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	Btu/hr.ft² .°F
Window/Wall Ratio (WIWAR) (%)	0.60			
Shading Coefficient (SC)	0.45			

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 (%)	10%		0%		90%		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	25	L/s.person	53	CFM/person

%OA 17.93%

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	5.47	L/s.m²	1.08	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	

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	22.5	°C	72.5	°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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New 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 (%)	0%	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	4.2
	MJ/m².yr	164

ARCHITECTURAL LIGHTING

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	13.0 W/m²	1.2	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	30%	0%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.5
	MJ/m².yr	19

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	183

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	67	72	50	200	50	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.1	
Connected Load	2.4 W/m²	2.5 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2 W/m²
	0.2 W/ft²	0.2 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	95%	95%	90%	90%	100%	100%
Diversity Unoccupied Period	60%	60%	50%	20%	20%	60%
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)	7.8 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	4.5 W/m²	0.4 W/ft²

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EUI	kWh/ft².yr	4.5
	MJ/m².yr	176

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	4.1
	MJ/m².yr	160

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Office** **Baseline**
SIZE: **> 9,300 m^2 (100,000 ft^2)**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	95%	0%	0%	3%	0%	2%	100%
Eff./COP	75%	80%	95%	1.70	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.05	0.59	0.29	0.22	1.00	

Peak Heating Load	59.4	W/m^2	18.8	$Btu/hr.ft^2$
Seasonal Heating Load (Tertiary Load)	176	$MJ/m^2.yr$	4.6	$kWh/ft^2.yr$
Sizing Factor	1.00			

Electric Fuel Share: 5.0% — Gas Fuel Share: 95.0% — Oil Fuel Share: 0.0%

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	Natural Gas EUI	Market Composite EUI
$kWh/ft^2.yr$	3.0	5.7	5.6
$MJ/m^2.yr$	115	220	215

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	75.0%	0.0%	25.0%	0.0%	0.0%	0.0%	100.0%
COP	4.6	6.1	4.4	4.2	2.8	0.9	1	
Performance (1 / COP) (kW/kW)	0.22	0.16	0.23	0.24	0.36	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	102	W/m^2	32	$Btu/hr.ft^2$	371	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	149.1	$MJ/m^2.yr$	3.9	$kWh/ft^2.yr$		

Sizing Factor: 1.00

A/C Saturation (Incidence of A/C): 100.0%

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
$kWh/ft^2.yr$	1.3	0.0	1.3
$MJ/m^2.yr$	49	0	49

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	35.00%	14.00%	0.00%	19.60%	1.40%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.62	0.91

Service Hot Water load ($MJ/m^2.yr$) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
$kWh/ft^2.yr$	0.6	0.9	0.9
$MJ/m^2.yr$	25	37	33.1

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Large Office Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Lower Mainland

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.08	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	9.3	W/m²	0.86	W/ft²
Fan Design Load VAV	9.3	W/m²	0.86	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	10%	90%	100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	35%	65%	0%	100%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit area	0.2	L/s.m²	0.04	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	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)	2.04	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	85%			
Sizing Factor	1.0			
Pump Connected Load	1.04	W/m²	0.10	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.006	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	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	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	1.2	kWh/m².yr
Condenser Pump Energy Consumption	3.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	7.7	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	3.9
	MJ/m².yr	150.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Office	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**19.0** kWh/ft².yr	**736.5** MJ/m².yr	**Gas:**	**6.2** kWh/ft².yr	**239.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	164.0
ARCHITECTURAL LIGHTING	0.5	19.2
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	4.5	175.9
HVAC ELECTRICITY	3.9	150.9
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	4.1	160.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.1	5.8	5.4	209.4
SPACE COOLING	1.3	48.5	0.0	0.0
SERVICE HOT WATER	0.2	7.5	0.7	25.6
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

Summary Building Profile

Building Type:	New Medium Office	**Location:**	Lower Mainland
Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program and NRCan's CBIP Program.		**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 72,900 ft² - average footprint 8,100 ft² assumes a 90' x 90' footprint - 9 stories	

Building Specifications:						
roof construction:	0.24 W/m².°C					
wall construction:	0.71 W/m².°C					
windows:	2.8 W/m².°C					
shading coefficient	0.45					
window to wall ratio	0.5					
General Lighting & LPD	500 Lux		12.9 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	0%	0%	100%	
Architectural Lighting & LPD	300 Lux		12.7 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	25%	0%	0%	65%	
Overall LPD	12.3 W/m²					
Plug Loads (office equipment) EPD	7.4 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	50%	50%	0%	0%	0%	
System air Flow	5.1 L/s.m²		1.01 CFM/ft²			
Fan Power	11.2 W/m²		1.05 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	25%	45%	30%	0%	0
Calculated Capacity	116 W/m²		326 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	1.0 W/m²		0.1 W/ft²			
Condenser Pumps	0.7 W/m²		0.1 W/ft²			
Condenser Fan Size	3.1 W/m²		0.3 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	238	6.1		
Architectural Lighting	19	0.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	14	0.4	199.3	5.1
Space Cooling	58	1.5	0.0	5.1
HVAC Equipment	227	5.9		
DHW	8	0.2	28.3	0.7
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	100	2.6		
Total	**784**	**20.3**	**231.8**	**11**

COMMERCIAL SECTOR BUILDING PROFILE

NWE BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F	Typical Building Size	6,777	m²	72,921	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	753	m²	8,102	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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) (%)	0.50								
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	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: 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	5.15 L/s.m²	1.01 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	

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	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

NWE BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.95		
Connected Load	12.9 W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	2900		
Unocc. Period(Hrs./yr.)	5860		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	45%		
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 (%)	0%	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	6.1
	MJ/m².yr	238

ARCHITECTURAL LIGHTING

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	12.7 W/m²	1.2	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	25%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.5
	MJ/m².yr	19

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	7
	MJ/m².yr	257

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.1	
Connected Load	1.9 W/m²	3.0 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2 W/m²
	0.2 W/ft²	0.3 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	100%	10%
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)	7.4 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	1.9 W/m²	0.2 W/ft²

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EUI	kWh/ft².yr	3.0
	MJ/m².yr	116

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% — Electricity Fuel Share: 17.0%

	Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	2.6
	MJ/m².yr	100

COMMERCIAL SECTOR BUILDING PROFILE

NWE BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System							Electric	
	Boilers		District	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High	Steam					
System Present (%)	0%	90%	0%	0%	5%	0%	5%	100%
Eff./COP	75%	83%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	60.9	W/m²	19.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	184	MJ/m².yr	4.7	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 10.0% Gas Fuel Share 90.0% Oil Fuel Share 0.0%

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

Natural Gas EUI	
kWh/ft².yr	5.7
MJ/m².yr	221

Market Composite EUI	
kWh/ft².yr	5.5
MJ/m².yr	213

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Recprocting Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	W. H.	CW	
System Present (%)	0.0%	25.0%	0.0%	45.0%	30.0%	0.0%	0.0%	100.0%
COP	4.7	6	4.4	4.2	2.8	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.17	0.23	0.24	0.36	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	116	W/m²	37	Btu/hr.ft²	326	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	153.2	MJ/m².yr	4.0	kWh/ft².yr		

Sizing Factor 1.00

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	1.7
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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	52.50%	17.50%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.56		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	25

Natural Gas EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

Market Composite EUI	
kWh/ft².yr	0.9
MJ/m².yr	35.8

COMMERCIAL SECTOR BUILDING PROFILE

NWE BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Lower Mainland
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.01	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	8.4	W/m²	0.78	W/ft²
Fan Design Load VAV	11.2	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%	50%	100%	
Operation	Continuous	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 area	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.13	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	0.006	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	0.69	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	3200	hrs./year
Supply Fan Unocc. Period	5560	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	3.0	kWh/m².yr
Condenser Pump Energy Consumption	2.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.6	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	227.3

COMMERCIAL SECTOR BUILDING PROFILE

NWE BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Office	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.3** kWh/ft².yr	**784.5** MJ/m².yr	
	Gas:	**6.0** kWh/ft².yr	**231.8** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.1	238.2
ARCHITECTURAL LIGHTING	0.5	18.8
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	3.0	115.9
HVAC ELECTRICITY	5.9	227.3
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	2.6	100.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	13.7	5.1	199.3
SPACE COOLING	1.5	58.4	0.0	0.0
SERVICE HOT WATER	0.2	7.5	0.7	28.3
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

Summary Building Profile

Building Type:	New Large Retail	Location:	Lower Mainland

Description: This archetype is based on generic commercial design practices for new construction. BC Hydro's Design Assistance Program has seen little interest from retail developers in efficient new construction hence little information is available on current design practices.

New construction is assumed to be little changed from the existing stock except for a few components such as fluorescent lighting (default new construction is assumed to be T8 lighting). Windows are assumed to be double pane.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 250,000 ft²
- one storey

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.78	
window to wall ratio	0.1	

General Lighting & LPD 600 Lux 27.8 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	15%	10%	0%	0%	60%	15%

Common Area, Atria Lighting & LPD 500 Lux 26.1 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	10%	10%	0%	0%	20%	60%

Overall LPD 22.2 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	80%	20%	0%	0%	0%	

System air Flow	5.0	L/s.m²	0.99	CFM/ft²
Fan Power	10.5	W/m²	0.97	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	20%	0%	20%	60%	0%	

Calculated Capacity 92 W/m² 411 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.5	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	402	10.4		
Architectural Lighting	121	3.1		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	69	1.8		
Space Heating	4	0.1	146.5	3.8
Space Cooling	65	1.7	0.0	3.8
HVAC Equipment	158	4.1		
DHW	5	0.1	32.5	0.8
Refrigeration Equipment	10	0.3		
Food Service Equipment	2	0.0	33.2	0.0
Miscellaneous	45	1.2		
Total	**882**	**22.8**	**212.2**	**8**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Retail** **Baseline**
SIZE: **> 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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 17.67%
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	1.7			
Total Air Circulation or Design Air Flow	5.03	L/s.m²	0.99	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	

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	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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Retail	> 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600 Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.80		
Connected Load	27.8 W/m²	2.6	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	

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					600

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	10%	0%	0%	60%	15%	0%	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 10.4
MJ/m².yr 402

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	26.1 W/m²	2.4	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%	100%	0%	0%	100%
Weighted Average					500

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	10%	0%	0%	20%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 3.1
MJ/m².yr 121

OTHER (HIGH BAY) 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%	0%
Weighted Average					0

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0
MJ/m².yr 0

TOTAL LIGHTING

EUI TOTAL kWh/ft².yr 14
MJ/m².yr 523

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	100%	20%
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)	3.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	0.9 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.8
MJ/m².yr 69

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI		All 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 EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 0.3
MJ/m².yr 10.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.2
MJ/m².yr 45

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	2%	1%	0%	2%	100%
Eff./COP	75%	88%	95%	3.20	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.31	0.29	0.22	1.00	

Peak Heating Load	41.8	W/m²	13.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	116	MJ/m².yr	3.0	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% — Gas Fuel Share 95.0% — Oil Fuel Share 0.0%

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	2.0
	MJ/m².yr	77
Natural Gas EUI	kWh/ft².yr	4.0
	MJ/m².yr	154
Market Composite EUI	kWh/ft².yr	3.9
	MJ/m².yr	150

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	20.0%	0.0%	20.0%	60.0%	0.0%	0.0%	100.0%
COP	4.8	5.4	4.4	3.7	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.27	0.37	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	411	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	143.3	MJ/m².yr	3.7	kWh/ft².yr		
Sizing Factor	1.00					
A/C Saturation (Incidence of A/C)	95.0%					

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	64.00%	16.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.56		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

All Electric EUI	kWh/ft².yr	0.6
	MJ/m².yr	25
Natural Gas EUI	kWh/ft².yr	1.0
	MJ/m².yr	41
Market Composite EUI	kWh/ft².yr	1.0
	MJ/m².yr	37.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.99	CFM/ft²
System Static Pressure CAV	650	Pa	2.6	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	6.8	W/m²	0.63	W/ft²
Fan Design Load VAV	10.5	W/m²	0.97	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	Continuous	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 area	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)	2.49	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	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	0.006	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	36.0	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	1.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.4	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	4.1
	MJ/m².yr	158.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Lower Mainland**

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**22.8** kWh/ft².yr	**881.6** MJ/m².yr	**Gas:**	**5.5** kWh/ft².yr	**212.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	10.4	402.2
ARCHITECTURAL LIGHTING CORI	3.1	120.8
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.8	69.4
HVAC ELECTRICITY	4.1	158.3
REFRIGERATION EQUIPMENT	0.3	10.0
MISCELLANEOUS EQUIPMENT	1.2	45.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.1	3.9	3.8	146.5
SPACE COOLING	1.7	65.4	0.0	0.0
SERVICE HOT WATER	0.1	5.0	0.8	32.5
FOOD SERVICE EQUIPMENT	0.0	1.7	0.9	33.2

Summary Building Profile

Building Type:	New Medium Retail	Location:	Lower Mainland

Description: This archetype is based on generic commercial design practices for new construction. BC Hydro's Design Assistance Program has seen little interest from retail developers in efficient new construction, hence little information is available on current design practices.

New construction is assumed to be little changed from the existing stock except for a few components such as fluorescent lighting (default new construction is assumed to be T8 lighting). Windows are assumed to be double pane. DX cooling performance of packaged rooftop heat-cool units is assumed to be EER 9.5.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 80,700 ft², with a footprint of 127' x 635'
- one storey

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.78	
window to wall ratio	0.1	

General Lighting & LPD — 620 Lux — 24.6 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	10%	0%	0%	80%	

Architectural Lighting & LPD — 480 Lux — 19.9 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	20%	0%	0%	70%	

Overall LPD — 23.4 W/m²

Plug Loads (office equipment) EPD — 5.1 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	3.7	L/s.m²	0.73	CFM/ft²
Fan Power	0.0	W/m²	0.00	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	0%	100%	0%	0

Calculated Capacity — 90 W/m² — 420 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.0	W/m²	0.0	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.4	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	511	13.2		
Architectural Lighting	30	0.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	67	1.7		
Space Heating	4	0.1	123.5	3.2
Space Cooling	46	1.2	0.0	3.2
HVAC Equipment	112	2.9		
DHW	11	0.3	12.4	0.3
Refrigeration Equipment	9	0.2		
Food Service Equuipment	2	0.0	8.3	0.2
Miscellaneous	43	1.1		
Total	**836**	**21.6**	**144.1**	**7**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Retail	**50,000 - 100,000 ft2**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	7,500	m²	80,700	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	7,500	m²	80,700	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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)	0.78				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	21.45%
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: 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	3.73 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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	620	Lux	57.6	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	24.6	W/m²	2.3	W/ft²
Occ. Period(Hrs./yr.)	5000			
Unocc. Period(Hrs./yr.)	3760			
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)	300	500	700	1000	Total
% Distribution	0%	40%	60%	0%	100%
Weighted Average					**620**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	10%	0%	0%	80%	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	13.2
	MJ/m².yr	511

ARCHITECTURAL LIGHTING

Light Level	480	Lux	44.6	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	19.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	5500			
Unocc. Period(Hrs./yr.)	3260			
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	30%	50%	20%	0%	100%
Weighted Average					**480**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	20%	0%	0%	70%	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	30

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	14
	MJ/m².yr	541

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0.2		0.2		0.1		0.1		0.1			
Connected Load	0.4	W/m²	0.7	W/m²	0.2	W/m²	0.8	W/m²	0.2	W/m²	3	W/m²
	0.0	W/ft²	0.1	W/ft²	0.02	W/ft²	0.07	W/ft²	0.02	W/ft²	0.28	W/ft²
Diversity Occupied Period	85%		85%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		50%		10%		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)	5.1	W/m²	0.5	W/ft²
Total end-use load (unocc. period)	0.7	W/m²	0.1	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	1.7
	MJ/m².yr	67

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% | Electricity Fuel Share: 17.0%

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.2
	MJ/m².yr	10.0		MJ/m².yr	9.6

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	1.1
	MJ/m².yr	43

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Medium Retail Baseline
SIZE: 50,000 - 100,000 ft2
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
	Hot Water System						Electric	
System Present (%)	95%	0%	0%	1%	0%	0%	4%	100%
Eff./COP	69%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.45	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load: 32.9 W/m² — 10.4 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 90 MJ/m².yr — 2.3 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% — Gas Fuel Share: 95.0% — Oil Fuel Share: 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.1	3.4	3.3
MJ/m².yr	82	130	128

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	3	5.4	4.4	3.6	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.33	0.19	0.23	0.28	0.34	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: 90 W/m² — 29 Btu/hr.ft² — 420 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 117.0 MJ/m².yr — 3.0 kWh/ft².yr

Sizing Factor: 1.00

A/C Saturation (Incidence of A/C): 95.0%

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	1.3	0.0	1.3
MJ/m².yr	49	0	49

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	32.00%	8.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	40%		60%
Blended Efficiency	0.56		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 17.3

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.8	0.6
MJ/m².yr	19	31	23.8

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

HVAC ELECTRICITY

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	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.5	W/m²	0.33	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	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	85%	15%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit area	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.43	W/m²	0.23	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	0.006	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	5500	hrs./year
Supply Fan Unocc. Period	3260	hrs./year
Supply Fan Energy Consumption	29.2	kWh/m².yr
Exhaust Fan Occ. Period	5500	hrs./year
Exhaust Fan Unocc. Period	3260	hrs./year
Exhaust Fan Energy Consumption	1.1	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	7000	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	112.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:			
Electricity:	21.6 kWh/ft².yr	835.7 MJ/m².yr	
Gas:	3.7 kWh/ft².yr	144.1 MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	13.2	510.8
ARCHITECTURAL LIGHTING	0.8	30.3
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.7	67.0
HVAC ELECTRICITY	2.9	112.3
REFRIGERATION EQUIPMENT	0.2	8.6
MISCELLANEOUS EQUIPMENT	1.1	43.3

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.1	4.1	3.2	123.5
SPACE COOLING	1.2	46.4	0.0	0.0
SERVICE HOT WATER	0.3	11.4	0.3	12.4
FOOD SERVICE EQUIPMENT	0.0	1.6	0.2	8.3

Summary Building Profile

Building Type:	New Food Retail	**Location:**	Lower Mainland

Description: This archetype is based on generic commercial design practices for new construction. BC Hydro's Design Assistance Program has seen little interest from the retail food sector in efficient new construction.

New construction is assumed to be little changed from the existing stock except for a few components such as fluorescent lighting (default new construction is assumed to be T8 lighting). Windows are assumed to be double pane. DX cooling performance of packaged rooftop heat-cool units is assumed to be EER 9.5.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 13,000 ft²
- single storey

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.79	
window to wall ratio	0.11	

General Lighting & LPD 600 Lux 22.8 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	2%	3%	0%	0%	15%	80%

Architectural Lighting & LPD 420 Lux 12.6 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	0%	0%	0%	0%	80%	20%

Overall LPD 20.5 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	5.1	L/s.m²	1.01	CFM/ft²
Fan Power	10.6	W/m²	0.99	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	20%	0%	20%	60%	0%	

Calculated Capacity 132 W/m² 286 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.1	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	3.6	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	527	13.6		
Architectural Lighting	40	1.0		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	21	0.5	337.6	8.7
Space Cooling	56	1.5	0.0	8.7
HVAC Equipment	146	3.8		
DHW	10	0.3	65.6	1.7
Refrigeration Equipment	1125	29.0		
Food Service Equipment	3	0.1	103.8	0.0
Miscellaneous	57	1.5		
Total	**2102**	**54.3**	**507.0**	**19**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Food Retail** **Baseline** | **SIZE:** **0** | **VINTAGE:** | **REGION:** **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	1,225	m²	13,181	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	1,225	m²	13,181	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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)	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	70	L/s.person	148	CFM/person

%OA 30.46%

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: 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	5.11	L/s.m²	1.01	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	

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	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	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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Food Retail	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	22.8	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	65%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	50%	50%	0%				100%
Weighted Average								**600**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	2%	3%	0%	0%	15%	80%	0%	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 13.6
MJ/m².yr 527

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	420	Lux	39.0	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	12.6	W/m²	1.2	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	40%	60%	0%	0%				100%
Weighted Average								**420**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 1.0
MJ/m².yr 40

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0
MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 15; MJ/m².yr 567

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	3.7	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	3.7	W/m²	0.3	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 3.0
MJ/m².yr 116

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.2	0.5
MJ/m².yr	125.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 29.0
MJ/m².yr 1125.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.5
MJ/m².yr 57

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Food Retail Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	90%	0%	0%	5%	0%	0%	5%	100%
Eff./COP	80%	88%	95%	3.20	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.25	1.14	1.05	0.31	0.33	0.22	1.00	

Peak Heating Load: 47.9 W/m² — 15.2 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 300 MJ/m².yr — 7.7 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Gas Fuel Share: 90.0% — Oil Fuel Share: 0.0%

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	5.5	212
Natural Gas EUI	9.7	375
Market Composite EUI	9.3	359

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	20.0%	0.0%	20.0%	60.0%	0.0%	0.0%	100.0%
COP	4.7	5.2	4.4	3.2	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.31	0.34	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: 132 W/m² — 42 Btu/hr.ft² — 286 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 133.6 MJ/m².yr — 3.4 kWh/ft².yr

Sizing Factor: 1.00

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 Maintenar

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	1.7	66
Natural Gas EUI	0.0	0
Market Composite EUI	1.7	66

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	72.00%	8.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.56	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 45.5

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.3	50
Natural Gas EUI	2.1	82
Market Composite EUI	2.0	75.6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Food Retail	0		Lower Mainland
Baseline			

HVAC ELECTRICITY

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	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.3	W/m²	0.49	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	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	0.2	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.57	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	0.007	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	0.008	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.11	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	28.8	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	1.1	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	7.6	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	3.8
	MJ/m².yr	146.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Food Retail	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**54.3**	kWh/ft².yr	**2,102.2**	MJ/m².yr	**Gas:**	**13.1** kWh/ft².yr **507.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	13.6	527.2					
ARCHITECTURAL LIGHTING CORF	1.0	39.7	SPACE HEATING	0.5	21.2	8.7	337.6
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	1.5	56.2	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	3.0	116.3	SERVICE HOT WATER	0.3	10.0	1.7	65.6
HVAC ELECTRICITY	3.8	146.2	FOOD SERVICE EQUIPMENT	0.1	3.4	2.7	103.8
REFRIGERATION EQUIPMENT	29.0	1,125.0					
MISCELLANEOUS EQUIPMENT	1.5	57.0					

Summary Building Profile

Building Type: New Large Hotel	**Location:** Lower Mainland
Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Hydro's Hotel/Motel Load Research Study (1996).	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 200,000 ft² - 10 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.4	

GENERAL LIGHTING (SUITES) 125 Lux 8.5 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
25%	65%	0%	0%	10%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 15.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	40%	0%	0%	45%	

Overall LPD 6.4 W/m²

Plug Loads (office equipment) EPD 2.9 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Fan Coils
66%	0%	0%	0%	0%	34%

System air Flow	3.6	L/s.m²	0.71	CFM/ft²
Fan Power	9.5	W/m²	0.88	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	33%	33%	33%	0%	0

Calculated Capacity 92 W/m² 410 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8	W/m²	0.1	W/ft²
Condenser Pumps	0.6	W/m²	0.1	W/ft²
Condenser Fan Size	2.5	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	95	2.5		
Lobby, Ballrooms, Corridors, Back-of-house	95	2.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	93	2.4		
Space Heating	18	0.5	281.1	7.3
Space Cooling	40	1.0	0.0	7.3
HVAC Equipment	122	3.1		
DHW	13	0.3	296.7	7.7
Refrigeration Equipment	25	0.6		
Food Service Equipment	0	0.0	116.2	3.0
Miscellaneous	53	1.4		
Total	**554**	**14.3**	**694.0**	**25**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Hotel	> 100,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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) (%)	0.40								
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	FCoils	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	34.61%
Occupancy Schedule Occ. Period	45%					
Occupancy Schedule Unocc. Period	80%					
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	1.6			
Total Air Circulation or Design Air Flow	3.61	L/s.m²	0.71	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	

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	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)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Hotel	**> 100,000 ft2**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	8.5	W/m²	0.8	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	40%
Usage During Unoccupied Period	50%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	75%	25%	0%				100%
Weighted Average								**125**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	65%	0%	0%	10%	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	2.5
	MJ/m².yr	95

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	15.4	W/m²	1.4	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	85%
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	40%	0%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.5
	MJ/m².yr	95

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	190

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0		0		0		0		0			
Connected Load	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	4.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.00	W/ft²	0.00	W/ft²	0.39	W/ft²
Diversity Occupied Period	0%		0%		0%		0%		0%		70%	
Diversity Unoccupied Period	0%		0%		0%		0%		0%		70%	
Operation Occ. Period (hrs./year)	0		0		0		0		0		3000	
Operation Unocc. Period (hrs./year)	8760		8760		8760		8760		8760		5760	

Total end-use load (occupied period)	2.9	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	2.9	W/m²	0.3	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	2.4
	MJ/m².yr	93

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	3.6	EUI	kWh/ft².yr	0.1
	MJ/m².yr	140.0		MJ/m².yr	2.4

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI	kWh/ft².yr	1.4
	MJ/m².yr	53

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Large Hotel Baseline | **SIZE:** > 100,000 ft2 | **VINTAGE:** | **REGION:** Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	90%	0%	3%	2%	0%	5%	100%
Eff./COP	75%	83%	95%	3.20	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.31	0.29	0.22	1.00	

Peak Heating Load: 37.6 W/m² — 11.9 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 259 MJ/m².yr — 6.7 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Gas Fuel Share: 90.0% — Oil Fuel Share: 0.0%

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%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	4.6	180
Natural Gas EUI	8.1	312
Market Composite EUI	7.7	299

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	HE	Screw Chillers	Reciprocating Chillers Open	DX	Absorption Chillers W. H.	CW	Total
System Present (%)	0.0%	33.3%	0.0%	33.3%	33.4%	0.0%	0.0%	100.0%
COP	4.7	5.2	4.4	3.5	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.34	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: 92 W/m² — 29 Btu/hr.ft² — 410 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 115.0 MJ/m².yr — 3.0 kWh/ft².yr

Sizing Factor: 0.90

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 Maintenar

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.3	50
Natural Gas EUI	0.0	0
Market Composite EUI	1.3	50

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	0.00%	0.00%	0.00%	90.20%	4.80%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	95%	5%
Blended Efficiency	0.76	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 236.6

Wetting Use Percentage: 90%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	6.7	260
Natural Gas EUI	8.1	312
Market Composite EUI	8.0	309.7

NEW BUILDINGS: **New Large Hotel** **Baseline**
SIZE: **> 100,000 ft2**
VINTAGE:
REGION: **Lower Mainland**

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.6	L/s.m²	0.71	CFM/ft²
System Static Pressure CAV	375	Pa	1.5	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	3.2	W/m²	0.30	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	100%	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.49	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	0.55	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.006	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	23.8	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	1.6	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	3.1
	MJ/m².yr	121.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Hotel	**> 100,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **14.3** kWh/ft².yr **554.2** MJ/m².yr **Gas:** **17.9** kWh/ft².yr **694.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	2.5	95.4
LOBBY, BALLROOMS, CORRIDORS	2.5	94.9
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.4	92.7
HVAC ELECTRICITY	3.1	121.7
REFRIGERATION EQUIPMENT	0.6	25.0
MISCELLANEOUS EQUIPMENT	1.4	53.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	18.0	7.3	281.1
SPACE COOLING	1.0	40.1	0.0	0.0
SERVICE HOT WATER	0.3	13.0	7.7	296.7
FOOD SERVICE EQUIPMENT	0.0	0.4	3.0	116.2

Summary Building Profile

Building Type: New Medium Hotel	**Location:** Lower Mainland
Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Hydro's Hotel/Motel Load Research Study (1996).	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 64,560 ft² - 4 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.57	
window to wall ratio	0.4	

GENERAL LIGHTING (SUITES) 125 Lux 9.1 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
30%	60%	0%	0%	10%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 14.8 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	30%	0%	0%	55%	

Overall LPD 6.8 W/m²

Plug Loads (office equipment) EPD 3.2 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	F.coils/Ptac
66%	0%	0%	0%	0%	34%

System air Flow	3.7	L/s.m²	0.72	CFM/ft²
Fan Power	12.8	W/m²	1.19	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	25%	75%	0%	0%

Calculated Capacity 69 W/m² 546 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.6	W/m²	0.1	W/ft²
Condenser Pumps	0.4	W/m²	0.0	W/ft²
Condenser Fan Size	1.9	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	103	2.6		
Lobby, Ballrooms, Corridors, Back-of-house	92	2.4		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	93	2.4		
Space Heating	20	0.5	130.4	3.4
Space Cooling	30	0.8	0.0	3.4
HVAC Equipment	111	2.9		
DHW	52	1.3	249.9	6.5
Refrigeration Equipment	25	0.6		
Food Service Equipment	0	0.0	83.0	2.1
Miscellaneous	53	1.4		
Total	**577**	**14.9**	**463.3**	**15**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Medium Hotel** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	6,000	m²	64,560	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	1,500	m²	16,140	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	FCoils	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	21.89%
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
(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	3.65	L/s.m²	0.72	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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Hotel	50,000 to 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	9.1	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	2100			
Unocc. Period(Hrs./yr.)	6660			
Usage During Occupied Period	40%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	75%	25%	0%	100%
Weighted Average					**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	30%	60%	0%	0%	10%	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 103

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	14.8	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	30%	0%	0%	55%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.4; MJ/m².yr 92

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 5; MJ/m².yr 194

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.37 W/ft²
Diversity Occupied Period	0%	0%	0%	0%	0%	80%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	70%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	3.2 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	2.8 W/m²	0.3 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 2.4; MJ/m².yr 93

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Kitchen services

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	2.6	0.1
MJ/m².yr	100.0	2.4

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 1.4; MJ/m².yr 53

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
New Medium Hotel **50,000 to 100,000 ft²** **Lower Mainland**
Baseline

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	80%	0%	10%	0%	0%	10%	100%
Eff./COP	75%	83%	95%	3.20	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.31	0.33	0.22	1.00	

Peak Heating Load	47.7	W/m²	15.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	135	MJ/m².yr	3.5	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 20.0% Gas Fuel Share 80.0% Oil Fuel Share 0.0%

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	100
Natural Gas EUI	kWh/ft².yr	4.2
	MJ/m².yr	163
Market Composite EUI	kWh/ft².yr	3.9
	MJ/m².yr	150

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	25.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.5	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.34	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	69	W/m²	22	Btu/hr.ft²	546	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	112.7	MJ/m².yr	2.9	kWh/ft².yr		
Sizing Factor	0.85					
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	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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	0.00%	0.00%	0.00%	76.00%	4.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.76		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.7	8.1	7.8
MJ/m².yr	260	312	301.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Medium Hotel Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Lower Mainland

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.7	L/s.m²	0.72	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	2.9	W/m²	0.27	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	Continuous	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 area	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)	1.87	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	0.004	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	0.41	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.004	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	22.2	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	1.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	2.9
	MJ/m².yr	110.6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Hotel	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.9** kWh/ft².yr	**577.3** MJ/m².yr	**Gas:**	**12.0** kWh/ft².yr	**463.3** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING (SUITES)	2.6	102.6					
LOBBY, BALLROOMS, CORRIDORS	2.4	91.6	SPACE HEATING	0.5	19.9	3.4	130.4
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	0.8	29.5	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.4	92.6	SERVICE HOT WATER	1.3	52.0	6.5	249.9
HVAC ELECTRICITY	2.9	110.6	FOOD SERVICE EQUIPMENT	0.0	0.4	2.1	83.0
REFRIGERATION EQUIPMENT	0.6	25.0					
MISCELLANEOUS EQUIPMENT	1.4	53.0					

Summary Building Profile

Building Type: New Hospital

Location: Lower Mainland

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and generic commercial design practices.

The archetype is also based on current design trends for new hospitals that include:
- move towards CAV systems due to better ability to pressurize and limit cross-contamination
- higher total fan system pressures from increased filtration (6 inches) with consequent higher fan loads and energy use
- higher plug loads from increased density of diagnostic equipment.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 150,000 ft²
- 10 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.38	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.74	
window to wall ratio	0.2	

PATIENT ROOMS 300 Lux 7.7 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIE, ICU, RECOVERY 700 Lux 18.1 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

Overall LPD 2.3 W/m²

Plug Loads (office equipment) EPD 7.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Fcoils
50%	20%	0%	0%	0%	30%

System air Flow	5.8	L/s.m²	1.14	CFM/ft²
Fan Power	13.1	W/m²	1.21	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	100%	0%	0%	0%	0

Calculated Capacity 111 W/m² 342 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.7	W/m²	0.1	W/ft²
Condenser Pumps	1.1	W/m²	0.1	W/ft²
Condenser Fan Size	1.4	W/m²	0.1	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Patient Rooms	23	0.6		
Nursing Stations, Examination, Laboratories	93	2.4		
Corridors, Other	90	2.3		
Plug Loads & Office Equipment	166	4.3		
Space Heating	0	0.0	890.0	23.0
Space Cooling	45	1.2	0.0	23.0
HVAC Equipment	329	8.5		
DHW	0	0.0	156.2	4.0
Refrigeration Equipment	15	0.4		
Food Service Equipment	1	0.0	99.6	0.0
Miscellaneous	30	0.8		
Total	**793**	**20.5**	**1145.8**	**50**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Hospital	**0**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft² .°F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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)	0.74				Typical # Stories	10			
					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	FCoils	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	40.15%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	75%					
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	2.3			
Total Air Circulation or Design Air Flow	5.81	L/s.m²	1.14	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	

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	24	°C	75.2	°F	16.5	°C	61.7	°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	24	°C	75.2	°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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Hospital	0		Lower Mainland
Baseline			

LIGHTING

PATIENT ROOMS

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (GLFF)	0.30			
Connected Load	7.7	W/m²	0.7	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	50%
Usage During Unoccupied Period	25%

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	0%	0%	100%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	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	0.6
	MJ/m².yr	23

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY

Light Level	700	Lux	65.1	ft-candles
Floor Fraction (ALFF)	0.35			
Connected Load	18.1	W/m²	1.7	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	60%
Usage During Unoccupied Period	40%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	0%	100%	0%	100%
Weighted Average					**700**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.4
	MJ/m².yr	93

CORRIDORS, OTHER

Light Level	250.00	Lux	23.2	ft-candles
Floor Fraction (HBLFF)	0.35			
Connected Load	8.2	W/m²	0.8	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	100%
Usage During Unoccupied Period	100%

Light Level (Lux)	200	300	500	700	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**250**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	0%	0%	90%	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	2.3
	MJ/m².yr	90

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	207

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.05	0.05	0	0	0	
Connected Load	0.1 W/m²	0.1 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	15 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	1.39 W/ft²
Diversity Occupied Period	90%	90%	0%	0%	0%	50%
Diversity Unoccupied Period	40%	40%	0%	0%	0%	30%
Operation Occ. Period (hrs./year)	0	0	0	0	0	2000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	6760

Total end-use load (occupied period)	7.7	W/m²	0.7	W/ft²
Total end-use load (unocc. period)	4.6	W/m²	0.4	W/ft²

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EUI	kWh/ft².yr	4.3
	MJ/m².yr	166

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food services

	Natural Gas EUI			All Electric EUI	
EUI	kWh/ft².yr	3.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	120.0		MJ/m².yr	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Hospital Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	100%	0%	0%	0%	0%	0%	0%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	36.4 W/m²	11.5 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	668 MJ/m².yr	17.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	0.0%	Gas Fuel Share 100.0%	Oil Fuel Share 0.0%

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	0.0	0
Natural Gas EUI	23.0	890
Market Composite EUI	23.0	890

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
COP	4.7	6.1	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.16	0.23	0.28	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	111 W/m²	35 Btu/hr.ft²	342 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	133.6 MJ/m².yr	3.4 kWh/ft².yr	
Sizing Factor	0.65		
A/C Saturation (Incidence of A/C)	100.0%		
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 Maintenar

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	1.2	45
Natural Gas EUI	0.0	0
Market Composite EUI	1.2	45

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	0.00%	0.00%	0.00%	95.00%	5.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	100%	0%
Blended Efficiency	0.76	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 118.3

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	3.4	130
Natural Gas EUI	4.0	156
Market Composite EUI	4.0	156.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Hospital, Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

HVAC ELECTRICITY

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	1.66	W/ft²
Fan Design Load VAV	13.1	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%	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)	0.5	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)	1.44	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	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	1.11	W/m²	0.10	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	75.3	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	3.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.0	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	8.5
	MJ/m².yr	329.4

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Hospital	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.5** kWh/ft².yr	**793.2** MJ/m².yr	**Gas:**	**29.6** kWh/ft².yr	**1,145.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
PATIENT ROOMS	0.6	22.7
NURSING STATIONS, EXAMINATIO	2.4	93.5
CORRIDORS, OTHER	2.3	90.4
OFFICE EQUIPMENT & PLUG LOAI	4.3	166.5
HVAC ELECTRICITY	8.5	329.4
REFRIGERATION EQUIPMENT	0.4	15.0
MISCELLANEOUS EQUIPMENT	0.8	30.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.0	0.0	23.0	890.0
SPACE COOLING	1.2	45.1	0.0	0.0
SERVICE HOT WATER	0.0	0.0	4.0	156.2
FOOD SERVICE EQUIPMENT	0.0	0.7	2.6	99.6

Summary Building Profile

Building Type:	New Nursing Home	**Location:**	Lower Mainland

Description: This archetype is based on knowledge of current commercial construction practices and seen in BC Hydro's Design Assistance Program and NRCan's CBIP Program.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 60,000 ft²
- 2 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.44	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.2	

GENERAL LIGHTING (SUITES) 200 Lux 8.5 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
10%	25%	0%	0%	65%	

SERVICES, KITCHEN, OFFICES, DINNING, RECREATION 400 Lux 14.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
5%	20%	0%	0%	70%	

Overall LPD 6.4 W/m²

Plug Loads (office equipment) EPD 2.5 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	3.0	L/s.m²	0.59	CFM/ft²
Fan Power	0.0	W/m²	0.00	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	20%	80%	0%	0

Calculated Capacity 97 W/m² 389 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8	W/m²	0.1	W/ft²
Condenser Pumps	0.5	W/m²	0.0	W/ft²
Condenser Fan Size	2.6	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	91	2.4		
Services, Kitchen, Offices, Dining, Recreation	89	2.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	63	1.6	516.0	13.3
Space Cooling	22	0.6	0.0	13.3
HVAC Equipment	135	3.5		
DHW	15	0.4	171.7	4.4
Refrigeration Equipment	30	0.8		
Food Service Equipment	1	0.0	116.2	3.0
Miscellaneous	40	1.0		
Total	**544**	**14.1**	**803.9**	**34**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.44	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	5,600	m²	60,256	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	2,800	m²	30,128	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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) (%)	0.20								
Shading Coefficient (SC)	0.65				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	FCoils	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%	0%	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	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	44	L/s.person	93	CFM/person

%OA 48.72%

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	1.45			
Total Air Circulation or Design Air Flow	3.01	L/s.m²	0.59	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	

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	24	°C	75.2	°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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Nursing Home	50,000 to 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	200 Lux	18.6	ft-candles
Floor Fraction (GLFF)	0.75		
Connected Load	8.5 W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	4000		
Unocc. Period(Hrs./yr.)	4760		
Usage During Occupied Period	70%		
Usage During Unoccupied Period	25%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	0%	100%	0%	100%
Weighted Average					**200**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	25%	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 2.4; MJ/m².yr 91

SERVICES, KITCHEN, OFFICES, DINNING, RECREATION

Light Level	400 Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.25		
Connected Load	14.6 W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3000		
Unocc. Period(Hrs./yr.)	5760		
Usage During Occupied Period	90%		
Usage During Unoccupied Period	70%		
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 (%)	5%	20%	0%	0%	70%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.3; MJ/m².yr 89

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 5; MJ/m².yr 180

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	3.5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.33 W/ft²
Diversity Occupied Period	0%	0%	0%	0%	0%	70%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	45%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	2.5 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	1.6 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.5; MJ/m².yr 59

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation equipment

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.6	0.1
MJ/m².yr	140.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 1.0; MJ/m².yr 40

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Nursing Home	50,000 to 100,000 ft²		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	85%	0%	0%	5%	0%	0%	10%	100%
Eff./COP	77%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.30	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 37.8 W/m² — 12.0 Btu/hr.ft²

Seasonal Heating Load (Tertiary Load): 467 MJ/m².yr — 12.1 kWh/ft².yr

Sizing Factor: 1.00

Electric Fuel Share: 15.0% — Gas Fuel Share: 85.0% — Oil Fuel Share: 0.0%

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	10.9	421
Natural Gas EUI	15.7	607
Market Composite EUI	15.0	579

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	20.0%	80.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.5	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.33	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: 97 W/m² — 31 Btu/hr.ft² — 389 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 94.8 MJ/m².yr — 2.4 kWh/ft².yr

Sizing Factor: 0.85

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 Maintenar

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	1.1	44
Natural Gas EUI	0.0	0
Market Composite EUI	1.1	44

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	13.50%	4.50%	0.00%	70.20%	1.80%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.72	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 136.5

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	3.9	150
Natural Gas EUI	4.9	191
Market Composite EUI	4.8	186.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.0	L/s.m²	0.59	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.6	W/m²	0.34	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	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)	0.5	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.63	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	45	kPa	15	ft
Pump Efficiency	55%			
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	0.006	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	23.7	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	1.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	3.5
	MJ/m².yr	134.6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.1** kWh/ft².yr	**544.4** MJ/m².yr	**Gas:**	**20.8** kWh/ft².yr	**803.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	2.4	91.4
SERVICES, KITCHEN, OFFICES, DII	2.3	88.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.1
HVAC ELECTRICITY	3.5	134.6
REFRIGERATION EQUIPMENT	0.8	30.0
MISCELLANEOUS EQUIPMENT	1.0	40.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.6	63.2	13.3	516.0
SPACE COOLING	0.6	21.9	0.0	0.0
SERVICE HOT WATER	0.4	15.0	4.4	171.7
FOOD SERVICE EQUIPMENT	0.0	0.7	3.0	116.2

Summary Building Profile

Building Type: New Large Schools	Location: Lower Mainland
Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Green Buildings Program.	**Average Building:** The average building characteristics used to define this building profile are as follows: - average building size 100,000 ft² - average footprint 50,000 ft² assumes a 100' x 500' footprint - mainly one storey

Building Specifications:

roof construction:	0.28	W/m².°C
wall construction:	0.44	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.45	
window to wall ratio	0.15	

General Lighting & LPD 450 Lux 11.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

Architectural Lighting & LPD 300 Lux 8.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
2%	8%	0%	0%	90%	

Overall LPD 9.9 W/m²

Plug Loads (office equipment) EPD 2.4 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
80%	20%	0%	0%	0%	

System air Flow	4.0	L/s.m²	0.79	CFM/ft²
Fan Power	3.8	W/m²	0.35	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	100%	0%	0

Calculated Capacity 120 W/m² 316 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0	W/m²	0.1	W/ft²
Condenser Pumps	0.7	W/m²	0.1	W/ft²
Condenser Fan Size	3.2	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	132	3.4		
Architectural Lighting	11	0.3		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	36	0.9		
Space Heating	28	0.7	491.8	12.7
Space Cooling	15	0.4	0.0	12.7
HVAC Equipment	108	2.8		
DHW	2	0.0	24.7	0.6
Refrigeration Equipment	2	0.1		
Food Service Equipment	0	0.0	4.2	0.0
Miscellaneous	12	0.3		
Total	**362**	**9.3**	**520.6**	**26**

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Interior
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.53	W/m².°C	0.09	Btu/hr.ft² .°F
Roof U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	4.40	W/m².°C	0.77	Btu/hr.ft² .°F
Window/Wall Ratio (WIWAR) (%)	0.16			
Shading Coefficient (SC)	0.89			

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	10	L/s.person	21	CFM/person

%OA 27.36%

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			
Total Air Circulation or Design Air Flow	3.66	L/s.m²	0.72	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	

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:**
Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.85			
Connected Load	12.3	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	30%			
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 (%)	0%	0%	40%	10%	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	4.2
	MJ/m².yr	161

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	13.8	W/m²	1.3	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	30%	10%	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 = Load X Hrs. X SF X GLFF

EUI		
EUI	kWh/ft².yr	0.4
	MJ/m².yr	17

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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		
EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	194

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0.08		0.08		0.03		0.02		0.02			
Connected Load	0.4	W/m²	0.7	W/m²	0.2	W/m²	0.4	W/m²	0.1	W/m²	0.4	W/m²
	0.0	W/ft²	0.1	W/ft²	0.01	W/ft²	0.04	W/ft²	0.01	W/ft²	0.04	W/ft²
Diversity Occupied Period	85%		85%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		50%		10%		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)	1.9	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.5	W/m²	0.0	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	0.8
	MJ/m².yr	31

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	2.1

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Schools** **Baseline**

SIZE: **> 50,000 ft2**

VINTAGE:

REGION: **Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	90%	0%	0%	5%	0%	0%	5%	100%
Eff./COP	73%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	47.6 W/m²	15.1 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	337 MJ/m².yr	8.7 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Gas Fuel Share 90.0%	Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.5	11.9	11.4
MJ/m².yr	250	462	441

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	2.0%	0.0%	0.0%	3.0%	95.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.37	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	13.0 °C	55.4 °F

Peak Cooling Load	113 W/m²	36 Btu/hr.ft²	335 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	139.6 MJ/m².yr	3.6 kWh/ft².yr	
Sizing Factor	1.00		
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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	1.7	0.0	1.7
MJ/m².yr	66	0	66

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	50.00%				50.00%
Eff./COP	0.520				0.750

	Fossil		Elec. Res.
Fuel Share	100%		0%
Blended Efficiency	0.64		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load)	17.3
Wetting Use Percentage	90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.7	0.7
MJ/m².yr	19	27	27.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Schools Baseline | **SIZE:** > 50,000 ft2 | **VINTAGE:** | **REGION:** Interior

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.7	L/s.m²	0.72	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	3.5	W/m²	0.32	W/ft²
Fan Design Load VAV	3.5	W/m²	0.32	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	Continuous	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 area	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)	3.05	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	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.67	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	4000	hrs./year
Supply Fan Unocc. Period	4760	hrs./year
Supply Fan Energy Consumption	23.6	kWh/m².yr
Exhaust Fan Occ. Period	4000	hrs./year
Exhaust Fan Unocc. Period	4760	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	1.1	kWh/m².yr
Circulating Pump Yearly Operation	4000	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	2.9
	MJ/m².yr	113.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **10.1** kWh/ft².yr **390.1** MJ/m².yr **Gas:** **11.5** kWh/ft².yr **447.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	161.1
ARCHITECTURAL LIGHTING	0.4	17.4
OTHER (HIGH BAY) LIGHTING	0.4	15.1
OFFICE EQUIPMENT & PLUG LOAI	0.8	30.5
HVAC ELECTRICITY	2.9	113.1
REFRIGERATION EQUIPMENT	0.1	2.1
MISCELLANEOUS EQUIPMENT	0.3	12.2

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	25.0	10.7	415.8
SPACE COOLING	0.3	13.2	0.0	0.0
SERVICE HOT WATER	0.0	0.0	0.7	27.2
FOOD SERVICE EQUIPMENT	0.0	0.4	0.1	4.2

Summary Building Profile

Building Type:	New Medium Schools	Location:	Lower Mainland

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Green Buildings Program

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 24,700 ft²
- average footprint 24,700 ft² assumes a 70' x 350' footprint
- one storey

Building Specifications:

roof construction:	0.35	W/m².°C
wall construction:	0.6	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.45	
window to wall ratio	0.15	

General Lighting & LPD 450 Lux 11.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

Architectural Lighting & LPD 300 Lux 8.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
2%	8%	0%	0%	90%	

Overall LPD 9.9 W/m²

Plug Loads (office equipment) EPD 2.4 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
90%	10%	0%	0%	0%	

System air Flow	2.8	L/s.m²	0.56	CFM/ft²
Fan Power	1.3	W/m²	0.13	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	100%	0%	0

Calculated Capacity 113 W/m² 335 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0	W/m²	0.1	W/ft²
Condenser Pumps	0.7	W/m²	0.1	W/ft²
Condenser Fan Size	3.1	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	118	3.0		
Architectural Lighting	11	0.3		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	36	0.9		
Space Heating	25	0.7	756.2	19.5
Space Cooling	15	0.4	0.0	19.5
HVAC Equipment	51	1.3		
DHW	2	0.0	26.0	0.7
Refrigeration Equipment	1	0.0		
Food Service Equipment	0	0.0	4.2	0.7
Miscellaneous	6	0.2		
Total	**281**	**7.2**	**786.3**	**40**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Medium Schools** **Baseline**

SIZE: **< 50,000 ft2**

VINTAGE:

REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space	50%			
Window/Wall Ratio (WIWAR) (%)	0.15				Defined as Exterior Zone				
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	45.69%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	13	L/s.person	28	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	1.2			
Total Air Circulation or Design Air Flow	2.85	L/s.m²	0.56	CFM/ft²

Separate Make-up air unit (100% OA): 0 L/s.m² 0.00 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)

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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Schools	< 50,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.85			
Connected Load	11.6	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
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	25%	75%	0%	0%				100%
Weighted Average								**450**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	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	3.0
	MJ/m².yr	118

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	8.9	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	2%	8%	0%	0%	90%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	11

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.4
	MJ/m².yr	15

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	4
	MJ/m².yr	144

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.08	0.08	0.03	0.02	0.02	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.4 W/m²	0.1 W/m²	0.9 W/m²
	0.0 W/ft²	0.1 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.08 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	2.4 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	0.5 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	1.1

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	0.2
	MJ/m².yr	6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Medium Schools Baseline | **SIZE:** < 50,000 ft2 | **VINTAGE:** | **REGION:** Lower Mainland

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	95%	0%	2%	0%	0%	3%	100%
Eff./COP	73%	83%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.20	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	53.7	W/m²	17.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	661	MJ/m².yr	17.1	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% | Gas Fuel Share 95.0% | Oil Fuel Share 0.0%

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	13.0	505
Natural Gas EUI	20.5	796
Market Composite EUI	20.2	781

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.33	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	113	W/m²	36	Btu/hr.ft²	335	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	84.8	MJ/m².yr	2.2	kWh/ft².yr		

Sizing Factor 1.00

A/C Saturation (Incidence of A/C) 40.0%

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	1.0	37
Natural Gas EUI	0.0	0
Market Composite EUI	1.0	37

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	45.00%	37.80%	1.80%	0.00%	5.40%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.60		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 17.3

Wetting Use Percentage 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.5	19
Natural Gas EUI	0.7	29
Market Composite EUI	0.7	27.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Medium Schools Baseline
SIZE: < 50,000 ft2
VINTAGE:
REGION: Lower Mainland

HVAC ELECTRICITY

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	0.13	W/ft²
Fan Design Load VAV	1.3	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	90%	10%	100%	
Operation	Continuous	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 area	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)	3.05	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	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.67	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	3000	hrs./year
Supply Fan Unocc. Period	5760	hrs./year
Supply Fan Energy Consumption	7.6	kWh/m².yr
Exhaust Fan Occ. Period	3000	hrs./year
Exhaust Fan Unocc. Period	5760	hrs./year
Exhaust Fan Energy Consumption	1.5	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	3000	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	1.3
	MJ/m².yr	51.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**7.2** kWh/ft².yr	**280.6** MJ/m².yr	**Gas:**	**20.3** kWh/ft².yr
					786.3 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	3.0	117.8					
ARCHITECTURAL LIGHTING	0.3	11.1	SPACE HEATING	0.7	25.3	19.5	756.2
OTHER (HIGH BAY) LIGHTING	0.4	15.1	SPACE COOLING	0.4	15.0	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	0.9	35.9	SERVICE HOT WATER	0.0	1.9	0.7	26.0
HVAC ELECTRICITY	1.3	51.3	FOOD SERVICE EQUIPMENT	0.0	0.2	0.1	4.2
REFRIGERATION EQUIPMENT	0.0	1.1					
MISCELLANEOUS EQUIPMENT	0.2	6.0					

Summary Building Profile

Building Type:	New University-Colleg	**Location:**	Lower Mainland

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 90,000 ft²
- average footprint 45,000 ft² with a 7:1 length to aspect ratio
- 2 stories

Building Specifications:		
roof construction:	0.28	W/m².°C
wall construction:	0.44	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.45	
window to wall ratio	0.3	

General Lighting & LPD 500 Lux 12.2 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
0%	0%	0%	0%	95%	5%

Architectural Lighting & LPD 300 Lux 10.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
5%	15%	0%	0%	80%	

Overall LPD 11.0 W/m²

Plug Loads (office equipment) EPD 4.1 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
50%	50%	0%	0%	0%	

System air Flow	4.0	L/s.m²	0.78	CFM/ft²
Fan Power	7.9	W/m²	0.73	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
0%	25%	0%	0%	75%	0%	

Calculated Capacity 107 W/m² 355 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.9	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	183	4.7		
Architectural Lighting	33	0.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	10	0.3	309.5	8.0
Space Cooling	11	0.3	0.0	8.0
HVAC Equipment	153	3.9		
DHW	3	0.1	27.7	0.7
Refrigeration Equipment	20	0.5		
Food Service Equipment	3	0.1	16.6	0.0
Miscellaneous	75	1.9		
Total	**549**	**14.2**	**353.8**	**17**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New University-Colleges	0		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.44	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	9,000	m²	96,840	ft²
Roof U value (W/m².°C)	0.28	W/m².°C	0.05	Btu/hr.ft² .°F	Typical Footprint (m²)	4,500	m²	48,420	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	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 (%)	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	30.58%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	17	L/s.person	36	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	1.65			
Total Air Circulation or Design Air Flow	3.97	L/s.m²	0.78	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	

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	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	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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New University-Colleges	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.90		
Connected Load	12.2 W/m²	1.1	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	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	95%	5%	0%	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

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.10		
Connected Load	10.4 W/m²	1.0	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	15%	0%	0%	80%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 0.8
MJ/m².yr 33

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0
MJ/m².yr 0

TOTAL LIGHTING

EUI TOTAL kWh/ft².yr 6
MJ/m².yr 215

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.1	0.1	0.15	0.05	0.05	
Connected Load	0.4 W/m²	0.6 W/m²	0.5 W/m²	0.7 W/m²	0.2 W/m²	2 W/m²
	0.0 W/ft²	0.1 W/ft²	0.05 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	4.1 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	1.2 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.5
MJ/m².yr 59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.5	0.5
MJ/m².yr	20.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.5
MJ/m².yr 20.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.9
MJ/m².yr 75

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New University-Colleges** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	95%	0%	2%	0%	1%	2%	100%
Eff./COP	75%	83%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	40.4	W/m²	12.8	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	270	MJ/m².yr	7.0	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% Gas Fuel Share 95.0% Oil Fuel Share 0.0%

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	201
Natural Gas EUI	kWh/ft².yr	8.4
	MJ/m².yr	326
Market Composite EUI	kWh/ft².yr	8.2
	MJ/m².yr	320

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.33	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	107	W/m²	34	Btu/hr.ft²	355	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	116.0	MJ/m².yr	3.0	kWh/ft².yr		

Sizing Factor 1.00

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	4.50%	4.50%	0.00%	76.50%	4.50%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.6	0.8	0.8
MJ/m².yr	25	31	30.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New University-Colleges	**0**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.0	L/s.m²	0.78	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	7.9	W/m²	0.73	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	50%	50%	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	0.0	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)	2.88	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	0.008	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	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	33.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.7	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	7000	hrs./year
Circulating Pump Energy Consumption	6.3	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	3.9
	MJ/m².yr	152.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New University-Colleges	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.2** kWh/ft².yr	**548.9** MJ/m².yr	**Gas:**	**9.1** kWh/ft².yr	**353.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.7	182.6
ARCHITECTURAL LIGHTING CORF	0.8	32.7
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.3
HVAC ELECTRICITY	3.9	152.7
REFRIGERATION EQUIPMENT	0.5	20.0
MISCELLANEOUS EQUIPMENT	1.9	75.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.1	8.0	309.5
SPACE COOLING	0.3	10.6	0.0	0.0
SERVICE HOT WATER	0.1	2.5	0.7	27.7
FOOD SERVICE EQUIPMENT	0.1	3.4	0.4	16.6

Summary Building Profile

Building Type:	Restaurant	**Location:**	Lower Mainland

Description: This archetype is based on data from the Building Check-up database. The BCU database contains 4 buildings ranging in size from 7,000 ft² constructed between 1940 and 1996. The average size of the sample is 8,400 ft².

Only end-use energy intensities available. No detailed specifications available to develop a full archetype.

Average Building:

Building Specifications:

roof construction:	W/m².°C	
wall construction:	W/m².°C	
windows:	W/m².°C	
shading coefficient		
window to wall ratio		

General Lighting & LPD — Lux — W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Architectural Lighting & LPD — Lux — W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Overall LPD — W/m²

Plug Loads (office equipment) EPD — W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other

System air Flow	L/s.m²	CFM/ft²
Fan Power	W/m²	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other

Calculated Capacity	W/m²	ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	W/m²	W/ft²
Condenser Pumps	W/m²	W/ft²
Condenser Fan Size	W/m²	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	619	16.0		
Architectural Lighting	51	1.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	78	2.0	156.1	4.0
Space Cooling	42	1.1	0.0	4.0
HVAC Equipment	149	3.8		
DHW	10	0.3	65.6	1.7
Refrigeration Equipment	1200	31.0		
Food Service Equipment	3	0.1	664.0	0.0
Miscellaneous	60	1.5		
Total	**2328**	**60.1**	**885.7**	**10**

Note that this profile is not fully "live"--only some of the summary values come from "profile"

Summary Building Profile

Building Type: New Warehouse/Whs **Location:** Lower Mainland

Description: This archetype is similar to the existing warehouse/wholesale archetype. New construction is assumed to be little changed from the existing stock.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 34,000 ft²

Building Specifications:							
roof construction:	0.35 W/m².°C						
wall construction:	0.45 W/m².°C						
windows:	2.8 W/m².°C						
shading coefficient	0.8						
window to wall ratio	0.05						
High Bay Lighting & LPD	400 Lux		14.1 W/m²				
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH	HPS
	0%	0%	0%	0%	15%	75%	10%
Other Office Lighting & LPD	300 Lux		10.1 W/m²				
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other	
	5%	10%	0%	0%	85%		
Overall LPD	13.4 W/m²						
Plug Loads (office equipment) EPD	4.5 W/m²						
Ventilation:							
System Type	CAV	VAV	DD	IU	100%OA	Other	
	100%	0%	0%	0%	0%		
System air Flow	2.1 L/s.m²		0.42 CFM/ft²				
Fan Power	4.4 W/m²		0.41 W/ft²				
Cooling Plant:							
System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	0%	0%	10%	90%	0%	
Calculated Capacity	40 W/m²		937 ft²/Ton				
Cooling Plant Auxiliaries							
Circulating Pumps	0.2 W/m²		0.0 W/ft²				
Condenser Pumps	0.0 W/m²		0.0 W/ft²				
Condenser Fan Size	1.1 W/m²		0.1 W/ft²				

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
High Bay Lighting	232	6.0		
Other Office Lighting	10	0.3		
Other Lighting	0	0.0		
Plug Loads & Office Equipment	96	2.5		
Space Heating	0	0.0	233.5	6.0
Space Cooling	8	0.2	0.0	6.0
HVAC Equipment	39	1.0		
DHW	6	0.2	23.0	0.6
Refrigeration Equipment	50	1.3		
Food Service Equipment	0	0.0	0.0	0.0
Miscellaneous	40	1.0		
Total	**481**	**12.4**	**256.5**	**13**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Warehouse/Whsale** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.45	W/m².°C	0.08	Btu/hr.ft² .°F
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	20	L/s.person	42	CFM/person

%OA 9.47%

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	2.11	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	

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	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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Warehouse/Whsale	0		Lower Mainland
Baseline			

LIGHTING
HIGH BAY LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	14.1	W/m²	1.3	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%	0%	15%	75%	10%	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	6.0
	MJ/m².yr	232

OTHER, OFFICE LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	10.1	W/m²	0.9	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	10%	0%	0%	85%	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 = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	10

OTHER 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%	0%
Weighted Average					**0**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	0%	0%	0%	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

EUI TOTAL		
	kWh/ft².yr	6.3
	MJ/m².yr	243

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.46 W/ft²
Diversity Occupied Period	0%	0%	0%	90%	100%	90%
Diversity Unoccupied Period	0%	0%	0%	10%	100%	40%
Operation Occ. Period (hrs./year)	0	0	0	2600	2600	3500
Operation Unocc. Period (hrs./year)	8760	8760	8760	6160	6160	5260

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.0 W/m²	0.2 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI		
	kWh/ft².yr	2.5
	MJ/m².yr	96

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

	Natural Gas EUI		All Electric EUI
EUI	kWh/ft².yr	0.0	kWh/ft².yr 0.0
	MJ/m².yr	0.0	MJ/m².yr 0.0

REFRIGERATION EQUIPMENT

Provide description below:

Large refrigeration storage

EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	50.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	1.0
	MJ/m².yr	40

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Warehouse/Whsale** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	100%	0%	0%	0%	0%	0%	100%
Eff./COP	75%	83%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	59.8 W/m²	19.0 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	194 MJ/m².yr	5.0 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	0.0%	Gas Fuel Share 100.0%	Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.0	6.0	6.0
MJ/m².yr	0	234	234

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	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	4.4	3.6	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.34	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	13.0 °C	55.4 °F

Peak Cooling Load	40 W/m²	13 Btu/hr.ft²	937 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	57.5 MJ/m².yr	1.5 kWh/ft².yr	
Sizing Factor	1.00		
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 Maintenar

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	0.7	0.0	0.7
MJ/m².yr	28	0	28

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	63.00%	7.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.56	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 18.2

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.8	0.7
MJ/m².yr	20	33	29.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Warehouse/Whsale	0		Lower Mainland
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	2.1	L/s.m²	0.42	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	2.2	W/m²	0.20	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	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.09	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	0.002	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	0.003	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	7.0	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	0.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	1.2	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	1.0
	MJ/m².yr	38.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**12.4** kWh/ft².yr	**481.0** MJ/m².yr	**Gas:**	**6.6** kWh/ft².yr	**256.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
HIGH BAY LIGHTING	6.0	232.3
OTHER, OFFICE LIGHTING	0.3	10.2
OTHER LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.5	95.6
HVAC ELECTRICITY	1.0	38.5
REFRIGERATION EQUIPMENT	1.3	50.0
MISCELLANEOUS EQUIPMENT	1.0	40.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.0	0.0	6.0	233.5
SPACE COOLING	0.2	8.4	0.0	0.0
SERVICE HOT WATER	0.2	6.0	0.6	23.0
FOOD SERVICE EQUIPMENT	0.0	0.0	0.0	0.0

Summary Building Profile

Building Type:	Mixed Use	**Location:**	Lower Mainland

Description: This archetype is based on data from the Building Check-up database, BC Hydro's High and LowiRise Apt. Bldgs. Audit and Simulation Study and end-use data supplied by Sheltair.

This profile assumes retail space in the first floor and apartments in all floors above.

Average Building: The average building characteristics used to define this building profile are as follows:
- average number of suites 89 at 750 ft²/suite
- average building size 80,000 ft² (assumes 20% additional floor space for corridors
- average footprint 8,100 ft² assumes 9 suites per floor (except first floor retail)
- 10 stories

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.62	W/m².°C
windows:	3.748	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.25	

General Lighting & LPD 97.5 Lux 12.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
82%	10%	8%	0%	0%	

Architectural Lighting & LPD 150 Lux 13.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
50%	30%	15%	0%	5%	

Overall LPD 9.9 W/m²

Plug Loads (office equipment) EPD 1.0 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	0.0	L/s.m²	0.00	CFM/ft²
Fan Power	0.0	W/m²	0.00	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
1%	0%	5%	94%	0%	0

Calculated Capacity 30 W/m² 1249 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.3	W/m²	0.0	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	0.0	W/m²	0.0	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Suite Lighting	32	0.8		
Corridor/Common Area Lighting	80	2.1		
High Bay Lighting	0	0.0		
Appliance, TV, Entertainment, Other	60	1.6		
Space Heating	112	2.9	0.0	0.0
Space Cooling	3	0.1	0.0	0.0
HVAC Equipment	2	0.1		
DHW	23	0.6	100.3	2.6
Residential Refrigerator	27	0.7		
Cooking Appliances (incl. Stove)	18	0.5	0.0	0.0
Miscellaneous	17	0.4		
Total	**375**	**9.7**	**100.3**	**3**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Mixed Use	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	7,500	m²	80,700	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	750	m²	8,070	ft²
Glazing U value (W/m².°C)	3.75	W/m².°C	0.66	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	1.25			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	75%			
Window/Wall Ratio (WIWAR) (%)	0.25								
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 (%)	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 ########
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 | 0.001 L/s.m² | 0.00 CFM/ft² | 75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.00	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)

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	

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

NEW BUILDINGS: New Mixed Use Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

LIGHTING

SUITE LIGHTING

Light Level	98 Lux	9.1	ft-candles
Floor Fraction (GLFF)	0.80		
Connected Load	12.4 W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	2900		
Unocc. Period(Hrs./yr.)	5860		
Usage During Occupied Period	5%		
Usage During Unoccupied Period	13%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	200	300	500	Total
% Distribution	75%	15%	10%	0%	100%
Weighted Average					**97.5**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	82%	10%	8%	0%	0%	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

CORRIDORS/COMMON AREAS

Light Level	150 Lux	13.9	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	13.9 W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	95%		
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%	70%	10%	20%	100%
Weighted Average					**150**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	50%	30%	15%	0%	5%	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 = Load X Hrs. X SF X GLFF

EUI: kWh/ft².yr 2.1; MJ/m².yr 80

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 3; MJ/m².yr 113

APPLIANCES, TV ENTERTAINMENT, OTHER

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0	0	0	
Connected Load	0.3 W/m²	0.4 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	2.4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.22 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

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI: kWh/ft².yr 1.6; MJ/m².yr 60

COOKING APPLIANCES STOVE

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

Electric stove with an annual consumption of 340 kWh/unit

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.0	0.5
MJ/m².yr	0.0	18.0

RESIDENTIAL REFRIGERATOR

Provide description below:

Residential refrigerator with an annual consumption of 636 kWh/unit

EUI: kWh/ft².yr 0.7; MJ/m².yr 27.0

MISCELLANEOUS EQUIPMENT

EUI: kWh/ft².yr 0.4; MJ/m².yr 17

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Mixed Use	0		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	0%	0%	0%	0%	0%	100%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	43.3	W/m²	13.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	112	MJ/m².yr	2.9	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 100.0% Gas Fuel Share 0.0% Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.9	0.0	2.9
MJ/m².yr	112	0	112

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	1.0%	0.0%	0.0%	5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	30	W/m²	10	Btu/hr.ft²	1249	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	63.5	MJ/m².yr	1.6	kWh/ft².yr		

Sizing Factor 1.00

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 Maintenar

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	0.7	0.0	0.7
MJ/m².yr	28	0	28

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	48.75%	3.75%	0.00%	22.50%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.61	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 81.9

Wetting Use Percentage 80%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.3	3.5	3.2
MJ/m².yr	90	134	122.8

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Mixed Use	**0**		**Lower Mainland**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	0.0	L/s.m²	0.00	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	0.0	W/m²	0.00	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	100%	0%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	20	L/s.washroom	42	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	0.002	L/s.m²	0.002	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	0.002	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	0.3	W/m²	0.02	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	0.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.6	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	0.0	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	0.1
	MJ/m².yr	2.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Mixed Use	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.7** kWh/ft².yr	**374.6** MJ/m².yr	**Gas:**	**2.6** kWh/ft².yr	**100.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
SUITE LIGHTING	0.8	32.3					
CORRIDORS/COMMON AREAS	2.1	80.3	SPACE HEATING	2.9	112.3	0.0	0.0
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	0.1	2.8	0.0	0.0
APPLIANCES, TV ENTERTAINMENT	1.6	60.1	SERVICE HOT WATER	0.6	22.5	2.6	100.3
HVAC ELECTRICITY	0.1	2.3	COOKING APPLIANCES STOV	0.5	18.0	0.0	0.0
RESIDENTIAL REFRIGERATOR	0.7	27.0					
MISCELLANEOUS EQUIPMENT	0.4	17.0					

MARBEK
Resource Consultants Ltd.

APPENDIX D

New Building Profiles – Interior

Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island.

Table of Contents

Note: Building profiles shown for Lower Mainland apply to both Lower Mainland and Vancouver Island. Blank specification boxes in the profiles indicate that no data were used.

Summary Building Profile

Building Type:	New Large Office	**Location:**	Interior

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program and NRCan's CBIP Program.

The Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 230,000 ft²
- average footprint 12,100 ft² assumes a 110 ' x 110 ' footprint
- 19 stories

Building Specifications:						
roof construction:	0.24 W/m².°C					
wall construction:	0.71 W/m².°C					
windows:	2.8 W/m².°C					
shading coefficient	0.45					
window to wall ratio	0.6					
General Lighting & LPD	440 Lux		11.4 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	0%	0%	100%	
Architectural Lighting & LPD	300 Lux		13.0 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	30%	0%	0%	60%	
Overall LPD	10.8 W/m²					
Plug Loads (office equipment) EPD	7.7 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	10%	90%	0%	0%	0%	
System air Flow	5.5 L/s.m²		1.08 CFM/ft²			
Fan Power	12.5 W/m²		1.16 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	65%	25%	10%	0%	
Calculated Capacity	111 W/m²		339 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	1.2 W/m²		0.1 W/ft²			
Condenser Pumps	1.1 W/m²		0.1 W/ft²			
Condenser Fan Size	2.2 W/m²		0.2 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	164	4.2		
Architectural Lighting	19	0.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	175	4.5		
Space Heating	7	0.2	266.2	6.9
Space Cooling	66	1.7	0.0	6.9
HVAC Equipment	206	5.3		
DHW	7	0.2	25.3	0.7
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	160	4.1		
Total	**810**	**20.9**	**295.7**	**15**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Office** **Baseline**
SIZE: **> 9,300 m² (100,000 ft²)**
VINTAGE:
REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	Btu/hr.ft² .°F
Window/Wall Ratio (WIWAR) (%)	0.60			
Shading Coefficient (SC)	0.45			

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 (%)	10%		0%		90%		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	25	L/s.person	53	CFM/person

%OA 17.81%

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	1.4			
Total Air Circulation or Design Air Flow	5.51	L/s.m²	1.08	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	

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	22.5	°C	72.5	°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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Office	> 9,300 m² (100,000 ft²)		Interior
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 (%)	0%	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	4.2
	MJ/m².yr	164

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	13.0	W/m²	1.2	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	30%	0%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.5
	MJ/m².yr	19

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	183

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	69	72	50	200	50	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.1	
Connected Load	2.4 W/m²	2.5 W/m²	0.3 W/m²	0.8 W/m²	0.2 W/m²	2 W/m²
	0.2 W/ft²	0.2 W/ft²	0.03 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	60%	60%	50%	20%	20%	60%
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)	7.7 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	4.5 W/m²	0.4 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	4.5
	MJ/m².yr	175

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI	kWh/ft².yr	4.1
	MJ/m².yr	160

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Office	**> 9,300 m² (100,000 ft²)**		**Interior**
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	95%	0%	0%	3%	0%	2%	100%
Eff./COP	75%	83%	95%	1.70	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.29	0.22	1.00	

Peak Heating Load	58.7	W/m²	18.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	233	MJ/m².yr	6.0	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% — Gas Fuel Share 95.0% — Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	3.8	7.2	7.1
MJ/m².yr	149	280	274

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	65.0%	0.0%	25.0%	10.0%	0.0%	0.0%	100.0%
COP	4.6	6	4.4	4.2	2.8	0.9	1	
Performance (1 / COP) (kW/kW)	0.22	0.17	0.23	0.24	0.36	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	111	W/m²	35	Btu/hr.ft²	339	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	237.7	MJ/m².yr	6.1	kWh/ft².yr		

Sizing Factor 1.00

A/C Saturation (Incidence of A/C) 95.0%

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	1.8	0.0	1.8
MJ/m².yr	70	0	70

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	35.00%	14.00%	0.00%	19.60%	1.40%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.62	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.5

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.6	0.9	0.8
MJ/m².yr	25	36	32.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
New Large Office **> 9,300 m² (100,000 ft²)** **Interior**
Baseline

HVAC ELECTRICITY

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	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	12.5	W/m²	1.16	W/ft²
Fan Design Load VAV	12.5	W/m²	1.16	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	10%	90%	100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	0%	100%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit area	0.2	L/s.m²	0.04	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	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)	2.23	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	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.14	W/m²	0.11	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	1.2	W/m²	0.11	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	42.9	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	3.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	8.5	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	206.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Office	**> 9,300 m² (100,000 ft²)**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.9** kWh/ft².yr	**810.0** MJ/m².yr	**Gas:**	**7.6** kWh/ft².yr	**295.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	164.0
ARCHITECTURAL LIGHTING	0.5	19.2
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	4.5	174.9
HVAC ELECTRICITY	5.3	206.2
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	4.1	160.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.4	6.9	266.2
SPACE COOLING	1.7	66.2	0.0	0.0
SERVICE HOT WATER	0.2	7.4	0.7	25.3
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

Summary Building Profile

Building Type:	New Medium Office	Location:	Interior

Description: This archetype is based on 46 medium sized office buildings with a combined published "rentable" floor area of 310,000 ft² (3,335,000 ft²). The buildings range in size from 50,000 to 100,000 ft² constructed between 1910 and 1999.
Electrical energy intensities (electrical bepi) ranges from 11 kWh/ft².yr to 39 kWh/ft².yr.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 72,900 ft²
- average footprint 8,100 ft² assumes a 90' x 90' footprint
- 9 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.71	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.45	
window to wall ratio	0.5	

General Lighting & LPD 500 Lux 12.9 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	0%	0%	100%	

Architectural Lighting & LPD 300 Lux 12.7 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	25%	0%	0%	65%	

Overall LPD 12.3 W/m²

Plug Loads (office equipment) EPD 7.4 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	50%	50%	0%	0%	0%	

System air Flow	5.2	L/s.m²	1.03	CFM/ft²
Fan Power	11.4	W/m²	1.06	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	25%	45%	30%	0%	0

Calculated Capacity 117 W/m² 324 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0	W/m²	0.1	W/ft²
Condenser Pumps	0.7	W/m²	0.1	W/ft²
Condenser Fan Size	3.2	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	238	6.1		
Architectural Lighting	19	0.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	43	1.1	241.3	6.2
Space Cooling	83	2.1	0.0	6.2
HVAC Equipment	234	6.0		
DHW	8	0.2	28.3	0.7
Refrigeration Equipment	4	0.1		
Food Service Equipment	1	0.0	4.2	0.1
Miscellaneous	100	2.6		
Total	**845**	**21.8**	**273.8**	**13**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Medium Office** **Baseline**

SIZE: **50,000 to 100,000 ft²**

VINTAGE:

REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.71	W/m².°C	0.13	Btu/hr.ft² .°F	Typical Building Size	6,777	m²	72,921	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	753	m²	8,102	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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) (%)	0.50								
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	18.83%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
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: 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	5.21	L/s.m²	1.03	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	

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	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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Interior
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	12.9	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	45%			
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 (%)	0%	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	6.1
	MJ/m².yr	238

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	12.7	W/m²	1.2	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	25%	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 = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	0.5
	MJ/m².yr	19

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	7
	MJ/m².yr	257

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.1			
Connected Load	1.9	W/m²	3.0	W/m²	0.3	W/m²	0.8	W/m²	0.2	W/m²	2	W/m²
	0.2	W/ft²	0.3	W/ft²	0.03	W/ft²	0.07	W/ft²	0.02	W/ft²	0.19	W/ft²
Diversity Occupied Period	85%		85%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		50%		10%		100%		10%	
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)	7.4	W/m²	0.7	W/ft²
Total end-use load (unocc. period)	1.9	W/m²	0.2	W/ft²

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EUI		
	kWh/ft².yr	3.0
	MJ/m².yr	116

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 83.0% — Electricity Fuel Share: 17.0%

Natural Gas EUI			All 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 EQUIPMENT

Provide description below:

Unknown

EUI		
	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	100

NEW BUILDINGS: New Medium Office Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	80%	0%	0%	5%	0%	15%	100%
Eff./COP	75%	83%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 60.9 W/m² — 19.3 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 250 MJ/m².yr — 6.5 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 20.0% — Gas Fuel Share: 80.0% — Oil Fuel Share: 0.0%

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	5.6	217
Natural Gas EUI	7.8	302
Market Composite EUI	7.3	285

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recprocting Chillers Open	Recprocting Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	25.0%	0.0%	45.0%	30.0%	0.0%	0.0%	100.0%
COP	4.7	6	4.4	4.2	2.8	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.17	0.23	0.24	0.36	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: 117 W/m² — 37 Btu/hr.ft² — 324 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 245.0 MJ/m².yr — 6.3 kWh/ft².yr

Sizing Factor: 1.00

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		

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	2.4	92
Natural Gas EUI	0.0	0
Market Composite EUI	2.4	92

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	52.50%	17.50%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.56	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	1.0	40
Market Composite EUI	0.9	35.8

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.2	L/s.m²	1.03	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	8.5	W/m²	0.79	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	Continuous	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 area	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.16	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	0.006	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	0.70	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	51.8	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	2.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	2.0	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	6.0	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	6.0
	MJ/m².yr	233.8

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Office	50,000 to 100,000 ft²		Interior
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	21.8 kWh/ft².yr	844.8 MJ/m².yr	Gas:	7.1 kWh/ft².yr	273.8 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.1	238.2
ARCHITECTURAL LIGHTING	0.5	18.8
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	3.0	115.9
HVAC ELECTRICITY	6.0	233.8
REFRIGERATION EQUIPMENT	0.1	4.0
MISCELLANEOUS EQUIPMENT	2.6	100.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.1	43.3	6.2	241.3
SPACE COOLING	2.1	82.6	0.0	0.0
SERVICE HOT WATER	0.2	7.5	0.7	28.3
FOOD SERVICE EQUIPMENT	0.0	0.7	0.1	4.2

Summary Building Profile

Building Type:	New Large Retail	**Location:**	Interior

Description: This archetype is based on generic commercial design practices for new construction. BC Hydro's Design Assistance Program has seen little interest from retail developers in efficient new construction, hence little information is available on current design practices.

New construction is assumed to be little changed from the existing stock except for a few components such as fluorescent lighting (default new construction is assumed to be T8 lighting). Windows are assumed to be double pane.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 250,000 ft²
- single storey

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.78	
window to wall ratio	0.1	

General Lighting & LPD 600 Lux 27.8 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
15%	10%	0%	0%	60%	15%

Architectural Lighting & LPD 500 Lux 26.1 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
10%	10%	0%	0%	20%	60%

Overall LPD 22.2 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
80%	20%	0%	0%	0%	

System air Flow	5.4	L/s.m²	1.06	CFM/ft²
Fan Power	11.2	W/m²	1.04	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
0%	20%	0%	20%	60%	0%	

Calculated Capacity 101 W/m² 376 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	2.7	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	402	10.4		
Architectural Lighting	121	3.1		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	69	1.8		
Space Heating	5	0.1	198.7	5.1
Space Cooling	76	2.0	0.0	5.1
HVAC Equipment	171	4.4		
DHW	5	0.1	32.5	0.8
Refrigeration Equipment	10	0.3		
Food Service Equipment	2	0.0	33.2	0.0
Miscellaneous	45	1.2		
Total	**906**	**23.4**	**264.4**	**11**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Retail	> 100,000 ft²		Interior
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	24,000 m²	258,240	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	24,000 m²	258,240	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	16.49%
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	1.5			
Total Air Circulation or Design Air Flow	5.39	L/s.m²	1.06	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	

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	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

NEW BUILDINGS: **New Large Retail** **Baseline** | **SIZE:** **> 100,000 ft²** | **VINTAGE:** | **REGION:** **Interior**

LIGHTING

GENERAL LIGHTING

Light Level	600 Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.80		
Connected Load	27.8 W/m²	2.6	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	

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	10%	0%	0%	60%	15%	0%	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 10.4; MJ/m².yr 402

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	26.1 W/m²	2.4	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%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	10%	0%	0%	20%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 3.1; MJ/m².yr 121

OTHER (HIGH BAY) 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%	0%
Weighted Average					**0**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 14; MJ/m².yr 523

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	100%	20%
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)	3.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	0.9 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.8; MJ/m².yr 69

FOOD SERVICE EQUIPMENT

Provide description below: — Gas Fuel Share: 83.0% — Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	1.0	0.3
MJ/m².yr	40.0	10.0

REFRIGERATION EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 0.3; MJ/m².yr 10.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.2; MJ/m².yr 45

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
New Large Retail **> 100,000 ft²** **Interior**
Baseline

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	2%	1%	0%	2%	100%
Eff./COP	75%	88%	95%	3.20	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.31	0.29	0.22	1.00	

Peak Heating Load	41.8 W/m²	13.3 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	157 MJ/m².yr	4.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Gas Fuel Share 95.0%	Oil Fuel Share 0.0%

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	2.7	103
Natural Gas EUI	5.4	209
Market Composite EUI	5.3	204

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	20.0%	0.0%	20.0%	60.0%	0.0%	0.0%	100.0%
COP	4.6	5.2	4.4	3.2	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.22	0.19	0.23	0.31	0.34	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	101 W/m²	32 Btu/hr.ft²	376 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	177.0 MJ/m².yr	4.6 kWh/ft².yr	
Sizing Factor	1.00		
A/C Saturation (Incidence of A/C)	95.0%		
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	2.1	80
Natural Gas EUI	0.0	0
Market Composite EUI	2.1	80

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	64.00%	16.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.56	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	1.0	41
Market Composite EUI	1.0	37.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Interior**

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.4	L/s.m²	1.06	CFM/ft²
System Static Pressure CAV	650	Pa	2.6	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	7.3	W/m²	0.68	W/ft²
Fan Design Load VAV	11.2	W/m²	1.04	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	Continuous	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 area	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)	2.71	W/m²	0.25	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	0.006	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	38.9	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	1.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.9	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	4.4
	MJ/m².yr	171.4

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Retail	> 100,000 ft²		Interior
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	23.4 kWh/ft².yr	906.4 MJ/m².yr	Gas:	6.8 kWh/ft².yr	264.4 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	END USE:	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	10.4	402.2					
ARCHITECTURAL LIGHTING CORF	3.1	120.8	SPACE HEATING	0.1	5.1	5.1	198.7
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	2.0	75.8	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.8	69.4	SERVICE HOT WATER	0.1	5.0	0.8	32.5
HVAC ELECTRICITY	4.4	171.4	FOOD SERVICE EQUIPMENT	0.0	1.7	0.9	33.2
REFRIGERATION EQUIPMENT	0.3	10.0					
MISCELLANEOUS EQUIPMENT	1.2	45.0					

Summary Building Profile

Building Type:	New Medium Retail	**Location:**	Interior

Description: This archetype is based on generic commercial design practices for new construction. BC Hydro's Design Assistance Program has seen little interest from retail developers in efficient new construction, hence little information is available on current design practices.

New construction is assumed to be little changed from the existing stock except for a few components such as fluorescent lighting (default new construction is assumed to be T8 lighting). Windows are assumed to be double pane. DX cooling performance of packaged rooftop heat-cool units is assumed to be EER 9.5.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 80,700 ft², with a footprint of 127' x 635'
- one storey

Building Specifications:						
roof construction:	0.32 W/m².°C					
wall construction:	0.4732 W/m².°C					
windows:	2.8 W/m².°C					
shading coefficient	0.78					
window to wall ratio	0.1					
General Lighting & LPD	620 Lux		24.6 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	10%	0%	0%	80%	
Architectural Lighting & LPD	480 Lux		19.9 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	10%	20%	0%	0%	70%	
Overall LPD	23.4 W/m²					
Plug Loads (office equipment) EPD	5.1 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	
System air Flow	3.9 L/s.m²		0.76 CFM/ft²			
Fan Power	0.0 W/m²		0.00 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	0%	100%	0%	
Calculated Capacity	100 W/m²		378 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	0.0 W/m²		0.0 W/ft²			
Condenser Pumps	0.0 W/m²		0.0 W/ft²			
Condenser Fan Size	2.7 W/m²		0.3 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	511	13.2		
Architectural Lighting	30	0.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	67	1.7		
Space Heating	18	0.5	202.1	5.2
Space Cooling	61	1.6	0.0	5.2
HVAC Equipment	117	3.0		
DHW	11	0.3	12.4	0.3
Refrigeration Equipment	9	0.2		
Food Service Equipment	2	0.0	8.3	0.3
Miscellaneous	43	1.1		
Total	**869**	**22.4**	**222.7**	**11**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Medium Retail** **Baseline**
SIZE: **50,000 - 100,000 ft2**
VINTAGE:
REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	7,500 m²	80,700	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	7,500 m²	80,700	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	5		
					Percent Conditioned Space	100%		
					Percent Conditioned Space	29%		
Window/Wall Ratio (WIWAR) (%)	0.10				Defined as Exterior Zone			
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	20.73%
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: 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			
Total Air Circulation or Design Air Flow	3.86	L/s.m²	0.76	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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Retail	50,000 - 100,000 ft2		Interior
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	620	Lux	57.6	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	24.6	W/m²	2.3	W/ft²
Occ. Period(Hrs./yr.)	5000			
Unocc. Period(Hrs./yr.)	3760			
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)	300	500	700	1000				Total
% Distribution	0%	40%	60%	0%				100%
Weighted Average								**620**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	10%	0%	0%	80%	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	13.2
	MJ/m².yr	511

ARCHITECTURAL LIGHTING

Light Level	480	Lux	44.6	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	19.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	5500			
Unocc. Period(Hrs./yr.)	3260			
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	30%	50%	20%	0%				100%
Weighted Average								**480**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	20%	0%	0%	70%	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 = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	0.8
	MJ/m².yr	30

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	14
	MJ/m².yr	541

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0.1	0.1	0.1	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.8 W/m²	0.2 W/m²	3 W/m²
	0.0 W/ft²	0.1 W/ft²	0.02 W/ft²	0.07 W/ft²	0.02 W/ft²	0.28 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	5.1 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	0.7 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI		
	kWh/ft².yr	1.7
	MJ/m².yr	67

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI		All Electric EUI	
EUI	kWh/ft².yr	0.3	kWh/ft².yr	0.2
	MJ/m².yr	10.0	MJ/m².yr	9.6

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI		
	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	1.1
	MJ/m².yr	43

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Retail	50,000 - 100,000 ft2		Interior
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	88%	0%	0%	1%	0%	0%	11%	100%
Eff./COP	69%	88%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.45	1.14	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	32.9	W/m²	10.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	158	MJ/m².yr	4.1	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 12.0% | Gas Fuel Share 88.0% | Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	3.9	5.9	5.7
MJ/m².yr	152	230	220

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recproctng Chillers Open	Recproctng Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	3	5.4	4.4	3.6	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.33	0.19	0.23	0.28	0.34	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	100	W/m²	32	Btu/hr.ft²	378	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	156.9	MJ/m².yr	4.0	kWh/ft².yr		
Sizing Factor	1.00					
A/C Saturation (Incidence of A/C)	95.0%					

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	1.7	0.0	1.7
MJ/m².yr	64	0	64

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	32.00%	8.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	40%		60%
Blended Efficiency	0.56		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 17.3

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.8	0.6
MJ/m².yr	19	31	23.8

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Retail	**50,000 - 100,000 ft2**		**Interior**
Baseline			

HVAC ELECTRICITY

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	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.7	W/m²	0.34	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	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	85%	15%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit area	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.70	W/m²	0.25	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	0.006	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	5500	hrs./year
Supply Fan Unocc. Period	3260	hrs./year
Supply Fan Energy Consumption	30.2	kWh/m².yr
Exhaust Fan Occ. Period	5500	hrs./year
Exhaust Fan Unocc. Period	3260	hrs./year
Exhaust Fan Energy Consumption	1.1	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	7000	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	3.0
	MJ/m².yr	117.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Retail	**50,000 - 100,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**22.4** kWh/ft².yr	**869.3** MJ/m².yr	**Gas:**	**5.7** kWh/ft².yr	**222.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	13.2	510.8					
ARCHITECTURAL LIGHTING	0.8	30.3	SPACE HEATING	0.5	18.3	5.2	202.1
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	1.6	61.1	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.7	67.0	SERVICE HOT WATER	0.3	11.4	0.3	12.4
HVAC ELECTRICITY	3.0	117.0	FOOD SERVICE EQUIPMENT	0.0	1.6	0.2	8.3
REFRIGERATION EQUIPMENT	0.2	8.6					
MISCELLANEOUS EQUIPMENT	1.1	43.3					

Summary Building Profile

Building Type: New Food Retail

Location: Interior

Description: This archetype is based on generic commercial design practices for new construction. BC Hydro's Design Assistance Program has seen little interest from the retail food sector in efficient new construction.

New construction is assumed to be little changed from the existing stock except for a few components such as fluorescent lighting (default new construction is assumed to be T8 lighting). Windows are assumed to be double pane. DX cooling performance of packaged rooftop heat-cool units is assumed to be EER 9.5.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 13,000 ft²
- single storey

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.79	
window to wall ratio	0.11	

General Lighting & LPD 600 Lux 22.8 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
2%	3%	0%	0%	15%	80%

Architectural Lighting & LPD 420 Lux 12.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH
0%	0%	0%	0%	80%	20%

Overall LPD 20.5 W/m²

Plug Loads (office equipment) EPD 3.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	5.5	L/s.m²	1.08	CFM/ft²
Fan Power	11.4	W/m²	1.06	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
0%	20%	0%	20%	60%	0%	

Calculated Capacity 141 W/m² 269 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.2	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	3.8	W/m²	0.4	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	527	13.6		
Architectural Lighting	40	1.0		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	26	0.7	420.2	10.8
Space Cooling	78	2.0	0.0	10.8
HVAC Equipment	157	4.1		
DHW	10	0.3	65.6	1.7
Refrigeration Equipment	1125	29.0		
Food Service Equipment	3	0.1	103.8	0.0
Miscellaneous	57	1.5		
Total	**2141**	**55.3**	**589.6**	**23**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Food Retail	**0**		**Interior**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	1,225	m²	13,181	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	1,225	m²	13,181	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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)	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	26.34%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	65	L/s.person	138	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	1.3			
Total Air Circulation or Design Air Flow	5.48	L/s.m²	1.08	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	

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	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	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

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Food Retail	**0**		**Interior**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	22.8	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	65%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	2%	3%	0%	0%	15%	80%	0%	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 13.6
MJ/m².yr 527

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	420	Lux	39.0	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	12.6	W/m²	1.2	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	40%	60%	0%	0%	100%
Weighted Average					**420**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	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	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 1.0
MJ/m².yr 40

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0
MJ/m².yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 15; MJ/m².yr 567

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.01	0.01	0.01	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.1 W/m²	4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.01 W/ft²	0.37 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	90%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	3.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	3.7 W/m²	0.3 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 3.0
MJ/m².yr 116

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.2	0.5
MJ/m².yr	125.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 29.0
MJ/m².yr 1125.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.5
MJ/m².yr 57

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Food Retail** **Baseline** | **SIZE:** **0** | **VINTAGE:** | **REGION:** **Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	90%	0%	0%	5%	0%	0%	5%	100%
Eff./COP	80%	88%	95%	3.20	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.25	1.14	1.05	0.31	0.33	0.22	1.00	

Peak Heating Load: 47.9 W/m² — 15.2 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 374 MJ/m².yr — 9.6 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% | Gas Fuel Share: 90.0% | Oil Fuel Share: 0.0%

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	265

Natural Gas EUI	
kWh/ft².yr	12.1
MJ/m².yr	467

Market Composite EUI	
kWh/ft².yr	11.5
MJ/m².yr	447

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	20.0%	0.0%	20.0%	60.0%	0.0%	0.0%	100.0%
COP	4.7	5.2	4.4	3.2	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.31	0.34	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: 141 W/m² — 45 Btu/hr.ft² — 269 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 189.3 MJ/m².yr — 4.9 kWh/ft².yr

Sizing Factor: 1.00

A/C Saturation (Incidence of A/C): 95.0%

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	72.00%	8.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.56	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 45.5

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	50

Natural Gas EUI	
kWh/ft².yr	2.1
MJ/m².yr	82

Market Composite EUI	
kWh/ft².yr	2.0
MJ/m².yr	75.6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Food Retail	**0**		**Interior**
Baseline			

HVAC ELECTRICITY

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	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.7	W/m²	0.53	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	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	0.2	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.80	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	0.009	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.2	W/m²	0.11	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	31.0	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	1.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	8.1	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	4.1
	MJ/m².yr	157.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Food Retail	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**55.3** kWh/ft².yr	**2,140.6** MJ/m².yr	**Gas:**	**15.2** kWh/ft².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity			Gas	
				kWh/ft².yr	MJ/m².yr		kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	13.6	527.2						
ARCHITECTURAL LIGHTING CORF	1.0	39.7	SPACE HEATING	0.7	26.5		10.8	420.2
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	2.0	78.5		0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	3.0	116.3	SERVICE HOT WATER	0.3	10.0		1.7	65.6
HVAC ELECTRICITY	4.1	157.0	FOOD SERVICE EQUIPMENT	0.1	3.4		2.7	103.8
REFRIGERATION EQUIPMENT	29.0	1,125.0						
MISCELLANEOUS EQUIPMENT	1.5	57.0						

Summary Building Profile

Building Type: New Large Hotel

Location: Interior

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program, and BC Hydro's Hotel/Motel Load Research Study (1996)

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 200,000 ft²
- 10 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.4732	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.4	

GENERAL LIGHTING (SUITES) 125 Lux 8.5 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
25%	65%	0%	0%	10%	

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER 300 Lux 15.4 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
15%	40%	0%	0%	45%	

Overall LPD 6.4 W/m²

Plug Loads (office equipment) EPD 2.9 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	FCoils
66%	0%	0%	0%	0%	33%

System air Flow	4.2	L/s.m²	0.83	CFM/ft²
Fan Power	11.0	W/m²	1.03	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	33%	33%	33%	0%	0

Calculated Capacity 101 W/m² 373 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	0.6	W/m²	0.1	W/ft²
Condenser Fan Size	2.7	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	95	2.5		
Lobby, Ballrooms, Corridors, Back-of-house	95	2.5		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	93	2.4		
Space Heating	23	0.6	355.8	9.2
Space Cooling	66	1.7	0.0	9.2
HVAC Equipment	141	3.6		
DHW	65	1.7	234.3	6.0
Refrigeration Equipment	25	0.6		
Food Service Equipment	0	0.0	116.2	0.0
Miscellaneous	53	1.4		
Total	**656**	**16.9**	**706.2**	**24**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Large Hotel** **Baseline**
SIZE: **> 100,000 ft2**
VINTAGE:
REGION: **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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) (%)	0.40								
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	FCoils	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	33%	0%		99%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	60	m²/person	646	ft²/person	%OA	29.67%
Occupancy Schedule Occ. Period	45%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	75	L/s.person	159	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	4.21	L/s.m²	0.83	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	

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	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)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Hotel	> 100,000 ft2		Interior
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	8.5	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	2100			
Unocc. Period(Hrs./yr.)	6660			
Usage During Occupied Period	40%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	75%	25%	0%				100%
Weighted Average								**125**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	65%	0%	0%	10%	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	2.5
	MJ/m².yr	95

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	15.4	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	40%	0%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.5
	MJ/m².yr	95

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	190

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0		0		0		0		0			
Connected Load	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	4.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.00	W/ft²	0.00	W/ft²	0.39	W/ft²
Diversity Occupied Period	0%		0%		0%		0%		0%		70%	
Diversity Unoccupied Period	0%		0%		0%		0%		0%		70%	
Operation Occ. Period (hrs./year)	0		0		0		0		0		3000	
Operation Unocc. Period (hrs./year)	8760		8760		8760		8760		8760		5760	

Total end-use load (occupied period)	2.9	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	2.9	W/m²	0.3	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	2.4
	MJ/m².yr	93

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	3.6	EUI	kWh/ft².yr	0.1
	MJ/m².yr	140.0		MJ/m².yr	2.4

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI	kWh/ft².yr	1.4
	MJ/m².yr	53

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Large Hotel Baseline | **SIZE:** > 100,000 ft2 | **VINTAGE:** | **REGION:** Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	90%	0%	3%	2%	0%	5%	100%
Eff./COP	75%	83%	95%	3.20	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.31	0.29	0.22	1.00	

Peak Heating Load	37.6	W/m²	11.9	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% | Gas Fuel Share 90.0% | Oil Fuel Share 0.0%

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	228
Natural Gas EUI	kWh/ft².yr	10.2
	MJ/m².yr	395
Market Composite EUI	kWh/ft².yr	9.8
	MJ/m².yr	379

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	33.3%	0.0%	33.3%	33.4%	0.0%	0.0%	100.0%
COP	4.7	5.2	4.4	3.5	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.34	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	101	W/m²	32	Btu/hr.ft²	373	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	188.7	MJ/m².yr	4.9	kWh/ft².yr		

Sizing Factor 0.90

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	1.9
	MJ/m².yr	73
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.9
	MJ/m².yr	73

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	0.00%	0.00%	0.00%	71.25%	3.75%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.76	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.7	8.1	7.7
MJ/m².yr	260	312	299.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Hotel	> 100,000 ft2		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.2	L/s.m²	0.83	CFM/ft²
System Static Pressure CAV	375	Pa	1.5	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	3.8	W/m²	0.35	W/ft²
Fan Design Load VAV	11.0	W/m²	1.03	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%	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.74	W/m²	0.25	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	0.006	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	27.7	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	1.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.4	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.8	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	3.6
	MJ/m².yr	140.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Hotel	**> 100,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**16.9** kWh/ft².yr	**655.6** MJ/m².yr	**Gas:**	**18.2** kWh/ft².yr	**706.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	2.5	95.4
LOBBY, BALLROOMS, CORRIDORS	2.5	94.9
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.4	92.7
HVAC ELECTRICITY	3.6	140.7
REFRIGERATION EQUIPMENT	0.6	25.0
MISCELLANEOUS EQUIPMENT	1.4	53.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.8	9.2	355.8
SPACE COOLING	1.7	65.6	0.0	0.0
SERVICE HOT WATER	1.7	65.0	6.0	234.3
FOOD SERVICE EQUIPMENT	0.0	0.4	3.0	116.2

Summary Building Profile

Building Type:	New Medium Hotel	**Location:**	Interior

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Hydro's Hotel/Motel Load Research Study (1996).

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 64,560 ft²
- 4 stories

Building Specifications:						
roof construction:	0.24 W/m².°C					
wall construction:	0.4732 W/m².°C					
windows:	2.8 W/m².°C					
shading coefficient	0.57					
window to wall ratio	0.4					
GENERAL LIGHTING (SUITES)	125 Lux		9.1 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	30%	60%	0%	0%	10%	
LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER	300 Lux		14.8 W/m²			
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	15%	30%	0%	0%	55%	
Overall LPD	6.8 W/m²					
Plug Loads (office equipment) EPD	3.2 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	FCoils
	66%	0%	0%	0%	0%	34%
System air Flow	4.1 L/s.m²		0.80 CFM/ft²			
Fan Power	14.2 W/m²		1.32 W/ft²			
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	25%	75%	0%	0%
Calculated Capacity	80 W/m²		474 ft²/Ton			
Cooling Plant Auxiliaries						
Circulating Pumps	0.7 W/m²		0.1 W/ft²			
Condenser Pumps	0.5 W/m²		0.0 W/ft²			
Condenser Fan Size	2.2 W/m²		0.2 W/ft²			

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	103	2.6		
Lobby, Ballrooms, Corridors, Back-of-house	92	2.4		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	93	2.4		
Space Heating	14	0.4	205.1	5.3
Space Cooling	17	0.4	0.0	5.3
HVAC Equipment	126	3.3		
DHW	26	0.7	281.1	7.3
Refrigeration Equipment	25	0.6		
Food Service Equipment	0	0.0	83.0	2.1
Miscellaneous	53	1.4		
Total	**547**	**14.1**	**569.2**	**20**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Medium Hotel Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Interior

CONSTRUCTION

Wall U value (W/m².°C)	0.47 W/m².°C	0.08 Btu/hr.ft² .°F	Typical Building Size	6,000 m² / 64,560 ft²
Roof U value (W/m².°C)	0.24 W/m².°C	0.04 Btu/hr.ft² .°F	Typical Footprint (m²)	1,500 m² / 16,140 ft²
Glazing U value (W/m².°C)	2.80 W/m².°C	0.49 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	FCoils	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 19.68%
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
(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	1.15	
Total Air Circulation or Design Air Flow	4.07 L/s.m²	0.80 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: 0.50 L/s.m² | 0.10 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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Hotel	50,000 to 100,000 ft²		Interior
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	9.1	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	2100			
Unocc. Period(Hrs./yr.)	6660			
Usage During Occupied Period	40%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	75%	25%	0%	100%
Weighted Average					**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	30%	60%	0%	0%	10%	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	103

LOBBY, BALLROOMS, CORRIDORS, BACK OF HOUSE OTHER

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	14.8	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	30%	0%	0%	55%	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 = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.4
	MJ/m².yr	92

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL	kWh/ft².yr	5
	MJ/m².yr	194

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Fax Machines		Plug Loads	
Measured Power (W/device)	55		85		50		200		50			
Density (device/occupant)	0		0		0		0		0			
Connected Load	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	0.0	W/m²	4	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.00	W/ft²	0.00	W/ft²	0.37	W/ft²
Diversity Occupied Period	0%		0%		0%		0%		0%		80%	
Diversity Unoccupied Period	0%		0%		0%		0%		0%		70%	
Operation Occ. Period (hrs./year)	0		0		0		0		0		3000	
Operation Unocc. Period (hrs./year)	8760		8760		8760		8760		8760		5760	

Total end-use load (occupied period)	3.2	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	2.8	W/m²	0.3	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI	kWh/ft².yr	2.4
	MJ/m².yr	93

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Kitchen services

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.1
	MJ/m².yr	100.0		MJ/m².yr	2.4

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI	kWh/ft².yr	1.4
	MJ/m².yr	53

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Hotel	50,000 to 100,000 ft²		Interior
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers		District	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High	Steam					
System Present (%)	0%	90%	0%	5%	0%	0%	5%	100%
Eff./COP	75%	83%	95%	3.20	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.31	0.33	0.22	1.00	

Peak Heating Load	47.7	W/m²	15.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	189	MJ/m².yr	4.9	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share: 10.0% — Gas Fuel Share: 90.0% — Oil Fuel Share: 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	3.5	5.9	5.6
MJ/m².yr	136	228	219

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Recprocting Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	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	4.4	3.5	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.34	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	474	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	199.0	MJ/m².yr	5.1	kWh/ft².yr		
Sizing Factor	0.85					
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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.1	0.0	2.1
MJ/m².yr	83	0	83

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	0.00%	0.00%	0.00%	85.50%	4.50%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.76	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 236.6

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	6.7	8.1	7.9
MJ/m².yr	260	312	307.1

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Medium Hotel	50,000 to 100,000 ft²		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	4.1	L/s.m²	0.80	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	1100	Pa	4.4	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	14.2	W/m²	1.32	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	Continuous	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 area	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)	2.15	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	0.004	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	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.005	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	24.7	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	1.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.6	kWh/m².yr
Circulating Pump Yearly Operation	7000	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	3.3
	MJ/m².yr	126.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Medium Hotel	**50,000 to 100,000 ft²**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.1**	kWh/ft².yr	**547.4**	MJ/m².yr		
	Gas:	**14.7**	kWh/ft².yr	**569.2**	MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING (SUITES)	2.6	102.6					
LOBBY, BALLROOMS, CORRIDORS	2.4	91.6	SPACE HEATING	0.4	13.6	5.3	205.1
OTHER (HIGH BAY) LIGHTING	0.0	0.0	SPACE COOLING	0.4	16.5	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.4	92.6	SERVICE HOT WATER	0.7	26.0	7.3	281.1
HVAC ELECTRICITY	3.3	126.0	FOOD SERVICE EQUIPMENT	0.0	0.4	2.1	83.0
REFRIGERATION EQUIPMENT	0.6	25.0					
MISCELLANEOUS EQUIPMENT	1.4	53.0					

Summary Building Profile

Building Type:	New Hospital	**Location:**	Interior

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program , NRCan's CBIP Program and generic commercial design practices.

The archetype is also based on current design trends for new hospitals that include:
- move towards CAV systems due to better ability to pressurize and limit cross-contamination
-higher total fan system pressures from increased filtration (6 inches) with consequent higher fan loads and energy use
-higher plug loads from increased density of diagnostic equipment.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 150,000 ft²
- 10 stories

Building Specifications:

roof construction:	0.24	W/m².°C
wall construction:	0.38	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.15	

PATIENT ROOMS 300 Lux 7.7 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY 700 Lux 18.1 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

Overall LPD 2.3 W/m²

Plug Loads (office equipment) EPD 7.7 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
50%	20%	0%	0%	0%	

System air Flow	5.5	L/s.m²	1.09	CFM/ft²
Fan Power	12.4	W/m²	1.15	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	0%	0%	

Calculated Capacity 131 W/m² 288 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.9	W/m²	0.1	W/ft²
Condenser Pumps	1.3	W/m²	0.1	W/ft²
Condenser Fan Size	1.7	W/m²	0.2	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Patient Rooms	23	0.6		
Nursing Stations, Examination, Laboratories	93	2.4		
Corridors, Other	90	2.3		
Plug Loads & Office Equipment	166	4.3		
Space Heating	7	0.2	974.4	25.2
Space Cooling	31	0.8	0.0	25.2
HVAC Equipment	324	8.4		
DHW	0	0.0	156.2	4.0
Refrigeration Equipment	15	0.4		
Food Service Equipment	1	0.0	99.6	0.0
Miscellaneous	30	0.8		
Total	**781**	**20.2**	**1230.1**	**54**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Hospital** **Baseline** | **SIZE:** **0** | **VINTAGE:** | **REGION:** **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft² .°F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.24	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	10			
					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	FCoils	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	70	L/s.person	148	CFM/person

%OA 42.20%

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: 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	1.9			
Total Air Circulation or Design Air Flow	5.53	L/s.m²	1.09	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	

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	24	°C	75.2	°F	16.5	°C	61.7	°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	24	°C	75.2	°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

NEW BUILDINGS: New Hospital Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Interior

LIGHTING

PATIENT ROOMS

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (GLFF)	0.30		
Connected Load	7.7 W/m²	0.7	W/ft²
Occ. Period(Hrs./yr.)	2100		
Unocc. Period(Hrs./yr.)	6660		
Usage During Occupied Period	50%		
Usage During Unoccupied Period	25%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	0%	0%	100%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	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 0.6; MJ/m².yr 23

NURSING STATIONS, EXAMINATION ROOMS, LABORATORIES, ICU, RECOVERY

Light Level	700 Lux	65.1	ft-candles
Floor Fraction (ALFF)	0.35		
Connected Load	18.1 W/m²	1.7	W/ft²
Occ. Period(Hrs./yr.)	3000		
Unocc. Period(Hrs./yr.)	5760		
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)	300	500	700	1000	Total
% Distribution	0%	0%	100%	0%	100%
Weighted Average					**700**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 2.4; MJ/m².yr 93

CORRIDORS, OTHER

Light Level	250.00 Lux	23.2	ft-candles
Floor Fraction (HBLFF)	0.35		
Connected Load	8.2 W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	4000		
Unocc. Period(Hrs./yr.)	4760		
Usage During Occupied Period	100%		
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)	200	300	500	700	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**250**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%	0%	0%	90%	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 2.3; MJ/m².yr 90

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 5; MJ/m².yr 207

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.05	0.05	0	0	0	
Connected Load	0.1 W/m²	0.1 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	15 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	1.39 W/ft²
Diversity Occupied Period	90%	90%	0%	0%	0%	50%
Diversity Unoccupied Period	40%	40%	0%	0%	0%	30%
Operation Occ. Period (hrs./year)	0	0	0	0	0	2000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	6760

Total end-use load (occupied period)	7.7 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	4.6 W/m²	0.4 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 4.3; MJ/m².yr 166

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food services

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	3.1	0.1
MJ/m².yr	120.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft².yr 0.8; MJ/m².yr 30

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Hospital** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System							Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller		Resistance	Total
System Present (%)	99%	0%	0%	0%	0%	0%		1%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50		1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22		1.00	

Peak Heating Load: 32.5 W/m² | 10.3 Btu/hr.ft²

Seasonal Heating Load (Tertiary Load): 738 MJ/m².yr | 19.1 kWh/ft².yr

Sizing Factor: 1.00

Electric Fuel Share: 1.0% | Gas Fuel Share: 99.0% | Oil Fuel Share: 0.0%

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	19.1
MJ/m².yr	738

Natural Gas EUI	
kWh/ft².yr	25.4
MJ/m².yr	984

Market Composite EUI	
kWh/ft².yr	25.3
MJ/m².yr	982

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
COP	4.7	6.1	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.16	0.23	0.28	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: 131 W/m² | 42 Btu/hr.ft² | 288 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 165.8 MJ/m².yr | 4.3 kWh/ft².yr

Sizing Factor: 0.75

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 Maintenar

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

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	0.00%	0.00%	0.00%	95.00%	5.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	100%	0%
Blended Efficiency	0.76	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 118.3

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	3.4
MJ/m².yr	130

Natural Gas EUI	
kWh/ft².yr	4.0
MJ/m².yr	156

Market Composite EUI	
kWh/ft².yr	4.0
MJ/m².yr	156.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Hospital	0		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.09	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	16.9	W/m²	1.57	W/ft²
Fan Design Load VAV	12.4	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	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)	1.71	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	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	1.32	W/m²	0.12	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.008	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	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	72.6	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	3.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.9	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	8.4
	MJ/m².yr	324.4

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Hospital	0		Interior
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	20.2 kWh/ft².yr	781.5 MJ/m².yr	Gas:	31.8 kWh/ft².yr	1,230.1 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
PATIENT ROOMS	0.6	22.7
NURSING STATIONS, EXAMINATIO	2.4	93.5
CORRIDORS, OTHER	2.3	90.4
OFFICE EQUIPMENT & PLUG LOAI	4.3	166.5
HVAC ELECTRICITY	8.4	324.4
REFRIGERATION EQUIPMENT	0.4	15.0
MISCELLANEOUS EQUIPMENT	0.8	30.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.4	25.2	974.4
SPACE COOLING	0.8	30.9	0.0	0.0
SERVICE HOT WATER	0.0	0.0	4.0	156.2
FOOD SERVICE EQUIPMENT	0.0	0.7	2.6	99.6

Summary Building Profile

Building Type:	New Nursing Home	**Location:**	Interior

Description: This archetype is based on knowledge of current commercial construction practices and seen in BC Hydro's Design Assistance Program and NRCan's CBIP Program.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 60,000 ft²
- 2 stories

Building Specifications:

roof construction:	0.2 W/m².°C
wall construction:	0.38 W/m².°C
windows:	2.8 W/m².°C
shading coefficient	0.65
window to wall ratio	0.2

GENERAL LIGHTING (SUITES) 200 Lux 8.5 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
10%	25%	0%	0%	65%	

SERVICES, KITCHEN, OFFICES, DINNING, RECREATION 400 Lux 14.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
5%	20%	0%	0%	70%	

Overall LPD 6.4 W/m²

Plug Loads (office equipment) EPD 2.5 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
100%	0%	0%	0%	0%	

System air Flow	3.2 L/s.m²	0.62 CFM/ft²
Fan Power	8.4 W/m²	0.78 W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	0%	0%	

Calculated Capacity 108 W/m² 350 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.8 W/m²	0.1 W/ft²
Condenser Pumps	0.6 W/m²	0.1 W/ft²
Condenser Fan Size	2.9 W/m²	0.3 W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting (Suites)	91	2.4		
Services, Kitchen, Offices, Dining, Recreation	89	2.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	32	0.8	877.2	22.6
Space Cooling	32	0.8	0.0	22.6
HVAC Equipment	144	3.7		
DHW	8	0.2	181.2	4.7
Refrigeration Equipment	0	0.0		
Food Service Equipment	1	0.0	116.2	0.0
Miscellaneous	0	0.0		
Total	**454**	**11.7**	**1174.6**	**50**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Nursing Home** **Baseline** | **SIZE:** **50,000 to 100,000 ft²** | **VINTAGE:** | **REGION:** **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft² .°F	Typical Building Size	5,600 m²	60,256	ft²
Roof U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Footprint (m²)	2,800 m²	30,128	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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) (%)	0.20							
Shading Coefficient (SC)	0.65				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	FCoils	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%	0%	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	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	45	L/s.person	95	CFM/person

%OA 47.36%

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	1.1			
Total Air Circulation or Design Air Flow	3.17	L/s.m²	0.62	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	

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	24	°C	75.2	°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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Nursing Home	50,000 to 100,000 ft^2		Interior
Baseline			

LIGHTING

GENERAL LIGHTING (SUITES)

Light Level	200	Lux	18.6	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	8.5	W/m^2	0.8	W/ft^2
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	70%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	0%	100%	0%	100%
Weighted Average					**200**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	10%	25%	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/ft^2.yr 2.4; MJ/m^2.yr 91

SERVICES, KITCHEN, OFFICES, DINNING, RECREATION

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	14.6	W/m^2	1.4	W/ft^2
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	70%			
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 (%)	5%	20%	0%	0%	70%	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 2.3; MJ/m^2.yr 89

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	14.0	W/m^2	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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/ft^2.yr 0.0; MJ/m^2.yr 0

TOTAL LIGHTING — EUI TOTAL kWh/ft^2.yr 5; MJ/m^2.yr 180

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0	0	
Connected Load	0.0 W/m^2	0.0 W/m^2	0.0 W/m^2	0.0 W/m^2	0.0 W/m^2	3.5 W/m^2
	0.0 W/ft^2	0.0 W/ft^2	0.00 W/ft^2	0.00 W/ft^2	0.00 W/ft^2	0.33 W/ft^2
Diversity Occupied Period	0%	0%	0%	0%	0%	70%
Diversity Unoccupied Period	0%	0%	0%	0%	0%	45%
Operation Occ. Period (hrs./year)	0	0	0	0	0	3000
Operation Unocc. Period (hrs./year)	8760	8760	8760	8760	8760	5760

Total end-use load (occupied period)	2.5 W/m^2	0.2 W/ft^2
Total end-use load (unocc. period)	1.6 W/m^2	0.1 W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft^2.yr 1.5; MJ/m^2.yr 59

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Commercial food preparation equipment

	Natural Gas EUI	All Electric EUI
EUI kWh/ft^2.yr	3.6	0.1
MJ/m^2.yr	140.0	4.0

REFRIGERATION EQUIPMENT

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 EQUIPMENT

EUI kWh/ft^2.yr 1.0; MJ/m^2.yr 40

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Nursing Home Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Interior

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	95%	0%	0%	2%	0%	0%	3%	100%
Eff./COP	77%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.30	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 35.4 W/m² | 11.2 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% | Gas Fuel Share: 95.0% | Oil Fuel Share: 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	16.5	23.8	23.5
MJ/m².yr	638	923	909

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	20.0%	80.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.5	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.33	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: 108 W/m² | 34 Btu/hr.ft² | 350 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 148.0 MJ/m².yr | 3.8 kWh/ft².yr

Sizing Factor: 0.85

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 Maintenar

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	1.6	0.0	1.6
MJ/m².yr	63	0	63

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	14.25%	4.75%	0.00%	74.10%	1.90%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	95%	5%
Blended Efficiency	0.72	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 136.5

Wetting Use Percentage: 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	3.9	4.9	4.9
MJ/m².yr	150	191	188.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Nursing Home	**50,000 to 100,000 ft²**		**Interior**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.2	L/s.m²	0.62	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.8	W/m²	0.35	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)	0.5	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	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.92	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	0.008	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.59	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	24.9	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	1.4	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	5.7	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	3.7
	MJ/m².yr	143.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Nursing Home	**50,000 to 100,000 ft²**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**13.5** kWh/ft².yr	**524.3** MJ/m².yr	**Gas:**	**30.3** kWh/ft².yr	**1,174.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING (SUITES)	2.4	91.4
SERVICES, KITCHEN, OFFICES, DII	2.3	88.5
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.1
HVAC ELECTRICITY	3.7	143.7
REFRIGERATION EQUIPMENT	0.8	30.0
MISCELLANEOUS EQUIPMENT	1.0	40.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	31.9	22.6	877.2
SPACE COOLING	0.8	31.5	0.0	0.0
SERVICE HOT WATER	0.2	7.5	4.7	181.2
FOOD SERVICE EQUIPMENT	0.0	0.7	3.0	116.2

Summary Building Profile

Building Type:	New Large Schools	**Location:**	Interior

Description: This archetype is based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Green Buildings Program.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 100,000 ft²
- average footprint 50,000 ft² assumes a 100' x 500' footprint
- Two storeys

Building Specifications:						
roof construction:	0.28 W/m².°C					
wall construction:	0.44 W/m².°C					
windows:	2.8 W/m².°C					
shading coefficient	0.45					
window to wall ratio	0.15					
General Lighting & LPD	450 Lux	11.6 W/m²				
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	0%	0%	0%	0%	100%	
Architectural Lighting & LPD	300 Lux	8.9 W/m²				
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	2%	8%	0%	0%	90%	
Overall LPD	9.9 W/m²					
Plug Loads (office equipment) EPD	2.4 W/m²					
Ventilation:						
System Type	CAV	VAV	DD	IU	100%OA	Other
	80%	20%	0%	0%	0%	
System air Flow	4.0 L/s.m²	0.79 CFM/ft²				
Fan Power	3.8 W/m²	0.35 W/ft²				
Cooling Plant:						
System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	0%	0%	50%	50%	0%	0
Calculated Capacity	109 W/m²	347 ft²/Ton				
Cooling Plant Auxiliaries						
Circulating Pumps	0.9 W/m²	0.1 W/ft²				
Condenser Pumps	0.7 W/m²	0.1 W/ft²				
Condenser Fan Size	2.9 W/m²	0.3 W/ft²				

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	132	3.4		
Architectural Lighting	11	0.3		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	36	0.9		
Space Heating	27	0.7	463.4	12.0
Space Cooling	60	1.6	0.0	12.0
HVAC Equipment	107	2.8		
DHW	2	0.0	24.7	0.6
Refrigeration Equipment	2	0.0		
Food Service Equipment	0	0.0	4.2	0.0
Miscellaneous	11	0.3		
Total	**403**	**10.4**	**492.2**	**25**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.44	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	9,300	m²	100,068	ft²
Roof U value (W/m².°C)	0.28	W/m².°C	0.05	Btu/hr.ft² .°F	Typical Footprint (m²)	4,650	m²	50,034	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	%OA 29.91%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	0%				
Fresh Air Requirements or Outside Air	12	L/s.person	25	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	4.01	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	

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	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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Schools	> 50,000 ft2		Interior
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450 Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.85		
Connected Load	11.6 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	20%		
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 (%)	0%	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 3.4
MJ/m².yr 132

ARCHITECTURAL LIGHTING

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	8.9 W/m²	0.8	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	2%	8%	0%	0%	90%	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 11

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.4
MJ/m².yr 15

TOTAL LIGHTING EUI TOTAL kWh/ft².yr 4
MJ/m².yr 158

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.08	0.08	0.03	0.02	0.02	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.4 W/m²	0.1 W/m²	0.9 W/m²
	0.0 W/ft²	0.1 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.08 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	2.4 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	0.5 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 0.9
MJ/m².yr 36

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.1	0.0
MJ/m².yr	5.0	1.3

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.0
MJ/m².yr 1.7

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 0.3
MJ/m².yr 11

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Large Schools	> 50,000 ft2		Interior
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	90%	0%	5%	2%	0%	3%	100%
Eff./COP	73%	83%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.20	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	31.0 W/m²	9.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	427 MJ/m².yr	11.0 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Gas Fuel Share 90.0%	Oil Fuel Share 0.0%

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%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	6.9	268
Natural Gas EUI	13.3	515
Market Composite EUI	12.7	490

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.33	0.33	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	109 W/m²	35 Btu/hr.ft²	347 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	110.0 MJ/m².yr	2.8 kWh/ft².yr	
Sizing Factor	1.00		
A/C Saturation (Incidence of A/C)	100.0%		
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		

	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.6	60
Natural Gas EUI	0.0	0
Market Composite EUI	1.6	60

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	33.30%	33.30%	1.80%	17.10%	4.50%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.63		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load)	17.3
Wetting Use Percentage	90%

	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.5	19
Natural Gas EUI	0.7	27
Market Composite EUI	0.7	26.6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Large Schools Baseline
SIZE: > 50,000 ft2
VINTAGE:
REGION: Interior

HVAC ELECTRICITY

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	Continuous	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 area	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)	2.95	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	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.65	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.007	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	4000	hrs./year
Supply Fan Unocc. Period	4760	hrs./year
Supply Fan Energy Consumption	22.3	kWh/m².yr
Exhaust Fan Occ. Period	4000	hrs./year
Exhaust Fan Unocc. Period	4760	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	1.7	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	4000	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	2.8
	MJ/m².yr	107.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Large Schools	**> 50,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **10.4** kWh/ft².yr **402.8** MJ/m².yr **Gas:** **12.7** kWh/ft².yr **492.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.4	131.7
ARCHITECTURAL LIGHTING	0.3	11.3
OTHER (HIGH BAY) LIGHTING	0.4	15.1
OFFICE EQUIPMENT & PLUG LOAI	0.9	35.9
HVAC ELECTRICITY	2.8	107.2
REFRIGERATION EQUIPMENT	0.0	1.7
MISCELLANEOUS EQUIPMENT	0.3	11.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	26.8	12.0	463.4
SPACE COOLING	1.6	60.1	0.0	0.0
SERVICE HOT WATER	0.0	1.9	0.6	24.7
FOOD SERVICE EQUIPMENT	0.0	0.2	0.1	4.2

Summary Building Profile

Building Type:	Medium Schools	**Location:**	Interior

Description: This archetype is initially based on knowledge of current commercial construction practices seen in BC Hydro's Design Assistance Program, NRCan's CBIP Program and BC Green Buildings Program.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 24,700 ft²
- average footprint 24,700 ft² assumes a 70' x 350' footprint
- one storey

Building Specifications:

roof construction:	0.35	W/m².°C
wall construction:	0.6	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.45	
window to wall ratio	0.15	

General Lighting & LPD 450 Lux 11.6 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
0%	0%	0%	0%	100%	

Architectural Lighting & LPD 300 Lux 8.9 W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	Other
2%	8%	0%	0%	90%	

Overall LPD 9.9 W/m²

Plug Loads (office equipment) EPD 2.4 W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other
90%	10%	0%	0%	0%	

System air Flow	4.0	L/s.m²	0.79	CFM/ft²
Fan Power	1.9	W/m²	0.18	W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
0%	0%	0%	100%	0%	0

Calculated Capacity 126 W/m² 300 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.1	W/m²	0.1	W/ft²
Condenser Pumps	0.8	W/m²	0.1	W/ft²
Condenser Fan Size	3.4	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	118	3.0		
Architectural Lighting	11	0.3		
High Bay Lighting	15	0.4		
Plug Loads & Office Equipment	36	0.9		
Space Heating	33	0.9	588.8	15.2
Space Cooling	27	0.7	0.0	15.2
HVAC Equipment	66	1.7		
DHW	1	0.0	27.4	0.7
Refrigeration Equipment	1	0.0		
Food Service Equipment	0	0.0	4.2	0.7
Miscellaneous	6	0.2		
Total	**314**	**8.1**	**620.3**	**32**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **Medium Schools** **Baseline** | **SIZE:** **< 50,000 ft2** | **VINTAGE:** | **REGION:** **Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	13	L/s.person	28	CFM/person

%OA 32.24%

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: 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	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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Interior
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450 Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.85		
Connected Load	11.6 W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2400		
Unocc. Period(Hrs./yr.)	6360		
Usage During Occupied Period	85%		
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	25%	75%	0%	0%	100%
Weighted Average					450

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	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 3.0; MJ/m².yr 118

ARCHITECTURAL LIGHTING

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	8.9 W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	2400		
Unocc. Period(Hrs./yr.)	6360		
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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	2%	8%	0%	0%	90%	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 11

EUI = Load X Hrs. X SF X GLFF

OTHER (HIGH BAY) 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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.4; MJ/m².yr 15

TOTAL LIGHTING — EUI TOTAL kWh/ft².yr 4; MJ/m².yr 144

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.08	0.08	0.03	0.02	0.02	
Connected Load	0.4 W/m²	0.7 W/m²	0.2 W/m²	0.4 W/m²	0.1 W/m²	0.9 W/m²
	0.0 W/ft²	0.1 W/ft²	0.01 W/ft²	0.04 W/ft²	0.01 W/ft²	0.08 W/ft²
Diversity Occupied Period	85%	85%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	2.4 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	0.5 W/m²	0.0 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 0.9; MJ/m².yr 36

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 83.0% Electricity Fuel Share: 17.0%

Cafeteria

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.1	0.0
MJ/m².yr	5.0	1.1

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.0; MJ/m².yr 1.1

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 0.2; MJ/m².yr 6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **Medium Schools** **Baseline** | **SIZE:** **< 50,000 ft2** | **VINTAGE:** | **REGION:** **Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	90%	0%	5%	2%	0%	3%	100%
Eff./COP	73%	83%	95%	2.60	3.10	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.37	1.20	1.05	0.38	0.32	0.22	1.00	

Peak Heating Load	53.7	W/m²	17.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	543	MJ/m².yr	14.0	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 10.0% | Gas Fuel Share 90.0% | Oil Fuel Share 0.0%

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	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	8.6	16.9	16.1
MJ/m².yr	332	654	622

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	2.5	5.4	4.4	3.6	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.40	0.19	0.23	0.28	0.33	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	126	W/m²	40	Btu/hr.ft²	300	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	129.4	MJ/m².yr	3.3	kWh/ft².yr		

Sizing Factor 1.00

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	1.4	0.0	1.4
MJ/m².yr	54	0	54

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	47.50%	39.90%	1.90%	0.00%	5.70%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	95%	5%
Blended Efficiency	0.60	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 17.3

Wetting Use Percentage 90%

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.5	0.7	0.7
MJ/m².yr	19	29	28.4

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **Medium Schools** **Baseline** | **SIZE:** **< 50,000 ft2** | **VINTAGE:** | **REGION:** **Interior**

HVAC ELECTRICITY

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	60%			
Fan Motor Efficiency	88%			
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	90%	10%	100%	
Operation	Continuous	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 area	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)	3.41	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	0.75	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.008	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	3000	hrs./year
Supply Fan Unocc. Period	5760	hrs./year
Supply Fan Energy Consumption	10.8	kWh/m².yr
Exhaust Fan Occ. Period	3000	hrs./year
Exhaust Fan Unocc. Period	5760	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	1.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	3000	hrs./year
Circulating Pump Energy Consumption	3.2	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	1.7
	MJ/m².yr	65.8

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.1** kWh/ft².yr	**314.4** MJ/m².yr	**Gas:**	**16.0** kWh/ft².yr	**620.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
GENERAL LIGHTING	3.0	117.8					
ARCHITECTURAL LIGHTING	0.3	11.1	SPACE HEATING	0.9	33.2	15.2	588.8
OTHER (HIGH BAY) LIGHTING	0.4	15.1	SPACE COOLING	0.7	27.2	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	0.9	35.9	SERVICE HOT WATER	0.0	1.0	0.7	27.4
HVAC ELECTRICITY	1.7	65.8	FOOD SERVICE EQUIPMENT	0.0	0.2	0.1	4.2
REFRIGERATION EQUIPMENT	0.0	1.1					
MISCELLANEOUS EQUIPMENT	0.2	6.0					

Summary Building Profile

Building Type:	New University-Colleg	**Location:**	Interior

Description: This archetype is based on knowledge of current commercial construction practice seen in BC Hydro's Design Assistance Program.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 90,000 ft²
- average footprint 45,000 ft² with a 7:1 length to aspect ratio
- 2 stories

Building Specifications:

roof construction:	0.28	W/m².°C
wall construction:	0.44	W/m².°C
windows:	2.8	W/m².°C
shading coefficient	0.45	
window to wall ratio	0.3	

General Lighting & LPD — 500 Lux — 12.2 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	0%	0%	0%	0%	95%	5%

Architectural Lighting & LPD — 300 Lux — 10.4 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH
	5%	15%	0%	0%	80%	0%

Overall LPD — 11.0 W/m²

Plug Loads (office equipment) EPD — 4.1 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	50%	50%	0%	0%	0%	

System air Flow	3.8	L/s.m²	0.76	CFM/ft²
Fan Power	7.6	W/m²	0.71	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	25%	0%	0%	75%	0%	

Calculated Capacity — 114 W/m² — 332 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	1.0	W/m²	0.1	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	3.1	W/m²	0.3	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	183	4.7		
Architectural Lighting	33	0.8		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	59	1.5		
Space Heating	17	0.4	518.9	13.4
Space Cooling	20	0.5	0.0	13.4
HVAC Equipment	153	4.0		
DHW	3	0.1	27.7	0.7
Refrigeration Equipment	20	0.5		
Food Service Equipment	3	0.1	0.0	0.0
Miscellaneous	75	1.9		
Total	**566**	**14.6**	**546.6**	**28**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New University-Colleges Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Interior

CONSTRUCTION

Wall U value (W/m².°C)	0.44	W/m².°C	0.08	Btu/hr.ft² .°F	Typical Building Size	9,000 m²	96,840	ft²
Roof U value (W/m².°C)	0.28	W/m².°C	0.05	Btu/hr.ft² .°F	Typical Footprint (m²)	4,500 m²	48,420	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	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 (%)	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	17	L/s.person	36	CFM/person

%OA 31.64%

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	1.3			
Total Air Circulation or Design Air Flow	3.84	L/s.m²	0.76	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	

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	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	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

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New University-Colleges	**0**		**Interior**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500 Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.90		
Connected Load	12.2 W/m²	1.1	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	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	95%	5%	0%	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

ARCHITECTURAL LIGHTING CORRIDORS

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.10		
Connected Load	10.4 W/m²	1.0	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	15%	0%	0%	80%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 0.8; MJ/m².yr 33

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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 0.0; MJ/m².yr 0

TOTAL LIGHTING

EUI TOTAL kWh/ft².yr 6; MJ/m².yr 215

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.1	0.1	0.15	0.05	0.05	
Connected Load	0.4 W/m²	0.6 W/m²	0.5 W/m²	0.7 W/m²	0.2 W/m²	2 W/m²
	0.0 W/ft²	0.1 W/ft²	0.05 W/ft²	0.07 W/ft²	0.02 W/ft²	0.19 W/ft²
Diversity Occupied Period	75%	75%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	50%	10%	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)	4.1 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	1.2 W/m²	0.1 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 1.5; MJ/m².yr 59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 1-% Electricity Fuel Share: 17.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.5	0.5
MJ/m².yr	20.0	20.0

REFRIGERATION EQUIPMENT

Provide description below:

Unknown

EUI kWh/ft².yr 0.5; MJ/m².yr 20.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.9; MJ/m².yr 75

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New University-Colleges Baseline
SIZE: 0
VINTAGE:
REGION: Interior

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	0%	95%	0%	2%	0%	1%	2%	100%
Eff./COP	75%	83%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load: 40.4 W/m² — 12.8 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 453 MJ/m².yr — 11.7 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% Gas Fuel Share: 95.0% Oil Fuel Share: 0.0%

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	8.7	335
Natural Gas EUI	14.1	546
Market Composite EUI	13.8	536

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	3	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.33	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: 114 W/m² — 36 Btu/hr.ft² — 332 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 157.5 MJ/m².yr — 4.1 kWh/ft².yr

Sizing Factor: 1.00

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 Maintenar

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	1.7	67
Natural Gas EUI	0.0	0
Market Composite EUI	1.7	67

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	4.50%	4.50%	0.00%	76.50%	4.50%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.8

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.6	25
Natural Gas EUI	0.8	31
Market Composite EUI	0.8	30.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New University-Colleges Baseline
SIZE: 0
VINTAGE:
REGION: Interior

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.8	L/s.m²	0.76	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	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	50%	50%	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	0.0	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)	3.08	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	0.006	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	0.007	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	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	3200	hrs./year
Supply Fan Unocc. Period	5560	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	1.7	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	7000	hrs./year
Circulating Pump Energy Consumption	6.7	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	4.0
	MJ/m².yr	153.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New University-Colleges	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.6** kWh/ft².yr	**565.6** MJ/m².yr	
	Gas:	**14.1** kWh/ft².yr	**546.6** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.7	182.6
ARCHITECTURAL LIGHTING CORF	0.8	32.7
OTHER (HIGH BAY) LIGHTING	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	1.5	59.3
HVAC ELECTRICITY	4.0	153.3
REFRIGERATION EQUIPMENT	0.5	20.0
MISCELLANEOUS EQUIPMENT	1.9	75.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	16.8	13.4	518.9
SPACE COOLING	0.5	20.0	0.0	0.0
SERVICE HOT WATER	0.1	2.5	0.7	27.7
FOOD SERVICE EQUIPMENT	0.1	3.4	0.0	0.0

Summary Building Profile

Building Type: Restaurant | **Location:** Interior

Description: This archetype is based on data from the Building Check-up database. The BCU database contains 4 buildings ranging in size from 7,000 ft² constructed between 1940 and 1996. The average size of the sample is 8,400 ft².

Only end-use energy intensities available. No detailed specifications available to develop a full archetype.

Average Building:

Building Specifications:

roof construction:	W/m².°C
wall construction:	W/m².°C
windows:	W/m².°C
shading coefficient	
window to wall ratio	

General Lighting & LPD Lux W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Architectural Lighting & LPD Lux W/m²

System Types

INC	CFL	T12ES	T8Magnetc	T8Electron	MH

Overall LPD W/m²

Plug Loads (office equipment) EPD W/m²

Ventilation:

System Type

CAV	VAV	DD	IU	100%OA	Other

System air Flow L/s.m² CFM/ft²

Fan Power W/m² W/ft²

Cooling Plant:

System Type

Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other

Calculated Capacity W/m² ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	W/m²	W/ft²
Condenser Pumps	W/m²	W/ft²
Condenser Fan Size	W/m²	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
General Lighting	619	16.0		
Architectural Lighting	51	1.3		
High Bay Lighting	0	0.0		
Plug Loads & Office Equipment	116	3.0		
Space Heating	78	2.0	156.1	4.0
Space Cooling	42	1.1	0.0	4.0
HVAC Equipment	149	3.8		
DHW	10	0.3	65.6	1.7
Refrigeration Equipment	1200	31.0		
Food Service Equipment	3	0.1	664.0	0.0
Miscellaneous	60	1.5		
Total	**2328**	**60.1**	**885.7**	**10**

Note that this profile is not fully "live"--only some of the summary values come from "profile"

Summary Building Profile

Building Type:	New Warehouse/Whsl	**Location:**	Interior

Description: This archetype is similar to the existing warehouse/wholesale archetype. New construction is assumed to be little changed from the existing stock.

Average Building: The average building characteristics used to define this building profile are as follows:
- average building size 34,000 ft²

Building Specifications:							
roof construction:	0.35 W/m².°C						
wall construction:	0.45 W/m².°C						
windows:	2.8 W/m².°C						
shading coefficient	0.8						
window to wall ratio	0.05						
High Bay Lighting & LPD	400 Lux		14.1 W/m²				
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	MH	HPS
	0%	0%	0%	0%	15%	75%	10%
Other Office Lighting & LPD	300 Lux		10.1 W/m²				
System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other	
	5%	10%	0%	0%	85%		
Overall LPD	13.4 W/m²						
Plug Loads (office equipment) EPD	4.5 W/m²						
Ventilation:							
System Type	CAV	VAV	DD	IU	100%OA	Other	
	100%	0%	0%	0%	0%		
System air Flow	3.1 L/s.m²		0.60 CFM/ft²				
Fan Power	6.4 W/m²		0.59 W/ft²				
Cooling Plant:							
System Type	Centrifugal	Centri HE	Screw	Recip Open	DX	LiBr.	Other
	0%	0%	0%	10%	90%	0%	
Calculated Capacity	53 W/m²		713 ft²/Ton				
Cooling Plant Auxiliaries							
Circulating Pumps	0.2 W/m²		0.0 W/ft²				
Condenser Pumps	0.0 W/m²		0.0 W/ft²				
Condenser Fan Size	1.4 W/m²		0.1 W/ft²				

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
High Bay Lighting	232	6.0		
Other Office Lighting	10	0.3		
Other Lighting	0	0.0		
Plug Loads & Office Equipment	96	2.5		
Space Heating	22	0.6	233.2	6.0
Space Cooling	8	0.2	0.0	6.0
HVAC Equipment	52	1.3		
DHW	6	0.2	23.0	0.6
Refrigeration Equipment	50	1.3		
Food Service Equipment	0	0.0	0.0	0.0
Miscellaneous	40	1.0		
Total	**516**	**13.3**	**256.1**	**13**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: New Warehouse/Whsale Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Interior

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)	0.35	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	3,200	m²	34,432	ft²
Glazing U value (W/m².°C)	2.80	W/m².°C	0.49	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	6.53%
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
(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	3.06	L/s.m²	0.60	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	

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	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

NEW BUILDINGS: **New Warehouse/Whsale** **Baseline**

SIZE: **0**

VINTAGE:

REGION: **Interior**

LIGHTING

HIGH BAY LIGHTING

Light Level	400 Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.95		
Connected Load	14.1 W/m²	1.3	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%	0%	15%	75%	10%	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 6.0
MJ/m².yr 232

OTHER, OFFICE LIGHTING

Light Level	300 Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	10.1 W/m²	0.9	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 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	10%	0%	0%	85%	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 = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 0.3
MJ/m².yr 10

OTHER 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%	0%
Weighted Average					**0**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	0%	0%	0%	0%	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

EUI TOTAL kWh/ft².yr 6.3
MJ/m².yr 243

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0	0	0	0.01	0.05	
Connected Load	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.46 W/ft²
Diversity Occupied Period	0%	0%	0%	90%	100%	90%
Diversity Unoccupied Period	0%	0%	0%	10%	100%	40%
Operation Occ. Period (hrs./year)	0	0	0	2600	2600	3500
Operation Unocc. Period (hrs./year)	8760	8760	8760	6160	6160	5260

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.0 W/m²	0.2 W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI kWh/ft².yr 2.5
MJ/m².yr 96

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

	Natural Gas EUI	All Electric EUI
EUI kWh/ft².yr	0.0	0.0
MJ/m².yr	0.0	0.0

REFRIGERATION EQUIPMENT

Provide description below:

Large refrigeration storage

EUI kWh/ft².yr 1.3
MJ/m².yr 50.0

MISCELLANEOUS EQUIPMENT

EUI kWh/ft².yr 1.0
MJ/m².yr 40

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Warehouse/Whsale	**0**		**Interior**
Baseline			

SPACE HEATING

Heating Plant Type

	Hot Water System							Electric	
	Boilers		District	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High	Steam					
System Present (%)	0%	90%	0%	0%	0%	0%	10%	100%
Eff./COP	75%	83%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.20	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	59.8 W/m²	19.0 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	215 MJ/m².yr	5.6 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Gas Fuel Share 90.0%	Oil Fuel Share 0.0%

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	5.6	215
Natural Gas EUI	6.7	259
Market Composite EUI	6.6	255

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	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	4.4	3.6	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.34	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	53 W/m²	17 Btu/hr.ft²	713 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	94.2 MJ/m².yr	2.4 kWh/ft².yr	
Sizing Factor	1.00		
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 Maintenar

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	1.1	42
Natural Gas EUI	0.0	0
Market Composite EUI	1.1	42

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	63.00%	7.00%	0.00%	0.00%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.56	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 18.2

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	0.5	20
Natural Gas EUI	0.8	33
Market Composite EUI	0.7	29.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Warehouse/Whsale	0		Interior
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	3.1	L/s.m²	0.60	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	3.2	W/m²	0.30	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	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	0.027	kW/kW	0.09	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	0.003	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	0.003	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	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	10.2	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	0.8	kWh/m².yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	1.4	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	51.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Warehouse/Whsale	**0**		**Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**13.3**	kWh/ft².yr	**515.8**	MJ/m².yr	**Gas:**	**6.6** kWh/ft².yr	**256.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Gas kWh/ft².yr	Gas MJ/m².yr
HIGH BAY LIGHTING	6.0	232.3					
OTHER, OFFICE LIGHTING	0.3	10.2	SPACE HEATING	0.6	21.5	6.0	233.2
OTHER LIGHTING	0.0	0.0	SPACE COOLING	0.2	8.4	0.0	0.0
OFFICE EQUIPMENT & PLUG LOAI	2.5	95.6	SERVICE HOT WATER	0.2	6.0	0.6	23.0
HVAC ELECTRICITY	1.3	51.7	FOOD SERVICE EQUIPMENT	0.0	0.0	0.0	0.0
REFRIGERATION EQUIPMENT	1.3	50.0					
MISCELLANEOUS EQUIPMENT	1.0	40.0					

Summary Building Profile

Building Type:	New Mixed Use	**Location:**	Blended Interior

Description: This archetype is based on data from the Building Check-up database, BC Hydro's High and LowiRise Apt. Bldgs. Audit and Simulation Study and end-use data supplied by Sheltair.

This profile assumes retail space in the first floor and apartments in all floors above.

Average Building: The average building characteristics used to define this building profile are as follows:
- average number of suites 62 at 750 ft²/suite
- average building size 56,500 ft² (assumes 20% additional floor space for corridors
- average footprint 8,100 ft² assumes 9 suites per floor (except first floor retail)
- 7 stories

Building Specifications:

roof construction:	0.32	W/m².°C
wall construction:	0.62	W/m².°C
windows:	5.212	W/m².°C
shading coefficient	0.65	
window to wall ratio	0.29	

General Lighting & LPD 112.5 Lux 14.0 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	80%	10%	10%	0%	0%	

Architectural Lighting & LPD 150 Lux 13.9 W/m²

System Types	INC	CFL	T12ES	T8Magnetc	T8Electron	Other
	50%	30%	15%	0%	5%	

Overall LPD 11.2 W/m²

Plug Loads (office equipment) EPD 1.0 W/m²

Ventilation:

System Type	CAV	VAV	DD	IU	100%OA	Other
	100%	0%	0%	0%	0%	

System air Flow	0.0	L/s.m²	0.00	CFM/ft²
Fan Power	0.0	W/m²	0.00	W/ft²

Cooling Plant:

System Type	Centrifugal	Centri HE	Recip Open	DX	LiBr.	Other
	1%	0%	5%	94%	0%	0

Calculated Capacity 57 W/m² 658 ft²/Ton

Cooling Plant Auxiliaries

Circulating Pumps	0.5	W/m²	0.0	W/ft²
Condenser Pumps	0.0	W/m²	0.0	W/ft²
Condenser Fan Size	0.0	W/m²	0.0	W/ft²

End-Use Summary	**Electricity**		**Gas**	
	MJ/m².yr	**kWh/ft².yr**	**MJ/m².yr**	**kWh/ft².yr**
Suite Lighting	30	0.8		
Corridor/Common Area Lighting	80	2.1		
High Bay Lighting	0	0.0		
Appliance, TV, Entertainment, Other	60	1.6		
Space Heating	126	3.2	95.1	2.5
Space Cooling	1	0.0	0.0	2.5
HVAC Equipment	6	0.2		
DHW	23	0.6	100.3	2.6
Residential Refrigerator	27	0.7		
Cooking Appliances (incl. Stove)	18	0.5	0.0	0.0
Miscellaneous	17	0.4		
Total	**386**	**10.0**	**195.4**	**7**

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Mixed Use** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Blended Interior**

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² .°F	Typical Building Size	5,250	m²	56,490	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² .°F	Typical Footprint (m²)	750	m²	8,070	ft²
Glazing U value (W/m².°C)	5.21	W/m².°C	0.92	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	1.25			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	75%			
Window/Wall Ratio (WIWAR) (%)	0.29								
Shading Coefficient (SC)	0.65				Typical # Stories	7			
					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 ########

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: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.001 L/s.m² 0.00 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.00	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)

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	

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

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
New Mixed Use	0		Blended Interior
Baseline			

LIGHTING

SUITE LIGHTING

Light Level	113 Lux	10.5	ft-candles
Floor Fraction (GLFF)	0.80		
Connected Load	14.0 W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	2900		
Unocc. Period(Hrs./yr.)	5860		
Usage During Occupied Period	5%		
Usage During Unoccupied Period	10%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	200	300	500	Total
% Distribution	65%	25%	10%	0%	100%
Weighted Average					**112.5**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	80%	10%	10%	0%	0%	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	30

CORRIDORS/COMMON AREAS

Light Level	150 Lux	13.9	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	13.9 W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	90%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	100	200	300	500	Total
% Distribution	70%	10%	20%	0%	100%
Weighted Average					**150**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	50%	30%	15%	0%	5%	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 = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	2.1
	MJ/m².yr	80

OTHER (HIGH BAY) LIGHTING

Light Level	300.00 Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	14.0 W/m²	1.3	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	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	0%	0%	0%	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	0.0
	MJ/m².yr	0

TOTAL LIGHTING

EUI TOTAL		
	kWh/ft².yr	3
	MJ/m².yr	110

APPLIANCES, TV ENTERTAINMENT, OTHER

Equipment Type	Computers	Monitors	Printers	Copiers	Fax Machines	Plug Loads
Measured Power (W/device)	55	85	50	200	50	
Density (device/occupant)	0.2	0.2	0	0	0	
Connected Load	0.3 W/m²	0.4 W/m²	0.0 W/m²	0.0 W/m²	0.0 W/m²	2.4 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.00 W/ft²	0.00 W/ft²	0.22 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

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

EUI		
	kWh/ft².yr	1.6
	MJ/m².yr	60

COOKING APPLIANCES STOVE

Provide description below: Gas Fuel Share: 0.0% Electricity Fuel Share: 100.0%

Electric stove with an annual consumption of 340 kWh/unit

	Natural Gas EUI		All Electric EUI
EUI	kWh/ft².yr 0.0	EUI	kWh/ft².yr 0.5
	MJ/m².yr 0.0		MJ/m².yr 18.0

RESIDENTIAL REFRIGERATOR

Provide description below:

Residential refrigerator with an annual consumption of 636 kWh/unit

EUI		
	kWh/ft².yr	0.7
	MJ/m².yr	27.0

MISCELLANEOUS EQUIPMENT

EUI		
	kWh/ft².yr	0.4
	MJ/m².yr	17

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **New Mixed Use** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Blended Interior**

SPACE HEATING

Heating Plant Type

	Hot Water System: Boilers Stan.	Boilers High	District Steam	A/A HP	W. S. HP	H/R Chiller	Electric Resistance	Total
System Present (%)	0%	40%	0%	0%	0%	0%	60%	100%
Eff./COP	75%	88%	95%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.14	1.05	0.59	0.33	0.22	1.00	

Peak Heating Load	61.9	W/m²	19.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	209	MJ/m².yr	5.4	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 60.0% — Gas Fuel Share 40.0% — Oil Fuel Share 0.0%

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
Natural Gas EUI	kWh/ft².yr	6.1
	MJ/m².yr	238
Market Composite EUI	kWh/ft².yr	5.7
	MJ/m².yr	221

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Reciprocating Chillers Open	Reciprocating Chillers DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	1.0%	0.0%	0.0%	5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	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	658	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	150.1	MJ/m².yr	3.9	kWh/ft².yr		

Sizing Factor 1.00

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 Maintenar

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	7
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	0.2
	MJ/m².yr	7

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	48.75%	3.75%	0.00%	22.50%	0.00%
Eff./COP	0.550	0.600	0.900	0.750	0.900

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.61	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 81.9

Wetting Use Percentage 80%

All Electric EUI		Natural Gas EUI		Market Composite EUI	
kWh/ft².yr	2.3	kWh/ft².yr	3.5	kWh/ft².yr	3.2
MJ/m².yr	90	MJ/m².yr	134	MJ/m².yr	122.8

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Mixed Use	**0**		**Blended Interior**
Baseline			

HVAC ELECTRICITY

SUPPLY FANS

System Design Air Flow	0.0	L/s.m²	0.00	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	0.0	W/m²	0.00	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	100%	0%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	20	L/s.washroom	42	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	0.003	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	0.004	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	0.05	W/ft²		

Supply Fan Occ. Period	3200	hrs./year
Supply Fan Unocc. Period	5560	hrs./year
Supply Fan Energy Consumption	0.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.6	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	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	0.2
	MJ/m².yr	5.8

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
New Mixed Use	**0**		**Blended Interior**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**10.0** kWh/ft².yr	**386.5** MJ/m².yr	**Gas:**	**5.0** kWh/ft².yr	**195.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
SUITE LIGHTING	0.8	29.5
CORRIDORS/COMMON AREAS	2.1	80.3
OTHER (HIGH BAY) LIGHTING	0.0	0.0
APPLIANCES, TV ENTERTAINMENT	1.6	60.1
HVAC ELECTRICITY	0.2	5.8
RESIDENTIAL REFRIGERATOR	0.7	27.0
MISCELLANEOUS EQUIPMENT	0.4	17.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	3.2	125.5	2.5	95.1
SPACE COOLING	0.0	0.7	0.0	0.0
SERVICE HOT WATER	0.6	22.5	2.6	100.3
COOKING APPLIANCES STOV	0.5	18.0	0.0	0.0

MARBEK
Resource Consultants Ltd.

APPENDIX E

Technology Screening of Energy Efficiency Measures

Exhbit 4.4 Summary of Measures TRC Screening Results

Name	Target Market				Simple Payback (Yrs)	Measure TRC [$]	B/C Ratio
	Service Area(s)	Sub Sector(s)	Vintage	Full/Incr			
DHW - Pre-Rinse Spray Valve (new)	All	small, medium & large	new	I	0.2	939	15.4
DHW - Pre-Rinse Spray Valve (existing)	All	small, medium & large	existing	F	0.3	904	10.0
Commercial Food Preparation - Gas Broilers	All	small, medium & large	existing & new	I	0.3	1,726	9.6
Ultra Efficient Building Design to 60% Below Current Practice (large)	All	large	new	I	1.4	1,609,017	9.0
High Efficiency Boilers (Existing) - Near-Condensing	All	medium & large	existing	I	1.1	48,158	5.0
DHW - High Efficiency Condensing DHW Boiler	All	large	existing & new	I	1.4	2,165	4.5
High Efficiency Boilers (New) - Near-Condensing	All	medium & large	new	I	1.4	29,532	4.0
Commercial Food Preparation - Gas Ranges	All	small, medium & large	existing & new	I	0.9	1,951	3.4
Demand Controlled Ventilation (large)	Interior	large	existing	F	1.3	19,942	3.3
DHW - High Efficiency Condensing DHW Heaters	All	medium & large	existing & new	I	1.6	2,165	2.1
Energy Efficient Building Design to 30% Below Current Practice (large)	All	large	new	I	5.9	238,752	1.9
Energy Efficient Building Design to 30% Below Current Practice (medium	All	small and medium	new	I	6.0	80,657	1.9
Improved Building Operations - "Next Generation" BAS	All	large	existing	F	4.9	40,596	1.5
DHW - Instantaneous Hot Water Heaters	All	restaurants & med hotels	existing & new	I	2.5	1,058	1.5
High Efficiency Boilers (Existing) - Condensing	All	medium & large	existing	I	4.2	21,630	1.3
DHW - Drainwater Heat Recovery (New)	All	rest, large hotels, nursing homes, hospitals	new	I	3.6	3,885	1.2
Improved Building Operations - Building Recommissioning	All	medium & large	existing	F	6.1	20,596	1.2
High Efficiency Boilers (New) - Condensing	All	medium & large	new	I	4.6	10,352	1.2
DHW - Drainwater Heat Recovery (Existing)	All	rest, large hotels, nursing homes, hospitals	existing	F	4.2	885	1.0
High-Performance Glazings (New) - HIT Windows	All	large	new	I	11.7	-4,339	1.0
Demand Controlled Ventilation (medium)	Interior	medium	existing	F	6.3	-1,439	0.9
Commercial Food Preparation - Gas Fryers	All	small, medium & large	existing & new	I	5.1	-526	0.6
High Efficiency Rooftop Units - Modulating	All	small & medium	existing	I	13.1	-29,959	0.4
High-Performance Glazings (Existing) - Energy Star Windows	All	large	existing	I	19.5	-71,926	0.3
High-Performance Building Envelopes - Gas-Filled Wall Panels	All	large	new	I	24.9	-93,645	0.2
Increased Roof Insulation for Flat Roofs	All	small & medium low-rise	existing	I	25.1	-43,804	0.2
High-Performance Glazings (Existing) - HIT Windows	All	large	existing	I	29.1	-259,842	0.2
High-Performance Building Envelopes - Vacuum Panel Insulation	All	large	new	I	103.6	-568,374	0.1

Marginal Cost of New Supply - By Load Shape, Service Area and Measure Life								
Natural Gas	Load Shape							
	Peaky (e.g., space heat)				Flat (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	5.756	5.685	5.716	5.782	5.102	5.041	5.031	4.978
Lower Mainland	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782
Interior	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782

Marginal Cost of New Supply - By Load Shape, Service Area and Measure Life - CPR version with losses								
Electricity	Load Shape							
	Peaky (e.g., space heat)				Flat (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Lower Mainland	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Interior	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94

$/MWh			
M. Life (yrs)	LM	VI	Interior
10	53.56	54.04	49.65
15	52.51	52.98	48.67
20	51.70	52.16	47.92
25	51.04	51.50	47.32

Provided by BCH

Customer Energy Prices						
	Residential		Commercial		Manufacturing	
	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0132	$0.0169	$0.0113	$0.0135	$0.0094	$0.0135
Lower Mainland	$0.0105	$0.0169	$0.0099	$0.0135	$0.0087	$0.0135
Interior	$0.0104	$0.0169	$0.0098	$0.0135	$0.0086	$0.0135
Customer EnergyTax Rate (%)	1		1		1	

Discount Rate	8.0%

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Increased Insulation For Flat Roofs

- Add Additional Roof Insulation to Existing Low Rise Commercial Buildings at Time of Roof 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)		
1	**Medium Commercial**	2,634,525	-	2,436,936	0	I	$56,000	$0	25	197,589	0	197,589	$2,232.76	25.1	-$43,804	0.2
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Increased Insulation For Flat Roofs

- Add Additional Roof Insulation to Existing Low Rise Commercial Buildings at Time of Roof 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)		
1	**Medium Commercial**	2,634,525	-	2,436,936	0	I	$56,000	$0	25	197,589	0	197,589	$1,955.15	28.6	-$41,278	0.3
2																
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Increased Insulation For Flat Roofs

- Add Additional Roof Insulation to Existing Low Rise Commercial Buildings at Time of Roof 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)		
1	**Medium Commercial**	2,634,525	-	2,436,936	0	I	$56,000	$0	25	197,589	0	197,589	$1,934.60	28.9	-$41,278	0.3
2																
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:

The existing commercial building is based on a building size of 6,505 m² (~70,000 ft²) and a total natural gas energy intensity of 450 MJ/m².yr (11.6 ekWh/ft².yr) of which 405 MJ/m².yr is space heating and 45 MJ/m².yr is SHW.

Adding an additional 50 mm (2 inches) of insulation at the time of roof replacement in medium commercial buildings will save between 5 and 10% of the total space heating energy use based on the results from CEEAM simulations of medium schools and non-food retail buildings. The energy savings are equivalent to a reduction of 20 to 40 MJ/m².yr by increasing the roof insulation from R20 which is assumed to be the current level of current practice for reroofing existing flat BU roof to R28.

The incremental cost used in the analysis is for material only since the analysis assumes the need for re-roofing. The cost of additional styrofoam insulation is assumed to be $0.40/ft².inch. Total cost for 2 additional inches covering 6,505 m² is $56,000.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazings (Existing)

- Replacing Glazing in High WWR Buildings with HP Glazing at Time of Replacement in Existing Buildings

	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	**Existing Large Commercial *Upgrade 1 Double low e-+ argon + Ins spacer - Uvalue 0.36 (R2.8)***	6,497,750	-	6,042,908	0	I	$100,000	$0	25	454,843	0	454,843	$5,139.72	19.5	-$71,926	0.3
2	**Existing Large Commercial *Upgrade 2 HIT window Uvalue 0.25 (R4)***	6,497,750	-	5,523,088	0	I	$320,000	$0	25	974,663	0	974,663	$11,013.69	29.1	-$259,842	0.2
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazings (Existing)

- Replacing Glazing in High WWR Buildings with HP Glazing at Time of Replacement in Existing Buildings

	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	**Existing Large Commercial *Upgrade 1 Double low e-+ argon + Ins spacer - Uvalue 0.36 (R2.8)***	6,497,750	-	6,042,908	0	I	$100,000	$0	25	454,843	0	454,843	$4,500.67	22.2	-$66,110	0.3
2	**Existing Large Commercial *Upgrade 2 HIT window Uvalue 0.25 (R4)***	6,497,750	-	5,523,088	0	I	$320,000	$0	25	974,663	0	974,663	$9,644.29	33.2	-$247,378	0.2
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazings (Existing)

- Replacing Glazing in High WWR Buildings with HP Glazing at Time of Replacement in Existing Buildings

	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	**Existing Large Commercial *Upgrade 1 Double low e-+ argon + Ins spacer - Uvalue 0.36 (R2.8)***	6,497,750	-	6,042,908	0	I	$100,000	$0	25	454,843	0	454,843	$4,453.36	22.5	-$66,110	0.3
2	**Existing Large Commercial *Upgrade 2 HIT window Uvalue 0.25 (R4)***	6,497,750	-	5,523,088	0	I	$320,000	$0	25	974,663	0	974,663	$9,542.92	33.5	-$247,378	0.2
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:

The size of the existing large commercial building is derived based on the average consumption per customer for all large commercial customers. Using an average space heating and SHW energy intensity of 390 MJ/m².yr (10 ekWh/ft².yr) results in a building size of 18,565 m² (~200,000 ft²) of which 350 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

The analysis is applied to large commercial buildings with high window-wall ratios (WWR) ratios of 0.3 to 0.5. The savings are based on the large office archetype with a WWR of 0.38 and an upgrade at the time of replacement from double 6/12/6 Uvalue 0.40 (R2.5) to super double with a Uvalue 0.36 (R2.8) and HIT windows with a Uvalue of 0.25 (R4). Savings are estimated to be as follows:
- 7% reduction in space heating energy use for the super double windows
- 15% savings in space heating energy use for the high insulation technology (HIT) windows

The above savings are based on CEEAM simulations. The incremental cost of the super double windows is $3/ft² of window area. This is equivalent to a cost of $0.50/ft² of floor area for the archetype building. The incremental cost of the HIT window from Visionwall Technology ranges from 8 to $13/ft² of window area. This is equivalent to a cost of $1.20 to $2.00/ft² of floor area for the archetype building.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazing (New)

- HIT Windows Option as an Upgrade in High WWR Buildings for New Construction -

	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	**New Large Commercial *Upgrade 2 HIT window Uvalue 0.25 (R4)***	4,269,950	10,800,000	3,629,458	10,260,000	I	$160,000	$0	25	640,493	540,000	1,180,493	$14,527.57	11.0	-$12,530	0.9
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazing (New)

- HIT Windows Option as an Upgrade in High WWR Buildings for New Construction -

	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	**New Large Commercial *Upgrade 2 HIT window Uvalue 0.25 (R4)***	4,269,950	10,800,000	3,629,458	10,260,000	I	$160,000	$0	25	640,493	540,000	1,180,493	$13,627.67	11.7	-$4,339	0.97
2																
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazing (New)

- HIT Windows Option as an Upgrade in High WWR Buildings for New Construction -

	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	**New Large Commercial *Upgrade 2 HIT window Uvalue 0.25 (R4)***	4,269,950	10,800,000	3,629,458	10,260,000	I	$160,000	$0	25	640,493	540,000	1,180,493	$13,561.06	11.8	-$4,339	0.97
2																
3	etc															

** *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:

The new large commercial building is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 270 MJ/m².yr (7 ekWh/ft².yr) of which 230 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

The analysis is applied to large commercial buildings with high window-wall ratios (WWR) of 0.3 to 0.5. The savings are based on the large office archetype with a WWR of 0.38 and an upgrade at the time of replacement from double 6/12/6 Uvalue 0.40 (R2.5) to HIT windows with a Uvalue of 0.25 (R4). Savings are estimated to be in the range of 15% of the space heating energy use based on CEEAM simulations.

The incremental cost of high insulation technology (HIT) windows from Visionwall Technology range from 8 to $13/ft² of window area. This is equivalent to a cost of $1.20 to $2.00/ft² of floor area for the archetype building. For new construction the cost is assumed to be half this value. This is based on the assumption that the use of HIT windows in new construction is for very high performance construction that will employ an IDP with equipment cost trade-offs from equipment downsizing. The cost savings from equipment downsizing amount to half of the incremental costs of the better equipment and windows. See "Integrated Designs and HVAC Equipment Sizing", in the September 2004 issue of the ASHRAE Journal. For new construction 5% additional electrical savings attributable to the improved envelope design are also included in the analysis which are equivalent to 29 $MJ/m^2 \cdot yr$ (0.75 $kWh/f^{t2}.yr$)

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Building Envelopes

- High Performance Building Envelopes for New Commercial Construction -

	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	**New Large Commercial *Upgrade 1 Gas Filled Panels to R30***	4,269,950	-	3,842,955	0	I	$120,000	$0	25	426,995	0	426,995	$4,825.04	24.9	-$93,645	0.2
2	**New Large Commercial *Upgrade 2 Vacuum Panel Insulation to R40***	4,269,950	-	3,757,556	0	I	$600,000	$0	25	512,394	0	512,394	$5,790.05	103.6	-$568,374	0.1
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Building Envelopes

- High Performance Building Envelopes for New Commercial Construction -

	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	**New Large Commercial *Upgrade 1 Gas Filled Panels to R30***	4,269,950	-	3,842,955	0	I	$120,000	$0	25	426,995	0	426,995	$4,225.12	28.4	-$88,185	0.3
2	**New Large Commercial *Upgrade 2 Vacuum Panel Insulation to R40***	4,269,950	-	3,757,556	0	I	$600,000	$0	25	512,394	0	512,394	$5,070.14	118.3	-$561,822	0.1
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Building Envelopes

- High Performance Building Envelopes for New Commercial Construction -

	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	**New Large Commercial *Upgrade 1 Gas Filled Panels to R30***	4,269,950	-	3,842,955	0	I	$120,000	$0	25	426,995	0	426,995	$4,180.71	28.7	-$88,185	0.3
2	**New Large Commercial *Upgrade 2 Vacuum Panel Insulation to R40***	4,269,950	-	3,757,556	0	I	$600,000	$0	25	512,394	0	512,394	$5,016.85	119.6	-$561,822	0.1
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:

The new large commercial building is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 270 MJ/m².yr (7 ekWh/ft².yr) of which 230 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

Energy savings from using Gas Filled Panels (GFP) and Vacuum Panel Insulation (VPI) are from the ability to construct walls with higher levels of insulation without an increase in the wall thickness. GFP can provide insulation levels of R7/inch with argon filling. VPI can achieve levels of R30/inch. Energy savings are based on CEEAM simulations and are as follows:

- GFP walls will achieve savings of 8 to 14% in space heating energy use based on improving the wall insulation from a range of R12 to R16 in current construction to R30. A 10% reduction in space heating (35 MJ/m²) is assumed.

- VPI walls will achieve savings of 10 to 16% in space heating energy use based on improving the wall insulation from a range of R12 to R16 in current construction to R40. A 12% reduction in space heating (42 MJ/M^2) is assumed

GFP have a suggested cost of US$0.70/ft² based on research work from LBL Building Technology Program (Brent Griffish). A cost of Can$1/ft² per inch has been used. Typical new construction wall insulation ranges from R12 to R16. This will require 2 inches of GFP to reach R30. The incremental cost will be approximately $120,000 for a 20-storey 200,000 ft² high rise building.

Costs of VPI are estimated to be roughly 10 to 20 times higher than traditional fiberglass and rigid insulation. A cost of $10/ft² is assumed in this analysis. The incremental cost will be approximately $600,000 for a 20-storey 200,000 ft² high rise building.

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 30% Below Current Practice

- New Building Construction 30% Below Current Practice -

	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	**New Large Office**	5,012,550	13,536,000	3,508,785	11,505,600	I	$259,910	$0	25	1,503,765	2,030,400	3,534,165	$44,402.94	5.9	$238,752	1.9
2	**New Medium Office**	1,829,250	4,723,920	1,280,475	4,015,332	I	$94,850	$0	25	548,775	708,588	1,257,363	$15,767.10	6.0	$80,657	1.9
3																

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 30% Below Current Practice

- New Building Construction 30% Below Current Practice -

	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	**New Large Office**	5,012,550	13,536,000	3,508,785	11,505,600	I	$259,910	$0	25	1,503,765	2,030,400	3,534,165	$42,290.15	6.1	$257,982	2.0
2	**New Medium Office**	1,829,250	4,723,920	1,280,475	4,015,332	I	$94,850	$0	25	548,775	708,588	1,257,363	$14,996.07	6.3	$87,675	1.9
3																

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 30% Below Current Practice

- New Building Construction 30% Below Current Practice -

	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	**New Large Office**	5,012,550	13,536,000	3,508,785	11,505,600	I	$259,910	$0	25	1,503,765	2,030,400	3,534,165	$42,133.76	6.2	$257,982	2.0
2	**New Medium Office**	1,829,250	4,723,920	1,280,475	4,015,332	I	$94,850	$0	25	548,775	708,588	1,257,363	$14,938.99	6.3	$87,675	1.9
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:

The new large office building is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 270 MJ/m².yr (7 ekWh/ft².yr) of which 230 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

The new medium office building is based on a building size of 6,775 m² (~72,900 ft²) and a total natural gas energy intensity of 270 MJ/m².yr (7 ekWh/ft².yr) of which 230 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

Savings of 30% in natural gas use are assumed from the use of high efficiency boiler, better thermal envelope (wall and windows) and use of heat recovery and/or DCV control strategies. Additional electricity savings of ~15% are assumed from efficient lighting designs. This is equivalent to 22 kWh/m².yr (2 kWh/ft².yr).

The incremental cost is assumed to range from 0.5 to 2% of total construction cost or $5/m² to $22/m² ($0.5/ft² to $2.0/ft²). An average cost of $14/m² is assumed for both large office and medium office scenarios.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 60% Below Current Practice

- Ultra High Performance New Building Construction 60% Below Current Practice -

	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	**New Large Office**	5,012,550	13,536,000	2,005,020	5,414,400	I	$200,000	$0	25	3,007,530	8,121,600	11,129,130	$143,626.69	1.4	$1,609,017	9.0
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 60% Below Current Practice

- Ultra High Performance New Building Construction 60% Below Current Practice -

	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	**New Large Office**	5,012,550	13,536,000	2,005,020	5,414,400	I	$200,000	$0	25	3,007,530	8,121,600	11,129,130	$139,401.11	1.4	$1,647,478	9.2
2																
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 60% Below Current Practice

- Ultra High Performance New Building Construction 60% Below Current Practice -

	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	**New Large Office**	5,012,550	13,536,000	2,005,020	5,414,400	I	$200,000	$0	25	3,007,530	8,121,600	11,129,130	$139,088.33	1.4	$1,647,478	9.2
2																
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:

The new large office building is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 270 MJ/m².yr (7 ekWh/ft².yr) of which 230 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

Savings of 60% in natural gas and electricity energy use are assumed based on an ultra low performance displacement ventilation design. This design requires an extremely well insulated envelope that includes HIT windows (Rvalue >4), high Rvalue opaque walls and use of high efficiency condensing heating plants and condensing DHW heaters. Additional electricity savings of 60% are also assumed based on ultra low LPD lighting designs that include daylighting control and very low fan energy use from the displacement ventilation design.

The incremental cost is assumed to be equal to 1% of total construction cost or ~$1/ft². While IDP designs that are 25 to 40% better than current practice exhibit incremental costs of 1 to 3%, high performance designs (similar to C-2000) often display no incremental costs because of the "tunnelling through the cost barrier" effect that occurs with equipment downsizing trade-offs present with very high performance designs.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (Existing)

- Existing Standard Efficiency Atmospheric Boiler Replacement with High Efficiency and Condensing Boilers -

	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	**Large Commercial *Upgrade 1 High Efficiency Boiler 85% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency boiler 85% Et (80% seasonal efficiency)	6,497,750	-	5,523,088	0	I	$12,000	$0	25	974,663	0	974,663	$11,013.69	1.1	$48,158	5.0
2	**Large Commercial *Upgrade 2 Condensing Boiler 94% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency condensing boiler 94% Et (89% seasonal efficiency)	6,497,750	-	4,964,573	0	I	$73,000	$0	25	1,533,177	0	1,533,177	$17,324.90	4.2	$21,630	1.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (Existing)

- Existing Standard Efficiency Atmospheric Boiler Replacement with High Efficiency and Condensing Boilers -

	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	**Large Commercial *Upgrade 1 High Efficiency Boiler 85% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency boiler 85% Et (80% seasonal efficiency)	6,497,750	-	5,523,088	0	I	$12,000	$0	25	974,663	0	974,663	$9,644.29	1.2	$60,622	6.1
2	**Large Commercial *Upgrade 2 Condensing Boiler 94% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency condensing boiler 94% Et (89% seasonal efficiency)	6,497,750	-	4,964,573	0	I	$73,000	$0	25	1,533,177	0	1,533,177	$15,170.79	4.8	$41,237	1.6

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (Existing)

- Existing Standard Efficiency Atmospheric Boiler Replacement with High Efficiency and Condensing Boilers -

	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	**Large Commercial *Upgrade 1 High Efficiency Boiler 85% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency boiler 85% Et (80% seasonal efficiency)	6,497,750	-	5,523,088	0	I	$12,000	$0	25	974,663	0	974,663	$9,542.92	1.3	$60,622	6.1
2	**Large Commercial *Upgrade 2 Condensing Boiler 94% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency condensing boiler 94% Et (89% seasonal efficiency)	6,497,750	-	4,964,573	0	I	$73,000	$0	25	1,533,177	0	1,533,177	$15,011.34	4.9	$41,237	1.6

** *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:

The size of the existing large commercial building is derived based on the average consumption per customer for all large commercial customers. Using an average space heating and SHW energy intensity of 390 MJ/m².yr (10 ekWh/ft².yr) results in a building size of 18,565 m² (~200,000 ft²) of which 350 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

For the HE boilers, the baseline peak load estimated to be 20 to 25 btu/hr/sqft based on heat loss model - we used 25 btu/hr/sqft to allow for redundancy, and a 5% size reduction.
For the condensing boilers, the baseline peak load estimated to be 20 to 25 btu/hr/sqft based on heat loss model - we used 25 btu/hr/sqft to allow for redundancy, and a 10% size reduction .

The baseline seasonal efficiency is 68% as per Terasen Gas Boiler Program results.
The condensing boiler seasonal efficiency is 89% since in a retrofit application, the boiler typically does not operate in a condensing mode during the coldest periods since the heat exchangers are typically designed for 180 deg F and a 20 deg F delta T.

The boiler costs are as follows:
- Standard efficiency atmospheric boiler at $7/kBtu as per Terasen Gas
- High efficiency at $10/kBtu as per supplier information
- High efficiency condensing at $24/kBtu as per Terasen Gas

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (New)

- High Efficiency and Condensing Boiler Options for New Construction -

	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	**Large Commercial *Upgrade 1 High Efficiency Boiler 85% Et* -** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency boiler 85% Et (80% seasonal efficiency)	4,269,950	-	3,629,458	0	I	$10,000	$0	25	640,493	0	640,493	$7,237.57	1.4	$29,532	4.0
2	**Large Commercial *Upgrade 2 Condensing Boiler 90% Et* -** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency condensing boiler 94% Et (92% seasonal efficiency)	4,269,950	-	3,156,050	0	I	$58,400	$0	25	1,113,900	0	1,113,900	$12,587.07	4.6	$10,352	1.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (New)

- High Efficiency and Condensing Boiler Options for New Construction -

	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	**Large Commercial *Upgrade 1 High Efficiency Boiler 85% Et* -** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency boiler 85% Et (80% seasonal efficiency)	4,269,950	-	3,584,649	0	I	$10,000	$0	25	685,301	0	685,301	$6,781.05	1.5	$41,062	5.1
2	**Large Commercial *Upgrade 2 Condensing Boiler 90% Et* -** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency condensing boiler 94% Et (92% seasonal efficiency)	4,269,950	-	3,156,050	0	I	$58,400	$0	25	1,113,900	0	1,113,900	$11,022.04	5.3	$24,597	1.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (New)

- High Efficiency and Condensing Boiler Options for New Construction -

	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	**Large Commercial *Upgrade 1 High Efficiency Boiler 85% Et* -** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency boiler 85% Et (80% seasonal efficiency)	4,269,950	-	3,584,649	0	I	$10,000	$0	25	685,301	0	685,301	$6,709.78	1.5	$41,062	5.1
2	**Large Commercial *Upgrade 2 Condensing Boiler 90% Et* -** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency condensing boiler 94% Et (92% seasonal efficiency)	4,269,950	-	3,156,050	0	I	$58,400	$0	25	1,113,900	0	1,113,900	$10,906.19	5.4	$24,597	1.4

** *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:

The new large commercial building is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 270 MJ/m².yr (7 ekWh/ft².yr) of which 230 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

The baseline seasonal efficiency is 68% as per Terasen Gas Boiler Program results.
The condensing boiler seasonal efficiency is 92% as per Terasen Gas Boiler Program results.

For the HE boilers, the baseline peak load estimated to be 15 to 20 btu/hr/sqft based on heat loss model - we used 20 btu/hr/sqft to allow for redundancy, and a 5% size reduction.
For the condensing boilers, the baseline peak load estimated to be 15 to 20 btu/hr/sqft based on heat loss model - we used 20 btu/hr/sqft to allow for redundancy, and a 10% size reduction .

The boiler costs are shown as follows:
- Standard efficiency atmospheric boiler at $7/kBtu as per Terasen Gas
- High efficiency at $10/kBtu as per supplier information
- High efficiency condensing at $24/kBtu as per Terasen Gas

The life of the boiler is assumed to be 25 to 30 years based on information from the 2003 ASHRAE HVAC Applications, Chapter 36, Table 3, page 36.3. A life of 25 years is used in the analysis.

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Improved Building Operations
- Recommissioning and Next Generation BAS in Existing Buildings -

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

#	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	**Large Commercial *Upgrade 1 - Building Recommissioning***	6,497,750	10,800,000	6,010,419	9,990,000	F	$100,000	$0	10	487,331	810,000	1,297,331	$16,441.84	6.1	$20,596	1.2
2	**Large Commercial *Upgrade 2 - Next Generation BAS***	6,497,750	10,800,000	6,010,419	9,990,000	F	$80,000	$0	10	487,331	810,000	1,297,331	$16,441.84	4.9	$40,596	1.5
3																

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Improved Building Operations
- Recommissioning and Next Generation BAS in Existing Buildings -

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Large Commercial *Upgrade 1 - Building Recommissioning***	6,497,750	10,800,000	6,010,419	9,990,000	F	$100,000	$0	10	487,331	810,000	1,297,331	$15,757.14	6.3	$24,559	1.2
2	**Large Commercial *Upgrade 2 - Next Generation BAS***	6,497,750	10,800,000	6,010,419	9,990,000	F	$80,000	$0	10	487,331	810,000	1,297,331	$15,757.14	5.1	$44,559	1.6
3																

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Improved Building Operations
- Recommissioning and Next Generation BAS in Existing Buildings -

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

#	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	**Large Commercial *Upgrade 1 - Building Recommissioning***	6,497,750	10,800,000	6,010,419	9,990,000	F	$100,000	$0	10	487,331	810,000	1,297,331	$15,706.46	6.4	$24,559	1.2
2	**Large Commercial *Upgrade 2 - Next Generation BAS***	6,497,750	10,800,000	6,010,419	9,990,000	F	$80,000	$0	10	487,331	810,000	1,297,331	$15,706.46	5.1	$44,559	1.6
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:

Upgrade 1 - Recommissioning

The size of the existing large commercial building is derived based on the average consumption per customer for all large commercial customers. Using an average space heating and SHW energy intensity of 390 MJ/m².yr (10 ekWh/ft².yr) results in a building size of 18,565 m² (~200,000 ft²) of which 350 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

Building recommissioning is assumed to save between 5 to 10% of space heating energy use through adjustment of OA dampers, institution of better reset schedules in air handling units and adjustment of VAV boxes and room controls. Electrical energy savings of 5 to 10% are also achieved from reduced HVAC equipment operation. A 7.5% savings is assumed in this analysis.

The cost for recommissioning ranges from 40 to 60 cents/ft² (Recommissioning Options Paper, Marbek 2002). A cost of 50 cents/ft² is used in this analysis.

Upgrade 2 - Next Generation BAS

Installation of a BAS second generation system that includes a new front-end, new control strategies and revamped control strategies is assumed to save between 5 to 10% of space heating energy use by reinstituting equipment shutdown schedules, improved control reset schedules and temperature setback. Electrical energy savings of 5 to 10% can also be achieved from reduced and optimized operation of HVAC equipment.

The cost of an upgraded BAS can range from 30 to 50 cents/ft². An average cost of 40 cents/ft² is assumed in this analysis.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Demand Controlled Ventilation

- Demand Controlled Ventilation for Existing Buildings -

	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)		
									15							

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Demand Controlled Ventilation

- Demand Controlled Ventilation for Existing Buildings -

	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)		
									15							

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Demand Controlled Ventilation

- Demand Controlled Ventilation for Existing Buildings -

	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	**Large Commercial**	6,497,750	-	6,010,419	0	F	$5,850	$325	15	487,331	0	487,331	$4,446.46	1.3	$19,942	3.3
2	**Medium Commercial**	2,634,525	-	2,436,936	0	F	$9,600	$400	15	197,589	0	197,589	$1,534.60	6.3	-$1,439	0.9

** *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:

The size of the existing large commercial building is derived based on the average consumption per customer for all large commercial customers. Using an average space heating and SHW energy intensity of 390 MJ/m².yr (10 ekWh/ft².yr) results in a building size of 18,565 m² (~200,000 ft²) of which 350 MJ/m².yr is space heating and 40 MJ/m².yr is SHW.

The existing medium commercial building is based on a building size of 6,505 m² (~70,000 ft²) and a total natural gas energy intensity of 450 MJ/m².yr (11.6 ekWh/ft².yr) of which 405 MJ/m².yr is space heating and 45 MJ/m².yr is SHW

DCV is mainly applicable to existing large and medium commercial buildings in the interior of BC where there is a sufficient ventilation heating load

Demand Controlled Ventilation is assumed to reduce overall space heating requirements by 5 to 10% in large commercial buildings. AHUs in these buildings employ mixed air control strategies which blend OA with RA and minimize the need for heating ventilation at low OA temperatures. For this reason, DCV only achieve energy savings when the OA dampers are at minimum. A value of 10% savings is assumed in large commercial. Similarly medium commercial buildings that are typically equipped with package heat-cool units will realize savings levels

For large commercial buildings with a BAS the cost of implementing DCV is assumed to be in the range of $5,400 to $6,300 based on the installation of DVC on 6 to 7 AHU systems ($900 on the installation of DVC on 6 to 7 AHU systems ($900 per DCV module)

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Modulating Rooftop Units

- Existing Rooftop Heat-Cool Unit Replacement with High Efficiency Modulating Roof Top Units-

#	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	**Medium Commercial *Upgrade 1 Modulating RTU 83% Et*** - Baseline RTU 80% Et (70% seasonal efficiency) Modulating RTU 83% Et (80% seasonal efficiency)	2,634,525	5,796,000	2,305,209	5,765,760	I	$54,000	$0	20	329,316	30,240	359,556	$4,129.51	13.1	-$29,959	0.4
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Modulating Rooftop Units

- Existing Rooftop Heat-Cool Unit Replacement with High Efficiency Modulating Roof Top Units-

#	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	**Medium Commercial *Upgrade 1 Modulating RTU 83% Et*** - Baseline RTU 80% Et (70% seasonal efficiency) Modulating RTU 83% Et (80% seasonal efficiency)	2,634,525	5,796,000	2,305,209	5,765,760	I	$54,000	$0	20	329,316	30,240	359,556	$3,666.82	14.7	-$26,157	0.5
2																
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Modulating Rooftop Units

- Existing Rooftop Heat-Cool Unit Replacement with High Efficiency Modulating Roof Top Units-

#	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	**Medium Commercial *Upgrade 1 Modulating RTU 83% Et*** - Baseline RTU 80% Et (70% seasonal efficiency) Modulating RTU 83% Et (80% seasonal efficiency)	2,634,525	5,796,000	2,305,209	5,765,760	I	$54,000	$0	20	329,316	30,240	359,556	$3,632.57	14.9	-$26,157	0.5
2																
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:

The existing medium commercial building is based on a building size of 6,505 m² (~70,000 ft²) and a total natural gas energy intensity of 450 MJ/m².yr (11.6 ekWh/ft².yr) of which 405 MJ/m².yr is space heating and 45 MJ/m².yr is SHW.

Modulating rooftop heat-cool units are assumed to maintain their efficiency near the steady state value. In addition, the units are better insulated and exhibit lower heat losses from the enclosure. The heat loss through the RTUs enclosure is assumed to be 3% compared to 5% for a standard unit.

There are additional electricity savings from a more efficient A/C section. It is assumed that these units will operate with an EER of 10.5 vs. 9.5 for baseline units (COP of 3.1 vs. 2.8) . This is equivalent to a 10% increase in cooling energy performance. Electricity savings are estimated to be approximately 30,240 MJ/yr (8,400 kWh/yr).

The typical cost of a gas heat-cool RTU equipped with an economizer is approximately $1,200/Ton based on estimates from the RS Means Mechanical Cost Data. A modulating rooftop unit has an incremental cost that ranges from $150 to $500/Ton based on discussion with distributors and information from the literature. A price of $300/Ton is used in this analysis. Based on a total capacity estimated to be 180 Tons (@ 400 sq.ft../ton) the incremental cost is $54,000.

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.005	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous DHW Heaters

- Instantaneous Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial *Upgrade 1 Instantaneous Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Instantaneous 80% Et	292,725	-	219,544	0	I	$2,100	$0	15	73,181	0	73,181	$826.95	2.5	$1,058	1.5
2																
3																

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous DHW Heaters

- Instantaneous Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial *Upgrade 1 Instantaneous Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Instantaneous 80% Et	292,725	-	219,544	0	I	$2,100	$0	15	73,181	0	73,181	$724.13	2.9	$1,461	1.7
2																
3																

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous DHW Heaters

- Instantaneous Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial *Upgrade 1 Instantaneous Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Instantaneous 80% Et	292,725	-	219,544	0	I	$2,100	$0	15	73,181	0	73,181	$716.52	2.9	$1,461	1.7
2																
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:

The existing medium commercial building is based on a building size of 6,505 m² (~70,000 ft²) and a total natural gas energy intensity of 450 MJ/m².yr (11.6 ekWh/ft².yr) of which 405 MJ/m².yr is space heating and 45 MJ/m².yr is DHW

The efficiency of an instantaneous water heater is assumed to be 80% compared to an energy factor of 0.6 for a power vent water heater.

The installed cost of a standard 100 Gal water heater equipped with a power vent is estimated to be $1,700 as per RS Means.

The installed cost for an equivalent 4 USGPM commercial grade instantaneous water heater is estimated to be $3,800 as per supplier quote.

The life of instantaneous water heaters is reported to be in the range of 20 to 30 years. A life of 15 years has been used in this analysis since it more closely represents the life of a standa power vent water heater.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Condensing DHW Boiler

- High Efficiency Condensing Boilers for Existing Customers with Large DHW Use -

	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	**Large Hotel *Upgrade 1 Condensing DHW Boiler*** - Baseline boiler 75% Et - Condensing boiler 90% Et	7,426,000	-	6,188,333	0	I	$17,000	$0	25	1,237,667	0	1,237,667	$13,985.63	1.2	$59,391	4.5
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Condensing DHW Boiler

- High Efficiency Condensing Boilers for Existing Customers with Large DHW Use -

	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	**Large Hotel *Upgrade 1 Condensing DHW Boiler*** - Baseline boiler 75% Et - Condensing boiler 90% Et	7,426,000	-	6,188,333	0	I	$17,000	$0	25	1,237,667	0	1,237,667	$12,246.71	1.4	$75,218	5.4
2																
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Condensing DHW Boiler

- High Efficiency Condensing Boilers for Existing Customers with Large DHW Use -

	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	**Large Hotel *Upgrade 1 Condensing DHW Boiler*** - Baseline boiler 75% Et - Condensing boiler 90% Et	7,426,000	-	6,188,333	0	I	$17,000	$0	25	1,237,667	0	1,237,667	$12,117.99	1.4	$75,218	5.4
2																
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:

The large hotel is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 790 MJ/m².yr (20 ekWh/ft².yr) of which 390 MJ/m².yr is space heating and 400 MJ/m².yr is DHW

The operating efficiency of standard boilers is assumed to be in the range of 70 to 80% (avg 75%) while the operating efficiency of condensing boilers is assumed to be 90%.

Large condensing boilers for DHW applications are assumed to cost the same of similar boilers for space heating applications. The estimated costs are as follows:

- Standard efficiency atmospheric boiler at $7/kBtu as per Terasen Gas
- High efficiency condensing at $24/kBtu as per Terasen Gas

The boiler size is based on a maximum hot water demand of 2.5 to 5 gph/suite and 200 suites will be between 750,000 and 1.3 million Btu/hr. A 1 million Btu/hr input will be used as an average.

The life of the boiler is assumed to be 25 to 30 years based on information from the 2003 ASHRAE HVAC Applications, Chapter 36, Table 3, page 36.3. A life of 25 years is used in the

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: HE Condensing DHW Heaters

- Condensing Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial *Upgrade 1 Condensing Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Condensing DHW Heater 95% Et	292,725	-	184,879	0	I	$2,000	$0	10	107,846	0	107,846	$1,218.66	1.6	$2,165	2.1
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: HE Condensing DHW Heaters

- Condensing Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial *Upgrade 1 Condensing Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Condensing DHW Heater 95% Et	292,725	-	184,879	0	I	$2,000	$0	10	107,846	0	107,846	$1,067.14	1.9	$3,042	2.5
2																
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: HE Condensing DHW Heaters

- Condensing Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial *Upgrade 1 Condensing Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Condensing DHW Heater 95% Et	292,725	-	184,879	0	I	$2,000	$0	10	107,846	0	107,846	$1,055.92	1.9	$3,042	2.5
2																
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:

The existing medium commercial building is based on a building size of 6,505 m² (~70,000 ft²) and a total natural gas energy intensity of 450 MJ/m².yr (11.6 ekWh/ft².yr) of which 405 MJ/m².yr is space heating and 45 MJ/m².yr is DHW.

The baseline technology is an 80 to 100 USG power vent tank heater with an energy factor of 0.6.

A 100 gallon condensing DHW tank heater is estimated to cost $3,700 and have an efficiency of 95% as per supplier information.

The life of a condensing water heater is estimated to be 10 years.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.005	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Pre-Rinse Spray Valve

- Pre-Rinse Spray Valve For Existing and New Restaurants and Kitchens

	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	**Existing Restaurant/Tavern** ***Upgrade*** ***1 Pre-Rinse Spray Valve (Existing)*** - Baseline: 15 Lpm	57,000		27,672		F	$100	$0	10	29,328	0	29,328	$331.41	0.3	$904	10.0
2	**New Restarant/Tavern** ***Upgrade*** ***1 Pre-Rinse Spray Valve (New)*** - Baseline: 15 Lpm	57,000		27,672		I	$65	$0	10	29,328	0	29,328	$331.41	0.2	$939	15.4
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Pre-Rinse Spray Valve

- Pre-Rinse Spray Valve For Existing and New Restaurants and Kitchens

	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	**Existing Restaurant/Tavern** ***Upgrade*** ***1 Pre-Rinse Spray Valve (Existing)*** - Baseline: 15 Lpm	57,000		27,672		F	$100	$0	10	29,328	0	29,328	$290.21	0.3	$1,039	11.4
2	**New Restarant/Tavern** ***Upgrade*** ***1 Pre-Rinse Spray Valve (New)*** - Baseline: 15 Lpm	57,000		27,672		I	$65	$0	10	29,328	0	29,328	$290.21	0.2	$1,074	17.5
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Pre-Rinse Spray Valve

- Pre-Rinse Spray Valve For Existing and New Restaurants and Kitchens

	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	**Existing Restaurant/Tavern** ***Upgrade*** ***1 Pre-Rinse Spray Valve (Existing)*** - Baseline: 15 Lpm	57,000		27,672		F	$100	$0	10	29,328	0	29,328	$287.16	0.3	$1,039	11.4
2	**New Restarant/Tavern** ***Upgrade*** ***1 Pre-Rinse Spray Valve (New)*** - Baseline: 15 Lpm	57,000		27,672		I	$65	$0	10	29,328	0	29,328	$287.16	0.2	$1,074	17.5
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:

The "new and existing restaurant/tavern" building is based on an estimated 600 m² (~ 6,400 ft²) facility with a DHW natural gas energy intensity of 95 MJ/m².yr

The traditional pre-rinse spray valve has a flow rate to 10 to 20 Lpm (average 15) and an average use of 1 hour per day , and the efficient valve has an average flow rate of 6 Lpm

The energy savings are based on 50% hot water a 90 deg F delta T (140-50) and an average generation efficiency of 70%. Water savings are not included.

A pre-rinse spray valve is estimated to cost $65 + $35 for installation

The service life is estimated to be 5 to 10 years (The model only accepts 10 years - Veritec Consulting Inc. estimated a 5 year life-cycle)

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.005	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Drainwater Heat Recovery
Drainwater Heat Recovery for Laundries and Kitchens

	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	Large Hotel *Upgrade 1 Drainwater Heat Recovery (Existing Hotel Laundry)*	7,426,000	-	6,982,945	0	F	$21,000	$0	20	443,055	0	443,055	$5,006.52	4.2	$885	1.0
2	Large Hotel *Upgrade 1 Drainwater Heat Recovery (New Hotel Laundry)*	7,426,000	-	6,982,945	0	I	$18,000	$0	20	443,055	0	443,055	$5,006.52	3.6	$3,885	1.2
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Drainwater Heat Recovery
Drainwater Heat Recovery for Laundries and Kitchens

	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	Large Hotel *Upgrade 1 Drainwater Heat Recovery (Existing Hotel Laundry)*	7,426,000	-	6,982,945	0	F	$21,000	$0	20	443,055	0	443,055	$4,384.03	4.8	$3,864	1.2
2	Large Hotel *Upgrade 1 Drainwater Heat Recovery (New Hotel Laundry)*	7,426,000	-	6,982,945	0	I	$18,000	$0	20	443,055	0	443,055	$4,384.03	4.1	$6,864	1.4
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Drainwater Heat Recovery
Drainwater Heat Recovery for Laundries and Kitchens

	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	Large Hotel *Upgrade 1 Drainwater Heat Recovery (Existing Hotel Laundry)*	7,426,000	-	6,982,945	0	F	$21,000	$0	20	443,055	0	443,055	$4,337.95	4.8	$3,864	1.2
2	Large Hotel *Upgrade 1 Drainwater Heat Recovery (New Hotel Laundry)*	7,426,000	-	6,982,945	0	I	$18,000	$0	20	443,055	0	443,055	$4,337.95	4.1	$6,864	1.4
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:

The large hotel is based on a building size of 18,565 m² (~200,000 ft²) and a total natural gas energy intensity of 790 MJ/m².yr (20 ekWh/ft².yr) of which 390 MJ/m².yr is space heating and 400 MJ/m².yr is DHW

The efficiency of the heat exchanger to recover heat from the laundry waste water is assumed to be in the range of 30 to 50%. This is based on information from FEMP (www.eren.doe.gov/femp). The lower efficiency is due to the varying temperature of waste water which is typically lower than the temperature at point of use. A typical application is assumed to have 30% recovery potential.

The cost of the installation is estimated to be $21,000 for 3 washers in an existing laundry and $18,000 for new application based on a GFX heat exchanger and RS Means.

The life is assumed to be 20 years.

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.005	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Commercial Food Preparation

- Efficient Commercial Food Preparation Equipment -

	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	**Commercial Gas Range** Baseline gas range: 25 to 30% efficient - High efficiency product: 45 to 60%	168,766	-	88,401	0	I	$800	$0	10	80,365	0	80,365	$908.12	0.9	$1,951	3.4
2	**Commercial Gas Broiler** Baseline gas range: 20% efficient - High efficiency product: 30%	168,766	-	112,511	0	I	$200	$0	10	56,255	0	56,255	$635.69	0.3	$1,726	9.6
3	**Commercial Gas Fryers** Baseline gas range: 25 to 50% efficient - High efficiency product: 50 to 65%	79,109	-	56,507	0	I	$1,300	$0	10	22,603	0	22,603	$255.41	5.1	-$526	0.6

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Commercial Food Preparation

- Efficient Commercial Food Preparation Equipment -

	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	**Commercial Gas Range** Baseline gas range: 25 to 30% efficient - High efficiency product: 45 to 60%	168,766	-	88,401	0	I	$800	$0	10	80,365	0	80,365	$795.21	1.0	$2,320	3.9
2	**Commercial Gas Broiler** Baseline gas range: 20% efficient - High efficiency product: 30%	168,766	-	112,511	0	I	$200	$0	10	56,255	0	56,255	$556.65	0.4	$1,984	10.9
3	**Commercial Gas Fryers** Baseline gas range: 25 to 50% efficient - High efficiency product: 50 to 65%	79,109	-	56,507	0	I	$1,300	$0	10	22,603	0	22,603	$223.65	5.8	-$422	0.7

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Commercial Food Preparation

- Efficient Commercial Food Preparation Equipment -

	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	**Commercial Gas Range** Baseline gas range: 25 to 30% efficient - High efficiency product: 45 to 60%	168,766	-	88,401	0	I	$800	$0	10	80,365	0	80,365	$786.85	1.0	$2,320	3.9
2	**Commercial Gas Broiler** Baseline gas range: 20% efficient - High efficiency product: 30%	168,766	-	112,511	0	I	$200	$0	10	56,255	0	56,255	$550.80	0.4	$1,984	10.9
3	**Commercial Gas Fryers** Baseline gas range: 25 to 50% efficient - High efficiency product: 50 to 65%	79,109	-	56,507	0	I	$1,300	$0	10	22,603	0	22,603	$221.30	5.9	-$422	0.7

** *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:

The three commercial food equipment types covered are the three largest consumers of natural gas in a typical commercial kitchen and account for approximately 69% of the annual natural gas use. Their contribution to the total natural gas use in a typical commercial kitchen is as follows:

- commercial gas ranges account for ~32% of the total natural gas use
- commercial gas broilers account for ~19% of total natural gas use
- commercial gas fryers account for ~18% of total natural gas use

The appliances display a range of efficiency levels as shown. The efficiency levels assumed for each product are as follows:

- baseline gas range is assumed to have a 27.5% efficiency and the high efficiency product is assumed to be 52.5% efficient
- baseline gas broiler is assumed to have a 20% efficiency and the high efficiency product is assumed to be 30% efficient
- baseline gas fryer is assumed to have a 37.5% efficiency and the high efficiency product is assumed to be 57.5% efficient

TThe incremental cost of the high efficiency appliances relative to entry level units is as follows:

- high efficiency commercial gas range $800
- more efficient gas broiler exhibits no incremental cost - assume $200 incremental cost
- high efficiency commercial gas fryer $1,300

The life of commercial food preparation appliances is estimated to be 10 years

APPENDIX F

Technology Screening of Fuel Choice Measures

Exhbit 4.4 Summary of Measures TRC Screening Results

Name	Target Market				Simple Payback (Yrs)	Measure TRC [$]	B/C Ratio
	Service Area(s)	Sub Sector(s)	Vintage	Full/Incr			
Electric DHW to Gas (New) - Natural Gas Water Heater	All	small, medium & large	New	I	(0.3)	11,307	2.1
Electric DHW to Gas (Existing) - Natural Gas Water Heater	All	small, medium & large	Existing	I	(0.3)	11,307	2.1
Electric DHW to Gas (Existing) - Multiple Natural Gas Water Heaters	All	small, medium & large	Existing	I	(1.0)	10,322	2.0
Electric DHW to Gas (New) - Multiple Natural Gas Water Heaters	All	small, medium & large	New	I	(2.3)	8,979	1.7
Electric DHW to Gas (Existing) - Instantaneous Natural Gas Water Heater	All	small, medium & large	Existing	I	416.5	3,283	1.6
Electric DHW to Gas (New) - Instantaneous Natural Gas Water Heater	All	small, medium & large	New	I	(18.3)	1,066	1.2
Electric Heating to Gas (New) - Forced Air Heating Application	All	small, medium & large	New	I	(28.8)	10,176	1.2
Electric Heating to Gas (Existing) - Forced Air Heating Application	All	small, medium & large	Existing	I	(32.7)	-2,522	0.9
Electric Heating to Gas (Existing) - Hydronic Heating Application	All	small, medium & large	Existing	I	(210.9)	-256,969	0.5
Electric Heating to Gas (New) - Hydronic Heating Application	All	small, medium & large	New	I	(188.9)	-238,698	0.4

Marginal Cost of New Supply - By Load Shape, Service Area and Measure Life								
Natural Gas	Load Shape							
	Peaky (e.g., space heat)				Flat (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	5.756	5.685	5.716	5.782	5.102	5.041	5.031	4.978
Lower Mainland	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782
Interior	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782

Marginal Cost of New Supply - By Load Shape, Service Area and Measure Life - CPR version with losses								
Electricity	Load Shape							
	Peaky (e.g., space heat)				Flat (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Lower Mainland	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Interior	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94

$/MWh			
M. Life (yrs)	LM	VI	Interior
10	53.56	54.04	49.65
15	52.51	52.98	48.67
20	51.70	52.16	47.92
25	51.04	51.50	47.32

Provided by BCH

Customer Energy Prices						
	Residential		Commercial		Manufacturing	
	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0132	$0.0169	$0.0113	$0.0135	$0.0094	$0.0135
Lower Mainland	$0.0105	$0.0169	$0.0099	$0.0135	$0.0087	$0.0135
Interior	$0.0104	$0.0169	$0.0098	$0.0135	$0.0086	$0.0135
Customer EnergyTax Rate (%)	1		1		1	

Discount Rate	8.0%

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - New Buildings
- Electric DHW to Natural Gas for New Small, Medium and Large Commercial Buidings

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.005	$0.011
Discount Rate	8.00%	

#	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	**New Medium Office** ***Upgrade 1*** ***Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$695.10	-0.3	$11,307	2.1
2	**New Medium Office** ***Upgrade 2*** ***Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$796.92	-1.0	$10,322	2.0
3	**New Food Retail** ***Upgrade 3*** ***Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		50,186	56,373	648	I	$2,300	$50	10	-56,373	49,538	-6,835	-$18.26	-126.0	$1,066	1.2

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - New Buildings
- Electric DHW to Natural Gas for New Small, Medium and Large Commercial Buidings

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

#	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	**New Medium Office** ***Upgrade 1*** ***Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$294.72	-0.7	$9,999	1.9
2	**New Medium Office** ***Upgrade 2*** ***Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$385.64	-2.1	$8,979	1.7
3	**New Food Retail** ***Upgrade 3*** ***Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		50,186	56,373	648	I	$2,300	$50	10	-56,373	49,538	-6,835	$60.95	37.7	$807	1.2

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - New Buildings
- Electric DHW to Natural Gas for New Small, Medium and Large Commercial Buidings

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

#	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	**New Medium Office** ***Upgrade 1*** ***Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$265.08	-0.8	$9,999	1.9
2	**New Medium Office** ***Upgrade 2*** ***Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$355.19	-2.3	$8,979	1.7
3	**New Food Retail** ***Upgrade 3*** ***Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		50,186	56,373	648	I	$2,300	$50	10	-56,373	49,538	-6,835	$66.81	34.4	$807	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:

New Medium Office
- The "new medium office" building is based on a 6,785 m² (~ 70,000 ft²) 9 storey facility with a total natural gas energy intensity of 363 MJ/m².yr (9.3 ekWh/ft².yr) of which 221 MJ/m².yr is for space heating, 42 MJ/m².yr is for DHW, and 10 MJ/m².yr is for food service equipment.
- An 85 USG electric water heater has an energy factor (EF) of 0.91, a 1st hour rating of 290 USG, 45 kW of electric heating element, and an estimated installed cost of $1,500 (adapted from Means); the equivalent natural gas water heater has an EF of 0.6, a storage capacity of 90 USG, a 1st hour rating of 300 USG, and an installed cost of $1,700 (adapted from Means)
- A 50 USG electric water heater has an energy factor (EF) of 0.91, a 1st hour rating of 90 USG, 9 kW of electric heating element, and and an estimated installed cost of $700 (adapted from Means); the equivalent power vented natural gas water heater has an EF of 0.6, a storage capacity of 50 USG, a 1st hour rating of 90 USG, and an installed cost of $900 (adapted from Means)
- The expected service life is estimated to be 10 to 12 years for a storage tank heater.

New Food Retail
- The "new food retail" building is based on a 1,208 m² (~ 13,000 ft²) one storey facility with a total natural gas energy intensity of 458 MJ/m².yr (11.8 ekWh/ft².yr) of which 375 MJ/m².yr is for space heating, 63 MJ/m².yr is for DHW, and 20 MJ/m².yr is for food service equipment.
- An 85 USG electric water heater has an energy factor (EF) of 0.91, a 1st hour rating of 290 USG, 45 kW of electric heating element, and an estimated installed cost of $1,500 (adapted from Means); the equivalent instantaneous (natural gas) water heater has an EF of 0.81, a capacity of 4 USGPM at 90 F delta T, and an installed cost of $3,800 (based on supplier quote for a Takagi TM-1 commercial unit)

The expected service life is estimated to be 10 to 12 years for a storage tank heater and 20 years for an instantaneous heater.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.005	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - Existing Buildings

- Electric DHW to Natural Gas for Existing Small, Medium and Large Commercial Buidings

	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	**Existing Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$695.10	-0.3	$11,307	2.1
2	**Existing Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$796.92	-1.0	$10,322	2.0
3	**Existing Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		79,660	89,481	648	I	$2,300	$50	10	-89,481	79,012	-10,469	$5.52	416.5	$3,283	1.6

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - Existing Buildings

- Electric DHW to Natural Gas for Existing Small, Medium and Large Commercial Buidings

	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	**Existing Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$294.72	-0.7	$9,999	1.9
2	**Existing Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$385.64	-2.1	$8,979	1.7
3	**Existing Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		79,660	89,481	648	I	$2,300	$50	10	-89,481	79,012	-10,469	$131.24	17.5	$2,873	1.5

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.017	$0.014
Natural Gas	$0.006	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - Existing Buildings

- Electric DHW to Natural Gas for Existing Small, Medium and Large Commercial Buidings

	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	**Existing Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$265.08	-0.8	$9,999	1.9
2	**Existing Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$355.19	-2.3	$8,979	1.7
3	**Existing Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		79,660	89,481	648	I	$2,300	$50	10	-89,481	79,012	-10,469	$140.55	16.4	$2,873	1.5

** *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:

Existing Medium Office

- The "existing medium office" building is based on a 6,785 m² (~ 70,000 ft²) 9 storey facility with a total natural gas energy intensity of 437 MJ/m².yr (11.2 ekWh/ft².yr) of which 385 MJ/m².yr is for space heating, 42 MJ/m².yr is for DHW, and 10 MJ/m².yr is for food service equipment.
- An 85 USG electric water heater has an energy factor (EF) of 0.91, a 1st hour rating of 290 USG, 45 kW of electric heating element, and an estimated installed cost of $1,500 (adapted from Means); the equivalent natural gas water heater has an EF of 0.6, a storage capacity of 90 USG, a 1st hour rating of 300 USG, and an installed cost of $1,700 (adapted from Means)
- A 50 USG electric water heater has an energy factor (EF) of 0.91, a 1st hour rating of 90 USG, 9 kW of electric heating element, and and an estimated installed cost of $700 (adapted from Means); the equivalent power vented natural gas water heater has an EF of 0.6, a storage capacity of 50 USG, a 1st hour rating of 90 USG, and an installed cost of $900 (adapted from Means)
- The expected service life is estimated to be 15 years for a storage tank heater.

Existing Food Retail

- The "existing food retail" building is based on a 1,208 m² (~ 13,000 ft²) facility with a total natural gas energy intensity of 380 MJ/m².yr (9.8 ekWh/ft².yr) of which 260 MJ/m².yr is for space heating,100 MJ/m².yr is for DHW, and 20 MJ/m².yr is for food service equipment
- An 85 USG electric water heater has an energy factor (EF) of 0.91, a 1st hour rating of 290 USG, 45 kW of electric heating element, and an estimated installed cost of $1,500 (adapted from Means); the equivalent instantaneous (natural gas) water heater has an EF of 0.81, a capacity of 4 USGPM at 90 F delta T, and an installed cost of $3,800 (based on supplier quote for a Takagi TM-1 commercial unit)

The expected service life is estimated to be 15 years for a storage tank heater and 20 years for an instantaneous heater.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**New Medium Hotel *Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	-$1,720.08	-188.9	-$238,698	0.4
2	**New Food Retail *Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	-$757.95	-28.8	$10,176	1.2
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**New Medium Hotel *Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	-$287.83	-1129.2	-$251,735	0.4
2	**New Food Retail *Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	-$105.07	-207.7	$5,411	1.1
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**New Medium Hotel *Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	-$181.81	-1787.6	-$251,735	0.4
2	**New Food Retail *Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	-$56.74	-384.7	$5,411	1.1
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:

New Medium Hotel

- The "new medium hotel" is based on a 6,040 m^2 (~ 65,000 ft^2) 4 storey facility with a total natural gas energy intensity of 573 $MJ/m^2.yr$ (14.77 $ekWh/ft^2.yr$) of which 163 $MJ/m^2.yr$ is for space heating 400 $MJ/m^2.yr$ is for DHW, and 10 $MJ/m^2.yr$ is for food service equipment.
- The baseline consists of perimeter electric heating, either PTAC, fan coils, or electric BB with an estimated efficiency of 98%
- The upgrade consists of installing a gas-fired high efficiency boiler with an estimate seasonal efficiency of 80%, perimeter hydronic heating system radiation, and gas-fired ventilation systems
- The upgrade costs are based on the mid-point of the range - $3.5 to $6.5 per sqft as per Means
- The expected service life is estimated to be 25 years for a boiler.

New Food Retail

- The "new food retail" building is based on a 1,208 m^2 (~ 13,000 ft^2) one storey facility with a total natural gas energy intensity of 458 $MJ/m^2.yr$ (11.8 $ekWh/ft^2.yr$) of which 375 $MJ/m^2.yr$ is for space heating, 63 $MJ/m^2.yr$ is for DHW, and 20 $MJ/m^2.yr$ is for food service equipment.
- The baseline consists of 3 - 10 ton packaged rooftop units equipped with electric heating and cooling with an estimated heating efficiency of 98%.
- The upgrade consists of installing 3 - 10 ton gas-fired rooftop units with an estimated seasonal efficiency of 78%.
- The baseline cost is estimated to be $7,225 per unit, and the upgrade cost is estimated to be $14,500 per unit (as per Means)
- The expected service life is estimated to be 15 years for a rooftop unit.

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.006	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - Existing Buildings
- Electric Space Heating to Natural gas for Existing Small, Medium and Large Commercial Buildings

	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	**Existing Medium Hotel** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		1,208,178	1,480,019	32,227	I	$390,000	#####	25	-1,480,019	1,175,951	-304,067	-$1,848.87	-210.9	-$256,969	0.5
2	**Existing Food Retail** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal		240,403	302,045	0	I	$21,825	$500	15	-302,045	240,403	-61,642	-$667.67	-32.7	-$2,522	0.9
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings
- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**Existing Medium Hotel** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	#####	25	-1,019,401	799,937	-219,464	-$287.83	-1129.2	-$251,735	0.4
2	**Existing Food Retail** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	-$105.07	-207.7	$5,411	1.1
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.019	$0.014
Natural Gas	$0.007	$0.010
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings
- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**Existing Medium Hotel** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	#####	25	-1,019,401	799,937	-219,464	-$181.81	-1787.6	-$251,735	0.4
2	**Existing Food Retail** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	-$56.74	-384.7	$5,411	1.1
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:

Existing Medium Hotel
- The "existing medium hotel" is based on a 4 storey 6,040 m² (~ 65,000 ft²) facility with a total natural gas energy intensity of 670 MJ/m².yr (17.2 ekWh/ft².yr) of which 260 MJ/m².yr is for space heating, 400 MJ/m².yr is for DHW, and 10 MJ/m².yr is for food service equipment.
- The baseline consists of perimeter electric heating, either PTAC, fan coils, or electric BB with an estimated efficiency of 98%
- The upgrade consists of installing a gas-fired high efficiency boiler with an estimate seasonal efficiency of 80%, perimeter hydronic heating system radiation, and gas-fired ventilation systems
- The upgrade costs are based on $6/sqft. This represents the higher end of the range - $3.5 to $6.5 per sqft (as per Means) since it is a retrofit.
- The expected service life is estimated to be 25 years for a boiler.

Existing Food Retail
- The "existing food retail" building is based on a 1,208 m² (~ 13,000 ft²) one storey facility with a total natural gas energy intensity of 380 MJ/m².yr (9.76 ekWh/ft².yr) of which 260 MJ/m².yr is for space heating, 100 MJ/m².yr is for DHW, and 20 MJ/m².yr is for food service equipment.
- The baseline consists of 3 - 10 ton packaged rooftop units equipped with electric heating and cooling with an estimated heating efficiency of 98%.
- The upgrade consists of installing 3 - 10 ton gas-fired rooftop units with an estimated seasonal efficiency of 78%.
- The baseline cost is estimated to be $7,225 per unit, and the upgrade cost is estimated to be $14,500 per unit (as per Means)
- The expected service life is estimated to be 15 years for a rooftop unit.

MARBEK
Resource Consultants Ltd.

APPENDIX G

Action Profiles

1. INTRODUCTION

This document provides a “straw dog” set of Actions for the commercial sector. The specific Actions build directly from the Economic Potential savings, as contained in Section 5 of the draft Report presented in September 2005.

The attached Action Profiles provide a framework for the workshop discussions to be held on October 31. They are intended to provide a logic framework that defines an overall rationale and direction without getting into the much greater detail required of program design (which is beyond the scope of this project).

1.1 WORKSHOP GOAL AND OUTCOME

Workshop participants are all involved is some aspect of the technologies and/or markets affecting energy efficiency and fuel choice opportunities affecting British Columbia’s commercial sector. The goal of this workshop is to make maximum advantage of the participant’s experience and knowledge by promoting active discussion of each Action Profile related, in particular, to the following factors:

- Review of expected energy savings per participant
- Best estimate of “Most likely” and “Upper” customer participation rates
- As applicable, expected levels of incentives or other conditions necessary to achieve the customer participation rates.

It is hoped that the outcome of this workshop will be general agreement on the above factors, which will enable the Terasen Gas Conservation Potential Review to complete the development of a “high level” estimate of achievable potential for the commercial sector.

1.2 CONTENTS

This document contains the following background information:

- Exhibit 1 - Summary of Action Profiles
- Exhibit 2 - Generalized Barriers – for reference and/or refinement when reviewing the Action Profiles
- Exhibit 3 - Generalized Interventions - for reference and/or refinement when reviewing the Action Profiles
- 7 Energy Efficiency Action Profiles and 2 Fuel Choice Action Profiles (in the order shown below in Exhibit 1). Each Action Profile is presented on two pages. The first page provides a “high level” description of the Action; the second page presents the quantitative information to be discussed during the workshop. As illustrated, the consultants will provide the initial technical and cost information that has been developed as part of the Conservation Potential Review work to date.

Exhibit 1A
Summary of Action Profiles

Action Profile #	Title	Approximate % of Economic Savings Potential
C1	Ultra High Efficiency New Construction	38
C2	New Construction –High Efficiency Space & Water Heating	In above
C3	Existing Commercial: High Efficiency Space & Water Heating Retrofit	36
C4	Existing Commercial: Next Generation BAS	8
C5	Existing Commercial: Recommissioning	7
C6	EE Food Preparation Equipment	10
C7	Commercial Hot Water Reduction for Food Preparation	1

Exhibit 1B
Summary of Fuel Choice Action Profiles

Action Profile #	Title	Approximate % of Economic Savings Potential
CFC1	Space Heating Conversion	75
CFC2	Water Heating Conversion	25

Exhibit 2
Generalized Barriers

Customer EE Awareness	• Awareness that EE opportunities & products exist • Awareness of benefits – cost and co-benefit • Customers' technical ability to assess the options.
Product and Service Availability	• Local or national product availability. • Existence of a viable infrastructure of trade allies. • Vendor or trade ally awareness of the efficiency options and their understanding of the technical issues.
Financing	• Access to appropriate financing • Size of required EE investment vs asset base • Payback Ratio – Actual vs Required
Transaction Costs	• Level of effort/hassle required to become informed, select products, choose contractor(s) and install
Perceived Risk/Reward	• Level of perceived risk that the EE product may not perform as promised • Level of positive external/personal recognition for "doing the right thing" by installing the EE measure(s)
Split Incentive/Motivation	• Level to which the incentives of the agent charged with purchasing the EE are aligned with those of the person(s) that would benefit.
Regulatory	• Codes or standards that prohibit implementation of innovative EE technologies • Level of EE performance that is required in codes or standards

(Source: BC Hydro Conservation Potential Review 2002)

Exhibit 3
Generalized Interventions

Ref	Name	Sample Descriptions
A	Information & Promotion	• Passive provision of information to market participants re: EE opportunities and benefits. • Product or building EE labelling • Employee EE awareness programs
B	Technical services to customers	• Energy audits (walk-through, pre-feasibility, investment grade) • Web based self analysis • Metering • Design assistance • Energy performance benchmarking • Commissioning and recommissioning • Direct management of third party utilities • Third party verification • Post installation technical support re: EE equipment.
C	Specialized customer support	• Provide solutions to sub sector specific EE constraints e.g., Assist property managers/owners to establish language in lease agreements enabling cost recovery of EE capital investments. • Provide market recognition for customer EE achievements
D	Vendor and Customer Links	• Providing customer contacts to contractors • Providing contractor contacts to customers • Contractor certification • Providing sales, marketing and/or technical training about products or services to individuals responsible for selling it. • Vertical integration of market between upstream and downstream market actors (i.e., forming a relationship between contractors and suppliers).
E	Trade Ally Training	• Providing training to trade-allies so that they better understand new or existing practices or procedures • O&M training • Recommissioning and commissioning training
F	Financial incentives	• Product rebates to customer • Product rebates to vendor • Performance incentives ($/GJ/year) • Below market interest rate loans with repayment through energy bills • Revolving fund for feasibility studies • Direct audit incentives • Subsidize industrial process improvements
G	Rates	• Time of use rates • Curtailable and interruptible energy rates. • Emission credits- perhaps considering GHG credit purchase for customer DSM.
H	EE Procurement	• Utility bulk purchases target product to bring price down and establish agreement with trade allies to sell the product. • Development of EE procurement guidelines for Municipal, C/I sectors
I	Standards and Regulations	• Product energy test standards and energy performance rating • Standardized protocols for installation and operation of energy equipment • Regulations prescribing minimum energy efficiency performance levels
J	Emerging technology accelerated market adoption	• Providing demonstration of the use/performance of energy efficient technologies to market actors • Bulk purchase • Take equity position in companies developing technologies

Commercial Energy Efficiency Action Profiles

Action Profile C1 – Ultra High Efficiency New Construction

Overview:

This Action will promote high performance new construction through the application of an integrated design approach (IDA) in all new small, medium, and large commercial buildings. The goal is to design commercial buildings that use between 30 to 60 percent less energy than the Model National Energy Code Buildings (MNECB). Energy efficient designs attain high performance levels through the application of IDA coupled with a high degree of integration and the use of energy efficient equipment and renewable technologies. BC Hydro is currently in the process of rolling out their High Performance Buildings Program. The BC Hydro Program provides funding assistance for an initial "design options" study and, based on the study results, a separate MOU is signed with the builder that provides an incentive for incorporation of the agreed high performance design options.

The broad strategy for this Action assumes that the current BC Hydro roll out of a similar initiative provides good opportunity for collaboration; one that will enable builders to address total energy options (not just electricity) and will provide opportunities for program administrative efficiencies. It will include:

- Promotional efforts in collaboration with Power Smart High Performance Buildings program.
- Efforts to facilitate a team approach to designing buildings (Engineers, architects, LEED consultants, contractors)
- Customized incentives.

Although the changes required to the design process within the IDA are economic, they represent a significant departure from today's conventional practices. Consequently, it is assumed that short-term market penetration of this Action will be limited. Therefore a complementary Action Profile C2 is outlined separately that will encourage the adoption of some of the individual technologies that contribute to the savings in Action C1.

Target Technologies and Sub Segments:

- Ultra Efficient Building Design to 60% Below Current Practice for large commercial buildings
- Energy Efficient Building Design to 30% Below Current Practice for small and medium commercial buildings

Target Stakeholder Group:

- Design community including architect, engineers, and LEED accredited professionals
- Owners, developers, facility managers, BOMA members

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers to the design of high performance commercial buildings through the application of IDA is:

- IDA has only been adopted by a small fraction of the owners, developers and engineering practitioners for various reasons including perceived risks, time constraints, costs, and a lack of understanding of the benefits as elaborated below.
- Split incentive. For spec buildings, additional construction costs may be hard to pass on to purchasers; and in the case of lease agreements, the inability to pass on the electricity costs to tenants reduces the incentive to developers and owners.
- Transaction costs for the additional studies of the systems
- Financing for the incremental upfront cost
- Risk that the energy savings will not occur as expected.

This action will address the above barriers by combining the following interventions:

- Information and promotion – eg: make owners/developers aware of the benefits of IDA
- Specialized customer support – eg: provide training on lease agreement language to BOMA members
- Vendor & customer links – eg: contractor/customer links; contractor certification
- Technical services to customers – eg: design assistance
- Trade ally training eg: training of architects and engineers
- Financing or developer and trade ally incentives, passed on performance achievements.
- Support of pilot developments accompanied by case studies and other promotion of successful results.

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Links directly with BCH program, which is targeted to the same building population and trade allies.

<table>
<tr><th>Sub Sector</th><th colspan="3">Large Office</th><th>Medium Office</th><th>Large Non-Food Retail</th><th>Medium Non-Food Retail</th><th>Etc…</th></tr>
<tr><td>Approx % of Action Svgs</td><td colspan="3">✓</td><td colspan="4" rowspan="11">The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ The consultant will provide data in an updated version of this worksheet to be presented out at the workshop

✗ To be discussed during the workshop</td></tr>
<tr><td rowspan="2">Economic Savings Potential in Period (GJ/year)</td><td>05/06</td><td>10/11</td><td>15/16</td></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Participant Definition</td><td colspan="3">M² of building floor space
✓ ✗</td></tr>
<tr><td>Total Potential Participants in Period</td><td>05/06</td><td>10/11</td><td>15/16</td></tr>
<tr><td>M2 of floor space</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Approx. No. of Buildings</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="3">Major Technologies & Contribution to Economic Savings</td><td colspan="2">Technology</td><td>% of Eco Svg</td></tr>
<tr><td colspan="2">Tech 1 ✓</td><td>✓</td></tr>
<tr><td colspan="2">Tech 2 ✓</td><td>✓</td></tr>
<tr><td>Approximate Annual Svgs per Participant (GJ/year)</td><td colspan="3">✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Savings Adjustment Factor, if applicable</td><td colspan="3">✗
Comments re: above approximate participant savings level.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Approximate Measure B/C Ratio</td><td colspan="3">✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Approx Customer Payback (yrs)</td><td colspan="3">✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Participation Rate (# of Buildings in Period)</td><td>05/06</td><td>10/11</td><td>15/16</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Most Likely</td><td>✗</td><td>✗</td><td>✗</td></tr>
<tr><td>Upper</td><td>✗</td><td>✗</td><td>✗</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8"></td></tr>
<tr><td>Action Savings, by Milestone Year (GJ/year)</td><td>05/06</td><td>10/11</td><td>15/16</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>Most Likely</td><td colspan="3">Calculated based on above inputs</td></tr>
<tr><td>Upper</td><td colspan="3">Calculated based on above inputs</td></tr>
</table>

Action Profile C2 – New Construction: High Efficiency Space & Water Heating

Overview:

This Action will promote the installation of high efficiency space and water heating equipment in all new commercial construction. As noted in Action Profile C1, it is anticipated that only a limited share of new commercial construction will be induced to incorporate the high levels of energy performance associated with "Ultra High Efficiency" new construction. This Action, therefore, addresses the remaining stock of new commercial buildings not captured in Action C1.

The broad strategy for this Action consists of:

- Promotional efforts in collaboration with Power Smart High Performance Buildings program.
- Incentives based on level of equipment efficiency.

Target Technologies and Sub Segments:

To facilitate workshop discussions, Action C2 has been divided into the following technology areas:

- C2A – Condensing Boilers for Space Heating
- C2B – Near Condensing Boilers for Space Heating
- C2C – Condensing DHW Boilers and Heaters

To further facilitate the discussion, the workshop will focus on the new large and medium buildings only. Small commercial will be addressed outside of the workshop setting.

Target Stakeholder Group

- Design community including architect, engineers, and LEED accredited professionals
- ASHRAE local chapters
- Owners, developers, facility managers, BOMA members

Key Barriers and Interventions

Key barriers include:

- Split incentive. For spec buildings, additional construction costs may be hard to pass on to purchasers; and in the case of lease agreements, the inability to pass on the electricity costs to tenants reduces the incentive to developers and owners.
- Transaction costs for the additional studies of the systems
- Financing for the incremental upfront cost
- Risk that the energy savings will not occur as expected.

This action will address the above barriers by combining the following interventions:

- Information and promotion – eg: make owners/developers aware of the benefits of target technologies
- Specialized customer support – eg: provide training on lease agreement language to BOMA members (?)
- Vendor & customer links – eg: contractor/customer links; contractor certification
- Technical services to customers – eg: design assistance
- Trade ally training eg: training of architects and engineers
- Financing or developer and trade ally incentives, passed on performance achievements.
- Support of pilot developments accompanied by case studies and other promotion of successful results

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Terasen Gas is currently offering the Efficient Boiler Program to the commercial market. Average incentive amount is $12,000 for condensing or near-condensing boilers. Approximately 130 participants over two years are expected from all sub sectors.

Sub Sector	Large Office			Medium Office	Large Non-Food Retail	Medium Non-Food Retail	Etc…
Approx % of Action Svgs	✓						
Economic Savings Potential in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M² of building floor space ✓ ✗						
Total Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Economic Savings	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Svgs per Participant ***(GJ/year)***	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate ***(# of Buildings in Period)***	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ The consultant will provide data in an updated version of this worksheet to be presented out at the workshop

✗ To be discussed during the workshop

Action Profile C3 – Existing Commercial: High Efficiency Space & Water Heating Retrofit

Overview:

This Action will promote energy efficiency retrofits including the installation of high efficiency heating equipment such as boilers and DHW heaters in existing medium and large commercial buildings. The goal is to upgrade capital equipment on replacement with more efficient equipment, and to increase the efficiency of building systems.

The broad strategy for this Action consists of:

- Promotional efforts in collaboration with BC Hydro's Power Smart Partners program.
- Customized incentives for large and medium customers
- Training and capacity development for ESCOs and service providers in the commercial sector

Target Technologies and Sub Segments:

To facilitate workshop discussions, Action C3 has been divided into the following technology areas:

- C3A – Condensing Boilers for Space Heating
- C3B – Near Condensing Boilers for Space Heating
- C3C – Condensing DHW Boilers and Heaters

To further facilitate the discussion, the workshop will focus on the new large and medium buildings only. Small commercial will be addressed outside of the workshop setting.

Target Stakeholder Group:

- Owners, developers, facility managers, BOMA members
- Engineering community/designers, including ASHRAE local chapters
- Boiler / heater manufacturers and contractors
- ESCOs

Key Barriers and Interventions:

- Lack of customer awareness
- Split incentive, including leasing arrangements
- Transaction cost to do the necessary audits and analysis
- Financing of the retrofits
- Perceived risk that the retrofits will not perform as promised

The Action will address the above barriers by combining the following interventions

- Information and promotion
- Financing or incentives
- Pilot projects and case studies to address perceived risk of these technologies

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Terasen Gas is currently offering the Efficient Boiler Program to the commercial market. Average incentive amount is $12,000 for condensing or near-condensing boilers. Approximately 130 participants over two years are expected from all sub sectors.

Sub Sector	Large Office			Medium Office	Large Non-Food Retail	Medium Non-Food Retail	Etc…
Approx % of Action Svgs	✓			*The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.* ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M^2 of building floor space ✓ ✗						
Total Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Economic Savings	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Svgs per Participant ***(GJ/year)***	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate ***(# of Buildings in Period)***	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

Action Profile C4 – Existing Commercial: Next Generation BAS

Overview:

This Action will promote more energy efficient operations in existing buildings though the installation of next generation building automation systems (BAS).

The broad strategy for this Action includes:

- Promotional efforts in collaboration with BC Hydro's Power Smart Partners program.
- Customized incentives
- Training and capacity development for building operators, ESCOs and service providers in the commercial sector

Target Technologies and Sub Segments:

This Action targets BAS controls in existing commercial buildings, particularly large office, hospitals, nursing homes, schools, and university/colleges.

Key Barriers and Interventions

- Lack of customer awareness
- Split incentive, including leasing arrangements
- Transaction cost to do the necessary audits and analysis
- Financing of the retrofits
- Perceived risk that the retrofits will not perform as promised

The Action will address the above barriers by combining the following interventions

- Information and promotion
- Financing or incentives (need to understand how the current Terasen boiler program fits into this).
- Pilot projects and case studies to address perceived risk of these technologies

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Sub Sector	**Large Office**			**Medium Office**	**Large Non-Food Retail**	**Medium Non-Food Retail**	**Etc…**
Approx % of Action Svgs	✓			*The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.* ✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop** ✗ **To be discussed during the workshop**			
Economic Savings Potential in Period ***(GJ/year)***	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M² of building floor space ✓ ✗						
Total Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Economic Savings	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Svgs per Participant ***(GJ/year)***	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate ***(# of Buildings in Period)***	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

Action Profile C5 – Existing Commercial: Recommissioning

Overview:

This Action will promote improved building operations in existing buildings though the recommisioning of building systems. The goal is to improve building operations and reduce energy consumption.

The broad strategy for the larger customers will include:

- Promotional efforts in collaboration with BC Hydro's Power Smart Partners program.
- Customized incentives
- Training and capacity development for building operators, ESCOs and service providers in the commercial sector

Target Technologies and Sub Segments:

This Action targets HVAC equipment and BAS controls through equipment recommissioning, maintenance, and owner/operator training. The action targets all existing large and medium size commercial buildings, particularly large office, hospitals, nursing homes, schools, and university/colleges.

Key Barriers and Interventions

- Lack of customer awareness
- Split incentive, including leasing arrangements
- Transaction cost to do the necessary audits and analysis
- Financing of the retrofits
- Perceived risk that the retrofits will not perform as promised

The Action will address the above barriers by combining the following interventions

- Information and promotion
- Financing or incentives (need to understand how the current Terasen boiler program fits into this).
- Pilot projects and case studies to address perceived risk of these technologies

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Sub Sector	Large Office			Medium Office	Large Non-Food Retail	Medium Non-Food Retail	Etc…
Approx % of Action Svgs	✓						
Economic Savings Potential in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M^2 of building floor space ✓ ✗						
Total Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Economic Savings	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Svgs per Participant *(GJ/year)*	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate *(# of Buildings in Period)*	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**

✗ **To be discussed during the workshop**

Action Profile C6 – EE Food Preparation Equipment

Overview:

This Action will promote energy efficient gas food preparation equipment in all commercial sector buildings having food preparation facilities. The goal is to increase the efficiency of natural gas fired ranges and broilers.

The broad strategy for this Action will include:

- Focus on those commercial sub sectors that have a high penetration of food services end use
- Collaborative promotion with equipment manufacturers and distributors
- Financial incentives

Target Technologies and Sub Segments:

Efficient Gas Ranges for large and medium commercial buildings, both new construction (including kitchen renovation) and retrofits of existing operations.

Efficient Gas Broilers for large and medium commercial buildings, both new construction (including renovation of kitchens) and retrofits of existing operations.

Target Stakeholder Group:

- Owners / operators of restaurants and cooking facilities.
- Venders of efficient equipment

Key Barriers and Interventions:

- Lack of customer awareness
- Split incentive
- Financing of the new equipment (assumes that the efficient equipment is more expensive)
- Perceived risk that the equipment will not perform as promised

This action will address the above barriers by:

- Information and promotion
- Case studies to demonstrate that the savings are achievable
- Financial incentives

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

<table>
<tr><th>Sub Sector</th><th colspan="3">Large Office</th><th>Medium Office</th><th>Large Non-Food Retail</th><th>Medium Non-Food Retail</th><th>Etc…</th></tr>
<tr><td>Approx % of Action Svgs</td><td colspan="3">✓</td><td colspan="4" rowspan="10">The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ The consultant will provide data in an updated version of this worksheet to be presented out at the workshop

✗ To be discussed during the workshop</td></tr>
<tr><td rowspan="2">Economic Savings Potential in Period (GJ/year)</td><td>05/06</td><td>10/11</td><td>15/16</td></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Participant Definition</td><td colspan="3">M² of building floor space
✓ ✗</td></tr>
<tr><td>Total Potential Participants in Period</td><td>05/06</td><td>10/11</td><td>15/16</td></tr>
<tr><td>M2 of floor space</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Approx. No. of Buildings</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="3">Major Technologies & Contribution to Economic Savings</td><td colspan="2">Technology</td><td>% of Eco Svg</td></tr>
<tr><td colspan="2">Tech 1 ✓</td><td>✓</td></tr>
<tr><td colspan="2">Tech 2 ✓</td><td>✓</td></tr>
<tr><td>Approximate Annual Svgs per Participant (GJ/year)</td><td colspan="3">✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Savings Adjustment Factor, if applicable</td><td colspan="3">✗
Comments re: above approximate participant savings level.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Approximate Measure B/C Ratio</td><td colspan="3">✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Approx Customer Payback (yrs)</td><td colspan="3">✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Participation Rate (# of Buildings in Period)</td><td>05/06</td><td>10/11</td><td>15/16</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Most Likely ✗</td><td>✗</td><td>✗</td></tr>
<tr><td>Upper</td><td>✗</td><td>✗</td><td>✗</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8"></td></tr>
<tr><td rowspan="3">Action Savings, by Milestone Year (GJ/year)</td><td>05/06</td><td>10/11</td><td>15/16</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td colspan="3">Most Likely: Calculated based on above inputs</td></tr>
<tr><td colspan="3">Upper: Calculated based on above inputs</td></tr>
</table>

Action Profile C7 – Commercial Hot Water Reduction for Food Preparation

Overview:

This Action will promote the installation of pre-rinse spray valves in existing food preparation facilities to reduce the use of hot water. The broad strategy for this Action will include:

- Focus on those commercial sub sectors that have a high penetration of food services end use
- Collaborative promotion with equipment manufacturers and distributors
- Financial incentives

Target Technologies and Sub Segments:

- Pre-Rinse Spray Valves – all commercial facilities with food preparation facilities.

Target Stakeholder Group:

- Owners / operators of restaurants and cooking facilities.
- Venders of efficient equipment

Key Barriers and Interventions:

- Lack of customer awareness

This action will address the above barriers by:

- Information and promotion
- Modest financial incentive

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Sub Sector	Large Office			Medium Office	Large Non-Food Retail	Medium Non-Food Retail	Etc…
Approx % of Action Svgs	✓						
Economic Savings Potential in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M^2 of building floor space ✓ ✗						
Total Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Economic Savings	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Svgs per Participant *(GJ/year)*	✓						
Savings Adjustment Factor, if applicable	✗ *Comments re: above approximate participant savings level.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate *(# of Buildings in Period)*	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Savings, by Milestone Year (GJ/year)	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**

✗ **To be discussed during the workshop**

Commercial Fuel Choice Action Profiles

Action Profile CFC1 – Space Heating Conversion

Overview:

This Action will encourage commercial customers to choose natural gas to meet their space heating needs. For the relatively small share of existing electrically heated commercial buildings, this will typically mean choosing a gas-fired rooftop unit instead of an electric one at the time of replacement. It is important to note that most buildings heated with natural gas have some form of electric heating that in most cases cannot be practically displaced by gas. For new construction, the target population will be the relatively small portion that is currently choosing electric space heating.

The broad strategy for this Action consists of:

- Promotional efforts to developers, architects and designers and trade allies
- Incentives for retrofit opportunities; in the existing market, this includes early replacement

Target Technologies and Sub Segments:

- Natural gas fired space heating – Forced Air Application (replace electric roof top units with gas-fired roof top units)

Most building segments in the Lower Mainland and Interior currently have natural gas space heating shares that are in the range of 90 to 98%. Gas shares on Vancouver Island are lower, and in most segment range from about 70% to over 90%.

Target Stakeholder Group

- New construction community including developers, architect, engineers, and contractors
- Owners, developers, facility managers, BOMA members

Key Barriers and Interventions

Key barriers include:

- Split incentive. For spec buildings, additional construction costs may be hard to pass on to purchasers; and in the case of lease agreements, the ability to pass on the electricity costs to tenants reduces the incentive to developers and owners.
- Financing for the incremental upfront cost
- Risk that the energy savings will not occur as expected.
- For retrofit, if replacement on failure, additional time to get natural gas to the location of the roof top equipment may be a constraint.

This action will address the above barriers by combining the following interventions:

- Information and promotion – eg: make owners/developers aware of the benefits of target technologies
- Vendor & customer links – eg: contractor/customer links; contractor certification
- Technical services to customers – eg: design assistance
- Trade ally training eg: training of architects and engineers
- Incentives for retrofit situations.
- Support of pilot developments accompanied by case studies and other promotion of successful results

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

The high natural gas space heating shares in new construction are likely to present program design challenges as free riders will be very high.

Sub Sector	Large Office			Medium Office	Large Non-Food Retail	Medium Non-Food Retail	Etc…
Approx % of Action Svgs	✓						
Potential Natural Gas Increase in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M^2 of building floor space ✓ ✗						
<u>Total</u> Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M^2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Increased Natural Gas Use	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Gas Use Increase per Participant *(GJ/year)*	✓						
Energy Use Adjustment Factor, if applicable	✗ *Comments re: above approximate participant energy use levels.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate ***(# of Buildings in Period)***	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Impacts, by Milestone Year ***(GJ/year)***	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**

✗ **To be discussed during the workshop**

Action Profile CFC2 – Water Heating Conversion

Overview:

This Action will encourage commercial customers to choose natural gas instead of electricity to meet their water heating needs in both existing buildings and new construction

.

The broad strategy for this Action consists of:

- Promotional efforts to developers, architects and designers and trade allies
- Incentives for retrofit opportunities; in the existing market, this includes early replacement

Target Technologies and Sub Segments:

- Natural gas fired water heating – Central DHW Application (replace central electric heater with a standard natural gas heater equipped with a power-vent system)
- Natural gas fired water heating – Distributed DHW Application (replace distributed water heaters with standard natural gas tanks with power-vent systems)
- Natural gas Instantaneous Heater – On Demand DHW Application (replace electric heater with commercial-grade instantaneous natural gas heater)

Most building segments in the Lower Mainland and Interior currently have natural gas water heating shares that are in the range of 70 to 90%, or higher. Gas water heating shares on Vancouver Island are moderately lower than in the other service regions.

Target Stakeholder Group

- New construction community including developers, architect, engineers, and contractors
- Owners, developers, facility managers, BOMA members

Key Barriers and Interventions

Key barriers include:

- Split incentive. For spec buildings, additional construction costs may be hard to pass on to purchasers; and in the case of lease agreements, the ability to pass on the electricity costs to tenants reduces the incentive to developers and owners.
- Financing for the incremental upfront cost
- Risk that the energy savings will not occur as expected.
- For retrofit, if replacement on failure, additional time to get natural gas to the location of the water heaters may be a constraint.

This action will address the above barriers by combining the following interventions:

- Information and promotion – eg: make owners/developers aware of the benefits of target technologies
- Vendor & customer links – eg: contractor/customer links; contractor certification
- Technical services to customers – eg: design assistance
- Trade ally training eg: training of architects and engineers
- Incentives for retrofit situations.
- Support of pilot developments accompanied by case studies and other promotion of successful results

Time Frame:

Promotional efforts begin in 2006. Incentives provided until 2010.

Additional Information:

Sub Sector	Large Office			Medium Office	Large Non-Food Retail	Medium Non-Food Retail	Etc…
Approx % of Action Svgs	✓						
Potential Natural Gas Increase in Period *(GJ/year)*	*05/06*	*10/11*	*15/16*				
	✓	✓	✓				
Participant Definition	M^2 of building floor space ✓ ✗						
<u>Total</u> Potential Participants in Period	*05/06*	*10/11*	*15/16*				
M^2 of floor space	✓	✓	✓				
Approx. No. of Buildings	✓	✓	✓				
Major Technologies & Contribution to Increased Natural Gas Use	*Technology*		*% of Eco Svg*				
	Tech 1 ✓		✓				
	Tech 2 ✓		✓				
Approximate Annual Gas Use Increase per Participant *(GJ/year)*	✓						
Energy Use Adjustment Factor, if applicable	✗ *Comments re: above approximate participant energy use levels.*						
Approximate Measure B/C Ratio	✓						
Approx Customer Payback (yrs)	✓						
Participation Rate *(# of Buildings in Period)*	*05/06*	*10/11*	*15/16*				
Most Likely	✗	✗	✗				
Upper	✗	✗	✗				
Action Impacts, by Milestone Year *(GJ/year)*	*05/06*	*10/11*	*15/16*				
Most Likely	*Calculated based on above inputs*						
Upper	*Calculated based on above inputs*						

The approach shown for the large office sub-sector will be applied to the remaining sub-sectors.

✓ **The consultant will provide data in an updated version of this worksheet to be presented out at the workshop**

✗ **To be discussed during the workshop**

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Resource Consultants Ltd.

APPENDIX H

Action Worksheets

C1-Energy Efficient New Const.

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	13%			2%			12%			2%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	27	118	204	5	20	35	26	106	179	4	16	28	4	16	29
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	177	769	1,329	57	244	423	227	924	1,558	74	301	507	29	110	202
Annual Applicable Participants (‘000s of m2)	88	118	112	29	37	36	114	139	127	37	45	41	14	16	18
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.153			0.082			0.115			0.055			0.146		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	9.0			1.9			9.0			1.9			1.9		
Approx. Customer Payback (yrs)	1.4			6.0			1.4			6.0			6.0		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*22*	*28*	*0*	*21*	*42*	*0*	*18*	*36*	*0*	*18*	*36*	*0*	*18*	*36*
Upper	*0*	*28*	*56*	*0*	*42*	*84*	*0*	*36*	*73*	*0*	*36*	*73*	*0*	*36*	*73*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*26*	*51*	*0*	*4*	*11*	*0*	*19*	*49*	*0*	*3*	*8*	*0*	*3*	*8*
Upper	*0*	*33*	*86*	*0*	*8*	*22*	*0*	*39*	*98*	*0*	*6*	*15*	*0*	*6*	*16*

C1-Energy Efficient New Const.

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	10%			2%			7%			3%			20%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	23	90	148	5	21	32	18	70	108	7	31	53	41	166	313
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	59	233	382	31	124	209	27	103	159	13	57	95	121	491	927
Annual Applicable Participants (‘000s of m2)	30	35	30	16	19	17	14	15	11	6	9	8	61	74	87
Major Technologies & % Contribution to Economic Savings	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*
	N/A		100%	N/A		100%	N/A		100%	N/A		100%	N/A		100%
Approx Annual Svgs per Participant GJ/yr	0.388			0.154			0.677			0.552			0.338		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			0.5		
Approx. B/C Ratio	9.0			1.9			9.0			9.0			9.0		
Approx. Customer Payback (yrs)	1.4			6.0			1.4			1.4			1.4		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*9*	*18*	*0*	*9*	*18*	*0*	*38*	*75*	*0*	*38*	*75*	*0*	*38*	*75*
Upper	*0*	*18*	*36*	*0*	*18*	*36*	*0*	*50*	*100*	*0*	*50*	*100*	*0*	*50*	*100*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*8*	*20*	*0*	*2*	*4*	*0*	*27*	*61*	*0*	*12*	*30*	*0*	*31*	*88*
Upper	*0*	*16*	*40*	*0*	*4*	*9*	*0*	*35*	*81*	*0*	*16*	*39*	*0*	*42*	*117*

C1-Energy Efficient New Const.

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	9%			10%			3%			5%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	18	73	139	19	79	153	6	22	39	11	44	73	3	14	25
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	76	314	606	85	343	650	41	158	277	131	546	911	25	102	186
Annual Applicable Participants ('000s of m2)	38	48	58	43	52	61	20	23	24	66	83	73	13	15	17
Major Technologies & % Contribution to Economic Savings	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*
	N/A		100%	N/A		100%	N/A		100%	N/A		100%	N/A		100%
Approx Annual Svgs per Participant GJ/yr	0.229			0.236			0.141			0.081			0.133		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			9.0			1.9			1.9			1.9		
Approx. Customer Payback (yrs)	6.0			1.4			6.0			6.0			6.0		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*38*	*75*	*0*	*38*	*75*	*0*	*9*	*18*	*0*	*2*	*5*	*0*	*9*	*18*
Upper	*0*	*50*	*100*	*0*	*50*	*100*	*0*	*18*	*36*	*0*	*4*	*10*	*0*	*18*	*36*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*27*	*78*	*0*	*30*	*86*	*0*	*2*	*5*	*0*	*1*	*3*	*0*	*1*	*3*
Upper	*0*	*36*	*104*	*0*	*39*	*115*	*0*	*4*	*11*	*0*	*2*	*5*	*0*	*2*	*7*

Total Savings, by Year	2006	2011	2016
Economic Savings	*217*	*885*	*1,558*
Most Likely	*0*	*196*	*505*
Upper	*0*	*288*	*764*

C2a-Condensing Boilers Space

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	11%			4%			10%			3%			3%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	10.5	45.5	78.9	3.6	15.2	26.5	10.1	40.8	68.9	3.2	13.0	22.0	3.0	11.8	21.8
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	177	769	1,329	57	244	423	227	924	1,558	74	301	507	29	110	202
Annual Applicable Participants ('000s of m2)	88	118	112	29	37	36	114	139	127	37	45	41	14	16	18
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.059			0.063			0.044			0.043			0.108		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	4.6			4.6			4.6			4.6			4.6		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*20*	*32*	*0*	*4*	*5*	*0*	*10*	*14*	*0*	*2*	*3*	*0*	*2*	*3*
Upper	*0*	*36*	*39*	*0*	*9*	*3*	*0*	*24*	*12*	*0*	*5*	*2*	*0*	*5*	*2*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*8.9*	*20.5*	*0.0*	*0.6*	*1.2*	*0.0*	*4.2*	*8.5*	*0.0*	*0.3*	*0.5*	*0.0*	*0.2*	*0.5*
Upper	*0.0*	*16.4*	*29.7*	*0.0*	*1.3*	*1.5*	*0.0*	*9.8*	*12.5*	*0.0*	*0.6*	*0.8*	*0.0*	*0.6*	*0.8*

C2a-Condensing Boilers Space

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital		
Approx % of Action Savings	4%			2%			6%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016
	4.9	19.3	31.8	1.6	6.5	11.1	6.9	26.2	40.3
Participant Definition	m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	59	233	382	31	124	209	27	103	159
Annual Applicable Participants ('000s of m2)	30	35	30	16	19	17	14	15	11
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.083			0.053			0.254		
Savings Adjustment Factor (if applicable)	okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2		
Approx. Customer Payback (yrs)	4.6			4.6			4.6		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*11*	*18*	*0*	*2*	*4*	*0*	*8*	*6*
Upper	*0*	*21*	*29*	*0*	*4*	*6*	*0*	*13*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*2.2*	*4.7*	*0.0*	*0.1*	*0.3*	*0.0*	*2.0*	*2.7*
Upper	*0.0*	*4.0*	*7.8*	*0.0*	*0.3*	*0.5*	*0.0*	*3.3*	*2.5*

Sub Sector	Nursing Homes			Large School		
Approx % of Action Savings	3%			18%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016
	2.3	10.6	17.9	17.0	68.8	129.7
Participant Definition	m2			m2		
Total Applicable Participants in Period ('000s of m2)	13	57	95	121	491	927
Annual Applicable Participants ('000s of m2)	6	9	8	61	74	87
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.188			0.140		
Savings Adjustment Factor (if applicable)	okay			okay		
Approx. B/C Ratio	1.2			1.2		
Approx. Customer Payback (yrs)	4.6			4.6		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*8*	*6*	*0*	*63*	*25*
Upper	*0*	*13*	*0*	*0*	*50*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.8*	*1.2*	*0.0*	*43.0*	*56.7*
Upper	*0.0*	*1.3*	*1.1*	*0.0*	*34.4*	*32.4*

C2a-Condensing Boilers Space

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	16%			9%			2%			8%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	14.9	60.8	116.5	7.8	31.7	61.7	2.6	10.0	17.5	8.1	33.8	56.4	1.9	7.8	14.2
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	76	314	606	85	343	650	41	158	277	131	546	911	25	102	186
Annual Applicable Participants (‘000s of m2)	38	48	58	43	52	61	20	23	24	66	83	73	13	15	17
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.192			0.095			0.063			0.062			0.076		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	4.6			4.6			4.6			4.6			4.6		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*63*	*25*	*0*	*63*	*25*	*0*	*2*	*4*	*0*	*1*	*2*	*0*	*5*	*8*
Upper	*0*	*50*	*0*	*0*	*50*	*0*	*0*	*6*	*6*	*0*	*2*	*4*	*0*	*8*	*13*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*38.0*	*50.9*	*0.0*	*19.8*	*27.0*	*0.0*	*0.2*	*0.5*	*0.0*	*0.3*	*0.8*	*0.0*	*0.4*	*0.9*
Upper	*0.0*	*30.4*	*29.1*	*0.0*	*15.8*	*15.4*	*0.0*	*0.6*	*1.0*	*0.0*	*0.6*	*1.6*	*0.0*	*0.6*	*1.5*
										Total Savings, by Year			2006	2011	2016

C2b-Near Cond. Boilers Space

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	11%			4%			10%			3%			3%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	6.1	26.2	45.4	2.1	8.7	15.2	5.8	23.5	39.6	1.8	7.5	12.6	1.7	6.8	12.5
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	177	769	1,329	57	244	423	227	924	1,558	74	301	507	29	110	202
Annual Applicable Participants ('000s of m2)	88	118	112	29	37	36	114	139	127	37	45	41	14	16	18
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.034			0.036			0.025			0.025			0.062		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	4.0			4.0			4.0			4.0			4.0		
Approx. Customer Payback (yrs)	1.4			1.4			1.4			1.4			1.4		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*15*	*20*	*0*	*4*	*5*	*0*	*9*	*12*	*0*	*2*	*3*	*0*	*2*	*3*
Upper	*0*	*18*	*4*	*0*	*5*	*2*	*0*	*10*	*7*	*0*	*3*	*2*	*0*	*3*	*2*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*3.8*	*7.8*	*0.0*	*0.3*	*0.7*	*0.0*	*2.1*	*4.2*	*0.0*	*0.1*	*0.3*	*0.0*	*0.1*	*0.3*
Upper	*0.0*	*4.7*	*5.0*	*0.0*	*0.4*	*0.5*	*0.0*	*2.3*	*3.3*	*0.0*	*0.2*	*0.3*	*0.0*	*0.2*	*0.3*

C2b-Near Cond. Boilers Space

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	4%			2%			6%			3%			18%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	2.8	11.1	18.3	0.9	3.8	6.4	4.0	15.1	23.2	1.3	6.1	10.3	9.8	39.6	74.6
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	59	233	382	31	124	209	27	103	159	13	57	95	121	491	927
Annual Applicable Participants ('000s of m2)	30	35	30	16	19	17	14	15	11	6	9	8	61	74	87
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.048			0.031			0.146			0.108			0.080		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	4.0			4.0			4.0			4.0			4.0		
Approx. Customer Payback (yrs)	1.4			1.4			1.4			1.4			1.4		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*10*	*16*	*0*	*2*	*4*	*0*	*7*	*5*	*0*	*7*	*5*	*0*	*0*	*0*
Upper	*0*	*15*	*16*	*0*	*4*	*5*	*0*	*9*	*0*	*0*	*9*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*1.1*	*2.4*	*0.0*	*0.1*	*0.2*	*0.0*	*1.0*	*1.3*	*0.0*	*0.4*	*0.6*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*1.7*	*2.9*	*0.0*	*0.1*	*0.3*	*0.0*	*1.4*	*1.1*	*0.0*	*0.6*	*0.5*	*0.0*	*0.0*	*0.0*

C2b-Near Cond. Boilers Space

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	16%			9%			2%			8%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	8.6	35.0	67.0	4.5	18.2	35.5	1.5	5.7	10.0	4.7	19.4	32.4	1.1	4.5	8.1
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	76	314	606	85	343	650	41	158	277	131	546	911	25	102	186
Annual Applicable Participants ('000s of m2)	38	48	58	43	52	61	20	23	24	66	83	73	13	15	17
Major Technologies & % Contribution to Economic Savings	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*
	N/A		100%	N/A		100%	N/A		100%	N/A		100%	N/A		100%
Approx Annual Svgs per Participant GJ/yr	0.110			0.055			0.036			0.036			0.044		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	4.0			4.0			4.0			4.0			4.0		
Approx. Customer Payback (yrs)	1.4			1.4			1.4			1.4			1.4		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*4*	*0*	*2*	*5*	*0*	*5*	*9*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*5*	*0*	*5*	*8*	*0*	*9*	*12*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.3*	*0.0*	*0.5*	*1.1*	*0.0*	*0.2*	*0.6*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.5*	*0.0*	*0.9*	*2.0*	*0.0*	*0.4*	*0.8*

Total Savings, by Year	2006	2011	2016
Economic Savings	*57*	*231*	*411*
Most Likely	*0*	*10*	*20*
Upper	*0*	*13*	*18*

C2c-Condensing DHW

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	8%			4%			10%			2%			4%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	1.5	6.5	11.3	0.7	2.9	5.0	1.9	7.6	12.8	0.5	1.8	3.1	0.8	3.0	5.5
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	134	579	1,003	46	195	339	124	503	848	39	160	271	25	98	181
Annual Applicable Participants ('000s of m2)	67	89	85	23	30	29	62	76	69	20	24	22	13	15	16
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.008			0.012			0.008			0.006			0.027		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.7			2.1			2.1			2.1			2.1		
Approx. Customer Payback (yrs)	1.7			1.9			1.9			1.9			1.9		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

C2c-Condensing DHW

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	15%			8%			3%			3%			6%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	3.1	12.1	19.9	1.7	6.9	10.2	0.7	2.5	3.9	0.5	2.4	3.8	1.0	4.0	7.6
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	62	245	402	35	139	232	27	103	159	14	61	102	121	491	929
Annual Applicable Participants ('000s of m2)	31	36	31	18	21	19	14	15	11	7	10	8	61	74	87
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.052			0.049			0.025			0.040			0.008		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	4.3			4.3			4.3			3.9			2.4		
Approx. Customer Payback (yrs)	1.2			1.2			1.2			1.3			1.6		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*11*	*18*	*0*	*2*	*4*	*0*	*8*	*6*	*0*	*8*	*6*	*0*	*0*	*0*
Upper	*0*	*21*	*29*	*0*	*4*	*6*	*0*	*13*	*0*	*0*	*13*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*1.4*	*3.0*	*0.0*	*0.2*	*0.3*	*0.0*	*0.2*	*0.3*	*0.0*	*0.2*	*0.3*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*2.5*	*4.9*	*0.0*	*0.3*	*0.5*	*0.0*	*0.3*	*0.2*	*0.0*	*0.3*	*0.2*	*0.0*	*0.0*	*0.0*

C2c-Condensing DHW

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	4%			2%			17%			8%			6%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.7	3.0	5.7	0.4	1.8	3.4	3.4	13.3	23.2	1.5	6.3	10.5	1.2	4.8	8.7
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	73	300	581	79	319	606	37	145	253	125	520	868	25	102	186
Annual Applicable Participants ('000s of m2)	37	45	56	40	48	57	19	21	22	62	79	69	13	15	17
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.009			0.005			0.084			0.012			0.046		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			4.0			2.1			2.1			2.8		
Approx. Customer Payback (yrs)	1.7			1.2			1.9			1.9			1.7		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*63*	*25*	*0*	*2*	*4*	*0*	*0*	*0*	*0*	*5*	*8*
Upper	*0*	*0*	*0*	*0*	*50*	*0*	*0*	*6*	*6*	*0*	*0*	*0*	*0*	*8*	*13*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*1.1*	*1.5*	*0.0*	*0.3*	*0.7*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.6*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*0.9*	*0.8*	*0.0*	*0.8*	*1.4*	*0.0*	*0.0*	*0.0*	*0.0*	*0.4*	*0.9*

Total Savings, by Year	2006	2011	2016
Economic Savings	*20*	*79*	*135*
Most Likely	*0*	*4*	*6*
Upper	*0*	*5*	*9*

C3a-Condensing Boilers Space

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	21%			2%			6%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	28.9	101.0	173.2	2.2	7.6	13.0	7.7	27.2	46.7	0.6	2.2	3.9	0.3	1.2	2.1
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	307	1,076	1,844	98	345	591	269	942	1,614	88	307	526	46	162	277
Annual Applicable Participants ('000s of m2)	154	154	154	49	49	49	135	135	135	44	44	44	23	23	23
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.094			0.022			0.029			0.007			0.007		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.3			1.3			1.3			1.3			1.3		
Approx. Customer Payback (yrs)	4.2			4.2			4.2			4.2			4.2		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*20*	*30*	*0*	*10*	*15*	*0*	*10*	*20*	*0*	*5*	*10*	*0*	*5*	*10*
Upper	*0*	*40*	*75*	*0*	*20*	*38*	*0*	*20*	*40*	*0*	*10*	*20*	*0*	*10*	*20*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*20.2*	*52.0*	*0.0*	*0.8*	*1.9*	*0.0*	*2.7*	*9.3*	*0.0*	*0.1*	*0.4*	*0.0*	*0.1*	*0.2*
Upper	*0.0*	*40.4*	*129.9*	*0.0*	*1.5*	*4.9*	*0.0*	*5.4*	*18.7*	*0.0*	*0.2*	*0.8*	*0.0*	*0.1*	*0.4*

C3a-Condensing Boilers Space

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	5%			0%			8%			2%			16%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	6.4	22.5	38.7	0.6	2.0	3.4	11.2	39.4	67.5	2.2	7.8	13.4	22.7	79.9	137.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	65	228	392	38	132	226	36	127	218	18	64	109	250	874	1,498
Annual Applicable Participants ('000s of m2)	33	33	33	19	19	19	18	18	18	9	9	9	125	125	125
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.099			0.015			0.310			0.123			0.091		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.3			1.3			1.3			1.3			1.3		
Approx. Customer Payback (yrs)	4.2			4.2			4.2			4.2			4.2		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*2*	*5*	*0*	*1*	*3*	*0*	*40*	*60*	*0*	*40*	*60*	*0*	*10*	*25*
Upper	*0*	*10*	*25*	*0*	*5*	*13*	*0*	*50*	*75*	*0*	*50*	*75*	*0*	*20*	*50*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.5*	*1.9*	*0.0*	*0.0*	*0.1*	*0.0*	*15.7*	*40.5*	*0.0*	*3.1*	*8.0*	*0.0*	*8.0*	*34.3*
Upper	*0.0*	*2.3*	*9.7*	*0.0*	*0.1*	*0.4*	*0.0*	*19.7*	*50.6*	*0.0*	*3.9*	*10.0*	*0.0*	*16.0*	*68.5*

C3a-Condensing Boilers Space

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	15%			23%			0%			1%			1%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	20.9	73.0	125.2	32.8	115.1	197.3	0.4	1.4	2.5	2.0	7.1	12.2	1.1	4.0	6.9
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	169	591	1,014	176	617	1,058	65	227	389	183	640	1,098	42	147	252
Annual Applicable Participants ('000s of m2)	84	84	84	88	88	88	32	32	32	91	91	91	21	21	21
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.124			0.187			0.006			0.011			0.027		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.3			1.3			1.3			1.3			1.3		
Approx. Customer Payback (yrs)	4.2			4.2			4.2			4.2			4.2		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*3*	*8*	*0*	*40*	*60*	*0*	*5*	*10*	*0*	*2*	*5*	*0*	*5*	*10*
Upper	*0*	*7*	*17*	*0*	*50*	*75*	*0*	*10*	*20*	*0*	*5*	*10*	*0*	*10*	*20*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*2.4*	*10.4*	*0.0*	*46.0*	*118.4*	*0.0*	*0.1*	*0.2*	*0.0*	*0.1*	*0.6*	*0.0*	*0.2*	*0.7*
Upper	*0.0*	*4.9*	*20.9*	*0.0*	*57.5*	*148.0*	*0.0*	*0.1*	*0.5*	*0.0*	*0.4*	*1.2*	*0.0*	*0.4*	*1.4*

	2006	2011	2016
Total Savings, by Year			
Economic Savings	*140*	*492*	*843*

C3b-Near Cond. Boilers Space

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	21%			2%			6%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	18.3	64.2	110.1	1.4	4.8	8.2	4.9	17.3	29.7	0.4	1.4	2.5	0.2	0.8	1.3
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	307	1,076	1,844	98	345	591	269	942	1,614	88	307	526	46	162	277
Annual Applicable Participants ('000s of m2)	154	154	154	49	49	49	135	135	135	44	44	44	23	23	23
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.060			0.014			0.018			0.005			0.005		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	5.0			5.0			5.0			5.0			5.0		
Approx. Customer Payback (yrs)	1.1			1.1			1.1			1.1			1.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*70*	*60*	*0*	*70*	*65*	*0*	*80*	*70*	*0*	*75*	*70*	*0*	*75*	*70*
Upper	*0*	*50*	*15*	*0*	*60*	*43*	*0*	*70*	*50*	*0*	*70*	*60*	*0*	*70*	*60*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*45.0*	*66.1*	*0.0*	*3.4*	*5.4*	*0.0*	*13.8*	*20.8*	*0.0*	*1.1*	*1.7*	*0.0*	*0.6*	*0.9*
Upper	*0.0*	*32.1*	*16.5*	*0.0*	*2.9*	*3.5*	*0.0*	*12.1*	*14.8*	*0.0*	*1.0*	*1.5*	*0.0*	*0.5*	*0.8*

C3b-Near Cond. Boilers Space

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	5%			0%			8%			2%			16%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	4.1	14.3	24.6	0.4	1.3	2.1	7.1	25.0	42.9	1.4	5.0	8.5	14.5	50.8	87.1
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	65	228	392	38	132	226	36	127	218	18	64	109	250	874	1,498
Annual Applicable Participants ('000s of m2)	33	33	33	19	19	19	18	18	18	9	9	9	125	125	125
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.063			0.009			0.197			0.078			0.058		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	5.0			5.0			5.0			5.0			5.0		
Approx. Customer Payback (yrs)	1.1			1.1			1.1			1.1			1.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*88*	*85*	*0*	*79*	*78*	*0*	*50*	*30*	*0*	*50*	*30*	*0*	*80*	*65*
Upper	*0*	*80*	*65*	*0*	*75*	*68*	*0*	*40*	*15*	*0*	*40*	*15*	*0*	*70*	*40*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*12.6*	*20.9*	*0.0*	*1.0*	*1.7*	*0.0*	*12.5*	*12.9*	*0.0*	*2.5*	*2.6*	*0.0*	*40.6*	*56.6*
Upper	*0.0*	*11.5*	*16.0*	*0.0*	*0.9*	*1.5*	*0.0*	*10.0*	*6.4*	*0.0*	*2.0*	*1.3*	*0.0*	*35.6*	*34.8*

C3b-Near Cond. Boilers Space

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	15%			23%			0%			1%			1%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	13.3	46.4	79.6	20.9	73.1	125.4	0.3	0.9	1.6	1.3	4.5	7.8	0.7	2.5	4.4
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	169	591	1,014	176	617	1,058	65	227	389	183	640	1,098	42	147	252
Annual Applicable Participants ('000s of m2)	84	84	84	88	88	88	32	32	32	91	91	91	21	21	21
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.079			0.119			0.004			0.007			0.017		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	5.0			5.0			5.0			5.0			5.0		
Approx. Customer Payback (yrs)	1.1			1.1			1.1			1.1			1.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*77*	*72*	*0*	*50*	*30*	*0*	*75*	*70*	*0*	*78*	*75*	*0*	*75*	*70*
Upper	*0*	*73*	*63*	*0*	*40*	*15*	*0*	*70*	*60*	*0*	*75*	*70*	*0*	*70*	*60*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*35.6*	*57.0*	*0.0*	*36.6*	*37.6*	*0.0*	*0.7*	*1.1*	*0.0*	*3.5*	*5.8*	*0.0*	*1.9*	*3.1*
Upper	*0.0*	*34.0*	*50.4*	*0.0*	*29.3*	*18.8*	*0.0*	*0.6*	*0.9*	*0.0*	*3.4*	*5.4*	*0.0*	*1.8*	*2.6*

Total Savings, by Year	2006	2011	2016
Economic Savings	*89*	*312*	*536*
Most Likely	*0*	*211*	*294*
Upper	*0*	*178*	*175*

C3c-Cond. DHW Boilers & Heaters

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	10%			11%			0%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	1.7	6.0	10.3	1.9	6.7	11.4	1.0	1.2	0.0	0.7	0.8	0.0	0.7	0.9	0.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	581	2,034	3,488	197	691	1,184	367	1,285	2,204	117	410	703	103	361	620
Annual Applicable Participants (‘000s of m2)	291	291	291	99	99	99	184	184	184	59	59	59	52	52	52
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.0029			0.0096			0.0000			0.0000			0.0000		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	Boilers	4.5		Boilers	4.5		Boilers	4.5		Boilers	4.5		Boilers	4.5	
	Heaters	2.1		Heaters	2.1		Heaters	2.1		Heaters	2.1		Heaters	2.1	
Approx. Customer Payback (yrs)	Boilers	1.2		Boilers	1.2		Boilers	1.2		Boilers	1.2		Boilers	1.2	
	Heaters	1.9		Heaters	1.9		Heaters	1.9		Heaters	1.9		Heaters	1.9	
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*2*	*3*	*0*	*0*	*0*	*0*	*10*	*20*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*4*	*8*	*0*	*0*	*0*	*0*	*20*	*40*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.1*	*0.3*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*0.2*	*0.8*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

C3c-Cond. DHW Boilers & Heaters

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	7%			15%			8%			0%			7%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	1.6	4.6	7.0	2.5	8.6	14.7	1.1	4.6	8.3	0.2	0.4	0.5	1.1	4.0	6.9
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	171	599	1,027	93	326	558	91	318	545	47	164	281	626	2,192	3,758
Annual Applicable Participants (‘000s of m2)	86	86	86	47	47	47	45	45	45	23	23	23	313	313	313
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.0068			0.0264			0.0153			0.0016			0.0018		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	Boilers	4.5		Boilers	4.5		Boilers	4.5		Boilers	4.5		Boilers	4.5	
	Heaters	2.1		Heaters	2.1		Heaters	2.1		Heaters	2.1		Heaters	2.1	
Approx. Customer Payback (yrs)	Boilers	1.2		Boilers	1.2		Boilers	1.2		Boilers	1.2		Boilers	1.2	
	Heaters	1.9		Heaters	1.9		Heaters	1.9		Heaters	1.9		Heaters	1.9	
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*4*	*10*	*0*	*1*	*3*	*0*	*40*	*60*	*0*	*40*	*60*	*0*	*10*	*25*
Upper	*0*	*20*	*50*	*0*	*5*	*13*	*0*	*50*	*75*	*0*	*50*	*75*	*0*	*20*	*50*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.2*	*0.7*	*0.0*	*0.1*	*0.4*	*0.0*	*1.8*	*5.0*	*0.0*	*0.2*	*0.3*	*0.0*	*0.4*	*1.7*
Upper	*0.0*	*0.9*	*3.5*	*0.0*	*0.4*	*1.8*	*0.0*	*2.3*	*6.3*	*0.0*	*0.2*	*0.3*	*0.0*	*0.8*	*3.4*

C3c-Cond. DHW Boilers & Heaters

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	15%			0%			15%			0%			11%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	2.6	9.0	15.5	0.9	1.1	0.0	3.4	10.1	15.6	1.4	1.7	0.0	1.8	6.4	10.9
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	407	1,424	2,441	412	1,441	2,470	148	519	890	436	1,525	2,614	105	367	629
Annual Applicable Participants ('000s of m2)	203	203	203	206	206	206	74	74	74	218	218	218	52	52	52
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.0063			0.0000			0.0175			0.0000			0.0173		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	Boilers	4.5		Boilers	4.5		Boilers	4.5		Boilers	4.5		Boilers	4.5	
	Heaters	2.1		Heaters	2.1		Heaters	2.1		Heaters	2.1		Heaters	2.1	
Approx. Customer Payback (yrs)	Boilers	1.2		Boilers	1.2		Boilers	1.2		Boilers	1.2		Boilers	1.2	
	Heaters	1.9		Heaters	1.9		Heaters	1.9		Heaters	1.9		Heaters	1.9	
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*3*	*8*	*0*	*40*	*60*	*0*	*5*	*10*	*0*	*2*	*5*	*0*	*5*	*10*
Upper	*0*	*7*	*17*	*0*	*50*	*75*	*0*	*10*	*20*	*0*	*5*	*10*	*0*	*10*	*20*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.3*	*1.3*	*0.0*	*0.4*	*0.0*	*0.0*	*0.5*	*1.6*	*0.0*	*0.0*	*0.0*	*0.0*	*0.3*	*1.1*
Upper	*0.0*	*0.6*	*2.6*	*0.0*	*0.6*	*0.0*	*0.0*	*1.0*	*3.1*	*0.0*	*0.1*	*0.0*	*0.0*	*0.6*	*2.2*

Total Savings, by Year	2006	2011	2016
Economic Savings	*23*	*66*	*101*
Most Likely	*0*	*4*	*12*

C4-BAS Upgrade

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	24%			0%			12%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	112.2	112.2	112.2	0.0	0.0	0.0	58.0	58.0	58.0	0.0	0.0	0.0	0.0	0.0	0.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	768	2,689	4,610	246	861	1,477	673	2,354	4,035	219	767	1,315	116	404	693
Annual Applicable Participants ('000s of m2)	384	384	384	123	123	123	336	336	336	110	110	110	58	58	58
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.024			0.000			0.014			0.000			0.000		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	6.1			6.1			6.1			6.1			6.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*30*	*30*	*0*	*0*	*0*	*0*	*15*	*15*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*50*	*50*	*0*	*0*	*0*	*0*	*25*	*25*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*16.8*	*33.6*	*0.0*	*0.0*	*0.0*	*0.0*	*4.3*	*8.7*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*28.0*	*56.1*	*0.0*	*0.0*	*0.0*	*0.0*	*7.2*	*14.5*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

C4-BAS Upgrade

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	8%			0%			9%			4%			18%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	39.9	39.9	39.9	0.0	0.0	0.0	44.2	44.2	44.2	17.9	17.9	17.9	83.5	83.5	83.5
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	163	571	979	94	330	566	91	318	545	46	159	273	624	2,185	3,746
Annual Applicable Participants ('000s of m2)	82	82	82	47	47	47	45	45	45	23	23	23	312	312	312
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.041			0.000			0.081			0.065			0.022		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	6.1			6.1			6.1			6.1			6.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*10*	*10*	*0*	*0*	*0*	*0*	*10*	*10*	*0*	*10*	*10*	*0*	*15*	*15*
Upper	*0*	*15*	*15*	*0*	*0*	*0*	*0*	*15*	*15*	*0*	*15*	*15*	*0*	*25*	*25*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*2.0*	*4.0*	*0.0*	*0.0*	*0.0*	*0.0*	*2.2*	*4.4*	*0.0*	*0.9*	*1.8*	*0.0*	*6.3*	*12.5*
Upper	*0.0*	*3.0*	*6.0*	*0.0*	*0.0*	*0.0*	*0.0*	*3.3*	*6.6*	*0.0*	*1.3*	*2.7*	*0.0*	*10.4*	*20.9*

C4-BAS Upgrade

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	0%			24%			0%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.0	0.0	0.0	115.3	115.3	115.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	422	1,478	2,534	441	1,542	2,644	162	567	972	457	1,601	2,744	105	367	629
Annual Applicable Participants ('000s of m2)	211	211	211	220	220	220	81	81	81	229	229	229	52	52	52
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.000			0.044			0.000			0.000			0.000		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	6.1			6.1			6.1			6.1			6.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*15*	*15*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*25*	*25*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*8.6*	*17.3*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*14.4*	*28.8*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Total Savings, by Year	2006	2011	2016
Economic Savings	*471*	*471*	*471*

C5-Recommissioning

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	15%			5%			8%			3%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	112.1	112.1	112.1	38.7	38.7	38.7	60.8	60.8	60.8	23.0	23.0	23.0	12.3	12.3	12.3
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	768	2,689	4,610	246	861	1,477	673	2,354	4,035	219	767	1,315	116	404	693
Annual Applicable Participants ('000s of m2)	384	384	384	123	123	123	336	336	336	110	110	110	58	58	58
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.024			0.026			0.015			0.017			0.018		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	6.1			6.1			6.1			6.1			6.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*30*	*30*	*0*	*10*	*10*	*0*	*15*	*15*	*0*	*5*	*5*	*0*	*5*	*5*
Upper	*0*	*50*	*50*	*0*	*17*	*17*	*0*	*25*	*25*	*0*	*8*	*8*	*0*	*8*	*8*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*16.8*	*33.6*	*0.0*	*1.9*	*3.9*	*0.0*	*4.6*	*9.1*	*0.0*	*0.6*	*1.2*	*0.0*	*0.3*	*0.6*
Upper	*0.0*	*28.0*	*56.0*	*0.0*	*3.2*	*6.4*	*0.0*	*7.6*	*15.2*	*0.0*	*1.0*	*1.9*	*0.0*	*0.5*	*1.0*

C5-Recommissioning

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	3%			1%			6%			2%			12%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	24.8	24.8	24.8	10.1	10.1	10.1	44.5	44.5	44.5	17.4	17.4	17.4	89.9	89.9	89.9
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	163	571	979	94	330	566	91	318	545	46	159	273	624	2,185	3,746
Annual Applicable Participants ('000s of m2)	82	82	82	47	47	47	45	45	45	23	23	23	312	312	312
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.025			0.018			0.082			0.064			0.024		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	6.1			6.1			6.1			6.1			6.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*30*	*30*	*0*	*10*	*10*	*0*	*10*	*10*	*0*	*3*	*3*	*0*	*15*	*15*
Upper	*0*	*50*	*50*	*0*	*15*	*15*	*0*	*15*	*15*	*0*	*5*	*5*	*0*	*25*	*25*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*3.7*	*7.4*	*0.0*	*0.5*	*1.0*	*0.0*	*2.2*	*4.5*	*0.0*	*0.3*	*0.6*	*0.0*	*6.7*	*13.5*
Upper	*0.0*	*6.2*	*12.4*	*0.0*	*0.8*	*1.5*	*0.0*	*3.3*	*6.7*	*0.0*	*0.4*	*0.9*	*0.0*	*11.2*	*22.5*

C5-Recommissioning

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	10%			17%			2%			10%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	74.7	74.7	74.7	127.6	127.6	127.6	14.7	14.7	14.7	73.8	73.8	73.8	12.9	12.9	12.9
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	422	1,478	2,534	441	1,542	2,644	162	567	972	457	1,601	2,744	105	367	629
Annual Applicable Participants ('000s of m2)	211	211	211	220	220	220	81	81	81	229	229	229	52	52	52
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.029			0.048			0.015			0.027			0.020		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.2			1.2			1.2			1.2			1.2		
Approx. Customer Payback (yrs)	6.1			6.1			6.1			6.1			6.1		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*5*	*5*	*0*	*15*	*15*	*0*	*5*	*5*	*0*	*2*	*2*	*0*	*2*	*2*
Upper	*0*	*8*	*8*	*0*	*25*	*25*	*0*	*8*	*8*	*0*	*3*	*3*	*0*	*3*	*3*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*1.9*	*3.7*	*0.0*	*9.6*	*19.1*	*0.0*	*0.4*	*0.7*	*0.0*	*0.6*	*1.2*	*0.0*	*0.1*	*0.2*
Upper	*0.0*	*3.1*	*6.2*	*0.0*	*15.9*	*31.9*	*0.0*	*0.6*	*1.2*	*0.0*	*1.0*	*2.0*	*0.0*	*0.2*	*0.4*

Total Savings, by Year	2006	2011	2016
Economic Savings	*737*	*737*	*737*
Most Likely	*0*	*50*	*100*
Upper	*0*	*83*	*166*

C6-EE Food Prep-Exist

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	2%			1%			11%			1%			6%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.6	2.2	3.7	0.2	0.7	1.3	4.3	15.0	25.7	0.4	1.2	2.1	2.4	8.5	14.6
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s of m2)	687	2,405	4,124	234	819	1,404	591	2,069	3,547	195	681	1,167	107	375	643
Annual Applicable Participants (‘000s of m2)	344	344	344	117	117	117	296	296	296	97	97	97	54	54	54
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%	
	Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%	
Approx Annual Svgs per Participant GJ/yr	0.001			0.001			0.007			0.002			0.023		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.4			2.4			2.4			2.4			2.4		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*8*	*35*	*0*	*0*	*0*	*0*	*8*	*35*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*12*	*50*	*0*	*0*	*0*	*0*	*12*	*50*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*1.2*	*9.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.7*	*5.1*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*1.8*	*12.9*	*0.0*	*0.0*	*0.0*	*0.0*	*1.0*	*7.3*

C6-EE Food Prep-Exist

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	11%			5%			4%			3%			1%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	4.2	14.7	25.2	1.8	6.4	10.9	1.7	5.8	10.0	1.1	3.8	6.5	0.5	1.8	3.2
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	165	579	992	100	351	601	77	268	459	43	150	257	580	2,031	3,482
Annual Applicable Participants ('000s of m2)	83	83	83	50	50	50	38	38	38	21	21	21	290	290	290
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%	
	Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%	
Approx Annual Svgs per Participant GJ/yr	0.025			0.018			0.022			0.025			0.001		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.4			2.4			2.4			2.4			2.4		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*8*	*35*	*0*	*8*	*26*	*0*	*14*	*45*	*0*	*14*	*45*	*0*	*0*	*0*
Upper	*0*	*12*	*50*	*0*	*12*	*40*	*0*	*21*	*70*	*0*	*21*	*70*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*1.2*	*8.8*	*0.0*	*0.5*	*2.8*	*0.0*	*0.8*	*4.5*	*0.0*	*0.5*	*2.9*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*1.8*	*12.6*	*0.0*	*0.8*	*4.4*	*0.0*	*1.2*	*7.0*	*0.0*	*0.8*	*4.6*	*0.0*	*0.0*	*0.0*

C6-EE Food Prep-Exist

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	1%			4%			51%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.3	1.2	2.1	1.4	4.8	8.3	20.0	70.1	120.2	0.0	0.0	0.0	0.0	0.0	0.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	378	1,322	2,266	380	1,329	2,278	138	483	829	382	1,336	2,291	97	339	582
Annual Applicable Participants ('000s of m2)	189	189	189	190	190	190	69	69	69	191	191	191	48	48	48
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%	
	Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%	
Approx Annual Svgs per Participant GJ/yr	0.001			0.004			0.145			0.000			0.000		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.4			2.4			2.4			2.4			2.4		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*14*	*45*	*0*	*4*	*25*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*21*	*70*	*0*	*6*	*35*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*0.7*	*3.7*	*0.0*	*2.8*	*30.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*1.0*	*5.8*	*0.0*	*4.2*	*42.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Total Savings, by Year	2006	2011	2016
Economic Savings	*39*	*136*	*234*
Most Likely	*0*	*8*	*67*
Upper	*0*	*13*	*97*

C6-EE Food Prep-New

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	1%			1%			14%			1%			6%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.172	0.745	1.290	0.688	0.251	0.437	1.736	7.071	11.918	0.143	0.580	0.978	0.718	2.773	5.092
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	158	685	1,186	54	231	401	200	813	1,370	66	266	450	26	102	187
Annual Applicable Participants ('000s of m2)	79	105	100	27	35	34	100	123	111	33	40	37	13	15	17
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%	
	Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%	
Approx Annual Svgs per Participant GJ/yr	1			1			9			2			27		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.4			2.4			2.4			2.4			2.4		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2006	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*8*	*35*	*0*	*0*	*0*	*0*	*8*	*35*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*12*	*50*	*0*	*0*	*0*	*0*	*12*	*50*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2006	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*3*	*0*	*0*	*0*	*0*	*0*	*1*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*4*	*0*	*0*	*0*	*0*	*0*	*2*

C6-EE Food Prep-New

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	13%			5%			4%			3%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	1.796	12.353	11.640	0.713	2.824	4.768	0.599	2.269	3.496	0.363	1.648	2.746	0.122	0.493	0.375
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	59	231	382	33	130	219	23	87	134	12	54	90	112	453	858
Annual Applicable Participants ('000s of m2)	29	35	30	16	19	18	11	13	9	6	8	7	56	68	81
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%	
	Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%	
Approx Annual Svgs per Participant GJ/yr	22			22			26			30			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.4			2.4			2.4			2.4			2.4		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2011	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*8*	*35*	*0*	*8*	*26*	*0*	*14*	*45*	*0*	*14*	*45*	*0*	*0*	*0*
Upper	*0*	*12*	*50*	*0*	*12*	*40*	*0*	*21*	*70*	*0*	*21*	*70*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2011	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*0*
Upper	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*2*	*0*	*0*	*1*	*0*	*0*	*0*

C6-EE Food Prep-New

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	1%			3%			47%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.073	0.302	0.585	0.318	1.281	2.432	6.028	23.391	40.934	0.000	0.000	0.000	0.000	0.000	0.000
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	67	277	538	73	294	559	35	134	235	109	456	760	23	95	172
Annual Applicable Participants ('000s of m2)	34	42	52	37	44	53	17	20	20	55	69	61	12	14	15
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%		Ranges	64%	
	Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%		Fryers	36%	
Approx Annual Svgs per Participant GJ/yr	1			4			174			0			0		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	2.4			2.4			2.4			2.4			2.4		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2016	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2006	2016
Most Likely	*0*	*0*	*0*	*0*	*14*	*45*	*0*	*4*	*25*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*21*	*70*	*0*	*6*	*35*	*0*	*0*	*0*	*0*	*0*	*0*
Action Savings, by Milestone Year (1000 GJ/yr)	2016	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2006	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*1*	*6*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*1*	*8*	*0*	*0*	*0*	*0*	*0*	*0*

Total Savings, by Year	2006	2011	2016
Economic Savings	*13*	*56*	*87*
Most Likely	*0*	*4*	*13*
Upper	*0*	*5*	*19*

C7-Pre-Rinse Spray Valve--Exist

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	0%			0%			1%			0%			2%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.2	0.2	0.2	0.1	0.1	0.1	1.2	1.2	1.2	0.1	0.1	0.1	2.1	2.1	2.1
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	581	2,034	3,488	197	691	1,184	367	1,285	2,204	117	410	703	103	361	620
Annual Applicable Participants ('000s of m2)	291	291	291	99	99	99	184	184	184	59	59	59	52	52	52
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.000			0.000			0.001			0.000			0.003		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	10.0			10.0			10.0			10.0			10.0		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*
Upper	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.3*	*0.6*	*0.0*	*0.0*	*0.0*	*0.0*	*0.5*	*1.1*
Upper	*0.0*	*0.1*	*0.2*	*0.0*	*0.0*	*0.1*	*0.0*	*0.5*	*1.1*	*0.0*	*0.0*	*0.1*	*0.0*	*1.0*	*1.9*

C7-Pre-Rinse Spray Valve--Exist

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	16%			6%			4%			3%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	14.7	14.7	14.7	5.7	5.7	5.7	3.9	3.9	3.9	2.3	2.3	2.3	0.2	0.2	0.2
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	171	599	1,027	93	326	558	91	318	545	47	164	281	626	2,192	3,758
Annual Applicable Participants ('000s of m2)	86	86	86	47	47	47	45	45	45	23	23	23	313	313	313
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.014			0.010			0.007			0.008			0.000		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	10.0			10.0			10.0			10.0			10.0		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*
Upper	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*3.7*	*7.3*	*0.0*	*1.4*	*2.8*	*0.0*	*1.0*	*1.9*	*0.0*	*0.6*	*1.1*	*0.0*	*0.0*	*0.1*
Upper	*0.0*	*6.6*	*13.2*	*0.0*	*2.6*	*5.1*	*0.0*	*1.7*	*3.5*	*0.0*	*1.0*	*2.1*	*0.0*	*0.1*	*0.1*

C7-Pre-Rinse Spray Valve--Exist

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	0%			1%			66%			0%			0%		
Economic Savings Potential in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.1	0.1	0.1	0.6	0.6	0.6	59.9	59.9	59.9	0.0	0.0	0.0	0.0	0.0	0.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s of m2)	407	1,424	2,441	412	1,441	2,470	148	519	890	436	1,525	2,614	105	367	629
Annual Applicable Participants ('000s of m2)	203	203	203	206	206	206	74	74	74	218	218	218	52	52	52
Major Technologies & % Contribution to Economic Savings	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Svgs per Participant GJ/yr	0.000			0.000			0.067			0.000			0.000		
Savings Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	10.0			10.0			10.0			10.0			10.0		
Approx. Customer Payback (yrs)	0.3			0.3			0.3			0.3			0.3		
Participation Rate (% of Buildings in Period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*25*	*50*	*0*	*0*	*0*	*0*	*25*	*50*
Upper	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*45*	*90*	*0*	*0*	*0*	*0*	*45*	*90*
Action Savings, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.1*	*0.0*	*0.1*	*0.3*	*0.0*	*15.0*	*30.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*0.1*	*0.1*	*0.0*	*0.3*	*0.5*	*0.0*	*27.0*	*53.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Number of Annual Participant Buildings		
#REF!	#REF!	#REF!

Total Savings, by Year	2006	2011	2016
Economic Savings	*91*	*91*	*91*
Most Likely	*0*	*23*	*45*
Upper	*0*	*41*	*82*

CFC1-Space Heating Exist

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	16%			10%			6%			3%			3%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	6.0	20.9	35.6	3.7	12.7	21.6	2.3	8.0	13.6	1.0	3.6	6.1	1.0	3.4	5.7
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	307	1,076	1,844	98	345	591	269	942	1,614	88	307	526	46	162	277
Annual Applicable Participants ('000s of m2)	154	154	154	49	49	49	135	135	135	44	44	44	23	23	23
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.019			0.037			0.008			0.012			0.021		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.08			1.08			1.08			1.08			1.08		
Approx. Customer Payback (yrs)	-208.36			-208.36			-208.36			-208.36			-208.36		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC1-Space Heating Exist

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital		
Approx % of Action Savings	10%			6%			2%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016
	3.8	13.2	22.2	2.1	7.3	12.3	0.6	2.0	3.5
Participant Definition	m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	65	228	392	38	132	226	36	127	218
Annual Applicable Participants ('000s of m2)	33	33	33	19	19	19	18	18	18
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.057			0.055			0.016		
Increase Adjustment Factor (if applicable)	okay			okay			okay		
Approx. B/C Ratio	1.08			1.08			1.08		
Approx. Customer Payback (yrs)	-208.36			-208.36			-208.36		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Sub Sector	Nursing Homes			Large School		
Approx % of Action Savings	4%			18%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016
	1.5	5.3	9.0	6.8	23.8	40.5
Participant Definition	m2			m2		
Total Applicable Participants in Period ('000s m2)	18	64	109	250	874	1,498
Annual Applicable Participants ('000s of m2)	9	9	9	125	125	125
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.082			0.027		
Increase Adjustment Factor (if applicable)	okay			okay		
Approx. B/C Ratio	1.08			1.08		
Approx. Customer Payback (yrs)	-208.36			-208.36		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016
Most Likely	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Upper	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

CFC1-Space Heating Exist

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	11%			9%			1%			1%			2%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	4.2	14.7	25.0	3.3	11.4	19.4	0.4	1.4	2.5	0.2	0.8	1.4	0.9	3.1	5.4
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	169	591	1,014	176	617	1,058	65	227	389	183	640	1,098	42	147	252
Annual Applicable Participants ('000s of m2)	84	84	84	88	88	88	32	32	32	91	91	91	21	21	21
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.025			0.018			0.006			0.001			0.021		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.08			1.08			1.08			1.08			1.08		
Approx. Customer Payback (yrs)	-208.36			-208.36			-208.36			-208.36			-208.36		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

Number of Annual Participant Buildings		
#REF!	#REF!	#REF!

Total Savings, by Year	2006	2011	2016
Economic Savings	*38*	*132*	*224*
Most Likely	*0*	*0*	*0*
Upper	*0*	*0*	*0*

CFC1-Space Heating New

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	10%			7%			7%			3%			4%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	2.6	10.5	18.6	1.8	7.1	12.5	1.8	7.4	12.4	0.7	2.8	4.8	1.1	4.2	7.7
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	177	769	1,329	57	244	423	227	924	1,558	74	301	507	29	110	202
Annual Applicable Participants ('000s of m2)	88	118	112	29	37	36	114	139	127	37	45	41	14	16	18
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
				0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.014			0.030			0.008			0.009			0.038		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.17			1.17			1.17			1.17			1.17		
Approx. Customer Payback (yrs)	-207.06			-207.06			-207.06			-207.06			-207.06		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC1-Space Heating New

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	12%			5%			1%			4%			25%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	3.4	12.9	21.7	1.3	5.1	8.9	0.3	1.2	1.8	0.9	4.2	6.9	5.7	23.0	44.1
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s m2)	59	233	382	31	124	209	27	103	159	13	57	95	121	491	927
Annual Applicable Participants (‘000s of m2)	30	35	30	16	19	17	14	15	11	6	9	8	61	74	87
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
	0	0%		0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.057			0.043			0.011			0.073			0.048		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.17			1.17			1.17			1.17			1.17		
Approx. Customer Payback (yrs)	-207.06			-207.06			-207.06			-207.06			-207.06		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC1-Space Heating New

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	13%			4%			1%			1%			3%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	2.7	11.3	23.1	0.8	3.3	6.9	0.2	0.7	1.2	0.2	0.6	1.0	0.7	2.9	5.3
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s m2)	76	314	606	85	343	650	41	158	277	131	546	911	25	102	186
Annual Applicable Participants (‘000s of m2)	38	48	58	43	52	61	20	23	24	66	83	73	13	15	17
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
	0	0%		0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.038			0.011			0.004			0.001			0.028		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.17			1.17			1.17			1.17			1.17		
Approx. Customer Payback (yrs)	-207.06			-207.06			-207.06			-207.06			-207.06		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

Number of Annual Participant Buildings		
#REF!	#REF!	#REF!

Total Savings, by Year	2006	2011	2016
Economic Savings	*24*	*97*	*177*
Most Likely	*0*	*0*	*0*
Upper	*0*	*0*	*0*

CFC2-SHW Exist

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	13%			5%			24%			6%			4%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	3.3	11.6	19.6	1.2	4.2	7.1	5.4	20.1	35.6	1.4	5.2	9.3	0.8	3.0	5.4
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	581	2,034	3,488	197	691	1,184	367	1,285	2,204	117	410	703	103	361	620
Annual Applicable Participants ('000s of m2)	291	291	291	99	99	99	184	184	184	59	59	59	52	52	52
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
				0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.006			0.006			0.016			0.013			0.009		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			1.9			1.9			1.9			1.5		
Approx. Customer Payback (yrs)	-0.7			-0.7			-0.7			-0.7			17.5		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC2-SHW Exist

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	14%			14%			0%			1%			3%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	3.5	12.3	21.1	3.4	11.9	20.3	0.1	0.3	0.6	0.3	1.2	2.1	0.7	2.4	4.0
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s m2)	171	599	1,027	93	326	558	91	318	545	47	164	281	626	2,192	3,758
Annual Applicable Participants (‘000s of m2)	86	86	86	47	47	47	45	45	45	23	23	23	313	313	313
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*
	N/A		100%	N/A		100%	N/A		100%	N/A		100%	N/A		100%
	0		0%	0		0%	0		0%	0		0%	0		0%
Approx Annual Gas Use Incr. per Participant GJ/yr	0.021			0.036			0.001			0.008			0.001		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			1.9			1.9			1.9			1.9		
Approx. Customer Payback (yrs)	-0.7			-0.7			-0.7			-0.7			-0.7		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC2-SHW Exist

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	2%			3%			7%			1%			2%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.5	1.7	2.8	0.6	2.2	4.0	1.5	5.5	9.6	0.3	1.1	2.0	0.6	2.1	3.5
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	407	1,424	2,441	412	1,441	2,470	148	519	890	436	1,525	2,614	105	367	629
Annual Applicable Participants ('000s of m2)	203	203	203	206	206	206	74	74	74	218	218	218	52	52	52
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
	0	0%		0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.001			0.002			0.011			0.001			0.006		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			1.9			1.9			1.9			1.9		
Approx. Customer Payback (yrs)	-0.7			-0.7			-0.7			-0.7			-0.7		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

Number of Annual Participant Buildings		
#REF!	#REF!	#REF!

Total Savings, by Year	2006	2011	2016
Economic Savings	*24*	*85*	*147*
Most Likely	*0*	*0*	*0*
Upper	*0*	*0*	*0*

CFC2-SHW New

Sub Sector	Large Office			Medium Office			Large Non-Food Retail			Medium Non-Food Retail			Food Retail		
Approx % of Action Savings	12%			4%			23%			6%			3%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	1.1	6.3	11.3	0.3	2.2	4.0	2.4	13.0	22.5	0.8	3.7	6.3	0.2	1.4	2.7
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	177	769	1,329	57	244	423	227	924	1,558	74	301	507	29	110	202
Annual Applicable Participants ('000s of m2)	88	118	112	29	37	36	114	139	127	37	45	41	14	16	18
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
				0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.009			0.009			0.014			0.013			0.013		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			1.9			1.9			1.9			1.2		
Approx. Customer Payback (yrs)	-0.7			-0.7			-0.7			-0.7			37.7		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC2-SHW New

Sub Sector	Large Hotel			Medium Hotel/Motel			Hospital			Nursing Homes			Large School		
Approx % of Action Savings	16%			19%			0%			2%			2%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	2.0	8.8	15.5	1.0	4.7	19.0	0.1	0.2	0.4	0.1	0.6	1.9	0.2	1.1	2.3
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period ('000s m2)	59	233	382	31	124	209	27	103	159	13	57	95	121	491	927
Annual Applicable Participants ('000s of m2)	30	35	30	16	19	17	14	15	11	6	9	8	61	74	87
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*		*Technology*	*% of Eco*	
	N/A	100%		N/A	100%		N/A	100%		N/A	100%		N/A	100%	
	0	0%		0	0%		0	0%		0	0%		0	0%	
Approx Annual Gas Use Incr. per Participant GJ/yr	0.040			0.091			0.002			0.020			0.002		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			1.9			1.9			1.9			1.9		
Approx. Customer Payback (yrs)	-0.7			-0.7			-0.7			-0.7			-0.7		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

CFC2-SHW New

Sub Sector	Medium School			University/College			Restaurant/Tavern			Warehouse/Whsale			Mixed Use		
Approx % of Action Savings	2%			2%			5%			1%			3%		
Potential Natural Gas Increase in Period (thousand GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
	0.1	0.7	1.5	0.2	0.9	1.7	0.4	2.8	5.2	0.1	0.6	1.0	0.4	1.8	3.2
Participant Definition	m2			m2			m2			m2			m2		
Total Applicable Participants in Period (‘000s m2)	76	314	606	85	343	650	41	158	277	131	546	911	25	102	186
Annual Applicable Participants (‘000s of m2)	38	48	58	43	52	61	20	23	24	66	83	73	13	15	17
Major Technologies & % Contribution to Increased Natural Gas Use	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*	*Technology*		*% of Eco*
	N/A		100%	N/A		100%	N/A		100%	N/A		100%	N/A		100%
	0		0%	0		0%	0		0%	0		0%	0		0%
Approx Annual Gas Use Incr. per Participant GJ/yr	0.002			0.003			0.019			0.001			0.017		
Increase Adjustment Factor (if applicable)	okay			okay			okay			okay			okay		
Approx. B/C Ratio	1.9			1.9			1.9			1.9			1.9		
Approx. Customer Payback (yrs)	-0.7			-0.7			-0.7			-0.7			-0.7		
Participation Rate (% of buildings in period)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Upper	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Action Impacts, by Milestone Year (1000 GJ/yr)	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016	2006	2011	2016
Most Likely	*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*
Upper	*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*

Number of Annual Participant Buildings		
#REF!	#REF!	#REF!

Total Savings, by Year	2006	2011	2016
Economic Savings	*9*	*49*	*99*
Most Likely	*0*	*0*	*0*
Upper	*0*	*0*	*0*

TERASEN GAS
CONSERVATION POTENTIAL REVIEW

Manufacturing Sector Report

–Final Report–

Submitted to:
Terasen Gas

Prepared by:
Marbek Resource Consultants
and
Willis Energy Services Ltd.

April 2006

Marbek Resource Consultants
300-222 Somerset Street West
Ottawa, Ontario K2P 2G3
Tel: 613.523.0784 ⬩ Fax: 613.523.0717 ⬩ www.marbek.ca

EXECUTIVE SUMMARY

❑ Background and Objectives

This Conservation Potential Review (CPR) provides Terasen Gas with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long range energy efficiency and fuel choice strategy
- Design and implement energy efficiency and fuel choice programs
- Assess the impact of energy efficiency and fuel choice programs on both peak and annual loads
- Set annual energy efficiency and fuel choice targets and budgets.

❑ Scope

The scope of this study was designed to coincide as much as possible with the structure and approach of the BC Hydro CPR, which was completed in 2003. The intent was to ensure that: this study would benefit from the substantial body of information and modelling work prepared for BC Hydro as part of its Conservation Potential Review – Update 2002; and, the results of this study would enable the assessment of not only energy efficiency opportunities, but also opportunities where natural gas could cost effectively replace electricity in selected markets.

Sector Coverage: The study addresses three sectors: residential (Rate 1, plus Rate 2 and 3 multi-unit buildings), commercial/institutional (Rate 2, 3 and 23 – non process loads) and manufacturing (Rate 5, 25, 3 and 23 – process loads). Terasen's 300 largest manufacturing accounts (Rate 7 and 22) are outside the scope of this study.

Geographical Coverage: The study results are presented for the total Terasen Gas service region and for the three service areas of: Lower Mainland, Interior and Vancouver Island.

Study Period: The base year for this study is fiscal year FY 2003/04. The time period covered by this study is to FY 2015/16, with a milestone at FY 2010/11.

Technologies: The study addresses both energy efficiency and fuel choice options.

❑ Approach

Analysis of the manufacturing sector employed a customized spreadsheet model. The model is organized by major sub sector, end use, technology and efficiency level e.g., standard efficiency boilers, condensing boilers, standard lumber dry kilns, efficient lumber dry kilns etc. The analysis addresses each specific manufacturing sub sector by treating the whole sub sector as one plant within each of the three service areas.

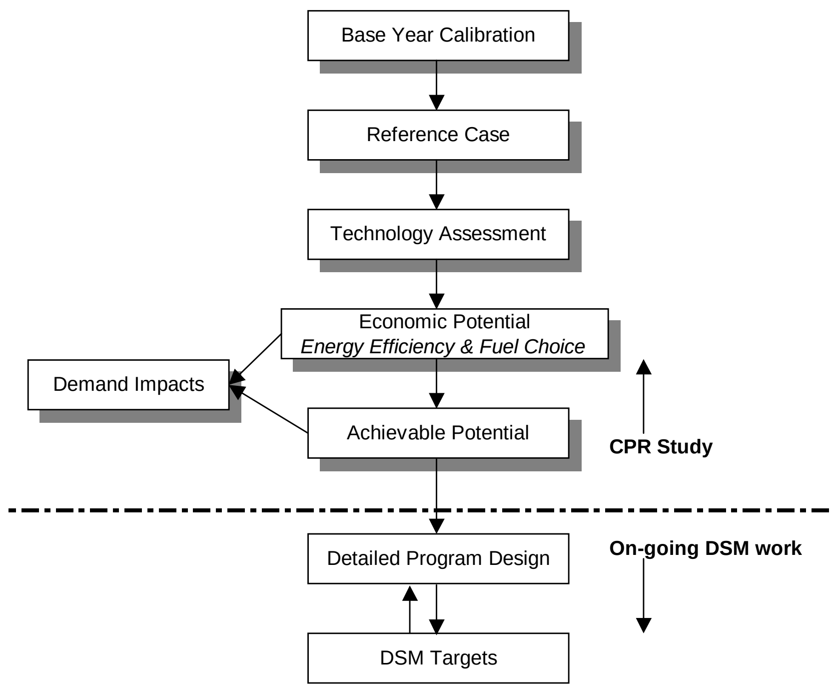
The model contains information on the major equipment and processes that are used to generate the major final products for each sub sector.

The major “drivers” within the manufacturing spreadsheet model that affect natural gas use are:

- Activity levels within each sub sector (Useful heat requirement)
- Production processes employed
- The type and efficiency of specific major operating equipment.

The major steps involved in the analysis are shown in Exhibit E1 and are discussed in the following paragraphs. 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.

Exhibit E1
Study Approach: Major Analytical Steps



❑ Major Analytic Steps and Definitions

This study employs numerous terms that are unique to analyses such as this one; 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 manufacturing 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 development of estimates of expected growth in production levels for the major sub sectors together with an estimation of "natural" changes affecting energy consumption over the study period.

Technology Assessment

Energy efficiency and fuel choice 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 base line technology and the measure total resource cost (TRC) was calculated for each option.

The measure total resource cost 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 8%.

Economic Potential Forecasts

The Economic Potential Forecast is the level of energy consumption that would occur if all equipment and facilities were upgraded to the level that is cost-effective, from Terasen Gas's perspective using life-cycle costing, against the long-run avoided cost of new natural gas supply. All the energy efficiency and fuel choice options included in the technology assessment that had a positive measure TRC were incorporated into the Economic Potential Forecasts.

Two economic potential forecasts were prepared: energy efficiency and fuel choice.

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 practically difficult to induce customers to purchase and install all the energy efficiency or fuel choice options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as "Most Likely" and "Upper".

Estimates provided were developed in a workshop involving energy efficiency program personnel from Terasen Gas and BC Hydro together with the consulting team.

Peak Day Load Impacts

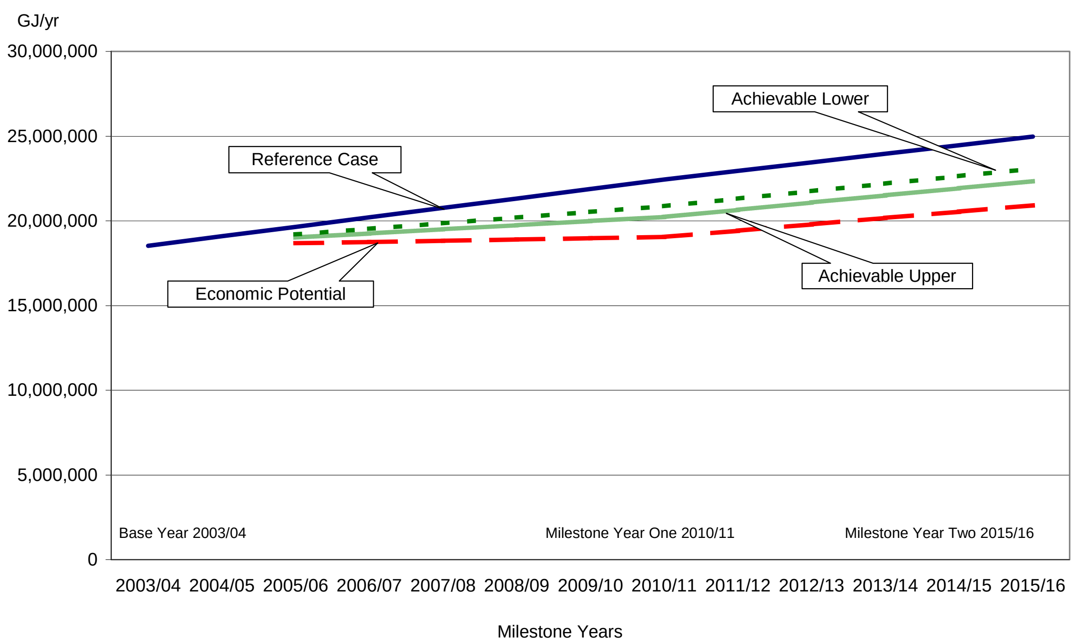
Load factors provided by Terasen Gas were used to derive the peak-day load impacts from the natural gas savings contained in each of the achievable potential estimates noted above.

❑ Results and Findings

A summary of the levels of annual natural gas consumption contained in each of the preceding forecasts, by milestone year, is presented in Exhibit E2 and discussed briefly in the paragraphs below.

Exhibit E2
Summary of Forecast Results (thousand GJ/yr.)
Energy Efficiency

Annual Consumption (thousand GJ /yr.) Manufacturing Sector				Potential Annual Savings (thousand GJ/yr.)		
Milestone Year	Base Year	Reference Case	Economic	Economic	Achievable Most Likely	Achievable Upper
2003/04	18,529					
2010/11		22,438	19,044	3,394	1,576	2,213
2015/16		24,971	20,915	4,056	1,890	2,623



Base Year Natural Gas Use

In the base year of 2003/04, Terasen Gas's manufacturing sector customers consumed approximately 18,529,000 GJ of natural gas. Exhibits E3 and E4, respectively, provide additional details on the major end uses and sub sectors where manufacturing sector natural gas consumption occurs.

Exhibit E3 shows that standard efficiency boilers used to generate process heat account for approximately 23 % of the total base year manufacturing sector natural gas use, whereas efficient and condensing boilers account for 18%. Wood products drying technologies, including standard and efficient lumber dry kilns and veneer dryers, account for approximately 36% of base year natural gas use. The remaining base year natural gas use is split between comfort heat (9%), other process heat (9%), heat treating and annealing technologies in the metal fabrication industry (3%), and distribution system insulation losses (2%).

Exhibit E4 shows that the food and wood sub sectors, combined, account for almost 80% of the base year natural gas use in the manufacturing sector.

Exhibit E3
Graphic of Base Year Natural Gas Consumption
Distribution of Use by End Use
Manufacturing Sector

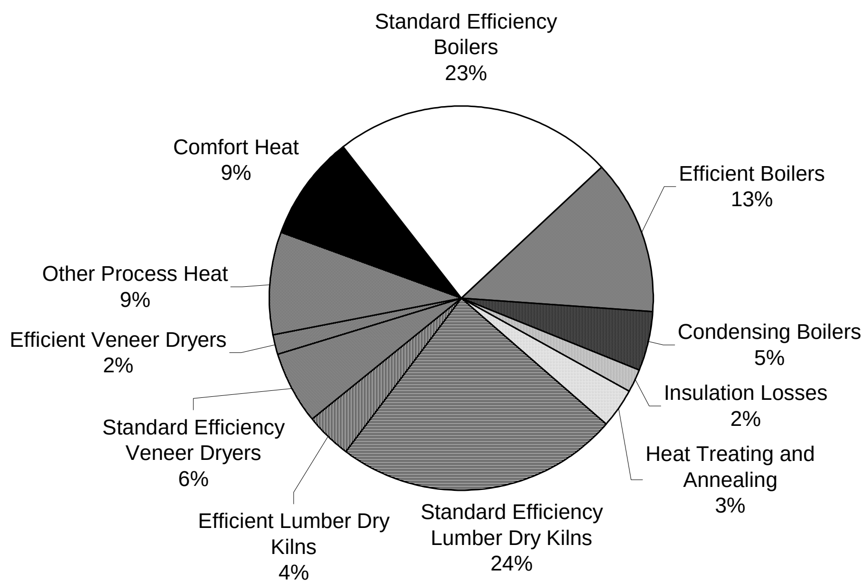
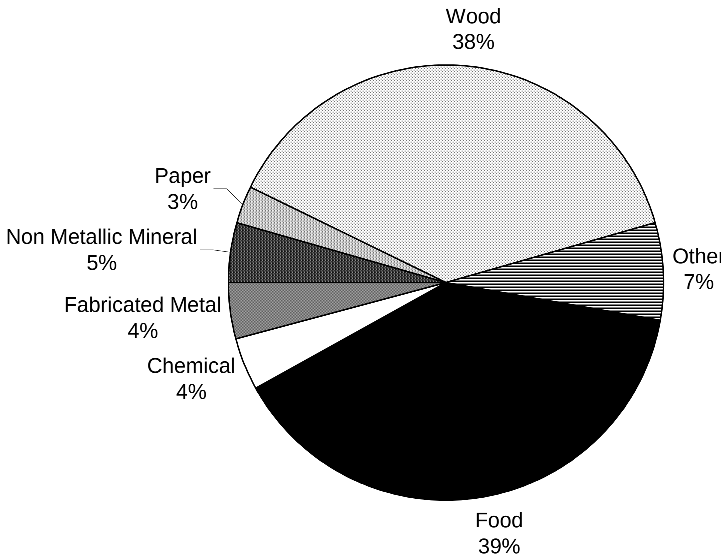


Exhibit E4
Graphic of Base Year Natural Gas Consumption
Distribution of Use by Manufacturing Sub Sector



Reference Case

In the absence of new demand side management (DSM) initiatives, the study estimates that natural gas use in the manufacturing sector will grow from the base year (FY 2003/04) consumption of approximately 18,529,000 GJ/yr. to 22,438,000 GJ/yr. by FY 2010/11 and 24,970,000 GJ/yr. by FY 2015/16. This represents an overall growth of about 6,559,000 GJ/yr. in the period.

Economic Potential Forecast – Energy Efficiency Scenario[1]

Under the conditions of the Economic Potential Forecast – Energy Efficiency Scenario, the study estimated that consumption in the manufacturing sector would grow to about 20,900,000 GJ/yr. by FY 2015/16. Annual savings relative to the Reference Case are about 4,056,000 GJ/yr. or about 16%. The Economic Potential annual savings are about 3,400,000 GJ/yr. in FY 2010/11.

[1] Energy markets in Canada and worldwide have experienced a number of extraordinary events in the recent past. As a result, natural gas costs have risen substantially since the start of this CPR. As current natural gas costs are higher than those used in this analysis, the benefits of efficiency measures may be understated while the benefits of fuel choice measures may be overstated. Within the limits of the time and resources available, this CPR has attempted to accommodate the increasing natural gas prices by applying a "high level" price sensitivity analysis to the measures screening process. Efficiency measures that were close but did not initially pass the measures TRC test have been included in the Economic Potential scenario. This approach recognizes that the measures will be subject to further economic screening during the detailed program design stage, which will provide a further opportunity to decide on the specific measures to be included in Terasen's program portfolio.

Achievable Potential – Energy Efficiency Scenario

The natural gas savings opportunities identified in the Economic Potential Forecast were "bundled", by end use, into a set of "Actions" reflecting a way in which initiatives may be undertaken. A brief profile was developed for each of the identified Actions. The Action Profiles provided a "high-level" logic framework that guided participant discussions in a half-day workshop. The results are presented in Exhibit E5 by Action and by milestone year.

Consistent with the results in the Economic Potential Forecast, the most significant Achievable Savings opportunities were in the Actions that addressed lumber kilns and process boilers.

Exhibit E5
Summary of Achievable Savings – Energy Efficiency
For Total Terasen Gas Service Area
by Action and Milestone Year

Action	Savings Re: Reference Case			
	2010/11		2015/16	
	Most Likely	Upper	Most Likely	Upper
M1: Efficient Lumber Dry Kilns	599,514	798,313	781,518	1,006,222
M2: Efficient Veneer Dryers	40,189	94,396	45,828	108,630
M3: Efficient Boilers	650,831	868,150	750,760	1,008,253
M4: Fully Insulated Process Heat Distribution Systems	193,101	267,040	200,123	277,091
Other	92,650	185,300	111,475	222,950
Total All Service Areas	1,576,286	2,213,198	1,889,704	2,623,145

Peak Day Load Impacts – Achievable Energy Efficiency Scenarios

The peak day savings associated with each of the preceding achievable energy efficiency scenarios were calculated using load factor data provided by Terasen Gas. The results are summarized in Exhibit E6. As illustrated, the achievable peak day savings in FY 2015/16 range from a decrease of about 20,000 GJ/day (Most Likely scenario) to a decrease of approximately 27,500 GJ/day (Upper scenario) for the total Terasen Gas service region.

Exhibit E6
Summary of Peak Day Load Impacts – Energy Efficiency
For Total Terasen Gas Service Area, by Scenario and Milestone Year

Service Region & Scenario	Peak Day Saving by Milestone Year & Scenario (GJ)	
	2010/11	2015/16
Total Terasen Gas		
Achievable - Most Likely	10,747	19,921
Achievable- Upper	15,090	27,535

Greenhouse Gas Emission Reduction

The natural gas savings associated with each of the achievable potential scenarios would also result in a significant reduction of greenhouse gas emissions. Under the most likely scenario, the GHG reductions are estimated to be approximately 80,000 tonnes/year in FY2010/11, increasing to approximately 112,000 tonnes/year by FY 2015/16.

❑ Fuel Choice Options

The study assessed fuel choice options involving the cost effective substitution of natural gas for electricity in the manufacturing sector but concluded that none of the available options provided a practical opportunity. Rather, the study concluded that recent natural gas price increases may pose load retention issues in the manufacturing sector.

❑ Summary of Findings

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in B.C.'s Manufacturing sector. Two particularly significant opportunities are identified in the study results:

- Energy efficient boilers for the greenhouse and food processing facilities in the Lower Mainland.
- Energy efficient kilns for sawmills and planer mills in the Interior.

Although the study did not identify any fuel choice opportunities for this sector, the promotion of energy efficient kilns is expected to contribute to load retention objectives within the wood products sub sector.

❑ Interpretation of Results

The study findings identified in these sector, combined with those identified in the residential and commercial sector reports, could have significant implications for Terasen Gas. If the cost effective DSM measures identified in the three sectors are pursued by Terasen Gas, then a significant increase in annual DSM investment in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels. This increased level of DSM investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario.

The current Terasen Gas DSM incentive mechanism provides an allowable return of 5% of the Total Resource Cost (TRC). The DSM measures identified for this sector, when combined with those identified in the commercial and manufacturing sector reports, could result in a larger scale DSM effort that might have a TRC value of $30 million, or more. A TRC value of $30 million would provide a $1.5 million annual payment through the DSM incentive mechanism. If the utility was to apply for increased DSM funding levels, a larger DSM incentive mechanism or equivalent shared savings mechanism could also be considered.

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Appendices

Table of Exhibits

1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

This Conservation Potential Review (CPR) provides Terasen Gas 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.

This report provides the CPR results for the Manufacturing Sector; the Residential and Commercial sectors are presented in separate documents.

1.2 STUDY SCOPE

Sector Coverage: The study addresses three sectors: residential (Rate 1 plus Rate 2 and 3 multi-unit), commercial/ institutional (Rate 2, 3 and 23 – non-process loads) and manufacturing (Rate 5, 25, 3 and 23 – process loads). Terasen's 300 largest industrial accounts (Rate 7, 27 and 22) are outside the scope of this study.

Geographical Coverage: The study results are presented for the total Terasen Gas service region and for the three service areas of: Lower Mainland, Interior and Vancouver Island.

Study Period: The base year for this study is fiscal year (FY) 2003/04. The time period covered by this study is to FY 2015/16, with a milestone at FY 2010/11.

Technologies: The study addresses both energy efficiency and fuel choice technologies.

Relation to BC Hydro CPR: This study builds on the substantial body of information and modelling work prepared for BC Hydro as part of its Conservation Potential Review – Update 2002. Wherever possible, this study builds on the existing energy use data compiled for the BC Hydro study.

1.3 DEFINITIONS

This study employs numerous terms that are unique to analyses such as this one. Below is a brief description of some of the most important terms. Key terms include the following:

Base Year	The Base Year of fiscal year 2003/04 is the starting point for the analysis. It provides a detailed description of "where" and "how" energy is currently used in the existing manufacturing 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 demand side management 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 fuel choice technologies were identified that met the criteria outlined above in the study's scope. Technology cost and performance data were compiled relative to the base line technology. A measure total resource cost (TRC) was calculated for each option.

The measure total resource cost 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 8%.

Economic Potential Forecast

The Economic Potential Forecast is the level of energy consumption that would occur if all technologies were upgraded to the level that is cost-effective, from Terasen Gas's perspective using life cycle costing, against the long-run avoided cost of new natural gas supply. All the energy efficiency technologies included in the technology assessment, which had a positive measure total resource cost, were incorporated into the Economic Potential Forecast.

An Economic Potential Forecast for fuel choice technologies was not developed as none of the major fuel choice technologies for the manufacturing sector provided a practical opportunity for implementation.

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 practically difficult to induce customers to purchase and install all the energy efficiency technologies that meet the criteria defined by the Economic Potential Forecast. The results of the Achievable Potential were presented as a range, defined as "Most Likely" and " Upper".

Estimates provided were developed in a workshop involving energy efficiency program personnel from Terasen Gas and BC Hydro together with the consulting team.

Peak Day Load Impacts Load factors provided by Terasen Gas were used to derive the peak day load impacts from the natural gas savings contained in each of the achievable potential estimates noted above.

1.4 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. At the completion of each step, Terasen Gas reviewed the results and, as applicable, revisions were identified and incorporated into the interim results. The study then progressed to the next step. A summary of the steps is presented below.

Step 1: **Develop Base Year Calibration Using Actual Terasen Gas Billing Data**

- Compile and analyze available data on British Columbia's existing manufacturing sub sectors.
- Develop detailed technical descriptions of the existing technologies within each manufacturing sub sector.
- Compile actual Terasen Gas billing data.
- Create sub sector model inputs and generate results.
- Calibrate sub sector model results using actual billing data.

Step 2: **Develop Reference Case**

- Compile and analyze data on forecast growth in output for 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 Fuel Choice Technologies**

- Develop list of energy efficiency and fuel choice technologies.
- Compile detailed cost and performance data for each technology.
- Identify the baseline technologies employed in the Reference Case.
- Compile Terasen Gas and BC Hydro economic data on current and forecast costs for new supply of natural gas and electricity generation.

- Determine the measure total resource cost for each energy efficiency and fuel choice technology.

Step 4: **Estimate Economic Energy Efficiency Potential**[2]

- Screen the identified technologies from Step 3 against the economic data.
- Identify the combinations of energy efficiency technologies and manufacturing sub sectors where the measure total resource cost is positive.
- Apply the economically attractive energy efficiency technologies from Step 3 within the energy use simulation model developed previously for each manufacturing sub sector.
- Compare the consumption levels when all economic energy efficiency technologies are used with the Reference Case Forecast consumption levels and calculate the natural gas consumption impacts.

Step 5: **Estimate Achievable Savings Potential**

- "Bundle" the energy efficiency technologies 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 Terasen Gas and BC Hydro personnel, review preliminary estimates and reach general agreement on "most likely" and "upper" inputs to the Achievable Potential Forecast.

Step 6: **Estimate Peak Day Load Impacts of Achievable Savings Potential**

- Calculate peak day load impacts for each of the achievable energy efficiency scenario results by applying load factors that correlate "average" to "peak" consumption, as provided by Terasen Gas for each rate class and service region.

1.5 ANALYTICAL MODELS

Analysis of the manufacturing sector employed a customized spreadsheet model. The model is organized by service area, major sub sector, major end use, and technology.

- The service areas are the Lower Mainland, Vancouver Island and Interior.
- The major sub sectors are food, chemicals, paper, fabricated metal, non-metallic minerals, wood, and other.
- The major end uses are comfort and process heat.
- The technologies include those used to generate all of the major final products for each sub sector; the specific list of technologies is provided in Section 2.

[2] No feasible fuel choice options were identified in Step 3.

The model addresses each manufacturing sub sector by treating the whole sub sector within a given service region as one plant. Each efficiency level of a technology (e.g. standard kilns and efficient kilns) is allocated market share corresponding to the estimated installed market share in the service area at all plants in that particular sub sector.

The primary input variables within the model that affect natural gas use are:

- Activity levels within each sub sector (useful heat requirement)
- Production processes employed
- The type and efficiency of specific major operating equipment.

The model outputs include total natural gas consumed, technology market share, and rate of change, at the level of sub sector and service area (e.g., food sub sector, Lower Mainland).

1.6 THIS REPORT

The remainder of this report is organized as follows:

- **Section 2** presents the results and the specific tasks involved in developing the base year calibration.

- **Section 3** presents the Manufacturing Reference Case for the FY 2003/04 to FY 2015/16.

- **Section 4** identifies and assesses energy efficiency and fuel choice technology options within the Manufacturing Sector.

- **Section 5** presents the Manufacturing Sector Economic Potential Forecast – Energy Efficiency for the study period (FY 2003/04 to FY 2015/16).

- **Section 6** estimates the proportion of energy savings opportunities identified in the Economic Potential Forecast that can realistically be achieved within the study period.

- **Section 7** estimates the peak day impacts of the Economic and Achievable Potential Forecasts.

- **Section 8** summarizes the key study findings and identifies areas that warrant further consideration.

- **Section 9** lists sources and references.

2. BASE YEAR NATURAL GAS USE

2.1 INTRODUCTION

This section describes natural gas use in British Columbia's manufacturing sector in the Base Year of fiscal year 2003/04. Based on available data, this section presents total natural gas consumption in B.C.'s manufacturing sector, together with an estimate of how that consumption is distributed by service area, sub sector, end use and technology.

The remainder of this section outlines the steps involved in preparing the Base Year calibration and presents a summary of the results. The discussion is organized into the following subsections:

- Segmentation of manufacturing facilities
- Allocation of Terasen Gas sales data
- Distribution of natural gas consumption by end use
- Estimated fuel share by major end use
- Summary of Base Year natural gas.

2.2 SEGMENTATION OF MANUFACTURING FACILITIES

The first step in the base year calibration required that the manufacturing accounts be segmented into sub sectors. To facilitate the analysis of energy efficiency options in later stages of this analysis, the accounts were grouped such that the natural gas using processes and technologies were approximately similar within each sub sector. The segmentation process benefited from the existence of NAICs codes for over 90% of Terasen's manufacturing load.

Exhibit 2.1 shows the study-defined sub sectors, the corresponding Terasen Gas sub sector definitions, and a brief description of the accounts within each sub sector. The Terasen Gas sub sector definitions were used as much as possible. In some cases, a further breakdown was required in order to have groups of accounts with consistent processes. In other cases, the Terasen defined sectors were grouped together.

Exhibit 2.1: Manufacturing Sector Descriptions

Study Defined Manufacturing Sub Sectors and Division	Terasen Defined Manufacturing Sub Sectors	Description
Food - Drinks	Food and Beverage Manufacturing	Dairies, wineries and breweries
Food - Food Processing	Food and Beverage Manufacturing	Meat packing, other food processing
Food - Bakeries	Food and Beverage Manufacturing	Large, commercial bakeries
Food - Agriculture	Agriculture	Mixed, uncovered farms
Food - Poultry	Agriculture	Poultry farms and processing facilities
Food - Greenhouses	Greenhouses	Covered vegetable, mushroom and ornamental plant greenhouses
Chemicals	Chemical Manufacturing	Small and medium sized chemical manufacturing facilities
Fabricated Metal	Metal Manufacturing	Foundries, metal fabrication, and metal mines
Non-metallic Minerals	Non-Metal Manufacturing Mining	Non-metallic minerals manufacturing facilities, including cements and plastics facilities Coal mines
Wood - Lumber	Wood Products	Processes where the primary gas load is for lumber kiln drying
Wood - Plywood	Wood Products	Processes where the primary gas load is for veneer drying
Wood - Other	Wood Products	Mostly small wood products manufacturing facilities that include carpentry, wood treating, and curing
Other	Laundry and Other Services Printing Textile Manufacturing Miscellaneous Manufacturing	A mixture of laundries, printing shops, mixed small manufacturing, and textile manufacturing

2.3 ALLOCATION OF TERASEN SALES DATA, BY SECTOR

Exhibit 2.2, overleaf, presents a summary of the allocation of Terasen Gas sales data, by sector. As noted previously, rates 7, 22 and 27 are outside the scope of this study. Further detail is provided below for each of the service regions.

- **Lower Mainland.** Virtually all of the manufacturing sector load in this service region was allocated on the basis of the NAICs code.

- **Vancouver Island**. The manufacturing load on Vancouver Island, which accounts for 3% of the total, was allocated on the basis of recommendations provided by Terasen's Vancouver Island staff.

- **Interior.** Approximately 90% of the manufacturing load in the Interior was allocated on using NAICs codes. The remaining 10% of the manufacturing load was allocated in equal proportion to those with NAICs codes.

Exhibit 2.2: Allocation of Terasen Gas Sales Data Within Study Scope, by Sector

Service Area:		*Lower Mainland*		Sector Allocation (GJ) FY 2003/04			
Rate Class	*% of Sales*	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
1	44%	494,843	52,844,936	52,844,936	0	0	0
2	14%	51,841	16,667,241	5,266,848	9,366,990	2,033,403	0
3	12%	4,079	14,234,817	7,387,870	5,053,360	1,793,587	0
23	3%	732	3,352,708	855,352	1,586,477	885,995	24,884
5	3%	372	3,646,499	2,251,633	785,252	609,614	0
25	7%	469	8,761,471	1,188,612	2,226,146	5,346,713	0
7	0%	4	63,619	0	0	0	63,619
22	12%	32	14,692,785	0	0	0	14,692,785
27	4%	90	4,856,841	0	0	0	4,856,841
Total GJ		552,462	119,120,916	69,795,251	19,018,225	10,669,312	19,638,129
% Total		100%	100%	59%	16%	9%	16%

Service Area:		*Vancouver Island*		Sector Allocation (GJ) FY 2003/04			
Rate Class	*% of Sales*	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
Equiv. to 1	11%	71,413	3,939,513	3,939,513	0	0	0
Equiv. to 2 & 3	20%	9,022	6,758,601	1,250,289	4,958,312	550,000	0
Transportation	69%	9	23,568,066	0	0	0	23,568,066
Total GJ		80,444	34,266,180	5,189,802	4,958,312	550,000	23,568,066
% Total		100%	100%	15%	14%	2%	69%

Service Area:		*Interior*		Sector Allocation (GJ) FY 2003/04			
Rate Class	*% of Sales*	**# of Customers**	**Consumption (GJ/Yr)**	**Residential (incl High-Rise Apts)**	**Commercial (inc Institutional)**	**Manufacturing**	**Beyond Study Scope**
1	30%	213,032	18,714,253	18,714,253	0	0	0
2	10%	21,703	6,431,661	1,865,182	3,858,996	707,483	0
3	5%	819	2,893,920	1,030,235	1,446,960	416,724	0
23	1%	130	699,445	15,822	430,280	247,314	6,029
5	1%	50	774,046	48,911	441,992	283,143	0
25	11%	165	6,563,106	43,820	864,233	5,655,054	0
7	0%	2	21,384	0	0	0	21,384
22	40%	27	25,019,059	0	0	0	25,019,059
27	1%	9	778,860	0	0	0	778,860
Total GJ		235,937	61,895,733	21,718,223	7,042,461	7,309,718	25,825,332
% Total		100%	100%	35%	11%	12%	42%
Grand Total		868,843	215,282,830	96,703,276	31,018,998	18,529,031	69,031,527
%		100%	100%	45%	14%	9%	32%

Exhibit 2.3 presents a further breakdown of the Base Year natural gas consumption in each service area by sub sector. Based on discussions with Terasen Gas Vancouver Island personnel, natural gas consumption in the chemical, fabricated metal and paper sub sectors (within the scope of this study) on Vancouver Island was assumed to be negligible.

Exhibit 2.3: Manufacturing Base Year Gas Sales by Service Area

Manufacturing Sub Sector	Lower Mainland	Interior	Vancouver Island
Food	61%	9%	18%
Chemicals	4%	3%	N/A
Fabricated Metal	7%	1%	N/A
Non-Metallic Minerals	6%	3%	9%
Paper	4%	1%	N/A
Wood	7%	82%	64%
Other	11%	2%	9%
Total	100%	100%	100%

Exhibit 2.4 shows the total Base Year manufacturing sales (within the scope of this study) segmented by manufacturing sub sector, division and service area. As illustrated, the Lower Mainland and Interior service areas account for the bulk of gas sales. Similarly, food and wood are the largest sub sectors.

Exhibit 2.4: Base Year Gas Sales by Manufacturing Sub Sector and Service Area[3]

Manufacturing Sub Sector	Division	Base Year Natural Gas Consumption (GJ)			
		Lower Mainland	Vancouver Island	Interior	Total
Food	Food - Drinks Food - Food Processing Food - Agriculture Food - Poultry Food - Bakery Food - Greenhouses	6,527,366	100,000	637,465	7,264,833
Chemicals		467,127	N/A	227,005	694,132
Fabricated Metal		745,217	N/A	45,339	790,555
Non-Metallic Minerals		593,449	50,000	193,119	836,567
Paper		458,266	N/A	67,800	526,066
Wood	Wood - Lumber Wood - Plywood Wood - Other Wood	738,585	350,000	6,007,217	7,095,802
Other		1,139,302	50,000	131,773	1,321,074
Total		10,669,312	550,000	7,309,718	18,529,031
% of Total		58%	3%	39%	100%

[3] Minor discrepancies are due to rounding.

2.4 DISTRIBUTION OF NATURAL GAS CONSUMPTION BY END USE

The next step involved the distribution of natural gas use between the two major end uses: process heat and comfort heat.[4]

Exhibit 2.5 shows the estimated breakdown between process and comfort heat, by sub sector and service area. As illustrated, natural gas use in the manufacturing sector is dominated by process heat. The breakdown was calculated by examining the load profile for the individual accounts within each sub sector and division, if applicable. Further detail is provided below.

- For Vancouver Island, where account information was not correlated to sub sector, it was assumed that the process/comfort heat breakdown was the same as in the Interior.
- The accounts within Rates 2 and 3, which also were not correlated to sub sector, were assumed to have the same process to comfort heat breakdown as the Rate 5, 25, and 23 accounts in the same region.
- For sub sectors that have multiple divisions, such as food, a weighted percentage was calculated.

A detailed description of the methodology used to calculate the results shown in Exhibit 2.5 is provided in Appendix A.

Exhibit 2.5: Process/Comfort Heat Breakdown by Sector and Service Area

Manufacturing Sub Sector	Lower Mainland		Interior		Vancouver Island	
	% Process Heat	% Comfort Heat	% Process Heat	% Comfort Heat	% Process Heat	% Comfort Heat
Food	95%	5%	93%	7%	93%	7%
Chemicals	99%	1%	99%	1%	N/A	N/A
Fabricated Metal	76%	24%	54%	46%	N/A	N/A
Non-Metallic Mineral	68%	32%	52%	48%	52%	48%
Paper	91%	9%	80%	20%	N/A	N/A
Wood	72%	28%	99%	1%	99%	1%
Other	74%	26%	38%	62%	38%	62%

2.5 ESTIMATED FUEL SHARES, BY MAJOR END USE

Exhibits 2.6, 2.7 and 2.8 provide estimates of the current natural gas share by equipment size for, respectively, Lower Mainland, Vancouver Island and the Interior. Equipment size is shown in the exhibits as it provides a good indicator 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 show potential opportunities and threats to the current natural gas fuel shares.

[4] Process heat is heat consumed by the manufacturing processes; comfort heat is used for space conditioning.

Exhibit 2.6: Natural Gas Fuel Share – Lower Mainland

Equipment	Estimate of Existing Share	Opportunity	Threat
Large (Process)	90%	1/No significant opportunity to expand share.	1/ Significant threat from wood waste, wood pellets and coal due to current high price of natural gas.
Medium (Process)	95%	1/No significant opportunity to expand share.	1/No significant threat.
Small (Comfort)	60%	1/ In new developments gas share could be increased over electricity.	1/ Main threat is electric because of ease of installation and current high cost of natural gas.

Exhibit 2.7: Natural Gas Fuel Share – Vancouver Island

Equipment	Estimate of Existing Share	Opportunities	Threat
Large (Process)	80%	1/ A continual increase in lumber drying will provide opportunity to supply more dry kilns. 2/ Some large equipment now using propane or oil could be switched to natural gas with main extensions.	1/ With the cost of natural gas and the public's concern about how high it could go, wood waste is a serious competitor. 2/ Coal is also a threat although much less than wood waste due to environmental concerns.
Medium (Process)	80%	1/ Main extensions to new industrial parks.	1/ Wood pellets are a threat for medium size boilers.
Small (Comfort)	70%	1/ In new developments gas share could be increased over electricity.	1/ Main threat is electric because of ease of installation and current cost of natural gas.

Exhibit 2.8: Fuel Share Natural Gas – Interior

Equipment	Estimate of Existing Share	Opportunity	Threat
Large (Process)	90%	1/ Could be some main extension opportunities in areas not served by natural gas.	1/ Significant threat from wood waste particularly with lumber dry kilns. Possibility of losing most of that market.
Medium (Process)	95%	No significant opportunity to expand share.	No significant threat.
Small (Comfort)	70%	1/ In new developments gas share could be increased over electricity.	1/ Main threat is electric because of ease of installation and current high cost of natural gas.

Additional details related to the fuel shares shown in the above exhibits are provided below.

- **Large Process Equipment:** In general, it is not practical to use electricity for large capacity equipment where electric service entrance costs far outweigh gas connection costs. Also, 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/hour for a cost that is insignificant compared to the cost of the equivalent peak capacity high voltage transmission connection.

- **Lumber and Veneer Dryers:** Electric dehumidification kilns have been developed and applied in small-scale facilities, particularly for drying hardwood. However, in typical B.C. wood products facilities, electricity does not compete with natural gas as a fuel source for dryers. Rather, the fuels that compete with natural gas are wood waste, wood pellets, coal, biogas, and fuel oil, with wood waste making up the largest share.

- **Comfort Heat:** The relatively small capacity equipment used in comfort heating is the one end use that is suitable for electricity use.

2.6 SUMMARY OF BASE YEAR NATURAL GAS USE, BY SECTOR, END USE AND TECHNOLOGY

This sub section provides a summary of the Base Year natural gas consumption organized by manufacturing sub sector, service area, end use and technology. The results are presented in the following exhibits.

- Exhibits 2.9, 2.10 and 2.11 show the distribution of base year natural gas use by major technology and service area.

- Exhibits 2.12 through 2.18 show the distribution of base year natural gas use by major sub sector and end use for, respectively, each of the 3 service areas.

Overall the results contained in the following exhibits show that natural gas use in the Lower Mainland is dominated by boilers within the food industry, while lumber dry kilns and veneer dryers dominate in the Interior and on Vancouver Island.

Exhibit 2.9: Major Natural Gas Technology Market Share – Lower Mainland

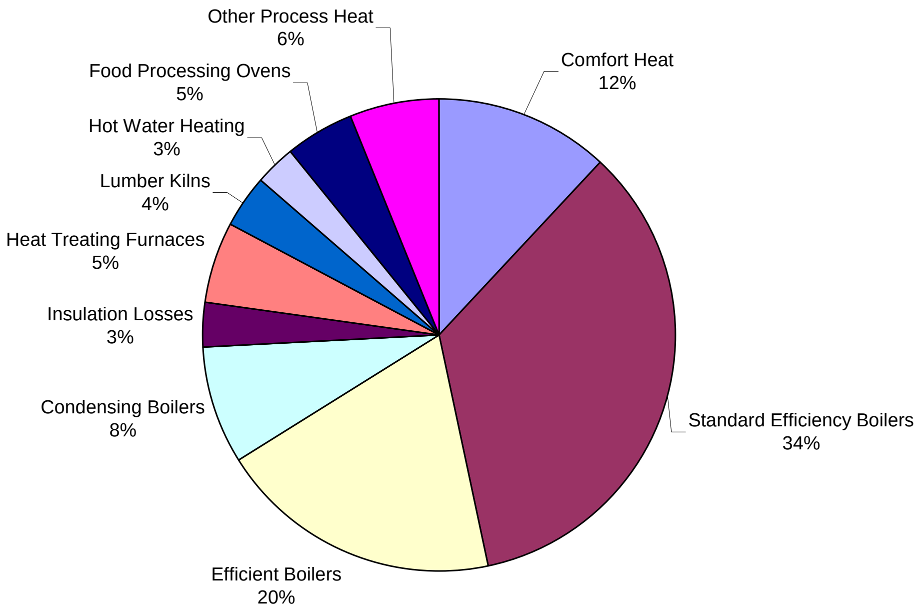

Exhibit 2.10: Major Natural Gas Technology Market Share – Interior

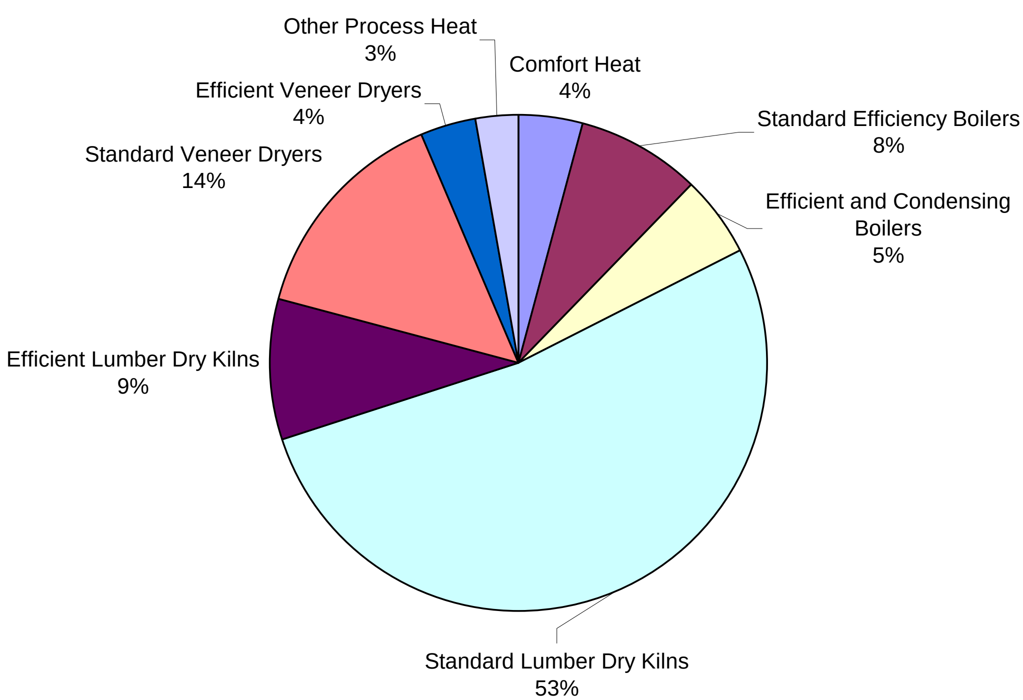

Exhibit 2.11: Major Natural Gas Technology Market Share – Vancouver Island

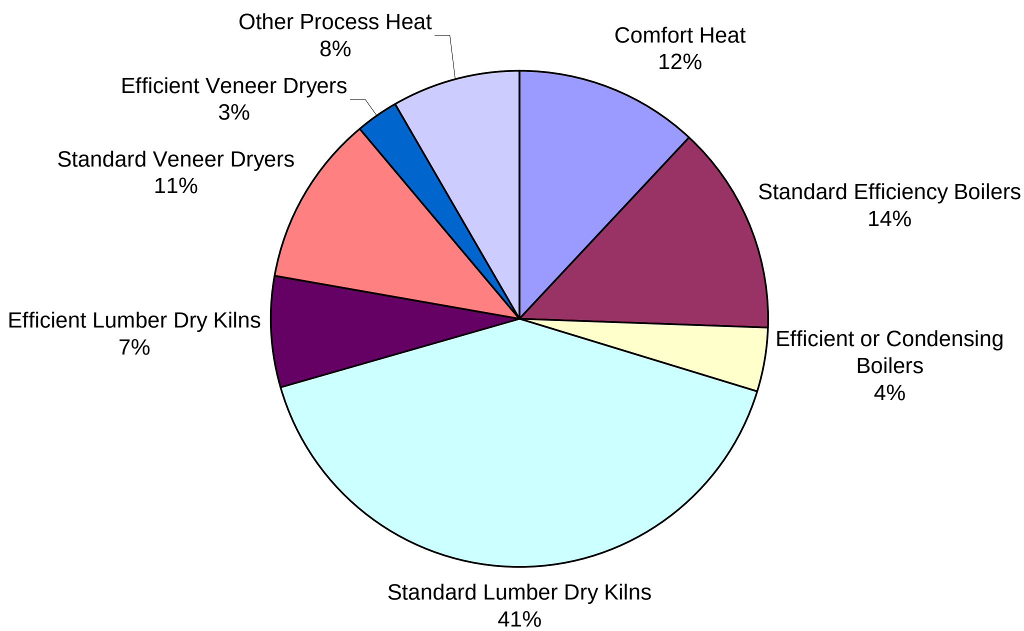

Exhibit 2.12: Summary of Base Year End Use and Technology Market Share for Fabricated Metal Manufacturing Sub Sector – All Service Areas

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	100%	199,470
	Total Comfort Heat		**100%**	**199,470**
Process Heat	Standard Efficiency Furnace	25%	66%	390,116
	Furnace with Sequential Firing, High Velocity Burners	40%	30%	177,326
	Standard Furnace Insulation	25%	3%	18,324
	Ceramic Fibre Insulation on Standard Efficiency Furnace	40%	1%	5,320
	Total Process Heat		**100%**	**591,085**
Total				**790,555**

Exhibit 2.13: Summary of Base Year End Use and Technology Market Share for Food Manufacturing Sub Sector – All Service Areas

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	73%	292,210
	Standard Efficiency Boiler	74%	23%	90,715
	Near Condensing Boilers	80%	3%	10,813
	Condensing Boiler	89%	0%	1,395
	Partly Insulated Distribution System	50%	2%	6,197
	Fully Insulated Distribution System	92%	0%	326
	Total Comfort Heat		**100%**	**401,657**
Process Heat	Standard Efficiency Boiler	74%	45%	3,077,728
	Near Condensing Boiler	80%	9%	594,981
	Condensing Boiler	89%	13%	890,775
	Bundled Standard Boiler Upgrades	85%	17%	1,137,305
	Partly Insulated Distribution System	50%	4%	260,801
	Fully Insulated Distribution System	92%	0%	13,726
	Direct Fired Heating	90%	2%	124,593
	Radiant Tube Heating	70%	0%	1,495
	Standard Efficiency Oven	65%	4%	289,639
	Efficient Oven	80%	4%	251,257
	Tank-type Water Heating	65%	2%	136,235
	Direct Fired Water Heating	95%	1%	48,872
	Heat Loss from Not Using Pinch Technology		1%	35,767
	Total Process Heat		**100%**	**6,863,174**
Total				**7,264,831**

Exhibit 2.14: Summary of Base Year End Use and Technology Market Share for Chemical Manufacturing Sub Sector – All Service Areas[5]

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	100%	6,941
	Total Comfort Heat		**100%**	**6,941**
Process Heat	Standard Efficiency Boiler	68%	61%	417,812
	Near Condensing Boiler	80%	10%	68,719
	Bundled Standard Boiler Upgrades	85%	16%	106,515
	Partly Insulated Distribution System	50%	4%	26,113
	Fully Insulated Distribution System	92%	0%	1,374
	Heat Loss from Not Using Pinch Technology		10%	66,658
	Total Process Heat		**100%**	**687,191**
Total				**694,132**

[5] Chemical sector end use breakdown based on references cited in Bibliography and on personal communication with Adam Paulson, Production Engineer, Ashland Chemicals

Exhibit 2.15: Summary of Base Year End Use and Technology Market Share for Non-Metallic Minerals Manufacturing Sub Sector – All Service Areas[6]

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	100%	307,136
	Total Comfort Heat		**100%**	**307,136**
Process Heat	Standard Efficiency Boiler	68%	65%	341,483
	Near Condensing Boiler	80%	10%	52,943
	Condensing Boiler	92%	3%	13,236
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	2%	10,589
	Bundled Standard Boiler Upgrades	85%	10%	52,943
	Partly Insulated Distribution System	50%	4%	20,118
	Fully Insulated Distribution System	92%	0%	1,059
	Tank-type Water Heating	65%	5%	26,472
	Direct Fired Water Heating	95%	2%	10,589
	Total Process Heat		**100%**	**529,431**
Total				**836,567**

Exhibit 2.16: Summary of Base Year End Use and Technology Market Share for Paper Manufacturing Sector – All Service Areas

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	50%	27,093
	Standard Efficiency Boiler	68%	27%	14,766
	Near Condensing Boilers	80%	18%	9,483
	Condensing Boiler	92%	1%	677
	Partly Insulated Distribution System	50%	4%	2,059
	Fully Insulated Distribution System	92%	0%	108
	Total Comfort Heat		**100%**	**54,186**
Process Heat	Standard Efficiency Boiler	68%	23%	107,353
	Near Condensing Boiler	80%	8%	35,391
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	1%	3,539
	Bundled Standard Boiler Upgrades	85%	30%	141,564
	Partly Insulated Distribution System	50%	4%	17,931
	Fully Insulated Distribution System	92%	0%	944
	Heat Loss from Not Using Pinch Technology		10%	47,188
	Steam Paper Drying	80%	23%	108,532
	Direct Fired Paper Drying	87%	2%	9,438
	Total Process Heat		**100%**	**471,880**
Total				**526,066**

[6] Based on team members experience the proportion of comfort heat that is provided by boilers in the non-metallic minerals manufacturing sector is small enough to be considered negligible.

Exhibit 2.17: Summary of Base Year End Use and Technology Breakdowns for Wood Manufacturing Sub Sector – All Service Areas

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	50%	135,457
	Standard Efficiency Boiler	68%	27%	73,822
	Near Condensing Boilers	80%	18%	47,410
	Condensing Boiler	92%	1%	3,386
	Partly Insulated Distribution System	50%	4%	10,296
	Fully Insulated Distribution System	92%	0%	542
	Total Comfort Heat		**100%**	**270,914**
Process Heat	Standard Efficiency Boiler	68%	2%	137,855
	Near Condensing Boiler	80%	0%	23,908
	Condensing Boiler	92%	0%	5,977
	Bundled Standard Boiler Upgrades	85%	1%	71,070
	Standard Efficiency Kiln	57%	65%	4,434,437
	Advanced Kiln Control	60%	4%	240,363
	High Efficiency Kiln	87%	8%	517,262
	Standard Efficiency Veneer Dryer	50%	16%	1,115,228
	Advanced Veneer Dryer	70%	4%	278,787
	Total Process Heat		**100%**	**6,824,888**
Total				**7,095,802**

Exhibit 2.18: Summary of Base Year End Use and Technology Breakdowns for Other Manufacturing Sub Sector – All Service Areas

End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Total Annual Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	80%	331,166
	Standard Efficiency Boiler	68%	10%	39,947
	Near Condensing Boilers	80%	6%	25,251
	Condensing Boiler	92%	0%	1,035
	Partly Insulated Distribution System	50%	4%	15,730
	Fully Insulated Distribution System	92%	0%	828
	Total Comfort Heat		**100%**	**413,957**
Process Heat	Standard Efficiency Boiler	68%	31%	276,670
	Near Condensing Boiler	80%	7%	63,498
	Condensing Boiler	92%	2%	18,142
	Bundled Standard Boiler Upgrades	85%	6%	49,891
	Partly Insulated Distribution System	50%	4%	34,470
	Fully Insulated Distribution System	92%	0%	1,814
	Tank-type Water Heating	65%	10%	90,712
	Direct Fired Water Heating	95%	1%	9,071
	Miscellaneous Standard Equipment	65%	30%	272,135
	Miscellaneous Efficient Equipment	80%	5%	45,356
	Direct Fired Gas Laundry Dryers	50%	5%	45,356
	Total Process Heat		**100%**	**907,117**
Total				**1,321,074**

3. REFERENCE CASE

3.1 INTRODUCTION

This section presents the manufacturing sector Reference Case Forecast for the study period (FY 2003/04 to FY 2015/16). The Reference Case Forecast 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 Forecast, therefore, provides the point of comparison for the subsequent calculation of economically attractive energy efficiency or fuel choice opportunities.

The discussion is presented within the following sub sections:

- Approach
- “Natural” efficiency improvements
- Expected growth in manufacturing sector useful heat requirements
- Forecast natural gas consumption levels (FY 2003/04 to FY 2015/16).

3.2 APPROACH

The manufacturing sector Reference Case Forecast 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 market shares for each technology were calculated, in terms of useful heat output, using the Base Year market shares (% of gas sold) and the estimated average seasonal efficiency for each technology.

- The naturally occurring changes in market share of new and/or more efficient technologies were estimated; these values were used to calculate the market share of useful heat output for each technology for the milestone years FY 2010/11 and FY 2015/16 at zero overall growth for the sector.

- The average production growth rates for each sub sector were estimated and used to calculate the useful heat requirements for the milestone years FY 2010/11 and FY 2015/16, by manufacturing sub sector and service area.

- The natural gas required to supply each technology’s portion of each sub sector’s useful heat requirement was calculated using the estimated seasonal efficiency of each technology. The sum of these requirements represents the forecast of natural gas sales in each period.

Further discussion is provided below.

3.3 "NATURAL" EFFICIENCY IMPROVEMENTS

Growth in the amount of natural gas sold to the manufacturing sector will be partially reduced due to "natural" increases in the use of more efficient technologies. Exhibit 3.1 presents the forecast levels of "natural" efficiency improvement in British Columbia's manufacturing sector over the study period. The exhibit shows the technologies expected to have the most influence on "natural" efficiency improvements, the expected rate of annual market share increase, and the applicable manufacturing sub sectors.

Exhibit 3.1: "Natural" Efficiency Improvements In B.C. Manufacturing Sector

Technology	Expected "Natural" Increase in Share of Installed Equipment	Applicable Sub Sectors
Near Condensing Boilers	0.8% per year	All except fabricated metal
Condensing Boilers	0.4% per year	All except fabricated metal
Bundled Standard Boiler Upgrades	3.0% per year	All except fabricated metal
Improved Distribution System Insulation	4.0 % per year	All except fabricated metal
Advanced Lumber Dry Kiln Controls	4.0 % per year	Wood
High Efficiency Lumber Dry Kilns	1.0% per year	Wood

The increasing share of more efficient boilers within the manufacturing sector shown in Exhibit 3.1 assumes an average boiler lifetime of 25 years.[7] This means that approximately 4% of the existing manufacturing sector boilers are replaced each year.

The natural increase in the market share of near condensing and condensing boilers is based on an informal survey of suppliers to the commercial marketplace, as reported by Terasen Gas. 70% of boilers sold today are standard type, 20% are near condensing and 10% are condensing. Combining current sales share with the estimated 4% annual replacement rate means that near condensing boilers are increasing their share of installed boilers at an annual rate of approximately 1% (e.g., 20% x 4% = 0.8% of all boilers) and full condensing boilers are increasing their share at an annual rate of approximately 0.5% (e.g., 10% of 4% = 0.4% of all boilers).

The natural increase in installed process distribution insulation is based on discussions with the North American Insulation Manufacturers Association and the professional judgment of the authors.

[7] Boiler lifetime 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 to 20 years for boilers with steel tubes and 15 to 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.

The natural increase in the market share of advanced lumber dry kiln controls and high efficiency lumber dry kilns is based on discussions with two major lumber dry kiln manufacturers and management at several Interior sawmills.

3.4 EXPECTED PRODUCTION GROWTH RATES (useful heat requirements)

British Columbia manufacturing statistics show that the compound rate of growth for the sub sectors addressed in this CPR was 2.9% from 1999 to 2004. Based on this prior experience and selected discussions with manufacturing sector personnel, the following production growth rates have been estimated for the periods covered by this study:

- **Wood sub sector –** annual growth is estimated to be 3% for the period FY 2003/04 to FY 2010/11 and 1.5% from FY 2010/11 to FY 2015/16. The projected decline in growth during the second period recognizes that harvesting the Pine Beetle kill timber will increase the level of wood manufacturing until FY 2010/11, but after that period there will be a decline in available fibre.

- **Food sub sector** - annual growth is estimated to be 3% for the period FY 2003/04 to FY 2010/11 and 3% from FY 2010/11 to FY 2015/16.

- **Remaining sub sectors –** annual growth is estimated to be 3% for the period FY 2003/04 to FY 2010/11 and 3% from FY 2010/11 to FY 2015/16.

3.5 REFERENCE CASE FORECAST

The manufacturing sector Reference Case Forecast is presented in the following exhibits.

- Exhibit 3.2 presents a summary of the results for the total Terasen Gas service area, by milestone year.

- Exhibits 3.3, 3.4 and 3.5 present the results for respectively, Lower Mainland, Interior and Vancouver Island, by technology and milestone year.

- Exhibits 3.6 and 3.7 present detailed results for the two largest Terasen Gas customer groups (Food, Lower Mainland Service Area and Wood, Interior Service Area).

Overall, the results of the Reference Case Forecast show that natural gas use grows in approximately the same proportion as manufacturing sector economic growth. The growth in natural gas sales is only slightly reduced by the increasing market share of efficient technologies.

Additional detailed results by manufacturing sub sector and service region are presented in Appendix B.

Exhibit 3.2: Reference Case Forecast Natural Gas Consumption for Total Terasen Gas Service Area

Year	Lower Mainland	Interior	Vancouver Island	Total
Base Year 2003/04	10,669,312	7,309,718	550,000	18,529,030
Milestone Year 2010/11	12,900,232	8,869,104	668,502	22,437,838
Milestone Year 2015/16	14,660,131	9,577,142	733,968	24,971,241

Exhibit 3.3: Reference Case Forecast – Technology Market Share as a Percent of Gas Sold – Lower Mainland Service Area

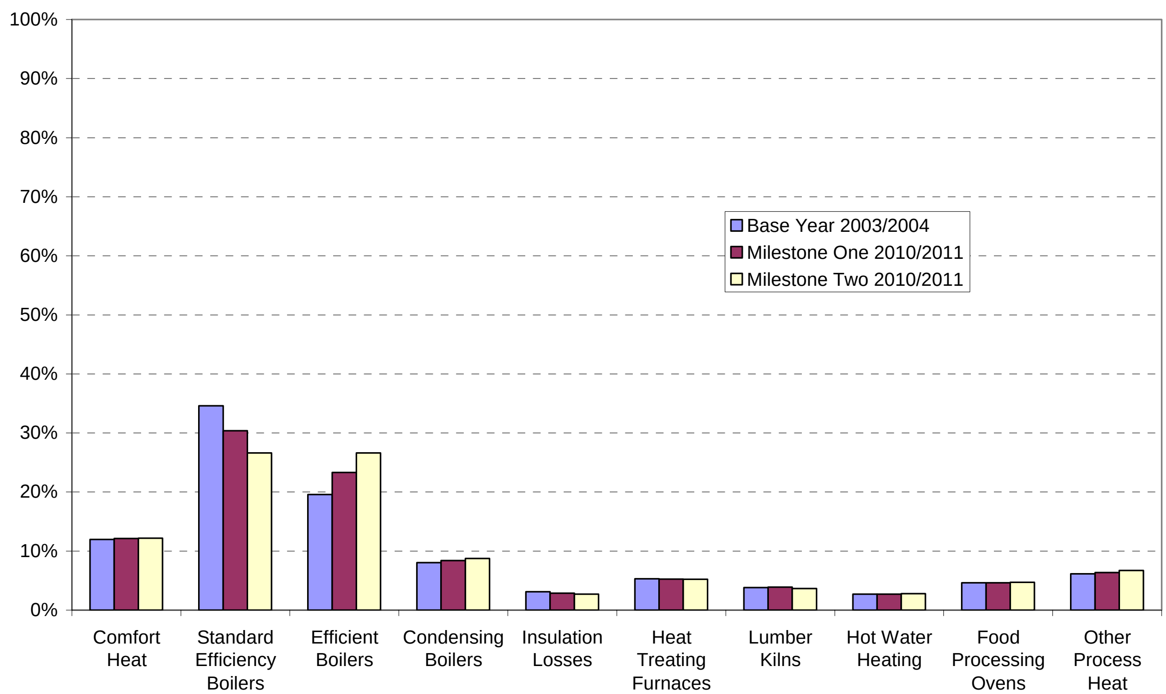

Exhibit 3.4: Reference Case Forecast – Technology Market Share as a Percent of Gas Sold – Interior Service Area

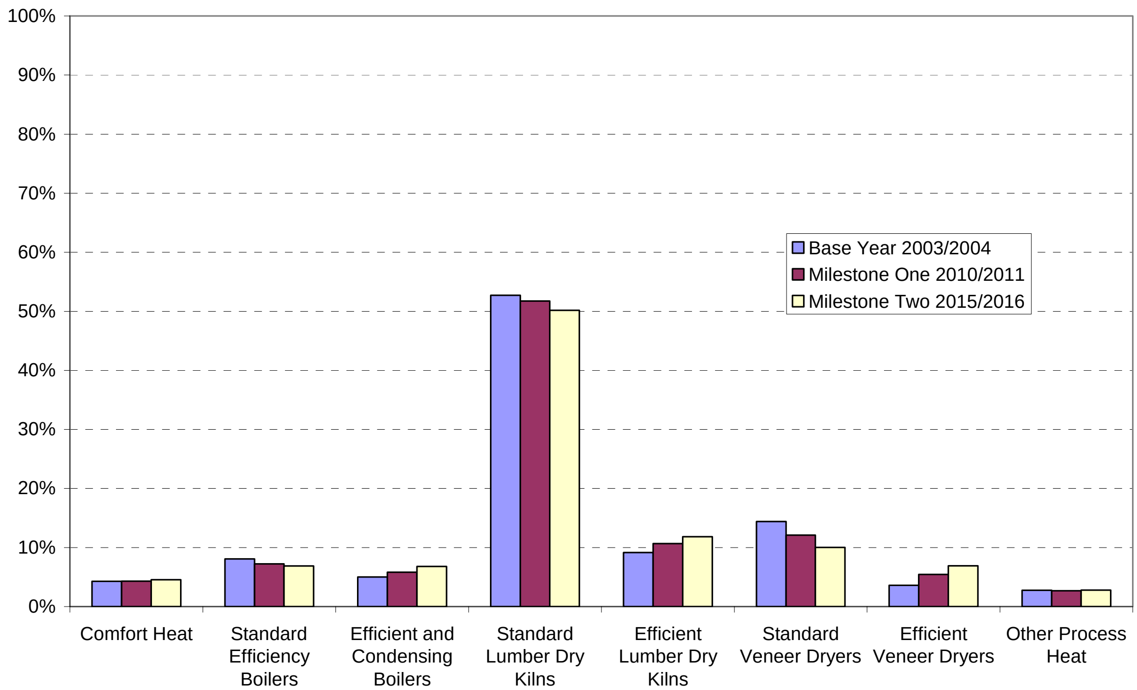

Exhibit 3.5: Reference Case Forecast – Technology Market Share as a Percent of Gas Sold – Vancouver Island Service Area

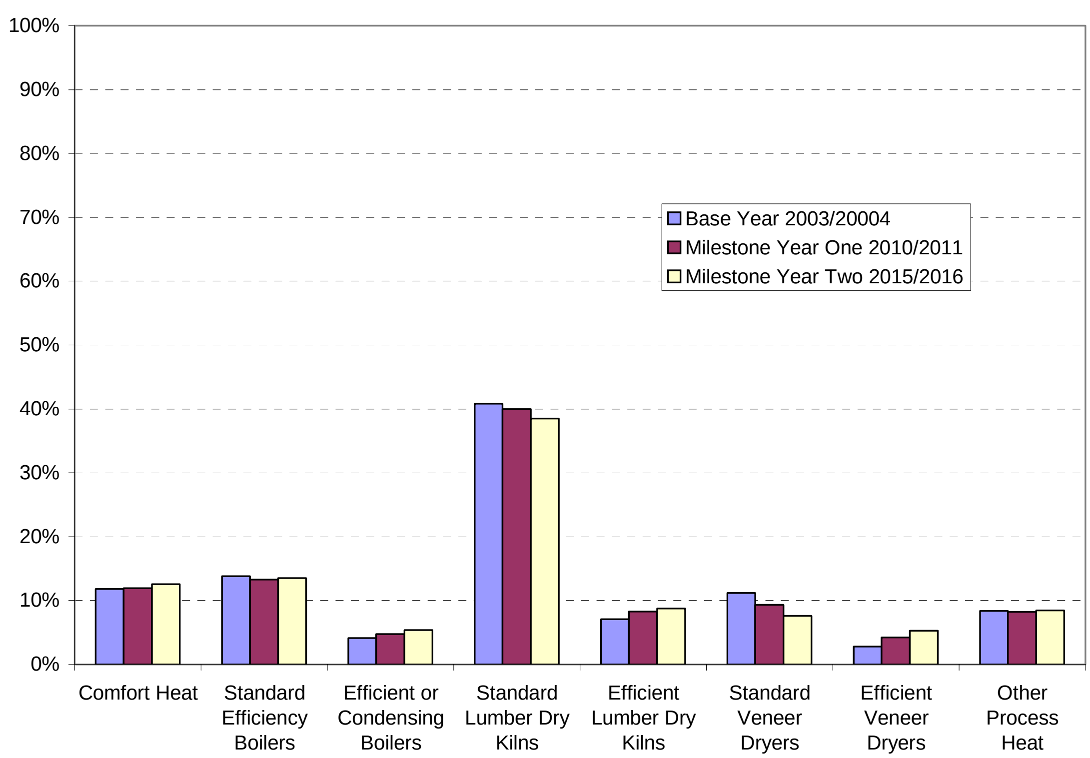

Exhibit 3.6: Reference Case Forecast for Food Sub Sector – Lower Mainland Service Area

			2003/2004				2010/2011						2015/16					
			Base Year				Sector Annual Growth Rate					3.0%	Sector Annual Growth Rate					3.0%
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	70.7%	170,419	243,456	0.0%	170,419	70.7%	209,594	69.5%	299,420	0.0%	209,594	70.7%	242,977	69.6%	347,110
	Standard Efficiency Boiler	68%	25.4%	25.2%	60,600	89,117	-0.1%	60,070	24.9%	73,879	25.2%	108,646	-0.1%	73,392	24.8%	85,081	25.1%	125,120
	Near Condensing Boilers	80%	3.1%	3.6%	8,603	10,753	0.8%	9,096	3.8%	11,187	3.2%	13,984	0.8%	11,642	3.9%	13,496	3.4%	16,870
	Condensing Boiler	92%	0.4%	0.5%	1,270	1,380	0.4%	1,306	0.5%	1,606	0.4%	1,746	0.4%	1,639	0.6%	1,900	0.4%	2,065
	Partly Insulated Distribution System	50%	1.7%			6,084	-1.6%				1.6%	6,696	-2.2%				1.4%	6,932
	Fully Insulated Distribution System	92%	0.1%			320	3.8%				0.1%	512	3.7%				0.1%	712
	Total Comfort Heat		**100.0%**	**100.0%**	**240,892**	**351,111**		**240,892**	**100.0%**	**296,267**	**100.0%**	**431,004**		**296,267**	**100.0%**	**343,454**	**100.0%**	**498,809**
Process Heat	Standard Efficiency Boiler	68%	44.0%	40.9%	1,849,600	2,720,000	-2.3%	1,575,157	34.9%	1,937,245	38.2%	2,848,889	-3.3%	1,636,597	29.5%	1,897,265	32.8%	2,790,095
	Near Condensing Boiler	80%	8.7%	9.5%	427,825	534,781	0.8%	452,365	10.0%	556,352	9.3%	695,441	0.8%	578,965	10.4%	671,180	9.9%	838,975
	Condensing Boiler	92%	13.4%	16.9%	762,198	828,476	0.4%	783,798	17.4%	963,972	14.1%	1,047,796	0.4%	983,406	17.7%	1,140,038	14.6%	1,239,171
	Bundled Standard Boiler Upgrades	85%	17.0%	19.7%	891,944	1,049,345	3.0%	1,096,978	24.3%	1,349,145	21.3%	1,587,229	3.0%	1,564,028	28.2%	1,813,138	25.1%	2,133,103
	Partly Insulated Distribution System	50%	3.8%			234,698	-1.6%				3.5%	258,340	-2.2%				3.1%	267,442
	Fully Insulated Distribution System	92%	0.2%			12,353	3.8%				0.3%	19,750	3.7%				0.3%	27,474
	Direct Fired Heating	90%	1.9%	2.3%	105,235	116,928	2.9%	128,469	2.8%	158,000	2.4%	175,556	5.0%	201,653	3.6%	233,771	3.1%	259,746
	Radiant Tube Heating	70%	0.0%	0.0%	984	1,405	0.5%	1,019	0.0%	1,253	0.0%	1,790	1.0%	1,317	0.0%	1,526	0.0%	2,180
	Standard Efficiency Oven	65%	4.3%	3.8%	171,774	264,268	-2.4%	145,315	3.2%	178,719	3.7%	274,952	-2.2%	159,799	2.9%	185,251	3.4%	285,001
	Efficient Oven	80%	3.7%	4.1%	184,435	230,543	1.9%	210,894	4.7%	259,373	4.3%	324,216	1.4%	278,293	5.0%	322,618	4.7%	403,272
	Tank-type Water Heating	65%	2.0%	1.8%	81,821	125,878	-0.6%	78,470	1.7%	96,508	2.0%	148,474	0.3%	97,918	1.8%	113,513	2.1%	174,636
	Direct Fired Water Heating	95%	0.7%	0.9%	41,163	43,329	1.1%	44,514	1.0%	54,747	0.8%	57,628	-0.5%	53,337	1.0%	61,832	0.8%	65,087
	Heat Loss from Not Using Pinch Technology		0.2%			14,250	0.0%				0.2%	17,525	0.0%				0.2%	20,317
	Total Process Heat		**100.0%**	**100.0%**	**4,516,978**	**6,176,255**		**4,516,978**	**100.0%**	**5,555,313**	**100.0%**	**7,457,586**		**5,555,313**	**100.0%**	**6,440,131**	**100.0%**	**8,506,499**
Total					**4,757,870**	**6,527,366**				**5,851,580**		**7,888,590**				**6,783,585**		**9,005,308**

Exhibit 3.7: Reference Case Forecast for Wood Sub Sector – Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					1.5%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	20,838	29,769	0.0%	20,838	51.0%	25,628	50.3%	36,612	0.0%	25,628	51.0%	27,609	50.5%	39,441
	Standard Efficiency Boiler	68%	27.3%	27.0%	11,032	16,224	-0.7%	10,535	25.8%	12,956	26.2%	19,053	-0.7%	12,498	24.9%	13,464	25.4%	19,800
	Near Condensing Boilers	80%	17.5%	20.4%	8,335	10,419	0.8%	8,813	21.6%	10,839	18.6%	13,549	0.8%	11,280	22.4%	12,152	19.4%	15,189
	Condensing Boiler	92%	1.3%	1.7%	685	744	0.4%	704	1.7%	866	1.3%	941	0.4%	883	1.8%	952	1.3%	1,034
	Partly Insulated Distribution System	50%	3.8%			2,262	-1.6%				3.4%	2,490	-2.2%				3.1%	2,396
	Fully Insulated Distribution System	92%	0.2%			119	3.8%				0.3%	190	3.7%				0.3%	246
	Total Comfort Heat		**100.0%**	**100.0%**	**40,890**	**59,537**		**40,890**	**100.0%**	**50,290**	**100.0%**	**72,836**		**50,290**	**100.0%**	**54,176**	**100.0%**	**78,107**
Process Heat	Standard Efficiency Boiler	68%	0.9%	1.0%	35,637	52,407	-4.2%	26,414	0.8%	32,486	0.7%	47,774	-6.8%	22,896	0.5%	24,665	0.5%	36,272
	Near Condensing Boiler	80%	0.2%	0.3%	8,847	11,058	0.8%	9,354	0.3%	11,504	0.2%	14,380	0.8%	11,972	0.3%	12,897	0.2%	16,122
	Condensing Boiler	92%	0.0%	0.1%	2,543	2,765	0.4%	2,615	0.1%	3,217	0.0%	3,496	0.4%	3,282	0.1%	3,535	0.0%	3,843
	Bundled Standard Boiler Upgrades	85%	0.7%	1.1%	37,598	44,233	3.0%	46,241	1.3%	56,871	0.9%	66,907	3.0%	65,929	1.5%	71,024	1.1%	83,558
	Standard Efficiency Kiln	57%	64.8%	62.5%	2,195,526	3,851,799	-0.5%	2,126,061	60.5%	2,614,786	63.5%	4,587,345	-0.6%	2,542,714	58.8%	2,739,225	62.4%	4,805,657
	Advanced Kiln Control	60%	3.7%	3.7%	130,260	217,100	4.0%	171,414	4.9%	210,817	4.9%	351,362	4.0%	256,491	5.9%	276,314	6.0%	460,523
	High Efficiency Kiln	87%	7.6%	11.2%	392,479	451,125	1.0%	420,790	12.0%	517,519	8.2%	594,850	1.0%	543,918	12.6%	585,954	8.7%	673,510
	Standard Efficiency Veneer Dryer	50%	17.7%	15.0%	526,877	1,053,754	-2.7%	435,830	12.4%	536,016	14.8%	1,072,031	-3.7%	444,474	10.3%	478,825	12.4%	957,649
	Advanced Veneer Dryer	70%	4.4%	5.2%	184,407	263,438	5.9%	275,454	7.8%	338,773	6.7%	483,962	4.9%	430,315	10.0%	463,572	8.6%	662,246
	Total Process Heat		**100.0%**	**100.0%**	**3,514,173**	**5,947,680**		**3,514,173**	**100.0%**	**4,321,990**	**100.0%**	**7,222,107**		**4,321,990**	**100.0%**	**4,656,011**	**100.0%**	**7,699,380**
Total					**3,555,063**	**6,007,217**				**4,372,280**		**7,294,943**				**4,710,187**		**7,777,487**

4. ENERGY EFFICIENCY AND FUEL CHOICE TECHNOLOGIES

4.1 INTRODUCTION

This section identifies and assesses the financial and economic attractiveness of the selected energy efficiency and fuel choice technologies for the manufacturing sector. The discussion is organized and presented as follows:

- Methodology
- Summary of energy efficiency technology screening results
- Summary of fuel choice technology results
- Description of energy efficiency technologies
- Description of fuel choice technologies.

4.2 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 (e.g., degree days, fuel costs etc.)
- 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 Terasen Gas personnel based on a combination of a literature review and the previous experience of both the consultants and Terasen Gas 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 were estimated.

The incremental cost is applicable when a technology is installed in a new facility, or at the end of the technologies 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 (2005) 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." [8] 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 ($/year)
AnnUpgr	= ongoing operating cost of the upgrade ($/year)

Step 5: Calculate the Measure Total Resource Cost (TRC)

The measure total resource cost 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 8%.

[8] 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.

A technology or measure with a positive measure total resource cost value is included in subsequent phases of the analysis, which consists of the economic and achievable potential scenarios. A measure with a negative measure total resource cost value is not economically attractive and is therefore not included in subsequent stages of the analysis.

It should be noted that the measure total resource cost 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.

4.2.1 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 Terasen Gas. The data provided were segmented on the basis of future year (over a 25 year period), end use or load shape and service area. Exhibit 4.1, provides a summary of the avoided natural gas supply costs for each combination of year, load shape and service area. To make the data more manageable, the annual values were averaged for each of the time periods shown in Exhibit 4.1. The distinction between low and high load factors reflects the difference in costs to supply each load type. Similarly, the cost data shown in Exhibit 4.1 reflect the modest differences in the cost of serving different service areas within the province.

Exhibit 4.1: Natural Gas – Avoided Supply Costs

Natural Gas	Load Shape							
	Low Load Factor (e.g., space heat)				High Load Factor (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	5.756	5.685	5.716	5.782	5.102	5.041	5.031	4.978
Lower Mainland	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782
Interior	6.968	6.85	6.892	6.98	5.786	5.685	5.716	5.782

1 kWh =3.6 MJ; 1GJ = 1000 MJ

- **Avoided Supply Cost of Electricity**

The avoided supply costs of electricity used in this analysis are shown in Exhibit 4.2. As illustrated, the electricity values have been organized symmetrically with the natural gas prices on the basis of measure life, load shape and service region.

The electricity supply costs shown in Exhibit 4.2 are estimated values based on the avoided cost of $0.06/kWh that was used in the earlier BC Hydro study. This value was an average value and reflected the cost of delivering an incremental kWh of new electricity supply to a lower mainland busbar.

Although the BC Hydro study used a single avoided cost value for all end uses, BC Hydro is also confronted with higher supply costs for end uses such as space heating that have peaky requirements. Detailed electricity supply costs were not available to this study for each of the defined load types. Consequently, based on discussions with the study team personnel, it was decided to assume that end uses with low load factors, such as space heating cost, on average, 10% more to supply than for end uses that have relatively high load factors, such as hot water. BC Hydro personnel confirmed that this value was generally consistent with recent values estimated by the utility. To accommodate this 10% cost spread and to also adhere to the same average avoided cost of $0.06/kWh, low load factor values were adjusted upwards by 5% from the average BC Hydro values and high load factor values were adjusted downwards by 5%.

The values shown in Exhibit 4.2 have also been adjusted to account for the delivery destination. The Terasen Gas values are for delivery to the customer. As the BC Hydro values are at a distribution busbar, the values were adjusted upwards by 7% (3% area transmission and 4% distribution)[9] to account for losses between the busbar and the customer.

As the same electricity avoided cost value was used for all three service areas in the BC Hydro study, no attempt was made to generate distinct service area values in this study.

[9] This approach omits bulk transmission losses of 5%; however, this is consistent with the approach that was applied in the BC Hydro CPR. It is also consistent with the general assumption that the most likely future electricity supply technologies will be developed closer to the load rather that at remote sites, such as the historical large-scale hydroelectric developments.

Exhibit 4.2: Electricity – Avoided Supply Costs

Electricity	Load Shape							
	Low Load Factor (e.g., space heat)				High Load Factor (e.g., DHW)			
Measure Life (Yrs)	10	15	20	25	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ	$/GJ
Service Area								
Vancouver Island	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Lower Mainland	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94
Interior	18.73	18.73	18.73	18.73	16.94	16.94	16.94	16.94

1 kWh =3.6 MJ; 1GJ = 1000 MJ

- **Customer Energy Prices**

The customer energy prices used in this analysis are presented in Exhibit 4.3. These values are used in the calculation of customer payback periods that are presented in later sections of this report. In the case of both electricity and natural gas, 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.

Exhibit 4.3: Customer Energy Prices

Customer Energy Prices	Residential		Commercial		Manufacturing	
	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0132	$0.0169	$0.0113	$0.0135	$0.0094	$0.0135
Lower Mainland	$0.0105	$0.0169	$0.0099	$0.0135	$0.0087	$0.0135
Interior	$0.0104	$0.0169	$0.0098	$0.0135	$0.0086	$0.0135

4.3 SUMMARY OF ENERGY EFFICIENCY SCREENING RESULTS

A summary of the screening results for the energy efficiency technologies is presented Exhibit 4.4 below. Due to the number of technologies involved, Exhibit 4.4 shows only those that pass the measure TRC test. Additional, detailed results for all energy efficiency technologies are presented in Appendix C.

Exhibit 4.4: Summary of TRC Measure Screening Results Manufacturing Sector Energy Efficiency Technologies

Technology	Target Market			Simple Payback (Yrs)	Measure TRC	B/C Ratio
	Service Area	Major End Use and Sub Sector(s)	Full/Incr			
3.3 MMBTU Condensing Boiler Constant Load	VI	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	3.5	99,266	1.5
3.3 MMBTU Condensing Boiler Constant Load	L M & Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	3.8	146,015	1.8
3.3 MMBTU Condensing Boiler Variable Load	V I	Process Heat in Food- Greenhouses	Full	3.5	146,015	1.8
3.3 MMBTU Condensing Boiler Variable Load	L M & Int	Process Heat in Food- Greenhouses	Full	3.3	238,773	2.4
Distribution System Insulation on Constant Process Heat Load	V I	Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	1.5	24,389	3.5
Distribution System Insulation on Constant Process Heat Load	LM & Int	Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	1.5	29,779	4.3
Pinch Technology	LM & Int	Food, Chemicals and Paper Process Heat	Full	5.0	13,108	1.1
High Efficiency Lumber Dry Kilns	V I	Wood Process Heat	Incr	4.0	157,602	1.2
High Efficiency Lumber Dry Kilns	LM & Int	Wood Process Heat	Incr	4.0	329,212	1.4
High Efficiency Veneer Dryers	V I	Wood Process Heat	Incr	3.0	177,586	1.5
High Efficiency Veneer Dryers	LM & Int	Wood Process Heat	Incr	3.0	268,608	1.9

Selected highlights from Exhibit 4.4 are summarized below.

- Condensing boilers, distribution system insulation, and pinch technology are all economic on a full cost basis. This means that it is economic to install these technologies even if they replace existing, standard efficiency equipment that are not yet near the end of their useful life.

- 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 are not included in the results shown in Exhibit 4.4, due to their small market share. These include: heat treating furnace upgrades, efficient food processing ovens, direct fired hot water heating; direct fired paper drying; boiler upgrades such as controls and heat recovery; and radiant tube heating.

4.4 SUMMARY OF FUEL CHOICE SCREENING RESULTS

None of the manufacturing sector fuel choice technologies assessed in this study provided economic and practical opportunities for the cost effective substitution of natural gas for electricity.

4.5 DESCRIPTION OF ENERGY EFFICIENCY TECHNOLOGIES

This section provides a brief description of each of the energy efficiency technologies that are included in this study, as listed in Exhibit 4.5.

Exhibit 4.5: Energy Efficiency Technologies for the Manufacturing Sector

Near-condensing boiler	Direct-fired water heating
Condensing boiler	Absorption chillers
Boiler combustion air preheat from exhaust	Sequential firing burners
Feedstock preheating	High-velocity burners
Boiler economizer	Oxy-fuel burner for scrap aluminium melting
Boiler condensation heat recovery	Advanced lumber dry kiln controls
Advanced boiler controls	Advanced laundry technologies
Boiler low excess air burners	Efficient veneer dryers
Distribution System Insulation	Pinch technology
Furnace insulation	High efficiency food processing ovens
Efficient lumber dry kiln	Boiler turbulators
Direct fired heating	Radiant tube heating

The discussion is organized and presented in the following sub sections:

- Boilers
- Wood product technologies
- Metal fabricating technologies
- Food processing technologies
- Other applicable technologies
- Non-applicable technologies.

In each case, the text provides the following:

- The current baseline technology
- A brief description of the upgrade technology
- The target sub sectors and processes where the technology can be practically applied
- Information on the technologies energy performance and cost relative to the baseline technology
- The expected useful life of the technology
- If the technology has been dropped from further review, a reason is given for doing so.

Detailed cost and performance data are provided in Appendix C.

4.5.1 Boilers[10]

Boilers are used for process steam or process hot water heating. For the purposes of this study, it is assumed that boiler load is negligible in the fabricated metal manufacturing sector, and in the lumber and plywood and divisions of the wood sub sector.

Seasonal efficiency is used throughout this discussion; seasonal boiler efficiencies for process heat applications range from 68% for a standard efficiency boiler to 92% for a condensing boiler. For manufacturing sector retrofits, it is assumed that the installed cost is 2.5 times capital cost. Installed cost may be higher in the manufacturing sector than for a comparable boiler size in the commercial sector due to the complexity of some retrofits.

Energy efficiency opportunities for boilers include:

- Near condensing boilers
- Condensing boilers
- Boiler economizers
- Boiler combustion air pre-heating
- Boiler condensation heat recovery
- Advanced boiler controls
- Low excess air burners
- Turbulators.

- **Near Condensing Boilers**

Near condensing boilers are suitable for process hot water applications where the return water temperature is above that required for condensing boilers e.g., laundries. Near condensing boilers typically have a peak efficiency of 85%. These boilers achieve high efficiency with advanced heat exchangers, modulating burner control, high quality insulation, and a number of other features including those treated separately below.

An installed cost of about $33/kBTU capacity is reported by vendors and in the literature for near condensing boilers. The useful life of near condensing boilers is assumed to be 25 years. There is no substantial increase in maintenance or electricity consumption compared to a standard boiler. 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 are appropriate for process hot water heating where the return water temperature can be maintained below 49 °C e.g., greenhouse heating.

Condensing boilers have high efficiency components such as modulating control and low excess air burners, and they also have condensing heat exchangers that transfer heat from

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[10] 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.

the exhaust flue gas to the return water. Condensing boilers need low return water temperatures (below 49 °C) and low flow rates to operate at peak efficiency. If return water temperatures below 49 °C cannot be provided, a condensing boiler will operate at efficiencies typical of a near-condensing boiler. Condensing boilers are not always feasible in the manufacturing sector as complex retrofits may be required. For steam applications, a condensation heat exchanger can be used to transfer heat from the exhaust flue gases to boiler make up water or some other heat sink. Condensation heat exchangers are treated separately below.

An installed cost of about $46/kBTU capacity is reported by vendors and in the literature for condensing 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. Increased maintenance costs of approximately $1,600 annually (2 days labour for a skilled tradesperson) over a standard efficiency boiler are assumed.

- **Bundled Standard Boiler Upgrades**

Bundled standard boiler upgrades include advanced control, efficient burners, and condensation heat recovery. These upgrades are suitable for steam applications where a heat sink, such as boiler make up water, is available e.g., a steam boiler in the Chemicals sub sector. This analysis assumes that the upgrades are added as a bundle to a standard efficiency boiler, although it may be possible to add each technology individually.

The addition of a condensation heat recovery unit to a boiler combustion stack recovers the latent heat of the flue gases for combustion air preheating and/or makeup water preheating. This is an economic retrofit for processes that have a heat sink, such as boiler make up water, but do not necessarily have conditions appropriate for a condensing boiler.

Advanced boiler controls can lead to significant energy savings. For example, 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 enable 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 with 5% excess air.

An installed cost of about $29/kBTU is reported by vendors and in the literature for the above bundle of upgrades on a standard efficiency boiler. The useful life of the upgrades is assumed to be 15 years. The average natural gas efficiency increase is assumed to be from a seasonal efficiency of 68% for a standard boiler to a seasonal efficiency of 85%

for a standard boiler with all of the upgrades. No increase in maintenance costs, over a standard efficiency boiler, is assumed.

- **Other Boiler Improvements**

A number of boiler improvements exist that are suitable for minor efficiency improvements to existing boilers. In general, these technologies may be considered low cost retrofits for applications where replacing the entire boiler is not feasible.

Boiler Economizers

Economizers transfer waste heat from boiler exhaust gas to boiler feedwater or makeup water, thereby reducing the amount of heat that must be supplied by the fuel.

Economizers are suitable when flue temperatures are below 230°C. Most high efficiency boilers are equipped with internal economizers; consequently, this technology is primarily applicable to retrofit applications.

The cost of an installed economizer in a retrofit application varies greatly depending on boiler configuration. Experience has shown that only a modest number of retrofit applications have configurations that make this option practical.

The useful life of economizers is 15 years. The average natural gas seasonal efficiency increase is approximately 4% when added to a standard efficiency boiler.

Boiler Combustion Air Preheaters

Boiler combustion air preheaters capture waste heat in the boiler flue gases to preheat the combustion air. This transfer reduces the amount of fuel needed to bring the air up to combustion temperature.

A simple payback period of one year is reported by vendors and in the literature for installations on standard efficiency boilers. The useful life of combustion air preheaters is 15 years. The average natural gas seasonal efficiency increase is 4% when added to a standard efficiency boiler.

Boiler Turbulators

Older fire-tube boilers can benefit from installation of turbulators in boiler tubes to increase heat exchange. This measure might be considered as a short-term measure, until complete replacement of the boiler is feasible.

4.5.2 Wood Sub Sector Technologies[11]

Lumber and wood products drying are the major uses of natural gas in the wood products sub sector. 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 British Columbia which, in addition to using significant amounts of thermal energy, also use a lot of electricity for fan power. Some larger sawmill operations have converted to boiler heated steam or thermal oil for kiln heating, in which case the fuel is wood waste, not natural gas. The sawmill industry as a whole is moving away from natural gas and towards wood waste alternatives for heating dry kilns.

Three energy efficiency technologies were assessed:

- Advanced dry kilns
- Efficient dry kilns
- High efficiency veneer dryers.

- **Advanced Dry Kiln Controls**

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 controls improves energy efficiency, drying time, and final product quality.

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 from an efficiency of 55% 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. No increase in maintenance costs is assumed.

- **Efficient Dry Kilns**

In addition to control systems, a number of upgrades are possible to convert an average kiln into an energy efficient kiln. These upgrades include automatic venting, load balancing, improved 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 seasonal efficiency is assumed to increase from 55% for a standard kiln to 85% for an advanced kiln. The average reduction in electricity consumption is assumed to be 20% following the upgrades. No increase in maintenance costs is assumed.

[11] Dry Kiln economics based on references cited in Bibliography and on personal communication with Fred Spinola, General Manager, Coe Manufacturing, and Ken McClure, Sales and Marketing Manager, Wellons Canada.

- **High Efficiency Veneer Dryers**

Veneer dryers are the major gas consumer at plywood plants in the wood sub sector.

Veneer dryers operate as a continuous process with multiple lines of veneer. The typical configuration of a veneer dryer is a long chamber with rollers on belts to move the veneer through the dryer. Temperatures in the dryer may be as high as 100°C. 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 current trend in the plywood sector is 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 seasonal efficiency is assumed to increase from 50% for a standard veneer dryer to 70% for an efficient veneer dryer.[12] No increase in maintenance costs is assumed.

4.5.3 Metal Sub Sector Technologies

Heat treating and annealing are used primarily in the fabricated metal sector. Two measures were assessed:

- Sequential firing, high velocity burners
- Furnace ceramic fibre insulation.

- **Sequential Firing, High Velocity Burners**

Sequential firing is 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 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 a 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, and high velocity burners are added as a bundle to standard efficiency heat treating furnaces.

A simple payback period of three years is reported by vendors and in the literature for new installations. The useful life of these technologies is assumed to be 15 years. The average natural gas seasonal efficiency increase is from a standard burner efficiency of

[12] Veneer dryer performance based on references cited in the Bibliography and on personal communication with Dave Chard, Westmill Industries.

25% to an upgraded burner efficiency of 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. No increase in maintenance costs is assumed.

- **Furnace Ceramic Fibre Insulation**

High temperature ovens used in forges, foundries and metal fabrication require insulation capable of withstanding severe thermal cycling and sometimes, abrasive and chemical attack. Ceramic insulation was demonstrated on the space shuttles and other re-entry vehicles to be capable of withstanding these stresses, and soon became popular in industry.

Ceramic fibre insulation is now made in blanket, board and block form to meet all installation and application requirements.

The installed cost of ceramic fibre insulation in new installations or scheduled replacement of refractory is about the same as for traditional insulating refractory brick and block. Retrofit installations usually pay back the cost in three years. When applied in the proper applications there is no net change in maintenance costs. The useful life of ceramic fibre insulation is about ten years. It is assumed that a 15% reduction in natural gas use is observed after replacing standard furnace insulation with ceramic fibre insulation.[13] No increase in maintenance costs is assumed.

4.5.4 Food Sub Sector Technologies

Two technologies were assessed that are applicable specifically within the food sub sector. They are:

- High efficiency ovens
- Direct-fired and radiant tube heat.

- **High Efficiency Ovens**

High efficiency ovens are found in the food processing and baking divisions of the food 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 seasonal efficiency increase is from 65% for a standard oven to 80% for an efficient oven.[14] No increase in maintenance costs is assumed.

[13] Ceramic Fibre insulation economics and performance based on references cited in Bibliography and on personal communication with Barry Allan, Inproheat.

[14] Oven economics and heat savings based on references cited in Bibliography and on personal communication with Revent Oven of New Jersey, USA.

- **Direct-Fired and Radiant Tube Heating**

Direct fired heating and radiant tube heating are both used in the food sub sector. Direct fired heating is used in food processing and in poultry barns, and radiant tube heating is used only in poultry barns. Direct fired heating offers savings over boiler heat because it has higher natural gas efficiency and radiant tube heating offers savings over boiler heat because it allows poultry barns to operate at a lower overall temperature.

A natural gas seasonal efficiency of 90% is assumed for direct fired heating, and 85% 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. No increase in maintenance costs is assumed.

4.5.5 Other Applicable Technologies

In addition to the preceding technologies, there are a number of others that have application in a range of sub sectors. They are:

- Distribution system insulation
- Pinch technology
- Direct fired paper drying
- Direct fired water heating.

- **Distribution System Insulation**

This measure assesses insulating a facility's piping distribution system at partial and full levels. The baseline was assumed to be a food processing plant with a partially insulated distribution system, which retains 50% of the heat lost in bare piping. A model facility was developed to calculate the potential savings on a plant wide basis. A fully insulated distribution system was assumed to be insulated to the economic thickness of one inch, and to retain 92% of the heat that would be lost from bare piping, as per the North American Insulation Manufacturers Association (NAIMA) software 3E Plus. The simple payback period for the installation of fully insulation was calculated to be one and a half years with a lifetime of 20 years, as per NAIMA.

- **Pinch Technology**

Pinch technology is a process heat integration software used to optimize heat recovery between operations at different temperatures. Pinch technology is most effective at facilities that have a range of different temperature applications such as pulp mills, oil refineries and drink processing plants.

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. Pinch analysis provided the tools to analyze and optimize the 'recycling' of heat within a plant to minimize the requirement for purchased energy. As Pinch Technology developed, benefits went beyond energy conservation. 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 technology 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 BC uncovered opportunities which resulted in the reduction of 275,000 GJ of natural gas annually, with the potential for a further 155,000 GJ per year. When completed, the mill may save $2.1 million per year in fuel costs, providing a 7 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.

Pinch Technology crosses over to all process streams within an operation. This study assumes that a plant-wide reduction in energy consumption of 10% is possible with an investment that would result in a five year payback. This payback is an estimated average value. The application of pinch Technology will increase maintenance requirements in some areas, but will decrease maintenance in others. This study assumes no net change.

- **Direct Fired Paper Drying**

The paper sub 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 desired form.

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 the slow rate of drying from 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 infra red 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 infra-red 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 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 reduction in fuel usage of about 7% per tonne of product, but will allow an increase in production of approximately 17%, providing a simple payback of three years. The useful life of direct-heated gas drying technologies is assumed to be 20 years.

- **Direct Fired Water Heating**

Direct gas fired water heaters have 98% or greater heat transfer efficiency. Direct fired hot water heaters are suitable for applications where process hot water is consumed, rather than re-circulated as in a boiler system e.g., sanitation in a poultry plant.

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 year is assumed for the installation of direct fired water heaters over standard tank type water heaters. The useful life of direct fired water heaters is assumed to be ten years. The natural gas efficiency increase is assumed to be from a tank type water heater efficiency of 75% to a direct fired water heater seasonal efficiency of 95%.[15] The useful life of the technology is assumed to be ten years.

4.5.6 Non-Applicable Technologies

A number of additional energy efficiency technologies received a preliminary review and based on the results of that initial review, were discarded from further analysis. A brief description of these additional technologies is provided below.

[15] Direct fired water heating economics and performance based on references cited in Bibliography and personal communication with Luc Mandeville, Sofame Technologies, and with Bill Carson, Direct Contact Inc.

- **Absorption Chillers and Gas-Engine Driven Chillers**

Most chillers are mechanically powered by electric motors. Absorption chillers however, chill water by using a thermodynamic process that uses the heat energy from burning natural gas. Absorption chillers consist of a generator and evaporator, and an absorbent fluid and a refrigerant fluid. In the past, absorption chillers found application where large amounts of waste heat were available, or where the demand charge for electricity was excessive, such as in the downtown core of some large cities.

Absorption chillers became generally uneconomic when technological improvements increased the efficiency and reliability of electrically powered chillers. Today, even when 'free' waste heat is available, customers usually choose an electrically powered mechanical chiller over an absorption chiller. At present, the absorption chilling process is mainly used for non-grid connected applications like recreational vehicle refrigerators.

A detailed economic analysis of technologies for providing chilled water to schools in the interior of British Columbia was completed by Stantec Consulting Ltd. of Kelowna. The report states "Gas rates would have to be $2.25 or less, to make gas fired machines cost effective." Both gas-engine driven and absorption chillers were investigated, and the absorption chillers had by far the worst economics. Although the Stantec study was done only for school applications, the virtual non-existence of gas driven chillers in the market suggests that their low efficiency and high gas chiller capital costs combined with the high cost of natural gas will eliminate gas chillers from virtually all markets. Therefore, natural gas powered chillers were not considered as a feasible fuel displacement technology for the purposes of this study.

- **Oxy-Fuel Burner for Scrap Aluminum Melting**

Aluminium scrap melting is a very small industry in BC. The one large aluminium scrap melting facility is a large interruptible customer and, therefore, is outside the scope of this CPR.

- **Advanced Laundry Equipment**

Advanced technologies, such as washing clothes in liquid CO_2, are under development but are not considered to be commercially proven.

- **Feedstock Preheating Using Load Recuperation and Regeneration**

Load recuperation is the process of capturing heat from combustion exhaust gases and transferring the heat to incoming process feedstock. Facilities that have condensing boilers and process feedstock that requires heating can benefit from load recuperation. Load recuperation is most effective in continuous processes and when the waste heat from the boiler or furnace cannot be used to preheat combustion air or boiler feed water. In most cases, a higher level of heat recovery is possible if the heat is recycled to combustion air or feed water, as described above.

Combustion air and feed water preheating provide the same benefits as load recuperation or regeneration. As these technologies are easier to quantify and are more widely available, they were included in the analysis rather than load recuperation.

4.6 FUEL CHOICE OPPORTUNITIES

This sub section provides a brief description of the fuel choice technologies and measures that were addressed in this study, as listed in Exhibit 4.6.

Exhibit 4.6: Fuel Choice Technologies for the Manufacturing Sector

Infra-red heating to replace steam on paper machines	Gas engine-driven air compressors
Direct fired paper-drying	Gas flame cutting
Rapid heating (steel, glass)	Co-firing gas in solid-fuelled boilers
Ceramic radiant tube heat-treating	Gas lean-burn for NO_X control in solid fuel combustion
Direct fired laundry drying	Direct fired lumber dry kilns

As noted previously in Section 4.4, none of the manufacturing sector fuel choice technologies assessed in this study provided economic and practical opportunities for the cost effective substitution of natural gas for electricity. Below is a brief description of the technologies that were considered.

4.6.1 Direct Fired Paper Drying

Direct fired paper drying is discussed in detail under fuel efficiency measures, where the technology competes with steam natural gas fired boilers. At the large pulp and paper mills that are outside of the scope of this study, direct fired paper drying would compete with wood waste fired boilers. In those cases, direct fired paper drying would be a fuel choice technology.

4.6.2 Rapid Heating (Steel, Glass)

Rapid heating technology applies to the steel forging industry, primarily where mass production or large batch production of steel forging is done, or to glass manufacturers that use continuous production. The forging operations within the scope of this study tend to be custom or small batch operations. These operations can benefit form the use of ceramic fibre insulation, sequential firing, and high velocity burners, all of which are covered in this report. Rapid melting of glass applies to very large continuous operations, which are outside of the scope of this study.

4.6.3 Ceramic Radiant Tube Heating

Ceramic radiant tubes are used to heat-treat steel castings or forgings where exposure to combustion gases would cause deterioration of the metal being heat treated. The type of steel for which this applies is not generally produced in BC and when required, can be produced using ‘atmosphere gases’ or muffle ovens, although not as efficiently.

4.6.4 Gas Engine Driven Chillers

This subject is covered in Absorption Chillers, above.

4.6.5 Gas Flame Cutting

Although large metal manufacturing shops can save on flame cutting costs by using natural gas, the total energy required for flame cutting is low. The small market share of this technology in B.C. is too small to warrant further review.

4.6.5 Co-Firing Gas in Solid Fuel Boilers

The design of solid fuel boilers has improved to the point where gas is required only to light the boiler from cold. The large gas demand and very short duty cycle results in a very poor load factor for gas. Gas usage in older solid fuel boilers such as in pulp mills is large, but these customers are outside the scope of this study.

4.6.6 Gas Lean-Burn for NO_X Control in Solid Fuel Combustion

NO_X control for large boilers is becoming more important in large urban centres. Low cost techniques such as urea injection have been proven to provide NO_X control at much lower cost than by using natural gas together with complicated rich-burn lean-burn modes required to reduce NO_X levels. It is not expected that gas lean burn for NOx control will become a significant gas load. Therefore, this technology did not warrant further review.

4.6.7 Gas Fired Lumber Dry Kilns

In the British Columbia wood products industry there is a movement away from natural gas and towards wood waste for heating fuel. A number of motivators are behind this trend, including cost, Kyoto protocol benefits, and increased regulations regarding the traditional disposal methods of wood waste. A direct fired lumber dry kiln or veneer dryer will give a higher overall fuel efficiency than indirect heat, but because of the reasons given above, any changes to the heat source for dry kilns and veneer dryers is expected to be towards wood waste fuel, not towards direct fired natural gas.

The exception to this is small kiln operators. For small kilns (below 10,000 MBF of lumber) such as those found on Vancouver Island, direct fired natural gas systems are more economic due to their low capital cost. Kilns of this capacity are likely already using direct fired gas, not wood waste, and therefore do not truly represent a fuel choice opportunity. Also, kilns in this size range represent a very small portion (< 3%) of total gas use in the wood products sector. Consequently, fuel switching to direct fired natural gas was not reviewed further.

4.7 LOAD RETENTION CONSIDERATIONS

In the manufacturing sector, natural gas has become the fuel of choice for process heating loads. This has occurred over the last 20 years due to several factors including: environmental concerns with other fuels; ease of use; and, low price relative to electricity and other fuels. However, with the recent increase in natural gas prices relative to other alternatives, both electricity (boilers) and wood waste (kilns) are more competitive. Consequently, the issue confronting Terasen Gas at this time is not load addition employing fuel choice technologies but load retention.

During the analysis of energy efficiency and fuel choice opportunities, it became evident that high efficiency boilers and lumber kilns not only provide energy efficiency opportunities but, in addition, they may be key to load retention in a number of important applications.

Exhibits 4.7 and 4.8 provide two case examples of the potential contribution of, respectively, high efficiency natural gas boilers and lumber kilns to Terasen Gas's load retention objectives.

Exhibit 4.7: Case Example #1: High Efficiency Boilers and Load Retention

Sophisticated control technology can be used to operate electric boilers to supply a portion of the process heating load without incurring an electric demand charge. In these applications, the control technology is used to operate the electric boiler only when the electric demand for the facility is below the facility's monthly peak demand. This control strategy meets only a portion of the process heating load but, under proper conditions, can provide significant financial savings.

To determine whether the above option is financially attractive to customers this study compared the annual energy costs under two scenarios using BC Hydro's electricity rates and current natural gas costs. The analysis is based on a 3.3 million btu/hr boiler operating at full load 50% of the time.

The tables below show the results of this comparison. They indicate that for a standard efficiency boiler (68% seasonal efficiency assumed) in the Lower Mainland, the electric alternative would be approximately $30,000 a year less expensive. The $30,000 annual savings could be enough to induce customers to switch to electric boilers with controls to avoid demand charges, particularly if customers thought that gas prices were going to further increase.

On the other hand for a condensing boiler (92% seasonal efficiency assumed), the electric alternative would be approximately $3,000 more expensive.

Boiler Efficiency Versus Annual Fuel Requirements

Boiler Type	Efficiency (%)	Useful Heat (GJ/year)	Heat Purchased (GJ/year)
Standard Gas Boiler	68%	10,200	15,000
Condensing Gas Boiler	92%	10,200	11,087
Electric Boiler	100%	10,200	10,200

Gas Versus Electricity Costs in Each Service Area

Customer Energy Cost	Vancouver Island	Lower Mainland	Interior
Natural Gas	$9.40 / GJ	$8.67 / GJ	$8.60 / GJ
Electricity	$9.67 / GJ	$9.67 / GJ	$9.67 / GJ

Annual Operating Cost of Standard and Efficient Gas Boiler and Electric Boiler By Service Area

Cost to Operate 10,200 GJ/Yr Output Boiler	Vancouver Island	Lower Mainland	Interior
Standard Gas Boiler	$ 141,000 / year	$ 129,000 / year	$ 130,050 / year
Condensing Gas Boiler	$ 104,217 / year	$ 95,348 / year	$ 96,124 / year
Electric Boiler	$ 98,650 / year	$ 98,650 /year	$ 98,650 / year

Notes:
A typical annual process heat purchase within the sector is 15,000 GJ per year. The results above assume that 15,000 GJ/year is the amount of heat purchased to run a standard efficiency (68% seasonal efficiency) boiler.

The cost of electricity used is the BC Hydro Rate 1200 energy cost published by BC Hydro, and is calculated based on operating an electric boiler to provide the same amount of useful heat as a standard gas boiler consuming 15,000 GJ annually.

Demand charges are not included in the cost of electricity. It is assumed that the customer has the ability to avoid demand charges by switching to gas during peak demand times.

Exhibit 4.8: Case Example #2: High Efficiency Kilns and Load Retention

With the recent increase in natural gas prices, the wood products industry has begun to seriously consider wood waste alternatives for their kiln operations.

For a typical sawmill and dry kiln operation, the capital cost of the wood waste heating system and its associated payback is the key consideration in the decision to convert from natural gas to wood waste. The efficiency of the natural gas kiln has a significant effect on the outcome of this financial analysis. Unfortunately, a significant number of the gas kilns in operation today are not being operated very efficiently, which makes the wood waste alternative more financially attractive.

The tables below analyze the impact of kiln efficiency on the payback period of the waste wood heating system investment. As illustrated, the payback for a typical kiln in the interior varies from about 2.6 years for an average efficiency kiln to 4.1 years for a high efficiency unit. It is important to note that these values are rough estimates only. However, they do indicate the significance of efficiency in maintaining load. A two year payback would typically be sufficient for the industry to invest in the waste wood system; however, the investment is unlikely if it has a 4 to 5 year payback.

It is also important to note that these payback calculations are based on what could be considered a relatively high cost of natural gas. The U.S. Department of Energy's long-term forecast for natural gas is lower than these levels. Accordingly, if the cost of natural gas does drop to the forecast lower long-term prices, the payback for the alternatives to natural gas will even be longer.

Kiln Efficiency Versus Annual Fuel Purchase

Lumber Dry Kiln Type	Efficiency	Purchased Gas (GJ / Year)	Useful Heat (GJ / Year)
Standard Gas Kiln	57%	59,400	32,670
Efficient Gas Kiln	87%	38,917	32,670
Wood Waste Kiln	100%	0	32,670

Fuel Cost and Capital Cost of Wood Waste Equipment

Customer Cost	Vancouver Island	Interior	Lower Mainland
Natural Gas	$ 9.40 / GJ	$ 8.60 / GJ	$ 8.67 / GJ
Wood Waste	$ 1.00 / GJ	$ 1.00 / GJ	$ 1.00 / GJ
Capital Cost of Conversion	$1,237,500	$1,237,500	$1,237,500

Simple Payback – Conversion to Wood Waste

Simple Payback	Vancouver Island	Interior	Lower Mainland
Standard Gas Kiln to Wood Waste Kiln	2.4 Years	2.6 Years	2.6 Years
Efficient Gas Kiln to Wood Waste Kiln	3.7 Years	4.1 Years	4.1 Years

Notes:
Standard lumber dry kiln gas consumption is assumed to be 59,400 GJ / year.

The seasonal efficiency is assumed to be 57% for a standard gas fired kiln and 87% for an efficient gas fired kiln. Capital cost of conversion from gas fuel to wood waste fuel is assumed to be $1,237,500. The cost is based on industry figure of 12 million dollars for 50 MMBtu/hr of useful heat, and 6,000 operating hours annually.

The cost of useful heat from wood waste is assumed to be $1.00 / GJ. This assumes that efficiency losses are captured in the price of $1.00 / GJ and therefore an efficiency of 100% is used in the calculations for wood waste economics

5. ECONOMIC POTENTIAL FORECAST – ENERGY EFFICIENCY SCENARIO

5.1 INTRODUCTION

This section presents the Manufacturing Sector Economic Potential Forecast – Energy Efficiency Scenario for the study period (FY 2003/04 to FY 2015/16). 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 Total Resource Cost (TRC) test, as discussed previously in Section 4.2[16]

The discussion in this section is organized and presented in the following subsections:

- Major modelling tasks
- Technologies included in Economic Potential Forecast
- Presentation of results
- Interpretation of results.

5.2 MAJOR MODELLING TASKS

By comparing the results of the manufacturing sector Economic Potential Forecast with the Reference Case Forecast, it is possible to determine the aggregate level of potential natural gas savings within the manufacturing sector and to identify specific sub sectors and technologies that provide the most significant opportunities for savings. To develop the manufacturing sector Economic Potential Forecast, the following tasks were undertaken:

- The results of the energy efficiency measures screening, which were presented in the preceding Section 4, were reviewed. All the natural gas energy efficiency upgrades that passed the measure total resource cost screening were included in this Economic Potential Forecast.

- The rate of stock entry and the applicable sub sector(s) were determined for each efficiency measure included in the forecast. For example, if a measure passed the measure total resource cost screening on a full cost basis, then it was introduced into the entire applicable stock in the first study year. Alternately, if a measure passed on an incremental basis, then it was introduced at the rate of normal stock replacement (i.e., as existing equipment reached the end of its life, or new capacity was added). It was assumed that normal stock replacement would occur once the equipment reached 75% of its useful life.

[16] Energy markets in Canada and worldwide have experienced a number of extraordinary events in the recent past. As a result, natural gas costs have risen substantially since the start of this CPR. As current natural gas costs are higher than those used in this analysis, the benefits of efficiency measures may be understated while the benefits of fuel choice measures may be overstated. Within the limits of the time and resources available, this CPR has attempted to accommodate the increasing natural gas prices by applying a "high level" price sensitivity analysis to the measures screening process. Efficiency measures that were close but did not initially pass the measures TRC test have been included in the Economic Potential scenario. This approach recognizes that the measures will be subject to further economic screening during the detailed program design stage, which will provide a further opportunity to decide whether the measures should continue to be included in Terasen's program portfolio.

- The technology market shares in the model were adjusted based on the results of preceding task and the Economic Potential Forecast was calculated.

- The results of the Economic Potential Forecast were compared to the Reference Case Forecast results and the energy savings were calculated.

5.3 TECHNOLOGIES INCLUDED IN ECONOMIC POTENTIAL FORECAST

The technologies presented in this energy efficiency Economic Potential Forecast can be grouped into three main categories. They are:

- Gas consuming technologies/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.

5.3.1 Technologies 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 75% 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 (for example, an efficient boiler can replace a standard boiler but cannot replace a rooftop air handling unit).

5.3.2 "Add-on" Technologies

Some technologies, such as 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. To avoid the risk of double counting energy savings, energy use from "add on" technologies is modelled separately from whatever technology the "add on" is applied to.

5.3.3 "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 5.1. 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 model.

Exhibit 5.1: Technologies Included in Economic Potential Forecast (Energy Efficiency)

End Use	Energy Efficiency Measures	Applicable Sub Sectors/Explanation
Comfort Heat	Boilers	Boilers are used to provide comfort heat in all three service areas in the following manufacturing sub sectors: other manufacturing, wood, paper, and food. Based on the results of the economic analysis, standard efficiency boilers are replaced with condensing boilers on an incremental basis. Replacement occurs at 75% of the useful life of the standard efficiency boiler, which is assumed to be approximately 19 years.
	Distribution System Insulation	Distribution system insulation is applicable in all three service areas in sub sectors wherever a significant portion of comfort heat is supplied by boilers. These sub sectors are: wood, food, paper, and other manufacturing. It is economic to upgrade comfort heat distribution system insulation on a full basis, that is, before the first milestone year. The market share of heat sold that is subsequently lost in poorly insulated distribution systems is zero by the first milestone year.
Process Heat	Boilers	Boilers provide some or all the process heat in all manufacturing sub sectors except fabricated metal. Based on the results of the economic analysis, it is economic to replace standard efficiency boilers with either condensing boilers or efficient boilers on a full cost basis, that is, before the first milestone year. Condensing boilers replace standard efficiency boilers for process hot water applications, and efficient boilers replace standard boilers for process steam applications. The market share of standard efficiency boilers is zero by the first milestone year. As discussed below under direct fired and radiant tube heat, a small portion of boiler stock is converted to direct fired heat at the rate of stock turnover
	Direct Fired Hot Water Heating	Direct fired hot water heating is used in all three service areas in the following sub sectors: food, non-metallic minerals, and other manufacturing. Based on the results of the economic analysis it is economic to replace tank type water heaters with direct fired hot water heaters on an incremental basis, that is, once the standard unit reaches 75% of its useful life. Over time, the market share of direct fired hot water heaters increases while the market share of tank type water heaters decreases.
	Distribution System Insulation	Distribution system insulation is applicable in all three service areas in sub sectors with a significant percentage of process heat supplied by boilers. These sub sectors are: food, chemical, non-metallic mineral, paper, and other manufacturing. Based on the results of the economic analysis, it is economic to install full insulation on all process heat distribution systems on a full basis, that is, by the first milestone year. The market share of heat sold that is subsequently lost in poorly insulated distribution systems is zero by the first milestone year.

Exhibit 5.1 (cont'd)

End Use	Energy Efficiency Measures	Applicable Sub sectors/Explanation
Process Heat	Heat Treating and Annealing Furnace Technologies	Heat treating and annealing furnace technologies are applicable in the fabricated metal sub sector. This sub sector has negligible market share on Vancouver Island. In both the Lower Mainland and Interior, it is economic to install ceramic fibre insulation on heat treating furnaces on a full basis; that is, by the first milestone year. It is economic to replace standard furnace burners with high velocity, sequential firing burners at the rate of stock replacement, which is assumed to be at when the unit reaches 75% of its useful life, or 8.9% annually. Over time the market share of standard furnaces declines while the market share of furnaces with high velocity, sequential firing burners grows.
	Efficient Bake Ovens	Bake ovens are used in the food sector in the Lower Mainland and Interior. Based on the results of the economic analysis, it is economic to replace standard efficiency ovens with high efficiency ovens on an incremental basis, that is, at the rate of stock replacement, which is assumed to be when the unit reaches 75% of its useful life, or 8.9% annually. Over time, the market share of high efficiency ovens grows while the market share of standard efficiency ovens shrinks.
	Pinch Technology	Pinch technology is assumed to be applicable in the food, chemicals and paper sub sectors in the Lower Mainland and Interior. It is economic to install pinch technology on a full basis, that is, by the first milestone year. The market share of heat sold that is subsequently lost due to not having pinch technology installed, is zero by the first milestone year.
	Gas Fired Laundry Dryers	Gas fired laundry dryers are used in the other manufacturing sector in all three service areas. There have been few developments in the efficiency of gas fired laundry dryers and currently there is no widely applicable efficiency upgrade for this technology. Therefore, it is assumed that equivalent technology is used in stock turnover and the technology maintains its original market share of useful heat.
	Direct Fired Heat and Radiant Tube Heat	Direct fired heat and radiant tube heat are applicable in the poultry and food processing sub sectors of the food sector. These two divisions of the food sub sector consume about one third of heat demand in the food sub sector. It is economic to replace boiler heat with direct fired heating on an incremental basis, that is, at the rate of boiler stock turnover. Approximately one third of process heat boilers in the Food sub sector are replaced with direct fired heat once the boiler reaches 75% of its useful life. It is economic to replace radiant tube heating with direct fired heat on an incremental basis, that is, at the rate of stock turnover, assumed to be when the unit reaches 75% of its useful life, or 5.3% annually. Over time, the market share of radiant tube heat decreases while the market share of direct fired heat increases.

Exhibit 5.1 (cont'd)

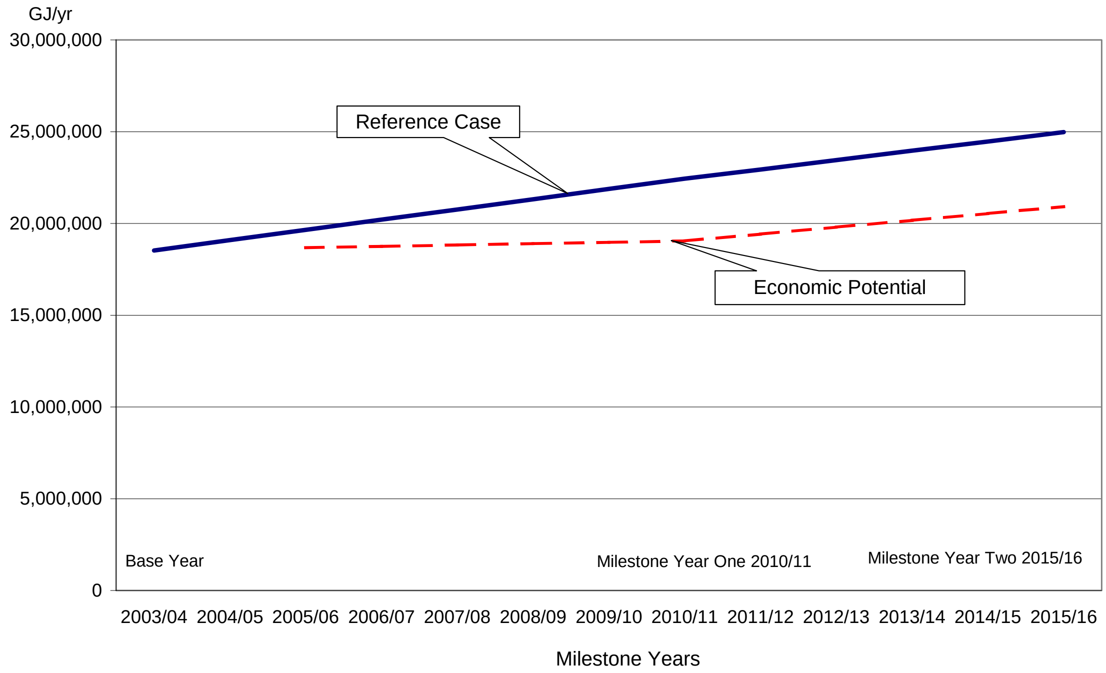
End Use	Energy Efficiency Measures	Applicable Sub sectors/Explanation
Process Heat	Wood Technologies	Efficient lumber dry kilns are used in the wood sub sector in all three service areas. Veneer dryers are used in the wood sub sector in the Interior only. It is economic to replace standard efficiency lumber dry kilns with efficient lumber dry kilns on an incremental basis, that is, at the rate of stock turnover. Likewise it is economic to convert standard efficiency lumber dry kilns with advanced control to high efficiency lumber dry kilns on an incremental basis, that is, at the rate of stock turnover. Stock turnover occurs at 75% of the standard kilns useful life, or 8.9% annually. The efficient lumber dry kiln market share of useful heat grows over time while that of standard lumber dry kilns and standard lumber dry kilns with advanced controls shrink. It is economic to replace standard efficiency veneer dryers with high efficiency veneer dryers on an incremental basis, that is, at the rate of stock replacement, which is assumed to be when the unit reaches 75% of its useful life, or 8.9% annually. The high efficiency veneer dryer market share of useful heat grows while that of standard efficiency veneer dryers shrinks in all regions.
	Direct Fired Paper Drying	Direct fired paper drying is applicable in the paper sub sector in the Lower Mainland and Interior Regions. It is assumed that in the base year paper drying takes up 25% of the steam produced from the boiler (reference: Energy Cost Reduction in the Pulp and Paper Industry, November 1999, Pulp and Paper Research Institute of Canada) It is economical to replace steam drying with direct fired drying on an incremental basis. Therefore direct fired drying replaces 25% of boiler heat at the rate of stock replacement.

5.4 PRESENTATION OF RESULTS

Exhibit 5.2 compares the manufacturing sector consumption results from the Reference Case Forecast to those in the Economic Potential Forecast.

As illustrated, under the Reference Case Forecast, manufacturing sector natural gas use would increase from the Base Year level of about 18,529,000 GJ/yr. to approximately 25,000,000 GJ/yr. by FY 2015/16. This contrasts with the Economic Potential Forecast in which natural gas use would increase to approximately 20,900,000 GJ/yr. by FY 2015/16 for a reduction of 4,100,000 GJ/yr, or just over 16% of the Reference Case Forecast.

Exhibit 5.2: Reference Case versus Economic Potential Forecast—Natural Gas Consumption for the Manufacturing Sector, (GJ/yr.)



5.4.1 Natural Gas Savings

Further details on the potential energy savings provided by the Economic Potential Forecast are provided in the following exhibits:

- Exhibit 5.3 presents the results by service region and milestone year.
- Exhibit 5.4 presents the results by sub sector and milestone year.
- Exhibit 5.5 presents the results by major end use.

Exhibit 5.3: Total Economic Potential Forecast Natural Gas Savings

Milestone Year	Lower Mainland	Interior	Vancouver Island	Total	Percent Savings Re: Reference Case
2010/11	1,801,054	1,487,654	105,180	3,393,888	15.1%
2015/16	1,982,285	1,939,593	133,902	4,055,780	16.2%
Percent Savings 2015/16 Over Reference Case	13.5%	20.2%	18.2%	16.2%	

Exhibit 5.4: Total Economic Potential Forecast Natural Gas Savings Over Reference Case by Sub Sector and Milestone Year, (GJ/yr.)

Sector	Total Savings		
	Base Year	2010/11	2015/16
Food	0	1,246,292	1,368,573
Chemical	0	189,091	193,363
Fabricated Metal	0	94,924	125,791
Non Metallic Mineral	0	134,613	150,984
Paper	0	90,302	85,032
Wood	0	1,439,513	1,894,643
Other	0	199,153	237,395
Total	**0**	**3,393,888**	**4,055,780**

Exhibit 5.5: Total Economic Potential Natural Gas Savings over Reference Case by Major Technology and End Use (GJ/yr.)

Technology End Use	Savings by 2015/16 (GJ/year)	% of Total
Lumber Drying	1,625,318	40%
Process Heat Boilers	1,322,486	33%
Distribution System Insulation	348,977	9%
Plywood	201,625	5%
Pinch Technology	159,586	4%
Hot Water Heaters	105,509	3%
Heat Treating and Annealing	125,791	3%
Bake Ovens	41,702	1%
Paper Drying	8,041	0%
Comfort Heat	78,832	2%
Other	37,914	1%
Total	4,055,780	100%

Detailed results are presented in Appendix D by sub sector, service area, end use and technology.

5.5 INTERPRETATION OF RESULTS

Highlights of the results presented in the preceding exhibits are summarized below.

❑ Savings by Manufacturing Sub Sector

- Given that the food and wood sub sectors account for over 75% of base year gas sales to the manufacturing customers included in this analysis, it is not surprising that these sectors also accounts for the highest proportion of identified savings.

- It is estimated that economic potential savings of approximately 1,400,000 GJ/year could be achieved in the food sub sector, and 1,900,000 GJ /year could be achieved in the wood sub sector. These two sub sectors account for 80% of total savings potential.

- The remaining savings are roughly distributed over the paper, chemical, fabricated metal, non-metallic minerals and other manufacturing sub sectors with paper having the highest potential savings and fabricated metal the lowest.

❑ Savings by Technology

- The dominant technologies used in the two sub sectors with the most savings potential, boilers in the food sub sector and lumber or veneer dryers in the wood sub sectors, are also those technology with the greatest potential savings.

- As illustrated in Exhibit 5.5, improved efficiency boiler equipment in all applicable sub sectors offers approximately 1,300,000 GJ/yr. of process heat savings potential by FY 2015/16. These savings come from a range of boiler equipment upgrades including condensing boilers for process hot water heating, and efficient boilers with heat recovery for process steam.

- Changes in lumber and veneer drying equipment in the wood sub sector offer approximately 1,800,000 GJ year of savings potential by FY 2015/2016. These savings are achieved by upgrading to high efficiency lumber dry kilns and veneer dryers with advanced control, heat recovery, improved insulation and air tightness.

- Other technologies with significant saving potential are distribution system insulation (9% of total, 350,000 GJ/year) and pinch technology (4% of total, 160,000 GJ/year).

❑ Savings by Service Area

- The Interior has a disproportionate amount of the economic savings potential compared to its base year sales. The Interior makes up 48% of economic savings potential, while accounting for 40% of total manufacturing sector base year sales. These results are explained by the large savings potential of lumber dry kilns and veneer dryers, the dominant gas consuming technologies in the region.

- The Lower Mainland provides about half of the economic savings potential, while accounting for almost 60% of base year sales. These results reflect the fact that the

Lower Mainland is the most diversified of the three service areas. Many gas-consuming technologies in the Lower Mainland, such as boilers, do have significant savings potential, but others, such as laundry technologies and warehouse unit heaters, do not have significant efficiency potential at this time. Furthermore, the Lower Mainland has a significant population of customers, such as large commercial greenhouse operations, that already use efficient technologies.

- Vancouver Island makes up both a small part of base year sales, and a small part of economic savings potential (approximately 3%).

Savings by Milestone Year

- Exhibit 5.2 shows that in the Reference Case Forecast, gas sales increase steadily to the first milestone year, FY 2010/11, and then continue to grow at a slightly reduced rate until the second milestone year, FY 2015/16. The reduction in the rate of growth leading up to the second milestone year is the result of an expected slowdown in the wood sub sector.

- In the Economic Potential Forecast, the rate of increase of gas sales is significantly less than that of the Reference Case Forecast leading up to the first milestone year. Between the first and second milestone year, the rate increases, but still stays below what is observed in the Reference Case Forecast. This pattern reflects the rate of introduction of efficient technologies. As discussed above, (see Exhibit 5.1) some efficient technologies, such as efficient boilers, are introduced to the economic potential model before the first milestone year, completely replacing the existing stock of standard boilers. The increase in efficiency of natural gas use offsets continuing growth in the manufacturing sector overall, and slows the rate of increase of gas sales. After the technology conversion is complete, the rate of growth of gas sales will eventually return to mirroring the rate of growth of the manufacturing sector, a trend that starts to appear towards the second milestone year.[17]

[17] The economic potential scenario assumes that technologies are introduced as soon as it is economic to do so, based on the economic inputs described under section 4. Replacement of the entire stock of standard boilers with efficient boilers by the first milestone year, as in the economic potential scenario, would not be economic if the marginal supply cost of gas were to fall below $4.00/GJ.

6. ACHIEVABLE POTENTIAL FORECAST

6.1 INTRODUCTION

This section presents the Manufacturing Sector Achievable Potential Forecast natural gas savings for the study period (FY 2003/04 to FY 2015/16). The Achievable Potential Forecast is defined as the proportion of the energy efficiency savings 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 sub sections:

- Description of Achievable Potential
- Approach to the Estimation of Achievable Potential
- Results.

6.2 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:

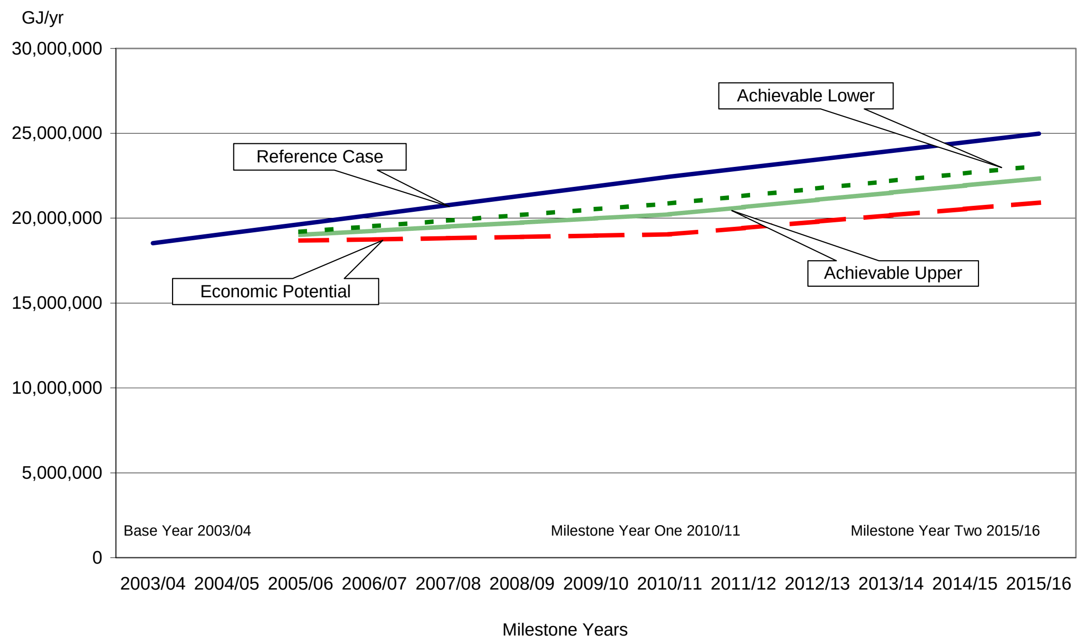
- Higher first cost of efficient product(s)
- Need to recover investment costs in a short period (payback)
- Lack of product performance information
- Lack of product availability.

The rate at which customers purchase energy-efficiency technologies will be influenced by the level of financial incentives, information and other measures put in place by Terasen Gas, BC Hydro, governments and the private sector to remove barriers such as those noted above.

Exhibit 6.1 (overleaf) presents the levels of natural gas consumption that are estimated in the Achievable Potential. 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 6.1 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 6.1 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 6.1: Annual Natural Gas Consumption—Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Manufacturing Sector, (GJ/yr.)



As also illustrated in Exhibit 6.1, 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 10-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: "most likely" and "upper".

- The "**Most Likely" Achievable Potential** scenario assumes B.C. market conditions that are similar to those contained in the Reference Case. That is, the customers' awareness of energy efficiency or fuel choice 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 Terasen Gas's ability to influence customers' decisions towards increased investments in energy efficiency or fuel choice options remain "roughly" in line with previous company DSM experience.

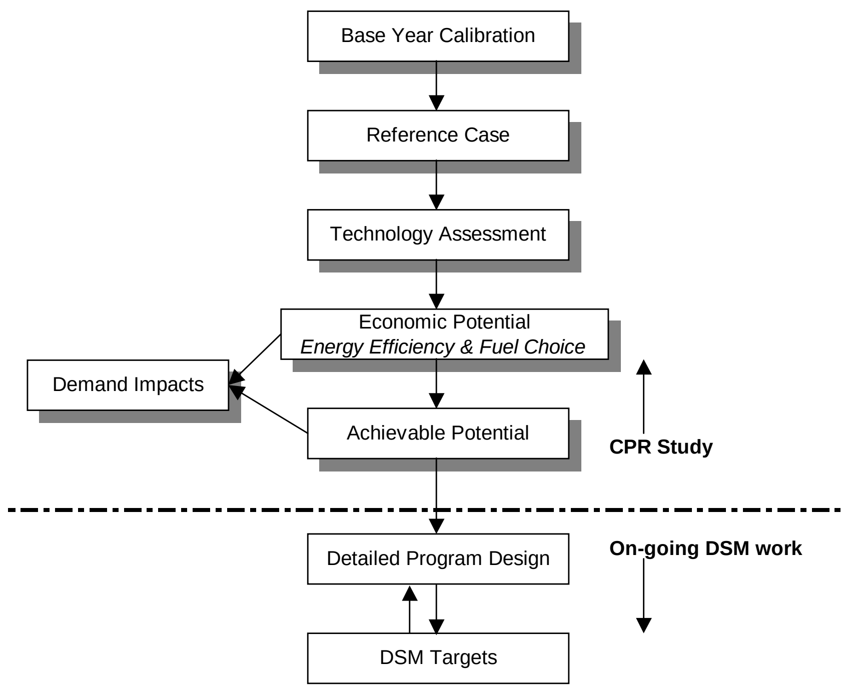
- The **"Upper" Achievable Potential** scenario assumes that B.C. market conditions become more supportive of investing in energy efficiency. For example, this scenario assumes that: real energy prices continue to increase over the study period; it also assumes that federal and provincial government actions to mitigate climate change result in increased levels of complementary energy efficiency initiatives. Upper 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.

6.2.1 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 6.2 illustrates the relationship between Achievable Potential and the more detailed program design.

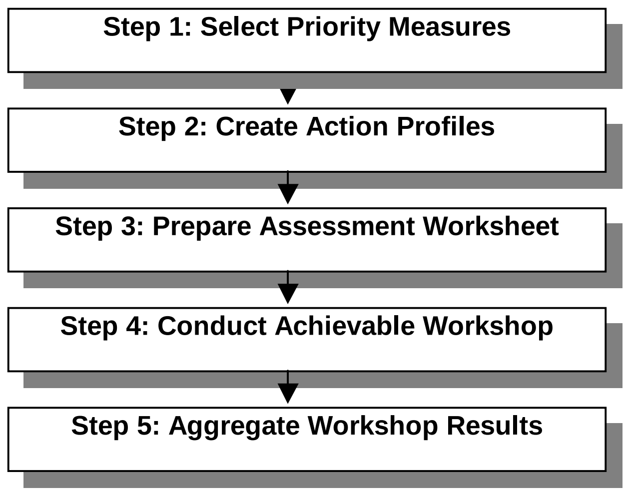
Exhibit 6.2: Achievable Potential versus Detailed Program Design



6.3 APPROACH TO THE ESTIMATION OF ACHIEVABLE POTENTIAL

The Achievable Potential Forecast was estimated in a five-step approach. A schematic showing the major steps is shown in Exhibit 6.3 and each step is discussed below.

Exhibit 6.3: Flow Chart Estimating Achievable Potential



6.3.1 Step 1: Select Priority Measures

The first step in developing the Achievable Potential estimates required that the energy saving technologies identified in the Economic Potential Forecasts be "bundled" into a set of Actions that would facilitate the subsequent assessment of their potential market penetration.

A summary of the selected energy efficiency Actions is provided in Exhibits 6.4. As illustrated, the Actions have been bundled by end use and Exhibits 6.4 shows the Action name, the target end use(s), the target sub sectors and technologies, and the approximate percentage that it represents of the total savings potential contained in the Economic Potential Forecasts.

Exhibit 6.4: Manufacturing Sector Actions

Action Profile #	Title	Approximate % of Economic Savings Potential
M1	**Efficient Lumber Dry Kiln**	40%
M2	**Efficient Veneer Dryer**	5%
M3	**Efficient Process Heat Boilers**	33%
M4	**Fully Insulated Process Heat Distribution Systems**	9%

6.3.2 Step 2: Create Action Profiles

The next step involved the development of brief profiles for each of the Actions noted above in Exhibit 6.4. A sample profile for Action M1 (Efficient Lumber Dry Kiln) is presented in Exhibit 6.5. (Profiles of all the Actions are in Appendix G.)

The purpose of the Action Profiles was to provide a "high-level" logic framework that would serve as a guide for participant discussions in the Achievable Workshop (see 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 Exhibit 6.4, each Action Profile addresses the following areas:

- ***Overview***—provides a summary statement of the broad goal and rationale for the Action.

- ***Target Technologies and Sub Sectors***—highlights the major technologies and the subsegments where the most significant opportunities have been identified in the Economic Potential Forecast.

- ***Target Stakeholder Groups***—identifies key market players that would be expected to be involved in the actual delivery of services. The list of stakeholders shown is intended to be "indicative" and is by no means comprehensive.

- ***Key Barriers and Interventions***—identifies key market barriers that are currently constraining the increased penetration of energy-efficient technologies or measures. Interventions for addressing the identified barriers are noted. Again, it is recognized that the interventions are not necessarily comprehensive; rather, their primary purpose was to help guide the workshop discussions.

- ***Time Frame***—identifies the potential timing of activities with the intent of assisting workshop participants to envision possible customer participation rates.

Exhibit 6.5: Sample Manufacturing Action Profile

Action Profile M1 - Efficient Lumber Dry Kiln

Overview:

This Action will encourage the purchase of high efficiency lumber dry kilns and major efficiency retrofits of existing kilns. The majority of the lumber dry kilns in British Columbia use natural gas. During the period from 1985 to 2000, natural gas in real terms became relatively inexpensive compared to other alternatives. As a result of the low price for natural gas and the industry's interest in high volume production, the efficiency of gas fired kilns in some cases deteriorated and in general efficiency improvements available due to technology improvements did not occur. With the recent increases in natural gas prices the industry has become very aware of the cost of natural gas and is very seriously considering fuel alternatives. It is important for the industry to realize the opportunities of improved efficiency before they make large capital expenditures in going to other fuel alternatives.

The broad strategy envisioned for this Action consists of:

- Strong up-front promotional efforts directed towards customers, vendors and trade allies emphasizing the cost savings through efficiency upgrades and new efficient kiln purchases.
- Two initial items would be workshops, jointly sponsored by Terasen, BC Hydro and NR Can.
- Incentives to install metering on a kiln by kiln basis so efficiency upgrades could be tracked.
- Consulting assistance to enable customers to objectively evaluate the cost of natural gas and the advantages of efficiency improvements.
- Financial incentives for customers who decide to continue to use natural gas as a fuel and to improve their equipment efficiency.

Target Technologies and Sub Segments:

Major energy efficiency retrofits including:

- Advanced controls with moisture metering, multiple zone control, steam management etc.
- Kiln shell improvement upgrades – insulation, air tightness.
- Air circulation improvement upgrades – floor and ceiling baffles.
- Ventilation heat recovery.
- Installation of VSD fans in alliance with BC Hydro Power Smart program.
- Purchase of new, efficient dry kilns.

Target Stakeholder Group:

Wood products manufacturers including:

- Sawmill and Planermills in the Interior Region
- Initially executives of large firms including West Fraser, Canfor, Tolko, Tembec, and Brascan.
- Mill managers and drying specialists at each of the mills.
- Two major kiln suppliers COE and Wellons.
- Upgrade vendors, control specialist, consultants specializing in kiln upgrades.

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- Competition from wood waste systems – companies are on the verge of making major decisions to select alternative systems.
- In the mills, lumber drying is considered an art form and each drying specialist has his or her own way of operating the kilns; consequently, it is difficult to get them to change.
- Good data on equipment efficiency levels is not available on a kiln by kiln basis; consequently, it is very difficult to show the differences in efficiency levels from kiln to kiln.
- Inertia of implementing changes.

This Action will address these barriers by combining the following interventions:

- Information and promotion through workshops and visits to major companies to make sure that efficiency improvement with existing natural gas systems is an alternative that should be considered compared to wood waste system alternatives.
- Assistance with metering so that customers can accurately determine the effect of efficiency.
- Financing for customers who remain on natural gas and improve efficiency.
-

Time Frame:

Program initiated 2006 and run through to 2010. Initial workshops should be scheduled in Prince George and Kamloops for winter 2006.

6.3.3 Step 3: Prepare Draft Action Assessment Worksheets

A draft Assessment Worksheet was prepared for each Action Profile in advance of the Achievable Workshop. The Assessment Worksheets complemented the information contained in the Action Profiles by providing quantitative data on the potential energy savings for each Action as well as eligible participants. Energy impacts and population data were taken from the detailed modelling results contained in the Economic Potential Forecast.

A sample Assessment Worksheet for ***Action M1—Efficient Lumber Dry Kiln*** is presented in Exhibit 6.6. (Complete Action Worksheets are in Appendix G.)

As illustrated in Exhibit 6.6, each Action Assessment Worksheet addresses the following areas:

- ***Participant Definition*****—**provides the definition of "participant" that is used in subsequent portions of the worksheet to calculate electricity savings. The definition of "participant" may vary depending on the specific Action.
- ***Service Area*** **–** indicates the division of economic potential by service region.
- ***Major Technologies and Contribution to Economic Savings*****—**provides additional detail on the composition of the economic savings for the Action. It was particularly intended to assist workshop participants in their discussions of potential participation rates where an Action may consist of several technologies.
- ***Approximate % of Action Savings by Service Area*****—**shows the contribution of the different service regions to the total energy impacts represented by each Action.
- ***Economic Potential Savings—***shows the total economic impacts on natural gas use, by milestone period, for the measures included in the Action.
- ***Approximate Total Number of Participants***—shows the total population of potential participants that could theoretically take part in the Action. Numbers shown are from the eligible populations used in the Economic Potential Forecasts.
- ***Number of Participants Eliminated by Constraints***—identifies, as appropriate, any portion of the applicable participants that are unlikely to adopt the action regardless of demand side management activities undertaken by Terasen Gas. Examples of constraints in the Manufacturing Sector are expected changes in operations, financial uncertainty of the operation as a whole, or commitment to a technology other than that proposed in the Action.
- ***Economic Potential Available for Demand Side Management***—indicates the remaining economic potential available for demand side management after the portion eliminated by constraints is removed.

Exhibit 6.6: Sample Worksheet: Action Profile M1—Efficient Lumber Dry Kiln

Energy Efficiency Measure	**M1- Efficient Lumber Dry Kiln**					
Participant Definition	**New or Major Retrofit of an Efficient Lumber Dry Kiln at Sawmills and Planer Mills in the Wood Sub Sector**					
Service Area	**Interior**			**Lower Mainland and Vancouver Island**		
Major Technology and % of Economic Potential	Technology		% of Potential	Technology		% of Potential
	Efficient Lumber Dry Kilns		100%	Efficient Lumber Dry Kilns		100%
Approximate % of Action Savings by Service Area	87%			13%		
Economic Potential Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
	1,043,807	369,193	1,413,000	156,000	56,000	212,000
Approximate Total Number of Participants	47	16	63	7	3	10
Number of Participants Eliminated by Constraints	5	2	6	2	1	3
Economic Potential Available for DSM	939,426	332,274	1,271,700	117,000	42,000	159,000
Approximate Economic Potential Savings per Participant per Year (GJ/year)	22,000			22,000		
Approximate Benefit Cost Ratio (Marginal Supply Cost of Gas ~ $6/GJ)	1.4			1.2		
Approximate Customer Payback (Customer Cost of Gas ~ $9/GJ)	4 years			4 years		
Participation Rate (% of Available Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	60%	50%	-	30%	25%	-
Upper	80%	60%	-	40%	30%	-
Action Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	563,656	166,137	729,793	35,100	10,500	45,600
Upper	751,541	199,364	950,905	46,800	12,600	59,400
Participation Rate (% of Total Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	54%	45%	52%	23%	19%	22%
Upper	72%	54%	67%	30%	23%	28%

Total Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Economic Potential	1,199,807	425,193	1,625,000
Most Likely	598,756	176,637	775,393
Upper	798,341	211,964	1,010,305

- ***Approximate Economic Potential Savings per Participant*—**indicates the annual natural gas savings (GJ/yr.) for a "typical" participant.

- ***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 Terasen Gas's perspective. This benefit cost ratio indicates the available scope of 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 Action. The customer payback indicates of the level of attractiveness of the Action to customers. 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 Action's attractiveness to customers without making the measures economically unattractive to Terasen Gas.

- ***Participation Rate (% of Available Economic Potential)*** —shows the expected participation rate of customers not eliminated by constraints, banded by most likely and upper.

- ***Action Savings*—**shows the Achievable Potential savings corresponding to the participation rates defined above.

- ***Participation Rate (% of Total Economic Potential)*—**shows the overall participation rate, including customers eliminated by constraints.

- ***Total Savings*—**shows the calculated natural gas savings in each milestone period based on the savings and participation rates presented in the preceding rows of the Worksheet.

6.3.4 Step 4: Conduct Achievable Workshop

The most critical step in developing the estimates of Achievable Potential was a half-day Achievable Potential Workshop on November 2, 2005. Workshop participants consisted of core members of the consultant team, demand side management program and technical personnel from both Terasen Gas and BC Hydro. Together, the participants 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 B.C. Background material on the Workshop is in Appendix G.

The purpose of this workshop was twofold:

- To promote discussion regarding the technical and market conditions confronting the identified energy efficiency opportunities.

- To compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

The discussion of each Action Profile began with a brief consultants 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 Action Profile and accompanying Worksheet.

Following discussion of the broad market and intervention conditions affecting the Action, workshop participant views were recorded on “most likely” and “upper” customer participation rates. General agreement was sought on rates to be carried forward into the analysis; estimates were rounded down for “most likely” and rounded up for “upper” estimates.

As noted earlier, it was not possible to fully address all Actions in the workshop. Consequently, the workshop focussed on the largest opportunities. It was assumed that with a broad based demand side management program, Terasen Gas could capture between 20% and 40% of the remaining opportunities not covered in the workshop.

6.3.5 Step 5: Aggregate Workshop Results

The final step involved aggregating the results of the individual Actions to calculate the potential achievable savings for the total manufacturing sector.

6.4 RESULTS

A summary of the “most likely” and “upper” Achievable Potential results is presented in the following exhibits. In each case the results shown are relative to the Reference Case Forecast.

- Exhibit 6.7 presents the results by Action, Milestone Year and Service Region.
- Exhibit 6.8 presents the results by Segment, Milestone Year and Service Region.

In Exhibits 6.7 and 6.8, the results represent the total annual cumulative natural gas savings at the end of each milestone year. For example, Exhibit 6.7 shows that Action M1—Efficient Lumber Dry Kilns in Sawmills and Planer Mills will achieve an annual saving of approximately 600,000 GJ/yr. by FY 2010/11 under the “most likely” scenario. This annual savings increases to approximately 782,000 GJ/yr. by FY 2015/16, again under the “most likely” scenario.

Selected highlights related to the participation rates used to calculate the energy efficiency impacts shown in Exhibits 6.7 and 6.8 are provided below. Detailed results showing the estimated participation rates and calculation of related energy impacts are provided in Appendices E and F.

Exhibit 6.7: Summary of Achievable Savings, by Action—"Most Likely" & "Upper" Scenarios[18]

	Savings Re: Reference Case			
All Service Areas	**2010/11**		**2015/16**	
	Most Likely	**Upper**	**Most Likely**	**Upper**
M1: Efficient Lumber Dry Kilns	599,514	798,313	781,518	1,006,222
M2: Efficient Veneer Dryers	40,189	94,396	45,828	108,630
M3: Efficient Boilers	650,831	868,150	750,760	1,008,253
M4: Fully Insulated Process Heat Distribution Systems	193,101	267,040	200,123	277,091
Other	92,650	185,300	111,475	222,950
Total All Service Areas	1,576,286	2,213,198	1,889,704	2,623,145
	Savings Re: Reference Case			
Lower Mainland	**2010/11**		**2015/16**	
	Most Likely	**Upper**	**Most Likely**	**Upper**
M1: Efficient Lumber Dry Kilns	21,871	28,527	28,358	36,091
M2: Efficient Veneer Dryers				
M3: Efficient Boilers	550,515	735,292	631,250	844,264
M4: Fully Insulated Process Heat Distribution Systems	174,034	238,927	180,571	247,902
Other	76,042	152,084	92,886	185,772
Total Lower Mainland	822,461	1,154,831	933,064	1,314,029
	Savings Re: Reference Case			
Interior	**2010/11**		**2015/16**	
	Most Likely	**Upper**	**Most Likely**	**Upper**
M1: Efficient Lumber Dry Kilns	563,656	751,541	734,843	946,817
M2: Efficient Veneer Dryers	38,341	90,017	43,735	102,681
M3: Efficient Boilers	93,565	123,889	111,502	153,138
M4: Fully Insulated Process Heat Distribution Systems	16,389	24,765	16,997	25,684
Other	15,377	30,754	17,133	34,267
Total Interior	727,328	1,020,967	924,210	1,262,587
	Savings Re: Reference Case			
Vancouver Island	**2010/11**		**2015/16**	
	Most Likely	**Upper**	**Most Likely**	**Upper**
M1: Efficient Lumber Dry Kilns	13,988	18,245	18,317	23,313
M2: Efficient Veneer Dryers	1,849	4,378	2,093	5,948
M3: Efficient Boilers	6,751	8,969	8,009	10,851
M4: Fully Insulated Process Heat Distribution Systems	2,678	3,347	2,556	3,505
Other	1,231	2,462	1,456	2,911
Total Vancouver Island	26,497	37,401	32,430	46,528

18 Note: The values shown in Exhibit 6.7 are based on the detailed model results; in some cases they may differ slightly from the workshop results contained in Appendix G. This is because some of the numbers presented in the workshop (e.g., average technology size, etc.) were rounded to facilitate the discussion.

Exhibit 6.8: Summary of Achievable Savings, by Sub Sector—"Most Likely" & "Upper" Scenarios

Sub Sector	Milestone Year			
	2010/11		2015/16	
	Most Likely	Upper	Most Likely	Upper
Food	697,979	930,972	793,238	1,080,897
Chemical	46,096	102,843	54,553	83,214
Fabricated Metal	18,985	37,970	25,158	50,316
Non Metallic Mineral	52,186	70,164	61,479	89,504
Paper	29,980	46,864	27,330	37,322
Wood	663,769	923,716	850,986	1,151,284
Other	67,290	100,670	76,960	130,608
Total	**1,576,286**	**2,213,198**	**1,889,704**	**2,623,145**

6.4.1 Action MI – Efficient Lumber Dry Kilns

Workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, participation rates of up to 72% could be achieved during the first milestone period in the Interior Service Area, where almost 90% of the savings potential is located. Participation rates of 54% were estimated for the second milestone period. Slightly lower participation rates were projected for the Lower Mainland and Vancouver Island Service Areas.

Selected highlights from the discussion of this Action are listed below:

Background

From 1985 to 1998, the price of gas decreased significantly in real dollar terms. These price decreases, combined with the design and environmental benefits provided by natural gas lumber dry kilns relative to other fuel options, have led to current dominance of natural gas systems in this market.

Drying lumber is as much an art as a science. The incoming material varies significantly in moisture content and drying characteristics (the ease with which moisture will migrate to the surface). Due to the historical low cost of natural gas, the prime considerations for kiln operators has been to minimize degrade (percentage of lumber down graded due to warping, splitting, checking, etc) and rate of production (measured in thousand board feet per year, or mfbm). Historically energy efficiency has not been a significant consideration. Kiln operators tended to have their own individual way of operating the kilns that was not contested as long as production and degrade levels were acceptable.

It appears that energy efficiency varies significantly between kilns and sawmills based on gas consumption per thousand board feet. However reliable data is very limited. A typical Interior sawmill has four to six kilns and the gas consumption per kiln is not known. Comparison between sawmills is complicated by changes in tree species and moisture content, which can significantly affect the consumption per thousand board feet.

Based on historical practices and industry knowledge, it appears that existing dry kilns are very inefficient. A lack of good baseline data makes determining existing efficiency, and benefits from efficiency upgrades, difficult to determine.

Current

The commodity price of natural gas for 2005 is 7.93 $/GJ. For 1999 it was 2.97 $/GJ, which represents an increase of over 250% in six years. Up until 1999 it had been relatively stable for a number of years. This dramatic increase means that the wood sub sector is seriously looking at their energy costs. However, in general they are looking at alternative fuels (mainly wood waste) and calculating the payback for the installation of a wood waste system considering the avoided cost of natural gas as a benefit cash flow stream. Unfortunately, in general they are not considering the alternative option of making their existing gas kilns more efficient.

Another factor is the amount of additional wood fibre that is being processed due to the pine beetle killed trees. Available fibre from pine beetle killed trees is expected to grow from 500 million cubic meters to 1 billion cubic metres, whereas the total allowable annual cut for B.C is only approximately 70 million cubic metres. To avoid the loss in timber value that occurs within 10 years following infestation, the forestry industry in BC is cutting down infested and dead trees as quickly as possible. Accordingly, the probable scenario in the Interior is that for the next 7 years there will be a significant increase in lumber processing capacity followed by 10 to 15 year declining period when the newly planted forests are too young too harvest.

Workshop participants concluded that the next 12 months are very opportune for Terasen to implement an efficient kiln program. It could accomplish the following:

- Retain load for gas fired kilns by encouraging an efficiency improvement versus a switch to wood waste.
- Demonstrate excellent customer service by assisting the wood products industry through a period of high natural gas prices.
- Encourage the choice of gas fuelled kilns at the new facilities being built as a result of the beetle infestation.

6.4.2 Action M2 –Efficient Veneer Dryers

Workshop participants concluded that under the ideal conditions represented by the Upper Achievable Forecast, participation rates of up to 54% could be achieved during the first milestone period in the Interior Service Area, where almost 90% of the savings potential is located. Participation rates of 23% were estimated for the second milestone period. Slightly lower participation rates were projected for the Lower Mainland and Vancouver Island service areas.

Selected highlights from the discussion of this Action are listed below:

- Veneer dryers will follow the same general trends identified above for lumber dry kilns.

- There is already considerable interest in efficient veneer dryers in the absence of any demand side management program. Several large facilities that use veneer dryers have recently upgraded to more efficient technologies, and new facilities built in the future are likely to purchase efficient veneer dryers over standard veneer dryers. The portion of the market where this trend is occurring "naturally" is incorporated in the Reference Case Forecast. As a result, it is expected the remaining portion of the market that is addressed by this Action will likely prove more challenging for a variety of reasons. Based on these conclusions, it was agreed that the participation rate for veneer dryers would be lower than that of lumber dry kilns.

- It was also noted that there are two main competitive wood product panels; plywood and Oriented Strand Board (OSB). Plywood consists of layers of veneer glued together and, consequently, veneer dryers are one of the main energy consumers in a plywood plant. OSB panels consist of wafers or small thin pieces of wood being glued together. These wafers also need to be dried before being glued and, consequently, dryers are the main energy consumer in OSB plants.

- For the purposes of this study, OSB plants and plywood plants were part of the same sub sector. In the future, most of the expansion in wood panel manufacturing will be in OSB plants, not plywood plants. This is because OSB plants can make better use of the wood fibre that is available, and generally produce a much lower cost wood panel than plywood facilities.

- Accordingly, the Achievable Forecast assumes that efficiency gains with veneer dryers will occur as a result of upgrading or replacing existing dryers. On the other most of the efficiency opportunity in OSB plants will occur through building more efficient new facilities.

6.4.3 Action M3 –Efficient Boilers

Several efficient boiler technologies are available. Consequently, two sets of participation rates were developed. The first set of participation rates covered upgrades to the most efficient boiler type available for the given application (condensing boilers for process hot water or bundled boiler upgrades for process steam). The second set of participation rates covered upgrades to the second most efficient boiler technology (near condensing boilers), and were applied to those participants that did not chose the first upgrade.

Workshop participants concluded that under ideal the conditions represented by the Upper Achievable Forecast, participation rates of 48% could be achieved during the first milestone period for upgrades to the most efficient boilers. During the same period, participation rates of 60% could be expected for upgrades to the second most efficient boiler. This would be followed in the second milestone period by participation rates of 34% and 50%, respectively, for the two efficiency levels.

Selected highlights from the discussion of this Action are listed below:

- Most of the opportunity for this Action is concentrated in the food sub sector in the Lower Mainland service area. Many of these customers are small family run operations that are not likely to make the large investment required to upgrade to the most efficient boiler. Nevertheless, energy is a large operating cost (up to 25% for greenhouses). Consequently, some of the customers who would not upgrade to the most efficient (and expensive) boiler may consider upgrading to the second most efficient technology.

- There is a risk that some of the larger customers that are eligible for this Action may convert to wood pellet or hog fuel systems. Large greenhouses, in particular, are considering fuel switching.

- This Action is expected to have the greatest participation rate early in the first milestone period. Similar demand side management programs at other utilities have had their highest participation rates soon after program inception, and decreasing participation rates over time. This trend may be the result of the following factors:

  - Although the first cost of upgrading to an efficient boiler is high, based on life cycle costs, it is economic to replace inefficient boilers with efficient boilers well before the inefficient boiler reaches the end of its useful life. If a program exists to help customers over the first cost hurdle, many customers will upgrade based on life cycle costs. For this reason, the participation rate will not necessarily be proportional to "natural" boiler stock replacement.

  - A typical useful life of a boiler is 25 years, but it is not unusual for boilers older than 30 years to still be in operation. After those older boilers are replaced early in the program, the participation rate will drop off.

6.4.4 Action M4 – Fully Insulated Process Heat Distribution Systems

As illustrated in Exhibits 6.7 and 6.8, workshop participants generally concluded that under ideal conditions represented by the Upper Achievable Forecast, participation rates in the Lower Mainland service area, where almost 90% of the savings potential is located, of up to 81% could be achieved during both milestone periods. Slightly lower participation rates were projected for the Vancouver Island and Interior Service Areas.

Selected highlights from the discussion of this Action are listed below:

- This action is expected to have a high participation rate that will be sustained over both milestone periods because it is attractive to both the customer and to Terasen Gas for the following reasons:

  - This Action typically has a customer payback of less than 2 years, which is the lowest customer payback of the four Actions.

  - Although savings per facility are modest, (~700 GJ/year), the measure could potentially reach most of the more than 400 facilities within the study group, making it attractive for marketing and public relations purposes.

- The major barrier to this measure is complexity of installation and access to skilled trades people in rural areas.

- The density of participants in the Vancouver Island and Interior service areas is lower than in the Lower Mainland. Therefore, it is expected to be more costly to implement this measure in the Vancouver Island and Interior service areas, and participation rates will accordingly be lower in these areas than in the Lower Mainland.

6.5 "PEAK DAY" LOAD IMPACT

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.).

- Terasen Gas provided load factors that correlate the relationship between "average" and "peak day" consumption levels for each rate class and service region. These rate based load factors were converted to sector based values using the same rate class to sector mapping as outlined previously in Exhibit 2.9. For example, the manufacturing sector defined in this CPR includes customers from rate classes 3, 23, 5 and 25. Exhibit 6.9 shows a Lower Mainland manufacturing sector load factor rate of 0.369. This is a sales-weighted value based on the relative share of manufacturing sector sales in the Lower Mainland represented by each of the rate classes.

- Finally, peak day load impacts were calculated by dividing the average daily consumption by the appropriate sector and service region load factors, as presented below in Exhibit 6.9.

Exhibit 6.9: Peak Day Load Factors, by Sector and Service Area

CPR Sector	Sales Weighted Average/Peak Load Factor, by Sector & Service Region*		
	Lower Mainland	Vancouver Island	Interior
Residential (incl High-Rise)	.316	.382	.304
Commercial & Institutional	.340	.491	.360
Manufacturing	.369	.509	.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	.308	.354	.304
2	.293	.473	.296
3	.366	.509	.347
5	.433	.51	.511

6.5.1 Results

Exhibit 6.10 presents a summary of the estimated peak day load impacts for each of the achievable energy efficiency scenarios. As illustrated, the total peak day savings for the total Terasen Gas service area is estimated to be in the range 20,000 to 27,500 GJ by FY 2015/16, depending on scenario.

Exhibit 6.10: Peak Day Load Impacts – By Scenario, Service Region and Milestone Year

Service Region & Scenario	Peak Day Saving by Milestone Year & Scenario (GJ)	
	2010/11	2015/16
Total Terasen Gas		
Achievable - Most Likely	10,747	19,921
Achievable- Upper	15,090	27,535
Lower Mainland		
Achievable - Most Likely	6,107	14,031
Achievable- Upper	8,574	19,476
Vancouver Island		
Achievable - Most Likely	143	175
Achievable- Upper	201	250
Interior		
Achievable - Most Likely	4,498	5,716
Achievable- Upper	6,314	7,808

6.6 GREENHOUSE GAS EMISSION IMPACT[19]

The natural gas savings associated with each of the achievable potential scenarios would also result in a significant reduction of greenhouse gas emissions. As illustrated in Exhibit 6.11 under the most likely scenario the GHG reductions are estimated to be approximately 80,000 tonnes/year in FY2010/11, increasing to approximately 112,000 tonnes/year by FY 2015/16.

Exhibit 6.11: Estimated GHG Emission Reductions – Achievable Potential, By Scenario and Milestone Year

Service Region & Scenario	Annual Natural Gas Savings (GJ/yr.)		Annual GHG Savings (tonnes/yr.)	
	2010/11	2015/16	2010/11	2015/16
Total Terasen Gas				
Achievable - Most Likely	1,576,286	1,889,704	79,918	95,808
Achievable- Upper	2,213,198	2,623,145	112,209	132,993

[19] GHG impacts are estimated based on an emissions factor of 50.7 kg of $CO_{2\ equiv.}$ per GJ of natural gas. This is the value currently employed by Natural Resources Canada.

7. STUDY CONCLUSIONS

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in B.C.'s manufacturing sector. In the "most likely" and "upper" achievable scenarios those energy efficiency improvements would provide between about 1,900 and 2,600 thousand GJ/yr. of savings in FY 2015/16. The same energy efficiency improvements would also provide reduced GHG emissions of approximately 80,000 to 112,000 tonnes per year as well as peak day load reductions of approximately 20 to 20.5 thousand GJ.

Two particularly significant opportunities are identified in the study results:

- Energy efficient boilers for the greenhouse and food processing facilities in the Lower Mainland.
- Energy efficient kilns for sawmills and planer mills in the Interior.

Although the study did not identify any fuel choice opportunities for this sector, the promotion of energy efficient kilns is expected to contribute to load retention objectives within the wood products sub sector. Increasing gas prices combined with changes being considered by the industry make the next 12 months particularly opportune for the implementation of an efficient kiln program.

❑ Interpretation of Results

The study findings identified in these sector, combined with those identified in the residential and commercial sector reports, could have significant implications for Terasen Gas. If the cost effective DSM measures identified in the three sectors are pursued by Terasen Gas, then a significant increase in annual DSM investment in program and incentive funding by Terasen Gas and its delivery partners would be required; this increase would be in the range of 3 to 5 times current levels. This increased level of DSM investment would be consistent with current investment levels in other Canadian jurisdictions, such as Ontario.

The current Terasen Gas DSM incentive mechanism provides an allowable return of 5% of the Total Resource Cost (TRC). The DSM measures identified for this sector, when combined with those identified in the commercial and manufacturing sector reports, could result in a larger scale DSM effort that might have a TRC value of $30 million, or more. A TRC value of $30 million would provide a $1.5 million annual payment through the DSM incentive mechanism. If the utility was to apply for increased DSM funding levels, a larger DSM incentive mechanism or equivalent shared savings mechanism could also be considered.

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TERASEN GAS
CONSERVATION POTENTIAL REVIEW

Manufacturing Sector Report

- Appendices-

Submitted to:

Terasen Gas

Prepared by:

Marbek Resource Consultants

and

Willis Energy Services Ltd.

February 2006

Marbek Resource Consultants

300-222 Somerset Street West

Ottawa, Ontario K2P 2G3

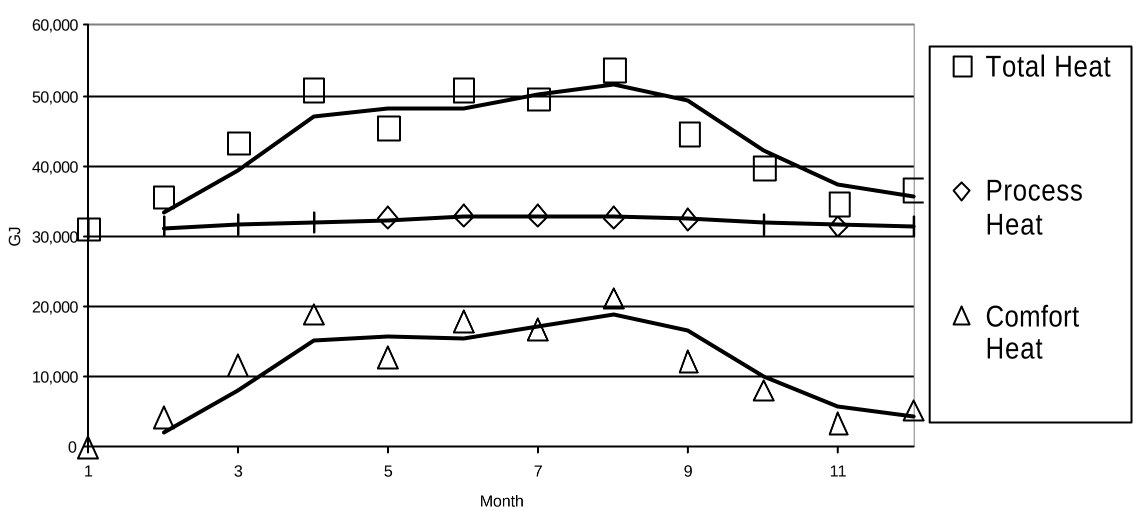
Tel: 613.523.0784 • Fax: 613.523.0717 • www.marbek.ca

Table of Appendices

APPENDIX A: END USE CALCULATION METHODOLOGY

1. Divide the Terasen accounts into sub sectors with similar manufacturing processes.
2. Examine the annual load profile for each sector and calculate the ratio of summer to winter heat load for each sector.
3. Note that the chemical sub sector load profile is almost flat, indicating that the load is mostly process heat, and that heat lost from process equipment to the plant interior is sufficient to provide almost all comfort heating needed.
4. Assume that the load profile of the chemical sub sector could be used to extract the process load and the comfort load for the other sectors.
5. For each sector, multiply the August natural gas consumption by the ratio of summer to winter load observed in the chemical sub sector, and then multiply by 12 to get the annual process heat load. See the figure below
6. Determine comfort heat by difference between total heat and process heat. Some sectors were treated differently. They are discussed below.
7. The Greenhouse portion of the food sub sector runs natural gas, hot water boilers to heat greenhouses. The annual natural gas profile for this sector is highly weather sensitive. Greenhouses are assumed to be 100% process heat, because a.) the greenhouse heat load will be much greater than any office or packing house heat load because of the different footprint, insulation, and temperature requirements (plants need to stay warm even if the when the packing house is closed) and b) extracting comfort heat may not be very accurate because process heat follows comfort heat for this sector.
8. Assume that the lumber and plywood portions of the wood sub sector use natural gas only for process heat. Although there probably is some natural gas fired comfort heat the large size of the lumber kiln drying and plywood veneer drying load is assumed to dwarf any comfort heating requirement. Comfort heat shows up in the wood sub sector because of the other portion, which includes carpentry shops and wood manufacturing shops that do have significant comfort heat.

Exhibit A.1: Typical Annual Gas Use Profile



APPENDIX B: DETAILED REFERENCE CASE FORECAST RESULTS

Exhibit B.1: Reference Case Forecast Food Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011						2015/16					
			Base Year				Sector Annual Growth Rate					3.0%	Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	70.7%	170,419	243,456	0.0%	170,419	70.7%	209,594	69.5%	299,420	0.0%	209,594	70.7%	242,977	69.6%	347,110
	Standard Efficiency Boiler	68%	25.4%	25.2%	60,600	89,117	-0.1%	60,070	24.9%	73,879	25.2%	108,646	-0.1%	73,392	24.8%	85,081	25.1%	125,120
	Near Condensing Boilers	80%	3.1%	3.6%	8,603	10,753	0.8%	9,096	3.8%	11,187	3.2%	13,984	0.8%	11,642	3.9%	13,496	3.4%	16,870
	Condensing Boiler	92%	0.4%	0.5%	1,270	1,380	0.4%	1,306	0.5%	1,606	0.4%	1,746	0.4%	1,639	0.6%	1,900	0.4%	2,065
	Partly Insulated Distribution System	50%	1.7%			6,084	-1.6%				1.6%	6,696	-2.2%				1.4%	6,932
	Fully Insulated Distribution System	92%	0.1%			320	3.8%				0.1%	512	3.7%				0.1%	712
	Total Comfort Heat		**100.0%**	**100.0%**	**240,892**	**351,111**		**240,892**	**100.0%**	**296,267**	**100.0%**	**431,004**		**296,267**	**100.0%**	**343,454**	**100.0%**	**498,809**
Process Heat	Standard Efficiency Boiler	68%	44.0%	40.9%	1,849,600	2,720,000	-2.3%	1,575,157	34.9%	1,937,245	38.2%	2,848,889	-3.3%	1,636,597	29.5%	1,897,265	32.8%	2,790,095
	Near Condensing Boiler	80%	8.7%	9.5%	427,825	534,781	0.8%	452,365	10.0%	556,352	9.3%	695,441	0.8%	578,965	10.4%	671,180	9.9%	838,975
	Condensing Boiler	92%	13.4%	16.9%	762,198	828,476	0.4%	783,798	17.4%	963,972	14.1%	1,047,796	0.4%	983,406	17.7%	1,140,038	14.6%	1,239,171
	Bundled Standard Boiler Upgrades	85%	17.0%	19.7%	891,944	1,049,345	3.0%	1,096,978	24.3%	1,349,145	21.3%	1,587,229	3.0%	1,564,028	28.2%	1,813,138	25.1%	2,133,103
	Partly Insulated Distribution System	50%	3.8%			234,698	-1.6%				3.5%	258,340	-2.2%				3.1%	267,442
	Fully Insulated Distribution System	92%	0.2%			12,353	3.8%				0.3%	19,750	3.7%				0.3%	27,474
	Direct Fired Heating	90%	1.9%	2.3%	105,235	116,928	2.9%	128,469	2.8%	158,000	2.4%	175,556	5.0%	201,653	3.6%	233,771	3.1%	259,746
	Radiant Tube Heating	70%	0.0%	0.0%	984	1,405	0.5%	1,019	0.0%	1,253	0.0%	1,790	1.0%	1,317	0.0%	1,526	0.0%	2,180
	Standard Efficiency Oven	65%	4.3%	3.8%	171,774	264,268	-2.4%	145,315	3.2%	178,719	3.7%	274,952	-2.2%	159,799	2.9%	185,251	3.4%	285,001
	Efficient Oven	80%	3.7%	4.1%	184,435	230,543	1.9%	210,894	4.7%	259,373	4.3%	324,216	1.4%	278,293	5.0%	322,618	4.7%	403,272
	Tank-type Water Heating	65%	2.0%	1.8%	81,821	125,878	-0.6%	78,470	1.7%	96,508	2.0%	148,474	0.3%	97,918	1.8%	113,513	2.1%	174,636
	Direct Fired Water Heating	95%	0.7%	0.9%	41,163	43,329	1.1%	44,514	1.0%	54,747	0.8%	57,628	-0.5%	53,337	1.0%	61,832	0.8%	65,087
	Heat Loss from Not Using Pinch Technology		0.2%			14,250	0.0%				0.2%	17,525	0.0%				0.2%	20,317
	Total Process Heat		**100.0%**	**100.0%**	**4,516,978**	**6,176,255**		**4,516,978**	**100.0%**	**5,555,313**	**100.0%**	**7,457,586**		**5,555,313**	**100.0%**	**6,440,131**	**100.0%**	**8,506,499**
Total					**4,757,870**	**6,527,366**				**5,851,580**		**7,888,590**				**6,783,585**		**9,005,308**

Exhibit B.2: Reference Case Forecast, Chemical Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 Base Year: Market Share as Percent of Heat Sold (%)	2003/04 Base Year: Market Share as Percent Useful Heat (%)	2003/04 Base Year: Useful Heat (GJ/year)	2003/04 Base Year: Annual Heat Sold (GJ/year)	2010/11 (Sub Sector Annual Growth Rate 3.0%): Technology Annual Growth Rate (% of GJs)	2010/11: Useful Heat Before Growth (GJ/year)	2010/11: Market Share as a Percent of Useful Heat (%)	2010/11: Useful Heat (GJ/year)	2010/11: Market Share as a Percent of Heat Sold (%)	2010/11: Annual Heat Sold (GJ/year)	2015/16 (Sub Sector Annual Growth Rate 3.0%): Technology Annual Growth Rate (% of GJs)	2015/16: Useful Heat Before Growth (GJ/year)	2015/16: Market Share as a Percent of Useful Heat (%)	2015/16: Useful Heat (GJ/year)	2015/16: Market Share as a Percent of Heat Sold (%)	2015/16: Annual Heat Sold (GJ/year)
Comfort Heat	Standard Air Handling Units and Unit Heaters	70%	100.0%	100.0%	3,270	4,671	0.0%	3,270	100.0%	4,021	100.0%	5,745	0.0%	4,021	100.0%	4,662	100.0%	6,660
	Total Comfort Heat		**100.0%**	**100.0%**	**3,270**	**4,671**		**3,270**	**100.0%**	**4,021**	**100.0%**	**5,745**		**4,021**	**100%**	**4,662**	**100.0%**	**6,660**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	191,198	281,173	-1.7%	175,070	60.6%	215,314	57.4%	316,638	-1.6%	198,680	55.9%	230,324	54.5%	338,712
	Near Condensing Boiler	80%	10.0%	12.8%	36,996	46,246	0.8%	39,119	13.5%	48,111	10.9%	60,139	0.8%	50,067	14.1%	58,041	11.7%	72,551
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	60,929	71,681	3.0%	74,934	25.9%	92,160	19.6%	108,423	3.0%	106,839	30.0%	123,855	23.4%	145,712
	Partly Insulated Distribution System	50%	3.8%			17,573	-1.6%				3.5%	19,344	-2.2%				3.2%	20,070
	Fully Insulated Distribution System	92%	0.2%			925	3.8%				0.3%	1,479	5.4%				0.4%	2,229
	Heat Loss from Not Using Pinch Technology		9.7%			44,858	-2.5%				8.3%	46,048	-4.4%				6.8%	42,688
Total					**292,393**	**467,127**				**359,606**		**557,815**				**416,882**		**628,621**

Exhibit B.3: Reference Case Forecast, Fabricated Metal Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 Base Year: Market Share as Percent of Heat Sold (%)	2003/04 Base Year: Market Share as Percent Useful Heat (%)	2003/04 Base Year: Useful Heat (GJ/year)	2003/04 Base Year: Annual Heat Sold (GJ/year)	2010/11 (Sub Sector Annual Growth Rate 3.0%): Technology Annual Growth Rate (% of GJs)	2010/11: Useful Heat Before Growth (GJ/year)	2010/11: Market Share as a Percent of Useful Heat (%)	2010/11: Useful Heat (GJ/year)	2010/11: Market Share as a Percent of Heat Sold (%)	2010/11: Annual Heat Sold (GJ/year)	2015/16 (Sub Sector Annual Growth Rate 3.0%): Technology Annual Growth Rate (% of GJs)	2015/16: Useful Heat Before Growth (GJ/year)	2015/16: Market Share as a Percent of Useful Heat (%)	2015/16: Useful Heat (GJ/year)	2015/16: Market Share as a Percent of Heat Sold (%)	2015/16: Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	125,104	178,720	0.0%	125,104	100.0%	153,862	100.0%	219,803	0.0%	153,862	100.0%	178,368	100%	254,812
	Total Comfort Heat		**100.0%**	**100.0%**	**125,104**	**178,720**		**125,104**	**100.0%**	**153,862**	**100.0%**	**219,803**		**153,862**	**100%**	**178,368**	**100.0%**	**254,812**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0
	Standard Efficiency Furnace	25%	66.0%	57.9%	93,472	373,888	-1.6%	83,364	51.6%	102,528	60.6%	410,111	-2.0%	92,532	46.6%	107,270	56.0%	429,080
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	67,980	169,949	2.0%	78,087	48.4%	96,037	35.5%	240,094	2.0%	106,033	53.4%	122,921	40.1%	307,304
	Standard Furnace Insulation	25%	3.1%			17,561	-2.0%				2.8%	18,791	-2.7%				2.5%	18,952
	Ceramic Fibre Insulation on Standard Efficiency Furnace	40%	0.9%			5,098	4.0%				1.2%	8,026	4.0%				1.4%	11,072
	Total Process Heat		**100.0%**	**100.0%**	**161,452**	**566,497**		**161,452**	**100.0%**	**198,565**	**100.0%**	**677,021**		**198,565**	**100%**	**230,191**	**100.0%**	**766,408**
Total					**286,556**	**745,217**				**352,427**		**896,824**				**408,560**		**1,021,220**

Exhibit B.4: Reference Case Forecast, Non-Metallic Mineral Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	133,662	190,945	0.0%	133,662	100.0%	164,387	100%	234,838	0.0%	164,387	100.0%	190,569	100.0%	272,242
	Total Comfort Heat		**100.0%**	**100.0%**	**133,662**	**190,945**		**133,662**	**100.0%**	**164,387**	**100.0%**	**234,838**		**164,387**	**100%**	**190,569**	**100.0%**	**272,242**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.3%	176,538	259,615	-1.2%	166,564	59.8%	204,853	61.6%	301,254	-1.0%	194,672	56.8%	225,679	59.1%	331,881
	Near Condensing Boiler	80%	10.0%	11.6%	32,200	40,250	0.8%	34,047	12.2%	41,874	10.7%	52,343	0.8%	43,576	12.7%	50,517	11.2%	63,146
	Condensing Boiler	92%	2.5%	3.3%	9,258	10,063	0.4%	9,520	3.4%	11,708	2.6%	12,726	0.4%	11,944	3.5%	13,847	2.7%	15,051
	Combustion Air Preheat from Exhaust on Standard Efficiency	72%	2.0%	2.1%	5,796	8,050	0.0%	5,796	2.1%	7,128	2.0%	9,901	0.0%	7,128	2.1%	8,264	2.0%	11,477
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	34,213	40,250	3.0%	42,077	15.1%	51,750	12.4%	60,882	3.0%	59,992	17.5%	69,548	14.6%	81,821
	Partly Insulated Distribution System	50%	3.8%			15,295	-1.6%				3.4%	16,836	-2.2%				3.1%	17,468
	Fully Insulated Distribution System	92%	0.2%			805	3.8%				0.3%	1,287	5.4%				0.3%	1,940
	Tank-type Water Heating	65%	5.0%	4.7%	13,081	20,125	-1.3%	11,944	4.3%	14,690	4.6%	22,600	-1.6%	13,565	4.0%	15,726	4.3%	24,194
	Direct Fired Water Heating	95%	2.0%	2.7%	7,648	8,050	2.0%	8,785	3.2%	10,804	2.3%	11,373	2.0%	11,929	3.5%	13,828	2.6%	14,556
	Total Process Heat		**100.0%**	**100.0%**	**278,734**	**402,504**		**278,734**	**100.0%**	**342,808**	**100.0%**	**489,202**		**342,808**	**100%**	**397,408**	**100.0%**	**561,533**
Total					**412,396**	**593,449**				**507,194**		**724,040**				**587,977**		**833,775**

Exhibit B.5: Reference Case Forecast, Paper Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	14,291	20,416	0.0%	14,291	51.0%	17,576	52.2%	25,108	0.0%	17,576	51.0%	20,375	52.3%	29,108
	Standard Efficiency Boiler	68%	27.3%	27.0%	7,566	11,126	-0.9%	7,225	25.8%	8,886	27.2%	13,067	-0.7%	8,571	24.9%	9,937	26.2%	14,613
	Near Condensing Boilers	80%	17.5%	20.4%	5,716	7,145	0.8%	6,044	21.6%	7,434	19.3%	9,292	0.8%	7,736	22.4%	8,968	20.1%	11,210
	Condensing Boiler	92%	1.3%	1.7%	470	510	0.4%	483	1.7%	594	1.3%	646	0.4%	606	1.8%	702	1.4%	763
	Partly Insulated Distribution System	50%	3.8%			1,552	0.0%				0.0%	0	0.0%				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			82	4.0%				0.0%	0	4.0%				0.0%	0
	Total Comfort Heat		**100.0%**	**100.0%**	**28,043**	**40,831**		**28,043**	**100.0%**	**34,489**	**100.0%**	**48,113**		**34,489**	**100%**	**39,982**	**100.0%**	**55,694**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	64,577	94,966	-9.7%	38,671	13.7%	47,561	14.2%	69,942	-15.4%	20,593	5.9%	23,872	6.4%	35,106
	Near Condensing Boiler	80%	7.5%	8.9%	25,046	31,308	0.8%	26,483	9.4%	32,570	8.2%	40,713	0.8%	33,894	9.8%	39,293	8.9%	49,116
	Combustion Air Preheat from Exhaust on Standard Efficiency	72%	0.8%	0.8%	2,254	3,131	0.0%	2,254	0.8%	2,772	0.8%	3,850	0.0%	2,772	0.8%	3,214	0.8%	4,464
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	106,446	125,231	3.0%	130,915	46.4%	161,009	38.3%	189,422	3.0%	186,654	53.7%	216,383	46.1%	254,568
	Partly Insulated Distribution System	50%	3.8%			15,863	-1.6%				3.5%	17,460	-2.2%				3.3%	18,116
	Fully Insulated Distribution System	92%	0.2%			835	3.8%				0.3%	1,335	5.4%				0.4%	2,012
	Heat Loss from Not Using Pinch Technology		10.0%			41,744	-2.4%				8.3%	43,336	-4.3%				6.8%	40,236
	Steam Paper Drying	80%	23.0%	27.2%	76,808	96,010	-0.2%	75,724	26.8%	93,131	23.6%	116,414	-0.2%	92,060	26.5%	106,722	24.2%	133,403
	Direct Fired Paper Drying	87%	2.0%	2.6%	7,288	8,349	2.0%	8,372	3.0%	10,297	2.4%	11,795	2.0%	11,368	3.3%	13,179	2.7%	15,096
	Total Process Heat		**100.0%**	**100.0%**	**282,420**	**417,435**		**282,420**	**100.0%**	**347,341**	**99.5%**	**494,269**		**347,341**	**100%**	**402,663**	**99.5%**	**552,117**
Total					**310,463**	**458,266**				**381,830**		**542,382**				**442,645**		**607,810**

Exhibit B.6: Reference Case Forecast, Wood Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 Base Year: Market Share as Percent of Heat Sold (%)	2003/04 Base Year: Market Share as Percent Useful Heat (%)	2003/04 Base Year: Useful Heat (GJ/year)	2003/04 Base Year: Annual Heat Sold (GJ/year)	2010/11 (Sub Sector Annual Growth Rate 3.0%): Technology Annual Growth Rate (% of GJs)	2010/11: Useful Heat Before Growth (GJ/year)	2010/11: Market Share as a Percent of Useful Heat (%)	2010/11: Useful Heat (GJ/year)	2010/11: Market Share as a Percent of Heat Sold (%)	2010/11: Annual Heat Sold (GJ/year)	2015/16 (Sub Sector Annual Growth Rate 1.5%): Technology Annual Growth Rate (% of GJs)	2015/16: Useful Heat Before Growth (GJ/year)	2015/16: Market Share as a Percent of Useful Heat (%)	2015/16: Useful Heat (GJ/year)	2015/16: Market Share as a Percent of Heat Sold (%)	2015/16: Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	72,768	103,954	0.0%	72,768	51.0%	89,495	50.3%	127,850	0.0%	89,495	51.0%	96,412	50.5%	137,731
	Standard Efficiency Boiler	68%	27.3%	27.0%	38,525	56,655	-0.9%	36,788	25.8%	45,245	26.2%	66,536	-0.7%	43,645	24.9%	47,018	25.3%	69,144
	Near Condensing Boilers	80%	17.5%	20.4%	29,107	36,384	0.8%	30,777	21.6%	37,852	18.6%	47,314	0.8%	39,390	22.4%	42,434	19.4%	53,043
	Condensing Boiler	92%	1.3%	1.7%	2,391	2,599	0.4%	2,459	1.7%	3,024	1.3%	3,287	0.4%	3,085	1.8%	3,323	1.3%	3,612
	Partly Insulated Distribution System	50%	3.8%			7,901	-1.6%				3.4%	8,696	-2.2%				3.1%	8,385
	Fully Insulated Distribution System	92%	0.2%			416	3.8%				0.3%	665	5.4%				0.3%	931
	Total Comfort Heat		**100.0%**	**100.0%**	**142,791**	**207,908**		**142,791**	**100.0%**	**175,615**	**100.0%**	**254,349**		**175,615**	**100%**	**189,187**	**100.0%**	**272,846**
Process Heat	Standard Efficiency Boiler	68%	15.5%	16.7%	56,024	82,388	-2.0%	50,614	15.1%	62,249	14.1%	91,543	-1.9%	56,662	13.8%	61,042	12.9%	89,767
	Near Condensing Boiler	80%	2.3%	2.9%	9,764	12,206	0.8%	10,325	3.1%	12,698	2.4%	15,872	0.8%	13,214	3.2%	14,235	2.6%	17,794
	Condensing Boiler	92%	0.6%	0.8%	2,807	3,051	0.4%	2,887	0.9%	3,550	0.6%	3,859	0.4%	3,622	0.9%	3,902	0.6%	4,241
	Bundled Standard Boiler Upgrades	85%	4.6%	6.2%	20,749	24,411	3.0%	25,519	12.0%	31,385	5.7%	36,924	3.0%	36,384	8.8%	39,196	6.6%	46,113
	Standard Efficiency Kiln	57%	67.5%	61.0%	204,178	358,207	-0.3%	199,668	59.7%	245,567	66.4%	430,819	-0.4%	241,005	58.6%	259,631	65.5%	455,492
	Advanced Kiln Control	60%	2.0%	1.9%	6,368	10,614	4.0%	8,380	2.5%	10,306	2.6%	17,177	4.0%	12,539	3.0%	13,508	3.2%	22,514
	High Efficiency Kiln	87%	7.5%	10.4%	34,627	39,801	1.0%	37,124	11.1%	45,658	8.1%	52,481	1.0%	47,987	11.7%	51,696	8.5%	59,421
	Total Process Heat		**100.0%**	**100.0%**	**334,518**	**530,677**		**334,518**	**104.4%**	**411,414**	**100.0%**	**648,675**		**411,414**	**100%**	**443,210**	**100.0%**	**695,343**
Total					**477,309**	**738,585**				**587,030**		**903,024**				**632,398**		**968,189**

Exhibit B.7: Reference Case Forecast, Other Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Standard Air Handling Units and Unit Heaters	70%	80.0%	82.8%	169,054	241,506	0.0%	169,054	82.8%	207,915	80%	297,021	0.0%	207,915	82.8%	241,030	81%	344,329
	Standard Efficiency Boiler	68%	9.6%	9.7%	19,809	29,132	-0.9%	18,945	9.3%	23,300	9%	34,264	-0.7%	22,503	9.0%	26,088	9%	38,364
	Near Condensing Boilers	80%	6.1%	7.2%	14,732	18,415	0.8%	15,577	7.6%	19,158	6%	23,947	0.8%	19,936	7.9%	23,112	7%	28,890
	Condensing Boiler	92%	0.3%	0.3%	694	755	0.4%	714	0.3%	878	0%	954	0.4%	896	0.4%	1,039	0%	1,129
	Partly Insulated Distribution System	50%	3.8%			11,472	-1.6%				3%	12,627	-2.2%				3%	13,101
	Fully Insulated Distribution System	92%	0.2%			604	3.8%				0%	965	5.4%				0%	1,455
	Total Comfort Heat		**100.0%**	**100.0%**	**204,290**	**301,882**		**204,290**	**100.0%**	**251,250**	**100%**	**369,780**		**251,250**	**100%**	**291,268**	**100%**	**427,268**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	173,681	255,413	-1.4%	161,555	29.1%	198,692	28.7%	292,194	-1.3%	186,389	27.3%	216,076	27.2%	317,758
	Near Condensing Boiler	80%	7.0%	8.4%	46,896	58,619	0.8%	49,586	8.9%	60,984	7.5%	76,230	0.8%	63,463	9.3%	73,571	7.9%	91,963
	Condensing Boiler	92%	2.0%	2.8%	15,409	16,748	0.4%	15,845	2.9%	19,488	2.1%	21,182	0.4%	19,880	2.9%	23,047	2.1%	25,051
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	39,149	46,058	3.0%	48,149	8.7%	59,217	6.8%	69,667	3.0%	68,649	10.1%	79,583	8.0%	93,627
	Partly Insulated Distribution System	50%	3.8%			31,822	-1.6%				3.4%	35,028	-2.2%				3.1%	36,343
	Fully Insulated Distribution System	92%	0.2%			1,675	3.8%				0.3%	2,678	5.4%				0.3%	4,036
	Tank-type Water Heating	65%	10.0%	9.8%	54,432	83,742	-0.4%	53,249	9.6%	65,490	9.9%	100,754	-0.4%	64,320	9.4%	74,565	9.8%	114,715
	Direct Fired Water Heating	95%	1.0%	1.4%	7,955	8,374	2.0%	9,138	1.6%	11,239	1.2%	11,831	2.0%	12,409	1.8%	14,385	1.3%	15,142
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	163,297	251,226	-1.3%	152,714	27.5%	187,819	28.4%	288,953	-1.3%	176,074	25.8%	204,118	26.9%	314,028
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	33,497	41,871	4.0%	44,080	7.9%	54,212	6.7%	67,765	4.0%	65,957	9.7%	76,463	8.2%	95,578
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	20,936	41,871	0.0%	20,936	3.8%	25,748	5.1%	51,496	0.0%	25,748	3.8%	29,849	5.1%	59,698
	Total Process Heat		**100.0%**	**100.0%**	**555,251**	**837,420**		**555,251**	**100.0%**	**682,889**	**100.0%**	**1,017,777**		**682,889**	**100%**	**791,656**	**100.0%**	**1,167,939**
Total					**759,541**	**1,139,302**				**934,140**		**1,387,557**				**1,082,924**		**1,595,207**

Exhibit B.8: Reference Case Forecast, Food Sub Sector, Interior Service Area

			2003/2004				2010/2011						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	95.9%	96.2%	29,330	41,900	0.0%	29,330	96.2%	36,072	95.9%	51,531	0.0%	36,072	96.2%	41,817	95.9%	59,739
	Standard Efficiency Boiler	68%	3.7%	3.6%	1,087	1,598	0.0%	1,084	3.6%	1,333	3.6%	1,960	0.0%	1,330	3.5%	1,542	3.6%	2,267
	Near Condensing Boilers	80%	0.1%	0.2%	48	60	0.8%	51	0.2%	62	0.1%	78	0.8%	65	0.2%	75	0.2%	94
	Condensing Boiler	92%	0.0%	0.0%	14	15	0.4%	14	0.05%	17	0.0%	19	0.4%	18	0.0%	21	0.0%	22
	Partly Insulated Distribution System	50%	0.3%			114	-1.6%				0.2%	125	-2.2%				0.2%	129
	Fully Insulated Distribution System	92%	0.0%			6.0	3.8%				0.0%	10	3.7%				0.0%	13
	Total Comfort Heat		**100.0%**	**100.0%**	**30,478**	**43,692**		**30,478**	**100.0%**	**37,484**	**100.0%**	**53,722**		**37,484**	**100.0%**	**43,454**	**100.0%**	**62,265**
Process Heat	Standard Efficiency Boiler	68%	51.8%	50.7%	209,051	307,428	-1.6%	187,068	45.4%	230,070	47.0%	338,338	-2.2%	206,346	40.7%	239,212	42.8%	351,782
	Near Condensing Boiler	80%	9.4%	10.8%	44,434	55,543	0.8%	46,983	11.4%	57,783	10.0%	72,229	0.8%	60,132	11.9%	69,709	10.6%	87,137
	Condensing Boiler	92%	10.3%	13.7%	56,458	61,368	0.4%	58,058	14.1%	71,404	10.8%	77,613	0.4%	72,844	14.4%	84,446	11.2%	91,789
	Bundled Standard Boiler Upgrades	85%	14.0%	17.2%	70,807	83,302	3.0%	87,083	21.1%	107,101	17.5%	126,002	3.0%	124,160	24.5%	143,935	20.6%	169,336
	Partly Insulated Distribution System	50%	3.8%			22,563	-1.6%				3.5%	24,836	-2.2%				3.1%	25,711
	Fully Insulated Distribution System	92%	0.2%			1,188	3.8%				0.3%	1,899	3.7%				0.3%	2,641
	Direct Fired Heating	90%	1.3%	1.7%	6,899	7,665	2.9%	8,455	2.1%	10,398	1.6%	11,553	5.0%	13,271	2.6%	15,385	2.1%	17,094
	Standard Efficiency Oven	65%	1.9%	1.8%	7,410	11,399	-1.3%	6,752	1.6%	8,304	1.8%	12,775	-1.5%	7,690	1.5%	8,915	1.7%	13,716
	Efficient Oven	80%	1.9%	2.2%	9,120	11,399	1.0%	9,777	2.4%	12,025	2.1%	15,031	1.0%	12,638	2.5%	14,651	2.2%	18,314
	Tank-type Water Heating	65%	1.0%	0.9%	3,705	5,700	-0.6%	3,549	0.9%	4,364	0.9%	6,714	-0.7%	4,219	0.8%	4,891	0.9%	7,524
	Direct Fired Water Heating	95%	0.8%	1.1%	4,381	4,611	0.5%	4,537	1.1%	5,580	0.8%	5,873	0.5%	5,725	1.1%	6,637	0.8%	6,987
	Heat Loss from Not Using Pinch Technology		3.6%			21,517	0.0%				3.7%	26,463	0.0%				3.7%	30,678
	Total Process Heat		**100.0%**	**100.0%**	**412,326**	**593,773**		**412,326**	**100.0%**	**507,109**	**100.0%**	**719,441**		**507,109**	**100.0%**	**587,879**	**100.0%**	**822,848**
Total					**442,804**	**637,465**				**544,594**		**773,164**				**631,333**		**885,112**

Exhibit B.9: Reference Case Forecast, Chemical Sub Sector, Interior Service Area

			2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	1,589	2,270	0.0%	1,589	100.0%	1,954	100.0%	2,792	0.0%	1,954	100.0%	2,266	100.0%	3,236
	Total Comfort Heat		**100.0%**	**100.0%**	**1,589**	**2,270**		**1,589**	**100.0%**	**1,954**	**100.0%**	**2,792**		**1,954**	**100.0%**	**2,266**	**100.0%**	**3,236**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	92,914	136,639	-1.3%	85,077	60.6%	104,634	57.4%	153,873	-1.6%	96,550	55.9%	111,928	54.5%	164,600
	Near Condensing Boiler	80%	10.0%	12.8%	17,979	22,474	0.8%	19,010	13.5%	23,380	10.9%	29,225	0.8%	24,330	14.1%	28,205	11.7%	35,257
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	29,609	34,834	3.0%	36,415	25.9%	44,786	19.6%	52,689	3.0%	51,919	30.0%	60,189	23.4%	70,810
	Partly Insulated Distribution System	50%	3.8%			8,540	-1.6%				3.5%	9,400	-2.2%				3.2%	9,753
	Fully Insulated Distribution System	92%	0.2%			449	3.8%				0.3%	719	5.4%				0.4%	1,083
	Heat Loss from Not Using Pinch Technology		9.7%			21,799	-2.5%				8.3%	22,377	-4.4%				6.8%	20,745
	Total Process Heat		**100.0%**	**100.0%**	**140,502**	**224,735**		**140,502**	**100.0%**	**172,800**	**100.0%**	**268,284**		**172,800**	**100.0%**	**200,322**	**99.9%**	**302,248**
Total					**142,091**	**227,005**				**174,754**		**271,076**				**202,588**		**305,485**

Exhibit B.10: Reference Case Forecast, Fabricated Metal Sub Sector, Interior Service Area

			2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
End Use	Technology	Seasonal Efficiency (%)	Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	14,525	20,750	0.0%	14,525	100.0%	17,864	100%	25,520	0.0%	17,864	100.0%	20,709	100.0%	29,585
	Total Comfort Heat		**100.0%**	**100.0%**	**14,525**	**20,750**		**14,525**	**100.0%**	**17,864**	**100.0%**	**25,520**		**17,864**	**100%**	**20,709**	**100.0%**	**29,585**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0.0%	0	0.0%	0	0%	0	0.0%	0	0.0%	0	0.0%	0
	Heat Loss from Not Using Pinch Technology		0.0%			0	0.0%				0.0%	0	0.0%				0.0%	0
	Standard Efficiency Furnace	25%	66.0%	57.9%	4,057	16,229	-1.6%	3,618	51.6%	4,450	60.6%	17,801	-2.0%	4,016	46.6%	4,656	56.0%	18,624
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	2,951	7,377	2.0%	3,389	48.4%	4,169	35.5%	10,421	2.0%	4,602	53.4%	5,335	40.1%	13,339
	Standard Furnace Insulation	25%	3.1%			762	-2.0%				2.8%	816	-2.7%				2.5%	823
	Ceramic Fibre Insulation on Standard Efficiency Furnace	40%	0.9%			221	4.0%				1.2%	354	4.0%				1.4%	488
	Steam Paper Drying	80%	0.0%	0.0%	0	0	4.0%	0	0.0%		0.0%	0	0.0%	0	0.0%	0	0.0%	
	Total Process Heat		**100.0%**	**100.0%**	**7,008**	**24,589**		**7,008**	**100.0%**	**8,619**	**100.0%**	**29,392**		**8,619**	**100.0%**	**9,992**	**100.0%**	**33,274**
Total					**21,533**	**45,339**				**26,483**		**54,912**				**30,701**		**62,858**

Exhibit B.11: Reference Case Forecast, Non-Metallic Mineral Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	64,607	92,295	0.0%	64,607	100.0%	79,458	100.0%	113,511	0.0%	79,458	100.0%	92,113	100.0%	131,591
	Total Comfort Heat		**100.0%**	**100.0%**	**64,607**	**92,295**		**64,607**	**100.0%**	**79,458**	**100.0%**	**113,511**		**79,458**	**100.0%**	**92,113**	**100.0%**	**131,591**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.3%	44,221	65,031	-0.8%	41,723	59.8%	51,314	61.5%	75,462	-1.0%	48,764	56.8%	56,531	59.0%	83,133
	Near Condensing Boiler	80%	10.0%	11.6%	8,066	10,082	0.8%	8,529	12.2%	10,489	10.7%	13,111	0.8%	10,915	12.7%	12,654	11.2%	15,817
	Condensing Boiler	92%	2.5%	3.3%	2,319	2,521	0.4%	2,385	3.4%	2,933	2.6%	3,188	0.4%	2,992	3.5%	3,469	2.7%	3,770
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	72%	2.0%	2.1%	1,452	2,016	0.0%	1,452	2.1%	1,786	2.0%	2,480	0.0%	1,786	2.1%	2,070	2.0%	2,875
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	8,570	10,082	3.0%	10,540	15.1%	12,963	12.4%	15,251	3.0%	15,028	17.5%	17,421	14.5%	20,495
	Partly Insulated Distribution System	50%	3.8%			3,831	-1.6%				3.4%	4,217	-2.2%				3.1%	4,366
	Fully Insulated Distribution System	92%	0.2%			202	3.8%				0.3%	322	3.7%				0.3%	449
	Tank-type Water Heating	65%	5.0%	4.7%	3,277	5,041	0.0%	3,277	4.7%	4,030	5.1%	6,200	0.0%	4,030	4.7%	4,672	5.1%	7,188
	Direct Fired Water Heating	95%	2.0%	2.7%	1,916	2,016	0.0%	1,916	2.7%	2,356	2.0%	2,480	0.0%	2,356	2.7%	2,731	2.0%	2,875
	Total Process Heat		**100.0%**	**100.0%**	**69,821**	**100,824**		**69,821**	**100.0%**	**85,871**	**100.0%**	**122,711**		**85,871**	**100.0%**	**99,548**	**100.0%**	**140,968**
Total					**134,427**	**193,119**				**165,328**		**236,223**				**191,661**		**272,559**

Exhibit B.12: Reference Case Forecast, Paper Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	4,674	6,678	0.0%	4,674	51.0%	5,749	50.3%	8,212	0.0%	5,749	51.0%	6,664	50%	9,521
	Standard Efficiency Boiler	68%	27.3%	27.0%	2,475	3,639	-0.7%	2,363	25.8%	2,906	26.2%	4,274	-0.7%	2,804	24.9%	3,250	25%	4,780
	Near Condensing Boilers	80%	17.5%	20.4%	1,870	2,337	0.8%	1,977	21.6%	2,431	18.6%	3,039	0.8%	2,530	22.4%	2,933	19%	3,667
	Condensing Boiler	92%	1.3%	1.7%	154	167	0.4%	158	1.7%	194	1.3%	211	0.4%	198	1.8%	230	1%	250
	Partly Insulated Distribution System	50%	3.8%			507	-1.6%				3.4%	559	-2.2%				3%	578
	Fully Insulated Distribution System	92%	0.2%			27	3.8%				0.3%	43	3.7%				0%	59
	Total Comfort Heat		**100.0%**	**100.0%**	**9,172**	**13,355**		**9,172**	**100.0%**	**11,281**	**100.0%**	**16,338**		**11,281**	**100.0%**	**13,077**	**100.0%**	**18,854**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	8,423	12,386	-7.1%	5,044	13.7%	6,203	14.2%	9,122	-15.4%	2,686	5.9%	3,114	6.4%	4,579
	Near Condensing Boiler	80%	7.5%	8.9%	3,267	4,083	0.8%	3,454	9.4%	4,248	8.3%	5,310	0.8%	4,421	9.8%	5,125	8.9%	6,406
	Condensing Boiler	92%	0.0%	0.0%	0	0	0.4%	0	0.0%	0	0.0%	0	0.4%	0	0.0%	0	0.0%	0
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	72%	0.8%	0.8%	294	408	0.0%	294	0.8%	362	0.8%	502	0.0%	362	0.8%	419	0.8%	582
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	13,883	16,334	3.0%	17,075	46.4%	21,000	38.5%	24,706	3.0%	24,345	53.7%	28,222	46.3%	33,203
	Partly Insulated Distribution System	50%	3.8%			2,069	-1.6%				3.5%	2,277	-2.2%				3.3%	2,358
	Fully Insulated Distribution System	92%	0.2%			109	3.8%				0.3%	174	3.7%				0.3%	242
	Heat Loss from Not Using Pinch Technology		10.0%			5,445	-3.1%				8.3%	5,354	-4.5%				6.8%	4,923
	Steam Paper Drying	80%	23.0%	27.2%	10,018	12,522	-0.2%	9,877	26.8%	12,147	23.7%	15,184	-0.2%	12,007	26.5%	13,920	24.3%	17,399
	Direct Fired Paper Drying	87%	2.0%	2.6%	951	1,089	2.0%	1,092	3.0%	1,343	2.4%	1,538	2.0%	1,483	3.3%	1,719	2.7%	1,969
	Total Process Heat		**100.0%**	**100.0%**	**36,835**	**54,445**		**36,835**	**100.0%**	**45,303**	**100.0%**	**64,168**		**45,303**	**100.0%**	**52,518**	**99.9%**	**71,661**
Total					**46,008**	**67,800**				**56,583**		**80,506**				**65,596**		**90,515**

Exhibit B.13: Reference Case Forecast, Wood Sub Sector, Interior Service Area

			2003/2004				2010/2011						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					1.5%
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	20,838	29,769	0.0%	20,838	51.0%	25,628	50.3%	36,612	0.0%	25,628	51.0%	27,609	50.5%	39,441
	Standard Efficiency Boiler	68%	27.3%	27.0%	11,032	16,224	-0.7%	10,535	25.8%	12,956	26.2%	19,053	-0.7%	12,498	24.9%	13,464	25.4%	19,800
	Near Condensing Boilers	80%	17.5%	20.4%	8,335	10,419	0.8%	8,813	21.6%	10,839	18.6%	13,549	0.8%	11,280	22.4%	12,152	19.4%	15,189
	Condensing Boiler	92%	1.3%	1.7%	685	744	0.4%	704	1.7%	866	1.3%	941	0.4%	883	1.8%	952	1.3%	1,034
	Partly Insulated Distribution System	50%	3.8%			2,262	-1.6%				3.4%	2,490	-2.2%				3.1%	2,396
	Fully Insulated Distribution System	92%	0.2%			119	3.8%				0.3%	190	3.7%				0.3%	246
	Total Comfort Heat		**100.0%**	**100.0%**	**40,890**	**59,537**		**40,890**	**100.0%**	**50,290**	**100.0%**	**72,836**		**50,290**	**100.0%**	**54,176**	**100.0%**	**78,107**
Process Heat	Standard Efficiency Boiler	68%	0.9%	1.0%	35,637	52,407	-4.2%	26,414	0.8%	32,486	0.7%	47,774	-6.8%	22,896	0.5%	24,665	0.5%	36,272
	Near Condensing Boiler	80%	0.2%	0.3%	8,847	11,058	0.8%	9,354	0.3%	11,504	0.2%	14,380	0.8%	11,972	0.3%	12,897	0.2%	16,122
	Condensing Boiler	92%	0.0%	0.1%	2,543	2,765	0.4%	2,615	0.1%	3,217	0.0%	3,496	0.4%	3,282	0.1%	3,535	0.0%	3,843
	Bundled Standard Boiler Upgrades	85%	0.7%	1.1%	37,598	44,233	3.0%	46,241	1.3%	56,871	0.9%	66,907	3.0%	65,929	1.5%	71,024	1.1%	83,558
	Standard Efficiency Kiln	57%	64.8%	62.5%	2,195,526	3,851,799	-0.5%	2,126,061	60.5%	2,614,786	63.5%	4,587,345	-0.6%	2,542,714	58.8%	2,739,225	62.4%	4,805,657
	Advanced Kiln Control	60%	3.7%	3.7%	130,260	217,100	4.0%	171,414	4.9%	210,817	4.9%	351,362	4.0%	256,491	5.9%	276,314	6.0%	460,523
	High Efficiency Kiln	87%	7.6%	11.2%	392,479	451,125	1.0%	420,790	12.0%	517,519	8.2%	594,850	1.0%	543,918	12.6%	585,954	8.7%	673,510
	Standard Efficiency Veneer Dryer	50%	17.7%	15.0%	526,877	1,053,754	-2.7%	435,830	12.4%	536,016	14.8%	1,072,031	-3.7%	444,474	10.3%	478,825	12.4%	957,649
	Advanced Veneer Dryer	70%	4.4%	5.2%	184,407	263,438	5.9%	275,454	7.8%	338,773	6.7%	483,962	4.9%	430,315	10.0%	463,572	8.6%	662,246
	Total Process Heat		**100.0%**	**100.0%**	**3,514,173**	**5,947,680**		**3,514,173**	**100.0%**	**4,321,990**	**100.0%**	**7,222,107**		**4,321,990**	**100.0%**	**4,656,011**	**100.0%**	**7,699,380**
Total					**3,555,063**	**6,007,217**				**4,372,280**		**7,294,943**				**4,710,187**		**7,777,487**

Exhibit B.14: Reference Case Forecast, Other Sub Sector, Interior Service Are a

Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	45,498	64,998	0.0%	45,498	82.8%	55,957	80%	79,939	0.0%	55,957	82.8%	64,870	80.6%	92,671
	Standard Efficiency Boiler	68%	9.6%	9.7%	5,331	7,840	-0.6%	5,099	9.3%	6,271	9%	9,222	-0.7%	6,056	9.0%	7,021	9.0%	10,325
	Near Condensing Boilers	80%	6.1%	7.2%	3,965	4,956	0.8%	4,192	7.6%	5,156	6%	6,445	0.8%	5,366	7.9%	6,220	6.8%	7,775
	Condensing Boiler	92%	0.3%	0.3%	187	203	0.4%	192	0.3%	236	0%	257	0.4%	241	0.4%	280	0.3%	304
	Partly Insulated Distribution System	50%	3.8%			3,087	-1.6%				3%	3,398	-2.2%				3.1%	3,518
	Fully Insulated Distribution System	92%	0.2%			162	3.8%				0%	260	3.7%				0.3%	361
	Total Comfort Heat		**100.0%**	**100.0%**	**54,981**	**81,247**		**54,981**	**100.0%**	**67,620**	**100%**	**99,521**		**67,620**	**100.0%**	**78,390**	**100.0%**	**114,955**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	10,479	15,410	-1.0%	9,747	29.1%	11,988	29%	17,630	-1.3%	11,246	27.3%	13,037	27.2%	19,172
	Near Condensing Boiler	80%	7.0%	8.4%	2,829	3,537	0.8%	2,992	8.9%	3,679	7%	4,599	0.8%	3,829	9.3%	4,439	7.9%	5,549
	Condensing Boiler	92%	2.0%	2.8%	930	1,011	0.4%	956	2.9%	1,176	2%	1,278	0.4%	1,199	2.9%	1,391	2.1%	1,511
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	2,362	2,779	3.0%	2,905	8.7%	3,573	7%	4,203	3.0%	4,142	10.1%	4,802	8.0%	5,649
	Partly Insulated Distribution System	50%	3.8%			1,920	-1.6%				3%	2,113	-2.2%				3.1%	2,188
	Fully Insulated Distribution System	92%	0.2%			101	3.8%				0%	162	3.7%				0.3%	225
	Tank-type Water Heating	65%	10.0%	9.8%	3,284	5,053	-0.3%	3,213	9.6%	3,951	10%	6,079	-0.4%	3,881	9.4%	4,499	9.8%	6,921
	Direct Fired Water Heating	95%	1.0%	1.4%	480	505	2.0%	551	1.6%	678	1%	714	2.0%	749	1.8%	868	1.3%	914
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	9,853	15,158	-1.0%	9,214	27.5%	11,332	28%	17,434	-1.3%	10,623	25.8%	12,316	26.9%	18,947
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	2,021	2,526	4.0%	2,660	7.9%	3,271	7%	4,089	4.0%	3,980	9.7%	4,613	8.2%	5,767
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	1,263	2,526	0.0%	1,263	3.8%	1,554	5%	3,107	0.0%	1,554	3.8%	1,801	5.1%	3,602
	Total Process Heat		**100.0%**	**100.0%**	**33,501**	**50,526**		**33,501**	**100.0%**	**41,202**		**61,408**		**41,202**	**100.0%**	**47,765**	**100.0%**	**70,444**
Total					**88,483**	**131,773**				**108,823**		**160,929**				**126,155**		**185,399**

Exhibit B.15: Reference Case Forecast, Food Sub Sector, Vancouver Island Service Area

			2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	4,798	6,854	0.0%	4,798	100.0%	5,901	100.0%	8,430	0.0%	5,901	100.0%	6,841	100.0%	9,772
	Total Comfort Heat		**100.0%**	**100.0%**	**4,798**	**6,854**		**4,798**	**100.0%**	**5,901**	**100.0%**	**8,430**		**5,901**	**100.0%**	**6,841**	**100.0%**	**9,772**
Process Heat	Standard Efficiency Boiler	68%	54.0%	54.1%	34,203	50,299	-0.5%	33,055	52.3%	40,654	53.0%	59,785	-0.6%	39,481	50.8%	45,770	52.1%	67,308
	Near Condensing Boiler	80%	5.0%	5.9%	3,726	4,657	0.8%	3,940	6.2%	4,845	5.4%	6,056	0.8%	5,042	6.5%	5,845	5.7%	7,306
	Condensing Boiler	92%	1.0%	1.4%	857	931	0.4%	881	1.4%	1,084	1.0%	1,178	0.4%	1,106	1.4%	1,282	1.1%	1,393
	Bundled Standard Boiler Upgrades	85%	5.0%	6.3%	3,959	4,657	3.0%	4,869	7.7%	5,988	6.2%	7,045	3.0%	6,942	8.9%	8,047	7.3%	9,467
	Partly Insulated Distribution System	50%	3.8%			3,540	-1.6%				3.5%	3,896	-2.2%				3.1%	4,042
	Fully Insulated Distribution System	92%	0.2%			186	3.8%				0.3%	298	5.4%				0.3%	449
	Standard Efficiency Oven	65%	15.0%	14.4%	9,082	13,972	-5.8%	6,728	10.6%	8,274	11.3%	12,729	-7.3%	5,661	7.3%	6,563	7.8%	10,097
	Efficient Oven	80%	10.0%	11.8%	7,452	9,315	4.0%	9,806	15.5%	12,060	13.4%	15,075	4.0%	14,673	18.9%	17,010	16.5%	21,262
	Tank-type Water Heating	65%	5.0%	4.8%	3,027	4,657	-0.9%	2,896	4.6%	3,561	4.9%	5,479	-0.7%	3,431	4.4%	3,978	4.7%	6,120
	Direct Fired Water Heating	95%	1.0%	1.4%	885	931	2.0%	1,016	1.6%	1,250	1.2%	1,316	2.0%	1,380	1.8%	1,600	1.3%	1,684
	Heat Loss from Not Using Pinch Technology		0.0%			0	0.0%				0.0%	0	0.0%				0.0%	0
	Total Process Heat		**100.0%**	**100.0%**	**63,190**	**93,146**		**63,190**	**100.0%**	**77,716**	**100.0%**	**112,857**		**77,716**	**100%**	**90,094**	**100.0%**	**129,129**
Total					**67,988**	**100,000**				**83,617**		**121,287**				**96,935**		**138,901**

Exhibit B.16: Reference Case Forecast, Non-Metallic Mineral Sub Sector, Vancouver Island Service Area

			2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**	**Technology Annual Growth Rate (% of GJs)**	**Useful Heat Before Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	16,727	23,896	0.0%	16,727	100.0%	20,572	100.0%	29,389	0.0%	20,572	100.0%	23,849	100.0%	34,070
	Total Comfort Heat		**100.0%**	**100.0%**	**16,727**	**23,896**		**16,727**	**100.0%**	**20,572**	**100.0%**	**29,389**		**20,572**	**100%**	**23,849**	**100.0%**	**34,070**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.3%	11,449	16,837	-0.8%	10,802	59.8%	13,286	61.6%	19,538	-1.0%	12,625	56.8%	14,636	59.1%	21,524
	Near Condensing Boiler	80%	10.0%	11.6%	2,088	2,610	0.8%	2,208	12.2%	2,716	10.7%	3,395	0.8%	2,826	12.7%	3,276	11.2%	4,095
	Condensing Boiler	92%	2.5%	3.3%	600	653	0.4%	617	3.4%	759	2.6%	825	0.4%	775	3.5%	898	2.7%	976
	Combustion Air Preheat from Exhaust on Standard	72%	2.0%	2.1%	376	522	0.0%	376	2.1%	462	2.0%	642	0.0%	462	2.1%	536	2.0%	744
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	2,219	2,610	3.0%	2,729	15.1%	3,356	12.4%	3,948	3.0%	3,891	17.5%	4,510	14.6%	5,306
	Partly Insulated Distribution System	50%	3.8%			992	-1.6%				3.4%	1,092	-2.2%				3.1%	1,133
	Fully Insulated Distribution System	92%	0.2%			52	3.8%				0.3%	83	5.4%				0.3%	126
	Tank-type Water Heating	65%	5.0%	4.7%	848	1,305	-1.8%	775	4.3%	953	4.6%	1,466	-1.58%	880	4.0%	1,020	4.3%	1,569
	Direct Fired Water Heating	95%	2.0%	2.7%	496	522	2.0%	570	3.2%	701	2.3%	738	2.0%	774	3.5%	897	2.6%	944
	Total Process Heat		**100.0%**	**100.0%**	**18,077**	**26,104**		**18,077**	**100.0%**	**22,232**	**100%**	**31,727**		**22,232**	**100.0%**	**25,774**	**100.0%**	**36,418**
Total					**34,804**	**50,000**				**42,805**		**61,116**				**49,622**		**70,488**

Exhibit B.17: Reference Case Forecast, Wood Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					1.5%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	1,214	1,735	0.0%	1,214	51.0%	1,493	50.3%	2,133	-0.8%	1,493	51.0%	1,609	50.5%	2,298
	Standard Efficiency Boiler	68%	27.2%	26.9%	642	944	-1.1%	613	25.7%	753	26.1%	1,108	-1.3%	727	24.8%	783	25.3%	1,151
	Near Condensing Boilers	80%	17.5%	20.4%	486	607	0.8%	514	21.6%	632	18.6%	789	0.8%	657	22.4%	708	19.4%	885
	Condensing Boiler	92%	1.3%	1.7%	40	43	0.4%	41	1.7%	50	1.3%	55	0.4%	51	1.8%	55	1.3%	60
	Partly Insulated Distribution System	50%	3.9%			134	-1.6%				3.5%	147	-2.2%				3.1%	142
	Fully Insulated Distribution System	92%	0.2%			7	3.8%				0.3%	11	5.4%				0.3%	16
	Total Comfort Heat		**100.0%**	**100.0%**	**2,381**	**3,469**		**2,381**	**100.0%**	**2,929**	**100.0%**	**4,244**		**2,929**	**100.0%**	**3,155**	**100.0%**	**4,552**
Process Heat	Standard Efficiency Boiler	68%	0.9%	1.0%	2,081	3,060	-1.3%	1,573	0.8%	1,935	0.7%	2,846	-1.5%	1,782	0.7%	1,919	0.6%	2,823
	Near Condensing Boiler	80%	0.2%	0.3%	515	644	0.8%	545	0.3%	670	0.2%	838	2.0%	740	0.3%	797	0.2%	997
	Condensing Boiler	92%	0.0%	0.1%	148	161	0.4%	152	0.1%	187	0.0%	204	0.5%	192	0.1%	207	0.1%	225
	Bundled Standard Boiler Upgrades	85%	0.7%	1.0%	2,062	2,426	3.0%	2,536	1.2%	3,119	0.9%	3,669	0.5%	3,197	1.3%	3,445	0.9%	4,052
	Standard Efficiency Kiln	57%	64.8%	62.5%	127,926	224,431	-0.5%	123,875	60.5%	152,351	63.5%	267,282	-0.4%	149,566	59.4%	161,125	62.9%	282,676
	Advanced Kiln Control	60%	3.7%	3.7%	7,589	12,649	4.0%	9,987	4.9%	12,283	4.9%	20,471	4.0%	14,944	5.9%	16,099	6.0%	26,832
	High Efficiency Kiln	87%	7.6%	11.2%	22,913	26,336	1.0%	24,565	12.0%	30,212	8.3%	34,727	0.1%	30,336	12.1%	32,680	8.4%	37,563
	Standard Efficiency Veneer Dryer	50%	17.7%	15.0%	30,737	61,475	-2.7%	25,433	12.4%	31,279	14.9%	62,558	-3.7%	25,905	10.3%	27,907	12.4%	55,814
	Advanced Veneer Dryer	70%	4.4%	5.2%	10,744	15,349	5.9%	16,049	7.8%	19,738	6.7%	28,197	4.9%	25,072	10.0%	27,009	8.6%	38,585
	Total Process Heat		**100.000%**	**100.0%**	**204,716**	**346,531**		**204,716**	**100.0%**	**251,774**	**100.0%**	**420,791**		**251,734**	**100.0%**	**271,189**	**100.0%**	**449,566**
Total					**207,097**	**350,000**				**254,703**		**425,035**				**274,344**		**454,118**

Exhibit B.18: Reference Case Forecast, Other Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11						2015/16					
			Base Year				Sub Sector Annual Growth Rate					3.0%	Sub Sector Annual Growth Rate					3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Technology Annual Growth Rate (% of GJs)	Useful Heat Before Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Useful Heat (GJ/year)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	17,264	24,662	0.0%	17,264	82.8%	21,232	80.3%	30,332	0.0%	21,232	82.8%	24,614	80.6%	35,163
	Standard Efficiency Boiler	68%	9.6%	9.7%	2,023	2,975	-0.6%	1,935	9.3%	2,379	9.3%	3,499	-0.7%	2,298	9.0%	2,664	9.0%	3,918
	Near Condensing Boilers	80%	6.1%	7.2%	1,504	1,881	0.8%	1,591	7.6%	1,956	6.5%	2,445	0.8%	2,036	7.9%	2,360	6.8%	2,950
	Condensing Boiler	92%	0.3%	0.3%	71	77	0.4%	73	0.3%	90	0.3%	97	0.4%	91	0.4%	106	0.3%	115
	Partly Insulated Distribution System	50%	3.8%			1,171	-1.6%				3.4%	1,289	-2.2%				3.1%	1,338
	Fully Insulated Distribution System	92%	0.2%			62	3.8%				0.3%	99	5.4%				0.3%	149
	Total Comfort Heat		**100.0%**	**100.0%**	**20,862**	**30,828**		**20,862**	**100.0%**	**25,658**	**100.0%**	**37,762**		**25,658**	**100.0%**	**29,744**	**100.0%**	**43,632**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	3,976	5,847	-1.0%	3,699	29.1%	4,549	28.7%	6,690	-1.3%	4,267	27.3%	4,947	27.2%	7,275
	Near Condensing Boiler	80%	7.0%	8.4%	1,074	1,342	0.8%	1,135	8.9%	1,396	7.5%	1,745	0.8%	1,453	9.3%	1,684	7.9%	2,105
	Condensing Boiler	92%	2.0%	2.8%	353	383	0.4%	363	2.9%	446	2.1%	485	0.4%	455	2.9%	528	2.1%	574
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	896	1,054	3.0%	1,102	8.7%	1,356	6.8%	1,595	3.0%	1,572	10.1%	1,822	8.0%	2,144
	Partly Insulated Distribution System	50%	3.8%			729	-1.6%				3.4%	802	-2.2%				3.1%	832
	Fully Insulated Distribution System	92%	0.2%			38	3.8%				0.3%	61	5.4%				0.3%	92
	Tank-type Water Heating	65%	10.0%	9.8%	1,246	1,917	-0.3%	1,219	9.6%	1,499	9.9%	2,307	-0.36%	1,473	9.4%	1,707	9.8%	2,626
	Direct Fired Water Heating	95%	1.0%	1.4%	182	192	2.0%	209	1.6%	257	1.2%	271	2.0%	284	1.8%	329	1.3%	347
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	3,739	5,752	-1.0%	3,496	27.5%	4,300	28.4%	6,615	-1.3%	4,031	25.8%	4,673	26.9%	7,189
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	767	959	4.0%	1,009	7.9%	1,241	6.7%	1,551	4.0%	1,510	9.7%	1,751	8.2%	2,188
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	479	959	0.0%	479	3.8%	589	5.1%	1,179	0.0%	589	3.8%	683	5.1%	1,367
	Total Process Heat		**100.0%**	**100.0%**	**12,712**	**19,172**		**12,712**	**100.0%**	**15,634**	**100.0%**	**23,301**		**15,634**	**100.0%**	**18,124**	**100.0%**	**26,739**
Total					**33,574**	**50,000**				**41,292**		**61,063**				**47,868**		**70,371**

APPENDIX C: DETAILED TECHNOLOGY SCREENING RESULTS

Technology	Target Market			Customer Payback (Yrs)	Measure TRC	B/C Ratio
	Service Area	Sub Sector(s)	Full/Incrr			
3.3 MMBTU Near Condensing Boiler Constant Load	V I	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	4.5	33,331	1.25
3.3 MMBTU Near Condensing Boiler Constant Load	L M/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	4.9	60,212	1.45
3.3 MMBTU Near Condensing Boiler Constant Load	V I	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Incr	1.8	114,181	3.19
3.3 MMBTU Near Condensing Boiler Constant Load	L M/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Incr	1.9	141,062	3.70
3.3 MMBTU Condensing Boiler Constant Load	V I	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	3.5	99,266	1.52
3.3 MMBTU Condensing Boiler Constant Load	L M/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	3.8	146,015	1.77
3.3 MMBTU Condensing Boiler Constant Load	V I	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Incr	1.9	180,116	2.65
3.3 MMBTU Condensing Boiler Constant Load	L M/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Incr	2.0	226,865	3.08
3.3 MMBTU Near Condensing Boiler Variable Load	VI	Process Heat in Food- Greenhouses	Full	4.8	43,132	1.29
3.3 MMBTU Near Condensing Boiler Variable Load	LM/Int	Process Heat in Food- Greenhouses	Full	4.0	123,365	2.12
3.3 MMBTU Near Condensing Boiler Variable Load	VI	Process Heat in Food- Greenhouses	Incr	1.9	123,982	2.79
3.3 MMBTU Near Condensing Boiler Variable Load	LM/Int	Process Heat in Food- Greenhouses	Incr	1.9	181,115	4.47
3.3 MMBTU Condensing Boiler Variable Load	VI	Process Heat in Food- Greenhouses	Full	3.5	146,015	1.77
3.3 MMBTU Condensing Boiler Variable Load	LM/Int	Process Heat in Food- Greenhouses	Full	3.2	255,852	2.71
3.3 MMBTU Condensing Boiler Variable Load	VI	Process Heat in Food- Greenhouses	Incr	1.9	226,865	3.08
3.3 MMBTU Condensing Boiler Variable Load	LM/Int	Process Heat in Food- Greenhouses	Incr	2.0	313,602	4.40
Economizer on Standard 3.3 MMBTU, Constant Load Boiler	VI	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	6.0	-13,798	0.77
Economizer on Standard 3.3 MMBTU, Constant Load Boiler	LM/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	6.5	-7,896	0.87
Combustion Air Preheat on Standard 3.3 MMBTU, Constant Load Boiler	VI	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	1.0	39,148	4.59
Combustion Air Preheat on Standard 3.3 MMBTU, Constant Load Boiler	LM/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	1.0	42,806	5.60
Bundled Upgrades on 3.3 MMBTU, Constant Load Standard Boiler	VI	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	2.4	129,717	2.4
Bundled Upgrades on 3.3 MMBTU, Constant Load Standard Boiler	LM/Int	Process Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	4.0	36,487	1.4
Direct Fired Water Heating in Constant Process Load	VI	Process Heat in Food & Other	Full	4.8	-49,511	0.75
Direct Fired Water Heating in Constant Process Load	LM/Int	Process Heat in Food & Other	Full	5.2	-29,336	0.85
Direct Fired Water Heating in Constant Process Load	V I	Process Heat in Food & Other	Incr	2.7	38,649	1.35
Direct Fired Water Heating in Constant Process Load	LM/Int	Process Heat in Food & Other	Incr	2.9	58,824	1.53
Distribution System Insulation on Constant Process Load	V I	All Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	1.5	24,389	3.50
Distribution System Insulation on Constant Process Load	LM/Int	All Heat in Food, Wood, Paper, Non-Metallic Minerals, Other, & Chemicals	Full	1.5	29,779	4.31
Sequential Firing, High Velocity Burners for Constant Load Furnaces	V I	Fabricated Metals Process Heat	Incr	3.0	141,934	1.53
Sequential Firing, High Velocity Burners for Constant Load Furnaces	LM/Int	Fabricated Metals Process Heat	Incr	3.0	214,683	1.87
Ceramic Fibre Insulation for Constant Load Furnaces	V I	Fabricated Metals Process Heat	Full	3.0	57,301	1.21
Ceramic Fibre Insulation for Constant Load Furnaces	LM/Int	Fabricated Metals Process Heat	Full	3.0	121,289	1.49
High Efficiency Ovens	V I	Food Process Heat	Incr	3.0	789	1.53
High Efficiency Ovens	LM/Int	Food Process Heat	Incr	3.0	1,193	1.87
Pinch Technology	V I	Food and Chemicals Process Heat	Full	5.0	-9,629	0.92
Pinch Technology	LM/Int	Food and Chemicals Process Heat	Full	5.0	13,108	1.12
Advanced Control on Lumber Dry Kiln Control	V I	Wood Process Heat	Incr	2.0	163,272	2.59
Advanced Control on Lumber Dry Kiln Control	LM/Int	Wood Process Heat	Incr	2.0	197,651	3.06
High Efficiency Lumber Dry Kilns	V I	Wood Process Heat	Incr	4.0	157,602	1.20
High Efficiency Lumber Dry Kilns	LM/Int	Wood Process Heat	Incr	4.0	329,212	1.45
High Efficiency Veneer Dryers	V I	Wood Process Heat	Incr	3.0	177,586	1.53
High Efficiency Veneer Dryers	LM/Int	Wood Process Heat	Incr	3.0	268,608	1.87
Direct Fired Paper Drying	VI	Paper Process Heat	Incr	3.0	38,681	1.75
Direct Fired Paper Drying	LM/Int	Paper Process Heat	Incr	3.0	54,878	2.15
Direct Heat	VI	Food - Poultry, and Food Processing Process Heat	Incr	2.5	89,194	2.65
Direct Heat	LM/Int	Food - Poultry, and Food Processing Process Heat	Incr	2.7	118,863	3.20
Radiant Tube Heat	VI	Food - Poultry, and Food Processing Process Heat	Incr	3.0	41,172	2.19
Radiant Tube Heat	LM/Int	Food - Poultry, and Food Processing Process Heat	Incr	3.0	59,520	2.86

APPENDIX D: DETAILED ECONOMIC POTENTIAL FORECAST RESULTS

Exhibit D.1: Economic Potential Forecast, Food Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	70.8%	170,419	243,456	170,419	209,594	70.8%	72.2%	299,420	209,594	242,977	70.8%	73.0%	347,110
	Standard Efficiency Boiler	68%	25.4%	25.2%	60,600	89,117	38,117	46,879	15.8%	16.6%	68,940	34,456	39,944	11.6%	12.4%	58,742
	Near Condensing Boilers	80%	3.1%	3.6%	8,603	10,753	5,411	6,655	2.25%	2.0%	8,319	4,891	5,670	1.65%	1.5%	7,088
	Condensing Boiler	90%	0.4%	0.5%	1,242	1,380	26,917	33,104	11.2%	8.9%	36,782	47,291	54,823	16.0%	12.8%	60,914
	Partly Insulated Distribution System	50%	1.7%			6,084				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.1%			320				0.4%	1,516				0.4%	1,758
	Total Comfort Heat		**100.0%**	**100.0%**	**240,864**	**351,111**	**240,864**	**296,233**	**100.0%**	**100.0%**	**414,978**	**296,233**	**343,415**	**100%**	**100.0%**	**475,612**
Process Heat	Standard Efficiency Boiler	68%	44.0%	40.9%	1,849,600	2,720,000	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	8.7%	9.5%	427,825	534,781	269,102	330,961	6.0%	6.5%	413,701	243,256	282,001	4.4%	4.8%	352,501
	Condensing Boiler	92%	13.4%	16.9%	762,198	828,476	2,006,787	2,468,095	44.4%	42.0%	2,682,712	2,529,488	2,932,370	45.5%	43.2%	3,187,359
	Bundled Standard Boiler Upgrades	85%	17.0%	19.7%	891,944	1,049,345	1,143,555	1,406,429	25.3%	25.9%	1,654,622	1,406,429	1,630,437	25.3%	26.0%	1,918,161
	Partly Insulated Distribution System	50%	3.8%			234,698				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			12,353				0.9%	58,489				0.9%	67,805
	Direct Fired Heating	90%	1.9%	2.3%	105,235	116,928	617,723	759,721	13.7%	13.2%	844,134	786,234	911,461	14.2%	13.7%	1,012,734
	Radiant Tube Heating	70%	0.0%	0.0%	984	1,405	619	761	0.0%	0.0%	1,087	559	648	0.0%	0.0%	926
	Standard Efficiency Oven	65%	4.3%	3.8%	171,774	264,268	64,759	79,645	1.4%	1.9%	122,531	44,203	51,243	0.8%	1.1%	78,836
	Efficient Oven	80%	3.7%	4.1%	184,435	230,543	291,450	358,447	6.5%	7.0%	448,058	393,889	456,625	7.1%	7.7%	570,781
	Tank-type Water Heating	65%	2.0%	1.8%	81,821	125,878	7,364	9,057	0.2%	0.2%	13,933	3,170	3,675	0.1%	0.1%	5,653
	Direct Fired Water Heating	95%	0.7%	0.9%	41,163	43,329	115,620	142,198	2.6%	2.3%	149,682	148,085	171,671	2.7%	2.5%	180,706
	Heat Loss from Not Using Pinch Technology		0.2%			14,250				0.0%	0	0	0	0.0%	0.0%	0
	Total Process Heat		**100.0%**	**100.0%**	**4,516,978**	**6,176,255**	**4,516,978**	**5,555,313**	**100.0%**	**100%**	**6,388,951**	**5,555,313**	**6,440,131**	**100.0%**	**100%**	**7,375,463**
Total					**4,757,842**	**6,527,366**		**5,851,546**			**6,803,929**		**6,783,546**			**7,851,075**

Exhibit D.2: Economic Potential Forecast, Chemical Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	3,270	4,671	3,270	4,021	100.0%	100.0%	5,745	4,021	4,662	100.0%	100.0%	6,660
	Total Comfort Heat		**100.0%**	**100.0%**	**3,270**	**4,671**	**3,270**	**4,021**	**100.0%**	**100.0%**	**5,745**	**4,021**	**4,662**	**100.0%**	**100.0%**	**6,660**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	191,198	281,173	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	10.0%	12.8%	36,996	46,246	23,271	28,620	8.0%	8.4%	35,775	21,036	24,386	5.9%	6.2%	30,483
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	60,929	71,681	265,852	326,965	92.0%	90.5%	384,664	334,549	387,834	94.1%	92.8%	456,275
	Partly Insulated Distribution System	50%	3.8%			17,573				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			925				1.0%	4,379				1.0%	5,077
	Heat Loss from Not Using Pinch Technology		9.7%			44,858				0.0%	0				0.0%	0
	Total Process Heat		**100.0%**	**100.0%**	**289,123**	**462,456**	**289,123**	**355,585**	**100.0%**	**100.0%**	**424,819**	**355,585**	**412,220**	**100.0%**	**100.0%**	**491,835**
Total					**292,393**	**467,127**		**359,606**			**430,564**		**416,882**			**498,495**

Exhibit D.3: Economic Potential Forecast, Fabricated Metal Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	125,104	178,720	125,104	153,862	100.0%	100.0%	219,803	153,862	178,368	100.0%	100.0%	254,812
	Total Comfort Heat		**100.0%**	**100.0%**	**125,104**	**178,720**	**125,104**	**153,862**	**100.0%**	**100.0%**	**219,803**	**153,862**	**178,368**	**100.0%**	**100.0%**	**254,812**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Standard Efficiency Furnace	25%	66.0%	57.9%	93,472	373,888	35,239	43,339	21.8%	29.6%	173,358	24,053	27,884	12.1%	17.3%	111,538
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	67,980	169,949	126,213	155,226	78.2%	66.2%	388,064	174,512	202,307	87.9%	78.3%	505,767
	Standard Furnace Insulation	25%	3.1%			17,561				0.0%	0				0.0%	0
	Ceramic Fibre Furnace Insulation	40%	0.9%			5,098				4.2%	24,629				4.4%	28,552
	Total Process Heat		**100.0%**	**100.0%**	**161,452**	**566,497**	**161,452**	**198,565**	**100.0%**	**100.0%**	**586,051**	**198,565**	**230,191**	**100.0%**	**100.0%**	**645,857**
Total					**286,556**	**745,217**		**352,427**			**805,854**		**408,560**			**900,669**

Exhibit D.4: Economic Potential Forecast, Non-Metallic Mineral Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	133,662	190,945	133,662	164,387	100.0%	100.0%	234,838	164,387	190,569	100.0%	100.0%	272,242
	Total Comfort Heat		**100.0%**	**100.0%**	**133,662**	**190,945**	**133,662**	**164,387**	**100.0%**	**100.0%**	**234,838**	**164,387**	**190,569**	**100.0%**	**100.0%**	**272,242**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.3%	176,538	259,615	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	10.0%	11.6%	32,200	40,250	20,254	24,910	7.3%	8.0%	31,137	18,309	21,225	5.3%	5.9%	26,531
	Condensing Boiler	92%	2.5%	3.3%	9,258	10,063	185,796	228,505	66.7%	64.2%	248,375	228,505	264,900	66.7%	64.4%	287,935
	Combustion Air Preheat from Exhaust on Standard	72%	2.0%	2.1%	5,796	8,050	3,646	4,484	1.3%	1.6%	6,227	3,296	3,820	1.0%	1.2%	5,306
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	34,213	40,250	48,309	59,415	17.3%	18.1%	69,900	67,204	77,908	19.6%	20.5%	91,656
	Partly Insulated Distribution System	50%	3.8%			15,295				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			805				1.0%	3,812				1.0%	4,419
	Tank-type Water Heating	65%	5.0%	4.7%	13,081	20,125	1,177	1,448	0.4%	0.6%	2,228	507	588	0.1%	0.2%	904
	Direct Fired Water Heating	95%	2.0%	2.7%	7,648	8,050	19,552	24,046	7.0%	6.5%	25,312	24,987	28,967	7.3%	6.8%	30,492
	Total Process Heat		**100.0%**	**100.0%**	**278,734**	**402,504**	**278,734**	**342,808**	**100.0%**	**100.0%**	**386,991**	**342,808**	**397,408**	**100.0%**	**100.0%**	**447,243**
Total					**412,396**	**593,449**		**507,194**			**621,829**		**587,977**			**719,485**

Exhibit D.5: Economic Potential Forecast, Paper Sub Sector, Lower Mainland Service Area

			2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Useful Heat Without Sector Growth (GJ/Year)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**	**Useful Heat Without Sector Growth (GJ/Year)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	14,291	20,416	14,291	17,576	51.0%	53.6%	25,108	17,576	20,375	51.0%	54.5%	29,108
	Standard Efficiency Boiler	68%	27.3%	27.0%	7,566	11,126	4,759	5,853	17.0%	18.4%	8,607	4,302	4,987	12.5%	13.7%	7,334
	Near Condensing Boilers	80%	17.5%	20.4%	5,716	7,145	3,596	4,422	12.8%	11.8%	5,528	3,250	3,768	9.4%	8.8%	4,710
	Condensing Boiler	92%	1.3%	1.7%	470	510	5,397	6,638	19.2%	15.4%	7,215	9,361	10,852	27.1%	22.1%	11,795
	Partly Insulated Distribution System	50%	3.8%			1,552				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			82				0.8%	387				0.8%	448
	Total Comfort Heat		**100.0%**	**100.0%**	**28,043**	**40,831**	**28,043**	**34,489**	**100.0%**	**100.0%**	**46,845**	**34,489**	**39,982**	**100.0%**	**100.0%**	**53,395**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	64,577	94,966	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	7.5%	8.9%	25,046	31,308	15,754	19,375	5.6%	5.8%	24,219	14,241	16,509	4.1%	4.3%	20,636
	Combustion Air Preheat from Exhaust on Standard	72%	0.8%	0.8%	2,254	3,131	1,418	1,744	0.5%	0.6%	2,422	1,282	1,486	0.4%	0.4%	2,064
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	106,446	125,231	181,152	222,794	64.1%	62.9%	262,110	228,390	264,767	65.8%	64.9%	311,490
	Partly Insulated Distribution System	50%	3.8%			15,863				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			835				0.9%	3,953				1.0%	4,583
	Heat Loss from Not Using Pinch Technology		10.0%			41,744				0.0%	0				0.0%	0
	Steam Paper Drying	80%	23.0%	27.2%	76,808	96,010	40,785	50,160	14.4%	15.1%	62,701	33,357	38,670	9.6%	10.1%	48,337
	Direct Fired Paper Drying	87%	2.0%	2.6%	7,288	8,349	43,311	53,268	15.3%	14.7%	61,017	70,071	81,232	20.2%	19.4%	93,049
	Total Process Heat		**100.0%**	**100.0%**	**282,420**	**417,435**	**282,420**	**347,341**	**100.0%**	**100.0%**	**416,422**	**347,341**	**402,663**	**100.0%**	**100.0%**	**480,159**
Total					**310,463**	**458,266**		**381,830**			**463,267**		**442,645**			**533,554**

Exhibit D.6: Economic Potential Forecast, Wood Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011					2015/2016				
			Base Year				Sector Annual Growth Rate				3.0%	Sector Annual Growth Rate				1.5%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	72,768	103,954	72,768	89,495	51.0%	53.6%	127,850	89,495	96,412	51.0%	54.5%	137,731
	Standard Efficiency Boiler	68%	27.3%	27.0%	38,525	56,655	24,232	29,803	17.0%	18.4%	43,828	21,905	23,598	12.5%	13.7%	34,703
	Near Condensing Boilers	80%	17.5%	20.4%	29,107	36,384	18,308	22,517	12.8%	11.8%	28,146	16,550	17,829	9.4%	8.8%	22,286
	Condensing Boiler	92%	1.3%	1.7%	2,391	2,599	27,483	33,800	19.2%	15.4%	36,739	47,665	51,349	27.1%	22.1%	55,814
	Partly Insulated Distribution System	50%	3.8%			7,901				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			416				0.8%	1,969				0.8%	2,121
	Total Comfort Heat		**100.0%**	**100.0%**	**142,791**	**207,908**	**142,791**	**175,615**	**100.0%**	**100.0%**	**238,532**	**175,615**	**189,187**	**100.0%**	**100.0%**	**252,655**
Process Heat	Standard Efficiency Boiler	68%	15.5%	16.7%	56,024	82,388	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	2.3%	2.9%	9,764	12,206	6,142	7,554	1.8%	1.8%	9,442	5,552	6,436	1.4%	1.5%	8,045
	Condensing Boiler	92%	0.6%	0.8%	2,807	3,051	70,152	86,278	21.0%	17.8%	93,780	92,533	99,684	22.4%	20.0%	108,352
	Bundled Standard Boiler Upgrades	85%	4.6%	6.2%	20,749	24,411	13,051	16,052	3.9%	3.6%	18,884	11,798	13,677	3.1%	3.0%	16,091
	Standard Efficiency Kiln	57%	67.5%	61.0%	204,178	358,207	76,975	94,670	23.0%	31.5%	166,087	52,542	56,602	12.7%	18.4%	99,302
	Advanced Kiln Control	60%	2.0%	1.9%	6,368	10,614	2,401	2,953	0.7%	0.9%	4,921	1,639	1,765	0.4%	0.5%	2,942
	High Efficiency Kiln	87%	7.5%	10.4%	34,627	39,801	165,797	203,909	49.6%	44.4%	234,378	247,351	266,467	59.9%	56.6%	306,284
	Total Process Heat		**100.0%**	**100.0%**	**334,518**	**530,677**	**334,518**	**411,414**	**100.0%**	**100.0%**	**527,493**	**411,414**	**444,633**	**100.0%**	**100.0%**	**541,017**
Total					**477,309**	**738,585**		**587,030**			**766,025**		**633,820**			**793,673**

Exhibit D.7: Economic Potential Forecast, Other Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	169,054	241,506	169,054	207,915	82.8%	83.7%	297,021	207,915	241,030	82.8%	84.2%	344,329
	Standard Efficiency Boiler	68%	9.6%	9.7%	19,809	29,132	12,460	15,324	6.1%	6.4%	22,536	11,263	13,057	4.5%	4.7%	19,202
	Near Condensing Boilers	80%	6.1%	7.2%	14,732	18,415	9,266	11,396	4.5%	4.0%	14,246	8,376	9,711	3.3%	3.0%	12,138
	Condensing Boiler	92%	0.3%	0.3%	694	755	13,509	16,615	6.6%	5.1%	18,059	23,696	27,470	9.4%	7.3%	29,858
	Partly Insulated Distribution System	50%	3.8%			11,472				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			604				0.8%	2,859				0.8%	3,314
	Total Comfort Heat		**100.0%**	**100.0%**	**204,290**	**301,882**	**204,290**	**251,250**	**100.0%**	**100.0%**	**354,721**	**251,250**	**291,268**	**100.0%**	**100.0%**	**408,842**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	173,681	255,413	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	7.0%	8.4%	46,896	58,619	29,497	36,278	5.3%	5.3%	45,347	26,664	30,911	3.9%	4.0%	38,639
	Condensing Boiler	92%	2.0%	2.8%	15,409	16,748	221,012	271,817	39.8%	34.6%	295,453	289,456	335,559	42.4%	37.5%	364,738
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	39,149	46,058	24,625	30,286	4.4%	4.2%	35,630	22,260	25,805	3.3%	3.1%	30,359
	Partly Insulated Distribution System	50%	3.8%			31,822				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			1,675				0.9%	7,930				0.9%	9,193
	Tank-type Water Heating	65%	10.0%	9.8%	54,432	83,742	4,899	6,025	0.9%	1.1%	9,269	2,109	2,445	0.3%	0.4%	3,761
	Direct Fired Water Heating	95%	1.0%	1.4%	7,955	8,374	57,489	70,704	10.4%	8.7%	74,425	74,620	86,505	10.9%	9.4%	91,058
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	163,297	251,226	87,092	107,112	15.7%	19.3%	164,787	71,408	82,781	10.5%	13.1%	127,356
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	33,497	41,871	109,702	134,920	19.8%	19.8%	168,650	170,624	197,799	25.0%	25.4%	247,249
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	20,936	41,871	20,936	25,748	3.8%	6.0%	51,496	25,748	29,849	3.8%	6.1%	59,698
	Total Process Heat		**100.0%**	**100.0%**	**555,251**	**837,420**	**555,251**	**682,889**	**100.0%**	**100.0%**	**852,989**	**682,889**	**791,656**	**100.0%**	**100.0%**	**972,053**
Total					**759,541**	**1,139,302**		**934,140**			**1,207,710**		**1,082,924**			**1,380,895**

Exhibit D.8: Economic Potential Forecast, Food Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	95.9%	96.2%	29,330	41,900	29,330	36,072	96.2%	96.5%	51,531	36,072	41,817	96.2%	96.6%	59,739
	Standard Efficiency Boiler	68%	3.7%	3.6%	1,087	1,598	684	841	2.2%	2.3%	1,236	618	716	1.6%	1.7%	1,053
	Near Condensing Boilers	80%	0.1%	0.16%	48	60	30	37	0.10%	0.1%	46	27	32	0.07%	0.1%	39
	Condensing Boiler	92%	0.0%	0.0%	14	15	435	535	1.4%	1.1%	581	767	889	2.0%	1.6%	967
	Partly Insulated Distribution System	50%	0.3%			114				0.0%	0				0.0%	0
	Total Comfort Heat		**100.0%**	**100.0%**	**30,478**	**43,692**	**30,478**	**37,484**	**100.0%**	**100.0%**	**53,423**	**37,484**	**43,454**	**100.0%**	**100.0%**	**61,831**
Process Heat	Standard Efficiency Boiler	68%	51.8%	50.7%	209,051	307,428	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	9.4%	10.8%	44,434	55,543	27,949	34,374	6.8%	7.4%	42,967	25,265	29,289	5.0%	0.0%	0
	Condensing Boiler	92%	10.3%	13.7%	56,458	61,368	194,593	239,325	47.2%	44.9%	260,135	245,701	284,835	48.5%	48.9%	309,603
	Bundled Standard Boiler Upgrades	85%	14.0%	17.2%	70,807	83,302	100,697	123,844	24.4%	25.1%	145,699	123,844	143,569	24.4%	26.7%	168,905
	Partly Insulated Distribution System	50%	3.8%			22,563				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			1,188				1.0%	5,623				1.0%	6,519
	Direct Fired Heating	90%	1.3%	1.7%	6,899	7,665	64,434	79,245	15.6%	15.2%	88,050	81,991	95,050	16.2%	16.7%	105,611
	Radiant Tube Heating	70%	0.0%	0.0%	63	90	40	49	0.0%	0.0%	69	36	41	0.0%	0.0%	59
	Standard Efficiency Oven	65%	1.9%	1.8%	7,410	11,399	2,793	3,436	0.7%	0.9%	5,285	1,907	2,210	0.4%	0.5%	3,401
	Efficient Oven	80%	1.9%	2.2%	9,120	11,399	13,736	16,893	3.3%	3.6%	21,116	18,422	21,356	3.6%	4.2%	26,695
	Tank-type Water Heating	65%	1.0%	0.9%	3,705	5,700	333	410	0.1%	0.1%	631	144	166	0.0%	0.0%	256
	Direct Fired Water Heating	95%	0.8%	1.1%	4,381	4,611	7,752	9,534	1.9%	1.7%	10,036	9,800	11,361	1.9%	1.9%	11,959
	Heat Loss from Not Using Pinch Technology		3.6%			21,517				0.0%	0	0	0	0.0%	0.0%	0
	Total Process Heat		**100.0%**	**100.0%**	**412,326**	**593,773**	**412,326**	**507,109**	**100.0%**	**100.0%**	**579,613**	**507,109**	**587,879**	**100.0%**	**100.0%**	**633,008**
Total					**442,804**	**637,465**		**544,594**			**633,037**		**631,333**			**694,840**

Exhibit D.9: Economic Potential Forecast, Chemical Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	1,589	2,270	1,589	1,954	100.0%	100.0%	2,792	1,954	2,266	100.0%	100.0%	3,236
	Total Comfort Heat		**100.0%**	**100.0%**	**1,589**	**2,270**	**1,589**	**1,954**	**100.0%**	**100.0%**	**2,792**	**1,954**	**2,266**	**100.0%**	**100.0%**	**3,236**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	92,914	136,639	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	10.0%	12.8%	17,979	22,474	11,309	13,908	8.0%	8.4%	17,385	10,223	11,851	5.9%	6.2%	14,813
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	29,609	34,834	129,193	158,892	92.0%	90.5%	186,931	162,577	188,472	94.1%	92.8%	221,731
	Partly Insulated Distribution System	50%	3.8%			8,540				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			449				1.0%	2,128				1.0%	2,467
	Heat Loss from Not Using Pinch Technology		9.7%			21,799				0.0%	0				0.0%	0
	Total Process Heat		**100.0%**	**100.0%**	**140,502**	**224,735**	**140,502**	**172,800**	**100.0%**	**100.0%**	**206,445**	**172,800**	**200,322**	**100.0%**	**100.0%**	**239,012**
Total					**142,091**	**227,005**		**174,754**			**209,237**		**202,588**			**242,248**

Exhibit D.10: Economic Potential Forecast, Fabricated Metal Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	14,525	20,750	14,525	17,864	100.0%	100.0%	25,520	17,864	20,709	100.0%	100.0%	29,585
	Total Comfort Heat		**100.0%**	**100.0%**	**14,525**	**20,750**	**14,525**	**17,864**	**100.0%**	**100.0%**	**25,520**	**17,864**	**20,709**	**100.0%**	**100.0%**	**29,585**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Standard Efficiency Furnace	25%	66.0%	57.9%	4,057	16,229	1,530	1,881	21.8%	29.6%	7,525	1,044	1,210	12.1%	17.3%	4,841
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	2,951	7,377	5,478	6,738	78.2%	66.2%	16,844	7,575	8,781	87.9%	78.3%	21,953
	Standard Furnace Insulation	25%	3.1%			762				0.0%	0				0.0%	0
	Ceramic Fibre Furnace Insulation	40%	0.9%			221				4.2%	1,069				4.4%	1,239
	Total Process Heat		**100.0%**	**100.0%**	**7,008**	**24,589**	**7,008**	**8,619**	**100.0%**	**100.0%**	**25,438**	**8,619**	**9,992**	**100.0%**	**100.0%**	**28,034**
Total					**21,533**	**45,339**		**26,483**			**50,958**		**30,701**			**57,618**

Exhibit D.11: Economic Potential Forecast, Non-Metallic Mineral Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sector Annual Growth Rate				3.0%	Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	64,607	92,295	64,607	79,458	100.0%	100.0%	113,511	79,458	92,113	100.0%	100.0%	131,591
	Total Comfort Heat		**100.0%**	**100.0%**	**64,607**	**92,295**	**64,607**	**79,458**	**100.0%**	**100.0%**	**113,511**	**79,458**	**92,113**	**100.0%**	**100.0%**	**131,591**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.3%	44,221	65,031	0	0	0.0%	0.0%	0	0	0	0%	0%	0
	Near Condensing Boiler	80%	10.0%	11.6%	8,066	10,082	5,073	6,240	7.3%	8.0%	7,800	4,586	5,317	5%	6%	6,646
	Condensing Boiler	92%	2.5%	3.3%	2,319	2,521	46,540	57,239	66.7%	64.2%	62,216	57,239	66,355	66.7%	64.4%	72,125
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	72%	2.0%	2.1%	1,452	2,016	913	1,123	1.3%	1.6%	1,560	826	957	1.0%	1.2%	1,329
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	8,570	10,082	12,101	14,883	17.3%	18.1%	17,509	16,834	19,515	19.6%	20.5%	22,959
	Partly Insulated Distribution System	50%	3.8%			3,831				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			202				1.0%	955				1.0%	1,107
	Tank-type Water Heating	65%	5.0%	4.7%	3,277	5,041	295	363	0.4%	0.6%	558	127	147	0.1%	0.2%	226
	Direct Fired Water Heating	95%	2.0%	2.7%	1,916	2,016	4,898	6,023	7.0%	6.5%	6,340	6,259	7,256	7.3%	6.8%	7,638
	Total Process Heat		**100.0%**	**100.0%**	**69,821**	**100,824**	**69,821**	**85,871**	**100.0%**	**100.0%**	**96,938**	**85,871**	**99,548**	**100.0%**	**100.0%**	**112,031**
Total					**134,427**	**193,119**		**165,328**			**210,449**		**191,661**			**243,621**

Exhibit D.12: Economic Potential, Forecast Paper Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat With Sector Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat With Sector Growth (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	4,674	6,678	4,674	5,749	51.0%	53.6%	8,212	5,749	6,664	51.0%	54.5%	9,521
	Standard Efficiency Boiler	68%	27.3%	27.0%	2,475	3,639	1,557	1,914	17.0%	18.4%	2,815	1,407	1,631	12.5%	13.7%	2,399
	Near Condensing Boilers	80%	17.5%	20.4%	1,870	2,337	1,176	1,446	12.8%	11.8%	1,808	1,063	1,232	9.4%	8.8%	1,541
	Condensing Boiler	92%	1.3%	1.7%	154	167	1,765	2,171	19.2%	15.4%	2,360	3,062	3,549	27.1%	22.1%	3,858
	Partly Insulated Distribution System	50%	3.8%			507				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			27				0.8%	126				0.8%	147
	Total Comfort Heat		**100.0%**	**100.0%**	**9,172**	**13,355**	**9,172**	**11,281**	**100.0%**	**100.0%**	**15,322**	**11,281**	**13,077**	**100.0%**	**100.0%**	**17,465**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	8,423	12,386	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	7.5%	8.9%	3,267	4,083	2,055	2,527	5.6%	5.9%	3,159	1,857	2,153	4.1%	4.3%	2,692
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	72%	0.8%	0.8%	294	408	185	0	0.0%			0	0	0.0%	0.0%	0
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	13,883	16,334	23,627	29,058	64.5%	63.3%	34,186	29,728	34,463	66.0%	65.1%	40,545
	Partly Insulated Distribution System	50%	3.8%			2,069				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			109				1.0%	516				1.0%	598
	Heat Loss from Not Using Pinch Technology		10.0%			5,445				0.0%	0				0.0%	0
	Steam Paper Drying	80%	23.0%	27.2%	10,018	12,522	5,319	6,542	14.5%	15.1%	8,178	4,351	5,044	9.7%	10.1%	6,304
	Direct Fired Paper Drying	87%	2.0%	2.6%	951	1,089	5,649	6,948	15.4%	14.7%	7,958	9,139	10,595	20.3%	19.5%	12,136
	Total Process Heat		**100.0%**	**100.0%**	**36,835**	**54,445**	**36,835**	**45,075**	**100.0%**	**100.0%**	**53,997**	**45,075**	**52,255**	**100%**	**100.0%**	**62,275**
Total					**46,008**	**67,800**		**56,356**			**69,319**		**65,332**			**79,739**

Exhibit D.13: Economic Potential Forecast, Wood Sub Sector, Interior Service Area

			2003/2004				2010/2011					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				1.5%
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Useful Heat Without Sector Growth (GJ/Year)**	**Useful Heat (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**	**Useful Heat Without Sector Growth (GJ/Year)**	**Useful Heat With Sector Growth (GJ/year)**	**Market Share as a Percent of Useful Heat (%)**	**Market Share as a Percent of Heat Sold (%)**	**Annual Heat Sold (GJ/year)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	20,838	29,769	20,838	25,628	51.0%	53.6%	36,612	25,628	27,609	51.0%	54.5%	39,441
	Standard Efficiency Boiler	68%	27.3%	27.0%	11,032	16,224	6,939	8,534	17.0%	18.4%	12,551	6,273	6,758	12.5%	13.7%	9,938
	Near Condensing Boilers	80%	17.5%	20.4%	8,335	10,419	5,243	6,448	12.8%	11.8%	8,060	4,739	5,106	9.4%	8.8%	6,382
	Condensing Boiler	92%	1.3%	1.7%	685	744	7,870	9,679	19.2%	15.4%	10,521	13,649	14,704	27.1%	22.1%	15,983
	Partly Insulated Distribution System	50%	3.8%			2,262				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			119				0.8%	564				0.8%	607
	Total Comfort Heat		**100.0%**	**100.0%**	**40,890**	**59,537**	**40,890**	**50,290**	**100.0%**	**100.0%**	**68,307**	**50,290**	**54,176**	**100.0%**	**100.0%**	**72,351**
Process Heat	Standard Efficiency Boiler	68%	0.9%	1.0%	35,637	52,407	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	0.2%	0.3%	8,847	11,058	5,565	6,844	0.2%	0.1%	8,555	5,030	5,419	0.1%	0.1%	6,774
	Condensing Boiler	92%	0.0%	0.1%	2,543	2,765	55,411	68,149	1.6%	1.2%	74,075	77,670	83,673	1.8%	1.5%	90,949
	Bundled Standard Boiler Upgrades	85%	0.7%	1.1%	37,598	44,233	23,649	29,086	0.7%	0.6%	34,218	21,378	23,030	0.5%	0.4%	27,094
	Standard Efficiency Kiln	57%	64.8%	62.5%	2,195,526	3,851,799	827,713	1,017,983	23.6%	29.8%	1,785,935	564,980	608,644	13.1%	17.6%	1,067,797
	Advanced Kiln Control	60%	3.7%	3.7%	130,260	217,100	49,108	60,397	1.4%	1.7%	100,661	33,520	36,111	0.8%	1.0%	60,185
	High Efficiency Kiln	87%	7.6%	11.2%	392,479	451,125	1,841,443	2,264,743	52.4%	43.4%	2,603,153	2,744,622	2,956,737	63.5%	55.9%	3,398,549
	Standard Efficiency Veneer Dryer	50%	17.7%	15.0%	526,877	1,053,754	198,633	244,293	5.7%	8.1%	488,586	135,583	146,061	3.1%	4.8%	292,122
	Advanced Veneer Dryer	70%	4.4%	5.2%	184,407	263,438	512,651	630,496	14.6%	15.0%	900,709	739,207	796,335	17.1%	18.7%	1,137,622
	Total Process Heat		**100.0%**	**100.0%**	**3,514,173**	**5,947,680**	**3,514,173**	**4,321,990**	**100.0%**	**100.0%**	**5,995,892**	**4,321,990**	**4,656,011**	**100.0%**	**100.0%**	**6,081,091**
Total					**3,555,063**	**6,007,217**		**4,372,280**			**6,064,198**		**4,710,187**			**6,153,442**

Exhibit D.14: Economic Potential Forecast, Other Manufacturing Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/11					2015/16				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				3.0%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	45,498	64,998	45,498	55,957	82.8%	83.7%	79,939	55,957	64,870	82.8%	84.2%	92,671
	Standard Efficiency Boiler	68%	9.6%	9.7%	5,331	7,840	3,353	4,124	6.1%	6.4%	6,065	3,031	3,514	4.5%	4.7%	5,168
	Near Condensing Boilers	80%	6.1%	7.2%	3,965	4,956	2,494	3,067	4.5%	4.0%	3,834	2,254	2,613	3.3%	3.0%	3,267
	Condensing Boiler	92%	0.3%	0.3%	187	203	3,636	4,472	6.6%	5.1%	4,860	6,377	7,393	9.4%	7.3%	8,036
	Partly Insulated Distribution System	50%	3.8%			3,087				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			162				0.8%	769				0.8%	892
	Total Comfort Heat		**100.0%**	**100.0%**	**54,981**	**81,247**	**54,981**	**67,620**	**100.0%**	**100.0%**	**95,468**	**67,620**	**78,390**	**100.0%**	**100.0%**	**110,034**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	10,479	15,410	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	7.0%	8.4%	2,829	3,537	1,780	2,189	5.3%	5.3%	2,736	1,609	1,865	3.9%	4.0%	2,331
	Condensing Boiler	92%	2.0%	2.8%	930	1,011	13,335	16,400	39.8%	34.6%	17,826	17,464	20,246	42.4%	37.5%	22,007
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	2,362	2,779	1,486	1,827	4.4%	4.2%	2,150	1,343	1,557	3.3%	3.1%	1,832
	Partly Insulated Distribution System	50%	3.8%			1,920				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			101				0.9%	478				0.9%	555
	Tank-type Water Heating	65%	10.0%	9.8%	3,284	5,053	296	364	0.9%	1.1%	559	127	147	0.3%	0.4%	227
	Direct Fired Water Heating	95%	1.0%	1.4%	480	505	3,469	4,266	10.4%	8.7%	4,490	4,502	5,219	10.9%	9.4%	5,494
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	9,853	15,158	5,255	6,463	15.7%	19.3%	9,942	4,308	4,995	10.5%	13.1%	7,684
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	2,021	2,526	6,619	8,140	19.8%	19.8%	10,176	10,295	11,934	25.0%	25.4%	14,918
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	1,263	2,526	1,263	1,554	3.8%	6.0%	3,107	1,554	1,801	3.8%	6.1%	3,602
	Total Process Heat		**100.0%**	**100.0%**	**33,501**	**50,526**		**41,202**	**100.0%**	**100.0%**	**51,465**	**41,202**	**47,765**	**100.0%**	**100.0%**	**58,649**
Total					**88,483**	**131,773**		**108,823**			**146,933**		**126,155**			**168,683**

Exhibit D.15: Economic Potential Forecast, Food Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 Base Year: Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	2010/11 (Sub Sector Annual Growth Rate 3.0%): Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	2015/16 (Sub Sector Annual Growth Rate 3.0%): Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	4,798	6,854	4,798	5,901	100%	100.0%	8,430	5,901	6,841	100%	100.0%	9,772
	Total Comfort Heat		**100.0%**	**100.0%**	**4,798**	**6,854**	**4,798**	**5,901**	**100.0%**	**100.0%**	**8,430**		**6,841**	**100.0%**	**100.0%**	**9,772**
Process Heat	Standard Efficiency Boiler	68%	54.0%	54.1%	34,203	50,299	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	5.0%	5.9%	3,726	4,657	2,344	2,882	3.7%	3.9%	3,603	1,813	2,102	2.3%	2.5%	2,627
	Condensing Boiler	92%	1.0%	1.4%	857	931	31,325	38,526	49.6%	45.8%	41,876	38,526	44,662	49.6%	46.2%	48,545
	Bundled Standard Boiler Upgrades (burners, control and	85%	5.0%	6.3%	3,959	4,657	9,076	11,163	14.4%	14.4%	13,132	12,232	14,180	15.7%	15.9%	16,683
	Partly Insulated Distribution System	50%	3.8%			3,540				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			186				1.0%	882				1.0%	1,023
	Standard Efficiency Oven	65%	15.0%	14.4%	9,082	13,972	3,424	4,211	5.4%	7.1%	6,478	2,337	2,709	3.0%	4.0%	4,168
	Efficient Oven	80%	10.0%	11.8%	7,452	9,315	13,110	16,123	20.7%	22.1%	20,154	17,997	20,863	23.2%	24.8%	26,079
	Tank-type Water Heating	65%	5.0%	4.8%	3,027	4,657	272	335	0.4%	0.6%	516	117	136	0.2%	0.2%	209
	Direct Fired Water Heating	95%	1.0%	1.4%	885	931	3,640	4,476	5.8%	5.2%	4,712	4,694	5,442	6.0%	5.5%	5,728
	Total Process Heat		**100.0%**	**100.0%**	**63,190**	**93,146**	**63,190**	**77,716**	**100.0%**	**100.0%**	**91,353**	**77,716**	**90,094**	**100.0%**	**100.0%**	**105,063**
Total					**67,988**	**100,000**		**83,617**			**99,782**		**96,935**			**114,835**

Exhibit D.16: Economic Potential Forecast, Non-Metallic Mineral Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 Base Year: Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	2010/11 (Sub Sector Annual Growth Rate 3.0%): Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	2015/16 (Sub Sector Annual Growth Rate 3.0%): Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	16,727	23,896	16,727	20,572	100%	100.0%	29,389	20,572	23,849	100%	100%	34,070
	Total Comfort Heat		**100.0%**	**100.0%**	**16,727**	**23,896**		**20,572**	**100%**	**100.0%**	**29,389**	**20,572**	**23,849**	**100.0%**	**100.0%**	**34,070**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.3%	11,449	16,837	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	10.0%	11.6%	2,088	2,610	1,314	1,616	7.3%	8.0%	2,019	1,187	1,377	5.4%	6.0%	1,721
	Condensing Boiler	92%	2.5%	3.3%	600	653	12,050	14,819	66.7%	64.2%	16,108	14,819	17,180	67.3%	65.2%	18,674
	Combustion Air Preheat from Exhaust on Standard	72%	2.0%	2.1%	376	522	236	291	1.3%	1.6%	404	214	0	0.0%	0.0%	0
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	2,219	2,610	3,133	3,853	17.3%	18.1%	4,533	4,358	5,053	19.8%	20.7%	5,944
	Partly Insulated Distribution System	50%	3.8%			992				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			52				1.0%	247				1.0%	287
	Tank-type Water Heating	65%	5.0%	4.7%	848	1,305	76	94	0.4%	0.6%	144	33	38	0.1%	0.2%	59
	Direct Fired Water Heating	95%	2.0%	2.7%	496	522	1,268	1,559	7.0%	6.5%	1,642	1,621	1,879	7.4%	6.9%	1,978
	Total Process Heat		**100%**	**100.0%**	**18,077**	**26,104**	**18,077**	**22,232**	**100.0%**	**100.0%**	**25,098**	**22,232**	**25,526**	**100.0%**	**100.0%**	**28,661**
Total					**34,804**	**50,000**		**42,805**			**54,487**		**49,375**			**62,731**

Exhibit D.17: Economic Potential Forecast, Wood Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011					2015/2016				
			Base Year				Sub Sector Annual Growth Rate				3.0%	Sub Sector Annual Growth Rate				1.5%
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)	Useful Heat Without Sector Growth (GJ/Year)	Useful Heat (GJ/year)	Market Share as a Percent of Useful Heat (%)	Market Share as a Percent of Heat Sold (%)	Annual Heat Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	1,214	1,735	1,214	1,493	51.0%	53.6%	2,133	1,493	1,609	51.0%	54.5%	2,298
	Standard Efficiency Boiler	68%	27.2%	26.9%	642	944	404	496	16.9%	18.3%	730	365	393	12.5%	13.7%	578
	Near Condensing Boilers	80%	17.5%	20.4%	486	607	305	376	12.8%	11.8%	470	276	297	9.4%	8.8%	372
	Condensing Boiler	92%	1.3%	1.7%	40	43	458	563	19.2%	15.4%	612	795	856	27.1%	22.1%	930
	Partly Insulated Distribution System	50%	3.9%			134				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			7				0.8%	33				0.8%	36
	Total Comfort Heat		**100.0%**	**100.0%**	**2,381**	**3,469**	**2,381**	**2,929**	**100.0%**	**100.0%**	**3,978**	**2,929**	**3,155**	**100.0%**	**100.0%**	**4,214**
Process Heat	Standard Efficiency Boiler	68%	0.9%	1.0%	2,081	3,060	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	0.2%	0.3%	515	644	324	399	0.2%	0.1%	498	293	316	0.1%	0.1%	395
	Condensing Boiler	92%	0.0%	0.1%	148	161	3,185	3,918	1.6%	1.2%	4,258	4,446	4,790	1.8%	1.5%	5,206
	Combustion Air Preheat from Exhaust on Standard	72%	0.0%	0.0%	0	0	0					0	0	0.0%	0.0%	0
	Bundled Standard Boiler Upgrades	85%	0.7%	1.0%	2,062	2,426	1,297	1,595	0.6%	0.5%	1,877	1,172	1,263	0.5%	0.4%	1,486
	Standard Efficiency Kiln	57%	64.8%	62.5%	127,926	224,431	48,228	59,314	23.6%	29.8%	104,060	32,919	35,464	13.1%	17.6%	62,217
	Advanced Kiln Control	60%	3.7%	3.7%	7,589	12,649	2,861	3,519	1.4%	1.7%	5,865	1,953	2,104	0.8%	1.0%	3,507
	High Efficiency Kiln	87%	7.6%	11.2%	22,913	26,336	107,338	132,013	52.4%	43.4%	151,739	159,974	172,337	63.5%	55.9%	198,088
	Standard Efficiency Veneer Dryer	50%	17.7%	15.0%	30,737	61,475	11,588	14,252	5.7%	8.2%	28,503	7,910	8,521	3.1%	4.8%	17,042
	Advanced Veneer Dryer	70%	4.4%	5.2%	10,744	15,349	29,893	36,765	14.6%	15.0%	52,522	43,107	46,439	17.1%	18.7%	66,341
	Total Process Heat		**100.0%**	**100.0%**	**204,716**	**346,531**	**204,716**	**251,774**	**100.0%**	**100.0%**	**349,322**	**251,774**	**271,232**	**100.0%**	**100.0%**	**354,281**
Total					**207,097**	**350,000**		**254,703**			**353,301**		**274,388**			**358,495**

Exhibit D.18: Economic Potential Forecast, Other Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011					2015/2016				
			Base Year				Sector Annual Growth Rate				3.0%	Sector Annual Growth Rate				3.0%
			Market Share as Percent of GJ Sold (%)	Market Share as Percent Useful GJ (%)	Useful Heat (GJ/year)	Annual GJ Sold (GJ/year)	Useful GJ Before Sector Growth	Useful Heat (GJ/year)	Market Share as a Percent of Useful GJ	Market Share as a Percent of GJ Sold (%)	Annual GJ Sold (GJ/year)	Useful GJ Before Growth	Useful Heat (GJ/year)	Market Share as a Percent of Useful GJ	Market Share as a Percent of GJ Sold (%)	Annual GJ Sold (GJ/year)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	17,264	24,662	17,264	21,232	82.8%	83.7%	30,332	21,232	24,614	82.8%	84.2%	35,163
	Standard Efficiency Boiler	68%	9.6%	9.7%	2,023	2,975	1,272	1,565	6.1%	6.4%	2,301	1,150	1,333	4.5%	4.7%	1,961
	Near Condensing Boilers	80%	6.1%	7.2%	1,504	1,881	946	1,164	4.5%	4.0%	1,455	855	992	3.3%	3.0%	1,240
	Condensing Boiler	92%	0.3%	0.3%	71	77	1,380	1,697	6.6%	5.1%	1,844	2,420	2,805	9.4%	7.3%	3,049
	Partly Insulated Distribution System	50%	3.8%			1,171				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			62				0.8%	292				0.8%	338
	Total Comfort Heat		**100.0%**	**100.0%**	**20,862**	**30,828**	**20,862**	**25,658**	**100.0%**	**100.0%**	**36,224**	**25,658**	**29,744**	**100.0%**	**100.0%**	**41,751**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	3,976	5,847	0	0	0.0%	0.0%	0	0	0	0.0%	0.0%	0
	Near Condensing Boiler	80%	7.0%	8.4%	1,074	1,342	675	831	5.3%	5.3%	1,038	610	708	3.9%	4.0%	885
	Condensing Boiler	92%	2.0%	2.8%	353	383	5,060	6,223	39.8%	34.6%	6,764	6,627	7,682	42.4%	37.5%	8,350
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	896	1,054	564	693	4.4%	4.2%	816	510	591	3.3%	3.1%	695
	Partly Insulated Distribution System	50%	3.8%			729				0.0%	0				0.0%	0
	Fully Insulated Distribution System	92%	0.2%			38				0.9%	182				0.9%	210
	Tank-type Water Heating	65%	10.0%	9.8%	1,246	1,917	112	138	0.9%	1.1%	212	48	56	0.3%	0.4%	86
	Direct Fired Water Heating	95%	1.0%	1.4%	182	192	1,316	1,619	10.4%	8.7%	1,704	1,708	1,980	10.9%	9.4%	2,085
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	3,739	5,752	1,994	2,452	15.7%	19.3%	3,773	1,635	1,895	10.5%	13.1%	2,916
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	767	959	2,512	3,089	19.8%	19.8%	3,861	3,906	4,528	25.0%	25.4%	5,661
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	479	959	479	589	3.8%	6.0%	1,179	589	683	3.8%	6.1%	1,367
	Total Process Heat		**100.0%**	**100.0%**	**12,712**	**19,172**	**12,712**	**15,634**	**100.0%**	**100.0%**	**19,528**	**15,634**	**18,124**	**100.0%**	**100.0%**	**22,254**
Total					**33,574**	**50,000**		**41,292**			**55,752**		**47,868**			**64,005**

APPENDIX E: DETAILED MOST LIKELY ACHIEVABLE POTENTIAL FORECAST RESULTS

Exhibit E1: Most Likely Achievable Potential Forecast, Food Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	70.7%	170,419	243,456	299,420	299,420	299,420	70.0%	347,110	347,110	347,110	70.2%
	Standard Efficiency Boiler	68%	25.4%	25.2%	60,600	89,117	108,646	68,940	100,705	23.5%	125,120	58,742	111,844	22.6%
	Near Condensing Boilers	80%	3.1%	3.6%	8,603	10,753	13,984	8,319	12,851	3.0%	16,870	7,088	14,914	3.0%
	Condensing Boiler	92%	0.4%	0.5%	1,270	1,380	1,746	36,782	8,753	2.0%	2,065	60,914	13,835	2.8%
	Partly Insulated Distribution System	50%	1.7%			6,084	6,696	0	5,357	1.3%	6,932	0	5,546	1.1%
	Fully Insulated Distribution System	92%	0.1%			320	512	1,516	713	0.2%	712	1,758	921	0.2%
	Total Comfort Heat		**100.0%**	**100.0%**	**240,892**	**351,111**	**431,004**	**414,978**	**427,799**	**100.0%**	**498,809**	**475,612**	**494,170**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	44.0%	40.9%	1,849,600	2,720,000	2,848,889	0	627,119	9.2%	2,790,095	0	146,172	1.9%
	Near Condensing Boiler	80%	8.7%	9.5%	427,825	534,781	695,441	413,701	1,584,409	23.1%	838,975	352,501	2,046,791	26.2%
	Condensing Boiler	92%	13.4%	16.9%	762,198	828,476	1,047,796	2,682,712	1,864,043	27.2%	1,239,171	3,187,359	2,088,068	26.7%
	Bundled Standard Boiler Upgrades	85%	17.0%	19.7%	891,944	1,049,345	1,587,229	1,654,622	1,587,229	23.2%	2,133,103	1,918,161	2,133,103	27.3%
	Partly Insulated Distribution System	50%	3.8%			234,698	258,340	0	105,920	1.5%	267,442	0	109,651	1.4%
	Fully Insulated Distribution System	92%	0.2%			12,353	19,750	58,489	42,606	0.6%	27,474	67,805	51,269	0.7%
	Direct Fired Heating	90%	1.9%	2.3%	105,235	116,928	175,556	844,134	229,647	3.4%	259,746	1,012,734	316,000	4.0%
	Radiant Tube Heating	70%	0.0%	0.0%	984	1,405	1,790	1,087	1,790	0.0%	2,180	926	2,180	0.0%
	Standard Efficiency Oven	65%	4.3%	3.8%	171,774	264,268	274,952	122,531	244,468	3.6%	285,001	78,836	243,768	3.1%
	Efficient Oven	80%	3.7%	4.1%	184,435	230,543	324,216	448,058	348,985	5.1%	403,272	570,781	436,774	5.6%
	Tank-type Water Heating	65%	2.0%	1.8%	81,821	125,878	148,474	13,933	121,566	1.8%	174,636	5,653	140,839	1.8%
	Direct Fired Water Heating	95%	0.7%	0.9%	41,163	43,329	57,628	149,682	76,039	1.1%	65,087	180,706	88,211	1.1%
	Heat Loss from Not Using Pinch Technology		0.2%			14,250	17,525	0	14,020	0.2%	20,317	0	16,253	0.2%
	Total Process Heat		**100.0%**	**100.0%**	**4,516,978**	**6,176,255**	**7,457,586**	**6,388,951**	**6,847,839**	**100.0%**	**8,506,499**	**7,375,463**	**7,819,081**	**100.0%**
Total					**4,757,870**	**6,527,366**	**7,888,590**	**6,803,929**	**7,275,638**		**9,005,308**	**7,851,075**	**8,313,251**	

Exhibit E2: Most Likely Achievable Potential Forecast, Chemical Sub Sector, Lower Mainland Service Area

			2003/04				2010/2011				2015/16			
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	3,270	4,671	5,745	5,745	5,745	100.0%	6,660	6,660	6,660	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**3,270**	**4,671**	**5,745**	**5,745**	**5,745**	**100.0%**	**6,660**	**6,660**	**6,660**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	191,198	281,173	316,638	0	241,751	46.3%	338,712	0	236,965	40.3%
	Near Condensing Boiler	80%	10.0%	12.8%	36,996	46,246	60,139	35,775	123,793	23.7%	72,551	30,483	159,036	27.0%
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	60,929	71,681	108,423	384,664	108,423	20.8%	145,712	456,275	145,712	24.8%
	Partly Insulated Distribution System	50%	3.8%			17,573	19,344	0	7,931	1.5%	20,070	0	8,229	1.4%
	Fully Insulated Distribution System	92%	0.2%			925	1,479	4,379	3,190	0.6%	2,229	5,077	3,909	0.7%
	Heat Loss from Not Using Pinch Technology		9.7%			44,858	46,048	0	36,838	7.1%	42,688	0	34,150	5.8%
	Total Process Heat		**100.0%**	**100.0%**	**289,123**	**462,456**	**552,070**	**424,819**	**521,926**	**100.0%**	**621,961**	**491,835**	**588,001**	**100.0%**
Total					**292,393**	**467,127**	**557,815**	**430,564**	**527,671**		**628,621**	**498,495**	**594,661**	

Exhibit E3: Most Likely Achievable Potential Forecast, Fabricated Metal Sub Sector, Lower Mainland Service Area

			2003/04				2010/2011				2015/16			
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	125,104	178,720	219,803	219,803	219,803	100.0%	254,812	254,812	254,812	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**125,104**	**178,720**	**219,803**	**219,803**	**219,803**	**100.0%**	**254,812**	**254,812**	**254,812**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Standard Efficiency Furnace	25%	66.0%	57.9%	93,472	373,888	410,111	173,358	362,760	55.1%	429,080	111,538	365,572	49.2%
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	67,980	169,949	240,094	388,064	269,688	40.9%	307,304	505,767	346,996	46.7%
	Standard Furnace Insulation	25%	3.1%			17,561	18,791	0	15,032	2.3%	18,952	0	15,161	2.0%
	Ceramic Fibre Furnace Insulation	40%	0.9%			5,098	8,026	24,629	11,347	1.7%	11,072	28,552	14,568	2.0%
	Total Process Heat		**100.0%**	**100.0%**	**161,452**	**566,497**	**677,021**	**586,051**	**658,827**	**100.0%**	**766,408**	**645,857**	**742,298**	**100.0%**
Total					**286,556**	**745,217**	**896,824**	**805,854**	**878,630**		**1,021,220**	**900,669**	**997,109**	

Exhibit E4: Most Likely Achievable Potential Forecast, Non-Metallic Minerals Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	133,662	190,945	234,838	234,838	234,838	100.0%	272,242	272,242	272,242	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**133,662**	**190,945**	**234,838**	**234,838**	**234,838**	**100.0%**	**272,242**	**272,242**	**272,242**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.2%	176,538	259,615	301,254	0	167,203	37.1%	331,881	0	170,371	32.9%
	Near Condensing Boiler	80%	10.0%	11.5%	32,200	40,250	52,343	31,137	109,146	24.2%	63,146	26,531	140,322	27.1%
	Condensing Boiler	92%	2.5%	3.3%	9,258	10,063	12,726	248,375	64,883	14.4%	15,051	287,935	69,293	13.4%
	Combustion Air Preheat from Exhaust on Standard Efficiency	78%	2.0%	2.2%	6,279	8,050	9,901	6,227	6,227	1.4%	11,477	5,306	8,264	1.6%
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	34,213	40,250	60,882	69,900	60,882	13.5%	81,821	91,656	81,821	15.8%
	Partly Insulated Distribution System	50%	3.8%			15,295	16,836	0	6,903	1.5%	17,468	0	7,162	1.4%
	Fully Insulated Distribution System	92%	0.2%			805	1,287	3,812	2,777	0.6%	1,940	4,419	3,402	0.7%
	Tank-type Water Heating	65%	5.0%	4.7%	13,081	20,125	22,600	2,228	18,525	4.1%	24,194	904	19,536	3.8%
	Direct Fired Water Heating	95%	2.0%	2.7%	7,648	8,050	11,373	25,312	14,160	3.1%	14,556	30,492	17,743	3.4%
	Total Process Heat		**100.0%**	**100.0%**	**279,217**	**402,504**	**489,202**	**386,991**	**450,706**	**100.0%**	**561,533**	**447,243**	**517,915**	**100.0%**
Total					**412,879**	**593,449**	**724,040**	**621,829**	**685,544**		**833,775**	**719,485**	**790,157**	

Exhibit E5: Most Likely Achievable Potential Forecast, Paper Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	14,291	20,416	25,108	25,108	25,108	52.5%	29,108	29,108	29,108	52.7%
	Standard Efficiency Boiler	68%	27.3%	27.0%	7,566	11,126	13,067	8,607	12,175	25.4%	14,613	7,334	13,157	23.8%
	Near Condensing Boilers	80%	17.5%	20.4%	5,716	7,145	9,292	5,528	8,539	17.8%	11,210	4,710	9,910	17.9%
	Condensing Boiler	92%	1.3%	1.7%	470	510	646	7,215	1,959	4.1%	763	11,795	2,970	5.4%
	Partly Insulated Distribution System	50%	3.8%			1,552	0	0	0	0.0%	0	0	0	0.0%
	Fully Insulated Distribution System	92%	0.2%			82	0	387	77	0.2%	0	448	90	0.2%
	Total Comfort Heat		**100.0%**	**100.0%**	**28,043**	**40,831**	**48,113**	**46,845**	**47,860**	**100.0%**	**55,694**	**53,395**	**55,234**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	64,577	94,966	69,942	0	19,471	4.2%	35,106	0	1,250	0.2%
	Near Condensing Boiler	80%	7.5%	8.9%	25,046	31,308	40,713	24,219	84,376	18.0%	49,116	20,636	78,778	14.9%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	0.8%	0.9%	2,442	3,131	3,850	2,422	2,772	0.6%	4,464	2,064	3,214	0.6%
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	106,446	125,231	189,422	262,110	189,422	40.5%	254,568	311,490	254,568	48.2%
	Partly Insulated Distribution System	50%	3.8%			15,863	17,460	0	7,159	1.5%	18,116	0	7,428	1.4%
	Fully Insulated Distribution System	92%	0.2%			835	1,335	3,953	2,880	0.6%	2,012	4,583	3,529	0.7%
	Heat Loss from Not Using Pinch Technology		10.0%			41,744	43,336	0	34,669	7.4%	40,236	0	32,189	6.1%
	Steam Paper Drying	80%	23.0%	27.2%	76,808	96,010	116,414	62,701	105,672	22.6%	133,403	48,337	116,390	22.0%
	Direct Fired Paper Drying	87%	2.0%	2.6%	7,288	8,349	11,795	61,017	21,639	4.6%	15,096	93,049	30,687	5.8%
	Total Process Heat		**100.0%**	**100.0%**	**282,608**	**417,435**	**494,269**	**416,422**	**468,060**	**100.0%**	**552,117**	**480,159**	**528,031**	**100.0%**
Total					**310,650**	**458,266**	**542,382**	**463,267**	**515,919**		**607,810**	**533,554**	**583,265**	

Exhibit E6: Most Likely Achievable Potential, Wood Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	72,768	103,954	127,850	127,850	127,850	50.9%	137,731	137,731	137,731	51.2%
	Standard Efficiency Boiler	68%	27.3%	27.0%	38,525	56,655	66,536	43,828	61,994	24.7%	69,144	34,703	62,256	23.2%
	Near Condensing Boilers	80%	17.5%	20.4%	29,107	36,384	47,314	28,146	43,481	17.3%	53,043	22,286	46,891	17.4%
	Condensing Boiler	92%	1.3%	1.7%	2,391	2,599	3,287	36,739	9,977	4.0%	3,612	55,814	14,053	5.2%
	Partly Insulated Distribution System	50%	3.8%			7,901	8,696	0	6,957	2.8%	8,385	0	6,708	2.5%
	Fully Insulated Distribution System	92%	0.2%			416	665	1,969	926	0.4%	931	2,121	1,169	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**142,791**	**207,908**	**254,349**	**238,532**	**251,186**	**100.0%**	**272,846**	**252,655**	**268,808**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	15.5%	16.7%	56,024	82,388	91,543	0	43,965	7.1%	89,767	0	32,912	5.0%
	Near Condensing Boiler	80%	2.3%	2.9%	9,764	12,206	15,872	9,442	35,543	5.8%	17,794	8,045	44,520	6.8%
	Condensing Boiler	92%	0.6%	0.8%	2,807	3,051	3,859	93,780	21,920	3.6%	4,241	108,352	23,025	3.5%
	Bundled Standard Boiler Upgrades	85%	4.6%	6.2%	20,749	24,411	36,924	18,884	36,924	6.0%	46,113	16,091	46,113	7.0%
	Standard Efficiency Kiln	57%	67.5%	61.0%	204,178	358,207	430,819	166,087	369,931	60.0%	455,492	99,302	377,131	57.5%
	Advanced Kiln Control	60%	2.0%	1.9%	6,368	10,614	17,177	4,921	14,358	2.3%	22,514	2,942	18,208	2.8%
	High Efficiency Kiln	87%	7.5%	10.4%	34,627	39,801	52,481	234,378	94,317	15.3%	59,421	306,284	113,731	17.3%
	Total Process Heat		**100.0%**	**100.0%**	**334,518**	**530,677**	**648,675**	**527,493**	**616,959**	**100.0%**	**695,343**	**541,017**	**655,639**	**100.0%**
Total					**477,309**	**738,585**	**903,024**	**136,999**	**868,144**		**968,189**	**793,673**	**924,447**	

Exhibit E7: Most Likely Achievable Potential, Other Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	169,054	241,506	297,021	297,021	297,021	81.0%	344,329	344,329	344,329	81.3%
	Standard Efficiency Boiler	68%	9.6%	9.7%	19,809	29,132	34,264	22,536	31,919	8.7%	38,364	19,202	34,532	8.2%
	Near Condensing Boilers	80%	6.1%	7.2%	14,732	18,415	23,947	14,246	22,007	6.0%	28,890	12,138	25,539	6.0%
	Condensing Boiler	92%	0.3%	0.3%	694	755	954	18,059	4,375	1.2%	1,129	29,858	6,875	1.6%
	Partly Insulated Distribution System	50%	3.8%			11,472	12,627	0	10,102	2.8%	13,101	0	10,481	2.5%
	Fully Insulated Distribution System	92%	0.2%			604	965	2,859	1,344	0.4%	1,455	3,314	1,827	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**204,290**	**301,882**	**369,780**	**354,721**	**366,768**	**100.0%**	**427,268**	**408,842**	**423,583**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	173,681	255,413	292,194	0	145,681	15.2%	317,758	0	142,675	13.0%
	Near Condensing Boiler	80%	7.0%	8.4%	46,896	58,619	76,230	45,347	136,804	14.3%	91,963	38,639	174,264	15.8%
	Condensing Boiler	92%	2.0%	2.8%	15,409	16,748	21,182	295,453	76,801	8.0%	25,051	364,738	82,895	7.5%
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	39,149	46,058	69,667	35,630	69,667	7.3%	93,627	30,359	93,627	8.5%
	Partly Insulated Distribution System	50%	3.8%			31,822	35,028	0	14,361	1.5%	36,343	0	14,901	1.4%
	Fully Insulated Distribution System	92%	0.2%			1,675	2,678	7,930	5,777	0.6%	4,036	9,193	7,079	0.6%
	Tank-type Water Heating	65%	10.0%	9.8%	54,432	83,742	100,754	9,269	82,457	8.6%	114,715	3,761	92,524	8.4%
	Direct Fired Water Heating	95%	1.0%	1.4%	7,955	8,374	11,831	74,425	24,350	2.5%	15,142	91,058	30,326	2.8%
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	163,297	251,226	288,953	164,787	264,120	27.5%	314,028	127,356	276,693	25.1%
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	33,497	41,871	67,765	168,650	87,942	9.2%	95,578	247,249	125,913	11.4%
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	20,936	41,871	51,496	51,496	51,496	5.4%	59,698	59,698	59,698	5.4%
	Total Process Heat		**100.0%**	**100.0%**	**555,251**	**837,420**	**1,017,777**	**852,989**	**959,456**	**100.0%**	**1,167,939**	**972,053**	**1,100,593**	**100.0%**
Total					**759,541**	**1,139,302**	**1,387,557**	**1,207,710**	**1,326,224**		**1,595,207**	**1,380,895**	**1,524,176**	

Exhibit E8: Most Likely Achievable Potential Forecast, Food Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	96.2%	29,330	41,900	51,531	51,531	51,531	96.0%	59,739	59,739	59,739	96.1%
	Standard Efficiency Boiler	68%	25.4%	3.6%	1,087	1,598	1,960	1,236	1,815	3.4%	2,267	1,053	2,024	3.3%
	Near Condensing Boilers	80%	3.1%	0.2%	48	60	78	46	71	0.1%	94	39	83	0.1%
	Condensing Boiler	92%	0.4%	0.0%	14	15	19	581	131	0.2%	22	967	211	0.3%
	Partly Insulated Distribution System	50%	1.7%			114	125	0	100	0.2%	129	0	103	0.2%
	Fully Insulated Distribution System	92%	0.1%			6	10	28	13	0.0%	13	33	17	0.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**30,478**	**43,692**	**53,722**	**53,423**	**53,662**	**100.0%**	**62,265**	**61,831**	**62,178**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	44.0%	50.7%	209,051	307,428	338,338	0	45,118	7.0%	351,782	0	1,919	0.3%
	Near Condensing Boiler	80%	8.7%	10.8%	44,434	55,543	72,229	42,967	176,776	27.6%	87,137	0	191,635	26.3%
	Condensing Boiler	92%	13.4%	13.7%	56,458	61,368	77,613	260,135	194,442	30.3%	91,789	309,603	248,512	34.1%
	Bundled Standard Boiler Upgrades	85%	17.0%	17.2%	70,807	83,302	126,002	145,699	126,002	19.6%	169,336	168,905	169,336	23.2%
	Partly Insulated Distribution System	50%	3.8%			22,563	24,836	0	13,660	2.1%	25,711	0	14,141	1.9%
	Fully Insulated Distribution System	92%	0.2%			1,188	1,899	5,623	3,575	0.6%	2,641	6,519	4,386	0.6%
	Direct Fired Heating	90%	1.9%	1.7%	6,899	7,665	11,553	88,050	20,742	3.2%	17,094	105,611	28,342	3.9%
	Radiant Tube Heating	70%	0.0%	0.0%	63	90	114	69	114	0.0%	139	59	139	0.0%
	Standard Efficiency Oven	65%	4.3%	1.8%	7,410	11,399	12,775	5,285	11,277	1.8%	13,716	3,401	11,653	1.6%
	Efficient Oven	80%	3.7%	2.2%	9,120	11,399	15,031	21,116	16,248	2.5%	18,314	26,695	19,990	2.7%
	Tank-type Water Heating	65%	2.0%	0.9%	3,705	5,700	6,714	631	5,498	0.9%	7,524	256	6,070	0.8%
	Direct Fired Water Heating	95%	0.7%	1.1%	4,381	4,611	5,873	10,036	6,706	1.0%	6,987	11,959	7,981	1.1%
	Heat Loss from Not Using Pinch Technology		0.2%			21,517	26,463	0	21,170	3.3%	30,678	0	24,542	3.4%
	Total Process Heat		**100.0%**	**100.0%**	**412,326**	**593,773**	**719,441**	**579,613**	**641,328**	**100.0%**	**822,848**	**633,008**	**728,647**	**100.0%**
Total					**442,804**	**637,465**	**773,164**	**633,037**	**694,990**		**885,112**	**694,840**	**790,825**	

Exhibit E9: Most Likely Achievable Potential Forecast, Chemical Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	1,589	2,270	2,792	2,792	2,792	100.0%	3,236	3,236	3,236	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**1,589**	**2,270**	**2,792**	**2,792**	**2,792**	**100.0%**	**3,236**	**3,236**	**3,236**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	92,914	136,639	153,873	0	101,333	40.2%	164,600	0	80,080	28.4%
	Near Condensing Boiler	80%	10.0%	12.8%	17,979	22,474	29,225	17,385	73,884	29.3%	35,257	14,813	107,099	38.0%
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	29,609	34,834	52,689	186,931	52,689	20.9%	70,810	221,731	70,810	25.1%
	Partly Insulated Distribution System	50%	3.8%			8,540	9,400	0	5,170	2.0%	9,753	0	5,364	1.9%
	Fully Insulated Distribution System	92%	0.2%			449	719	2,128	1,353	0.5%	1,083	2,467	1,706	0.6%
	Heat Loss from Not Using Pinch Technology		9.7%			21,799	22,377	0	17,902	7.1%	20,745	0	16,596	5.9%
	Total Process Heat		**100.0%**	**100.0%**	**140,502**	**224,735**	**268,284**	**206,445**	**252,332**	**100.0%**	**302,248**	**239,012**	**281,655**	**100.0%**
Total					**142,091**	**227,005**	**271,076**	**209,237**	**255,123**		**305,485**	**242,248**	**284,892**	

Exhibit E10: Most Likely Achievable Potential Forecast, Fabricated Metal Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	14,525	20,750	25,520	25,520	25,520	100.0%	29,585	29,585	29,585	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**14,525**	**20,750**	**25,520**	**25,520**	**25,520**	**100.0%**	**29,585**	**29,585**	**29,585**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Standard Efficiency Furnace	25%	66.0%	57.9%	4,057	16,229	17,801	7,525	15,746	55.1%	18,624	4,841	15,868	49.2%
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	2,951	7,377	10,421	16,844	11,706	40.9%	13,339	21,953	15,061	46.7%
	Standard Furnace Insulation	25%	3.1%			762	816	0	652	2.3%	823	0	658	2.0%
	Ceramic Fibre Furnace Insulation	40%	0.9%			221	354	1,069	497	1.7%	488	1,239	638	2.0%
	Total Process Heat		**100.0%**	**100.0%**	**7,008**	**24,589**	**29,392**	**25,438**	**28,601**	**100.0%**	**33,274**	**28,034**	**32,226**	**100.0%**
Total					**21,533**	**45,339**	**54,912**	**50,958**	**54,121**		**62,858**	**57,618**	**61,810**	

Exhibit E11: Most Likely Achievable Potential Forecast, Non-Metallic Minerals Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	64,607	92,295	113,511	113,511	113,511	100.0%	131,591	131,591	131,591	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**64,607**	**92,295**	**113,511**	**113,511**	**113,511**	**100.0%**	**131,591**	**131,591**	**131,591**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.2%	44,221	65,031	75,462	0	30,437	27.4%	83,133	0	25,393	20.1%
	Near Condensing Boiler	80%	10.0%	11.5%	8,066	10,082	13,111	7,800	30,571	27.5%	15,817	6,646	35,393	28.1%
	Condensing Boiler	92%	2.5%	3.3%	2,319	2,521	3,188	62,216	21,903	19.7%	3,770	72,125	29,238	23.2%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	2.0%	2.2%	1,573	2,016	2,480	1,560	1,560	1.4%	2,875	1,329	2,875	2.3%
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	8,570	10,082	15,251	17,509	15,251	13.7%	20,495	22,959	20,495	16.2%
	Partly Insulated Distribution System	50%	3.8%			3,831	4,217	0	2,319	2.1%	4,366	0	2,401	1.9%
	Fully Insulated Distribution System	92%	0.2%			202	322	955	607	0.5%	449	1,107	745	0.6%
	Tank-type Water Heating	65%	5.0%	4.7%	3,277	5,041	6,200	558	5,072	4.6%	7,188	226	5,795	4.6%
	Direct Fired Water Heating	95%	2.0%	2.7%	1,916	2,016	2,480	6,340	3,252	2.9%	2,875	7,638	3,828	3.0%
	Total Process Heat		**100.0%**	**100.0%**	**69,942**	**100,824**	**122,711**	**96,938**	**110,972**	**100.0%**	**140,968**	**112,031**	**126,164**	**100.0%**
Total					**134,548**	**193,119**	**236,223**	**210,449**	**224,483**		**272,559**	**243,621**	**257,754**	

Exhibit E12: Most Likely Achievable Potential Forecast, Paper Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	4,674	6,678	8,212	8,212	8,212	50.9%	9,521	9,521	9,521	51.3%
	Standard Efficiency Boiler	68%	27.3%	27.0%	2,475	3,639	4,274	2,815	3,982	24.7%	4,780	2,399	4,303	23.2%
	Near Condensing Boilers	80%	17.5%	20.4%	1,870	2,337	3,039	1,808	2,793	17.3%	3,667	1,541	3,241	17.4%
	Condensing Boiler	92%	1.3%	1.7%	154	167	211	2,360	641	4.0%	250	3,858	971	5.2%
	Partly Insulated Distribution System	50%	3.8%			507	559	0	447	2.8%	578	0	463	2.5%
	Fully Insulated Distribution System	92%	0.2%			27	43	126	59	0.4%	59	147	77	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**9,172**	**13,355**	**16,338**	**15,322**	**16,135**	**100.0%**	**18,854**	**17,465**	**18,576**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	8,423	12,386	9,122	0	1,026	1.7%	4,579	0	1,966	2.8%
	Near Condensing Boiler	80%	7.5%	8.9%	3,267	4,083	5,310	3,159	12,292	20.2%	6,406	2,692	8,583	12.4%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	0.8%	0.9%	319	408	502	0	362	0.6%	582	0	582	0.8%
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	13,883	16,334	24,706	34,186	24,706	40.6%	33,203	40,545	33,203	48.0%
	Partly Insulated Distribution System	50%	3.8%			2,069	2,277	0	1,253	2.1%	2,358	0	1,297	1.9%
	Fully Insulated Distribution System	92%	0.2%			109	174	516	328	0.5%	242	598	402	0.6%
	Heat Loss from Not Using Pinch Technology		10.0%			5,445	5,354	0	4,283	7.0%	4,923	0	3,938	5.7%
	Steam Paper Drying	80%	23.0%	27.2%	10,018	12,522	15,184	8,178	13,782	22.6%	17,399	6,304	15,180	22.0%
	Direct Fired Paper Drying	87%	2.0%	2.6%	951	1,089	1,538	7,958	2,822	4.6%	1,969	12,136	4,002	5.8%
	Total Process Heat		**100.0%**	**100.0%**	**36,860**	**54,445**	**64,168**	**53,997**	**60,853**	**100.0%**	**71,661**	**62,275**	**69,154**	**100.0%**
Total					**46,032**	**67,800**	**80,506**	**69,319**	**76,988**		**90,515**	**79,739**	**87,730**	

Exhibit E13: Most Likely Achievable Potential Forecast, Wood Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	20,838	29,769	36,612	36,612	36,612	50.9%	39,441	39,441	39,441	51.3%
	Standard Efficiency Boiler	68%	27.3%	27.0%	11,032	16,224	19,053	12,551	17,753	24.7%	19,800	9,938	17,828	23.2%
	Near Condensing Boilers	80%	17.5%	20.4%	8,335	10,419	13,549	8,060	12,451	17.3%	15,189	6,382	13,428	17.4%
	Condensing Boiler	92%	1.3%	1.7%	685	744	941	10,521	2,857	4.0%	1,034	15,983	4,024	5.2%
	Partly Insulated Distribution System	50%	3.8%			2,262	2,490	0	1,992	2.8%	2,396	0	1,917	2.5%
	Fully Insulated Distribution System	92%	0.2%			119	190	564	265	0.4%	246	607	318	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**40,890**	**59,537**	**72,836**	**68,307**	**71,930**	**100.0%**	**78,107**	**72,351**	**76,956**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	15.5%	1.0%	35,637	52,407	47,774	0	3,516	0.1%	36,272	0	2,530	0.0%
	Near Condensing Boiler	80%	2.3%	0.3%	8,847	11,058	14,380	8,555	29,914	0.5%	16,122	6,774	33,538	0.5%
	Condensing Boiler	92%	0.6%	0.1%	2,543	2,765	3,496	74,075	22,701	0.3%	3,843	90,949	13,638	0.2%
	Bundled Standard Boiler Upgrades	85%	4.6%	1.1%	37,598	44,233	66,907	34,218	66,907	1.0%	83,558	27,094	83,558	1.2%
	Standard Efficiency Kiln	57%	67.5%	62.5%	2,195,526	3,851,799	4,587,345	1,785,935	3,074,583	46.5%	4,805,657	1,067,797	2,861,970	41.4%
	Advanced Kiln Control	60%	2.0%	3.7%	130,260	217,100	351,362	100,661	215,984	3.3%	460,523	60,185	252,347	3.6%
	High Efficiency Kiln	87%	7.5%	11.2%	392,479	451,125	594,850	2,603,153	1,679,333	25.4%	673,510	3,398,549	2,090,530	30.2%
	Standard Efficiency Veneer Dryer	50%	0.0%	15.0%	526,877	1,053,754	1,072,031	488,586	937,839	14.2%	957,649	292,122	804,578	11.6%
	Advanced Veneer Dryer	70%	0.0%	5.2%	184,407	263,438	483,962	900,709	579,814	8.8%	662,246	1,137,622	771,582	11.2%
	Total Process Heat		**100.0%**	**100.0%**	**3,514,173**	**5,947,680**	**7,222,107**	**5,995,892**	**6,610,592**	**100.0%**	**7,699,380**	**6,081,091**	**6,914,271**	**100.0%**
Total					**3,555,063**	**6,007,217**	**7,294,943**	**6,064,198**	**6,682,522**		**7,777,487**	**6,153,442**	**6,991,227**	

Exhibit E14: Most Likely Achievable Potential Forecast, Other Sub Sector, Interior Service Area

			2003/04				2010/2011				2015/16			
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	45,498	64,998	79,939	79,939	79,939	81.0%	92,671	92,671	92,671	81.3%
	Standard Efficiency Boiler	68%	9.6%	9.7%	5,331	7,840	9,222	6,065	8,590	8.7%	10,325	5,168	9,294	8.2%
	Near Condensing Boilers	80%	6.1%	7.2%	3,965	4,956	6,445	3,834	5,923	6.0%	7,775	3,267	6,874	6.0%
	Condensing Boiler	92%	0.3%	0.3%	187	203	257	4,860	1,178	1.2%	304	8,036	1,850	1.6%
	Partly Insulated Distribution System	50%	3.8%			3,087	3,398	0	2,719	2.8%	3,518	0	2,815	2.5%
	Fully Insulated Distribution System	92%	0.2%			162	260	769	362	0.4%	361	892	468	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**54,981**	**81,247**	**99,521**	**95,468**	**98,710**	**100.0%**	**114,955**	**110,034**	**113,970**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	10,479	15,410	17,630	0	5,872	10.2%	19,172	0	11,310	16.9%
	Near Condensing Boiler	80%	7.0%	8.4%	2,829	3,537	4,599	2,736	9,076	15.8%	5,549	2,331	7,726	11.5%
	Condensing Boiler	92%	2.0%	2.8%	930	1,011	1,278	17,826	6,076	10.6%	1,511	22,007	5,430	8.1%
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	2,362	2,779	4,203	2,150	4,203	7.3%	5,649	1,832	5,649	8.4%
	Partly Insulated Distribution System	50%	3.8%			1,920	2,113	0	1,162	2.0%	2,188	0	1,203	1.8%
	Fully Insulated Distribution System	92%	0.2%			101	162	478	304	0.5%	225	555	373	0.6%
	Tank-type Water Heating	65%	10.0%	9.8%	3,284	5,053	6,079	559	4,975	8.7%	6,921	227	5,582	8.3%
	Direct Fired Water Heating	95%	1.0%	1.4%	480	505	714	4,490	1,469	2.6%	914	5,494	1,830	2.7%
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	9,853	15,158	17,434	9,942	15,936	27.7%	18,947	7,684	16,694	24.9%
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	2,021	2,526	4,089	10,176	5,306	9.2%	5,767	14,918	7,597	11.3%
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	1,263	2,526	3,107	3,107	3,107	5.4%	3,602	3,602	3,602	5.4%
	Total Process Heat		**100.0%**	**100.0%**	**33,501**	**50,526**	**61,408**	**51,465**	**57,487**	**100.0%**	**70,444**	**58,649**	**66,996**	**100.0%**
Total					**88,483**	**131,773**	**160,929**	**146,933**	**156,197**		**185,399**	**168,683**	**180,967**	

Exhibit E15: Most Likely Achievable Potential Forecast, Food Sub Sector, Vancouver Island Service Area

			2003/04				2010/2011				2015/16			
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	100.0%	4,798	6,854	8,430	8,430	8,430	100.0%	9,772	9,772	9,772	100.0%
	Standard Efficiency Boiler	68%	25.4%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Near Condensing Boilers	80%	3.1%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Condensing Boiler	92%	0.4%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Partly Insulated Distribution System	50%	1.7%			0	0	0	0	0.0%	0	0	0	0.0%
	Fully Insulated Distribution System	92%	0.1%			0	0	0	0	0.0%	0	0	0	0.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**4,798**	**6,854**	**8,430**	**8,430**	**8,430**	**100.0%**	**9,772**	**9,772**	**9,772**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	44.0%	54.1%	34,203	50,299	59,785	0	38,597	36.4%	67,308	0	46,041	37.7%
	Near Condensing Boiler	80%	8.7%	5.9%	3,726	4,657	6,056	3,603	15,072	14.2%	7,306	2,627	13,527	11.1%
	Condensing Boiler	92%	13.4%	1.4%	857	931	1,178	41,876	8,999	8.5%	1,393	48,545	11,704	9.6%
	Bundled Standard Boiler Upgrades	85%	17.0%	6.3%	3,959	4,657	7,045	13,132	7,045	6.6%	9,467	16,683	9,467	7.7%
	Partly Insulated Distribution System	50%	3.8%			3,540	3,896	0	1,597	1.5%	4,042	0	2,223	1.8%
	Fully Insulated Distribution System	92%	0.2%			186	298	882	643	0.6%	449	1,023	707	0.6%
	Direct Fired Heating	90%	1.9%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Standard Efficiency Oven	65%	4.3%	14.4%	9,082	13,972	12,729	6,478	11,479	10.8%	10,097	4,168	8,911	7.3%
	Efficient Oven	80%	3.7%	11.8%	7,452	9,315	15,075	20,154	16,091	15.2%	21,262	26,079	22,226	18.2%
	Tank-type Water Heating	65%	2.0%	4.8%	3,027	4,657	5,479	516	4,486	4.2%	6,120	209	4,937	4.0%
	Direct Fired Water Heating	95%	0.7%	1.4%	885	931	1,316	4,712	1,995	1.9%	1,684	5,728	2,493	2.0%
	Heat Loss from Not Using Pinch Technology		0.2%			0	0	0	0	0.0%	0	0	0	0.0%
	Total Process Heat		**100.0%**	**100.0%**	**63,190**	**93,146**	**112,857**	**91,353**	**106,004**	**100.0%**	**129,129**	**105,063**	**122,236**	**100.0%**
Total					**67,988**	**100,000**	**121,287**	**99,782**	**114,433**		**138,901**	**114,835**	**132,008**	

Exhibit E16: Most Likely Achievable Potential Forecast, Non-Metallic Minerals Sub Sector, Vancouver Island Service Area

			2003/04				2010/2011				2015/16			
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Most Likely Achievable Heat Sold (GJ/yr)**	**Most Likely Achievable Market Share as a Percent of Heat Sold (%)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	16,727	23,896	29,389	29,389	29,389	100.0%	34,070	34,070	34,070	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**16,727**	**23,896**	**29,389**	**29,389**	**29,389**	**100.0%**	**34,070**	**34,070**	**34,070**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.2%	11,449	16,837	19,538	0	12,963	43.5%	21,524	0	9,374	28.1%
	Near Condensing Boiler	80%	10.0%	11.5%	2,088	2,610	3,395	2,019	5,752	19.3%	4,095	1,721	10,471	31.4%
	Condensing Boiler	92%	2.5%	3.3%	600	653	825	16,108	3,593	12.1%	976	18,674	4,364	13.1%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	2.0%	2.2%	407	522	642	404	642	2.2%	744	0	744	2.2%
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	2,219	2,610	3,948	4,533	3,948	13.3%	5,306	5,944	5,306	15.9%
	Partly Insulated Distribution System	50%	3.8%			992	1,092	0	601	2.0%	1,133	0	464	1.4%
	Fully Insulated Distribution System	92%	0.2%			52	83	247	157	0.5%	126	287	221	0.7%
	Tank-type Water Heating	65%	5.0%	4.7%	848	1,305	1,466	144	1,201	4.0%	1,569	59	1,267	3.8%
	Direct Fired Water Heating	95%	2.0%	2.7%	496	522	738	1,642	918	3.1%	944	1,978	1,151	3.4%
	Total Process Heat		**100.0%**	**100.0%**	**18,108**	**26,104**	**31,727**	**25,098**	**29,776**	**100.0%**	**36,418**	**28,661**	**33,362**	**100.0%**
Total					**34,836**	**50,000**	**61,116**	**54,487**	**59,165**		**70,488**	**62,731**	**67,432**	

Exhibit E17: Most Likely Achievable Potential Forecast, Wood Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	1,214	1,735	2,133	2,133	2,133	50.9%	2,298	2,298	2,298	51.2%
	Standard Efficiency Boiler	68%	27.3%	26.9%	642	944	1,108	730	1,032	24.6%	1,151	578	1,037	23.1%
	Near Condensing Boilers	80%	17.5%	20.4%	486	607	789	470	725	17.3%	885	372	782	17.4%
	Condensing Boiler	92%	1.3%	1.7%	40	43	55	612	166	4.0%	60	930	234	5.2%
	Partly Insulated Distribution System	50%	3.8%			134	147	0	118	2.8%	142	0	113	2.5%
	Fully Insulated Distribution System	92%	0.2%			7	11	33	16	0.4%	16	36	20	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**2,381**	**3,469**	**4,244**	**3,978**	**4,191**	**100.0%**	**4,552**	**4,214**	**4,484**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	15.5%	1.0%	2,081	3,060	2,846	0	75	0.0%	2,823	0	180	0.0%
	Near Condensing Boiler	80%	2.3%	0.3%	515	644	838	498	1,947	0.5%	997	395	2,396	0.6%
	Condensing Boiler	92%	0.6%	0.1%	148	161	204	4,258	1,287	0.3%	225	5,206	961	0.2%
	Bundled Standard Boiler Upgrades	85%	4.6%	1.0%	2,062	2,426	3,669	1,877	3,669	0.9%	4,052	1,486	4,052	0.9%
	Standard Efficiency Kiln	57%	67.5%	62.5%	127,926	224,431	267,282	104,060	229,741	56.8%	282,676	62,217	234,175	54.6%
	Advanced Kiln Control	60%	2.0%	3.7%	7,589	12,649	20,471	5,865	17,112	4.2%	26,832	3,507	21,700	5.1%
	High Efficiency Kiln	87%	7.5%	11.2%	22,913	26,336	34,727	151,739	61,640	15.2%	37,563	198,088	72,879	17.0%
	Standard Efficiency Veneer Dryer	50%	0.0%	15.0%	30,737	61,475	62,558	28,503	56,087	13.9%	55,814	17,042	48,447	11.3%
	Advanced Veneer Dryer	70%	0.0%	5.2%	10,744	15,349	28,197	52,522	32,819	8.1%	38,585	66,341	43,858	10.2%
	Total Process Heat		**100.0%**	**100.0%**	**204,716**	**346,531**	**420,791**	**349,322**	**404,377**	**100.0%**	**449,566**	**354,281**	**428,649**	**100.0%**
Total					**207,097**	**350,000**	**425,035**	**353,301**	**408,568**		**454,118**	**358,495**	**433,134**	

Exhibit E18: Most Likely Achievable Potential Forecast, Other Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Most Likely Achievable Heat Sold (GJ/yr)	Most Likely Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	17,264	24,662	30,332	30,332	30,332	81.0%	35,163	35,163	35,163	81.3%
	Standard Efficiency Boiler	68%	9.6%	9.7%	2,023	2,975	3,499	2,301	3,260	8.7%	3,918	1,961	3,526	8.2%
	Near Condensing Boilers	80%	6.1%	7.2%	1,504	1,881	2,445	1,455	2,247	6.0%	2,950	1,240	2,608	6.0%
	Condensing Boiler	92%	0.3%	0.3%	71	77	97	1,844	447	1.2%	115	3,049	702	1.6%
	Partly Insulated Distribution System	50%	3.8%			1,171	1,289	0	1,032	2.8%	1,338	0	1,070	2.5%
	Fully Insulated Distribution System	92%	0.2%			62	99	292	137	0.4%	149	338	187	0.4%
	Total Comfort Heat		**100.0%**	**100.0%**	**20,862**	**30,828**	**37,762**	**36,224**	**37,454**	**100.0%**	**43,632**	**41,751**	**43,256**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	3,976	5,847	6,690	0	4,570	20.4%	7,275	0	5,047	19.7%
	Near Condensing Boiler	80%	7.0%	8.4%	1,074	1,342	1,745	1,038	3,132	14.0%	2,105	885	3,660	14.3%
	Condensing Boiler	92%	2.0%	2.8%	353	383	485	6,764	846	3.8%	574	8,350	868	3.4%
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	896	1,054	1,595	816	1,595	7.1%	2,144	695	2,144	8.4%
	Partly Insulated Distribution System	50%	3.8%			729	802	0	441	2.0%	832	0	341	1.3%
	Fully Insulated Distribution System	92%	0.2%			38	61	182	115	0.5%	92	210	162	0.6%
	Tank-type Water Heating	65%	10.0%	9.8%	1,246	1,917	2,307	212	1,888	8.4%	2,626	86	2,118	8.3%
	Direct Fired Water Heating	95%	1.0%	1.4%	182	192	271	1,704	557	2.5%	347	2,085	694	2.7%
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	3,739	5,752	6,615	3,773	6,047	27.0%	7,189	2,916	6,335	24.7%
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	767	959	1,551	3,861	2,013	9.0%	2,188	5,661	2,883	11.3%
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	479	959	1,179	1,179	1,179	5.3%	1,367	1,367	1,367	5.3%
	Total Process Heat		**100.0%**	**100.0%**	**12,712**	**19,172**	**23,301**	**19,528**	**22,383**	**100.0%**	**26,739**	**22,254**	**25,619**	**100.0%**
Total					**33,574**	**50,000**	**61,063**	**55,752**	**59,838**		**70,371**	**64,005**	**68,875**	

APPENDIX F: DETAILED UPPER ACHIEVABLE POTENTIAL FORECAST RESULTS

Exhibit F1: Upper Achievable Potential Forecast, Food Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	70.7%	170,419	243,456	299,420	299,420	299,420	70.5%	347,110	347,110	347,110	70.9%
	Standard Efficiency Boiler	68%	25.4%	25.2%	60,600	89,117	108,646	68,940	92,764	21.8%	125,120	58,742	98,569	20.1%
	Near Condensing Boilers	80%	3.1%	3.6%	8,603	10,753	13,984	8,319	11,718	2.8%	16,870	7,088	12,957	2.6%
	Condensing Boiler	92%	0.4%	0.5%	1,270	1,380	1,746	36,782	15,760	3.7%	2,065	60,914	25,605	5.2%
	Partly Insulated Distribution System	50%	1.7%			6,084	6,696	0	4,018	0.9%	6,932	0	4,159	0.8%
	Fully Insulated Distribution System	92%	0.1%			320	512	1,516	914	0.2%	712	1,758	1,130	0.2%
	Total Comfort Heat		**100.0%**	**100.0%**	**240,892**	**351,111**	**431,004**	**414,978**	**424,593**	**100.0%**	**498,809**	**475,612**	**489,530**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	44.0%	40.9%	1,849,600	2,720,000	2,848,889	0	60,038	0.9%	2,790,095	0	759	0.0%
	Near Condensing Boiler	80%	8.7%	9.5%	427,825	534,781	695,441	413,701	1,665,814	25.1%	838,975	352,501	928,847	12.3%
	Condensing Boiler	92%	13.4%	16.9%	762,198	828,476	1,047,796	2,682,712	2,191,194	33.0%	1,239,171	3,187,359	3,145,497	41.6%
	Bundled Standard Boiler Upgrades	85%	17.0%	19.7%	891,944	1,049,345	1,587,229	1,654,622	1,587,229	23.9%	2,133,103	1,918,161	2,133,103	28.2%
	Partly Insulated Distribution System	50%	3.8%			234,698	258,340	0	49,085	0.7%	267,442	0	50,814	0.7%
	Fully Insulated Distribution System	92%	0.2%			12,353	19,750	58,489	51,129	0.8%	27,474	67,805	60,142	0.8%
	Direct Fired Heating	90%	1.9%	2.3%	105,235	116,928	175,556	844,134	251,326	3.8%	259,746	1,012,734	338,669	4.5%
	Radiant Tube Heating	70%	0.0%	0.0%	984	1,405	1,790	1,087	1,790	0.0%	2,180	926	2,180	0.0%
	Standard Efficiency Oven	65%	4.3%	3.8%	171,774	264,268	274,952	122,531	213,984	3.2%	285,001	78,836	202,535	2.7%
	Efficient Oven	80%	3.7%	4.1%	184,435	230,543	324,216	448,058	373,753	5.6%	403,272	570,781	470,276	6.2%
	Tank-type Water Heating	65%	2.0%	1.8%	81,821	125,878	148,474	13,933	94,658	1.4%	174,636	5,653	107,043	1.4%
	Direct Fired Water Heating	95%	0.7%	0.9%	41,163	43,329	57,628	149,682	94,450	1.4%	65,087	180,706	111,334	1.5%
	Heat Loss from Not Using Pinch		0.2%			14,250	17,525	0	10,515	0.2%	20,317	0	12,190	0.2%
	Total Process Heat		**100.0%**	**100.0%**	**4,516,978**	**6,176,255**	**7,457,586**	**6,388,951**	**6,644,964**	**100.0%**	**8,506,499**	**7,375,463**	**7,563,390**	**100.0%**
Total					**4,757,870**	**6,527,366**	**7,888,590**	**6,803,929**	**7,069,557**		**9,005,308**	**7,851,075**	**8,052,920**	

Exhibit F2: Upper Achievable Potential Forecast, Chemical Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	3,270	4,671	5,745	5,745	5,745	100.0%	6,660	6,660	6,660	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**3,270**	**4,671**	**5,745**	**5,745**	**5,745**	**100.0%**	**6,660**	**6,660**	**6,660**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	191,198	281,173	316,638	0	88,315	18.2%	338,712	0	277,622	47.7%
	Near Condensing Boiler	80%	10.0%	12.8%	36,996	46,246	60,139	35,775	254,213	52.3%	72,551	30,483	124,477	21.4%
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	60,929	71,681	108,423	384,664	108,423	22.3%	145,712	456,275	145,712	25.0%
	Partly Insulated Distribution System	50%	3.8%			17,573	19,344	0	3,675	0.8%	20,070	0	3,813	0.7%
	Fully Insulated Distribution System	92%	0.2%			925	1,479	4,379	3,828	0.8%	2,229	5,077	4,536	0.8%
	Heat Loss from Not Using Pinch Technology		9.7%			44,858	46,048	0	27,629	5.7%	42,688	0	25,613	4.4%
	Total Process Heat		**100.0%**	**100.0%**	**289,123**	**462,456**	**552,070**	**424,819**	**486,084**	**100.0%**	**621,961**	**491,835**	**581,773**	**100.0%**
Total					**292,393**	**467,127**	**557,815**	**430,564**	**491,829**		**628,621**	**498,495**	**588,433**	

Exhibit F3: Upper Achievable Potential Forecast, Fabricated Metal Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	125,104	178,720	219,803	219,803	219,803	100.0%	254,812	254,812	254,812	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**125,104**	**178,720**	**219,803**	**219,803**	**219,803**	**100.0%**	**254,812**	**254,812**	**254,812**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Standard Efficiency Furnace	25%	66.0%	57.9%	93,472	373,888	410,111	173,358	315,410	49.2%	429,080	111,538	302,063	42.1%
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	67,980	169,949	240,094	388,064	299,282	46.7%	307,304	505,767	386,689	53.8%
	Standard Furnace Insulation	25%	3.1%			17,561	18,791	0	11,274	1.8%	18,952	0	11,371	1.6%
	Ceramic Fibre Furnace Insulation	40%	0.9%			5,098	8,026	24,629	14,667	2.3%	11,072	28,552	18,064	2.5%
	Total Process Heat		**100.0%**	**100.0%**	**161,452**	**566,497**	**677,021**	**586,051**	**640,633**	**100.0%**	**766,408**	**645,857**	**718,187**	**100.0%**
Total					**286,556**	**745,217**	**896,824**	**805,854**	**860,436**		**1,021,220**	**900,669**	**972,999**	

Exhibit F4: Upper Achievable Potential Forecast, Non-Metallic Minerals Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year) Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	2010/2011 Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	2015/16 Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	133,662	190,945	234,838	234,838	234,838	100.0%	272,242	272,242	272,242	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**133,662**	**190,945**	**234,838**	**234,838**	**234,838**	**100.0%**	**272,242**	**272,242**	**272,242**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.2%	176,538	259,615	301,254	0	124,007	28.4%	331,881	0	147,596	29.5%
	Near Condensing Boiler	80%	10.0%	11.5%	32,200	40,250	52,343	31,137	121,822	27.9%	63,146	26,531	93,103	18.6%
	Condensing Boiler	92%	2.5%	3.3%	9,258	10,063	12,726	248,375	85,787	19.6%	15,051	287,935	127,188	25.4%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	2.0%	2.2%	6,279	8,050	9,901	6,227	6,227	1.4%	11,477	5,306	8,264	1.6%
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	34,213	40,250	60,882	69,900	60,882	13.9%	81,821	91,656	81,821	16.3%
	Partly Insulated Distribution System	50%	3.8%			15,295	16,836	0	3,199	0.7%	17,468	0	3,319	0.7%
	Fully Insulated Distribution System	92%	0.2%			805	1,287	3,812	3,332	0.8%	1,940	4,419	3,948	0.8%
	Tank-type Water Heating	65%	5.0%	4.7%	13,081	20,125	22,600	2,228	14,451	3.3%	24,194	904	14,878	3.0%
	Direct Fired Water Heating	95%	2.0%	2.7%	7,648	8,050	11,373	25,312	16,948	3.9%	14,556	30,492	20,930	4.2%
	Total Process Heat		**100.0%**	**100.0%**	**279,217**	**402,504**	**489,202**	**386,991**	**436,656**	**100%**	**561,533**	**447,243**	**501,046**	**100.0%**
Total					**412,879**	**593,449**	**724,040**	**621,829**	**671,494**		**833,775**	**719,485**	**773,288**	

Exhibit F5: Upper Achievable Potential Forecast, Paper Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year) Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	2010/2011 Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	2015/16 Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	14,291	20,416	25,108	25,108	25,108	52.7%	29,108	29,108	29,108	53.1%
	Standard Efficiency Boiler	68%	27.3%	27.0%	7,566	11,126	13,067	8,607	11,283	23.7%	14,613	7,334	11,701	21.4%
	Near Condensing Boilers	80%	17.5%	20.4%	5,716	7,145	9,292	5,528	7,786	16.4%	11,210	4,710	8,610	15.7%
	Condensing Boiler	92%	1.3%	1.7%	470	510	646	7,215	3,273	6.9%	763	11,795	5,176	9.5%
	Partly Insulated Distribution System	50%	3.8%			1,552	0	0	0	0.0%	0	0	0	0.0%
	Fully Insulated Distribution System	92%	0.2%			82	0	387	155	0.3%	0	448	179	0.3%
	Total Comfort Heat		**100.0%**	**100.0%**	**28,043**	**40,831**	**48,113**	**46,845**	**47,606**	**100.0%**	**55,694**	**53,395**	**54,774**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	64,577	94,966	69,942	0	8,007	1.8%	35,106	0	33,797	6.5%
	Near Condensing Boiler	80%	7.5%	8.9%	25,046	31,308	40,713	24,219	94,120	20.8%	49,116	20,636	51,113	9.8%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	0.8%	0.9%	2,442	3,131	3,850	2,422	2,772	0.6%	4,464	2,064	3,214	0.6%
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	106,446	125,231	189,422	262,110	189,422	41.8%	254,568	311,490	254,568	49.0%
	Partly Insulated Distribution System	50%	3.8%			15,863	17,460	0	3,317	0.7%	18,116	0	3,442	0.7%
	Fully Insulated Distribution System	92%	0.2%			835	1,335	3,953	3,456	0.8%	2,012	4,583	4,094	0.8%
	Heat Loss from Not Using Pinch Technology		10.0%			41,744	43,336	0	26,002	5.7%	40,236	0	24,141	4.6%
	Steam Paper Drying	80%	23.0%	27.2%	76,808	96,010	116,414	62,701	94,929	20.9%	133,403	48,337	99,377	19.1%
	Direct Fired Paper Drying	87%	2.0%	2.6%	7,288	8,349	11,795	61,017	31,483	6.9%	15,096	93,049	46,277	8.9%
	Total Process Heat		**100.0%**	**100.0%**	**282,608**	**417,435**	**494,269**	**416,422**	**453,509**	**100.0%**	**552,117**	**480,159**	**520,023**	**100.0%**
Total					**310,650**	**458,266**	**542,382**	**463,267**	**501,115**		**607,810**	**533,554**	**574,798**	

Exhibit F6: Upper Achievable Potential, Wood Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	72,768	103,954	127,850	127,850	127,850	51.5%	137,731	137,731	137,731	52.0%
	Standard Efficiency Boiler	68%	27.3%	27.0%	38,525	56,655	66,536	43,828	57,453	23.2%	69,144	34,703	55,368	20.9%
	Near Condensing Boilers	80%	17.5%	20.4%	29,107	36,384	47,314	28,146	39,647	16.0%	53,043	22,286	40,740	15.4%
	Condensing Boiler	92%	1.3%	1.7%	2,391	2,599	3,287	36,739	16,668	6.7%	3,612	55,814	24,493	9.3%
	Partly Insulated Distribution System	50%	3.8%			7,901	8,696	0	5,218	2.1%	8,385	0	5,031	1.9%
	Fully Insulated Distribution System	92%	0.2%			416	665	1,969	1,186	0.5%	931	2,121	1,407	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**142,791**	**207,908**	**254,349**	**238,532**	**248,022**	**100.0%**	**272,846**	**252,655**	**264,770**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	15.5%	16.7%	56,024	82,388	91,543	0	29,007	4.8%	89,767	0	22,032	3.4%
	Near Condensing Boiler	80%	2.3%	2.9%	9,764	12,206	15,872	9,442	39,932	6.6%	17,794	8,045	23,786	3.7%
	Condensing Boiler	92%	0.6%	0.8%	2,807	3,051	3,859	93,780	29,159	4.8%	4,241	108,352	49,096	7.6%
	Bundled Standard Boiler Upgrades	85%	4.6%	6.2%	20,749	24,411	36,924	18,884	36,924	6.1%	46,113	16,091	46,113	7.2%
	Standard Efficiency Kiln	57%	67.5%	61.0%	204,178	358,207	430,819	166,087	351,399	57.9%	455,492	99,302	355,759	55.4%
	Advanced Kiln Control	60%	2.0%	1.9%	6,368	10,614	17,177	4,921	13,500	2.2%	22,514	2,942	17,034	2.7%
	High Efficiency Kiln	87%	7.5%	10.4%	34,627	39,801	52,481	234,378	107,050	17.6%	59,421	306,284	128,543	20.0%
	Total Process Heat		**100.0%**	**100.0%**	**334,518**	**530,677**	**648,675**	**527,493**	**606,973**	**100.0%**	**695,343**	**541,017**	**642,363**	**100.0%**
Total					**477,309**	**738,585**	**903,024**	**136,999**	**854,995**		**968,189**	**793,673**	**907,133**	

Exhibit F7: Upper Achievable Potential, Other Sub Sector, Lower Mainland Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	169,054	241,506	297,021	297,021	297,021	81.7%	344,329	344,329	344,329	82.0%
	Standard Efficiency Boiler	68%	9.6%	9.7%	19,809	29,132	34,264	22,536	29,573	8.1%	38,364	19,202	30,699	7.3%
	Near Condensing Boilers	80%	6.1%	7.2%	14,732	18,415	23,947	14,246	20,066	5.5%	28,890	12,138	22,189	5.3%
	Condensing Boiler	92%	0.3%	0.3%	694	755	954	18,059	7,796	2.1%	1,129	29,858	12,621	3.0%
	Partly Insulated Distribution System	50%	3.8%			11,472	12,627	0	7,576	2.1%	13,101	0	7,861	1.9%
	Fully Insulated Distribution System	92%	0.2%			604	965	2,859	1,723	0.5%	1,455	3,314	2,199	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**204,290**	**301,882**	**369,780**	**354,721**	**363,756**	**100.0%**	**427,268**	**408,842**	**419,897**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	173,681	255,413	292,194	0	99,618	10.7%	317,758	0	110,307	10.4%
	Near Condensing Boiler	80%	7.0%	8.4%	46,896	58,619	76,230	45,347	150,322	16.1%	91,963	38,639	61,965	5.9%
	Condensing Boiler	92%	2.0%	2.8%	15,409	16,748	21,182	295,453	99,093	10.6%	25,051	364,738	204,470	19.4%
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	39,149	46,058	69,667	35,630	69,667	7.5%	93,627	30,359	93,627	8.9%
	Partly Insulated Distribution System	50%	3.8%			31,822	35,028	0	6,655	0.7%	36,343	0	6,905	0.7%
	Fully Insulated Distribution System	92%	0.2%			1,675	2,678	7,930	6,932	0.7%	4,036	9,193	8,213	0.8%
	Tank-type Water Heating	65%	10.0%	9.8%	54,432	83,742	100,754	9,269	64,160	6.9%	114,715	3,761	70,334	6.7%
	Direct Fired Water Heating	95%	1.0%	1.4%	7,955	8,374	11,831	74,425	36,868	4.0%	15,142	91,058	45,509	4.3%
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	163,297	251,226	288,953	164,787	239,287	25.7%	314,028	127,356	239,359	22.7%
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	33,497	41,871	67,765	168,650	108,119	11.6%	95,578	247,249	156,247	14.8%
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	20,936	41,871	51,496	51,496	51,496	5.5%	59,698	59,698	59,698	5.6%
	Total Process Heat		**100.0%**	**100.0%**	**555,251**	**837,420**	**1,017,777**	**852,989**	**932,218**	**100.0%**	**1,167,939**	**972,053**	**1,056,633**	**100.0%**
Total					**759,541**	**1,139,302**	**1,387,557**	**1,207,710**	**1,295,974**		**1,595,207**	**1,380,895**	**1,476,531**	

Exhibit F8: Upper Achievable Potential Forecast, Food Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	96.2%	29,330	41,900	51,531	51,531	51,531	96.1%	59,739	59,739	59,739	96.2%
	Standard Efficiency Boiler	68%	25.4%	3.6%	1,087	1,598	1,960	1,236	1,670	3.1%	2,267	1,053	1,782	2.9%
	Near Condensing Boilers	80%	3.1%	0.2%	48	60	78	46	65	0.1%	94	39	72	0.1%
	Condensing Boiler	92%	0.4%	0.0%	14	15	19	581	244	0.5%	22	967	400	0.6%
	Partly Insulated Distribution System	50%	1.7%			114	125	0	75	0.1%	129	0	78	0.1%
	Fully Insulated Distribution System	92%	0.1%			6	10	28	17	0.0%	13	33	21	0.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**30,478**	**43,692**	**53,722**	**53,423**	**53,603**	**100.0%**	**62,265**	**61,831**	**62,091**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	44.0%	50.7%	209,051	307,428	338,338	0	236	0.0%	351,782	0	914	0.1%
	Near Condensing Boiler	80%	8.7%	10.8%	44,434	55,543	72,229	42,967	154,604	25.1%	87,137	0	87,137	12.4%
	Condensing Boiler	92%	13.4%	13.7%	56,458	61,368	77,613	260,135	224,782	36.4%	91,789	309,603	257,488	36.5%
	Bundled Standard Boiler Upgrades	85%	17.0%	17.2%	70,807	83,302	126,002	145,699	132,423	21.5%	169,336	168,905	169,336	24.0%
	Partly Insulated Distribution System	50%	3.8%			22,563	24,836	0	7,948	1.3%	25,711	0	8,228	1.2%
	Fully Insulated Distribution System	92%	0.2%			1,188	1,899	5,623	4,431	0.7%	2,641	6,519	5,278	0.7%
	Direct Fired Heating	90%	1.9%	1.7%	6,899	7,665	11,553	88,050	37,282	6.0%	17,094	105,611	112,813	16.0%
	Radiant Tube Heating	70%	0.0%	0.0%	63	90	114	69	114	0.0%	139	59	139	0.0%
	Standard Efficiency Oven	65%	4.3%	1.8%	7,410	11,399	12,775	5,285	9,779	1.6%	13,716	3,401	9,590	1.4%
	Efficient Oven	80%	3.7%	2.2%	9,120	11,399	15,031	21,116	17,465	2.8%	18,314	26,695	21,667	3.1%
	Tank-type Water Heating	65%	2.0%	0.9%	3,705	5,700	6,714	631	4,281	0.7%	7,524	256	4,617	0.7%
	Direct Fired Water Heating	95%	0.7%	1.1%	4,381	4,611	5,873	10,036	7,538	1.2%	6,987	11,959	8,976	1.3%
	Heat Loss from Not Using Pinch Technology		0.2%			21,517	26,463	0	15,878	2.6%	30,678	0	18,407	2.6%
	Total Process Heat		**100.0%**	**100.0%**	**412,326**	**593,773**	**719,441**	**579,613**	**616,762**	**100.0%**	**822,848**	**633,008**	**704,588**	**100.0%**
Total					**442,804**	**637,465**	**773,164**	**633,037**	**670,365**		**885,112**	**694,840**	**766,679**	

Exhibit F9: Upper Achievable Potential Forecast, Chemical Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	1,589	2,270	2,792	2,792	2,792	100.0%	3,236	3,236	3,236	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**1,589**	**2,270**	**2,792**	**2,792**	**2,792**	**100.0%**	**3,236**	**3,236**	**3,236**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	60.8%	66.1%	92,914	136,639	153,873	0	15,210	6.6%	164,600	0	17,105	6.6%
	Near Condensing Boiler	80%	10.0%	12.8%	17,979	22,474	29,225	17,385	118,661	51.3%	35,257	14,813	43,116	16.6%
	Bundled Standard Boiler Upgrades	85%	15.5%	21.1%	29,609	34,834	52,689	186,931	79,445	34.3%	70,810	221,731	181,410	70.0%
	Partly Insulated Distribution System	50%	3.8%			8,540	9,400	0	3,008	1.3%	9,753	0	3,121	1.2%
	Fully Insulated Distribution System	92%	0.2%			449	719	2,128	1,677	0.7%	1,083	2,467	2,024	0.8%
	Heat Loss from Not Using Pinch Technology		9.7%			21,799	22,377	0	13,426	5.8%	20,745	0	12,447	4.8%
	Total Process Heat		**100.0%**	**100.0%**	**140,502**	**224,735**	**268,284**	**206,445**	**231,428**	**100.0%**	**302,248**	**239,012**	**259,223**	**100.0%**
Total					**142,091**	**227,005**	**271,076**	**209,237**	**234,219**		**305,485**	**242,248**	**262,459**	

Exhibit F10: Upper Achievable Potential Forecast, Fabricated Metal Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	14,525	20,750	25,520	25,520	25,520	100.0%	29,585	29,585	29,585	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**14,525**	**20,750**	**25,520**	**25,520**	**25,520**	**100.0%**	**29,585**	**29,585**	**29,585**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	0.0%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Standard Efficiency Furnace	25%	66.0%	57.9%	4,057	16,229	17,801	7,525	13,690	49.2%	18,624	4,841	13,111	42.1%
	Furnace with Sequential Firing, High Velocity Burners	40%	30.0%	42.1%	2,951	7,377	10,421	16,844	12,990	46.7%	13,339	21,953	16,784	53.8%
	Standard Furnace Insulation	25%	3.1%			762	816	0	489	1.8%	823	0	494	1.6%
	Ceramic Fibre Furnace Insulation	40%	0.9%			221	354	1,069	640	2.3%	488	1,239	789	2.5%
	Total Process Heat		**100.0%**	**100.0%**	**7,008**	**24,589**	**29,392**	**25,438**	**27,810**	**100.0%**	**33,274**	**28,034**	**31,178**	**100.0%**
Total					**21,533**	**45,339**	**54,912**	**50,958**	**53,330**		**62,858**	**57,618**	**60,762**	

Exhibit F11: Upper Achievable Potential Forecast, Non-Metallic Minerals Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year) Market Share as Percent of Heat Sold (%)	2003/04 (Base Year) Market Share as Percent Useful Heat (%)	2003/04 (Base Year) Useful Heat (GJ/year)	2003/04 (Base Year) Annual Heat Sold (GJ/year)	2010/2011 Reference Case Heat Sold (GJ/yr)	2010/2011 Economic Potential Heat Sold (GJ/yr)	2010/2011 Upper Achievable Heat Sold (GJ/yr)	2010/2011 Upper Achievable Market Share as a Percent of Heat Sold (%)	2015/16 Reference Case Heat Sold (GJ/yr)	2015/16 Economic Potential Heat Sold (GJ/yr)	2015/16 Upper Achievable Heat Sold (GJ/yr)	2015/16 Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	64,607	92,295	113,511	113,511	113,511	100.0%	131,591	131,591	131,591	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**64,607**	**92,295**	**113,511**	**113,511**	**113,511**	**100.0%**	**131,591**	**131,591**	**131,591**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.2%	44,221	65,031	75,462	0	20,493	19.0%	83,133	0	1,036	0.9%
	Near Condensing Boiler	80%	10.0%	11.5%	8,066	10,082	13,111	7,800	34,275	31.8%	15,817	6,646	15,817	13.6%
	Condensing Boiler	92%	2.5%	3.3%	2,319	2,521	3,188	62,216	25,252	23.4%	3,770	72,125	64,263	55.4%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	2.0%	2.2%	1,573	2,016	2,480	1,560	2,480	2.3%	2,875	1,329	2,875	2.5%
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	8,570	10,082	15,251	17,509	15,251	14.1%	20,495	22,959	20,495	17.7%
	Partly Insulated Distribution System	50%	3.8%			3,831	4,217	0	1,350	1.3%	4,366	0	1,397	1.2%
	Fully Insulated Distribution System	92%	0.2%			202	322	955	752	0.7%	449	1,107	896	0.8%
	Tank-type Water Heating	65%	5.0%	4.7%	3,277	5,041	6,200	558	3,943	3.7%	7,188	226	4,403	3.8%
	Direct Fired Water Heating	95%	2.0%	2.7%	1,916	2,016	2,480	6,340	4,024	3.7%	2,875	7,638	4,780	4.1%
	Total Process Heat		**100.0%**	**100.0%**	**69,942**	**100,824**	**122,711**	**96,938**	**107,820**	**100.0%**	**140,968**	**112,031**	**115,964**	**100.0%**
Total					**134,548**	**193,119**	**236,223**	**210,449**	**221,331**		**272,559**	**243,621**	**247,554**	

Exhibit F12: Upper Achievable Potential Forecast, Paper Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year) Market Share as Percent of Heat Sold (%)	2003/04 (Base Year) Market Share as Percent Useful Heat (%)	2003/04 (Base Year) Useful Heat (GJ/year)	2003/04 (Base Year) Annual Heat Sold (GJ/year)	2010/2011 Reference Case Heat Sold (GJ/yr)	2010/2011 Economic Potential Heat Sold (GJ/yr)	2010/2011 Upper Achievable Heat Sold (GJ/yr)	2010/2011 Upper Achievable Market Share as a Percent of Heat Sold (%)	2015/16 Reference Case Heat Sold (GJ/yr)	2015/16 Economic Potential Heat Sold (GJ/yr)	2015/16 Upper Achievable Heat Sold (GJ/yr)	2015/16 Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	4,674	6,678	8,212	8,212	8,212	51.5%	9,521	9,521	9,521	52.0%
	Standard Efficiency Boiler	68%	27.3%	27.0%	2,475	3,639	4,274	2,815	3,690	23.2%	4,780	2,399	3,827	20.9%
	Near Condensing Boilers	80%	17.5%	20.4%	1,870	2,337	3,039	1,808	2,547	16.0%	3,667	1,541	2,816	15.4%
	Condensing Boiler	92%	1.3%	1.7%	154	167	211	2,360	1,071	6.7%	250	3,858	1,693	9.3%
	Partly Insulated Distribution System	50%	3.8%			507	559	0	335	2.1%	578	0	347	1.9%
	Fully Insulated Distribution System	92%	0.2%			27	43	126	76	0.5%	59	147	94	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**9,172**	**13,355**	**16,338**	**15,322**	**15,932**	**100.0%**	**18,854**	**17,465**	**18,298**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	22.8%	22.9%	8,423	12,386	9,122	0	419	0.7%	4,579	0	4,527	6.7%
	Near Condensing Boiler	80%	7.5%	8.9%	3,267	4,083	5,310	3,159	10,017	17.0%	6,406	2,692	6,406	9.4%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	0.8%	0.9%	319	408	502	0	502	0.9%	582	0	582	0.9%
	Bundled Standard Boiler Upgrades	85%	30.0%	37.7%	13,883	16,334	24,706	34,186	27,203	46.1%	33,203	40,545	33,203	48.9%
	Partly Insulated Distribution System	50%	3.8%			2,069	2,277	0	729	1.2%	2,358	0	754	1.1%
	Fully Insulated Distribution System	92%	0.2%			109	174	516	406	0.7%	242	598	484	0.7%
	Heat Loss from Not Using Pinch Technology		10.0%			5,445	5,354	0	3,212	5.4%	4,923	0	2,954	4.3%
	Steam Paper Drying	80%	23.0%	27.2%	10,018	12,522	15,184	8,178	12,381	21.0%	17,399	6,304	12,961	19.1%
	Direct Fired Paper Drying	87%	2.0%	2.6%	951	1,089	1,538	7,958	4,106	7.0%	1,969	12,136	6,036	8.9%
	Total Process Heat		**100.0%**	**100.0%**	**36,860**	**54,445**	**64,168**	**53,997**	**58,976**	**100.0%**	**71,661**	**62,275**	**67,908**	**100.0%**
Total					**46,032**	**67,800**	**80,506**	**69,319**	**74,908**		**90,515**	**79,739**	**86,206**	

Exhibit F13: Upper Achievable Potential Forecast, Wood Sub Sector, Interior Service Area

			2003/04 (Base Year)				2010/2011				2015/16			
End Use	**Technology**	**Seasonal Efficiency (%)**	**Market Share as Percent of Heat Sold (%)**	**Market Share as Percent Useful Heat (%)**	**Useful Heat (GJ/year)**	**Annual Heat Sold (GJ/year)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Upper Achievable Heat Sold (GJ/yr)**	**Upper Achievable Market Share as a Percent of Heat Sold (%)**	**Reference Case Heat Sold (GJ/yr)**	**Economic Potential Heat Sold (GJ/yr)**	**Upper Achievable Heat Sold (GJ/yr)**	**Upper Achievable Market Share as a Percent of Heat Sold (%)**
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	20,838	29,769	36,612	36,612	36,612	51.5%	39,441	39,441	39,441	52.0%
	Standard Efficiency Boiler	68%	27.3%	27.0%	11,032	16,224	19,053	12,551	16,452	23.2%	19,800	9,938	15,855	20.9%
	Near Condensing Boilers	80%	17.5%	20.4%	8,335	10,419	13,549	8,060	11,353	16.0%	15,189	6,382	11,666	15.4%
	Condensing Boiler	92%	1.3%	1.7%	685	744	941	10,521	4,773	6.7%	1,034	15,983	7,014	9.3%
	Partly Insulated Distribution System	50%	3.8%			2,262	2,490	0	1,494	2.1%	2,396	0	1,437	1.9%
	Fully Insulated Distribution System	92%	0.2%			119	190	564	340	0.5%	246	607	391	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**40,890**	**59,537**	**72,836**	**68,307**	**71,024**	**100.0%**	**78,107**	**72,351**	**75,805**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	15.5%	1.0%	35,637	52,407	47,774	0	2,216	0.0%	36,272	0	4,247	0.1%
	Near Condensing Boiler	80%	2.3%	0.3%	8,847	11,058	14,380	8,555	37,916	0.6%	16,122	6,774	16,122	0.2%
	Condensing Boiler	92%	0.6%	0.1%	2,543	2,765	3,496	74,075	16,704	0.3%	3,843	90,949	27,514	0.4%
	Bundled Standard Boiler Upgrades	85%	4.6%	1.1%	37,598	44,233	66,907	34,218	66,907	1.1%	83,558	27,094	83,558	1.3%
	Standard Efficiency Kiln	57%	67.5%	62.5%	2,195,526	3,851,799	4,587,345	1,785,935	2,570,330	40.3%	4,805,657	1,067,797	2,301,291	34.7%
	Advanced Kiln Control	60%	2.0%	3.7%	130,260	217,100	351,362	100,661	170,858	2.7%	460,523	60,185	192,296	2.9%
	High Efficiency Kiln	87%	7.5%	11.2%	392,479	451,125	594,850	2,603,153	2,040,828	32.0%	673,510	3,398,549	2,499,286	37.6%
	Standard Efficiency Veneer Dryer	50%	0.0%	15.0%	526,877	1,053,754	1,072,031	488,586	756,971	11.9%	957,649	292,122	598,264	9.0%
	Advanced Veneer Dryer	70%	0.0%	5.2%	184,407	263,438	483,962	900,709	709,005	11.1%	662,246	1,137,622	918,949	13.8%
	Total Process Heat		**100.0%**	**100.0%**	**3,514,173**	**5,947,680**	**7,222,107**	**5,995,892**	**6,371,734**	**100.0%**	**7,699,380**	**6,081,091**	**6,641,527**	**100.0%**
Total					**3,555,063**	**6,007,217**	**7,294,943**	**6,064,198**	**6,442,758**		**7,777,487**	**6,153,442**	**6,717,331**	

Exhibit F14: Upper Achievable Potential Forecast, Other Sub Sector, Interior Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04 (Base Year)				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	45,498	64,998	79,939	79,939	79,939	81.7%	92,671	92,671	92,671	82.0%
	Standard Efficiency Boiler	68%	9.6%	9.7%	5,331	7,840	9,222	6,065	7,959	8.1%	10,325	5,168	8,262	7.3%
	Near Condensing Boilers	80%	6.1%	7.2%	3,965	4,956	6,445	3,834	5,401	5.5%	7,775	3,267	5,972	5.3%
	Condensing Boiler	92%	0.3%	0.3%	187	203	257	4,860	2,098	2.1%	304	8,036	3,397	3.0%
	Partly Insulated Distribution System	50%	3.8%			3,087	3,398	0	2,039	2.1%	3,518	0	2,111	1.9%
	Fully Insulated Distribution System	92%	0.2%			162	260	769	464	0.5%	361	892	574	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**54,981**	**81,247**	**99,521**	**95,468**	**97,900**	**100.0%**	**114,955**	**110,034**	**112,986**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	10,479	15,410	17,630	0	3,593	6.4%	19,172	0	1,380	2.2%
	Near Condensing Boiler	80%	7.0%	8.4%	2,829	3,537	4,599	2,736	10,025	17.9%	5,549	2,331	5,549	8.8%
	Condensing Boiler	92%	2.0%	2.8%	930	1,011	1,278	17,826	6,935	12.4%	1,511	22,007	14,662	23.3%
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	2,362	2,779	4,203	2,150	4,203	7.5%	5,649	1,832	5,649	9.0%
	Partly Insulated Distribution System	50%	3.8%			1,920	2,113	0	676	1.2%	2,188	0	700	1.1%
	Fully Insulated Distribution System	92%	0.2%			101	162	478	377	0.7%	225	555	449	0.7%
	Tank-type Water Heating	65%	10.0%	9.8%	3,284	5,053	6,079	559	3,871	6.9%	6,921	227	4,244	6.8%
	Direct Fired Water Heating	95%	1.0%	1.4%	480	505	714	4,490	2,224	4.0%	914	5,494	2,746	4.4%
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	9,853	15,158	17,434	9,942	14,437	25.8%	18,947	7,684	14,442	23.0%
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	2,021	2,526	4,089	10,176	6,523	11.7%	5,767	14,918	9,427	15.0%
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	1,263	2,526	3,107	3,107	3,107	5.6%	3,602	3,602	3,602	5.7%
	Total Process Heat		**100.0%**	**100.0%**	**33,501**	**50,526**	**61,408**	**51,465**	**55,973**	**100.0%**	**70,444**	**58,649**	**62,849**	**100.0%**
Total					**88,483**	**131,773**	**160,929**	**146,933**	**153,873**		**185,399**	**168,683**	**175,835**	

Exhibit F15: Upper Achievable Potential Forecast, Food Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	69.3%	100.0%	4,798	6,854	8,430	8,430	8,430	100.0%	9,772	9,772	9,772	100.0%
	Standard Efficiency Boiler	68%	25.4%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Near Condensing Boilers	80%	3.1%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Condensing Boiler	92%	0.4%	0.0%	0	0	0	0	0	0.0%	0	0	0	0.0%
	Partly Insulated Distribution System	50%	1.7%			0	0	0	0	0.0%	0	0	0	0.0%
	Fully Insulated Distribution System	92%	0.1%			0	0	0	0	0.0%	0	0	0	0.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**4,798**	**6,854**	**8,430**	**8,430**	**8,430**	**100.0%**	**9,772**	**9,772**	**9,772**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	44.0%	54.1%	34,203	50,299	59,785	0	32,114	31.0%	67,308	0	38,425	32.3%
	Near Condensing Boiler	80%	8.7%	5.9%	3,726	4,657	6,056	3,603	16,984	16.4%	7,306	2,627	15,040	12.6%
	Condensing Boiler	92%	13.4%	1.4%	857	931	1,178	41,876	12,128	11.7%	1,393	48,545	16,017	13.5%
	Bundled Standard Boiler Upgrades	85%	17.0%	6.3%	3,959	4,657	7,045	13,132	7,045	6.8%	9,467	16,683	9,467	8.0%
	Partly Insulated Distribution System	50%	3.8%			3,540	3,896	0	1,247	1.2%	4,042	0	1,294	1.1%
	Fully Insulated Distribution System	92%	0.2%			186	298	882	695	0.7%	449	1,023	839	0.7%
	Direct Fired Heating	90%	1.9%	0.0%	0	0	0	0	0	0.0%	0	0		0.0%
	Standard Efficiency Oven	65%	4.3%	14.4%	9,082	13,972	12,729	6,478	10,229	9.9%	10,097	4,168	7,725	6.5%
	Efficient Oven	80%	3.7%	11.8%	7,452	9,315	15,075	20,154	17,107	16.5%	21,262	26,079	23,189	19.5%
	Tank-type Water Heating	65%	2.0%	4.8%	3,027	4,657	5,479	516	3,494	3.4%	6,120	209	3,755	3.2%
	Direct Fired Water Heating	95%	0.7%	1.4%	885	931	1,316	4,712	2,674	2.6%	1,684	5,728	3,302	2.8%
	Heat Loss from Not Using Pinch Technology		0.2%			0	0	0	0	0.0%	0	0	0	0.0%
	Total Process Heat		**100.0%**	**100.0%**	**63,190**	**93,146**	**112,857**	**91,353**	**103,716**	**100.0%**	**129,129**	**105,063**	**119,053**	**100.0%**
Total					**67,988**	**100,000**	**121,287**	**99,782**	**112,146**		**138,901**	**114,835**	**128,826**	

Exhibit F16: Upper Achievable Potential Forecast, Non-Metallic Minerals Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	100.0%	100.0%	16,727	23,896	29,389	29,389	29,389	100.0%	34,070	34,070	34,070	100.0%
	Total Comfort Heat		**100.0%**	**100.0%**	**16,727**	**23,896**	**29,389**	**29,389**	**29,389**	**100.0%**	**34,070**	**34,070**	**34,070**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	64.5%	63.2%	11,449	16,837	19,538	0	10,877	37.5%	21,524	0	5,632	17.4%
	Near Condensing Boiler	80%	10.0%	11.5%	2,088	2,610	3,395	2,019	6,253	21.6%	4,095	1,721	12,022	37.1%
	Condensing Boiler	92%	2.5%	3.3%	600	653	825	16,108	4,700	16.2%	976	18,674	5,781	17.8%
	Combustion Air Preheat from Exhaust on Standard Efficiency Boiler	78%	2.0%	2.2%	407	522	642	404	642	2.2%	744	0	744	2.3%
	Bundled Standard Boiler Upgrades	85%	10.0%	12.3%	2,219	2,610	3,948	4,533	3,948	13.6%	5,306	5,944	5,306	16.4%
	Partly Insulated Distribution System	50%	3.8%			992	1,092	0	349	1.2%	1,133	0	363	1.1%
	Fully Insulated Distribution System	92%	0.2%			52	83	247	195	0.7%	126	287	235	0.7%
	Tank-type Water Heating	65%	5.0%	4.7%	848	1,305	1,466	144	937	3.2%	1,569	59	965	3.0%
	Direct Fired Water Heating	95%	2.0%	2.7%	496	522	738	1,642	1,099	3.8%	944	1,978	1,357	4.2%
	Total Process Heat		**100.0%**	**100.0%**	**18,108**	**26,104**	**31,727**	**25,098**	**29,000**	**100.0%**	**36,418**	**28,661**	**32,406**	**100.0%**
Total					**34,836**	**50,000**	**61,116**	**54,487**	**58,389**		**70,488**	**62,731**	**66,476**	

Exhibit F17: Upper Achievable Potential Forecast, Wood Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/2004				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	50.0%	51.0%	1,214	1,735	2,133	2,133	2,133	51.6%	2,298	2,298	2,298	52.0%
	Standard Efficiency Boiler	68%	27.3%	26.9%	642	944	1,108	730	957	23.1%	1,151	578	922	20.9%
	Near Condensing Boilers	80%	17.5%	20.4%	486	607	789	470	662	16.0%	885	372	680	15.4%
	Condensing Boiler	92%	1.3%	1.7%	40	43	55	612	278	6.7%	60	930	408	9.2%
	Partly Insulated Distribution System	50%	3.8%			134	147	0	88	2.1%	142	0	85	1.9%
	Fully Insulated Distribution System	92%	0.2%			7	11	33	20	0.5%	16	36	24	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**2,381**	**3,469**	**4,244**	**3,978**	**4,138**	**100.0%**	**4,552**	**4,214**	**4,417**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	15.5%	1.0%	2,081	3,060	2,846	0	-788	-0.2%	2,823	0	-637	-0.2%
	Near Condensing Boiler	80%	2.3%	0.3%	515	644	838	498	2,183	0.5%	997	395	2,737	0.7%
	Condensing Boiler	92%	0.6%	0.1%	148	161	204	4,258	1,720	0.4%	225	5,206	1,270	0.3%
	Bundled Standard Boiler Upgrades	85%	4.6%	1.0%	2,062	2,426	3,669	1,877	3,669	0.9%	4,052	1,486	4,052	1.0%
	Standard Efficiency Kiln	57%	67.5%	62.5%	127,926	224,431	267,282	104,060	218,315	54.9%	282,676	62,217	220,948	52.7%
	Advanced Kiln Control	60%	2.0%	3.7%	7,589	12,649	20,471	5,865	16,089	4.0%	26,832	3,507	20,301	4.8%
	High Efficiency Kiln	87%	7.5%	11.2%	22,913	26,336	34,727	151,739	69,830	17.6%	37,563	198,088	82,510	19.7%
	Standard Efficiency Veneer Dryer	50%	0.0%	15.0%	30,737	61,475	62,558	28,503	47,233	11.9%	55,814	17,042	34,877	8.3%
	Advanced Veneer Dryer	70%	0.0%	5.2%	10,744	15,349	28,197	52,522	39,143	9.8%	38,585	66,341	53,573	12.8%
	Total Process Heat		**100.0%**	**100.0%**	**204,716**	**346,531**	**420,791**	**349,322**	**397,396**	**100.0%**	**449,566**	**354,281**	**419,630**	**100.0%**
Total					**207,097**	**350,000**	**425,035**	**353,301**	**401,533**		**454,118**	**358,495**	**424,046**	

Exhibit E18: Most Likely Achievable Potential Forecast, Other Sub Sector, Vancouver Island Service Area

End Use	Technology	Seasonal Efficiency (%)	2003/04				2010/2011				2015/16			
			Market Share as Percent of Heat Sold (%)	Market Share as Percent Useful Heat (%)	Useful Heat (GJ/year)	Annual Heat Sold (GJ/year)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)	Reference Case Heat Sold (GJ/yr)	Economic Potential Heat Sold (GJ/yr)	Upper Achievable Heat Sold (GJ/yr)	Upper Achievable Market Share as a Percent of Heat Sold (%)
Comfort Heat	Air Handling Units and Unit Heaters	70%	80.0%	82.8%	17,264	24,662	30,332	30,332	30,332	81.7%	35,163	35,163	35,163	82.0%
	Standard Efficiency Boiler	68%	9.6%	9.7%	2,023	2,975	3,499	2,301	3,020	8.1%	3,918	1,961	3,135	7.3%
	Near Condensing Boilers	80%	6.1%	7.2%	1,504	1,881	2,445	1,455	2,049	5.5%	2,950	1,240	2,266	5.3%
	Condensing Boiler	92%	0.3%	0.3%	71	77	97	1,844	796	2.1%	115	3,049	1,289	3.0%
	Partly Insulated Distribution System	50%	3.8%			1,171	1,289	0	774	2.1%	1,338	0	803	1.9%
	Fully Insulated Distribution System	92%	0.2%			62	99	292	176	0.5%	149	338	225	0.5%
	Total Comfort Heat		**100.0%**	**100.0%**	**20,862**	**30,828**	**37,762**	**36,224**	**37,147**	**100.0%**	**43,632**	**41,751**	**42,880**	**100.0%**
Process Heat	Standard Efficiency Boiler	68%	30.5%	31.3%	3,976	5,847	6,690	0	4,028	18.4%	7,275	0	4,435	17.7%
	Near Condensing Boiler	80%	7.0%	8.4%	1,074	1,342	1,745	1,038	3,426	15.7%	2,105	885	4,039	16.1%
	Condensing Boiler	92%	2.0%	2.8%	353	383	485	6,764	990	4.5%	574	8,350	991	3.9%
	Bundled Standard Boiler Upgrades	85%	5.5%	7.1%	896	1,054	1,595	816	1,595	7.3%	2,144	695	2,144	8.5%
	Partly Insulated Distribution System	50%	3.8%			729	802	0	257	1.2%	832	0	266	1.1%
	Fully Insulated Distribution System	92%	0.2%			38	61	182	143	0.7%	92	210	173	0.7%
	Tank-type Water Heating	65%	10.0%	9.8%	1,246	1,917	2,307	212	1,469	6.7%	2,626	86	1,610	6.4%
	Direct Fired Water Heating	95%	1.0%	1.4%	182	192	271	1,704	844	3.9%	347	2,085	1,042	4.1%
	Miscellaneous Standard Equipment	65%	30.0%	29.4%	3,739	5,752	6,615	3,773	5,478	25.0%	7,189	2,916	5,480	21.8%
	Miscellaneous Efficient Equipment	80%	5.0%	6.0%	767	959	1,551	3,861	2,475	11.3%	2,188	5,661	3,577	14.2%
	Direct Fired Gas Laundry Dryers	50%	5.0%	3.8%	479	959	1,179	1,179	1,179	5.4%	1,367	1,367	1,367	5.4%
	Total Process Heat		**100.0%**	**100.0%**	**12,712**	**19,172**	**23,301**	**19,528**	**21,885**	**100.0%**	**26,739**	**22,254**	**25,123**	**100.0%**
Total					**33,574**	**50,000**	**61,063**	**55,752**	**59,031**		**70,371**	**64,005**	**68,003**	

APPENDIX G: ACHIEVABLE POTENTIAL WORKSHOP BACKGROUND MATERIALS AND RESULTS

1. INTRODUCTION

This document provides a set of Actions for the manufacturing sector. The specific Actions build directly from the Economic Potential savings, as contained in Section 5 of the Manufacturing Sector Report.

The Action Profiles provide a framework for the workshop discussions to be held on November 2. They are intended to provide a logic framework that defines an overall rationale and direction without getting into the much greater detail required of program design (which is beyond the scope of this project).

1.1 WORKSHOP GOAL AND OUTCOME

Workshop participants are all involved in some aspect of the technologies and/or markets affecting energy efficiency opportunities affecting British Columbia's manufacturing sector. The goal of this workshop is to make maximum advantage of the participant's experience and knowledge by promoting active discussion of each Action Profile related, in particular, to the following factors:

- Review of expected energy savings per participant.
- Best estimate of "Most likely" and "Upper" customer participation rates.
- As applicable, expected levels of incentives or other conditions necessary to achieve the customer participation rates.

It is hoped that the outcome of this workshop will be general agreement on the above factors, which will enable the Terasen Gas Conservation Potential Review to complete the development of a "high level" estimate of achievable potential for the manufacturing sector.

1.2 CONTENTS

This document contains the following background information:

Exhibit G1: Summary of Action Profiles
Exhibit G2: Generalized Barriers – for reference and/or refinement when reviewing the Action Profiles
Exhibit G3: Generalized Interventions - for reference and/or refinement when reviewing the Action Profiles
Exhibits G4 to G12: Energy Efficiency Action Profiles and Assessment Worksheets.

Exhibit G1
Summary of Energy Efficiency Action Profiles

Action Profile #	Title	Approximate % of Economic Savings Potential
M1	Efficient Lumber Dry Kiln	40
M2	Efficient Veneer Dryer	5
M3	Efficient Process Heat Boilers	33
M4	Fully Insulated Process Heat Distribution Systems	9

Exhibit G2
Generalized Barriers

Customer Energy Efficiency Awareness	Awareness that energy efficiency opportunities & products exist. Awareness of benefits – cost and co-benefit. Customers' technical ability to assess the options.
Product and Service Availability	Local or national product availability. Existence of a viable infrastructure of trade allies. Vendor or trade ally awareness of the efficiency options and their understanding of the technical issues.
Financing	Access to appropriate financing. Size of required energy efficiency investment vs asset base. Payback Ratio – Actual vs Required.
Transaction Costs	Level of effort/hassle required to become informed, select products, choose contractor(s) and install.
Perceived Risk/Reward	Level of perceived risk that the energy efficient product may not perform as promised. Level of positive external/personal recognition for "doing the right thing" by installing the EE measure(s).
Split Incentive/Motivation	Level to which the incentives of the agent charged with purchasing the energy efficient product are aligned with those of the person(s) that would benefit.
Regulatory	Codes or standards that prohibit implementation of innovative energy efficient technologies. Level of energy efficient performance that is required in codes or standards.

(Source: BC Hydro Conservation Potential Review 2002)

Exhibit G3
Generalized Interventions

Ref	Name	Sample Descriptions
A	Information & Promotion	Passive provision of information to market participants regarding energy efficiency opportunities and benefits. Product or building energy efficiency labelling. Employee energy efficiency awareness programs.
B	Technical services to customers	Energy audits (walk-through, pre-feasibility, investment grade). Web based self analysis. Metering. Design assistance. Energy performance benchmarking. Commissioning and recommissioning. Direct management of third party utilities. Third party verification. Post installation technical support regarding energy efficiency equipment.
C	Specialized customer support	Provide solutions to sub sector specific energy efficiency constraints e.g., Assist property managers/owners to establish language in lease agreements enabling cost recovery of EE capital investments. Provide market recognition for customer energy efficiency achievements.
D	Vendor and Customer Links	Providing customer contacts to contractors. Providing contractor contacts to customers. Contractor certification. Providing sales, marketing and/or technical training about products or services to individuals responsible for selling it. Vertical integration of market between upstream and downstream market actors (i.e., forming a relationship between contractors and suppliers).
E	Trade Ally Training	Providing training to trade-allies so that they better understand new or existing practices or procedures Operations and maintenance training. Recommissioning and commissioning training.
F	Financial incentives	Product rebates to customer. Product rebates to vendor. Performance incentives ($/GJ/year). Below market interest rate loans with repayment through energy bills. Revolving fund for feasibility studies. Direct audit incentives. Subsidize industrial process improvements.
G	Rates	Time of use rates. Curtailable and interruptible energy rates. Emission credits- perhaps considering GHG credit purchase for customer demand side management.
H	Energy Efficiency Procurement	Utility bulk purchases target product to bring price down and establish agreement with trade allies to sell the product. Development of energy efficiency procurement guidelines for Municipal, Manufacturing, Residential sectors
I	Standards and Regulations	Product energy test standards and energy performance rating. Standardized protocols for installation and operation of energy equipment. Regulations prescribing minimum energy efficiency performance levels.
J	Emerging technology accelerated market adoption	Providing demonstration of the use/performance of energy efficient technologies to market actors. Bulk purchase. Take equity position in companies developing technologies.

Exhibit G4: Action Profile M1-Efficient Lumber Dry Kiln

Action Profile M1 - Efficient Lumber Dry Kiln

Overview:

This Action will encourage the purchase of high efficiency lumber dry kilns and major efficiency retrofits of existing kilns. The majority of the lumber dry kilns in British Columbia use natural gas. During the period from 1985 to 2000, natural gas in real terms became relatively inexpensive compared to other alternatives. As a result of the low price for natural gas and the industry's interest in high volume production, the efficiency of gas fired kilns in some cases deteriorated and in general efficiency improvements available due to technology improvements did not occur. With the recent increases in natural gas prices the industry has become very aware of the cost of natural gas and is very seriously considering fuel alternatives. It is important for the industry to realize the opportunities of improved efficiency before they make large capital expenditures in going to other fuel alternatives.

The broad strategy envisioned for this Action consists of:

- Strong up-front promotional efforts directed towards customers, vendors and trade allies emphasizing the cost savings through efficiency upgrades and new efficient kiln purchases.
- Two initial items would be workshops, jointly sponsored by Terasen, BC Hydro and NR Can.
- Incentives to install metering on a kiln by kiln basis so efficiency upgrades could be tracked.
- Consulting assistance to enable customers to objectively evaluate the cost of natural gas and the advantages of efficiency improvements.
- Financial incentives for customers who decide to continue to use natural gas as a fuel and to improve their equipment efficiency.

Target Technologies and Sub Segments:

Major energy efficiency retrofits including:

- Advanced controls with moisture metering, multiple zone control, steam management etc..
- Kiln shell improvement upgrades – insulation, air tightness.
- Air circulation improvement upgrades – floor and ceiling baffles.
- Ventilation heat recovery.
- Installation of VSD fans in alliance with BC Hydro Power Smart program.
- Purchase of new, efficient dry kilns.

Target Stakeholder Group:

Wood products manufacturers including:

- Sawmill and Planermills in the Interior Region.
- Initially executives of large firms including West Fraser, Canfor, Tolko, Tembec, and Brascan.
- Mill managers and drying specialists at each of the mills.
- Two major kiln suppliers COE and Wellons.
- Upgrade vendors, control specialist, consultants specializing in kiln upgrades.

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- Competition from wood waste systems – companies are on the verge of making major decisions to select alternative systems.
- In the mills, lumber drying is considered an art form and each drying specialist has his or her own way of operating the kilns; consequently, it is difficult to get them to change.
- Good data on equipment efficiency levels is not available on a kiln by kiln basis; consequently, it is very difficult to show the differences in efficiency levels from kiln to kiln.
- Inertia of implementing changes.

This Action will address these barriers by combining the following interventions:

- Information and promotion through workshops and visits to major companies to make sure that efficiency improvement with existing natural gas systems is an alternative that should be considered compared to wood waste system alternatives.
- Assistance with metering so that customers can accurately determine the effect of efficiency.
- Financing for customers who remain on natural gas and improve efficiency.

Time Frame:

Program initiated 2006 and run through to 2010. Initial workshops should be scheduled in Prince George and Kamloops for winter 2006.

Exhibit G5: Action Assessment Worksheet M1-Efficient Lumber Dry Kiln

Energy Efficiency Measure	**M1- Efficient Lumber Dry Kiln**					
Participant Definition	**New or Major Retrofit of an Efficient Lumber Dry Kiln at Sawmills and Planer Mills in the Wood Sub Sector**					
Service Area	**Interior**			**Lower Mainland and Vancouver Island**		
Major Technology and % of Economic Potential	Technology		% of Potential	Technology		% of Potential
	Efficient Lumber Dry Kilns		100%	Efficient Lumber Dry Kilns		100%
Approximate % of Action Savings by Service Area	87%			13%		
Economic Potential Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
	1,043,807	369,193	1,413,000	156,000	56,000	212,000
Approximate Total Number of Participants	47	16	63	7	3	10
Number of Participants Eliminated by Constraints	5	2	6	2	1	3
Economic Potential Available for DSM	939,426	332,274	1,271,700	117,000	42,000	159,000
Approximate Economic Potential Savings per Participant per Year (GJ/year)	22,000			22,000		
Approximate Benefit Cost Ratio (Marginal Supply Cost of Gas ~ $6/GJ)	1.4			1.2		
Approximate Customer Payback (Customer Cost of Gas ~ $9/GJ)	4 years			4 years		
Participation Rate (% of Available Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	60%	50%	-	30%	25%	-
Upper	80%	60%	-	40%	30%	-
Action Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	563,656	166,137	729,793	35,100	10,500	45,600
Upper	751,541	199,364	950,905	46,800	12,600	59,400
Participation Rate (% of Total Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	54%	45%	52%	23%	19%	22%
Upper	72%	54%	67%	30%	23%	28%

Total Savings (GJ/year)	Period One to 2010/11	Period Two to 2015/16	Total by 2015/2016
Economic Potential	1,199,807	425,193	1,625,000
Most Likely	598,756	176,637	775,393
Upper	798,341	211,964	1,010,305

Exhibit G6: Action Profile M2-Efficient Veneer Dryer

Action Profile M2- Efficient Veneer Dryer

Overview:

This Action will encourage the purchase of high efficiency veneer dryers and the upgrade of existing dryers for the plywood and engineered wood industries. A number of observations and reviews of existing veneer dryer operations have indicated that there are significant efficiency improvement opportunities with many veneer dryers. Due to the current high price of natural gas, the industry is seriously investigating alternatives to natural gas. These alternatives involve wood waste energy systems and large capital expenditures. It would be useful for industry to understand the economics of improving the efficiency of their existing systems prior to making large capital expenditures.

The broad strategy envisioned for this Action consists of:

- A promotional effort to help the industry understand the economics of improving the efficiency of their existing systems.
- Assistance with metering so the efficiency of dryers could be accurately monitored and immediate operational savings obtained.
- Work with BC Hydro, and NR Can in holding efficiency workshops.
- Financial incentives for veneer dryers that remain on natural gas and improve their efficiency of operation.

Target Technologies and Sub Segments:

Major energy efficiency retrofits including:

- Leak reduction through improvement of the shell insulation and air tightness and gas circulation improvements using baffles.
- Control improvements including multiple zones, moisture metering, and exhaust control.
- Installation of VSD fans in alliance with BC Hydro Power Smart program.
- The purchase of new, efficient veneer dryers.

Target Stakeholder Group:

Wood products manufacturers including:

- Relative small number of existing sites in the Interior Region.
- Large new OSB plants being built, efficient natural gas could be promoted for these installations.
- Major suppliers of these dryers including Raute and COE.
- Vendors with upgrade equipment, control specialists, contractors who specialize in upgrades.

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- Current price of natural gas is encouraging industry to seriously consider wood waste system alternatives.
- The inertia of making a change to existing system.
- Lack of understanding of efficiency economics.
- Capital cost of making improvements.

This Action will address these barriers by combining the following interventions:

- Promotion and workshops will help industry to become aware of efficiency economics
- Metering will assist customers to understand economics of their specific sites.
- Financial incentives for customers who decide to stay on natural gas but at the same time improve their level of efficiency.

Time Frame:

Program could be designed and implemented in conjunction with lumber dry kiln (Action M1); Initial startup could include workshops at Prince George and Kamloops in the winter of 2006, held in association with BC Hydro, and NRCan.

Exhibit G7: Action Assessment Worksheet M2-Efficient Veneer Dryer

Energy Efficiency Measure	**M2- Efficient Veneer Dryers**					
Participant Definition	**New or Major Retrofit of an Efficient Veneer Dryer at Engineered Wood Facilities**					
Service Area	**Interior**			**Vancouver Island**		
Major Technology and % of Economic Potential	Technology		% of Potential	Technology		% of Potential
	Efficient Veneer Dryers		100%	Efficient Veneer Dryers		100%
Approximate % of Action Savings by Service Area	95%			5%		
Economic Potential Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
	166,699	23,301	190,000	11,000	4,700	15,700
Approximate Total number of Participants in Period	14	2	16	1	0.39	1
Number of Participants Eliminated by Constraints	1	0	2	0	0.1	0
Economic Potential Available for DSM	150,029	20,971	171,000	8,250	3,525	11,775
Approximate Economic Potential Savings per Participant per Year (GJ/year)	12,000			12,000		
Approximate Benefit Cost Ratio (Marginal Supply Cost of Gas ~ $6/GJ)	1.9			1.5		
Approximate Customer Payback (Customer Cost of Gas ~ $9/GJ)	3 years			3 years		
Participation Rate (% of Available Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	25%	25%	-	25%	25%	-
Upper	60%	60%	-	60%	60%	-
Action Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	37,507	5,243	42,750	2,063	881	2,944
Upper	90,017	12,583	102,600	4,950	2,115	7,065
Participation Rate (% of Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	23%	23%	23%	19%	19%	19%
Upper	54%	54%	54%	45%	45%	45%

Total Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Economic Potential	177,699	28,001	205,700
Most Likely	39,570	6,124	45,694
Upper	94,967	14,698	109,665

Exhibit G8: Action Profile M3-Efficient Process Heat Boilers

Action Profile M3– Efficient Process Heat Boilers

Overview:

This Action will encourage the purchase of efficient boilers for process heat. The largest opportunity is in the food manufacturing sector that includes greenhouses, and food and drinks processing. Opportunities also exist in the chemicals, non-metallic minerals, paper and other manufacturing sectors. It is assumed that there is an opportunity to extend the existing Terasen Gas Efficient Boiler Program to process heat applications from its current scope of strictly comfort heat application. This extension could include participation by Natural Resources Canada.

The broad strategy envisioned for this Action consists of:

- Strong up-front promotional efforts directed towards customers, vendors and trade allies, including workshops and technical information.
- Financial incentives towards the design, purchase and monitoring of condensing or near condensing boilers.
- A schedule for review and completion of the program based on market penetration targets.

Target Technologies and Sub Segments:

- Efficient boilers for process hot water and process steam applications.
- Retrofits such as heat recovery and advanced controls to existing boilers.
- Condensing boilers where low grade waste heat can be used.

Target Stakeholder Group:

- Facility managers and owners, with emphasis on greenhouses and food processing facilities in the Lower Mainland Region.
- Vendors and trade allies.
- Mechanical consultants and contractors.

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- High initial cost of efficient and condensing boilers over standard boilers.
- Process design modifications required to accommodate efficient boiler systems.
- Lack of reliable, facility specific knowledge of the losses from inefficient boiler systems and the potential savings from upgrading at a specific facility.

This Action will address these barriers by combining the following interventions:

- Technical information – e.g., facility specific information on boiler losses and potential savings, either through providing facility audits or by building a database of case studies and data on similar facilities.
- Promotion – workshops for trade allies and vendors, targeted advertising for facility owners and managers.
- Financing – e.g., grants towards the design, purchase and monitoring of efficient boilers.

Time Frame:

Start up 2006; incentives provided through to 2010.

Exhibit G9: Action Assessment Worksheet M3.1- Condensing or High Efficiency Process Heat Boilers

Energy Efficiency Measure	**M3.1-Condensing or High Efficiency Process Heat Boilers**					
Participant Definition	**Condensing Process Hot Water or High Efficiency Process Steam Boilers**					
Service Area	**Lower Mainland**			**Interior and Vancouver Island**		
Major Technology and % of Economic Potential	Technology		% of Potential	Technology		% of Potential
	Condensing Boilers		75%	Condensing Boilers		75%
	Efficient Process Steam Boilers		15%	Efficient Process Steam		15%
	Direct Fired Heat		10%	Direct Fired Heat		
Approximate % of Action Savings by Service Area	90%			10%		
Economic Potential Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
	1,030,000	50,000	1,080,000	187,365	52,485	239,850
Approximate Total number of Participants in Period	197	10	207	36	10	46
Approximate Total Number of Participants Eliminated by Constraints	63	3	66	11	3	15
Economic Potential Available for DSM	700,400	34,000	734,400	127,408	35,690	163,098
Approximate Economic Potential Savings per Participant per Year (GJ/year)	5,222			5,222		
Approximate Benefit Cost Ratio (Marginal Supply Cost of Gas ~ $6/GJ)	1.8			1.5		
Approximate Customer Payback (Customer Cost of Gas ~ $9/GJ)	4 years			4 Years		
Participation Rate (% of Available Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	50%	40%	-	50%	40%	-
Upper	70%	60%	-	70%	60%	-
Action Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	350,200	13,600	363,800	63,704	14,276	77,980
Upper	490,280	20,400	510,680	89,186	21,414	110,600
Participation Rate (% of Total Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	34%	27%	34%	34%	27%	33%
Upper	48%	41%	47%	48%	41%	46%

Total Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Economic Potential	1,217,365	102,485	1,319,850
Most Likely	413,904	27,876	441,780
Upper	579,466	41,814	621,280

Exhibit G10: Action Assessment Worksheet M3.2-Near Condensing Process Heat Boilers

Energy Efficiency Measure	**M3.2: Near Condensing Process Heat Boilers**					
Participant Definition	**New Efficient Process Heat Boilers**					
Service Area	**Lower Mainland**			**Interior and Vancouver Island**		
Major Technology and % of Economic Potential	Technology		% of Potential	Technology		% of Potential
	Near Condensing Boilers		100%	Near Condensing Boilers		100%
Approximate % of Action Savings by Service Area	90%			10%		
Economic Potential Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
	407,720	215,600	623,320	74,167	14,833	89,000
Approximate Total number of Participants in Period	130	69	199	24	5	28
Approximate Total Number of Participants Eliminated by Constraints (beyond DSM influence)	33	17	50	6	1	7
Economic Potential Available for DSM	305,790	161,700	467,490	55,626	11,124	66,750
Approximate Economic Potential Savings per Participant per Year (GJ/year)	3,132			3,132		
Approximate Benefit Cost Ratio (Marginal Supply Cost of Gas ~ $6/GJ)	3.7			3.2		
Approximate Customer Payback (Customer Cost of Gas ~ $9/GJ)	2 years			2 years		
Participation Rate (% of Available Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	66%	40%	-	66%	40%	-
Upper	80%	60%	-	80%	60%	-
Action Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	201,821	64,680	266,501	36,713	4,450	41,163
Upper	244,632	97,020	341,652	44,500	6,675	51,175
Participation Rate (% of Total Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	50%	30%	43%	50%	30%	46%
Upper	60%	45%	55%	60%	45%	58%

Total Savings, by Year (GJ/year)	Period One to 2010/11	Period Two to 2015/16	Total by 2015/2016
Economic Potential	481,887	230,433	712,320
Most Likely	238,534	69,130	307,664
Upper	289,132	103,695	392,827

Exhibit G11: Action Profile M4-Fully Insulated Process Heat Distribution Systems

Action Profile M4 – Fully Insulated Process Heat Distribution Systems

Overview:

This Action will encourage the installation and improvement of insulation on the process heat distribution systems of new and existing manufacturing facilities.

The broad strategy envisioned for this Action consists of:

- Strong up-front promotional efforts directed towards customers, vendors and trade allies, included targeted advertising, technical information, and partnerships with trade and technical associations such as the North American Insulation Manufacturing Association (NAIMA).
- Financial incentives targeted to both customers and vendors for the first 5 years to boost market momentum
- Access by Terasen customers to information on the current losses and potential benefits of upgrading insulation at their particular facility.

Target Technologies and Sub Segments:

Fully insulated process heat distribution system at all manufacturing facilities with the exception of the Fabricated Metal sub sector. The major opportunities are in the food manufacturing sub sector in the Lower Mainland service area.

Target Stakeholder Group:

- Terasen manufacturing customers considering a retrofit of an existing facility, with emphasis on the Food sub sector in the Lower Mainland Region.
- Terasen customers considering an expansion or development of new facilities with emphasis on the food sector in the Lower Mainland Region.
- Vendors and trade allies.

Key Barriers and Interventions:

Experience to date indicates that the most significant barriers affecting this opportunity are:

- Labour costs.
- Lack of knowledge by the decision maker of the energy loss due to poor insulation at their particular facility.
- Complexity of installation.

This Action will address these barriers by combining the following interventions:

- Information and promotion – e.g., energy and cost savings; case studies, promotion of NAIMA's E3 software to calculate current losses and potential payback.
- Financing – e.g., grants towards hiring an expert to review opportunities for increased insulation at a given facility and develop payback and recommendations.

Time Frame:

Start up in 2006; incentives provided through to 2010.

Exhibit G12: Action Assessment Worksheet M4-Fully Insulated Process Heat Distribution System

Energy Efficiency Measure	**M4: Fully Insulated Process Heat Distribution Systems**					
Participant Definition	**A Manufacturing Facility with Incomplete Process Distribution System Insulation**					
Service Area	**Lower Mainland**			**Interior and Vancouver Island**		
Major Technology and % of Economic Potential	Technology		% of Potential	Technology		% of Potential
	Insulation		100%	Insulation		100%
Approximate % of Action Savings by Service Area	87%			13%		
Economic Potential Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
	295,000	11,000	306,000	41,000	2,000	43,000
Approximate Total number of Participants in Period	421	16	437	59	3	61
Approximate Total Number of Participants Eliminated by Constraints (beyond DSM influence)	42	2	44	6	0	6
Economic Potential Available for DSM	265,500	9,900	393	36,900	1,800	55
Approximate Economic Potential Savings per Participant per Year (GJ/year)	700			700		
Approximate Benefit Cost Ratio (Marginal Supply Cost of Gas = $6/GJ)	4.3			3.5		
Approximate Customer Payback (Customer Cost of Gas = $9/GJ)	2 years			2 years		
Participation Rate (% of Available Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	65%	65%	-	50%	50%	-
Upper	90%	90%	-	75%	75%	-
Action Savings (GJ/year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	172,575	6,435	179,010	18,450	900	19,350
Upper	238,950	8,910	247,860	27,675	1,350	29,025
Participation Rate (% of Total Economic Potential)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Most Likely	59%	59%	59%	45%	45%	45%
Upper	81%	81%	81%	68%	68%	68%

Total Savings (GJ/Year)	**Period One to 2010/11**	**Period Two to 2015/16**	**Total by 2015/2016**
Economic Potential	336,000	13,000	349,000
Most Likely	191,025	7,335	198,360
Upper	266,625	10,260	276,885

Appendix 2

TERASEN GAS INC.

2004 – 2007 MULTI-YEAR PERFORMANCE BASED RATE PLAN
2005 DSM STATUS REPORT

1. INTRODUCTION

Under the terms of the 2004 – 2007 Multi-Year PBR Settlement, Terasen Gas is required to submit an annual Demand Side Management ("DSM") Status Report to the Commission as part of the Annual Review process. This report follows the 2004 Status report in form and content and provides an overview of Terasen Gas' DSM activities in 2005 with details pertaining to the progress of individual DSM programs against forecasted targets and objectives for the year. As in prior years, Terasen Gas has offered several types of programs most of which are in progress at the time of this writing; therefore, impacts are estimated rather than actual results.

2. OVERVIEW OF DSM PROGRAMS AT TERASEN GAS

In 2005, Terasen Gas has continued efforts to promote natural gas conservation and efficiency to its customers through a combination of awareness, education and incentive programs. Energy conservation and efficiency is also being promoted by a number of other utilities, agencies and industry members; Terasen Gas has attempted, whenever feasible, to partner with others to leverage utility DSM funds—for example, of the $11 million of the *Opportunities Envelope* funding described later, nearly $3 million is earmarked for Terasen programs for 2005-2007.

Proposed programs are subjected to economic cost-benefit tests (most notably a standardized Total Resource Cost test) prior to launch and, when completed, major initiatives are subjected to third party evaluations. The evaluations have proved to be an important tool for process improvement (for example, by indicating delivery problems that should be corrected if the program is to be made available in the future) and for determining if the actual impact of the program is sufficient (for example, by measuring actual natural gas savings). In the case of programs where the energy-saving measures adopted by the customer are significant, as would be the case if a furnace or boiler is changed to a high efficiency model, Terasen Gas has utilized analysis of customer billing data.
DSM initiatives may also produce benefits for the utility, the customer, and society in general which are not considered part of the Total Resource Cost test. Of particular interest are the emission reductions which essentially lead to a reduction in greenhouse gases and improved local air quality.

3. PRIOR YEARS INITIATIVES EVALUATION

***Impact of Terasen Gas Pilot Fireplace Program (2004)*, Habart & Associates Consulting Inc., March 3, 2005.**

This report, is a preliminary evaluation of the 2004 Fireplace Pilot that provided incentives to consumers for upgrading their decorative log-sets to a heater-style fireplace with an EnerGuide Fireplace Efficiency Rating of 55% or higher.

The program generated considerable activity in the market, with three quarters of the trade allies reporting a 50% increase in queries during the program period. The increased level of queries continued after the program terminated.

The program had two types of impacts. It encouraged people with decorative log-sets who were not in the market to replace them, and it encouraged people who were in the market to move to more efficient fireplaces.

Both program participants and non-participants who were aware of the program expressed strong support for Terasen Gas incentive programs to encourage efficient use of natural gas; on a five point scale, participants rated this as 4.7 while non-participants rated this at 4.5.

A full copy of the report is appended after this DSM status report.

4.0 ONGOING INITIATIVES

Destination Conservation

Destination Conservation (DC) is a K-12 school program involving students, teachers and school facilities management staff.

The program is organized by the Pacific Resource Conservation Society, a BC based not-for-profit group, and offered to school districts. It features energy conservation curricula and support materials for participating teachers and technical assistance to school facilities management staff. Terasen Gas has contributed a portion of the first year operating costs for the program to a number of school districts in prior years. In 2005, Terasen Gas is supporting the Abbotsford and Richmond School Districts with funds for 16 schools.

The DC program includes an energy monitoring component which allows school districts to monitor, analyze and report energy usage information. Utilizing software programs such as ‘Utility Manager 4.0 Pro’ coupled with operator training, Schools are able to report weather-normalized energy savings resulting from implementation of energy efficiency measures. Terasen considers this approach to be a cost-effective means of monitoring program impacts. In addition, DC also supports ongoing monitoring of savings through third party evaluations.

Commercial Energy Utilization Advisory

This program is being offered to larger Rate 3/23 and Rate 5/25 customers by the Terasen Gas Commercial Energy Services group. The offer includes an initial benchmarking consultation and an onsite assessment of natural gas conservation and efficiency opportunities along with recommendations and estimated savings. To date there have been 44 completed assessments in 2005, and an expected total of 84 by year end. Typically, half of the customers who receive the assessment implement the recommended measures and average 600 GJs in annual savings.

Evaluation report pertaining to this program: BC Gas Commercial DSM Evaluation, R.A. Malatest and Associates Ltd., September 2002

Publications

Terasen Gas publishes a number of brochures and pamphlets to encourage residential customers to adopt energy savings measures and practices. In 2005 the Hot Tips booklet, Heart of your Home (a guide to energy efficient heating systems) and a number of data sheets were updated and published. These booklets and data sheets are available to customers on request. All publications are also available online at the utility web site.

Additional conservation tips and advice have been made available through Homeswest Magazine (a Terasen Gas advertiser-supported publication). And, as a new means of program promotion and education, energy efficiency is being promoted this fall via a trailer in the Terasen TV commercials.

Community Participation

Terasen Gas continues to be an active participant in community-based conservation initiatives (for example, the Community Energy Association) and collaborates with the provincial and federal governments to review energy efficiency standards.

5. SHORT TERM INITIATIVES

Residential Heating System Upgrade Program

An expanded version of programs offered by Terasen Gas in 2003 and 2004, this year's Residential Heating System Upgrade program once again offers financial incentives to residential customers to replace older furnaces and boilers with ENERGY STAR qualified high efficiency natural gas models. The program was launched September 1, 2005 and terminates December 31, 2006. TGI is partnering with Natural Resources Canada (NRCan), Ministry of Energy, Mines and Petroleum Resources (MEMPR), BC Hydro, FortisBC, Pacific Northern Gas, and 15 participating manufacturers who are contributing up to $3.1 million towards promotional costs and customer incentives.

Residential customers are offered a $250 utility bill credit towards the purchase of an ENERGY STAR qualified high efficiency natural gas furnace or boiler of which TGI is contributing $100, MEMPR is contributing $150, and BC Hydro and FortisBC are jointly funding an additional $100 incentive with NRCan if the selected furnace has a variable speed motor.

Additional supplier-funded incentives ranging from $150 to $1000 in value toward the purchase of 15 brands of ENERGY STAR qualified furnaces and boilers are being promoted by Terasen Gas as part of this program. Most of the major suppliers of high efficiency heating systems in BC are participating—contributing $2,000 towards the direct promotional costs of the campaign and, in some cases, conducting their own independent promotional campaigns. The manufacturers administer their own coupons and they are only valid between September 1, 2005 and December 31, 2005.

The program design for the 2005/6 program estimates the average annual natural gas savings at 13.8 GJ per participant and 8000 participants overall. The GJ savings and corresponding GHG reductions for the program provide a TRC of 1.73 and a reduction of 112 kilotonnes of CO_2E.

Evaluation report pertaining to this program: 2003 Residential DSM Campaign Evaluation, Habart & Associates Ltd., August 2004.

New Construction Energy Star Heating Systems

Historically, 95% of the natural gas furnaces installed in newly-constructed single family dwellings are mid-efficient. The Residential New Construction Heating program launched January 1, 2005 runs through December 31, 2006 and provides a $500 incentive to builders for installation of a natural gas DHW and ENERGY STAR qualified space heating equipment. Although the program runs through 2006, applications must be submitted by December 31, 2005. At the time of writing, over 1200 applications have been received with approximately 600 pertaining to homes being built in 2005.

The program design for the 2005/6 program estimates the average annual natural gas savings at 12.7 GJ per participant and 1500 participants overall. The GJ savings and corresponding GHG reductions for the program provide a TRC of 1.85 and a reduction of 19 kilotonnes of CO_2E.

Efficient Boiler Program

Similar in nature to the company's Efficient Boiler Program offered between 1994 and 2000, this initiative provides formula based incentives to purchasers of high efficiency natural gas condensing and "near-condensing" boilers and is available to both the new construction and retrofit markets. It is estimated that 45 commercial customers will be installing high efficiency boilers receiving program approval by December 31 and will therefore be eligible for a future incentive payment attributable to the 2005 program.

The program design for the 2005/6 program estimates the average annual natural gas savings at 1570 GJ per participant and 130 participants overall. The GJ savings and corresponding GHG reductions for the program provide a notable TRC of 3.0 and a reduction of 260 kilotonnes of CO_2E.

NRCan has been a key partner in the program and has heralded the program to other utilities. Since the launch of the program, NRCan has included the program criteria in CBIP (Commercial Building Incentive Program) and allowed access to the program across Canada. They are also considering launching a standalone boiler-program modelled after the TGI program.

6. RESEARCH INITIATIVES

Vertical Sub-Divisions (individually metered condominiums)

During high-rise construction, many developers select electric baseboards for in-suite heating due to the lower capital costs and simplicity of installation. There is also a lack of reliable information on design, installation and operational costs of more complex natural gas systems. In cooperation with BC Hydro, Terasen Gas is conducting research this fall on the life-cycle costs of various high-rise energy systems both gas and electric. The research is slated for completion in the first quarter of 2006 and will study approximately 20 buildings of various ages and locations and reconcile differences between modelled energy use and actual consumption. The purpose of the research will be to provide industry with information on the benefits of the various energy system configurations and assist TGI in the design of future DSM programs.

Multi-Utility Studies

In 2005, TGI participated in a number of multi-utility research initiatives including participating in the CGA Task Force steering committee for the "*DSM best practices: Canadian natural gas distribution utilities' best practices in DSM*", the "*Framework for natural gas DSM as part of the greenhouse gas domestic offset credit system*", and the *DSM Potential in Canada* study. TGI is also working with Enbridge and CANMET Energy Technology Centre - Ottawa (CETC-Ottawa) (in cooperation with several other North American utilities) on testing "near-market" technologies where the identification of reliable savings is needed before utilities could screen the technology for use in DSM. Results of the studies will provide a framework for future program design.

Conservation Potential Review

Terasen Gas is nearing completion of a Conservation Potential Review (CPR) to provide a 10-year analysis of Demand Side Management (DSM) potential by geographical area identifying the interrelationship between gas and electricity for the residential and commercial sectors. The review is being done in cooperation with BC Hydro and includes analysis of both energy conservation and Energy Choice (fuel substitution) potential.

Marbek Resource Consultants is conducting the TG CPR who were also the lead consultant on the 2002 BC Hydro CPR and are therefore able to leverage developed models, market profiles, data classifications and arch-types.

Key Deliverables of the CPR

The CPR is focussing on economic screening of natural gas and fuel-independent technologies as well as the combined utility economic analysis of *fuel substitution* (from electric to natural gas). It is examining resource potential at specified milestones, by specific market and end-use, over the 2005-2015 forecast period.

The primary outcome will be the identification of reference case forecast and the resulting change in gas and electric consumption for each of the identified opportunities. The study will also document the assumptions for each of the potential measures so both Terasen Gas and BC Hydro can re-test the opportunities in their respective cost-benefit models.

The deliverables for each of the outcomes are defined in the following table:

Outcome	Content
Analysis of natural gas DSM measures by geographical area	• Stock definition and update of technologies • technology profiles • economic potential • Sensitivity analysis (uncertain fuel costs) • GHG Impact
Analysis of fuel substitution economics by geographical area	• base year calibration • reference case development • impact on peak demand for gas and electric • consider costs of the marginal source of electrical supply based on geographical area • GHG Impacts
DSM Achievable potential	• A set of multi-participant workshops to consider delivery, timing and funding constraints

Need for Joint Fuel Substitution analysis

The scope of the 2002 BC Hydro CPR did not include an examination of fuel substitution. Terasen Gas believes there is a growing importance for this analysis—there seems to be a market failure in the selection of fuels by market players which could be corrected or improved to the benefit of gas and electric rate payers if the CPR identifies the measures as cost effective. The reasons for the failure could be attributable to some of the following:

- Builders and developers tend to focus on reduction of upfront capital cost versus long run operating costs by the eventual home owner. The capital cost of natural gas equipment may be a barrier. Anecdotal evidence from builders suggests a growing percentage of electric baseboard installations.
- Home buyers and realtors seem to largely ignore the role of home heating systems in the ongoing operating costs of the home.
- Growth in the popularity of electric fireplaces
- Postage stamp electrical rates do not reflect the varying cost of energy delivery based on service territory.
- Historical electric rates based on heritage supply give misleading price signals to the market that electrical rates may remain near current levels in the long term.

The CPR, however, will focus on the economic benefits: it examines fuel substitution, identifies the benefits of reducing peaking versus flat load, cost per kWh and GJ of the energy saved, and identifies the achievable potential of province wide programs.

Results of the CPR

Early indications are that approximately 1% of the TGI core-market load could be conserved through economic energy efficiency measures—which is nearly ten times the current DSM target. The identification of the fuel substitution potential is in progress at the time of writing.

It is anticipated that TGI will prepare an application to the commission in early 2006 proposing a portfolio of programs, their net benefit, likely partner funding and the likely change in incentive and program funding levels required to launch a more significant portfolio of programs.

Partnering Opportunities

Terasen Gas has attempted, whenever feasible, to partner with others to leverage utility DSM funds; Natural Resources Canada, BC Hydro, Fortis, and appliance manufacturers have all participated in Terasen programs benefiting customers.

In recent years, there has been a confluence of activity with hundreds of organisations interested in energy savings and reduction of GHGs. With MEMPR promising the seed funding from the federal “Opportunities Envelope” for $11 million over a three year period, TGI has met with over 50 organisations in the last year including municipalities, regional districts, provincial and federal governments and affiliated organisations, utilities, financial institutions, and educational institutions to facilitate combined offerings and move the market towards energy efficiency, conservation and action on climate change.

7. PROPOSED 2006 INITIATIVES

Notwithstanding a likely application in early 2006 for a much broader DSM portfolio, the following planned 2006 activities highlight new initiatives and supplementary activity to currently running programs.

a. Residential Programs

New Construction Energy Star Heating Systems

The existing new construction program requires applications to be submitted by the end of 2005 and installation to be completed by the end of 2006. After evaluation of the existing applications and discussions with the builders and developers, TGI intends to launch a complementary new construction program running parallel to the existing program to capture incremental new constructive activity in 2006.

Energy Star Heating System Upgrade

The existing Energy Star program runs until to December 31, 2006, however, the manufacturer coupons expire December 31, 2005. It is anticipated that a similar manufacturer coupon offer will be launched in the fall of 2006.

Fireplace Upgrade Program

One of the findings of the 2004 pilot program is that the demand for EnerGuide–rated fireplaces was significant during and after the three-month program offering, and contractors and dealers were largely unprepared for the level of interest that the program generated—many potential program participants were unable to find a contractor to install the equipment within the program period—installation wait times were in some cases 4-6 weeks. TGI plans to offer a modified fireplace program in 2006, considering a longer program period and an allowance for installation after the program end-date. Meetings with the industry produced a commitment from dealers and suppliers that they will be better prepared for the increase in activity.

b. Commercial Programs

Efficient Boiler Upgrade

The efficient boiler program, launched in April 2005, runs until December 31, 2006 with participants having 24 months to install the equipment after receiving their letter of approval from TGI.

Commercial Utilization Advisory

The continuation of this program is proposed for 2006.

Vertical Subdivision Program

At the conclusion of the 2005 study of high-rise energy systems, TGI intends to launch a program for new high-rise developers to assist builders in installing efficient and cost effective energy systems that lower the ongoing operating cost for the eventual residents.

Building Operator Training

TGI has been working with Douglas College, BC Hydro, MEMPR and BOMA to survey building managers and operators to identify training needs of building operators in order to improve the overall operating efficiency of existing building stock. The survey will be complete in late 2005, after which a training program will be developed and offered to the industry.

Gas Contractor Training

TGI, MEMPR, HVCI, the BC Safety Authority, and HRAI are currently surveying the 2000 registered gas contractors in the province to profile existing practices of gas contractors and identify training opportunities. The survey will be complete in late 2005, after which a training program will be developed and offered to the industry.

CHBA-BC Projects - Built-Green and EnerGuide80

Multiple partners including TGI, MEMPR, BC Hydro, Canadian Homebuilders Association--BC Chapter (CHBA-BC), and the Homeowner Protection office are working together to launch a "*Built Green-BC*" label modeled after *Built Green-Alberta*. The label will be applied to homes based on their score of a checklist. The brand is complementary to TGI DSM programs and the provincial target of having 2000 homes Energuide80 rated by March 2007.

8. SUMMARY OF 2005 SAVINGS

With most programs spanning into 2006, the forecast below is pro-rated to the likely 2005 participants:

Program	Participants		Savings (GJ)	
	Target	Projected	Target	Projected
Residential				
Heating System Upgrade	3000	3500	41,400	48,300
New Construction Program	750	600	9,518	7,614
Commercial				
Utilization Advisory	90	84	31,500	29,400
Efficient Boiler Program	15	45	23,535	70,605
Community Based				
Destination Conservation	20	16	4,000	3,200
Other Activities				
Awareness and Education	n/a	n/a	n/a	n/a
Research & Program Design	n/a	n/a	n/a	n/a
	3,875	4,245	**109,953**	**159,119**

Total Resource Cost Test and DSM Achievement Incentive Status

The Total Resource Cost (TRC) test is a measure of the net benefits of a utility's DSM programs. Terasen Gas calculates overall TRC impact on a 'portfolio' basis, that is, by examining the impact of the combined group of programs for the year.

For the 2005 portfolio (as identified in the table above), the TRC net benefit has been forecast at $5.8 million with a combined TRC ratio of 2.92. Assuming projected savings and participation levels remain as forecast, TGI would be eligible for an incentive payment of $174,000 through the DSM incentive mechanism.

Greenhouse Gas Reduction

In its residential rebate offers, Terasen Gas informs participating customers of its intent to record resulting emission reductions as part of the company's Greenhouse Gas Management Program. The net impact of these residential program savings amount to approximately 56 kilotonnes of CO_2E (metric tonnes of carbon dioxide equivalent); the net impact for all programs based on current projections is approximately 170 kilotonnes CO_2E

9. SUMMARY OF COSTS

Program and administration costs as well as customer incentive costs will have remained below the allowed levels in 2005.

	Allowed ($000)	Projected ($000)
Administration, marketing and research	1,624	1,500
Customer Incentives	1,500	1,500

2006 DEMAND SIDE MANAGEMENT STATUS REPORT

1. INTRODUCTION

Under the terms of the 2004 – 2007 Multi-Year PBR Settlement, Terasen Gas is required to submit an annual Demand Side Management ("DSM") Status Report to the Commission as part of the Annual Review process. This report follows the 2005 Status report in form and content and provides an overview of Terasen Gas' DSM activities in 2006 with details pertaining to the progress of individual DSM programs against forecasted targets and objectives for the year, and details pertaining to other DSM initiatives. As in prior years, Terasen Gas has offered several types of programs most of which are in progress at the time of this writing; therefore, impacts are estimated rather than actual results.

2. GENERAL OVERVIEW OF DSM PROGRAMS AT TERASEN GAS

In 2006, Terasen Gas continued efforts to promote natural gas conservation and efficiency to its customers through a combination of awareness, education and incentive programs. Very few changes were made to program offerings from 2005.

Energy conservation and efficiency is also being promoted by a number of other utilities, agencies and industry members. Terasen Gas continues, whenever feasible, to partner with others to leverage its DSM funds. For example, Terasen Gas was able to enter into a Contribution Agreement with the Ministry of Energy, Mines and Petroleum Resources ("MEMPR" or the "Ministry') in March 2006 for the amount of $2.4 million. This Contribution Agreement, which terminates on March 31, 2007, details the Ministry's contribution to both program and incentive costs for a market survey of gas contractors, for Energy Star furnace/boiler upgrades in residential new construction and retrofits, for a Commercial Boiler program, and for sponsorship of the 2006 BC Energy Forum. The majority of Terasen Gas initiatives to which the Ministry is making a financial contribution support the Government of British Columbia's strategy around "Energy Efficient Buildings: A Plan for BC". More information on this strategy can be found at http://www.em.gov.bc.ca/AlternativeEnergy/EnergyEfficiency/buildings.htm. However, at the time of writing, there is considerable uncertainty as to the nature and extent of federal funding for promoting energy efficiency. If the Government of Canada chooses to scale down investment in promoting energy efficiency, the opportunities to benefit ratepayers by continuing to leverage Terasen Gas' investment with funding partners such as Natural Resources Canada ("NR Can") and Environment Canada, and with the Ministry may be limited.

Another strategy which Terasen Gas and its partners adopted this year was to take a "bundling" approach, where incentives from Terasen Gas and its partners are offered in one "bundle" aimed at a particular market segment. By adopting a bundling approach to offerings and incentives, it is expected customer interest and participation will increase as the perceived total amount of incentives will be higher than stand-alone incentives and the application process will be much simpler and easier as there will be only one application required for the multiple incentives available. The success of this approach will be evaluated in 2007.

As in past years, programs are subjected to economic cost-benefit tests (most notably a standardized Total Resource Cost ("TRC") test) prior to launch. Terasen Gas did not have any programs conclude during the first half of 2006, however several programs are due to conclude by the end of the year and in 2007, and those programs will be evaluated by third parties at the time that they conclude. The planned evaluations will provide insight into opportunities for future improvement and assist in measuring actual natural gas savings against projections. In the case of programs where the projected energy-saving measures adopted by the customer are significant, as would be the case if a furnace or boiler is changed to a high efficiency model, Terasen Gas will utilize analysis of customer billing data to support projected gas savings.

DSM initiatives may also produce benefits for the utility, the customer, and society in general which are not considered part of the TRC test. Of particular interest are the emission reductions which essentially lead to a reduction in Greenhouse Gas ("GHG") emissions and improved local air quality (the latter arising from Criteria Air Contaminant ("CAC") emission reductions). GHG emission reductions from Terasen Gas programs were tracked and information gathered in 2006, however, projected CAC emission reductions are not actively tracked, because at this time, there does not appear to be a valuation and trading mechanism on the horizon for Canada for CAC emissions.

3. EDUCATION AND OUTREACH INITIATIVES

<u>Destination Conservation</u>

Destination Conservation ("DC") is a K-12 school program involving students, teachers and school facilities management staff.

The program is organized by the Pacific Resource Conservation Society, a BC based not-for-profit group, and offered to school districts. It features energy conservation curricula and support materials for participating teachers and technical assistance to school facilities management staff. The DC program includes an energy monitoring component which allows school districts to monitor, analyze and report energy usage information. Utilizing software programs such as 'Utility Manager 4.0 Pro' coupled with operator training, schools are able to report weather-normalized energy savings resulting from implementation of energy efficiency measures. Terasen Gas considers this approach to be a cost-effective means of monitoring program impacts.

Terasen Gas has contributed a portion of the first year operating costs for the program to a number of school districts in prior years. In 2006 school districts in the province experienced considerable uncertainty related to the teachers' contracts, thus non-core initiatives such as DC were pushed to one side, likely leading to lower participation by fewer schools than previously projected. However, Terasen Gas anticipates greater activity with more school districts adopting DC in 2007, and is evaluating a proposal from the Pacific Resource Conservation Society for "DC at Home", which would carry the DC messaging into students' homes.

Commercial Energy Utilization Advisory

This program is being offered to larger Rate 3/23 and Rate 5/25 commercial customers by the Terasen Gas Commercial Energy Services group. The offer includes an initial benchmarking consultation and an onsite assessment of natural gas conservation and efficiency opportunities along with recommendations and estimated savings. To date there have been 48 completed assessments in 2006, and an expected total of 60 by year end. Typically, 25% of the customers who receive the assessment implement the recommended measures and average 600 GJs in annual savings.

Publications

On an ongoing basis, Terasen Gas publishes a number of brochures and pamphlets to encourage residential customers to adopt energy savings measures and practices. These would include such items as our "Hot Tips" booklet, which contains a number of energy saving tips that homeowners can readily perform themselves.

Mass Media Communication

In 2006, Terasen Gas continued with the use of television commercials as a way to promote its energy efficiency programs and to draw attention to the importance of energy efficiency. For Fall 2006, the television campaign will contain program-related DSM "tags" at the end of the commercials. Further, Terasen Gas will be launching a series of radio "tags" as a means of promoting the Energy Star Heating Upgrade program, which should further reinforce the importance to consumers of energy efficiency measures to assist them in managing energy costs.

Community Energy Planning Participation

Terasen Gas continues to be an active participant in community-based conservation initiatives (i.e. the Community Energy Association) and collaborates with the provincial and federal governments to review and to implement energy efficiency standards. Terasen Gas is an active supporter of British Columbia's "Community Action on Energy Efficiency" strategy (http://www.em.gov.bc.ca/AlternativeEnergy/EnergyEfficiency/default.htm).

2006 BC Energy Forum

Terasen Gas in cooperation with BC Hydro, MEMPR and NR Can organized the 2006 BC Energy Forum, held at the Wosk Centre for Dialogue in Vancouver on January 24 and 25. The Forum brought together a number of experts in the fields of energy efficiency, alternative energy, transportation, as well as government and regulatory experts for two days of presentations and panel discussions. The purpose of the forum was to increase understanding and collaboration related to energy issues in British Columbia; it was well-received.

Trade Show Activity

Terasen Gas will be participating in the 2006 Vancouver Home and Interior Design Show, being held October 12 to 15 at BC Place Stadium in Vancouver. A major focus of our activity at this trade show will be promoting energy efficiency in general, focussed on Energy Star and specifically on our Residential Heating Upgrade incentive program for winter 2006.

Other Activities

Terasen Gas engages in a number of demand side management related activities designed to enhance energy efficiency-related outcomes in British Columbia. Some of them are described below:

- Terasen Gas participated and continues to participate on the Steering Committee for BC Hydro's Conservation Potential Review and on BC Hydro's Electricity Conservation and Efficiency Advisory Committee.
- Terasen Gas sponsored the Douglas College program called "Building Operator Training" which is designed to address ongoing maintenance and upgrades to commercial building operations by training facilities staff in efficiency techniques.
- Terasen Gas sponsored the Building Owners and Managers Association's development of an on-line training course related to energy efficiency.
- Terasen Gas supported the development of a consumer education campaign by the Hearth, Patio and Barbeque Association designed to increase consumer understanding of fireplace efficiencies.
- Terasen Gas supported Code Green Canada, a reality television show in which participants competed in making energy efficient upgrades to their homes.
- Terasen Gas participated in Natural Resources Canada's annual Energy Star meetings in Toronto, where Terasen Gas received an Energy Efficiency Recognition Award.

4. 2006 INCENTIVE PROGRAM DESCRIPTIONS

Energy Star Heating System Upgrade

Originally launched on September 1, 2005, and scheduled to expire December 31, 2006, the 2006 program represents a continuation of the original program. As in previous years, this year's Residential Heating System Upgrade program once again offers financial incentives to residential customers to replace older furnaces and boilers with ENERGY STAR qualified high efficiency natural gas models. The "Winter 2006" version of the program will be officially launched October 1, 2006, and has been extended from an original termination date of December 31, 2006 to March 31, 2007. This extension was implemented to coincide with the termination of Terasen Gas' agreement with the MEMPR. Other partners on this program include NR Can (to March 31, 2006), MEMPR, BC Hydro, FortisBC, and 15 participating brands (for Winter 2006). These partners are contributing funds to promotional costs and customer incentives.

Under this program, residential customers are offered a $250 utility bill credit towards the purchase of an ENERGY STAR qualified high efficiency natural gas furnace or boiler of which Terasen Gas is contributing $100, MEMPR is contributing $150, and BC Hydro and FortisBC are jointly funding an additional $100 incentive with MEMPR if the selected furnace has a variable speed motor.

Additional supplier-funded incentives ranging from $150 to $1,000 in value toward the purchase of 15 brands of ENERGY STAR qualified furnaces and boilers are being promoted by Terasen Gas as part of this program. Most of the major suppliers of high efficiency heating systems in BC are participating—contributing $2,000 towards the direct promotional costs of the campaign and, in some cases, conducting their own independent promotional campaigns. The manufacturers are responsible for administering their own coupons and, with the coupons only, valid for redemption between October 1, 2006 and January 31, 2007.

The program design for the 2006/7 program estimates the average annual natural gas savings at 13.8 GJ per participant and 3,300 participants overall. This results in a cumulative GJ savings of 45,540 GJ/annum, a cumulative CO2e savings of 2,308 tonnes, and a TRC of 1.82.

New Construction Energy Star Heating System/Power Smart New Home Program

The Residential New Construction Heating program originally launched January 1, 2005, has been bundled into the PowerSmart New Home Program, and extended through to March 31, 2007. The PowerSmart New Home Program was launched in July 2006, bundling the Terasen Gas incentives, BC Hydro incentives, and MEMPR incentives to offer builders and developers up to $3,000 for the installation of Energy Star equipment and a new home that achieves a rating of 80 on the Energuide for New Homes scale. BC Hydro and Terasen Gas are sharing the administration of the program with program inquiries handled by Terasen Gas staff while incentive processing is handled by BC Hydro Power Smart staff. For a single family dwelling (“SFD”), the customer incentives are as follows:

Incentive Description	**Incentive Amount**
Energy Star Windows Program	$1/square foot – generally approx. $500 in SFD
Energy Star Gas Heating	$500
Basic Appliance Rebate – Energy Star Fridge, Dishwasher, Vent Fan, 40% CFL lighting OR Full Appliance Rebate – As above plus Energy Star Clothes Washer, Natural Gas Range and Natural Gas Dryer (must have Gas Domestic Hot Water)	$150 or $600
Energuide for New Homes Rating of 77 OR Energuide for New Homes Rating of 80 with Electric Heat OR Energuide for New Homes Rating of 80 with Gas Heat	$200 OR $900 OR $1,400

Should a builder wish to select only the incentive for Energy Star Natural Gas heating, on a stand-alone basis, the builder may do so. The same is true of the appliance bundle, and the windows incentive. There are also incentives available for townhomes and high-rise condominiums, although the incentive amounts are lower because they typically do not have as much window space, lowering the incentive contribution from BC Hydro for Energy Star windows. In addition, many condominiums also do not have individual space heating appliances, eliminating the incentive for Energy Star Natural Gas Heating. The PowerSmart New Home program is Terasen Gas' first experience with bundling its incentives with partners' incentives, with the first opportunity to evaluate the effectiveness of this approach in late spring 2007.

To date there are about 176 applications for the Residential New Construction Program, and about 450 signed up for Power Smart New Home Program. The Residential New Construction program is tracking to expectations with a program goal for 2006 of 750 participants and most of those participants are expected to apply once the prime construction season is complete.

For the Residential New Construction Program, the program design for the 2006/7 program estimates the average annual natural gas savings at 9.1 GJ per participant and 750 participants overall. This results in a cumulative GJ savings of 6,825 GJ/annum, a cumulative CO2e savings of 346 tonnes/annum, and a TRC of 1.45.

For the Power Smart New Home Program, the program design for the 2006/7 program estimates the average annual natural gas savings at 30 GJ per participant and 300 participants overall. This results in a cumulative GJ savings of 9,000 GJ/annum, a cumulative CO2e savings of 456 tonnes/annum, and a TRC of 1.49.

Efficient Boiler Program

This program was modified from that which was offered in previous years. This program is jointly funded by Terasen Gas, NR Can and MEMPR. Due to run-ups in the commodity price of metals, purchase prices for boilers have significantly increased. The incentives offered under the Efficient Boiler Program were correspondingly increased, with the result that the market responded strongly to the program. The program consists of a base incentive plus a variable incentive calculated on boiler capacity. Incentive updates were as follows:

- Near-condensing boilers: $4,000 plus $3.00/MBH (an increase of $1/MBH).
- Condensing boilers: $6,000 plus $9.00/MBH (a $2,000 increase in the fixed incentive plus an increase of $3/MBH).

For condensing boilers, the increase in the fixed incentive is designed to address the additional cost of venting high efficiency boilers in new construction applications; in both cases, the incentives contribute about 50% of the incremental cost of an efficient boiler. At the time of writing (September 2006), this program which was originally designed to run to the end of 2006, was fully subscribed.

This program has been highly successful, such that NR Can is contemplating launching a national version of the program based on Terasen Gas' design.

The program design for the 2006 Efficient Boiler program estimates the average annual natural gas savings at 850 GJ per participant and 98 participants overall. This results in a cumulative GJ savings of 83,300 GJ/annum, a cumulative CO2e savings of 4,222 tonnes/annum, and a TRC of 2.43.

5. SUMMARY OF 2006 RESULTS

Total Resource Cost Test and DSM Incentive Status

The TRC test is a measure of the net benefits of a utility's DSM programs. Terasen Gas calculates overall TRC impact on a 'portfolio' basis, that is, by examining the impact of the combined group of programs for the year.

For the 2006 portfolio (as identified in the table below), the TRC net benefit for specific programs is forecasted to be approximately $6.5 million with a combined TRC ratio of 2.0. The numbers presented in the table below reflect only total projected incentive applications received in calendar year 2006 with some of the programs running into 2007. The TRC net benefit from programs, less the non-program specific DSM costs incurred for salaries, administration, overhead, research, and non-program related education, outreach and promotion is forecasted to be approximately $5.7 million.

Program Name	# of Participants	GJ saved per Participant	GJ saved per year	CO2e saved (tonnes) per year	TRC result	TRC Net Benefit
Energy Star Heating Upgrade	3300	13.8	45,540	2,308	1.82	$ 1,141,525
New Construction Heating Program	750	9.1	6,825	346	1.45	$ 162,158
Power Smart New Home Program	300	30	9,000	456	1.49	$ 604,529
Efficient Boiler Program	98	850	83,300	4,222	2.43	$ 4,101,737
Utilization Advisory	60 with 25% implementing	600	9,000	456	2.4	$ 366,204
Destination Conservation	18	113	2,034	103	2.21	$ 76,298
Totals			**155,699**	**7,892**	**1.97**	**$ 6,452,451**

Greenhouse Gas Reduction

In its demand side management incentive offers, Terasen Gas informs participating customers of its intent to record resulting emission reductions as part of the company's GHG Management Program. The net GHG savings resulting from Terasen Gas energy efficiency incentive programs is estimated to be 7,892 tonnes per year.

DSM Incentive Mechanism

To qualify for the DSM Incentive, a threshold of 75% of the established energy savings target of 177,425 GJs must be achieved, entitling Terasen Gas to an incentive of 3% of the TRC net benefits. Where the energy savings meet or exceed the threshold target of 177,425 GJs, the incentive percentage increases to 5% of the TRC net benefits. Given the projected energy savings and net TRC benefits for 2006, Terasen Gas would be eligible for a DSM incentive of approximately $170,000 (i.e. 3% of $5.7 million).

As the projections provided are estimates only at this time, Terasen Gas will be confirming the actual 2006 customer participation rates and energy savings in 2007 prior to submitting a final incentive payment request.

6. SUMMARY OF COSTS

Program and administration costs as well as customer incentive costs are forecasted to remain within the allowed levels in 2006.

	Allowed ($000)	Projected ($000)
Administration, marketing and research	1,624	1,600
Customer Incentives	1,500	1,500

7. PROPOSED 2007 INITIATIVES

In the absence of increased funding from that approved for DSM to support new programs, Terasen Gas will continue with its “core” initiatives in 2007; the Residential New Construction and Energy Star Heating Upgrades and the Commercial Efficient Boiler Program as these programs have been successful with residential and commercial customers. In addition, Terasen Gas intends to investigate the feasibility of expanding the Energy Star appliance program. Further, Terasen Gas is currently undertaking a feasibility study around offering a smaller efficient boiler program aimed at commercial customers served under Rate Schedules 2 and 3/23, as well as exploring areas of interest in the lodging and food processing sectors. It should be noted that effective January 1, 2008, MEMPR will be regulating Energy Star furnaces and boilers for residential new construction, so Terasen Gas intends to end its incentive program for Energy Star furnaces and boilers in single family new construction at that time.

8. RESEARCH INITIATIVES

Multi-Utility Studies

Terasen Gas continues to participate in a number of multi-utility research initiatives led primarily by the Canadian Gas Association. An example of this is Terasen Gas' financial participation in Canadian Gas Association's "DSM Protocol Study". Terasen Gas is also participating with Enbridge Gas in a study of domestic hot water appliances.

Gas Contractors Survey

Terasen Gas engaged Synovate to conduct a survey of BC Safety Authority-registered Gas Contractors to collect information about the type of work gas contractors do, and to determine how contractors prefer to receive training. The general result from the survey was that Gas Contractors prefer ½ day or breakfast seminars. This approach was tested at a training meeting for gas contractors in Kelowna in 2006, and it was positively received by the gas contractors who attended.

Conservation Potential Review

In 2006, Terasen Gas received the completed Conservation Potential Review ("CPR") conducted by Marbek Resource Consultants. Marbek was also the lead consultant on the 2002 BC Hydro CPR and was, therefore, able to leverage developed models, market profiles, data classifications and archetypes.

Key Deliverables of the CPR

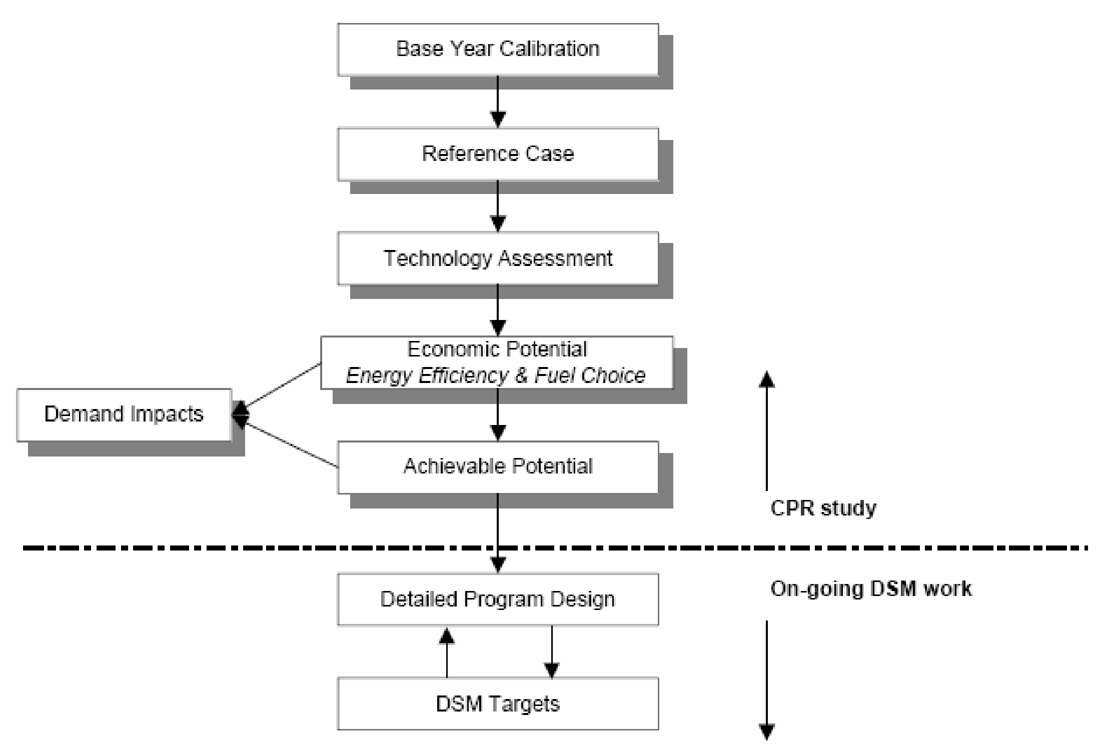
The CPR focuses on economic screening of natural gas and fuel-independent technologies as well as the combined utility economic analysis of *fuel substitution* (from electric to natural gas). It examines resource potential for efficiency at specified milestones, by specific market and end-use, over the 2005 - 2015 forecast period.

The deliverables for each of the outcomes are defined in the following table:

Outcome	Content
Analysis of natural gas DSM measures by geographical area	• Stock definition and update of technologies • technology profiles • economic potential • Sensitivity analysis (uncertain fuel costs) • GHG Impact
Analysis of fuel substitution economics by geographical area	• base year calibration • reference case development • impact on peak demand for gas and electric • consider costs of the marginal source of electrical supply based on geographical area* • GHG Impacts
DSM Achievable potential	• A set of multi-participant workshops to consider delivery, timing and funding constraints

__Overview of CPR Process__

The flow chart below describes the work process undertaken by Marbek in arriving at the conclusions found in the CPR.



Conclusions of the CPR

The high-level results of the CPR are presented below. Cumulative potential GJ amounts in the table below are comprised of a portfolio of potential measures for each sector and geographic region. A more detailed discussion follows of current thinking in British Columbia around energy efficiency, the results of the CPR and the potential for a broader DSM initiative at Terasen Gas.

By 2015/2016, GJ per year	TGVI	Lower Mainland	Interior	Total
Residential EE	-369,000	-5,298,000	-1,847,000	-7,514,000
Commercial EE	-385,000	-1,396,000	-431,000	-2,212,000
Industrial EE	-32,430	-933,064	-924,210	-1,889,704
Subtotal	-786,430	-7,627,064	-3,202,210	-11,615,704
Residential Fuel Sub				1,453,000
Potential Annual Impact				-10,162,704

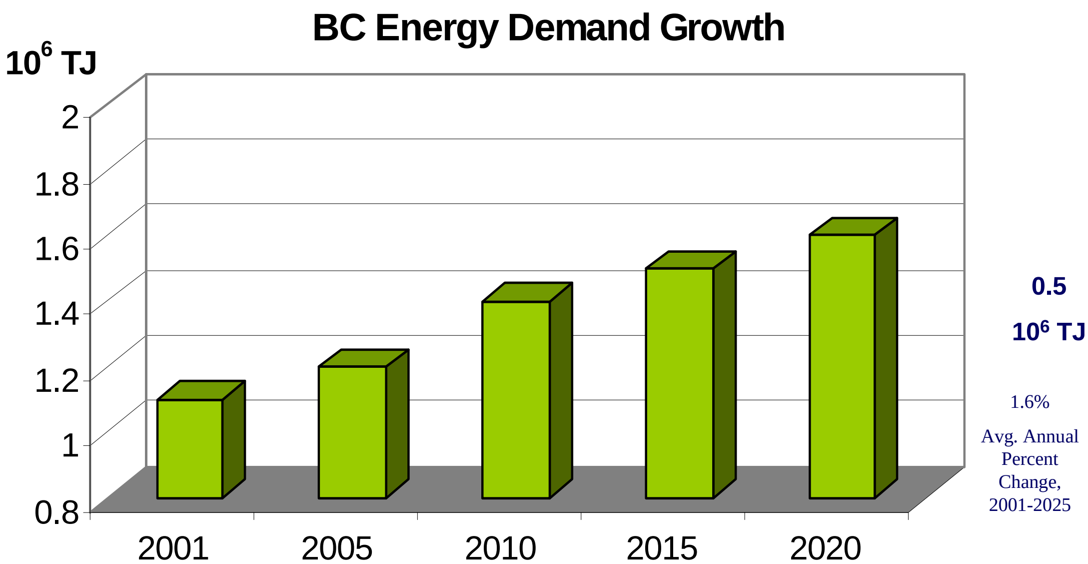
The CPR states that in order to achieve these results, Terasen Gas and its partners would need to increase investments in Terasen Gas demand side management programs by 3 to 5 times the current amount invested.

9. CONSERVATION AND ENERGY EFFICIENCY AT TERASEN GAS: TOWARDS SUSTAINABILITY

The Benefits of Conservation and Energy Efficiency

Terasen Gas believes natural gas provides a safe, reliable, secure, affordable and efficient energy choice to meet the growing needs of businesses and communities while enabling the pursuit of sustainability over the long run. Integral to achieving the sustainability goal in energy choice is the underlying notion of “the right fuel in the right place at the right time”. It makes sense to use natural gas with energy efficient appliances for space and hot water heating, helping to preserve heritage electric capacity for uses where it makes the most sense for things like powering computers, lighting and television.

This is becoming more importantly so, as demand for energy in the Province continues to increase. The following graph outlines the projected energy demand for British Columbia over the next two decades, with demand projected to grow to 1.6 exajoule (1 exajoule = 1,000,000 terajoule) by 2020.



Source: Strategic Imperative for BC's Energy Future – BC Progress Board report

New energy supplies are required to meet growing demand and support economic growth. Conservation and energy efficiency will help meet some of this demand, contributing to providing a sustainable energy solution to meet the energy challenges British Columbians face.

In addition to providing a sustainable energy solution, energy conservation and efficiency initiatives help Terasen Gas customers to lower their annual household energy costs. For example, from 2001 to 2005, first year annual gigajoule ("GJ") savings realized are estimated to have averaged 160,000 GJ per year or cumulatively 800,000 GJ over the five years. At today's residential variable rate of approximately $11.00 per GJ including commodity and delivery, those customers that have participated in energy efficiency opportunities will be saving close to $9 million per year in total.

For Terasen Gas, not only do promoting conservation and energy efficiency initiatives benefit its customers and help contribute to meeting the Province's energy challenges, it helps also to maintain the company's competitive position relative to other energy providers. With the escalation in natural gas prices the last number of years, the significant commodity price advantage that natural gas has enjoyed over other fuels historically, particularly electricity has eroded materially. This fact coupled with the high upfront capital costs of installing natural gas service is leading customers, builders and developers to choose other energy sources than natural gas for space and hot water heating.

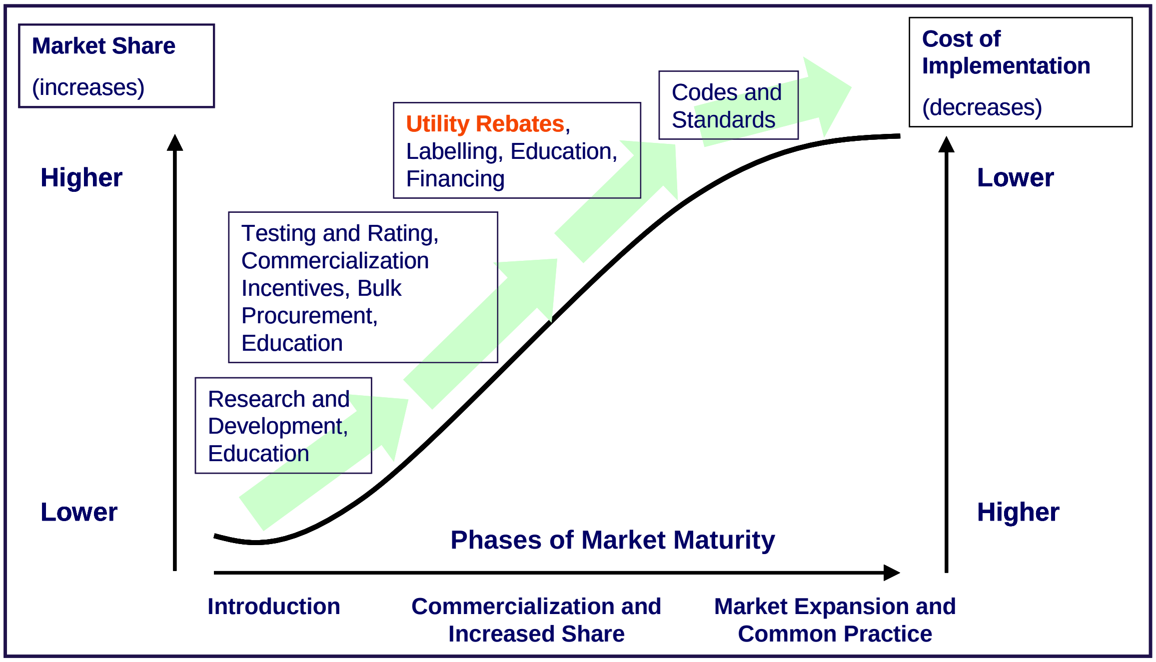
By encouraging use of efficient natural gas appliances through education, awareness and incentive programs, Terasen Gas is able to assist its customers to use natural gas more efficiently, making it that more economically attractive. For example residential customers who have a high efficiency natural gas furnace today pay 30% less for space heating that they would if they used electric space heating. In the long run, providing an efficient, competitively priced energy choice will help Terasen Gas retain and grow its customer base, and contribute to the optimal use and development of the gas distribution system.

Terasen Gas' Approach to Conservation and Energy Efficiency

Terasen Gas' focus and strategy has been to promote natural gas conservation and efficiency to its residential and commercial customers through a combination of awareness, education and incentive programs, incorporating a portfolio approach to DSM planning. Fundamental to maximizing the effectiveness of DSM programs for customers has been Terasen Gas' success in working with third parties such as BC Hydro, NR Can and the MEMPR in developing and implementing energy efficiency programs, with the third parties contributing funds towards the delivery of the programs and incentives paid to customers.

Terasen Gas firmly believes its plays an important role in encouraging conservation and energy efficiency, creating consumer awareness and contributing expertise and resources to encourage adoption of efficient gas technologies. The diagram below outlines the traditional process used to encourage adoption of energy efficiency measures, starting with research and development activities at the early stages, where acceptance of a new efficient technology is low and the costs of implementation are high due to low commercialization of the technology. By encouraging understanding and use of the new efficient technology through education, awareness and financial incentives, the market for the new efficient technology will "mature" to the point where codes and standards can be introduced to make it a mandatory requirement.

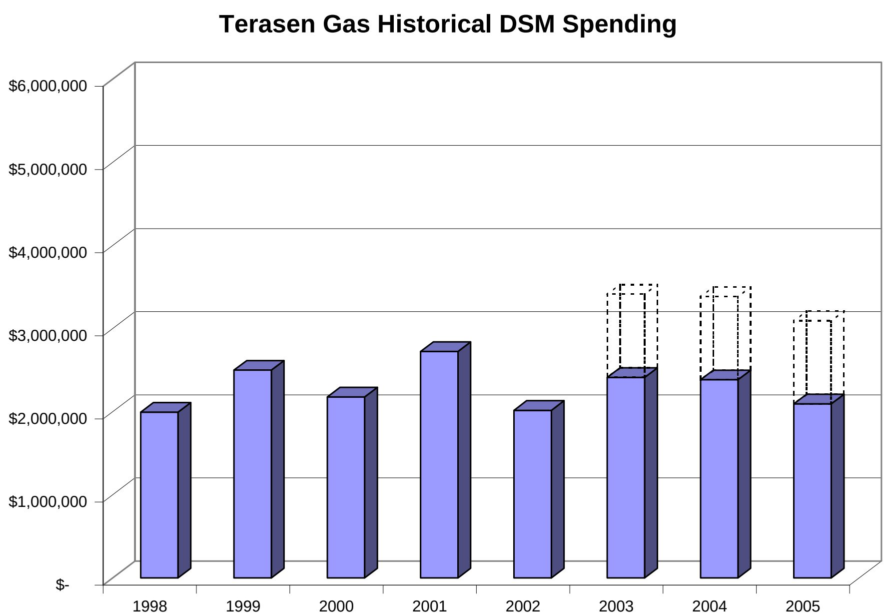
Energy Market Transformation – The Steps Along the Way



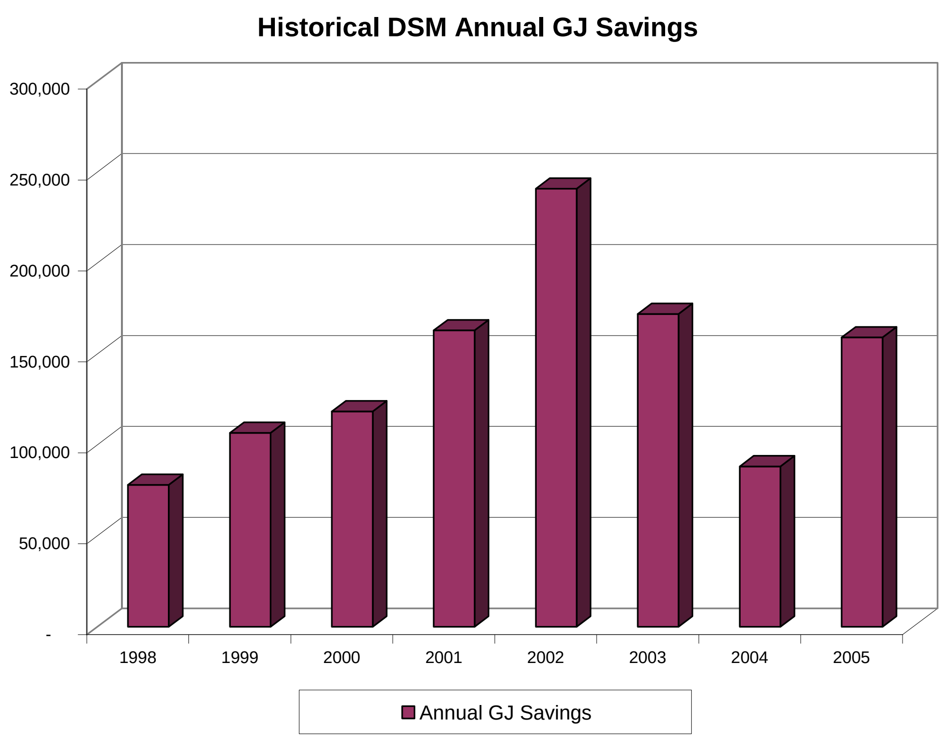
Source: BC Ministry of Energy and Mines

History of Terasen Gas DSM Activities

Terasen Gas' current approved funding of $3.1 million per year; $1.6 million in operating and maintenance expenses and $1.5 million in customer incentives was established as part of the Commission's decision on the 1998 – 2002 Performance Based Rate Plan and Revenue Requirements Application. Since then, no changes have been made to the approved funding levels. The chart following illustrates the actual levels of DSM spending for Terasen Gas from 1998 to 2005. Actual expenditures from 1998 to 2005 averaged about $2.5 million per year, varying from year to year depending on the types of programs launched and the actual customer sign-up rates. Not included in the total expenditures provided are financial contributions from third parties (i.e. NR Can) which are used primarily to increase the financial incentive to a customer for participating in an energy efficiency program. During the last several years, funding partners have contributed over $3 million towards Terasen Gas' energy efficiency programs (refer to graph and outlined sections of bar chart).



The chart below outlines the estimated annual GJ savings associated with the programs launched for each of the years presented.



Annual gas savings for customers have ranged between 80,000 to 240,000 GJs per year from 1998 to 2005 with an average of 125,000 GJs per year over the period. Annual energy savings achieved have been higher on average from 2001 onwards, the time when natural gas prices spiked, triggered by the energy crisis in California. The year 2002 has been the highest in annual energy savings achieved during the last number of years, highlighted with significant response from residential customers to the Furnace Tune-up program offering. First offered by Terasen Gas in the summer of 2001, the heating system tune-up was re-launched in mid 2002 to include both furnaces and boilers. Customer reaction was very positive in 2001, with some 27,000 customers participating. Similar to the 2001 program, the 2002 tune-up offer was formulated to encourage customers to engage a contractor registered with the provincial Gas Safety Program to perform a series of furnace or boiler maintenance operations, performance checks and appliance adjustments. The offer included a $25 utility bill credit for participants. Approximately 45,000 customers participated in 2002, bringing in total overall program participation over the two years to more than 70,000 customers.

The Changing Marketplace for Conservation and Energy Efficiency

Much has changed since 1998 when Terasen Gas' existing DSM funding level was determined. Energy use and cost for oil, gasoline, electricity and natural gas are very much on consumers' minds. Oil prices have risen dramatically in the last couple years and have stayed at the new high levels between $55 to $60 per barrel of oil. Gasoline prices, which significantly impact our daily lives, have jumped from the sixty cent litre of three years ago to just under a $1 per litre today. Electric rates are starting to trend upwards, with rates increasing 10% in the last several years. The natural gas commodity charge Terasen Gas charges has increased from about $2.50 per GJ in 1998 to today's rate of approximately $8.00 per GJ, an increase of approximately 300%. From a consumer's perspective, the economic attractiveness of undertaking energy efficiency improvements is a more pertinent issue today than it was eight years ago.

Use of energy and how best to supply the growing energy needs are also important issues often discussed these days as British Columbians face the challenging task of finding sustainable energy solutions that balance the economic, social and environmental needs of communities and stakeholders. Energy efficiency and conservation are now being seen by stakeholders as a fundamental element of a sustainable energy framework. Evidence of this increased importance is provided in two recent documents published by the MEMPR and the BC Progress Board.

In September 2005, the MEMPR published its Energy Efficient Buildings: A Plan for BC. The plan outlines a number of energy efficiency actions that deliver social, environmental and economic benefits throughout BC by conserving energy and improving the energy efficiency of homes and buildings. Specific to the use of natural gas are targeted annual gas savings by 2020 in the new construction sector of $99 million for new detached single family and row houses and $42 million in new commercial, institutional and industrial buildings.

In November 2005, the BC Progress Board, an independent panel of 18 senior business and academic leaders in British Columbia, issued a report outlining the energy opportunities in British Columbia along with specific actions that should be taken. One of these actions is Strategic Imperative #5 – Conservation and Energy Efficiency are Essential. The report states "*We must reduce energy consumption and emissions. Energy conservation, energy efficiency, and alternative energy sources are the only way to achieve this imperative*."

Comparison of DSM Funding for Natural Gas Utilities in Canada

As a percentage of total utility revenue, Terasen Gas' existing approved DSM funding of $3.1 million per year ranks the lowest when compared to the other major gas utilities DSM funding in Canada. The following table lists the gas utilities in Canada, their DSM funding and their ranking as a percentage of total utility revenue.

2004 DSM expenditures, by company, ranked in order of DSM expenditure as a proportion of revenue

LDC	Number of customers	DSM expenditure ($ millions)	Total utility revenue ($ millions)	% of total utility revenue	Utility revenue less cost of gas ($ millions)	% of utility revenue less cost of gas
Enbridge	1,671,442	$ 13.09	$ 2,408	0.54%	$ 987	1.33%
Gaz Metro	158,527	$ 5.55	$ 1,783	0.31%	$ 555	1.00%
Atco	906,550	$ 4.30	$ 1,550	0.28%	$ 407	1.06%
Union	1,223,584	$ 4.60	$ 1,791	0.26%	$ 885	0.52%
SaskEnergy	326,985	$ 0.73	$ 317	0.23%	$ 167	0.43%
Terasen	885,200	$ 2.20	$ 1,494	0.15%	$ 609	0.36%

Source: DSM Best Practices, Indeco 2005

Terasen Gas ranks last, at the bottom of the list with actual spending recorded in 2004 of $2.2 million, representing only 0.15% of total utility revenue of $1.5 billion. Gas utilities such as Atco Gas in Alberta and Enbridge Gas and Union Gas in Ontario that are similar in size to Terasen Gas in terms of the total number of customers and also the percentage of customers that are residential (i.e. ~90%) spend significantly more each year of their total utility revenues on DSM programs. In 2004, Enbridge Gas spent over $13 million on DSM programs or 0.54% of total revenues. Atco Gas spent over $4 million or 0.28% of total utility revenue whereas Union Gas spent $4.6 million or 0.26% of total utility revenue.

DSM funding for other gas utilities also continue to increase. As part of the Ontario Energy Board's recent decision dated August 25, 2006, on demand side management activities for natural gas utilities, Enbridge Gas' approved DSM funding was increased to $22 million for 2007 with annual increases thereafter of 5% per year resulting in an approved DSM budget for 2009 of $24.3 million. Union Gas' DSM funding for 2007 was approved for $17 million with annual increases of 10% per year for 2008 and 2009, leading to a DSM budget for 2009 of $20.6 million.

As mentioned earlier, Terasen Gas' DSM funding of $3.1 million was set back in 1998, as part of a multi-year performance based rate making agreement. At that time, the approved DSM funding represented approximately 0.4% of total utility revenues of $764 million. Since 1998, no change to DSM funding has been approved with the budget remaining at $3.1 million while the company's total utility revenue has topped approximately $1.5 billion, an increase of 100% largely due to higher commodity prices.

Higher commodity prices provide a greater incentive and benefit for customers to undertake energy efficiency improvements. Terasen Gas' approved DSM funding however has not kept pace with the growing demand for energy efficiency in the marketplace, unlike other utilities such as Enbridge Gas and Union Gas who will be increasing their DSM funding in the coming years, availing their customers the opportunity to manage their household energy costs while at the same time providing a solution to the province of Ontario's energy challenges.

The CPR study has identified a number of opportunities and sectors in which energy efficiency savings can be realized. With the existing approved DSM funding, Terasen Gas will be exploring and evaluating these opportunities in the next year or so with some more detailed research and/or potential pilot programs. However, additional funding will be required in the future to realize the available energy efficiency opportunities identified. Terasen Gas is planning to seek an increase in DSM funding in the future, but in light of the current PBR Settlement Agreement is not seeking such an increase at this time. A future DSM funding request would likely be in the range of at least double the current level of funding.

Following is a more detailed discussion of the opportunities Terasen Gas will be investigating and pursuing in the coming months.

Some Selected Opportunities identified by the Conservation Potential Review Study

Residential - High Efficiency Furnaces and Boilers

MEMPR is going to be regulating high-efficiency furnaces and boilers in new construction effective January 1, 2008, but have indicated that for now, they do not plan to regulate efficiency into the home heating retrofit market. This leaves an ongoing opportunity for high-efficiency home heating appliances to be integrated into existing homes. The CPR identified that participation rates of 58% efficient furnaces in existing single family/duplex homes could be achieved by 2015/2016. Terasen Gas has a track record of success with furnace and boiler upgrade programs, so this is expected to continue to be a core DSM activity.

Residential – Efficient Appliances

This is essentially a domestic hot water efficiency initiative that would incent Energy Star clothes washers and dishwashers in both new construction and retrofits. Terasen Gas is testing an appliance initiative in the PowerSmart New Home Program, co-funded by BC Hydro and MEMPR as a fuel substitution measure from the electricity standpoint, providing a $600 incentive to the customer for an Energy Star fridge, dishwasher, vent fan, and clothes washer and natural gas range and dryer.

Residential – Efficient Fireplaces

MEMPR is introducing legislation effective January 1, 2007, compelling fireplace manufacturers to label fireplaces with efficiency ratings. Terasen Gas will be supporting this legislation by working with the fireplace industry association on a public information campaign related to fireplace heating value and efficiency to coincide with the MEMPR labelling regulation. There is an opportunity for Terasen Gas to provide a stepped incentive to customers that purchase a more efficient fireplace, especially in electrically heated homes, that could potentially install a fireplace which has heating value (as opposed to one that is purely decorative). The CPR identified that participation rates of 30% efficient fireplaces could be achieved by 2015/2016, and also felt that this area had risk associated with the penetration of purely decorative electric fireplaces into the new construction market. Educating consumers about the potential for a fireplace to provide heat while consuming energy, rather than just being a decorative feature, could, in and of itself, prove to be an efficiency measure.

Commercial – Ultra High Efficiency New Construction

The focus of this measure is the application of an integrated design process to the construction of new commercial and institutional buildings, with a goal of designing to 60% savings over the Model National Energy Code for Buildings ("MNECB") for large buildings, and 30% savings over the MNECB for medium and smaller buildings. Interestingly, the incremental costs for an ultra-efficient building (at 60% below MNECB) are lower than the incremental costs for a building at 30% below MNECB, because of the equipment downsizing opportunities that are present with very high performance designs. Programs to incent integrated design in commercial buildings would also have spill over into the high-rise multifamily sector, and Terasen Gas would look to establish an incentive program aimed specifically at the multi-family sector as well as at commercial buildings. Where possible, Terasen Gas would leverage its investment in integrated design with partner programs, such as BC Hydro's High Performance Building program. Training and support for building operators, to ensure that high performance buildings are being maintained and are operating as they were designed, is an integral part of achieving the energy savings goals of efficient buildings. Terasen Gas has already significantly invested in two training initiatives: the Douglas College program and the Building Owners and Managers Association on-line training course, initial important steps towards making an efficient new commercial construction program reality.

Commercial – Improved Boilers in both New Buildings and Retrofits

As mentioned earlier, Terasen Gas' Efficient Boiler Program for large boilers (300,000 BTU/hr and up) has been very successful. The vast majority of the uptake to-date though has been for retrofits. The CPR study identified that approximately 80 to 90 per cent of the new construction market could be encouraged to adopt near-condensing equipment by 2015/2016, once some of the other barriers had been overcome. The CPR suggests that market participation would be highest in the institutional and commercial segments assuming the issue of long-term owner-occupancy is addressed adequately. The CPR study as indicates that a design standard for low temperature design, and operator training were also needed as complementary elements of a successful program.

Terasen Gas is currently investigating the feasibility of launching a similar program for smaller commercial boilers.

Commercial – Small Commercial

Terasen Gas has over 70,000 commercial customers served under Rate Schedule 2, representing a broad and diverse group of businesses. Any efficiency programs targeted to these small commercial customers would have to take this into consideration in designing a program that has broad appeal. Examples of some potential efficiency measures are pre-rinse spray valves for the food preparation sub-sector, efficient clothes washers and dryers for the laundry/dry-cleaning sub-sector, and energy efficient food preparation equipment for the restaurant sub-sector.

Fuel substitution

Fuel choice measures continue to be of great interest to Terasen Gas. Terasen Gas plans to work closely with MEMPR and with BC Hydro to examine ways to encourage and incent British Columbians, including the development community, to use the right fuel for the right place at the right time.

2007 DEMAND SIDE MANAGEMENT STATUS REPORT

1. INTRODUCTION

Under the terms of the extension of the 2004 – 2007 Multi-Year PBR Settlement, Terasen Gas is required to submit an annual Demand Side Management ("DSM") Status Report to the Commission as part of the Annual Review process. This report follows the 2006 Status report in form and content and provides an overview of Terasen Gas' DSM activities in 2007 with details pertaining to the progress of individual DSM programs against forecasted targets and objectives for the year, and details pertaining to other DSM initiatives. As in prior years, Terasen Gas has offered several types of programs most of which are in progress at the time of this writing; therefore, impacts are estimated rather than actual results.

2. GENERAL OVERVIEW OF DSM PROGRAMS AT TERASEN GAS

With the release of the Government of British Columbia's Energy Plan in 2007, the profile of Energy Efficiency and Conservation activities at Terasen Gas increased, and is one of the ways that Terasen Gas can support the provincial policy goals. In 2007, Terasen Gas continued efforts to promote natural gas conservation and efficiency to its customers through a combination of awareness, education and incentive programs. In 2007, the Residential New Construction Heating Program was closed to new applications, and the Efficient Boiler Program was limited to new construction applications.

Energy conservation and efficiency continues to be promoted by a number of other utilities, agencies and industry members. Terasen Gas continues, whenever feasible, to partner with others to better leverage its available DSM funds. BC Hydro and FortisBC are contributing to the Variable Speed Motor component of the Energy Star Heating Upgrade program, along with 15 furnace and boiler manufacturers. In March 2007, Terasen Gas's Contribution Agreement of $2.4 million with the Ministry of Energy, Mines and Petroleum Resources ("MEMPR" or "the Ministry") concluded. This entailed a contribution by the Ministry to both program and incentive costs for a market survey of gas contractors, for Energy Star furnace/boiler upgrades in residential new construction and retrofits, for a Commercial Boiler program and for sponsorship of the 2006 BC Energy Forum. The Government of Canada has implemented their Eco-Energy strategy of retrofits for various residential upgrades, and the 2007 version of the Energy Star Heating Upgrade program is incremental to the federal grant of $300 to $500 for an Energy Star furnace upgrade. More information about the federal government's Eco-Energy program is available at http://www.oee.nrcan.gc.ca/residential/personal/retrofit-homes/retrofit-qualify-grant.cfm?attr=4#eligible.

As in past years, programs are subjected to economic cost-benefit tests (most notably a standardized Total Resource Cost test) prior to launch, and in this report (in response to Commission Order G-160-06) Terasen Gas has also included information on the Ratepayer Impact Measure Test, the Participant Cost Test and the percentage of "free riders". Terasen Gas has launched an evaluation of the Energy Star Heating Upgrade program that ran from September 2005 to March 2007, and the first results are anticipated to be available early in 2008 and will be included in next year's Annual Review. The evaluation will provide insight into opportunities for future improvement and assist in measuring actual natural gas savings against projections, as well as free ridership rates.

DSM initiatives also produce benefits for the utility, the customer, and society in general which are not considered part of the Total Resource Cost ("TRC") test, particularly greenhouse gas emission reductions. The greenhouse gas ("GHG") emission reductions from Terasen's DSM activities are tracked but in the cost-benefit analysis that Terasen Gas performs, the GHG emission reductions have not been monetized.

3.0 EDUCATION AND OUTREACH INITIATIVES

Destination Conservation

Destination Conservation (DC) is a K-12 school program involving students, teachers and school facilities management staff. The program is organized by the Pacific Resource Conservation Society, a BC based not-for-profit group, and offered to school districts. It features energy conservation curricula and support materials for participating teachers and technical assistance to school facilities management staff. Terasen Gas contributes a portion of the first year operating costs for the program to a number of school districts in prior years. In the FortisBC service territory, FortisBC contributes the second year operating costs, providing another example of how Terasen works with partners to deliver programs. Although participation in the program last year was weak due to a distraction within BC's education system reflecting teachers' contract negotiations, this year participation has picked up significantly, partially because the labour situation is now settled, but also because of the focus provincially on conservation and climate change.

To date there are three new districts joining the Destination Conservation program for the 2007 school year with the support of Terasen Gas. Vancouver School District (SD #39) is operating a pilot of the program with 15 schools registered. The intention is for the program to expand based on the savings demonstrated by these 15 schools. Likewise the Central Okanagan School District (SD #23) has 11 schools registered to participate in DC this year, with the intent of expanding the program in 2008. The final district joining the program this year is Okanagan Skaha (SD #67) in the Penticton area. All 18 schools in this district are registered to participate in DC. There are 44 new schools in all supported by Terasen Gas in their first year.

As first year schools, all three districts will be participating in the energy workshop stream. The Orientation, Energy 1, Energy 2 and Celebration sessions engage the building occupants – staff, students and parent volunteers. There are also two building operator training workshops, usually held back to back. These mirror the occupant workshops focusing on lighting and heating, ventilation and air conditioning in year one.

Commercial Energy Utilization Advisory

This program is offered to larger Rate Schedule 3/23 and Rate Schedule 5/25 commercial customers. The offer includes an initial benchmarking consultation and an onsite assessment of natural gas conservation and efficiency opportunities along with recommendations and estimated savings. As of June 30 2007, there have been 59 completed assessments in 2007, and expected total of by year end is 100. Typically, 25% of the customers who receive the assessment implement the recommended measures and average 600 Gigajoules (“GJ”) in annual savings.

Publications

Terasen Gas continues to publish brochures and other collateral to encourage residential customers to adopt energy savings measures and practices. These include our “Hot Tips” booklet, which contains a number of energy saving tips that homeowners can readily perform themselves, as well as bill inserts and our customer newsletter.

Mass Media Communication

In 2007, Terasen Gas discontinued the use of television commercials as a way to promote its energy efficiency programs and to draw attention to the importance of energy efficiency.

Instead, the company focussed on radio as a cost-effective medium for communicating information about energy efficiency in general, and the Energy Star Heating Upgrade program in particular.

Community Energy Planning Participation

Terasen Gas continues to be an active participant in community-based conservation initiatives (i.e. the Community Energy Association) and collaborates with the provincial and federal governments to review and to implement energy efficiency standards. Terasen Gas is an active supporter of British Columbia's "Community Action on Energy Efficiency" strategy (http://www.em.gov.bc.ca/AlternativeEnergy/EnergyEfficiency/default.htm).

Trade Show Activity

Terasen Gas increased its trade show activity in 2007, promoting energy efficiency and conservation at Buildex 2007 (aimed at construction and building trades, as well as architects, engineers, developers and builders), the Vancouver Spring Home and Garden Show, the Vancouver Fall Home and Interior Design show as well as home shows in Kelowna and Kamloops. The company found this to be an effective way to reaching customers with energy saving information and answering their questions.

Other Activities

Terasen Gas engages in a number of demand side management related activities designed to enhance energy efficiency in British Columbia. Some of them are described below:

- Terasen Gas participated and continues to participate on the Steering Committee for BC Hydro's Conservation Potential Review and on BC Hydro's Electricity Conservation and Efficiency Advisory Committee.
- Terasen Gas's sponsorship of the Douglas College program "Building Operator Training" which is designed to address ongoing maintenance and upgrades to commercial building operations by training facilities staff in efficiency techniques was expanded to make the course available in Prince George and Kelowna
- Terasen Gas sponsored participation for members in the Building Owners and Managers Association's on-line training course related to energy efficiency.

4. 2007 INCENTIVE PROGRAM DESCRIPTIONS

Please note that in 2007, Terasen Gas commissioned and received from Willis Energy Services an updated model for calculating DSM cost/benefit ratios and TRC results. The method of presenting energy savings from DSM activity has changed from that presented in previous years to reflect this improved model. In previous Annual Reviews, energy savings have been presented as simple annual savings. Energy savings and cost/benefit test results are presented in the 2007 Annual Review as the present value of the savings over the measure life, to more appropriately represent energy savings from DSM activity. A discount rate of approximately 5.9%, representing Terasen's after tax weighted average cost of capital, was used to determine the present value of the energy savings. It is the intention of Terasen Gas to continue to use the present value measure life method of presenting savings and analyzing cost/benefit results in all future reviews.

Energy Star Heating System Upgrade

The 2007 program represents a continuation of previous years' programs. As in previous years, this year's Residential Heating System Upgrade program offers financial incentives to residential customers to replace older furnaces and boilers with ENERGY STAR qualified high efficiency natural gas models. The "Winter 2007" version of the program was officially launched September 1, 2007 and runs to March 31, 2008. Partners on this program are BC Hydro, FortisBC, and 15 participating manufacturers. These partners are contributing to customer incentives.

Under this program, residential customers are offered a $250 utility bill credit towards the purchase of an ENERGY STAR qualified high efficiency natural gas furnace or boiler. BC Hydro and FortisBC are contributing an additional $50 incentive if the selected furnace has a variable speed motor.

Additional supplier-funded incentives ranging from $150 to $1,000 in value toward the purchase of 15 brands of ENERGY STAR qualified furnaces and boilers are being promoted by Terasen Gas as part of this program. The manufacturers are responsible for administering their own coupons and the manufacturer coupons are only valid for redemption between September 1, 2007 and January 31, 2008

The program design for the Energy Star Heating System Upgrade program estimates the average annual natural gas savings at 13.8 GJ per participant. There have been 3666 participants in the program year to date, and Terasen estimates that there will be an additional 650 participants to December 31, 2007. This participation level results in a present value (PV) energy savings over the measure life of 344,369 GJ, a present value measure life GHG savings of 17,456 tonnes, and a Total Resource Cost Ratio (TRC) of 1.39.

<u>New Construction Energy Star Heating System Program/PowerSmart New Home Program</u>

This program was closed to new applications March 31, 2007. Effective January 1, 2008, the Government of British Columbia has legislated under the Energy Efficiency Act that all furnaces and boilers in new construction be Energy Star-rated. Given construction lead times, in order to minimize free rider rates, Terasen Gas felt that builders who were going to apply to the program for homes to be completed by December 31, 2007 would have done so by March 31 of this year.

Terasen's involvement in the BC Hydro PowerSmart New Home Program also ended March 31 2007. Terasen had 80 applications for the Energy Star heating and natural gas hot water components of the Power Smart New Home program. These participants have been incorporated into the results for the New Construction Energy Star Heating System program presented below

For the New Construction Energy Star Heating System Program, it is estimated that the average annual natural gas savings is 9.1 GJ per participant with 2981 homes participating. This results in a present value energy savings over the measure life of 250,950 GJ, a present value measure life GHG savings of 12,721 tonnes and a TRC of 1.73.

Efficient Boiler Program

This program was modified again from that which was offered in previous years. In 2006, the incentives offered under the Efficient Boiler Program were increased in response to increases in boiler prices and the market responded very positively to this modification in incentives. In order to stay within the funding envelope allocated for the program, incentives were restricted partway through 2007 to applications for new construction only.

Given the high degree of variability in both incentive amounts and in projected annual savings, only actual approved applications to date are reported here. It is impossible to estimate applications that might be submitted between now and the end of 2007 with any degree of certainty. The present value of energy savings over the measure life for applications received for the Efficient Boiler Program to date is 155,041 GJ, with a present value measure life GHG savings of 7,859 tonnes and a TRC of 1.47.

5. SUMMARY OF 2007 RESULTS

TRC Test and DSM Incentive Status

The TRC test is a measure of the net benefits of a utility's DSM programs. Terasen Gas calculates overall TRC impact on a 'portfolio' basis, that is, by examining the impact of the combined group of programs for the year.

For the 2007 portfolio (as identified in the table below), the TRC net benefit for specific programs is forecasted to be approximately $6,368,000 with a combined TRC ratio of 1.85. The numbers presented in the table below reflect actual incentive applications year to date for the Residential New Construction Heating Program, the PowerSmart New Home Program, the Efficient Boiler Program and Destination Conservation, and projections for the Energy Star Heating Upgrade Program and the Commercial Energy Assessment Program. The TRC net benefit from programs, less the non-program-specific DSM costs incurred for salaries, administration, overhead, research, and non-program related education, outreach and promotion is forecasted to be approximately $5,494,073

Discount Rate 5.9%

Program Name	Number of Participants	Savings per Participant per Year (GJ)	Measure Life (Years)	NPV Energy Savings over Measure Life (GJ)	GHG Savings over Measure Life (tonnes)	Free Rider Rate (%)	RIM Result	Participant Result	TRC Result	TRC Net Benefit
Energy Star Heating System Upgrade	4316	13.8	20	344,369	17,456	50	0.58	2.8	1.39	$1,123,000
New Construction Energy Star Heating System Program	2981	9.1	20	250,950	12,721	20	0.81	3.6	1.73	$1,222,000
Efficient Boiler Program	20	14650*	25	155,041	7,859	20	0.93	1.9	1.47	$571,000
Destination Conservation	44	113	3	13,315	675	0	0.74	6.4	1.56	$55,000
Commercial Energy Utilization Advisory	100	600	15	439,921	22,300	25	0.95	3.5	3.03	$3,397,000
			Program Portfolio Result	1,203,596	**61,010**		**0.78**	**3.1**	**1.85**	**$6,368,000**

* note that the savings for the Efficient Boiler Program are not presented per participant per year, but are instead an aggregate of savings for all participants for the year

Greenhouse Gas Reduction

In its demand side management incentive offers, Terasen Gas informs participating customers of its intent to record resulting emission reductions as part of the company's Greenhouse Gas Management Program. The present value of the GHG savings over the projected lives of the various measure resulting from Terasen Gas energy efficiency incentive programs is estimated to be 61,010 tonnes.

DSM Incentive Mechanism

To qualify for the DSM Incentive, a threshold of 75% of the established energy savings target of 177,425 GJs simple annual savings must be achieved, entitling Terasen Gas to an incentive of 3% of the TRC net benefits. Where the energy savings meet or exceed the threshold target of 177,425 GJs, the incentive percentage increases to 5% of the TRC net benefits. The simple annual savings from Terasen Gas DSM programs in 2007 are shown in the table below. Given the projected simple annual energy savings and net TRC benefits for 2007, Terasen Gas would be eligible for a DSM incentive of approximately $164,822.

Program Name	Number of Participants	Savings per Participant per Year (GJ)	Annual Savings (GJ)
Energy Star Heating System Upgrade	4316	13.8	59,561
New Construction Energy Star Heating System Program	2981	9.1	27,127
Efficient Boiler Program	20	14650*	14650*
Destination Conservation	44	113	4,972
Commercial Energy Utilization Advisory	100	600	60,000
Total Annual Savings			151,660

* note that the savings for the Efficient Boiler Program are not presented per participant per year, but are instead an aggregate of savings for all participants for the year

6. SUMMARY OF COSTS

Program and administration costs as well as customer incentive costs are forecasted to remain within the allowed levels in 2007. Program and administration costs are treated as O & M and incentives are recovered through a deferral account.

	Allowed ($000)	Projected ($000)
Administration, program costs, marketing and research	1,624	1,600
Customer Incentives	1,500	1,500

7. RESEARCH INITIATIVES

<u>Multi-Utility and Industry Studies</u>

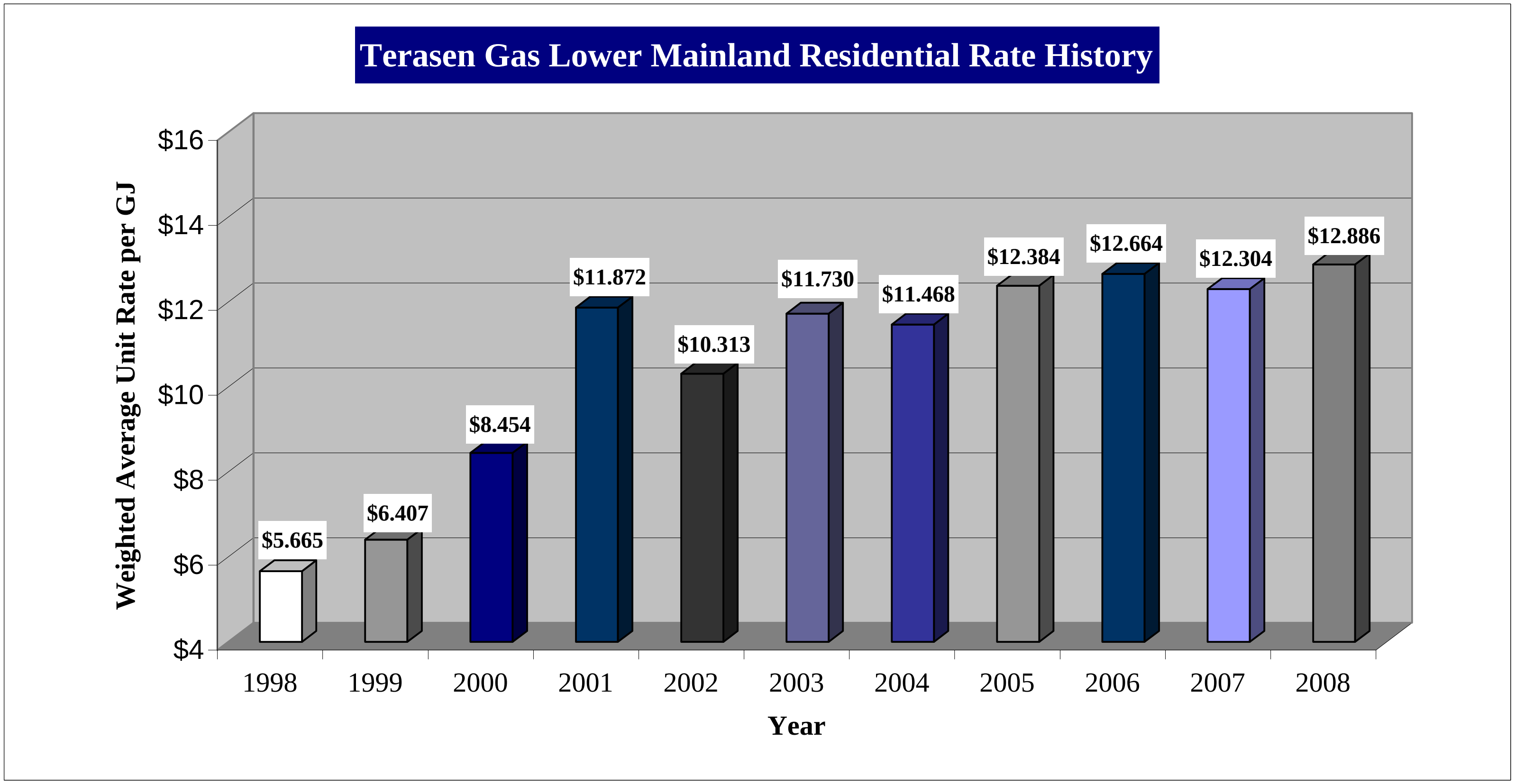
Terasen Gas continues to participate in a number of multi-utility research initiatives. The City of Vancouver's Sustainability Office has been particularly active in this area, and Terasen Gas has participated or is participating in studies around Pre-Rinse Spray Valves, Building Recommissioning, Efficiency Upgrades in Strata Buildings and an Energy Consumption Benchmarking Study for Multi-Family Dwellings. One new area of participation for Terasen Gas is with the Consortium for Energy Efficiency based in the United States, and the company anticipates participating in various equipment studies led by that organization.

8. PROPOSED 2008 ACTIVITY

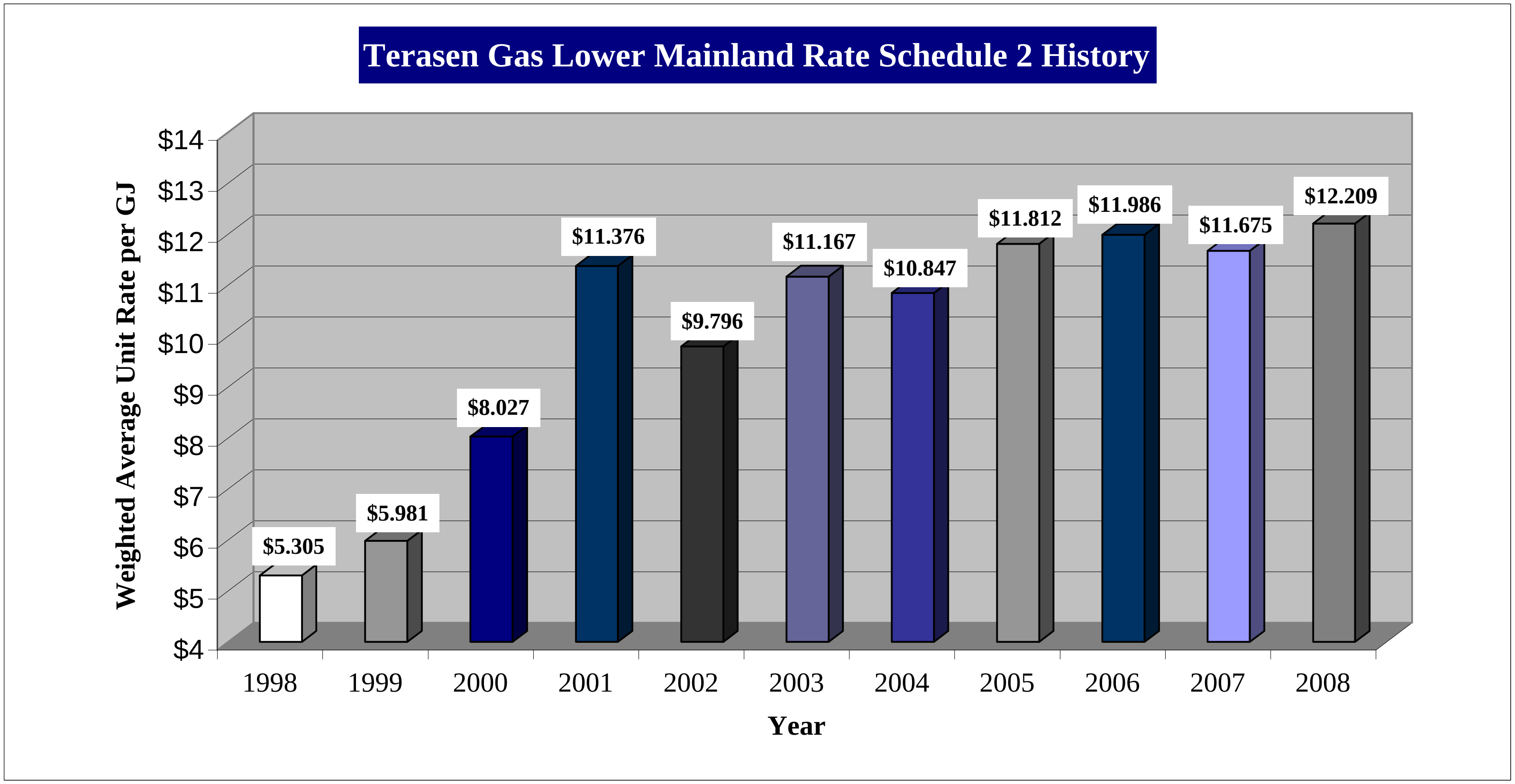
As part of the 2006 Annual Review process as well as the extension of the 2004-2007 PBR Settlement Agreement through 2009, the Company committed to filing an application in 2007 for Energy Efficiency and Conservation programs, commencing in 2008. Terasen Gas expects to submit this application later this year. Terasen Gas anticipates that the Company will be seeking increases in efficiency and conservation funding over the levels currently allowed for in the Settlement Agreement. The Company anticipates that the regulatory review of this application will not be complete until early in 2008.

For the purposes of this Annual Review materials filing, the Company has assumed that the level of incentives and O&M costs for DSM activities equals that included in the Settlement Agreement of $3.1 million per year. As stated above, the Company expects that the regulatory review of this application will not be complete until early in 2008, with the new programs commencing in 2008. As a result, the Company has not included additional expenditures in the 2008 test year forecast. The Company will seek, subject to Commission approval, deferral account treatment in 2008 for any additional expenditures approved by the Commission for 2008, as part of the review of the Company's Energy Efficiency and Conservation application.

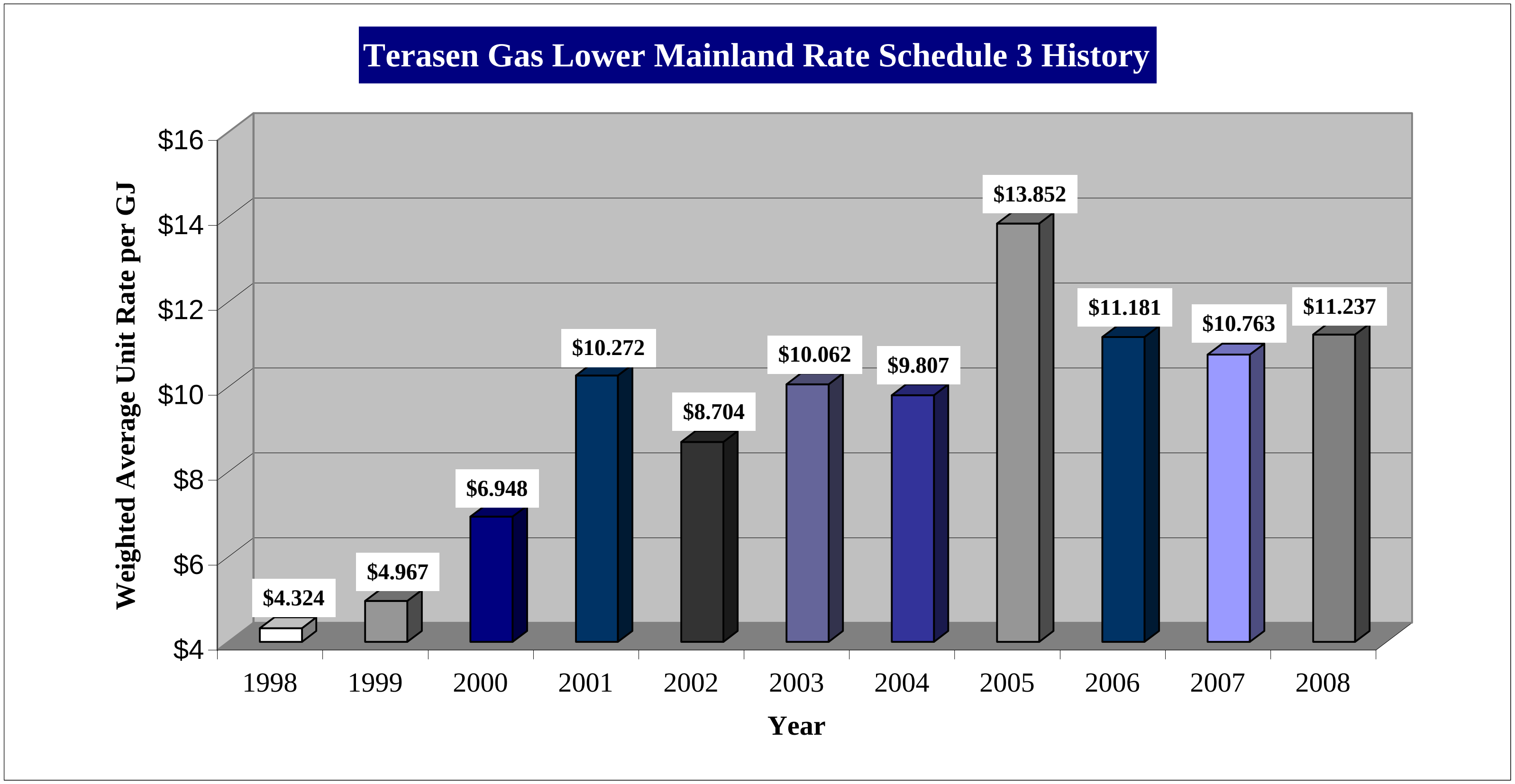
Appendix 3



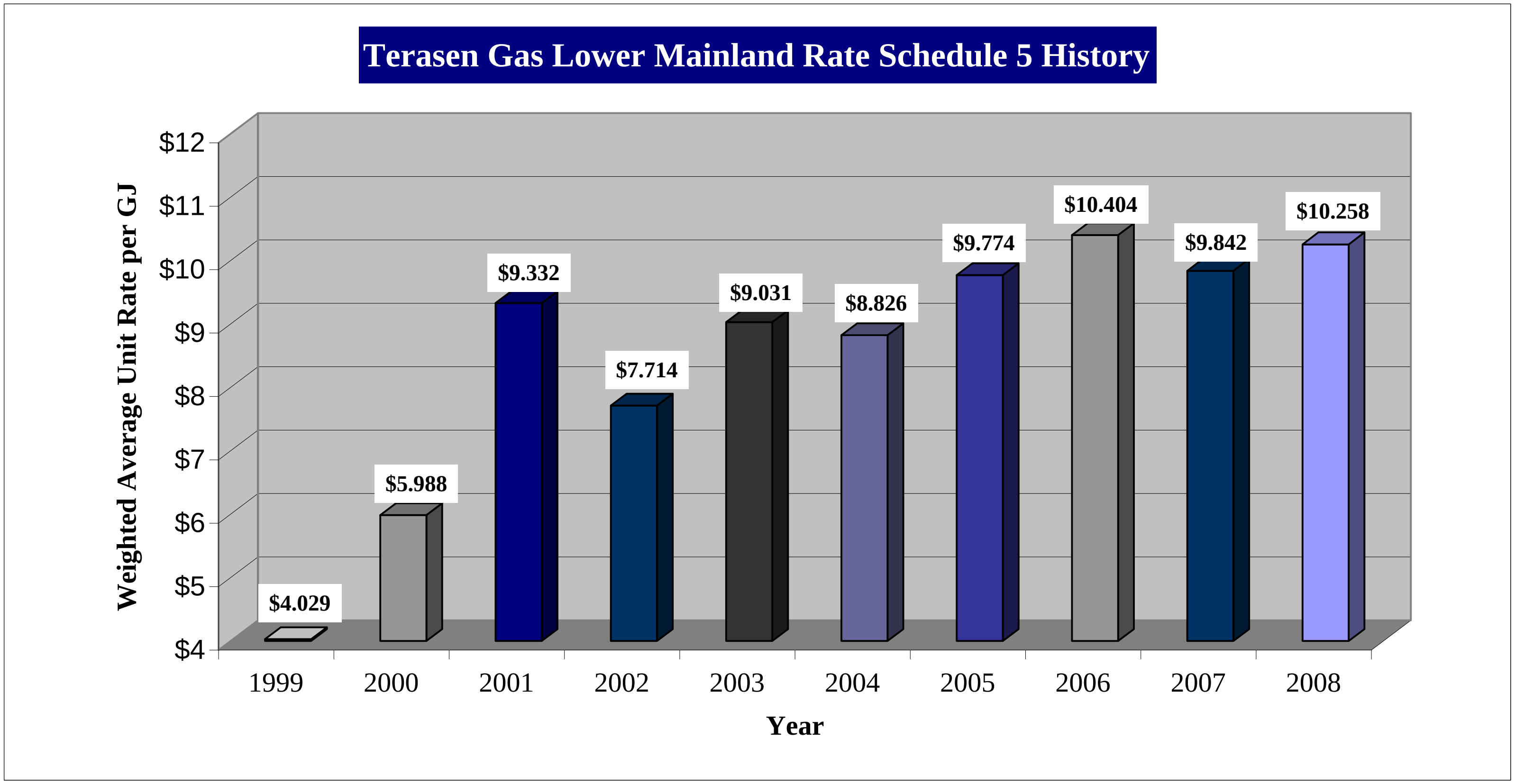
Terasen Gas Lower Mainland Residential Rate History
Weighted Average Unit Rate per GJ
$16
$14
$12
$10
$8
$6
$4
$5.665
$6.407
$8.454
$11.872
$10.313
$11.730
$11.468
$12.384
$12.664
$12.304
$12.886
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year



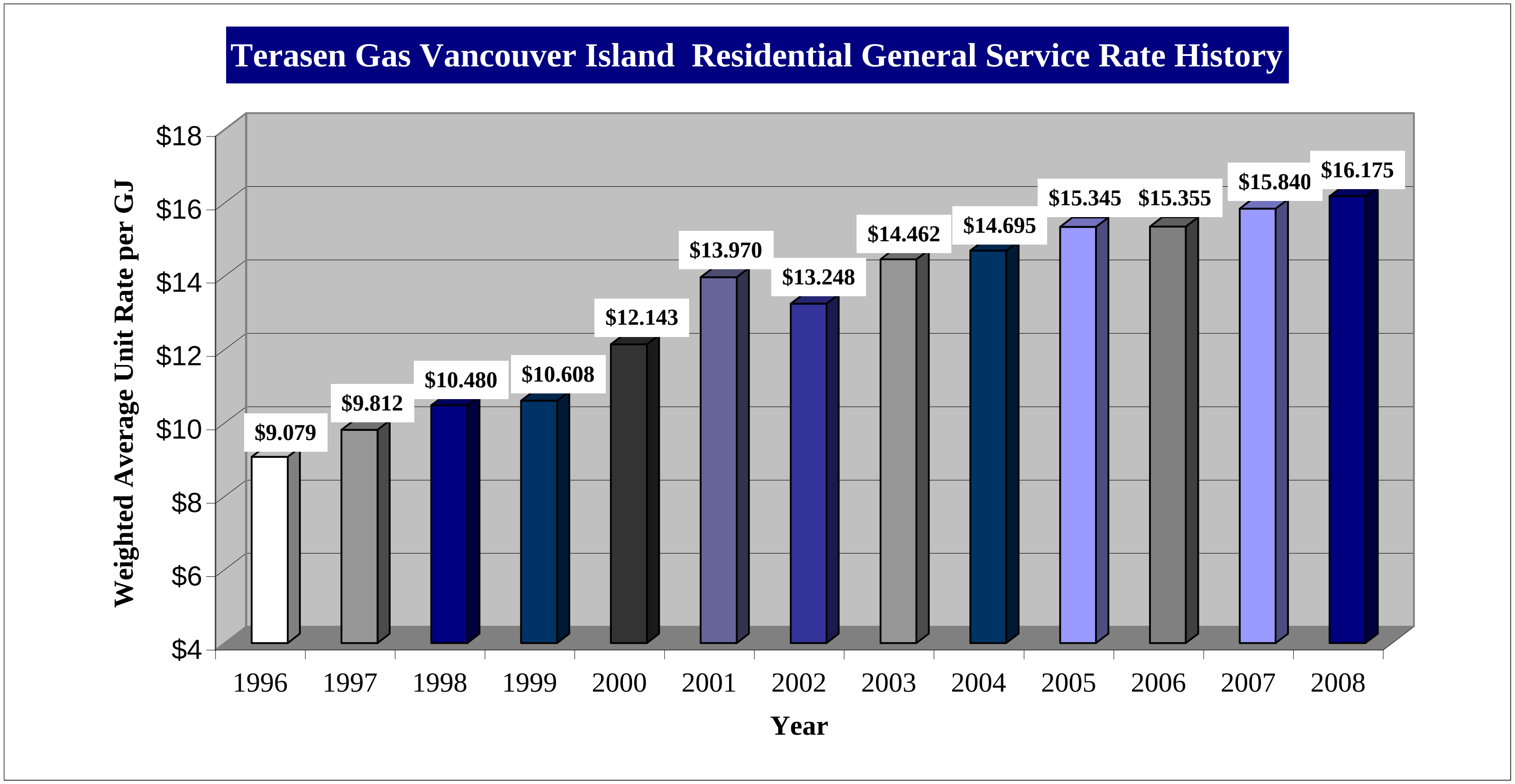
Terasen Gas Lower Mainland Rate Schedule 2 History
Weighted Average Unit Rate per GJ
$14
$13
$12
$11
$10
$9
$8
$7
$6
$5
$4
$5.305
$5.981
$8.027
$11.376
$9.796
$11.167
$10.847
$11.812
$11.986
$11.675
$12.209
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

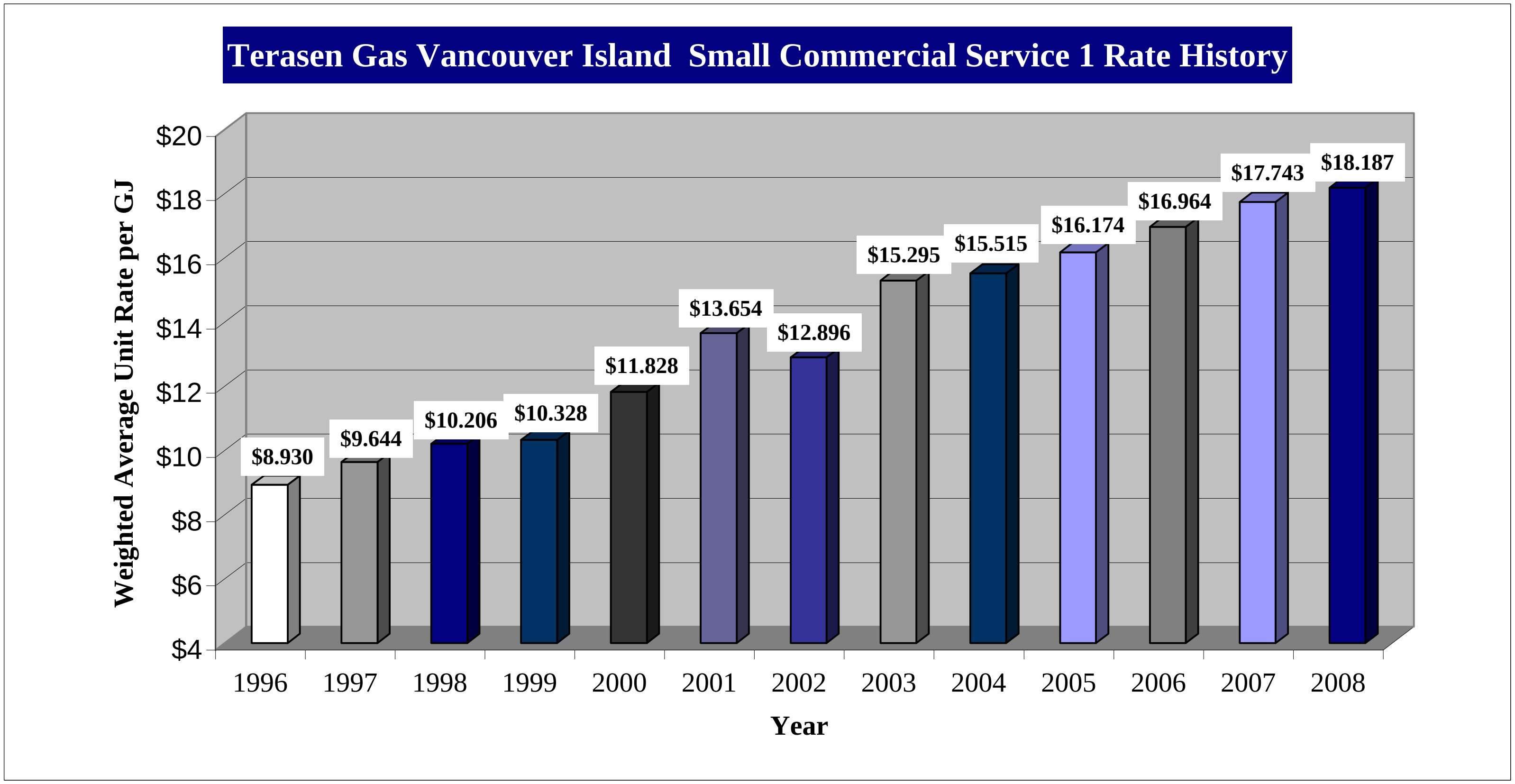


Terasen Gas Lower Mainland Rate Schedule 3 History
Weighted Average Unit Rate per GJ
$16
$14
$12
$10
$8
$6
$4
$4.324
$4.967
$6.948
$10.272
$8.704
$10.062
$9.807
$13.852
$11.181
$10.763
$11.237
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year



Terasen Gas Lower Mainland Rate Schedule 5 History
Weighted Average Unit Rate per GJ
$12
$11
$10
$9
$8
$7
$6
$5
$4
$4.029
$5.988
$9.332
$7.714
$9.031
$8.826
$9.774
$10.404
$9.842
$10.258
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year


Terasen Gas Vancouver Island Residential General Service Rate History
Weighted Average Unit Rate per GJ
$18
$16
$14
$12
$10
$8
$6
$4
$9.079
$9.812
$10.480
$10.608
$12.143
$13.970
$13.248
$14.462
$14.695
$15.345
$15.355
$15.840
$16.175
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year


Terasen Gas Vancouver Island Small Commercial Service 1 Rate History
Weighted Average Unit Rate per GJ
$20
$18
$16
$14
$12
$10
$8
$6
$4
$8.930
$9.644
$10.206
$10.328
$11.828
$13.654
$12.896
$15.295
$15.515
$16.174
$16.964
$17.743
$18.187
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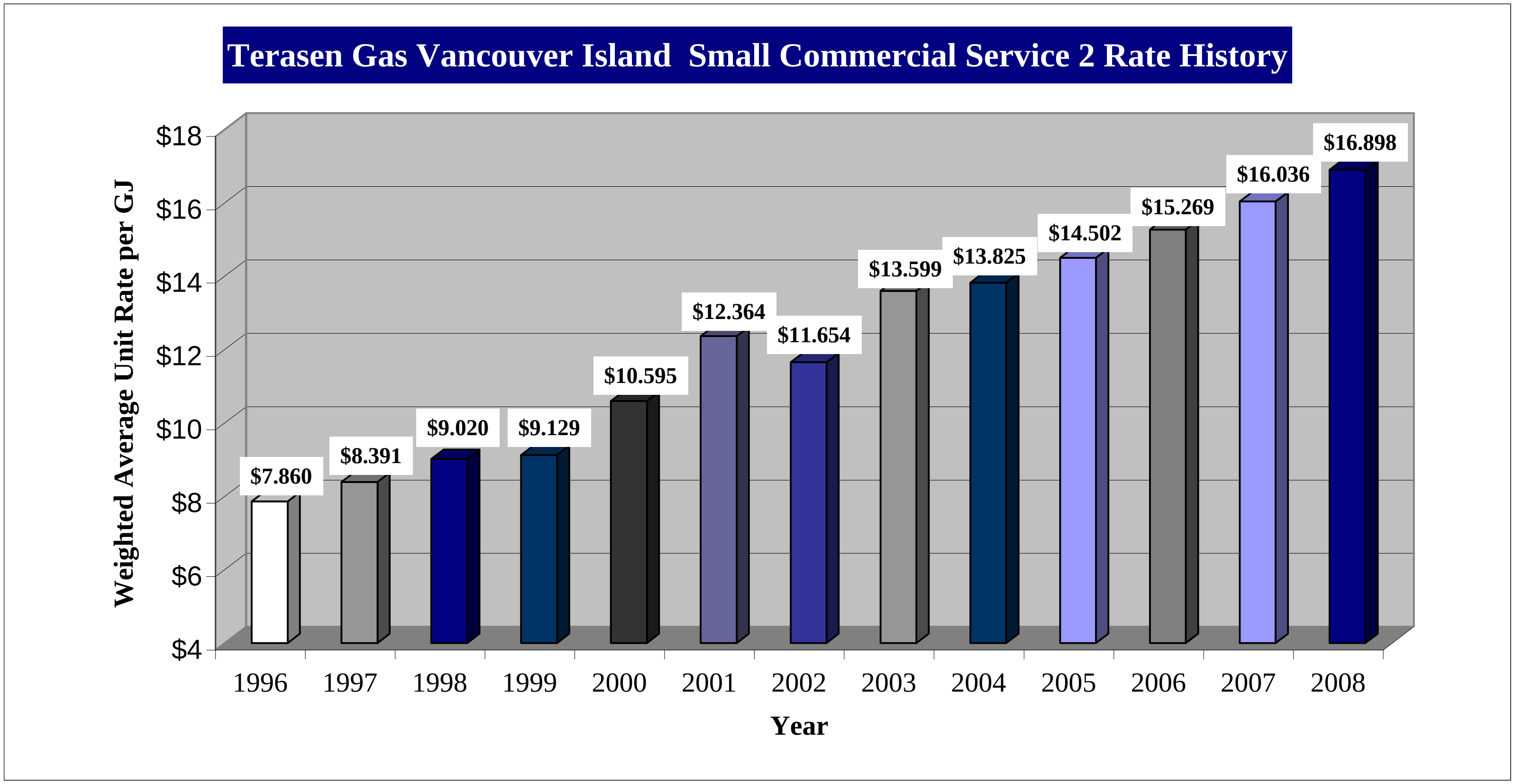
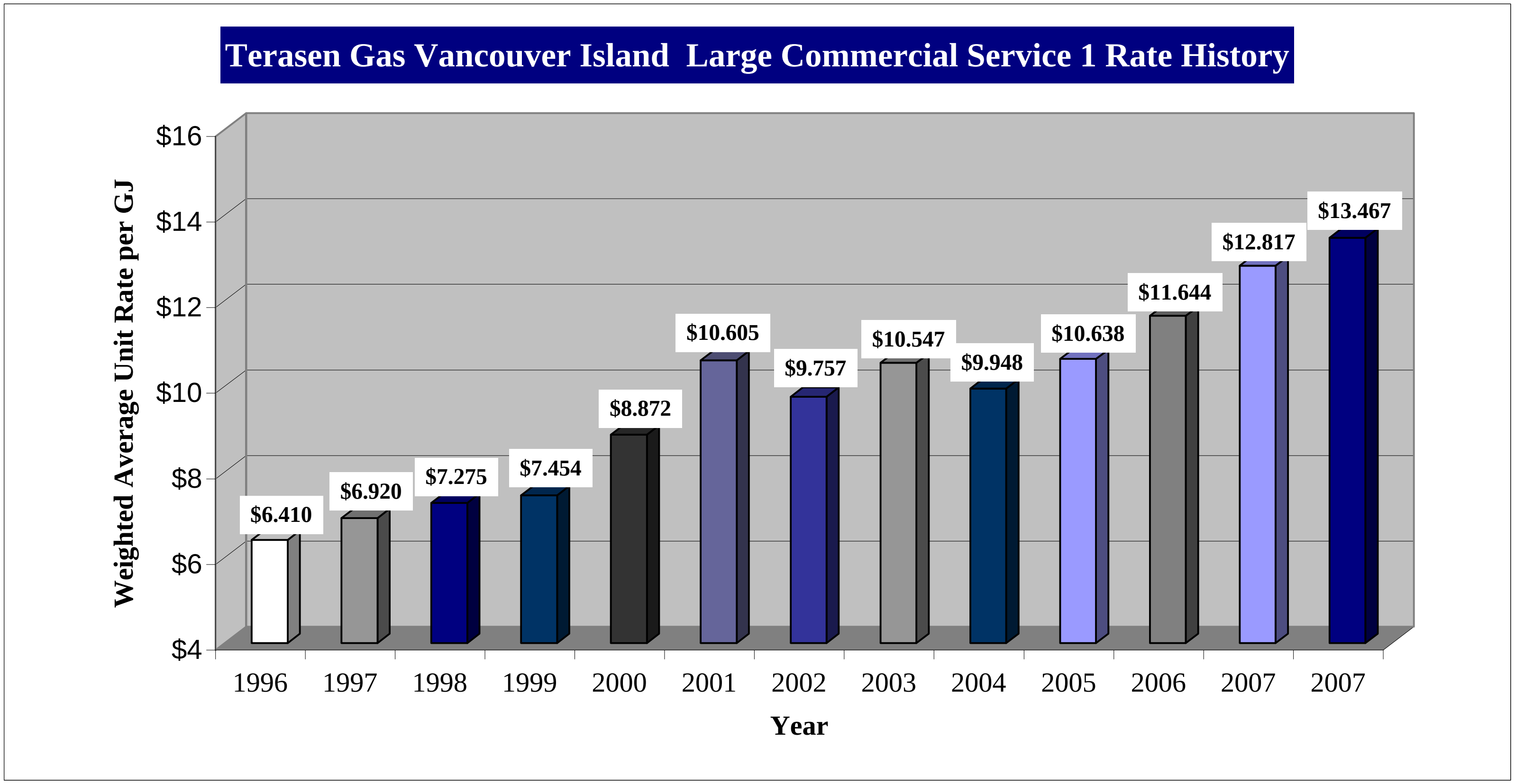
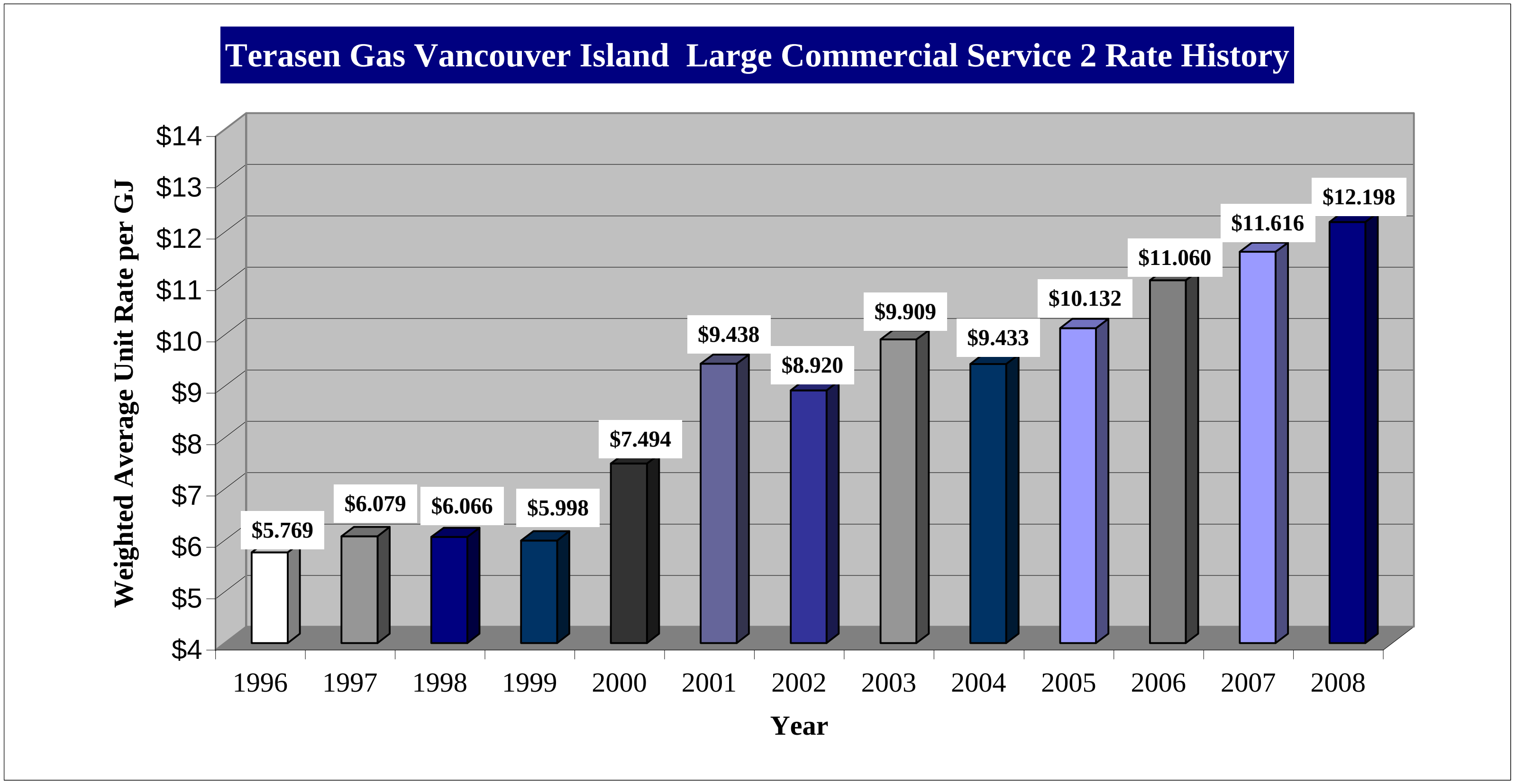
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

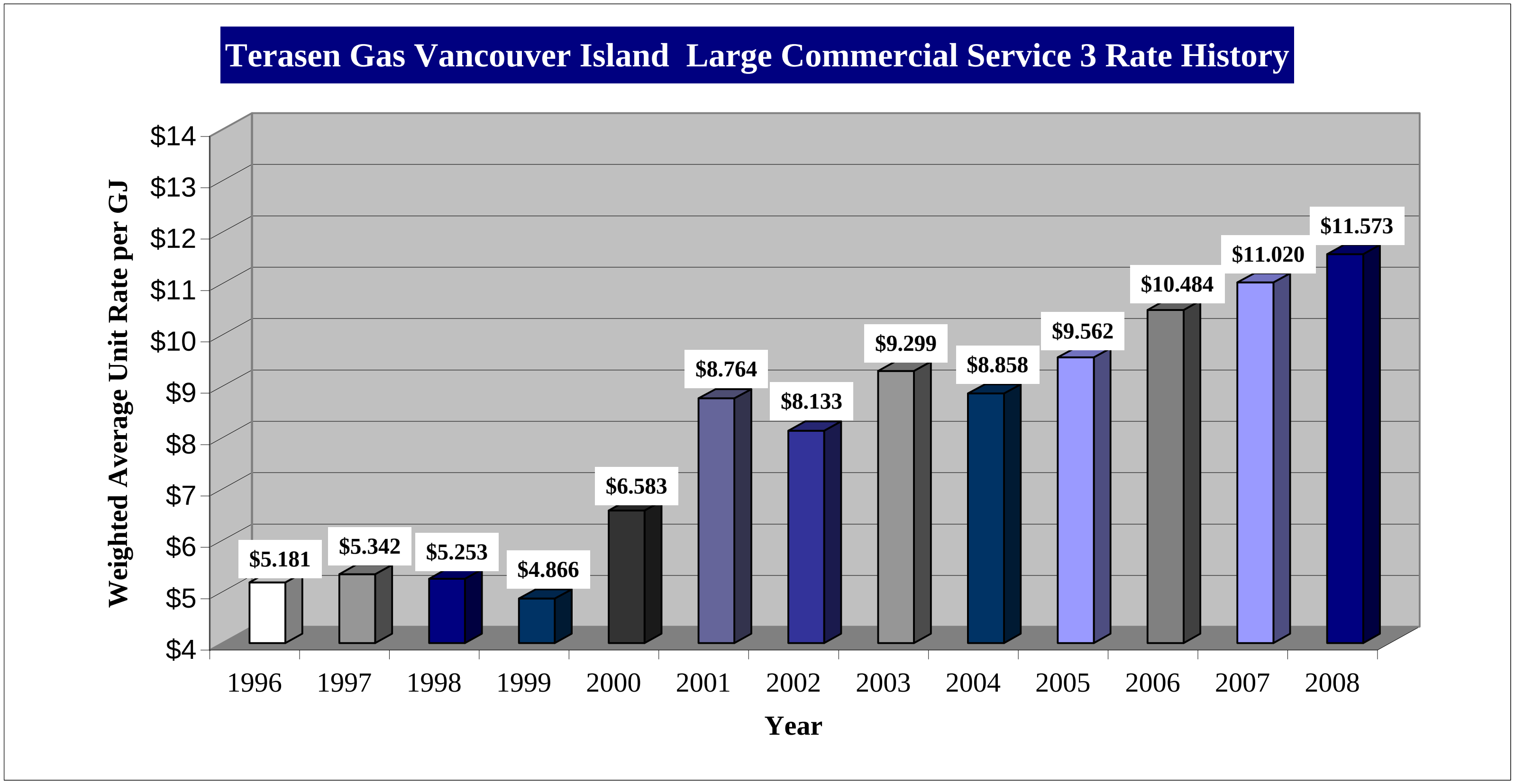


Terasen Gas Vancouver Island Small Commercial Service 2 Rate History
Weighted Average Unit Rate per GJ
$18
$16
$14
$12
$10
$8
$6
$4
$7.860
$8.391
$9.020
$9.129
$10.595
$12.364
$11.654
$13.599
$13.825
$14.502
$15.269
$16.036
$16.898
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year



Terasen Gas Vancouver Island Large Commercial Service 1 Rate History
Weighted Average Unit Rate per GJ
$16
$14
$12
$10
$8
$6
$4
$6.410
$6.920
$7.275
$7.454
$8.872
$10.605
$9.757
$10.547
$9.948
$10.638
$11.644
$12.817
$13.467
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2007
Year


Terasen Gas Vancouver Island Large Commercial Service 2 Rate History
Weighted Average Unit Rate per GJ
$14
$13
$12
$11
$10
$9
$8
$7
$6
$5
$4
$5.769
$6.079
$6.066
$5.998
$7.494
$9.438
$8.920
$9.909
$9.433
$10.132
$11.060
$11.616
$12.198
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year



Terasen Gas Vancouver Island Large Commercial Service 3 Rate History
Weighted Average Unit Rate per GJ
$14
$13
$12
$11
$10
$9
$8
$7
$6
$5
$4
$5.181
$5.342
$5.253
$4.866
$6.583
$8.764
$8.133
$9.299
$8.858
$9.562
$10.484
$11.020
$11.573
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

Appendix 4

Introduction

The selection of utilities was based on geography and jurisdiction. In general, U.S. utilities presented in this report tend to have larger Demand Side Management ("DSM") budgets than their Canadian counterparts. Canadian utilities referred to in this report include: ATCO Gas, BC Hydro and Power Authority Limited ("BC Hydro"), Enbridge Gas Distribution Inc ("EGD"), Gaz Métro Limited Partnership ("Gaz Metro"), Manitoba Hydro, SaskEnergy and Union Gas Limited ("Union Gas"). US utilities include: Puget Sound Energy ("PSE"), NW Natural, Pacific Gas and Electric Company ("PG&E"), and Southern California Gas ("SoCalGas").

Background research was collected via the internet from utility websites, public websites, utility commission and government websites. Initial findings were followed up by personal telephone interviews with key DSM personnel at these utilities. The first phase of research was carried out between May and July 2007, while the second phase of research took place from November to December 2007.

Canadian utilities are listed first. Company information is broken into two sections:

Company Overview – covering:

- core business details
- customer base
- revenue information
- other relevant facts and figures

DSM Programs Overview – covering:

- key information about DSM activities
- energy efficiency initiatives
- regulatory environment
- summaries of interview discussions with DSM personnel

It is important to note that the Ontario Energy Board ("OEB") issues regulatory rulings for both Union Gas and EGB. The 2006 OEB decision regarding the DSM activities of both companies applied common rules to each, with minor variations. In California, a similar situation applies with the California Public Utilities Commission ("CPUC") regulating both PG&E and SoCalGas. In 2007, the CPUC issued common rulings to both companies (together with San Diego Gas and Electric ("SDG&E") and Southern California Edison ("SCE") regarding levels of funding and a shared incentive mechanism.

Common information for these utilities pertaining to DSM and regulatory environment can be found under Ontario and California sub-sections, followed by information specific for each utility.

Canadian Utilities

BC Hydro

Company Overview

BC Hydro is one of the largest electric utilities in Canada, serving more than 1.7 million customers in an operating area containing over 94 per cent of British Columbia's population. BC Hydro's various facilities generate between 43,000 and 54,000 gigawatt hours of electricity annually, depending on prevailing water levels. Electricity is delivered through a network of 18,234 kilometres of transmission lines and 55,254 kilometres of distribution lines. For fiscal 2006, domestic electric sales volume reached 52,440 gigawatt hours, producing a net income for the company of $266 million. BC Hydro's revenues for 2006 were reported at $4.31 billion while the company's total asset base was $12.48 billion. Government owned and headquartered in Vancouver, BC Hydro, its subsidiaries, and British Columbia Transmission Corporation employs over 4,200 people[1].

DSM Overview

BC Hydro has been involved in DSM since the late 1980s when the Power Smart Program was launched. Offers to residential customers include a fridge buy-back program, efficient lighting incentives[2] and incentives for installation of Energy Star windows[3]. In addition BC Hydro provides extensive information regarding energy efficiency through various media including bill inserts, newspaper adverts and on their website.

BC Hydro's New Home Program encourages builders and developers of single family homes, town homes, or multi-family residential buildings to build energy-efficient homes that qualify under EnerGuide for New Houses ("EGNH") standards. The program offers financial incentives, promotional opportunities and funding, and opportunity for Power Smart branding to qualified builders and developers.

[1] http://www.bchydro.com/info/reports/reports921.html
[2] Lighting rebates ended April 29, 2007
[3] http://www.bchydro.com/powersmart/reno/reno48338.html

The Power Smart Product Incentive Program offers rebates for various energy efficiency measures to qualified retrofit business customers and residential stratas. Incentives through the program are available for a wide variety of technologies and include: fluorescent T8 and T5 lamps, compact fluorescent lighting ("CFLs"), halogen infrared lighting[4], LED exit signs, light strings and signage, as well as controls and sensors for selected Heating Ventilating Air Conditioning ("HVAC") and refrigeration equipment[5]. These rebate programs apply to the following industries:

- Hospitality;
- Office and religious buildings;
- Restaurants;
- Retail;
- Strata residential buildings; and,
- Non-profit organizations[6].

In addition, BC Hydro also has a High-Performance Building Program that provides financial incentives, resources and technical assistance to help developers of new commercial and multi-unit residential building projects. There are three types of offers available under this program:

- Whole Building Design targets new commercial or multi-unit residential buildings over 50,000 square feet in the early stages of the design process; it uses customized approach with a goal to create a high-performance building at a lower cost.
- Energy-Efficient Lighting Design provides financial incentives and tools to help building developers and their design teams create and install more effective and energy-efficient lighting in new commercial development projects; buildings over 6,000 square feet such as warehouses, offices, retail, multi-unit residential buildings, and government facilities, etc may qualify for this offer.
- In-Suite ENERGY STAR Package – offers a rebate up to $200 per suite and targets building developers of new multi-unit residential building and encourages them to install Energy Star fluorescent lighting and equipment.

[4] http://www.bchydro.com/rx_files/psbusiness/psbusiness47976.pdf p.5
[5] http://www1a.bchydro.com/ecatalog/PromoList.jsp
[6] Customers who do not fall in any of the above categories may qualify under other categories.

According to BC Hydro's "Report on Demand-Side Management Activities for the Twelve Months Ending March 31, 2007", DSM expenditures in 2007 were $4.942 million in operating costs[7], and $47.313 million in deferred capital[8]. This resulted in electrical savings of 569 GWh[9]. Deferred capital amounts are amortized to approximately match the costs with energy savings benefits over a period of time, not to exceed 10 years[10].

Terasen Gas has enjoyed partnerships with BC Hydro on specific DSM initiatives. The Companies participated in the External Review Panel for BC Hydro's Conservation Potential Review, and sit on BC Hydro's Electricity Conservation and Efficiency Advisory Committee. The Companies have also partnered with BC Hydro on specific programs; BC Hydro contributes to the Variable Speed Motor ("VSM") incentive for Terasen's Energy Star Heating Upgrade program, and Terasen Gas had participated in the Power Smart New Home Program. It is the hope of the Companies that through this application, additional opportunities for partnership based on the Terasen Companies having additional funding available can be developed.

FortisBC

Company Overview

FortisBC is an electric utility, serving over 106,000 customers directly in communities throughout south central British Columbia, including Kelowna, Osoyoos, Trail, Castlegar, Princeton and Rossland. The company also serves approximately 46,000 customers through the wholesale supply of power to municipal distributors in the communities of Summerland, Penticton, Kelowna, Grand Forks and Nelson. FortisBC has about 570 employees based in its Kelowna headquarters and in 12 field offices. The company is a wholly owned subsidiary of Fortis Inc. which is traded on the Toronto Stock Exchange ("TSX"). Fortis Inc. is also the owner of Terasen Gas. Fortis BC's 2006 annual revenues were $207.6 million, net earnings were $26.5 million and FortisBC's asset base was $731.2 million[11].

[7] Source: BC Hydro Power Smart, "Report on Demand-Side Management Activities for the Twelve Months Ending March 31, 2007; p.13
[8] Ibid, p. 4
[9] Ibid, p. 4
[10] Source: http://www.bchydro.com/info/epi/epi45408.html
[11] Source: http://www.fortisbc.com/about_us/investor_center/annual_reports.html

DSM Overview

West Kootenay Power, FortisBC's predecessor, launched the PowerSense program in 1989. In June 2004, the company was purchased by Fortis Inc. and became known as FortisBC. Today's FortisBC's PowerSense program provides financial incentives and advice on energy efficient technologies and practices to FortisBC customers. Residential programs are: home improvements including water savers; heat pumps; efficient lighting; and a new home program[12]. For customers in commercial sectors, programs are focused on lighting and on building improvements. For industrial customers, programs are focused on compressors and on efficiencies in industrial processes.

Currently PowerSense has eight full-time employees with a budget of $2.474 million[13] in 2007. DSM expenditures are treated as deferred expenditures and are factored into the rate base which allows the company to earn the approved rate of return over the amortization period. The amortization period is determined according to the life of a measure, i.e. if a compact fluorescent lamp ("CFL") has a 5-year life, the program costs are amortized over five years.

FortisBC uses a Shared Savings Mechanism ("SSM") designed in conjunction with British Columbia Utilities Commission ("BCUC") to calculate its DSM incentive. SSM is designed to send a signal to maximize the resource savings acquisition per dollar spent on energy efficiency measures. A minimum threshold (i.e. Base) is established annually for each sector, based on a 3-year rolling average. The sector performance is determined by calculating the acquired net benefits divided by the Base, expressed as a percentage. The table below shows how incentives and penalties are calculated for the three sectors at FortisBC:

DSM Performance Level % of Base Net Benefits	<50%	<70%	<90%	90-100%	100.1-110%	110.1-120%	>120.1 – 150%	>150%
Customer Sector	**Penalty**			**Neutral**	**Incentive**			**N/A**
Residential	-6.00%	-4.50%	-3.00%	0.00%	3.00%	4.50%	6.00%	
Commercial	-4.00%	-3.00%	-2.00%	0.00%	2.00%	3.00%	4.00%	
Industrial	-3.00%	-2.00%	-1.00%	0.00%	1.00%	2.00%	3.00%	

12 http://www.fortisbc.com/about_us/investor_center/annual_reports.html
13 Email Correspondence: Keith Veerman, January 2007.

The following scenarios apply:

- If the threshold is exceeded – meaning that acquired benefits are greater than the Base – the mechanism applies an incentive amount to the sector.
- If the 90 percent threshold is not met, then a penalty amount is applied to the sector.
- If sector performance reaches more than 150 percent of the threshold, the incentive amount is capped.
- If sector performance falls within the range of 90 and 100 percent of the threshold, neither an incentive nor a penalty apply.

The sum of the sectors incentive and/or penalty is the incentive amount available for shareholders. If the sum is less than zero, the incentive is zero.

The incentive amount is the product of the sector net benefits times the applicable incentive or penalty rate. E.g. in 2006 the residential net benefits of $1.45 million, which were 119 per cent of Base, resulted in a sector incentive of $65,400 ($1.45m @ 4.5 per cent).

The following table illustrates the DSM incentive earned by FortisBC in 2006:

2006	Net Benefits			Incentive	
		Eligible Net			
	Base	Benefits	Percent of Base	Incentive Rate	Incentive
Residential	$1,222,000	$1,454,000	119%	4.50%	$65,400
General Service	$2,171,000	$2,094,000	96%	0%	$0
Industrial	$290,000	$366,000	126%	3.00%	$11,000
Earned Incentive					$76,400

Terasen Gas has enjoyed partnerships with FortisBC on specific DSM initiatives, and is deeply interested in expanding co-activity with FortisBC, given that we have a common parent, Fortis Inc. , FortisBC contributes to the VSM incentive for Terasen’s Energy Star Heating Upgrade program for customers in the FortisBC service territory. As with BC Hydro, it is the hope of the Companies that through this application, additional opportunities for partnership based on the Terasen Companies having additional funding available can be developed.

ATCO Gas

Company Overview

ATCO Gas is an Alberta-based natural gas distribution company, serving 886,700 residential and 82,500 commercial customers in nearly 300 communities across the province. ATCO Gas is headquartered in Edmonton and has 62 district offices across the province. The Company has over 1,700 employees, and owns and operates 36,000 kilometres of distribution pipeline throughout Alberta.

In 2004, with the deregulation of the retail energy industry in Alberta, ATCO Group (the parent company), sold the retail operations of ATCO Gas and ATCO Electric to Direct Energy Marketing Ltd (DEML). ATCO Gas and ATCO Electric still operate as "distributors" (owning and operating the infrastructure that delivers natural gas or electricity in its service territories) but are no longer in the retail market. ATCO Group's revenues for 2006 were reported at $2.89 billion, with an asset base of $7.69 billion and annual earnings of $207 million. Revenues for the ATCO Utilities Group, which includes ATCO Gas, several electric distribution companies and a gas pipeline company, were listed at $1.11 billion for 2006.

DSM Overview

In 2001 ATCO Gas and ATCO Electric established the ATCO EnergySense program to provide their customers with energy efficiency advice and services for their home or business. ATCO's DSM initiatives are primarily informational in nature and focus on educating their customers about energy efficiency, environmental sustainability, and energy savings. EnergySense does not offer rebate programs; however, it offers fee-based audits for commercial customers.

The company's DSM team involves eight to twelve employees, depending on the workload. ATCO does not have a distinct DSM budget; funds for EnergySense are provided from the overall marketing budget. Funding is provided as part of the general rate settlements which usually occur every three years. Since EnergySense is treated as a marketing initiative rather than a DSM initiative, no approval for individual initiatives or progress reports to the regulator are required. EnergySense expenditures are treated as Operations and Maintenance ("O&M").

SaskEnergy

Company Overview

SaskEnergy is a provincial Crown Corporation that distributes natural gas to more than 325,000 residential, farming, commercial and industrial customers throughout Saskatchewan. SaskEnergy's integrated transmission and distribution network is made up of more than 80,000 kilometres of pipeline which serves over 92 per cent of the province's communities. Headquartered in Regina, SaskEnergy has over 1,000 employees throughout the province. The company's total annual revenues for 2006 were reported at $1.25 billion. Total assets were reported at $1.32 billion and net income at $53 million[14].

DSM Overview

Currently SaskEnergy offers two programs to its residential customers:

The Energy Star for New Homes program provides incentives to Saskatchewan residents who purchase or register either an Energy Star qualified or an R-2000 certified new home between April 1, 2007 and March 31, 2008. Homeowners have the potential to receive up to $2,400 in rebates for various measures. The purpose of this program is to help offset the cost premium that is often associated with purchasing an energy efficient home.

The Energy Star Loan Program focuses exclusively on Energy Star qualified furnaces that feature a high efficiency variable speed motor, and Energy Star qualified modulating and condensing boilers. This program also offered financing, OAC at prime rate, from April 1, 2007 to September 30, 2007.

SaskEnergy began its DSM programs in 2001. Currently, their DSM team consists of four full-time employees who design, manage and administer programs. In addition, up to five other employees spend a portion of their time supporting DSM requirements.

SaskEnergy's DSM budget for 2007 is reported at $1.6 million with $1.2 million for residential and $400,000 for commercial.

SaskEnergy's spending on DSM program incentives is deducted from its dividend payment to the provincial government and is approved by the Crown Investment

[14] http://www.saskenergy.com/about_saskenergy/annual_report/2006AnnualReport.pdf; p.4

Corporation. Funding for DSM initiatives is provided as part of the general rate settlement. Applications are submitted to the Saskatchewan Rate Review Panel ("SRRP") which serves as advisory committee to the Minister of the Crown Management Board. Appointed by the provincial government for a specified amount of time, the SRRP can only provide its observations and recommendations with respect to the matters that have been referred to it by the Minister. It does not have the authority to implement any of its recommendations. The final decision on whether there will be action on any recommendation is left to the provincial Cabinet.

Approval for an average 5.7 per cent delivery rate increase was announced in May 2007 with an effective date of June 1, 2007[15]. Part of the increase was assigned to cover increased costs for operating and maintaining the natural gas system, and additional resources for energy efficiency programs.

SaskEnergy is not required to apply for approval for individual DSM initiatives – nor is it required to update the SRRP on the progress of their DSM initiatives. DSM costs are treated as O&M; SaskEnergy does not have any DSM incentive mechanism in place.

Manitoba Hydro

Company Overview

Manitoba Hydro is a Crown Corporation and the province's major energy utility, headquartered in Winnipeg. Manitoba Hydro serves 516,800 electric customers throughout Manitoba and 259, 569 gas customers in nearly 100 southern Manitoba communities.

In 2006, the Crown Corporation's assets exceeded $11 billion. Annual revenues were reported at $517 million for natural gas and $1.001 billion for electricity. These revenues produced a $5 million loss for natural gas and an income of $420 million for electrical. Manitoba Hydro employs 3,200 employees province-wide. The governance of the Crown Corporation is delivered through the Manitoba Hydro-Electric Board, whose members are appointed by the Lieutenant-Governor in Council.

DSM Overview

Manitoba Hydro launched its first DSM program in 1989. In 1991, it established Power Smart as its customer-oriented brand for all of Manitoba Hydro's DSM programs,

[15] http://www.saskenergy.com/Residential/June07DeliveryRateFAQ.pdf

initiatives and activities. Natural gas programs were introduced to Manitoba Hydro's Power Smart DSM portfolio in 2001.

The Power Smart programs offered include financial assistance to customers planning home efficiency improvements, as well as rebates for installation of energy efficient products. In January 2008, Manitoba Hydro announced the launch of a new Energy Efficiency Program to help lower-income households take advantage of energy efficient opportunities. Lower-income households may qualify for an in-home energy evaluation and basic energy savings items as well as insulation and/or furnace upgrades. The program is available to lower-income homeowners and tenants that live in single, detached homes or semi-detached homes, and mobile homes on permanent foundations. To qualify, the household income must fall within a certain range and be within certain levels associated with the community size[16].
Commercial programs include incentives for installation of energy efficient equipment such as high-efficiency furnaces and condensing and near-condensing boilers, as well as building assessments and low-interest loans designed to assist customers in carrying out the recommendations identified in the building assessments. The Natural Gas Optimization Program provides industrial and large commercial customers with the technical support and financial incentives necessary to identify, investigate and implement system efficiency improvements throughout their facility. In addition, it provides educational materials that range from how to retrofit a home to energy efficient products and practices.

Approximately 50 people work with the design, implementation and marketing of electric and natural gas DSM residential and commercial programs. An additional seven people evaluate these programs, prepare long-range planning forecasts, and conduct market research. Approximately 35 engineers and technical staff also provide support for DSM programs.

The budget for DSM natural gas programs for 2006/2007 was $9 million dollars, while the budget for 2007/2008 is set for $11 million. Expenditure is allocated according to historical trends. Manitoba Hydro is not required to seek regulatory approval from the

[16] http://www.hydro.mb.ca/your_home/lower_income.shtml

Manitoba Public Utilities Board ("MPUB"). However, executive approval is required for all new DSM programs, and for any significant changes to an existing program.

There are two types of reports produced annually: the Power Smart Annual Review and the Power Smart Long Range Plan of DSM programs. The former reports on the cost-effectiveness of, and energy savings achieved by, existing programs; the latter projects the cost-effectiveness of future programs and estimates their contribution to energy savings targets. Both of them require an approval from the internal Planning Review Committee and Manitoba Hydro's Executive committee before they are submitted to the MPUB.

Manitoba Hydro treats its DSM costs as capital. However, the appropriateness of this treatment is currently being reviewed by Manitoba Hydro's accountants and they are investigating the possibility of treating DSM costs as operating costs. There is also a value realized for the greenhouse gas emission reductions that natural gas conservation enables through potential sale of GHG offsets.

Ontario Utilities Regulatory Environment

In 2006 the OEB initiated hearings to address a number of current and common issues related to DSM activities for Ontario's two natural gas utilities (Union Gas and EGD). As a result, a rules-based and standardized approach has been established where appropriate and practical. The guidelines listed below apply to both utilities as they operate in the same regulatory environment[17]:

- Processes for adjustments during the term of the plan;
- Formulaic approaches for DSM targets, budgets, and utility incentives;
- Determination of how costs should be allocated to rate classes;
- A framework for determining savings;
- A framework and process for evaluation and audit; and,
- The role of the gas utilities in electric Conservation and Demand Management activities and initiatives[18].

For both utilities, all DSM costs are recovered through the rate base. The DSM Variance Account ("DSMVA") is used to track any variance between budget and actual spending. At year end any unspent budget amounts in the DSMVA are returned to the ratepayer. The utilities may recover spending beyond the budget (up to a 15 per cent limit) through rates. This provision applies only to variable costs, i.e. customer incentives for DSM measures. The intent is to enable successful DSM programs to continue even if the initial incentive budget has been spent. DSM costs are outside the return on equity calculation, i.e. they are treated as flow-through costs and utilities cannot earn a return the monies spent on DSM; however, there is a mechanism that allows them to earn an incentive.

The OEB has mandated that the utilities may recover any revenues lost through DSM programs through the Lost Revenue Adjustment Mechanism ("LRAM"). This mechanism ensures that the utility is not penalized for implementing DSM programs by

[17] http://www.oeb.gov.on.ca/documents/cases/EB-2006-0021/dec_dsm_250806.pdf p. 3

[18] The utilities may engage in activities where electric savings are complementary and ancillary to gas DSM and do not involve investments in infrastructure.
http://www.oeb.gov.on.ca/documents/cases/EB-2006-0021/dec_dsm_250806.pdf , p.50

compensating for revenue lost through DSM programs. At the beginning of the year the forecast DSM volumes (by rate class) are factored into the calculation of rates for the year. At the end of the year the DSM actual volumetric results are audited and verified. If there is any difference between the forecast volumes and results, the adjustment is calculated and recorded for clearance when the next rates are set. If the utility delivered more DSM volumes than forecast, the LRAM results in a refund to the utility. If the utility delivered less DSM volumes than forecast, the LRAM results in a refund to the ratepayers.

The OEB has also 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"[19]) 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[20]). The indexing target used in the SSM calculation for 2007 for EGD is $150 million, and for Union Gas, $188 million. Targets for subsequent years are set according to a formula.

[19] 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.

[20] http://www.oeb.gov.on.ca/documents/cases/EB-2006-0021/dec_dsm_250806.pdf

% 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). When both companies applied for the initial DSM plan in 1997, they received an approval for five years which was followed up with a series of one-year DSM plan approvals. EGD and Union Gas are required to file a new plan by September 1, 2009 for another three years.

In 2007 both companies provided the OEB with a detailed plan; however, the OEB did not require a plan for subsequent years. The utilities have the flexibility to change programs that are under-achieving and are required to submit an annual report on DSM results to the OEB. The report is subject to an audit by an independent third party, and is also part of the requirement of the SSM process.

EGD

Company Overview

EGD, owned and operated by Enbridge Inc[21]. , distributes natural gas to 1.8 million industrial, commercial and residential customers primarily in Ontario. The company employs 1,961 people. EGD also operates smaller distribution systems in Quebec and upper New York State and is developing a gas distribution network in New Brunswick. EGD's revenues for 2006 were reported at $3 billion with annual income of $ 122.3 million and an asset base of $ 3.3 billion.

[21] Enbridge operates, in Canada and the U.S., the world's longest crude oil and liquids pipeline system. The company owns and operates Enbridge Pipelines Inc. and a variety of affiliated pipelines in Canada, and has an approximate 16.6% interest in Enbridge Energy Partners, L.P. which owns the Lakehead System in the U.S. These pipeline systems have operated for over 55 years and now comprise approximately 13,500 kilometres (8,500 miles) of pipeline, delivering more than 2 million barrels per day of crude oil and liquids. The company employs more than 5,000 people, primarily in Canada, the U.S. and South America.

DSM Overview

EGD has a broad portfolio of DSM programs for residential, commercial and industrial customers. Current residential offers include rebate programs for programmable thermostats and high-efficiency natural gas heating systems. Also, low-flow showerheads, faucet aerators and pipe wrap are installed through a direct install program. EGD's DSM offerings for commercial and industrial customers include free energy audits and incentives for energy-efficient upgrades.

EGD is responsible for all aspects of program delivery from marketing and promotion to processing rebate applications for most of their DSM initiatives. However, the delivery of TAPs[22] Partnership Program is contracted out to a number of qualified contractors who then directly install energy efficiency measures in customers' homes. There are also some instances where the EGD delivers the program jointly with various business and industry partners. In addition, Enbridge engages outside consultants for DSM research and evaluation.

The company has been offering DSM programs since 1995. Prior to that EGD (formerly "Consumers Gas") provided some educational information on energy efficiency for customers, but no incentive programs. EGD's DSM efforts are fully integrated with the company's overall marketing, sales and other functions. Currently, there are approximately 45 people involved in various aspects of DSM either on a full or part-time basis.

In 2007 Enbridge's DSM budget was set at $22 million with a 5 per cent annual increase for the next two years ($23.1 million in 2008) and ($24.25 million in 2009).

Union Gas

Company Overview

Union Gas is a major Canadian natural gas utility that provides energy delivery and related services to about 1.3 million residential, commercial and industrial customers in over 400 communities in northern, southwestern and eastern Ontario. The Company

[22] TAPs is an acronym which stands for thermostat, aerators and pipewraps.

also provides natural gas storage and transportation services for other utilities and energy market participants in Ontario, Quebec and the United States. Union Gas has assets of $4.6 billion and employs about 2,200 people. In 2006, it reported total revenues of $2.1 billion and net income of $104 million. Union Gas is a Spectra Energy Company headquartered in Chatham, Ontario.

DSM Overview

The current portfolio of DSM programs at Union Gas targets residential, commercial and industrial customers. Currently, Union Gas offers a rebate of $15 to residential customers who purchase and install a programmable thermostat; the offer is valid until December 10, 2008. Commercial and industrial programs include: energy assessments; performance testing and analysis; and rebates for energy efficient equipment.

Union Gas began its DSM programs in 1997. Currently, the utility has about 30 employees working full-time on DSM. An additional 15 employees work on DSM administration, program design, regulatory and policy analysis, evaluation and implementation.

Union Gas's annual budget for DSM in 2007 was reported at $17 million with a 10 per cent increase for 2008 and for 2009 ($18.7 and $20.6 million, respectively). Expenditure is allocated according to historical trends; however, Union Gas has two dedicated "buckets" – $1.3 million for low-income DSM and $1.0 million for market transformation (to help accelerate the introduction of new technologies).

Gaz Métro

Company Overview

Gaz Métro is headquartered in Montreal, Quebec. In 2006, the Company reported assets of $2.7 billion, $2 billion in revenues in 2006 and $147 million in annual income[23]. In addition to distributing natural gas to some 167,000 customers in Québec through its 10,000 kilometer underground system, the company also operates subsidiaries which provide maintenance and repair services for natural gas equipment, HVAC systems and leasing services for water heaters. In total, Gaz Métro has over 1,500 employees in Quebec.

In the US, Gaz Métro's wholly-owned subsidiary Vermont Gas Systems supplies natural gas to over 37,000 customers. Gaz Métro also has significant investment interests in two natural gas transportation enterprises (Trans Quebec & Maritimes and Portland Natural Gas Transmission System) and in an enterprise specializing in underground natural gas storage facilities (Intragas)[24].

DSM Overview

Gaz Métro offers a number of DSM programs to its commercial and residential customers. For its residential customers, the utility offers rebates for high-efficiency furnaces (both retrofit and new construction), high-efficiency boilers and programmable thermostats. The utility also offers a number of programs through the Energy Efficiency Fund ("EEF"[25]) which was created in 2000 as a joint venture between the Gaz Métro Society and a number of Québec socio-economic and environmental groups. The EEF programs are being offered to Gaz Métro customers whose main heating source is natural gas. Gaz Métro customers, whose homes are equipped with heat pumps or with dual-energy systems, are not eligible for some of these programs since their main heating system is considered to be electric. EEF programs offer rebates and financial assistance that cover building envelope and aim at new or emerging technology on the market.

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[23] Gaz Metro operates as an income trust. The income figure is the distribution to the income trust partners. The revenue and asset figures relate to all activities which includes GM's Quebec gas distribution business.

[24] http://www.corporatif.gazmetro.com/data/media/Rapport%20déc%2006%20anglais.pdf

[25] http://www.fee.qc.ca/en/fund.htm

Gaz Métro's commercial programs include the following programs[26]:

Programs	Appliance Efficiency	Gaz Métro Financial Incentive
Condensing boiler and direct contact system	Efficiency of 90% and higher	$900 to $25,000
Intermediate energy-efficiency boiler	Efficiency of 85% and higher	$600 to $6,000
High-efficiency warm air furnace	Efficiency of 90% and higher	$600
Condensing water heater	Efficiency of 90% and higher	$1,200 to $20,000
Intermediate energy-efficiency water heater	Efficiency of 85% and higher	$600 to $6,000
Infrared heating unit		$2.50 per 1,000 BTU/h

Gaz Métro has been providing DSM programs since 1999. Currently, their DSM team has six dedicated staff responsible for managing, designing, evaluating and administering programs. In addition, there are over 200 employees, contractors and business partners involved in the delivery of DSM programs.

In 2007, the utility's DSM budget was set at $8.8 million, which included $1.5 million for residential, $5.3 million for commercial, $740,000 for industrial, and $1 million for administration and research.

Gaz Métro requires regulatory approval for DSM expenditures. The funding request is included as a part of the general rate application. Funding approval for DSM funding is sought annually; however, the regulator requests a three-year rolling plan for programs. No approval for individual program elements is required as approval is given for the total plan. The utility provides a comprehensive plan which includes program details, costs, projections of customer uptake and savings.

The plan is updated every year to reflect uptake and future projections, and costs adjusted up or down in the next fiscal year as required. The DSM incentives of Gaz

[26] http://www.gazmetro.com/affaires/programme-aides-financieres/efficacite-energitique.aspx?culture=en-CA

Métro are part of a recently renegotiated Performance Based Rate ("PBR") settlement. Savings are split between the utility income trust unit holders (50 per cent), customers (35 per cent) and an energy-efficiency fund (15 per cent). The energy-efficiency fund is used to fund low-income customer initiatives and emerging technologies. The energy-efficiency fund must be spent within a certain time period. In March 2007 the Regie de l'energie approved an amendment to the Performance Incentive Mechanism ("PIM") which had originally been established in 2000 and modified in October 2004. The role of the incentive mechanism is to:

- encourage profit from new sales;
- optimize capital assets;
- encourage the displacement of "dirty' fuels such as oil; and,
- minimize operating costs.

The purpose of the amendment was to address changes in the business environment which impacted some of the assumptions made in constructing the incentive mechanism. The primary change was increased sales volatility and a decline in customer volumes due to energy conservation initiatives.

The performance incentive is set by assessing the Projected Cost of Service against a Reference Formula, which is based on the previous year's revenue plus inflation and with adjustments for factors that affect volumes. One of these factors is the impact on volumes of energy efficiency measures. In calculating the Reference Formula, the company is compensated for 90 per cent of volume variations due to energy efficiency measures.

If the cost of service is *less* than the result obtained by applying the Reference Formula, then Gaz Métro will retain a portion of the difference in the form of an incentive payment. If the cost of service is *greater* than the result obtained by applying the Reference Formula, then rates will be based on the cost of service figure; however, the company will have to either offset the difference by productivity gains or reimburse a portion to the ratepayers.

Separately the performance incentive contains a Global Energy Efficiency plan Performance Incentive ("GEEP"). In the 2007-2008 rate year, Gaz Métro will receive a financial reward of $4 million if they achieve a savings of 24 million cubic metres (925,000 GJ). For subsequent years the cumulative targets will rise by 24 million cubic meters annually, i.e. in 2008-2009 the target is 48 million cubic meters. The incentive program will be in place for five years and the intent behind this mechanism is to keep the utility close to the annual target. While this gives Gaz Métro some flexibility in terms of achieving their annual targets, there is a disincentive to underachieve in any given year because they will not receive a full yearly payout – even if the overall five year goal is reached. If the incentive savings achieved below the maximum targets, the utility earns a prorated incentive. The GEEP is calculated at the end of the rate year and recovered in the subsequent rate year. All DSM expenditures are treated as an operational expense.

US Utilities

PSE

Company Overview

PSE is Washington State's largest energy utility, serving more than one million electric customers and approximately 718,000 natural gas customers in the Puget Sound region. The utility serves more than 100 cities and towns within 11 Washington counties, from Puget Sound north to the Canadian border, and from Central Washington's Kittitas Valley west to the Olympic Peninsula. The distribution area covers approximately 6,000 square miles populated by over four million people. Headquartered in Bellevue, Washington, PSE has about 2,400 employees. In 2006, PSE reported $7.1 billion in assets and $2.9 billion in combined revenues of which $1.12 billion was derived from natural gas operations. Net income from the combined gas and electric utilities was $219 million[27].

DSM Overview

PSE has a broad array of programs, financial incentives (grants and rebates) and tools designed to offer their customers opportunities to participate in energy conservation efforts. The programs address natural gas and electric energy conservation needs, and are targeted at commercial, industrial, builder/developers, and residential customers. Commercial and industrial customers have access to the following programs[28]:

- Grants - includes customized rebates to fund energy efficiency projects and funding for energy efficient new construction (non-residential).
- Rebates - streamlined incentives for specific energy efficient products and for PSE customer groups (residential, commercial and industrial). Available for over a dozen measures with more than 100 options.
- Resource Conservation Manager Program - incentives to improve operations and maintenance practices to achieve better efficiency and to lower energy costs.
- Direct installation and maintenance programs - simple efficiency measures provided directly by PSE, or PSE's contractors.

[27] PSE 2006 Annual Report.
[28] http://www.pse.com/solutions/forbusiness/Pages/efficiencyComPrograms.aspx

- Tools – these include online energy audit; energy interval service (a web-based application that provides access to usage data from customer's meters); and virtual library and resources.

PSE also offers a number of rebates for Energy Star equipment to builders and developers. These help to offset the cost of installing higher efficiency appliances, systems and features into the homes they build. Rebates only apply to single family residences including townhomes, and any residential buildings with four units or less. Apartments are not eligible for rebates.

Residential programs include rebates for appliances and measures certified as Energy Star (such as furnaces, dishwashers and clothes washers); high-efficiency (natural gas water heaters or air-source electric heat pumps); lighting (CFL lights and Energy Star fixtures); and Energy Star manufactured homes.

PSE began implementing DSM programs in the early-1980's. PSE's Energy Efficiency group has over 80 employees assigned to administration, evaluation, planning, and program implementation. PSE also employs contractors and consultants as required. The numbers in the table below show how PSE's 2007 DSM budget is allocated to support electric and natural gas initiatives:

	Residential	**Energy Savings**	**Commercial Industrial**	**Energy Savings**	**Other Initiatives**	**Energy Savings**
Electric	$ 17,050,000	71,246 mWhs	$ 18,190,000	101,706 mWhs	$ 3,150,000	14500 mWhs
Gas	$ 3,850,000	118,000 GJs	$ 1,660,000	102,000 GJs	$ 590,000	N/A
Total Budget	$ 20,900,000		$ 19,850,000		$ 3,740,000	

The Utility & Transportation Commission ("UTC") requires PSE to file a detailed report outlining programs, costs, energy savings and program targets every two years. The projection numbers are based on PSE's Integrated Resource Plan and concurrence with PSE's Conservation Resource Advisory Group ("CRAG"). No approval for individual initiatives is required, although PSE consults with CRAG on any new or unplanned initiatives. The utility files semi-annual reconciliation reports to the UTC and quarterly updates to the CRAG. DSM costs are recovered from customers via a rider to their bills and therefore, the funding is neither O&M nor capital. Currently PSE does not have a

DSM incentive mechanism; however, the UTC recently approved an incentive and penalty mechanism for electric programs.[29]

NW Natural

Company Overview

NW Natural is a 148-year-old natural gas local distribution company headquartered in Portland, Oregon. The company employs over 1,200 people[30]. NW Natural serves more than 636,000 customers in Oregon and southwest Washington, including the Portland-Vancouver Métropolitan area, the Willamette Valley, the Oregon Coast, and the Columbia River Gorge. The company also operates an underground gas storage facility and contracts for additional gas storage outside its service territory. NW Natural operates two liquefied natural gas plants in its service area. The company also provides gas storage services to other energy companies in the Northwest interstate market. In 2006, NW Natural's revenues exceeded $1 billion resulting in net operating income of $340 million on an asset base of $1.957 billion.

DSM Overview

Although NW Natural operates in both Oregon and Washington, the DSM overview presented here applies only to their Oregon operations[31]. The company has had a weatherization program since 1980. These programs are designed to reduce and/or improve energy consumption of dwellings (typically insulation, caulking, and weather-stripping) and are usually targeted towards low-income customers. Between 1994 and 2002, the utility was responsible for implementing DSM programs, however as of 2003, the administration of most of NW Natural's DSM programs was transferred to the Energy Trust of Oregon (ETO). Program development and management of low-income weatherization initiatives continue to be managed by NW Natural. NW Natural has one

[29] Please refer to http://www.pse.com/SiteCollectionDocuments/rates/elec_sch_121.pdf for further information.
[30] NW Natural 2006 Annual report; source: http://www.snl.com/Cache/3683199.PDF?FID=3683199&O=PDF&T=&D=&IID=4057132&Y
[31] NW Natural currently offers two rebated programs to their Washington customers: qualified furnaces (https://www.nwnatural.com/residential/special_offers/fall.asp) and qualified fireplaces (https://www.nwnatural.com/residential/special_offers/hearth.asp?csid=148&sec=30. There are no DSM offers available to commercial or industrial customers in Washington state.

full-time dedicated employee looking after energy efficiency affairs; however, there are also up to four full-time employees assigned to provide additional support as required. NW Natural has a budget of over $2 million to fund low-income weatherization programs, provided for in a tariff.[32] The utility provides quarterly reports for low-income weatherization programs to the Public Utility Commission ("PUC") of Oregon.

NW Natural customers contribute to a Public Purpose Fund ("PPF") for energy efficiency initiatives (DSM and market transformation programs) implemented through the Energy Trust of Oregon ("ETO"). Oregon utility customers (electric and natural gas) contribute a mandatory 3 per cent tariff on top of their energy bill to support this non-for-profit organization.

The state-wide annual sum raised towards the PPF is between $60 and $80 million. Approximately $11 million is collected from NW Natural customers with $9 million funneled to the ETO to fund energy efficiency programs. The remaining two million is retained by NW Natural for low-income weatherization programs.

ETO is governed by a board of directors with oversight from the PUC of Oregon. The Commission requires Integrated Resource Plan efforts to be coordinated with ETO's efforts – resulting in recommendations on appropriate levels of public purpose funding. ETO reports annually, but commission staff members attend monthly reporting and planning meetings. ETO offers DSM programs to NW Natural residential and commercial customers, and customers of Portland General Electric and Pacific Power. The programs[33] offered through the ETO include cash incentives, energy audits and education to help customers manage their energy use. Residential programs include home energy reviews, home performance audits, rebates for Energy Star equipment (i.e. furnaces), as well as rebates for conservation measures such as weatherization equipment and Energy Star windows.

ETO's portfolio of DSM programs also includes several programs that target landlords of multi-family rental dwellings (there are two classifications: 2 - 4 units and 5+ units). Programs include home performance audits, rebates for Energy Star equipment upgrades and grants and assistance with installation of weatherization equipment[34]. Programs targeted towards the commercial sector include two categories: new construction and retrofit. The new construction programs include incentives and

[32] For more information on the tariff, please refer to the following document: https://www.nwnatural.com/CMS300/uploadedFiles/24320ai(1).pdf

[33] These responses reflect Oregon activity only.

[34] http://www.energytrust.org/residential/hes/plexes.html

technical support for energy modeling, commissioning and high-efficiency equipment.[35] Customers can choose from four different programs which include the following:

- Standard track;
- Custom track;
- U.S. Green Building Council for Leadership in Energy and Environmental Design Leadership in Energy and Environmental Design New Construction track (known as USGBC LEED® NCTrack); and,
- Energy Star track. The amount of incentives varies depending on the complexity of the project. Retrofit customers can take advantage of incentives and technical support for installing energy efficient measures in existing commercial, institutional and agricultural facilities[36].

ETO's Solar Heating Program also offers cash incentives for solar water heating systems to both residential and business customers. Homeowners can receive up to $1,500 (incentives vary by system and average $1,000 for customers with electric water heaters and $500 for those using gas water heaters), while business customers can qualify for up to 35 per cent of installation cost[37].

[35] http://www.energytrust.org/newbuildingefficiency/index.html
[36] http://www.energytrust.org/buildingefficiency/index.html
[37] http://www.energytrust.org/RR/SWH/index.html

California Regulatory Environment

Under most regulatory regimes in North America, energy utilities' earnings are tied to capital investment and the amount of energy distributed to customers. This represents a disincentive for energy efficiency programs because their goal is to encourage utility customers to reduce or modify energy demand. To resolve this energy efficiency paradox, the CPUC has put in place two measures. The first is a lost revenue mechanism which allows the utilities to increase rates to compensate for revenues foregone by implementing DSM programs. The second measure, approved in September 2007, is a risk/reward incentive mechanism which is designed to encourage four participating utilities[38] to promote DSM programs by rewarding them with additional revenue if they meet or exceed certain targets for energy savings. Conversely the utilities are penalized for failing to achieve certain minimums because the mechanism includes minimum and maximum caps.

The mechanism is deemed a shared risk/reward plan as energy savings benefit customers through lower rates because they do not have to pay for capital costs for system expansion which otherwise would have been incurred due to higher energy demand. At the same time, this incentive mechanism ensures that program savings are real and verified and imposes penalties for sub-standard performance. In other words, this mechanism is designed to produce "nega-watts" and "nega-therms" with a goal to maintain and in time reduce the overall demand for energy in California.[39]

In California, the utilities are required to apply to CPUC for approval of energy efficiency program portfolios. Each portfolio has associated costs and targets for energy savings. Once the CPUC reviews and approves the costs, targets and funding for these portfolios, monies are collected from the ratepayers through a PPF. However, the utilities have some discretion as to how and when the funds are spent on individual initiatives within their program portfolios. The intent is to ensure that funding is not continued for failing initiatives and that successful initiatives are not penalized. This approach gives the utilities enough flexibility to drop, add and amend according to success (or lack of) an individual program. This program flexibility applies to both mass and targeted

[38] The four participating utilities are: SCE, SoCalGas, PG&E and SDG&E.
[39] http://docs.cpuc.ca.gov/published/FINAL_DECISION/73172-01.htm

markets. While the customer pays for the incentive and the costs of the programs, they are rewarded by lower energy costs and lower capital costs. Regulatory progress updates are submitted monthly, quarterly and annually. Interveners' inquiries are addressed as required.

Up until 2003, approval for the program portfolio was required on an annual basis. The Commission then approved a two-year plan covering 2004 and 2005. The current plan covers three years (2006, 2007 and 2008).

CPUC established a sliding scale with caps at the bottom and the top which apply to all four utilities (for both natural gas and electric programs) and includes the following framework:

Verified Savings % of Goals	Total Verified Net Benefits	Shareholder Earnings		Ratepayers' Savings
125%	$3,919,000	$450,000	cap	$3,469,000
120%	$3,673,000	$441,000		$3,232,000
115%	$3,427,000	$411,000		$3,016,000
110%	$3,181,000	$382,000		$2,799,000
105%	$2,935,000	$352,000		$2,583,000
100%	$2,689,000	$323,000		$2,366,000
95%	$2,443,000	$220,000		$2,223,000
90%	$2,197,000	$198,000		$1,999,000
85%	$1,951,000	$176,000		$1,775,000
80%	$1,705,000	$0		$1,705,000
75%	$1,459,000	$0		$1,459,000
70%	$1,213,000	$0		$1,213,000
65%	$967,000	-$144,000		$1,111,000
60%	$721,000	-$168,000		$889,000
55%	$475,000	-$199,000		$674,000
50%	$228,000	-$239,000		$467,000
45%	-$18,000	-$276,000		$258,000
40%	-$264,000	-$378,000		$114,000
35%	-$510,000	-$450,000	cap	-$60,000

The highlights for this framework include the following points:

- If the utilities achieve between 85 per cent to 100 per cent of their targets, they receive 9 per cent of the savings achieved;
- If the utilities achieve above 100 per cent, the incentive rises to 12 per cent; and,

- If utility portfolio performance falls to 65 per cent of the savings goals or lower, then financial penalties begin to accrue;

All rewards and penalties are capped at $450 million (all four participating utilities combined over the three years of the agreement). The $450 million is allocated to each utility as follows: PG&E - $180 million; SCE - $200 million; SDG&E - $50 million and SoCalGas - $20 million[40].

There are three payments during each three-year program cycle. Two interim payments based on expected earnings and a final reconciliation payment when the program has been completed. Savings achieved through the programs are independently verified by the Commission's Energy Division and its evaluation, measurement and verification ("EM&V") contractors at the end of each cycle. The CPUC holds back 30 per cent of the interim payments until true-up to provide a margin for error. The utility receives its monies back by charging back to customers via rates according to the customer/shareholder reward split determined by CPUC.

PG&E

Company Overview

Incorporated in California in 1905, PG&E is one of the largest combined natural gas and electric utilities in the United States. Based in San Francisco, the company is a subsidiary of PG&E Corporation. There are approximately 20,000 employees who carry out Pacific Gas and Electric Company's primary business—the transmission and delivery of energy. The company provides natural gas and electric service to approximately 15 million people throughout a 70,000-square-mile service area in northern and central California.

As mentioned, PG&E and other utilities in the state are regulated by the CPUC. PG&E's service area stretches from Eureka in the north to Bakersfield in the south, and from the Pacific Ocean in the west to the Sierra Nevada in the east. The utility has over 40,123 miles of natural gas distribution pipelines and 6,136 miles of transportation pipelines. PG&E has 5.1 million

electric customer accounts and 4.2 million natural gas customer accounts. The company's 2006 annual report[41] showed total assets of $34.8 billion, operating revenues

[40] http://docs.cpuc.ca.gov/published/FINAL_DECISION/73172-15.htm#P1420_387465
[41] http://www.pgecorp.com/investors/pdfs/2006AnnualReport.pdf p.9

of $12.53 billion ($8.7 billion for electric and $ 3.7 billion for natural gas) and net income of $991 million.

DSM Overview

PG&E's size and dual customer base (electricity and natural gas) allows for a wide range of DSM offerings to residential, commercial and industrial customers. Residential customers can choose from programs that include rebates for Energy Star appliances, general home improvement projects, heating and cooling options, lighting, home electronics, and efficiency measures related to swimming pools.
The 2007 Residential New Construction Program targets builders and developers of single family homes within PG&E's service area with financial incentives. Depending on the number of Energy Star qualified features installed in the home, builders and developers can apply for rebates for each appliance or as a package.

Programs that target commercial and residential customers include the following categories: small businesses, schools, colleges and universities, large commercial and institutional buildings, retail, hotels, motels, resorts, food services, residential new construction projects, high tech, healthcare and biotech industries, manufacturing and heavy industries, water treatment industry, trade professionals, agricultural and food processing industries, architects and designers.

PG&E's first DSM programs were implemented in the mid -1970's. The company has one of the largest DSM teams in North America. Currently, there are about 350 full-time employees who are involved in program and policy design, administration, residential and commercial customer service and assistance. About 80 per cent of them are involved with natural gas programs. DSM staff members also work directly with commercial/industrial customers on design and implementation of energy efficiency solutions. PG&E also hires external staff to work with large industrial or commercial customers as required for certain complex or unique projects.

For the period 2006 – 2008 the cumulative DSM budget (natural gas and electrical) is set at $868 million. This covers labour, rebates and advertising. An additional $75 million has been allocated for market research, policy research, program evaluation, onsite audits, engineering studies and market potential studies. Approximately $20 million of that will be spent by PG&E and $55 million by the CPUC. Table below provides the breakdown for 2006-2008 PG&E budget[42]:

PG&E Program Portfolio

	2006	2007	2008	Electric	Natural Gas
Total Program Budget (with EM&V)	$ 244,653,750	$ 279,428,777	$ 343,385,716	$ 746,022,689	$121,445,554
Total Program Budget (without EM&V)	$ 265,927,985	$ 303,726,932	$ 373,245,343	$ 810,894,224	$132,006,036

The budgets for electric and gas differ within a three-year funding cycle. On average, 86 per cent of funds are related to the electric side, while the remaining 14 per cent relates to natural gas.

SoCalGas

Company Overview

SoCalGas has been delivering natural gas to its customers for nearly 140 years. SoCalGas is one of the largest natural gas distribution utility in the U.S., serving a population of 20.1 million consumers through 5.6 million gas meters in more than 500 communities. The company's service territory encompasses approximately 20,000 square miles of diverse terrain throughout Central and Southern California, from Visalia to the Mexican border. Headquartered in Los Angeles, SoCalGas is a subsidiary of Sempra Energy which is based in San Diego. The Company's annual revenue in 2006 was reported at $4.18 billion with $6.36 billion in total assets and $223 million in net income.

DSM Overview

SoCalGas's DSM portfolio includes programs for residential, commercial, and industrial customers, and builders and developers. The company also offers information and resources on their public website. Residential programs offered by SoCalGas include cash rebates on qualifying energy-efficiency upgrades or improvements made by

[42] http://docs.cpuc.ca.gov/published/Graphics/49863.PDF

customers to their single family home, condominium, or attached residential units (maximum of four.) Regular mail-in rebates include incentives for:

- Energy Star furnaces and dishwashers;
- high-efficiency natural gas storage water heaters;
- faucet aerators;
- low-flow showerheads;
- insulation (wall and attic); and,
- pipe-wraps.

The company also offers instant rebates to qualifying customers. Working in partnership with participating retailers, customers can instantly receive a rebate on 2007 Energy Star qualified clothes washers, 2007 Energy Star qualified dishwashers, and high-efficiency natural gas water heaters[43].

SoCalGas also offers a number of programs to low-income customers. These offers include a 20 per cent rate discount through the California Alternate Rates for Energy ("CARE") program, no-cost energy-saving home improvements (weatherization), one-time bill assistance, medical baseline allowance, gas assistance fund, payment programs and state assistance programs.

The programs offered to the Company's Commercial and Industrial customers include a wide variety portfolio of offers, grants, rebates and educational seminars designed for specific industry groups.

To assist builders and developers in building the most energy-efficient homes, SoCalGas offers consulting services, training and marketing tools and other resources at no charge.

SoCalGas began its DSM programs in the mid 1980's. Currently, the company has about 30 full-time staff involved in DSM program management and development. The annual DSM budget for the next three years is reported as follows[44]:

[43] http://www.socalgas.com/residential/savemoney/
[44] http://docs.cpuc.ca.gov/published/Graphics/49863.PDF; Table 7

DSM Activity at Other Utilities

	2006	2007	2008
Total Program Budget (with EM&V)	$47,868,782	$ 61,109,298	$ 73,457,283
Total Program Budget (without EM&V)	$44,323,164	$ 56,582,385	$ 68,015,720

Appendix 5

BRITISH
COLUMBIA

SPEECH FROM THE THRONE

The Honourable Steven L. Point, OBC
Xwě lī qwěl těl
Lieutenant-Governor

— *at the* —

Opening of the Fourth Session,

Thirty-Eighth Parliament

— *of the* —

Province of British Columbia

February 12, 2008

In opening this session of the 38th Parliament, it is important we remember and honour the contributions of British Columbians who have passed away since this Assembly last convened.

We all owe a special debt of gratitude to Master Corporal Colin Bason and Master Corporal Darrell Priede, who fell while serving in Afghanistan.

We mourn the passing of former members of this Assembly: George Mussallem, Burton Peter Campbell, Frank Garden, and Peter Rolston.

We have lost a giant of the Canadian legal profession — former B.C. Chief Justice Allan McEachern, as well as his colleagues former B.C. Supreme Court Justice Dermod Owen Flood, and former provincial court Judge Sidney Clark.

Many great British Columbians left us this past year, but their legacies remain.

We will miss Chief Harry Pierre of the Tl'azt'en Nation, Chief Patrick Alfred of the Namgis First Nation, hereditary Chief Cosmos Richard Frank of the Ahousaht First Nation, Chief James Cooper of the T'Sou-ke Nation, and Tsartlip First Nation Elder Dr. Sammy Sam.

Dr. William Sauder was a philanthropist and a leader in business and education who, with Herb Doman, helped define our forest industry in the last half century.

Exemplary citizens like Jannit Rabinovitch, Colleen McCrory, Dr. Gary Randhawa, Norval Morrisseau, Philip Despard Pemberton Holmes, Jane Rule, W.D. West, and the "Urban Peasant" James Barber have all left us.

As have George Athans Sr., Gary Lupul, Darcy Robinson, Roy Mah, Keith Bradbury, John Pifer, Colin Price and Jeani Read.

We salute the 63 dedicated members of the B.C. Public Service who passed away last year, among them, Autumn Jenkinson, John Webb, Regan Paetz, Kenyon Wells and Wayne Peters.

We will miss them all even as their contributions live on.

Today we begin the fourth session of the 38th Parliament of British Columbia. It is an auspicious day in an auspicious year.

Two years from today our province will host the world for the opening of the 2010 Olympic and Paralympic Winter Games. Over two billion people will witness that spectacle as the Olympic torch completes its journey and lights up BC Place.

British Columbians will watch with pride as the opening ceremonies introduce the world to our country and our province — from the grasslands of the Chilcotin and Cariboo, to the vast expanses of the

Peace, Northwest and North Coast, to the Kootenays, the Okanagan and Vancouver Island.

It will be a magic moment for us all as the world beholds the strength of B.C.'s First Nations, the diversity of our cultures and the character of all Canadians.

They will be our Olympics — the Olympics of Vancouver and Whistler. The Olympics of the Squamish, Lil'Wat, Tsleil-Waututh and Musqueam. As we watch that show unfold, all of Canada will be captured by the spirit of 2010 — the spirit of British Columbia — which will find its light in the eyes of our children.

This year, every venue for those Games will be completed and operational, with athletes training on their home field. The Olympics are a great unifying force. They are bringing our citizens together in support of Canada's athletes, in celebration of Canada's artists, and in pursuit of the most sustainable Games in history.

This year we celebrate another important milestone — British Columbia's 150th anniversary together. We celebrate our history, our heritage, and all that we have accomplished together. We look with confidence to the opportunities of our changed and changing world.

Building a New Relationship with B.C.'s First Nations

History has taught us that we all move forward by moving beyond the positions that have held us back.

That is the essence of your government's effort to build a New Relationship with First Nations.

It aspires to a brighter future for all Aboriginal Canadians, built on self-reliance and self-determination, and based on mutual respect, recognition and reconciliation.

The Transformative Change Accord calls on us to close the gaps for B.C.'s First Nations in health, housing, education and economic opportunity.

Working together, we are opening new doors for progress.

There are new land use agreements for the North Coast, the Central Coast, the Sea-to-Sky corridor, the area north of Tweedsmuir Park, and Haida Gwaii.

The true leadership provided by the Tsawwassen, the Huu-ay-aht, the Ka:'yu:'k't'h'/Che:k'tles7eth'h, the Toquaht, the Uchucklesaht, and the Ucluelet First Nations has resulted in the highest form of negotiated settlement — constitutionally protected treaties, which are awaiting ratification by Parliament. Those First Nations will soon join the Nisga'a.

Final agreement negotiations are underway with the Sliammon, Yale, Yekooche and In-SHUCK-ch Nations. The treaty process is producing real results. It can and will be improved.

Your government will support fast-tracked treaty negotiations at common tables, as suggested by the BC Treaty Commission and First Nations themselves. It will pursue "incremental treaty agreements" to help First Nations benefit earlier in the treaty-making process.

New mechanisms will facilitate effective engagement of all parties in meaningful consultation and help First Nations participate as equity partners in major economic development projects.

Aboriginal rights to harvest wood for domestic purposes on Crown land will be given new statutory recognition. New investments in carbon offset projects that benefit First Nations will be an integral part of your government's climate action plan.

The journey to reconciliation is about bridging the barriers that have divided Aboriginal Canadians from everyone else in Canada. Nowhere is that more important than in caring for our children.

It is time that all of Canada embraced Jordan's Principle. Simply put, that principle says the interests of Aboriginal children must always be paramount, and that no child, on- or off-reserve, should be put at risk due to jurisdictional disputes.

Your government will work with First Nations and the federal government to put Jordan's Principle into action, and to strengthen services for Aboriginal children and families.

New legislation will enable Aboriginal authorities to assume legal responsibility for the delivery of most child and family services in their communities.

Your government will contribute to the establishment of the Stehiyaq Healing and Wellness Village in the Fraser Valley. It will be a place of healing for Aboriginal youth and families from across British Columbia who are addressing histories of trauma, addiction and mental illness.

This August, the Cowichan Tribes will host the North American Indigenous Games. That event will be a celebration of competition, sport and First Nations cultures. Everyone is invited.

Our Common Goal is Sustainable Growth

We live in a time as transformative as the Industrial Revolution.

New knowledge, technology and solutions are reshaping our world at a record pace.

New challenges, like climate change, call everyone to action with new speed and urgency, and a new emphasis on sustainability.

New approaches, forward thinking and a new commitment to long-term results are demanded.

Your government's Five Great Goals for B.C. aspire to healthier families and sustainable health delivery; educational excellence; safe, supportive communities; environmental stewardship; and a strong economy.

Meeting those goals obliges us to act with resolve in a sustained effort to understand global change as both an ally and a fact of our lives.

The future we want is ours to build by taking actions that stand the test of time.

Each of our great goals is integrally linked to the others.

A healthy environment and educated populace are essential to healthy human development and a globally competitive economy. A safe, humane society is the object and outcome of an enlightened, prosperous and caring community. The bedrock of each goal is a strong economy.

Without a strong economy and prudent financial management, your government could not make record investments in health, education, housing, transportation and other public services, while still balancing the budget.

Equally critical to our success is long-term thinking that transcends the timelines of electoral cycles.

Many members of this legislature will not be alive in 2050. But most have or will have children and grandchildren who will be. It is for them, and all who follow in our footsteps, that today's decision makers must act.

Living Smart Starts with our Environment

British Columbians cherish their high quality of life and our province's natural environment.

Together, we have established new parks and new conservancies. More than 13 million hectares are now protected — an area equal to the size of Nova Scotia, New Brunswick and P.E.I. combined, over 14 per cent of our province — more than any other jurisdiction in Canada.

Our forest management practices and environmental management are second to none.

This session, all members will be asked to build on that record of stewardship with new conservancies and parks envisioned in approved land use plans.

Amendments to the *Wildlife Act* will build on the Mountain Caribou Recovery Plan, the Vancouver Island Marmot Recovery Project and the Kitasoo Spirit Bear Conservancy. Tough new penalties will prevent and punish poaching and killing endangered species.

Comprehensive air and water stewardship strategies will be released this spring, as new steps are taken to combat global warming.

British Columbians are taking decisive action on climate change.

The *Greenhouse Gas Reduction Targets Act* now requires us to reduce greenhouse gas emissions by 33 per cent from 2007 levels by 2020, and by 80 per cent below 2007 levels by 2050.

The Climate Action Team is working to identify the most credible, aggressive and economically viable greenhouse gas reduction targets possible for 2012 and 2016. Legislated targets for both years will be put in place by December 31st.

Your government will be carbon neutral by 2010.

A climate action plan to advance those targets will be released shortly after the budget. It will be annually updated and founded on personal responsibility, sound science and economic reality. And it will be driven by one simple truth: it is people who cause global warming and it is people who must act to stop it.

Waiting for others to act is not a solution — it compounds the problem.

Taking refuge in the status quo because others refuse to change is not an answer. It's avoiding responsibility and being generationally selfish.

The argument that British Columbia's mitigation efforts are, in global terms, too miniscule to matter misses the point.

Every molecule of carbon dioxide released into our atmosphere by human activities matters. It hangs there for decades or even centuries, and adds to the accumulated burden of global warming on our planet.

The benefit of our actions is not negated by the actions of others who add to the problem. They are cumulatively beneficial, globally significant and scientifically discernible. They contribute to the efforts being taken by growing legions of people around the world who are acting today to prevent the problem from becoming even worse.

We cannot be paralyzed into inaction by the scale of the task at hand. Rather, we will act now to make a real difference, and to encourage behavioural changes that will drive sustainable growth as a global imperative.

Market forces can play a positive role in this regard.

You Choose. You Save.

By living smarter, we can save on energy, water and fuel consumption. We can reduce waste and get better value from our land, our limited natural resources and our tax dollars.

This will reduce greenhouse gas emissions and drive innovation that will create new jobs and opportunities. It will conserve water and energy, and save us money.

Your government will give citizens new choices for new savings. "You choose. You save."

It will reward smart choices and create the competitive advantages of higher productivity, lower costs, less waste and higher quality products for our industries.

That is why British Columbia is participating in the Western Climate Initiative, The Climate Registry, and the International Carbon Action Partnership.

This session, legislation will be introduced to facilitate British Columbia's participation in a regional "cap and trade" system that is being developed under the Western Climate Initiative. The framework for that system is scheduled for completion this year.

It will help large emitters meet their obligations to live within legally mandated, declining emissions "caps", at the lowest possible cost.

All British Columbians will be asked to do their part in meeting B.C.'s legislated greenhouse gas reduction targets and in conserving energy.

As the cost of producing new, clean electricity unavoidably goes up, consumers will be given new tools to help conserve energy and save money on their power bills.

BC Hydro has been instructed to install Power Smart meters in every home in British Columbia by 2012 that will give families new information and control over their power consumption.

New “inclining block” rate structures will also allow families to choose and save by making Power Smart choices.

These changes and the BC Energy Plan will be supported by a new legislated direction for the BC Utilities Commission.

Government will encourage smart developments that minimize waste and increase affordability through better use of land, energy, water and building design.

This new initiative — LiveSmart BC — will help to contain urban sprawl and reward development that creates more affordable housing, new green spaces and more people-friendly neighbourhoods.

Carbon-smart communities are energy-smart, water-smart, health-smart and resource-smart. They are communities designed for human needs at the lowest “lifecycle” cost and highest long-term benefit possible — with the least impact possible on our environment.

Green developments waiting for provincial environmental approvals will be fast-tracked and given priority.

The new Green Building Code will be finalized and implemented to save energy and water.

All new provincial public buildings will be constructed to LEED Gold or equivalent standards. Existing buildings will be retrofitted to make them more energy efficient, climate friendly and healthier for public servants.

A new Trees for Tomorrow program will launch a large, urban afforestation initiative. Millions of trees will be planted in backyards, schoolyards, hospital grounds, civic parks, campuses, parking lots and other public spaces across B.C.

Major investments in tree nurseries will be made to assist this initiative.

Those new trees will help clean our air and "lock away" carbon dioxide that would otherwise contribute to global warming.

Other legislation will require local governments to incorporate greenhouse gas reduction targets and supporting strategies in their Official Community Plans and Regional Growth Strategies.

The discharge of landfill gas will be regulated to foster the capture and conversion of emissions into clean energy.

A new "Brownfields to Greenfields" redevelopment strategy will target existing "dirty" sites for the creation of well-treed, green, liveable communities.

Higher densities will be encouraged around new transit routes to help make them more affordable and create affordable housing.

Better transit leads to reduced greenhouse gases, cleaner air, shorter transit times and healthier communities.

That is the intent of your government's new $14-billion vision for expanded public transit across B.C.

That initiative will double transit ridership and renew existing fleets with cleaner technologies. It will increase the number of buses by 60 per cent in areas outside of Metro Vancouver and double TransLink's bus fleet by 2020.

That will substantially reduce emissions. It will mean that many citizens in TransLink's region will see more transit routes as well as a bus every 15 minutes, 15 hours per day, seven days a week.

There will be new RapidBus BC lines on nine major routes in Kelowna, Victoria and Metro Vancouver. There will be four new rapid transit lines — the new Canada Line, Evergreen Line, UBC Line, and an upgraded and expanded Expo Line.

The new Port Mann Bridge will also restore public transit across that corridor for the first time in 20 years. There will be new investments in cycling paths and pedestrian paths across B.C.

All of these improvements will give people new opportunities to choose alternative forms of transit, with more routes, more options and new savings in time and vehicle costs.

To further reduce transportation-related emissions, this legislature will be asked to adopt new California-equivalent vehicle tailpipe emission standards, in tandem with California and a number of other states and provinces.

Standards for low-carbon fuel content will be adopted to reduce the carbon intensity of motor vehicle fuels by 10 per cent by 2020.

New incentives will be created to encourage the purchase of fuel efficient vehicles.

The Scrap-It program will be expanded to get older vehicles with higher emissions off the road, while promoting newer, cleaner vehicles across the province.

New investments will be made in plug-in hybrid electric vehicles, hydrogen-powered buses, clean retrofits of dirty diesel trucks and the electrification of truck stops.

All these initiatives will stimulate innovation and job creation.

The Innovative Clean Energy Fund will help create 100,000 solar roofs in British Columbia and build on B.C.'s expertise in solar technology.

The new BC Bioenergy Strategy will create new opportunities in clean technology for rural communities, for independent power producers, and for our forest and agriculture industries.

A new Pacific Carbon Trust will foster economic growth from new opportunities in carbon credit trading and carbon offsets.

It will invest in made-in-B.C. offset projects that produce emissions reductions that are permanent, measurable, verifiable, and additional, and that are regulated by government.

Projects in energy efficiency, renewable energy, carbon capture and sequestration — including incremental tree planting — will all be eligible.

The Trust will manage the revenues generated from your government's plan to become carbon neutral by 2010. It will be open to offset purchases from private citizens, companies and other governments alike.

These new initiatives will help reduce British Columbia's greenhouse gas emissions while also creating jobs in new fields of employment like carbon accounting, carbon brokerage, carbon auditing and carbon trading.

A new Citizens' Conservation Council will support B.C.'s mitigation efforts with public education campaigns that will give citizens the tools and information they need to make informed choices.

A new Youth Climate Leadership Alliance will be formed that will comprise students and other young people from across B.C.

It will undertake paid government-sponsored field research, mitigation work, afforestation projects and adaptation efforts. It will also lead a new Youth LiveSmart outreach campaign to encourage young British Columbians to make carbon-smart lifestyle choices that are good for the environment, their health, their pocketbooks and our planet.

Other LiveSmart BC education and outreach initiatives will be launched by the government and the Pacific Institute for Climate Solutions, an exciting new consortium involving UVic, UBC, UNBC and SFU.

It will bring together British Columbia's world leaders in conducting climate research and developing cutting-edge solutions. It will help shape our actions to mitigate global warming and adapt to its unavoidable consequences.

Changing temperatures and precipitation patterns are already affecting our weather, water cycles and ecology. Climate change is now impacting our forests, ecosystems, water levels, infrastructure, agriculture industry and recreational opportunities.

Risks of flooding and storm surges pose new threats for human health, safety and property.

Warmer temperatures and drier conditions are compounding insect infestations and wildfire threats in our forests and communities.

Your government will expand British Columbia's hydrometric and other climate-related networks to improve our ability to monitor, predict and adapt to these conditions.

It is responding with a new 10-year commitment to flood prevention, the Mountain Pine Beetle Strategy and the Wildfire Prevention Strategy.

This government will make the most of that beetle-killed wood while it is still viable and valuable for lumber, wood products, pulp and paper, and new opportunities in bioenergy.

We have few natural allies in our fight against climate change that are more important than our forests. Our trees clean the air, manage our watersheds, provide habitat for wildlife and protect the land.

Today, nearly 700,000 hectares of forest lands in British Columbia are not sufficiently restocked through reforestation.

Each year, new developments, urbanization, agricultural conversions, new power lines and other utility corridors contribute to deforestation.

That releases greenhouse gases into the atmosphere and removes millions of trees that are absorbing and storing carbon.

To reverse this problem, your government will pursue a goal of zero net deforestation. It will work with First Nations, industry and communities to put that goal into law by 2010 and establish a viable strategy for realizing that vision by 2015.

All forest land currently identified as not sufficiently restocked will be replanted and no "NSR" backlogs will be allowed to develop in ensuing years.

In addition to reforestation required by law of licensees, the Forests for Tomorrow program will plant an additional 60 million seedlings over the next four years.

It is reforesting areas of Crown land affected by the catastrophic wildfires of 2003 and 2004, and by the mountain pine beetle that would otherwise remain unplanted.

This will create new jobs and years of steady employment in rural communities and will be assisted by new research in planting equipment and forest species.

These are only some of the many initiatives your government is taking to leverage the challenges of global warming into opportunities for sustainable growth, stable jobs and more liveable communities.

But the challenge of sustainability is not restricted to the environment. It also challenges the long-term viability of our health services.

Living Smart Means Healthier Families and Sustainable Health Delivery

British Columbians were asked how we might strengthen our health system within the *Canada Health Act* and secure it for future generations during the Conversation on Health.

That Conversation produced valuable ideas and helped inform British Columbians about their health system, its challenges and the need for renewal.

This session your government will act to improve health care for the long term through a new emphasis on healthy lifestyles, prevention and accountability.

There will be one public payer for services under the *Canada Health Act* that will continue to deliver services through public and private service providers.

British Columbia's health care system will be built on an express commitment to accessibility, universality, portability, comprehensiveness and public — not private — administration.

Amendments will define and enshrine those five principles of the *Canada Health Act* under the *Medicare Protection Act*. A sixth principle of sustainability will be added to ensure our health care system will be there for our children, our grandchildren and their families.

The Medical Services Plan will be required to be administered in a manner that is fiscally sustainable and provides for British Columbians' current health needs without compromising future generations' entitlement to similar MSP benefits.

Other amendments will codify a commitment to building a public health care system that is founded on the values of individual choice, personal responsibility, innovation, transparency and accountability.

Our goal is an efficient, effective, integrated health system that promotes the health of all citizens, and provides high-quality patient care that is medically appropriate and ensures reasonable access to medically necessary services consistent with the *Canada Health Act*.

Citizens will gain new access to their health records and medical information so they can play an informed role in making both preventative and therapeutic care choices.

People who choose to, will have the option of staying in their homes with their families as long as possible at the end of life.

This year the government will undertake a study of the opportunities and costs involved in the establishment of a new Independent Living Savings Account framework.

It would allow citizens to choose to invest a certain portion of their income each year, up to age 75, in a tax-sheltered savings account that can be used for home care support, assisted independent housing and supportive housing options.

Patient choice and access will also be improved through major new investments in eHealth and expansions to BC NurseLine, including a new "specialist referral service."

Since December, your government has waived the three-month residency period to access MSP benefits for soldiers and their families who are serving our country in Afghanistan and elsewhere abroad.

As of today, British Columbia will waive the wait period for all Canadian soldiers and their families who move to B.C. from elsewhere in Canada.

Your government urges all provinces to do likewise to show our national gratitude to those who serve in our military.

With their sacrifices in mind each of us can ask: what are we doing to help our planet, our country and future generations?

The fight against climate change is our fight. The battle to save Medicare is our battle. We all must do our part.

All the money raised from sales tax, Medicare premiums, tobacco tax, health-care fees, federal health transfer payments and corporate income tax combined does not cover the costs of our health services.

Health expenditures have grown at more than twice the rate of growth in GDP over the last 20 years and at nearly quadruple inflation rates in this decade.

If we fail to come to grips with that trend, it will be our children and their families who will pay the highest price.

This obliges us to adopt new effective strategies that at once improve the health of our citizens, improve health delivery and protect our public health system for the long term.

Throughout the Conversation on Health there was overwhelming support for more focus on disease prevention and health promotion.

Diseases like Alzheimer's, Parkinson's, and strokes rob aging individuals of their memories, motor skills and faculties. Mental illnesses like depression, schizophrenia and substance abuse typically begin in childhood, exerting a lifelong impact on the individual, their families and society.

The causes of childhood afflictions such as Fetal Alcohol Spectrum Disorder, Attention Deficit Hyperactivity Disorder, and Autism Spectrum Disorder remain poorly understood.

This legislature will be asked to approve major investments aimed at strengthening our ability to prevent and treat such conditions.

Your government will build on the expertise and success of the Brain Research Centre with a new Centre for Brain Health. It will help people avoid brain diseases and provide new treatment and rehabilitation options for patients.

B.C. is recognized across the country for its excellent work in cancer research.

Expanded pediatric oncology research will offer new hope for cancer prevention and treatment specifically focused on children.

Some 20 per cent of all hip fractures result in death and half of those who do survive are left with disabilities. Musculoskeletal diseases generate more direct and indirect costs than any other health condition in B.C.

New investments in the Centre for Hip Health and Musculoskeletal Research will be undertaken.

The Hip Centre will work to prevent falls and hip fractures through the development of early intervention programs for youth and seniors. It will enhance the detection of osteoarthritis at an early stage and the education of highly skilled scientists and clinicians.

Personal health starts with personal commitment to healthy eating, active living and responsible health management.

Your government will establish ActNow seniors' community parks throughout the province. They will be designed especially for seniors to help them stay mobile, physically active and healthy.

The best way to stay healthier later in life is to be health-smart all our lives.

Expectant parents have been given new tools and support to help them make healthy choices for their new babies.

Universal early screening programs have been introduced that have been complemented by early childhood development programs for infants, toddlers and preschoolers.

New daily minimum physical activity requirements are now in place for B.C. students.

Working with parents, educators and students, two new programs will be designed to provide our children with new opportunities for daily physical activities.

A new "Walking School Bus" program will be developed to enable young students to walk safely to their schools, accompanied by adults. A similar new program — the "Bicycle Train" — will give groups of children the chance to bicycle to class with adult supervision.

To encourage healthy eating, your government has introduced and is expanding the school fruit and vegetable nutritional program.

It has banned junk food in schools and vending machines in provincially-owned buildings.

It will now act to ban the use of trans fats in the preparation of foods in schools, restaurants and food-service establishments by 2010.

Smoking remains one of the most pernicious health threats to children.

It has now been banned in all indoor public spaces and on all school property. Yet more must be done.

The Canadian Cancer Society estimates that as many as one in five children are exposed to second-hand smoke while riding in passenger vehicles.

To ensure children are no longer subjected to second-hand smoke in any vehicle, new legislation will ban smoking in vehicles when children are present. There is nothing more precious or important than the health of our children.

BC Children's Hospital provides outstanding care for many of British Columbia's most seriously ill or injured children. It provides highly specialized services that are not available elsewhere in B.C.

Your government is committed to the upgrading and expansion of BC Children's Hospital. It will work with the BC Children's Hospital Foundation and the Provincial Health Services Agency to plan, modernize and refurbish that important health facility and improve its health services for children in all regions of British Columbia.

British Columbia has some of the best population health outcomes anywhere in the world. Yet each year, public health risks emerge.

Improvements to the *Public Health Act* will help deal decisively with these challenges and protect our citizens from infectious diseases and emergency health hazards.

Your government will strengthen its statutory capacity to guarantee the highest standards of safety and quality in service delivery.

A new BC Patient Safety Council will be established. It will enhance patient safety, reduce errors, promote transparency and identify best practices to improve patient care.

New Patient Care Quality Review Boards will also be established for all health regions. They will provide a clear, consistent, timely and transparent process for patients to register complaints about service quality or clinical appropriateness in the health system, including the residential care sector.

Health professionals are the lynchpins of quality health care. Access to qualified health professionals will be substantially expanded.

New legislative authority will be sought to ensure health professionals who are certified to practise in other Canadian jurisdictions will be welcomed to practise in B.C. and have their credentials recognized. This includes foreign-trained doctors.

A new restricted licence will allow internationally trained physicians to practise in their specific areas of qualification.

Residency positions will be significantly expanded to complement the recent doubling of medical school spaces. A new framework to allow Canadian citizens trained outside Canada to find residencies and practise in B.C. will be developed and implemented.

A three-year Bachelor of Nursing Science program will be established. It will permit nurses to gain their degree a year sooner with significant 'on-the-job' training.

Nurses will be trained and authorized to deliver a broader range of health services such as suturing, ultrasounds, allergy testing, local anaesthesia and cardiac stress testing.

They will be able to give medications for minor pain at triage while patients are waiting to see a doctor. They will be authorized to order lab work, blood tests and X-rays.

Amendments to the *Health Professions Act* will allow health providers the opportunity to utilize their full scope of training and expertise.

A new Health Profession Review Board will ensure that all qualified health workers can fully and appropriately utilize their training and skills, and not be denied that right by unnecessary credentialing and licensure restrictions.

Pharmacists will be permitted to authorize routine prescription renewals, making it easier for patients with chronic illnesses to manage their conditions.

Ambulance paramedics will be authorized to treat and release when appropriate. Naturopaths will be permitted to prescribe medicinal therapies as appropriate and restrictions on their access to medical labs for prescribed tests for patients will be removed.

Midwives will be authorized to deliver a broader range of services without a physician present to new and expectant mothers who choose to utilize their services.

These measures will be bolstered by expanded access to primary care, new independent living options, and improved service levels in assisted living and residential care.

Teams of health professionals working together for patients will be available 24 hours a day to provide clinically appropriate care that is now only available in emergency rooms.

New tools and support services will be created to help home caregivers and family members who are providing in-home care.

Better co-ordination of patient services across the Lower Mainland will reduce administration costs. Those revenues will be redirected to patient services.

Integrated approaches to health human resources training and recruitment, data collection, procurement and services will be implemented.

New investments will standardize information technology platforms and provide new tools for better managing and optimizing health expenditures.

Your government will also launch an innovation and integration fund for the Vancouver Coastal and Fraser Health Authorities to help move beyond "block funding" toward a new provincewide patient-centred funding model.

This new model will see health dollars follow patients, wherever they are treated. It will tie funding to performance and to increased service levels in specific priority areas, like emergency care and surgical backlogs.

These measures will improve the health of our citizens. They will improve access, choice, quality, transparency and accountability in public health delivery. They will make health care more sustainable.

Living Smart Means Safe, Supportive Communities

Safe, supportive communities encourage human interaction, citizen engagement and a heightened commitment to social responsibility.

They are places where women and children feel safe to walk outdoors and enjoy their parks.

The challenges of poverty, mental illness and addictions compound the societal challenges of housing, homelessness and crime.

There are victims and casualties in our society — injured, hurt, lost, isolated people who cannot find their way off the street, into a home, out of addiction and back to health.

Additional efforts to guide them to healthier lives will be immediately launched, as an updated 10-year mental health plan is also completed.

Communities will be required to include provision for mental health and addiction service facilities in their community plans.

Expanded outreach programs will help lift people out of the street and offer them personalized support.

Patients with severe mental illnesses who require intensive, sustained and complex medical treatment will be provided care in new and existing facilities at Willingdon in Burnaby, which will be retrofitted and opened this year, and at Riverview in Coquitlam.

People in the Downtown Eastside and elsewhere who can't cope will be cared for in safe and secure facilities until they are well. They will not be abandoned or consigned to a life of despair and destitution on the streets.

Your government has tripled its investments in housing and other initiatives aimed at breaking the cycle of homelessness. That has helped thousands of people find more affordable and appropriate housing.

Over 4,300 families have been given new support through the rent supplement program. It will be expanded this year.

A "211" service, in partnership with the United Way, will be launched to give citizens new telephone access to information about the full range of social services offered in their communities.

This will especially help women, seniors and persons with disabilities find support services that are delivered by multiple levels of government and private providers.

Supports for women fleeing abusive relationships, assisted living options and income assistance programs have all been enhanced.

More will be done, as your government implements the Hughes recommendations on child protection, improves programs to prevent violence against women, and increases support to people with developmental disabilities, children with special needs and their families.

A new multi-year investment will be made to revitalize Vancouver's Downtown Eastside.

Anchored by the new Woodward's project, new public initiatives will be undertaken in partnership with the city and the neighbourhoods to enhance the 40-block area that includes Gastown, Chinatown, Strathcona and Japantown.

Those improvements will be reinforced by new housing investments for people in the area.
This government will work with the city and the community to restore hope, pride and a safer, healthier environment for all who call these neighbourhoods home.

Community safety will continue to be a major focus of attention for your government.

New actions will be taken to better prevent, enforce and prosecute crime; and to enhance public confidence in our police and courts.

Two public inquiries have recently been initiated to serve that end.

Amendments to the *Police Act* will aim to implement Josiah Wood's recommendations to improve transparency, accountability and public confidence in the police complaints process.

British Columbians want to understand why sentences in their province tend to be shorter than in other provinces for crimes such as homicide, theft, property crimes, fraud, impaired driving and drug possession.

A comprehensive review of sentencing practices in B.C. courts will address those questions. It will also assess how the federal government's anti-crime measures might affect demands on our police, Crown prosecutors, courts and correctional system.

That information will all contribute to a Community Safety Strategy that will be released this fall.

It will build on recent initiatives to fight the scourge of crystal meth, gang violence, drug-related homicides, grow-ops, street racing, dangerous driving and property crimes.

That strategy will include enhanced policing, new community courts and expanded correctional capacity.

Your government will also work with local governments to explore the potential to further integrate policing and to examine the possibilities for amalgamating police forces and creating safer communities.

Living Smart Means Educational Excellence

Education is the key to our future.

Dozens of recent measures have improved quality, access, choice and accountability in education at all levels. Others are improving literacy for people of all ages.

Funding is up at record levels, average class sizes are down, and completion rates are up.

There is more choice in schooling and curriculum, and new Internet-based access to education. Parents now have a direct role in school planning. Teachers have higher pay cheques and will soon have an unfettered right to practise here and in Alberta.

A new program leading to a certificate in leadership will be introduced for teachers. New powers will be given to the College of Teachers to remove the teaching certificate of any member who is found to be incompetent.

Immediate steps will continue to strengthen early childhood learning.

Eighty-four StrongStart BC centres have opened to help preschool-age children and their parents get ready for kindergarten. Another 316 centres will be added in the next two years, for a total of 400 StrongStart centres that will be open across B.C. by 2010.

A new Early Childhood Learning Agency will be established. It will assess the feasibility and costs of full school day kindergarten for five-year-olds. It will also undertake a feasibility study of providing parents with the choice of day-long kindergarten for four-year-olds by 2010, and for three-year-olds by 2012. That report will be completed and released within the year.

A new Centre for Autism Education and Research will be developed. It will provide a residential environment for children with autism and create a national hub for research and a centre for parental supports.

Today, as a result of post-secondary expansion, students with a B average or better can look forward to advancing their education here in B.C.

Your government is now providing $1,000 to each new child born or adopted in B.C. on or after January 1, 2007. That money is collecting interest year after year, in credit towards their future post-secondary education needs.

This year, new steps will be taken to expand B.C.'s public university system, provide new clarity of purpose in our post-secondary institutions and create new opportunities for higher learning.

Funding will be targeted where it is needed most, to meet skills demands with added training capacity for skilled workers.

Major expansions to the Provincial Nominee Program and the successful Skills Connect for Immigrants program will also help meet new demands for skilled workers.

Post-secondary students will be given new consumer protection as institutional accountability is strengthened under the new Education Quality Assurance program.

This will enhance both our international educational initiatives and the marketability of our institutions abroad, particularly in the Asia Pacific, which is so central to your government's vision for a strong economy.

In the new creative economy, art and culture are increasingly recognized as critical competitive advantages in attracting and retaining skilled workers and building an enlightened society.

As a legacy of our 150th anniversary, major new investments will be earmarked to significantly enhance British Columbia's contributions to art and culture.

A major new arts endowment will provide lasting benefits to all British Columbians.

The Vancouver Art Gallery will enhance its international reputation as a showcase of B.C. art of all genres, cultures and regions. New steps will be taken to elevate both its international profile and the profile of B.C. artists' rich talent, creative capacity and inspiring originality.

To celebrate our maritime heritage, your government will support the establishment of a National Maritime Centre for the Pacific and the Arctic in North Vancouver.

Subject to federal matching dollars, that world-class Centre will be developed as a public-private partnership. It will be an important legacy for British Columbians and Canadians alike.

The Key to Smart Growth is a Strong Economy

Our economy is strong. Small business remains the most confident in Canada. It is the jobs engine that continues to see B.C. leading the nation in job creation.

Energy, mining, technology, construction, manufacturing, small business, retail, tourism, transportation and other sectors are doing well. But like other economies in North America, ours is being buffeted by some very strong winds, especially in forestry.

The new Working Roundtable on Forestry will recommend new possibilities for forestry, including new tenures. A 90-day regulatory and process review will cut unnecessary administrative and process costs.

Working with industry and labour, new pension bridging opportunities will be developed for older workers nearing retirement. New training opportunities will also be offered to help forest workers who have been temporarily laid off to upgrade skills and earning potential.

New tenures will increase access to waste material left on forest floors after harvesting, so that it can be converted to clean, renewable bioenergy.

The new BC Bioenergy Strategy will create new opportunities in cellulosic ethanol, biodiesel and other clean, renewable fuels. It's part of the new BC Energy Plan that will help make British Columbia an alternative energy powerhouse in the Pacific Century.

The consultation now underway will continue to advance the potential for Site C, which could be a major economic catalyst for rural British Columbia in years to come.

A new northern energy corridor from Prince Rupert to Prince George will also be pursued. That alone holds the potential for billions of dollars in new investment that will create new high-paying jobs for the North.

The Port of Prince Rupert is revitalizing northern and rural economies and creating a powerful platform for future development. The next phase of that port development will be pursued, in co-operation with First Nations and the federal government.

Working with the federal government, a new integrated Pacific Ports Strategy will also be developed, to make the most of Canada's Pacific Gateway.

Our agriculture industries are progressing, with our award-winning wineries leading the way. A new British Columbia Agriculture Plan will ensure farming continues to have a bright future in our province.

Amendments to the *Employment Standards Act* will improve protection for farm workers and prohibit agricultural producers from using unlicensed farm labour contractors.

The Future is Full of New Promise for British Columbia

In precisely two years, people from around the world will see how far we have come over the last 150 years.

They will see what British Columbians now see and feel: a province that is opening the door to Canada's Pacific Century.

A place that celebrates the creativity of our artists, the discoveries of our scientists, the resolve of our rural communities and the vitality of our cities and towns.

A people who are acting to bridge generational challenges and leave the world a better place.

A province living its Olympic dream, hosting the greatest sport and cultural spectacle on Earth.

In 2010, the world will see the majesty of our landscapes, the strength of our diversity, and the wealth of our human and natural potential. It will feel the promise of British Columbia.

And British Columbians will revel in that moment and the pride of all we have accomplished together.

The goals we have set for ourselves are great and the path your government is charting for our province is challenging.

But British Columbians' dreams are never small and are always earned. They are about reaching higher.

In this, a special year in our history, let us not shrink from our responsibilities to see beyond our lifetimes to a better time.

The best is yet to come for British Columbia. As has been said before, "history and our own conscience will judge us harsher if we do not now make every effort to test our hopes by action."

BRITISH
COLUMBIA

SPEECH FROM THE THRONE

The Honourable Iona Campagnolo

Lieutenant-Governor

— *at the* —

Opening of the Third Session,

Thirty-Eighth Parliament

— *of the* —

Province of British Columbia

February 13, 2007

I wish to recognize those in attendance including former Lieutenant-Governor, the Honourable Garde Gardom.

Once again I have the great privilege of addressing you as we begin a new session of the Parliament of British Columbia.

It is important we remember and honour British Columbians who have passed away since this Assembly last convened.

All British Columbians join the Nisga'a people in sadness at the loss of their Chief of Chiefs, Dr. Frank Calder.

We mourn the passing of former members of this Assembly, Val Anderson, Ray Williston, and Peter Hyndman.

Our communities were strengthened and built by former mayors we lost this year: 17-term Prince Rupert Mayor Peter Lester, Marilyn Baker of the District of North Vancouver, Doug Drummond of Burnaby, Ken Hill of Esquimalt, and Jack Loucks of North Vancouver City.

We mourn the loss of Hereditary Chief Jerry Jack of the Mowachaht-Muchalaht First Nation, Grand Chief Peter C. James of the Katzie First Nation, and Chief Roy Mussell of the Skwah Band of the Sto-lo Nation.

Our arts community lost friends with the passing of coastal painter E.J. Hughes, filmmaker Daryl Duke, actor and playwright Mavor Moore, poet Max Plater, entertainer Fran Dowie, and volunteers Ernie Fladell and Reva Lander.

The world of journalism lost the bylines of Elizabeth Aird and Denny Boyd.

We lost British Columbians who showed us that individuals can make a difference: Ken Willoughby, who raised awareness about prostate cancer; John Turvey, who helped the residents in Vancouver's Downtown Eastside; and Yung Quon Yu, president of the Chinese Benevolent Association of Vancouver.

We are saddened by the loss of former Supreme Court Justice John Caldwell Cowan, former deputy minister Stanley Paul Dubas, and Thomas Kunito Shoyama, one of Canada's most respected civil servants.

We remember our dedicated members of the public service who passed away in the last year: Wilma E. Blanchard, Roberta Campbell, Alice Chu, Allan Clayton, Brenda C. Code, Jeanne L. Cressey, Lyndon Cross, Jane Fernandez, Rita Foreman, Craig William Gibson, Karen Hoyseth, Mary C. Hudson, Debbie Hunt, Andrea LaCasse, Theresa Lewis, Douglas W. McKay, Theresa M. Marsolais, Richard Martin, Roger Motut, Parminder Nagra, Rosetta Neal, Nurani Rahemtulla, Joy E. Rushton, Susan H. Schneider, John W. Schildroth, John Schindel, Donna Sheardown, Barbara Sheldan, Lynne Webb, and Larry Wells.

We were also reminded of the sacrifices made by our Armed Forces serving in Afghanistan in mourning the loss of Corporal Andrew James Eykelenboom of Comox and Bombardier Myles Mansell of Victoria.

Tragedy touched us and took from us too soon Gerald Foisy and Shirley Rosette of 108 Mile House in the sinking of the *Queen of the North*, and Bob Newcombe, Doug Erickson, and paramedics Shawn Currier and Kim Weitzel in the Sullivan Mine tragedy. All are remembered with respect.

Over the last five years British Columbians have marshalled their effort and energy to turn the province into an economic powerhouse and a centre for social innovation and improvement.

Self confidence and optimism have created a legacy of leadership rooted in the power of individual aspiration and the potency of common purpose.

Today we live in a world redefined by enormous shifts in our demographic, economic, and environmental makeup.

At the heart of the government's agenda lies this simple question: What can we do today to secure the future for our children and grandchildren?

This is a time for partnership not partisanship, for boldness not trepidation, for action not procrastination.

British Columbians accomplish what we set our minds to do. We worked together to rebuild our financial foundation. Today, the economy is on track and, for the first time since 1983, we have regained a triple-A credit rating.

Over the last five years British Columbia has led the nation in job growth. The Conference Board of Canada ranks our health system as the best in Canada. Our students are outperforming their counterparts in international assessments.

We have worked together to preserve vast areas of wilderness, to create the Kitasoo Spirit Bear Conservancy, and to pioneer ecosystem-based management.

The Conservation Investment and Incentives Initiative creates a $120-million partnership to build economic development and conservation programs with First Nations in valuable coastal rainforests.

Last year's unprecedented labour agreements are widely recognized as a singular feat of leadership. Public sector workers worked with government to find solutions that were constructive, flexible, and innovative. There have been fewer strikes and lockouts due to labour disputes in B.C. over the past four years than at any time on record.

The precedent-setting Trade, Investment and Labour Mobility Agreement with Alberta will create jobs and opportunity in every region of the province.

Rural British Columbia has record levels of employment and economic growth. That is a credit to our citizens and their hard work.

When we act with resolve and with common purpose, we succeed. Nowhere is that more apparent than in the New Relationship we are forging with First Nations.

First Nations' leaders are leading Canada to close the gaps in health, education, housing, and economic opportunity. Their legacy is a testament to positive leadership and a lasting contribution to Canada.

The powerful currents sweeping across our lives today call for long-term vision not short-term expedience, for selfless rather than selfish actions, for focused rather than fractured responses, and for decision not delay. They demand we look to ourselves for change before asking it of others.

Today's youth are wondering what the future holds for them.

Will we have the courage to tackle difficult problems that have no easy solutions?

Can we find the resolve to ask more of ourselves than we demand of others?

Will we have the foresight to reach higher in education and literacy, to reduce the weight of our footprint on the environment, or to sustain our public health care system?

To these questions your government answers — yes.

We are obliged to act — individually and collectively — before the tipping point becomes the breaking point.

Your government will act:

- To lead Canada in partnership with First Nations.
- To tackle the challenges of global warming and unplanned urban sprawl.
- To increase affordable housing, reduce homelessness, and help those who cannot help themselves.
- To improve quality, choice, and accountability in our two most important public services — education and health care.
- To open up Canada's Pacific Gateway and strengthen our economic competitiveness.

These are the elements of the Pacific Leadership Agenda. They are all crucial to achieving the Five Great Goals for the Golden Decade that lies ahead.

Your Government has begun the Long Journey to Reconciliation with First Nations

The First Nations Leadership Council deserves our thanks for their open and positive leadership.

Today, three Final Agreements under the B.C. Treaty Commission are being considered for ratification by First Nations.

Those treaties are harbingers of hope and reconciliation of Aboriginal rights with the responsibilities of the Crown.

If they are ratified within the next few months, legislation will be brought to this House for full consideration.

The Province appreciates the federal government's partnership in reaching this historic stage in the treaty processes for the Maa-nulth, Lheidli T'enneh, and Tsawwassen people.

Last year's historic agreements with the Songhees, Esquimalt, Tsay Keh Dene, and Kwadacha people also attest to a New Relationship between First Nations and government.

The Transformative Change Accord, the new health, education and housing frameworks, and hundreds of working agreements between the Province and First Nations will enable First Nations to better control their own destinies.

Recognition of First Nations' contributions to our history and our culture are critical components of reconciliation.

New Osoyoos, Haida Gwaii, and Squamish-Lil'wat cultural centres will reconcile the past with a positive future.

New curricula will be developed with First Nations historians. Oral histories will be gathered through conversations with First Nations Elders.

More will be done to enhance and preserve First Nations languages.

With that spirit of respect and reconciliation in mind, your government will work with this Assembly and First Nations to act on the recommendation of the 2001 review dealing with the artwork in the lower rotunda of the Parliament Buildings.

British Columbia is leading the way towards a positive, contemporary vision for Canada that recognizes all of its founding partners.

It stands proudly for the inclusion of Canada's Aboriginal people as full founding partners in Confederation.

It stands firmly for the recognition and respect of Aboriginal rights, title, and self-determination within the Canadian Constitution.

As we have worked to establish a New Relationship with First Nations, so too must we redefine our relationship with our natural surroundings.

British Columbia has Established a Reputation for Environmental Leadership

Over the last five years the government has built on that legacy.

Wildlife habitat protection has expanded from 10,000 hectares to over four million hectares.

For the first time ever, a program is in place to clean up old contaminated sites on Crown land.

Today, 14 per cent of British Columbia land is protected — more than any other province.

This government has created 43 new Class A parks and expanded 38 existing parks.

Your government will act this year to establish several new Class A parks and conservancies and to expand many other existing ones.

Changes will be introduced to strengthen forest stewardship and reduce the risk of forest fires.

Other amendments will improve forest health, encourage better utilization of beetle-killed timber and salvage fiber, and strengthen actions against those who damage our forest or range resources.

After decades of inaction, both groundwater protection and a drinking water action plan are in place.

A $21-million Living Rivers Trust has been established to enhance watershed management and restore fish habitat.

The new $150-million Canada-British Columbia Municipal Rural Infrastructure Fund will support green projects that improve water quality, wastewater, sewage treatment, and public transit.

After years of denial, the evidence is clear.

Victoria's raw sewage is contaminating the ocean floor and polluting the Pacific.

That is not acceptable. And it will be remedied.

Your government will fund up to one-third of the costs of a new sewage treatment facility for Greater Victoria.

As important as all of these priorities are, none is more important than the critical problem of global warming and climate change.

The challenge of reversing global warming is more difficult today than it was in 1992 at the Rio Summit and more dire than it was in 1997 in Kyoto.

The Kyoto Treaty, which is now in place, just came into force two years ago this Friday.

Little has been done to seriously address this problem which is literally threatening life on Earth as we know it.

Since 1997, greenhouse gas emissions have continued to grow here in British Columbia and across Canada.

Voluntary regimes have not worked.

In 2007, British Columbia will take concerted provincial action to halt and reverse the growth in greenhouse gases.

We will forge new partnerships across both provincial and national boundaries.

The government will act now and will act deliberately.

British Columbia's greenhouse gas emissions are now estimated to be 35 per cent higher than in 1990. The rate of atmospheric warming over the last 50 years is faster than at any time in the past 1,000 years.

The science is clear. It leaves no room for procrastination. Global warming is real.

We will act to stem its growth and minimize the impacts already unleashed. The more timid our response is, the harsher the consequences will be.

If we fail to act aggressively and shoulder our responsibility, we know what our children can expect — shrinking glaciers and snow packs, drying lakes and streams, and changes in the ocean's chemistry.

Our wildlife, plant life, and ocean life will all be hurt in ways we cannot know and dare not imagine.

We do know this — what each of us does matters. What everyone does matters.

Things we take for granted and that have taken millennia to evolve could be at risk and lost in the lifetimes of our children.

Action on climate change was promised in your government's election platform. It is central to the Great Goal of leading the world in sustainable environmental management and it has been an important performance objective in the Province's last two strategic plans. The energy plan government adopted in 2002 is the cleanest, greenest energy plan in North America.

More air shed management plans have been developed over the past five years than in the entire previous decade. A 40-point action plan on climate change was adopted in 2004 and an energy efficient buildings plan in 2005.

Between 2000 and 2004, government's own emissions were reduced by 24 per cent. British Columbia now has the second lowest per capita greenhouse gas emissions in Canada.

However, our emissions are increasing at a rate far faster than most of our neighbours'.

We must act to arrest and reverse that trend.

This government will firmly establish British Columbia standards for action on climate change.

It will aim to reduce B.C.'s greenhouse gas emissions by at least 33 per cent below current levels by 2020. This will place British Columbia's greenhouse gas emissions at 10 per cent under 1990 levels by 2020.

It is an aggressive target and will set a new standard. To achieve that goal we will need to be focused and relentless in its pursuit.

Interim targets will be set for 2012 and 2016.

Leaders from business, community groups, and citizens themselves are calling for a new environmental playing field that is fair and balanced but that recognizes we all need to change. We all need to be part of the solution.

The soon-to-be released new climate action and energy plans will be complemented by an air quality improvement initiative.

Each of those plans will aspire to meet or beat the best practices in North America for reducing carbon and other greenhouse gases.

Because our emissions have grown so much since 1990, our task of reducing emissions in percentage terms will be that much more difficult.

Clearly there is a limit to what can be credibly accomplished within any given period of time.

A Climate Action Team will be established. Working with First Nations, other governments, industries, environmental organizations, and the scientific community it will determine the most credible, aggressive, and economically viable sector targets possible for 2012 and 2016.

The Climate Action Team will also be asked to identify practicable options and actions for making the government of British Columbia carbon neutral by 2010.

Your government is confident that balanced action will provide solutions that reduce costs, increase productivity, and make a leading contribution to environmental improvement.

This will be hard work but there is no place better suited to meet this challenge than B.C. because of our diverse and strong economy.

A longer-term emissions reduction target for 2050 will also be established for British Columbia, as it has been for Canada, California, and Oregon.

Citizens might be rightly skeptical of any such long-term targets. What we do today will rightly be judged for the example it sets.

Our economy has the strength and resources to be bold and far reaching.

Indeed, being bold and far sighted will foster innovation, new technologies, and plant the seeds of success. Just as the government's energy vision of 40 years ago led to massive benefits today, so will our decisions today provide far reaching benefits in 2040 and 2050.

Our actions will mean more jobs, new investments, and ultimately greater prosperity for British Columbia. Climate action must be seen and pursued as an economic opportunity as well as an environmental imperative.

Your government's comprehensive climate change and energy strategies will rest on a number of defining principles.

The new energy plan will require British Columbia to be electricity self-sufficient by 2016.

A new personal conservation ethic will form the core of citizen actions in the years ahead. Conservation provides huge benefits at minimal cost.

All new and existing electricity produced in B.C. will be required to have net zero greenhouse gas emissions by 2016.

That target may be unprecedented in North America, but it is achievable and realistic in B.C.

Under the new energy plan, British Columbia will reduce greenhouse gas emissions from the oil and gas industry to 2000 levels by 2016.

That will include a requirement for zero flaring at producing wells and production facilities.

The energy plan will require that at least 90 per cent of our electricity comes from clean, renewable sources.

Effective immediately, British Columbia will become the first jurisdiction in North America, if not the world, to require 100 per cent carbon sequestration for any coal-fired project.

That means no greenhouse gas emissions will be permitted for coal-fired electricity projects anywhere in British Columbia.

Your government will look to all forms of clean, alternative energy in meeting British Columbians' needs in our provincial economy.

Bioenergy, geothermal energy, tidal, run-of-the-river, solar, and wind power are all potential energy sources in a clean, renewable, low-carbon future.

Your government will pursue British Columbia's potential as a net exporter of clean, renewable energy.

A new $25-million Innovative Clean Energy Fund will be established to encourage the commercialization of alternative energy solutions and new solutions for clean remote energy that can solve many challenges we face right here in B.C.

Trees infested by the mountain pine beetle will be used to create new clean energy. Wood chips and other wood waste will be better utilized to produce clean power.

Beehive burners will be eliminated in British Columbia.

Legislation will be developed over the next year to phase in new requirements for methane capture in our landfills, the source of about nine per cent of B.C.'s greenhouse gas emissions.

That methane can and should be used for clean energy.

New technologies will be encouraged to "green the grid" and reduce energy losses in transmission.

In the weeks ahead, the Premier will meet the governors of Washington and California to work in partnership on several of these and other initiatives to reduce net greenhouse gases in the Pacific Coast Region.

British Columbia will work with California to assess and address the impacts of climate change on our ocean resources and establish common environmental standards for all our Pacific ports. Your government will seek federal co-operation to electrify our ports and reduce container ships' carbon emissions in all of Canada's ports.

A co-ordinated, integrated, market-based approach will be critical to meeting our targets.

Your government will work with the federal government and its Pacific partners to develop a sensible, efficient system for registering, trading, and purchasing carbon offsets and carbon credits.

Later this spring, your government will invite all Pacific Coast governors and their key cabinet members to British Columbia to forge a new Pacific Coast Collaborative that extends from Alaska to California.

Transportation represents about 40 per cent of B.C.'s total greenhouse gas emissions.

B.C. will work with its neighbours to create electrified truck stops and support other anti-idling measures for heavy vehicles.

A federal-provincial partnership will be investing $89 million for fuelling stations and the world's first fleet of 20 fuel cell buses. This expansion of the number of hydrogen fuelling stations is part of the initial phase of the hydrogen highway. That highway will run from Whistler to Vancouver, Surrey, and Victoria.

But that is just a start.

Your government will work with California and other Pacific states to push for a hydrogen highway that runs from Whistler to San Diego by 2010.

The Gateway Project will reduce congestion, improve traffic flow, and reduce emissions from vehicle idling.

It will dramatically expand cycling networks and connect communities as never before with safer cycling paths and healthier alternatives to driving.

It will establish, for the first time in 20 years, a new transit corridor and open the way for transit improvements to the Fraser Valley connecting Chilliwack, Abbotsford, Langley, and Surrey to Coquitlam and Vancouver.

Electronic tolls will help restrain traffic growth and transit funding will work in concert with decisions to increase densities, reduce sprawl, and reduce costs.

The new $40-million LocalMotion Fund will also help local governments build walkways, cycling paths, disability access, and other improvements aimed at getting people out of their cars and back on their feet.

The new Canada Line will reduce net greenhouse gas emissions by up to 14,000 tonnes by 2021.

New measures will be implemented to encourage and dramatically increase local transit alternatives.

Over the next year, new regional transit options will be established for our major urban areas in the Lower Mainland, the Fraser Valley, the Capital Regional District and the Okanagan.

New tailpipe emission standards for all new vehicles sold in B.C. will be phased in over the period 2009 to 2016.

Those standards will reduce carbon dioxide emissions by some 30 per cent for automobiles.

British Columbia will establish a low-carbon fuel standard.

It will reduce the carbon intensity of all passenger vehicles by at least 10 per cent by 2020.

These new standards will be developed in recognition of what is already mandated in California, to ensure they are viable and achievable.

Your government has already introduced fuel tax exemptions for ethanol and biodiesel portions of fuels blended with gasoline and diesel.

The $2,000 sales tax exemption on new hybrid vehicles will be extended to help make those cleaner cars more affordable.

Moving to a hybrid car from a four-wheel-drive SUV can cut personal transportation emissions by up to 70 per cent overnight.

Beginning this month, all new cars leased or purchased by the provincial government will be hybrid vehicles.

New measures will also be taken to reduce energy consumption and emissions in the public sector.

New strategies will be launched to promote Pacific Green universities, colleges, hospitals, schools, prisons, ferries, and airports.

An important symbol of leadership in that regard starts right here in the legislative precinct.

As the Legislative Buildings are upgraded to meet modern seismic standards, new standards of energy efficiency will be set and met.

Many other initiatives will form part of your government's climate action strategy.

A new unified B.C. Green Building Code will be developed over the next year with industry, professional, and community representatives.

Incentives will be implemented to retrofit existing homes and buildings to make them more energy efficient.

New measures will be taken to help homeowners undertake "energy audits" that show them where and how savings can be achieved.

New real-time, in-home smart metering will be launched to help homeowners measure and reduce their energy consumption.

These measures will demand new personal commitment, new investments, and new funding.

Your government remains committed to putting more money back in people's pockets, which allows them more choice in personal spending.

It remains committed to competitive tax rates that stimulate investment and job creation.

This government does not support new taxes on productivity that create disincentives to capital investment. But it does believe that our tax system should encourage responsible actions and individual choices.

The cost of climate change is directly related to our consumption.

Over the next year, the Province will consider the range of possibilities aimed at encouraging personal choices that are environmentally responsible.

It will look for new ways to encourage overall tax savings through shifts in behaviour that reduce carbon consumption.

For our goals to be met citizens must take primary responsibility and make choices that reflect their values.

Conservation is key to a greener future.

Public education and information is critical in that regard.

Your government will ensure that our children have the benefit of that knowledge in their school curricula.

It will work to build literacy on early actions that can be taken at home and at work to make a positive difference to reduce our individual impact on the environment.

A new Citizens' Conservation Council will be established and funded.

Your government will also invest in our forests, nature's carbon sinks.

Next year will mark the six-billionth tree planted in British Columbia since reforestation efforts began in 1930. It took 51 years of planting before our first billion trees were planted.

Today we are planting about 200 million trees a year, or one billion trees every five years.

In the new world, those new trees will have new value as carbon sinks and oxygen creators which help clean our air and offset greenhouse gases. On average, each new tree planted offsets up to one tonne of carbon dioxide over its lifetime.

Your government will substantially increase its tree-planting efforts, which will increase the amount of carbon that is offset each year through reforestation and afforestation.

The new Green Cities Project will foster innovations that reduce our imprint on the planet through sustainable community planning.

New measures will be developed to promote "urban forestry" and new community gardens.

These are just part of the Green Cities Project.

The Green City Awards will recognize B.C.'s most environmentally friendly communities.

The $21-million Towns For Tomorrow infrastructure program will help small towns across B.C. make improvements in their communities over the next three years.

The new B.C. Spirit Squares program will provide $20 million for communities to create or enhance outdoor public meeting places.

Those new outdoor gathering spaces will be built in celebration of the 150th anniversary of the founding of the Colony of British Columbia in 2008.

These new civic spaces will be legacies for our children to celebrate our heritage, culture and community achievements.

Vibrant communities are livable, lively places.

More housing choices and more pedestrian activity are key components of healthier communities.

Housing is the Cornerstone of Strong Social Policy

The challenges of housing, homelessness, addictions, and mental health require us to rethink the actions of a generation.

Homelessness is a plague that weakens our cities, siphons our strength, and erodes our social fabric.

It weakens us all. It is unacceptable.

The failed approaches of the past that require more money but deliver no improvement are also not acceptable.

New approaches are needed.

Your government believes municipal governments with populations greater than 25,000 should identify and zone appropriate sites for supportive housing and treatment facilities for persons with mental illnesses and addictions in official community plans by 2008.

Changes will be developed to existing funding and transfer payments to ensure integrated regional transportation and housing planning.

We will encourage local government to exempt small-unit, supportive housing projects from development cost charges and levies.

A new assessment class and new tax exemptions for small-unit, supportive housing will be developed over the next year for this legislature's consideration.

This government wishes to add to housing stock while reducing housing costs and reducing the environmental footprint of sprawling communities.

Urban sprawl puts pressure on our limited land base and increases servicing costs for property taxpayers for new roads, bridges, and rapid transit; for sewage and water services; and for increased energy and transmission.

Larger lots, larger homes, excessive fees, and longer time frames have pushed home prices beyond the economic reach of too many. Economic costs have increased and so have environmental ones.

Working with the Union of British Columbia Municipalities and the private sector the government will develop new incentives to encourage smaller lot sizes and smaller, more energy efficient homes that use less land, less energy, less water, and are less expensive to own.

Our communities should be places where women, children, and seniors can safely walk the streets.

Changes to make police financing equitable for smaller communities with fewer than 5,000 residents will be introduced this session.

Our communities should be places where children are cared for and are safe.

Further improvements to the *Child, Family and Community Service Act* will be introduced this session.

Your government will introduce legislation to end mandatory retirement as recommended by the Premier's Council on Aging and Seniors' Issues.

Your Government's Focus on Improving and Protecting Public Health Care Will Continue

The Conversation on Health is now well underway. It will guide future improvements.

The new First Nations Health Plan was a major milestone that will improve health determinants, health delivery, and health outcomes for Aboriginal people.

Major new initiatives in health promotion are underway.

The ActNow BC program is making progress in fostering greater physical activity, healthier eating habits, and tobacco reduction.

The Action Schools! BC program is spreading into our classrooms across the province to promote healthy living among our students.

Your government is eliminating junk food in all public schools and in all vending machines in provincially owned buildings.

The School Fruit and Vegetable Snack Program is in 50 schools this year and will be available to every public school by 2010.

New measures are being taken to reduce tobacco use.

New supports are being offered to persons on income assistance to help kick their smoking habit.

Legislation will be introduced this session to ban smoking on all school property.

Smoking will be phased out in all indoor public spaces by 2008.

As well as health promotion, new services will be added.

A new electronic surgical patient registry will give patients more control over their surgical options, improve public reporting of wait times, and enable better surgical treatment planning.

A new electronic medical records system will be launched to give physicians better access to patient records and improve service to patients.

The BC HealthGuide will be available in Punjabi and Chinese, to give families in those communities better access to health information in their mother language.

Despite efficiency gains, new funding, and increased service levels attained in the last five years, challenges in health delivery remain.

The demand for new services, technologies, drugs, and treatments continues to grow faster than our ability to pay for them.

The demand for more nurses, doctors, and other health providers grows faster than our capacity to hire and train them.

Insatiable demands for more funding in health care have gone past the tipping point.

Left unchecked, those demands will see our public health care system reach the breaking point, not in decades, but in a matter of years.

Health funding will be increased once again in the new fiscal year by an additional $885 million.

Overall health spending will have grown by 51.8 per cent since the year 2000 — or about four times the rate of inflation in that period.

Next year's increase in health funding will be 7.3 per cent — twice the rate of economic growth and over three times the current rate of inflation.

Yet the pressures on our health care system continue to escalate.

We must face up to that reality and do what is necessary to make our health care system sustainable for the future.

Your government will continue to listen and learn from British Columbians, to innovate, and to explore new ways of delivering better health services.

And it will lead fundamental health reforms that increase individual choice and maximize the supply of health services within the budgets available.

This will not be easy.

It will not come without controversy or change.

This government is determined to put our public health care system on a footing that ensures sustainability.

The most effective health promotion strategy we have discovered to date is education and individual action.

This Government is Determined to Make B.C. the Best Educated, Most Literate Jurisdiction on the Continent

Changes passed last year in this Assembly to reduce class sizes, increase accountability, and give parents a new role in class planning are paying off.

For the first time, all school districts are required to publicly report their class sizes, class by class and school by school.

For the first time, they are being held legally accountable for legislated class size and composition requirements.

Here are the results.

There are now over 1,000 more classes in our schools than there were last year, with over 12,000 fewer enrolled students.

In every single district across B.C. average class sizes have dropped this past year.

In every applicable grade, the number of classes with more than 30 students declined.

On average, the number of classes with over 30 students in Grades 4 to 12 declined by 65 per cent.

Parents, teachers and school boards should all be proud of that achievement.

The student-teacher ratio is now as low as it has ever been in British Columbia.

The number of classes across B.C. with two or more ESL students has gone down in the last year.

These are positive trends.

Student completion rates have gone up over the past five years.

However, one in five students does not complete, and over half of B.C.'s Aboriginal students do not complete their studies.

We need to improve to meet the needs of students who are failing to complete.

This year, new steps will be taken to lift our students to higher levels of achievement.

These reforms will be focused on improving quality, choice, and accountability.

British Columbians know that as good as our education system is, it can and must be even better.

Teachers certainly know that.

Your government will act to give teachers new recognition and financial incentives to reward improvements in student achievement and promote professional development.

Teachers will be offered voluntary leadership certification, new resources, professional development, and online supports.

A Premier's Award For Teaching Excellence will also be established to annually recognize and reward excellence in teaching.

New legislation will be introduced to broaden the mandate of school boards, as reflected in a new title: Boards of Education.

Amendments to the *School Act* will also be introduced to enable boards to offer "special academies" upon the approval of school planning councils and consultation with parents.

Boards will be authorized to charge fees approved by school planning councils to defray non-instructional costs or additional costs incurred in offering special academies, trades programs, and band instruments.

This measure will give boards the tools they need to offer students access to programs that might otherwise be closed as a result of the recent Supreme Court ruling.

Boards of Education will also be given a new opportunity to provide early learning programs to preschoolers.

Up to 80 StrongStart Centres will open in underutilized school spaces over the next year. They will help our youngest students to enter school ready to learn.

Boards of Education will be required to develop district literacy plans to improve literacy. They will help co-ordinate literacy initiatives in their communities.

The new ReadNow BC program will provide $27 million in initial funding to help British Columbians improve their reading skills.

The role of district superintendents will be expanded to be responsible to boards for improving student achievement.

New provincial Superintendents of Achievement will be appointed by the Province to report and make recommendations on improving student achievement in school districts.

New "sunshine legislation" will shed new light on school district companies' business practices. New public reporting and auditing requirements, and new obligations for their directors to be at arm's length from parent boards, will be established.

More choice and flexibility will be encouraged to better meet student needs.

The Graduation Portfolio Standard will be simplified to focus on physical activity, career planning, and community service.

While the Province will set standards for meeting graduation requirements, Boards of Education will determine the most appropriate learning and instruction methods for meeting provincial standards in their districts, including whether or not to offer a portfolio program.

Amendments will be introduced to broaden the Education Minister's capacity to create provincial schools and offer more choice in learning.

Provincial schools will offer new choices in curricula, new course content, and new demonstration schools better tailored to unique student needs.

These new provincial schools will build on the virtual school that is now serving over 16,000 students provincewide.

The virtual school is providing new round-the-clock access to learning, tutoring, and academic supports.

These new measures will be supported in a new B.C. Education Guarantee that assures that all students have ongoing access to courses required for high school completion and that all British Columbians who need it have free, easy access to adult basic education through LearnNowBC.

This year the government will:

Ensure new residents can obtain support in ESL training and streamlined professional and skilled labour certification, to help them use the skills they bring to B.C.;

Establish a teacher employment registry, administered by the College of Teachers, to publicly report the names of teachers disciplined for misconduct involving emotional, physical, or sexual abuse;

Require annual public reports for all public schools on the statistics relating to teacher hirings, terminations, disciplinary actions, and professional development;

And give government the ability to directly communicate with all teachers in B.C.

Amendments will be introduced to require all Boards of Education to establish codes of conduct for students that meet provincially set standards and that institute "zero tolerance" of bullying in B.C.'s schools.

Your government pledged to use underutilized school spaces as public spaces to deliver on public priorities.

It will work with boards to better manage capital planning across all school districts.

A new process will be put in place to ensure that schools or school lands are used for their highest and best use for maximum public benefit.

The Government Will Open Canada's Pacific Gateway to New Worlds of Knowledge and Economic Opportunity

Knowledge is the key to unlocking our citizens' true potential in the digital world.

Skilled workers are the sine qua non of a modern, competitive economy.

That is why your government has embarked on the largest post-secondary and apprenticeship expansion in 40 years.

It is why it is acting to create 2,500 new graduate spaces and 7,000 more apprenticeship spaces by 2010.

It is why it is expanding the number of industry training organizations in partnership with the Industry Training Authority and the private sector.

Across this province, access to advanced education is better than ever.

Over $1 billion has been invested in capital improvements in post-secondary education since 2001.

Another $800 million has been allocated to further expand our universities, colleges, and institutes.

The 25,000 new post-secondary spaces are well underway.

That new legacy of leadership will give B.C.'s young adults and lifelong learners new opportunities for higher learning where they live.

This year a new Children's Education Credit will be established and a new Pacific Leaders Fellowship will be created to provide university students new financial incentives to pursue careers in the provincial public service.

It will also provide existing public servants new opportunities to upgrade their skills.

Campus 2020 will help shape the vision of B.C.'s post-secondary system for years to come.

As your government works to train new workers and give them the skills they need to prosper in this Pacific Century, it will also do more to attract and recruit skilled workers.

The Provincial Nominee Program will be substantially expanded and new efforts will be made to expedite entry for temporary workers in skills-shortage areas.

All of these measures are aimed at maximizing our provincial potential in this time of profound change and global growth.

Central to your government's Great Goal on job creation is maximizing our Pacific advantage.

The government will invest in B.C.'s ports, airports, railways, roads, and bridges to capitalize on British Columbia's core competitive advantage — our location as Canada's only Pacific province.

The heart of your government's economic vision is British Columbia's unique competitive advantage — our proximity, cultural ties, and natural connections to the Asia-Pacific.

Our Pacific advantage will have positive impacts in transportation, in research and technology, in trade development, investment, immigration, and tourism.

The government will unleash our Pacific promise as a budding powerhouse of clean, renewable energy; profitable, sustainable forestry; world-leading technology; high-quality manufacturing; value-added agricultural products; award-winning wines; world-class mineral deposits; and superb tourism destinations.

Investment in mineral exploration in B.C. soared to a record-high $265 million in 2006 — an 800 per cent increase from 2001.

In that one sector alone, our province has incredible potential for new investment, jobs, opportunities, and partnerships with our Asia-Pacific customers.

Several amendments will be introduced this session to enhance mineral exploration and to also afford private property owners new rights of notice before any person can enter their land for mineral exploration.

New legislation will be tabled to facilitate resort development and establish new resort municipalities that open up our Pacific potential in tourism.

Other measures will be aimed at helping small business.

B.C.'s new tourism strategy will target new markets for growth in the Asia-Pacific and new potential for growth in eco-tourism, agri-tourism, Aboriginal tourism, and cultural tourism.

Your government will continue to pursue a true partnership with the Government of Canada to open Canada's Pacific Gateway.

British Columbians' tax dollars paid to build the St. Lawrence Seaway 50 years ago. Those investments consolidated Canada's place as the Atlantic's primary entrance to the heart of North America. All Canadians benefited.

It is time for Canada to make the same commitment and seize the same opportunity for its Pacific Gateway.

The Asia-Pacific Trade Council is building a blueprint for our province to fully seize upon our Pacific potential in key markets.

Japan, China, India, and South Korea are all vital to our future.

The government will dedicate new resources to capture British Columbia's Asia-Pacific opportunities.

The potential for mutual benefit is enormous.

Three Short Years from Today, British Columbians will be Living Their Olympic Dream

We will be one day past the opening ceremonies.

Canadians across this land will be glued to their televisions and computers as Canadian athletes reach higher, dig deeper, and go faster — striving to be the best in the world.

It has been said that, "In the course of history, there comes a time when humanity is called to shift to a new level.... A time when we have to shed our fear and give hope to each other. That time is now."

This is our time.

This is British Columbia's time to lead.

Let us strive to inspire others with our commitment and determination.

Let us seize this moment of strength and optimism to embrace the Olympic spirit and capture the Pacific promise.

The torch of hope is in our hands.

Let us hold the torch high and act with speed and purpose, confident in our endeavour.

Let us test our limits and give our grandchildren the gift of a better province, a better country, and a better world.

Appendix 6

The BC Energy Plan

A Vision for Clean Energy Leadership







BRITISH COLUMBIA
The Best Place on Earth

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MESSAGE FROM THE PREMIER

The BC Energy Plan: A Vision for Clean Energy Leadership is British Columbia's plan to make our province energy self-sufficient while taking responsibility for our natural environment and climate. The world has turned its attention to the critical issue of global warming. This plan sets ambitious targets. We will pursue them relentlessly as we build a brighter future for B.C.

The BC Energy Plan sets out a strategy for reducing our greenhouse gas emissions and commits to unprecedented investments in alternative technology based on the work that was undertaken by the Alternative Energy Task Force. Most importantly, this plan outlines the steps that all of us – including industry, environmental agencies, communities and citizens – must take to reach these goals for conservation, energy efficiency and clean energy so we can arrest the growth of greenhouse gases and reduce human impacts on the climate.

As stewards of this province, we have a responsibility to manage our natural resources in a way that ensures they both meet our needs today and the needs of our children and grandchildren. We will all have to think and act differently as we develop innovative and sustainable solutions to secure a clean and reliable energy supply for all British Columbians.

Our plan will make B.C. energy self-sufficient by 2016. To do this, we must maximize our conservation efforts. Conservation will reduce pressure on our energy supply and result in real savings for those who use less energy. Individual actions that reduce our own everyday energy consumption will make the difference between success and failure. For industry, conservation can lead to an effective, productive and significant competitive advantage. For communities, it can lead to healthier neighbourhoods and lifestyles for all of us.

We are looking at how we can use clean alternative energy sources, including bioenergy, geothermal, fuel cells, water-powered electricity, solar and wind to meet our province's energy needs. With each of these new options comes the opportunity for new job creation in areas such as research, development, and production of innovative energy and conservation solutions. The combination of renewable alternative energy sources and conservation will allow us to pursue our potential to become a net exporter of clean, renewable energy to our Pacific neighbours.

Just as the government's energy vision of 40 years ago led to massive benefits for our province, so will our decisions today. **The BC Energy Plan** will ensure a secure, reliable, and affordable energy supply for all British Columbians for years to come.

Premier Gordon Campbell

The BC Energy Plan: A Vision for Clean Energy Leadership is a made-in-B.C. solution to the common global challenge of ensuring a secure, reliable supply of affordable energy in an environmentally responsible way. In the next decade government will balance the opportunities and increased prosperity available from our natural resources while leading the world in sustainable environmental management.

This energy plan puts us in a leadership role that will see the province move to eliminating or offsetting greenhouse gas emissions for all new projects in the growing electricity sector, end flaring from oil and gas producing wells, and put in place a plan to make B.C. electricity self-sufficient by 2016.

In developing this plan, the government met with key stakeholders, environmental non-government organizations, First Nations, industry representatives and others. In all, more than 100 meetings were held with a wide range of parties to gather ideas and feedback on new policy actions and strategies now contained in **The BC Energy Plan**.

By building on the strong successes of Energy Plan 2002, this energy plan will provide secure, affordable energy for British Columbia. Today, we reaffirm our commitment to public ownership of our BC Hydro assets while broadening our supply of available energy.

We look towards British Columbia's leading edge industries to help develop new, greener generation technologies with the support of the new **Innovative Clean Energy Fund**. We're planning for tomorrow, today. Our energy industry creates jobs for British Columbians, supports important services for our families, and will play an important role in the decade of economic growth and environmental sustainability that lies ahead.

The Ministry of Energy, Mines and Petroleum Resources is responding to challenges and opportunities by delivering innovative, sustainable ways to develop British Columbia's energy resources.

Honourable Richard Neufeld
Minister of Energy, Mines and Petroleum Resources

In 2002, the Government of British Columbia launched an ambitious plan to invigorate the province's energy sector. Energy for Our Future: A Plan for BC was built around four cornerstones: low electricity rates and public ownership of BC Hydro; secure, reliable supply; more private sector opportunities; and environmental responsibility with no nuclear power sources. Today, our challenges include a growing energy demand, higher prices, climate change and the need for environmental sustainability. The BC Energy Plan: A Vision for Clean Energy Leadership builds on the successes of the government's 2002 plan and moves forward with new policies to meet the challenges and opportunities ahead.

- **Ensure clean or renewable electricity generation continues to account for at least 90 per cent of total generation.**
- **No nuclear power.**
- **Best coalbed gas practices in North America.**
- **Eliminate all routine flaring at oil and gas producing wells and production facilities by 2016 with an interim goal to reduce flaring by half (50 per cent) by 2011.**

Environmental Leadership

The BC Energy Plan puts British Columbia at the forefront of environmental and economic leadership by focusing on our key natural strengths and our competitive advantages of clean and renewable sources of energy. The plan further strengthens our environmental leadership through the following key policy actions:

- **Zero greenhouse gas emissions from coal fired electricity generation.**
- **All new electricity generation projects will have zero net greenhouse gas emissions.**
- **Zero net greenhouse gas emissions from existing thermal generation power plants by 2016.**

British Columbia's current electricity supply resources are 90 per cent clean and new electricity generation plants will have zero net greenhouse gas emissions.

A Strong Commitment to Energy Conservation and Efficiency

Conservation is integral to meeting British Columbia's future energy needs. The BC Energy Plan sets ambitious conservation targets to reduce the growth in electricity used within the province. British Columbia will:

- **Set an ambitious target, to acquire 50 per cent of BC Hydro's incremental resource needs through conservation by 2020.**
- **Implement energy efficient building standards by 2010.**

Current per household electricity consumption for BC Hydro customers is about 10,000 Kwh per year. Achieving this conservation target will see electricity use per household decline to approximately 9,000 Kwh per year by 2020.

Energy Security

The Government of British Columbia is taking action to ensure that the energy needs of British Columbians continue to be met now and into the future. As part of ensuring our energy security, The BC Energy Plan sets the following key policy actions:

- **Maintain public ownership of BC Hydro and the BC Transmission Corporation.**
- **Maintain our competitive electricity rate advantage.**
- **Achieve electricity self-sufficiency by 2016.**
- **Make small power part of the solution through a set purchase price for electricity generated from projects up to 10 megawatts.**
- **Explore value-added opportunities in the oil and gas industry by examining the viability of a new petroleum refinery and petrochemical industry.**
- **Be among the most competitive oil and gas jurisdictions in North America.**
- **BC Hydro and the Province will enter into initial discussions with First Nations, the Province of Alberta and communities to discuss Site C to ensure that communications regarding the potential project and the processes being followed are well known.**

Investing in Innovation

British Columbia has a proven track record in bringing ideas and innovation to the energy sector. From our leadership and experience in harnessing our hydro resources to produce electricity, to our groundbreaking work in hydrogen and fuel cell technology, British Columbia has always met its future energy challenges by developing new, improved and sustainable solutions. To support future innovation and to help bridge the gap experienced in bringing innovations through the pre-commercial stage to market, government will:

- **Establish an Innovative Clean Energy Fund of $25 million.**
- **Implement the BC Bioenergy Strategy to take full advantage of B.C.'s abundant sources of renewable energy.**
- **Generate electricity from mountain pine beetle wood by turning wood waste into energy.**

Ambitious Energy Conservation and Efficiency Targets

The more energy that is conserved, the fewer new sources of supply we will require in the future. That is why British Columbia is setting new conservation targets to reduce growth in electricity demand.

Inefficient use of energy leads to higher costs and many environmental and security of supply problems.

Conservation Target

The BC Energy Plan sets an ambitious conservation target, to acquire 50 per cent of BC Hydro's incremental resource needs through conservation by 2020. This will require building on the "culture of conservation" that British Columbians have embraced in recent years.

The plan confirms action on the part of government to complement these conservation targets by working closely with BC Hydro and other utilities to research, develop, and implement best practices in conservation and energy efficiency and to increase public awareness. In addition, the plan supports utilities in British Columbia and the BC Utilities Commission pursuing all cost effective and competitive demand side management programs. Utilities are also encouraged to explore and develop rate designs to encourage efficiency, conservation and the development of renewable energy.

Future energy efficiency and conservation initiatives will include:

- Continuing to remove barriers that prevent customers from reducing their consumption.
- Building upon efforts to educate customers about the choices they can make today with respect to the amount of electricity they consume.
- Exploring new rate structures to identify opportunities to use rates as a mechanism to motivate customers either to use less electricity or use less at specific times.
- Employing new rate structures to help customers implement new energy efficient products and technologies and provide them with useful information about their electricity consumption to allow them to make informed choices.
- Advancing ongoing efforts to develop energy-efficient products and practices through regulations, codes and standards.

The average household uses about 10,000 kilowatt-hours of electricity per year.

POLICY ACTIONS

COMMITMENT TO CONSERVATION

- **Set an ambitious conservation target, to acquire 50 per cent of BC Hydro's incremental resource needs through conservation by 2020.**
- **Ensure a coordinated approach to conservation and efficiency is actively pursued in British Columbia.**
- **Encourage utilities to pursue cost effective and competitive demand side management opportunities.**
- **Explore with B.C. utilities new rate structures that encourage energy efficiency and conservation.**

Implement Energy Efficiency Standards for Buildings by 2010

British Columbia implemented *Energy Efficient Buildings: A Plan for BC* in 2005 to address specific barriers to energy efficiency in our building stock through a number of voluntary policy and market measures. This plan has seen a variety of successes including smart metering pilot projects, energy performance measurement and labelling, and increased use of Energy Star appliances. In 2005, B.C. received a two year, $11 million federal contribution from the Climate Change Opportunities Envelope to support implementation of this plan.

Working together industry, local governments, other stakeholders and the provincial government will determine and implement cost effective energy efficiency standards for new buildings by 2010. Regulated standards for buildings are a central component of energy efficiency programs in leading jurisdictions throughout the world.

The BC Energy Plan supports reducing consumption by raising awareness and enhancing the efforts of utilities, local governments and building industry partners in British Columbia toward conservation and energy efficiency.

Aggressive Public Sector Building Plan

The design and retrofit of buildings and their surrounding landscapes offer us an important means to achieve our goal of making the government of British Columbia carbon neutral by 2010, and promoting Pacific Green universities, colleges, hospitals, schools, prisons, ferries, ports and airports.

British Columbia communities are already recognized leaders in innovative design practices. We know how to build smarter, faster and smaller. We know how to increase densities, reduce building costs and create new positive benefits for our environment. We know how to improve air quality, reduce energy consumption and make wise use of other resources, and how to make our landscapes and buildings healthy places for living, working and learning. We know how to make it affordable.

Government will set the following ambitious goals for all publicly funded buildings and landscapes and ask the Climate Action Team to determine the most credible, aggressive and economically viable options for achieving them:

- Require integrated environmental design to achieve the highest standards for greenhouse gas emission reductions, water conservation and other building performance results such as a certified standard.
- Supply green, healthy workspaces for all public service employees.
- Capture the productivity benefits for people who live and work in publicly funded buildings such as reduced illnesses, less absenteeism, and a better learning environment.
- Aim not only for the lowest impact, but also for restoration of the ecological features of the surrounding landscapes.

Gigawatt = 1,000,000 kilowatts
Kilowatt = amount of power to light ten 100-watt incandescent light bulbs.

Community Action on Energy Efficiency

British Columbia is working in partnership with local governments to encourage energy conservation at the community level through the Community Action on Energy Efficiency Program. The program promotes energy efficiency and community energy planning projects, providing direct policy and technical support to local governments through a partnership with the Fraser Basin Council. A total of 29 communities are participating in the program and this plan calls for an increase in the level of participation and expansion of the program to include transportation actions. The Community Action on Energy Efficiency Program is a collaboration among the provincial ministries of Energy, Mines and Petroleum Resources, Environment, and Community Services, Natural Resources Canada, the Fraser Basin Council, Community Energy Association, BC Hydro, FortisBC, Terasen Gas, and the Union of BC Municipalities.

Leading the Way to a Future with Green Buildings and Green Cities

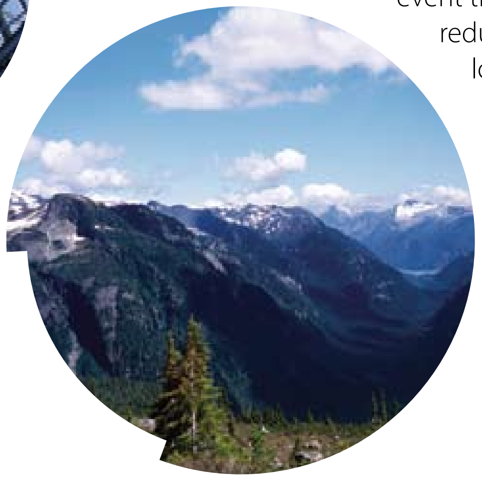
British Columbia has taken a leadership role in the development of green buildings. Through the Green Buildings BC Program, the province is working to reduce the environmental impact of government buildings by increasing energy and water efficiency and reducing greenhouse gas emissions. Through this program, and the Energy Efficient Buildings Strategy that establishes energy efficiency targets for all types of buildings, the province is inviting businesses, local governments and all British Columbians to do their part to increase energy efficiency and reduce greenhouse gas emissions.

The Green Cities Project sets a number of strategies to make our communities greener, healthier and more vibrant places to live. British Columbia communities are already recognized leaders in innovative sustainability practices, and the Green Cities Project will provide them with additional resources to improve air quality, reduce energy consumption and encourage British Columbians to get out and enjoy the outdoors. With the Green Cities Project, the provincial government will:

- Provide $10 million a year over four years for the new LocalMotion Fund, which will cost share capital projects on a 50/50 basis with municipal governments to build bike paths, walkways, greenways and improve accessibility for people with disabilities.
- Establish a new Green City Awards program to encourage the development and exchange of best practices by communities, with the awards presented annually at the Union of British Columbia Municipalities convention.
- Set new financial incentives to help local governments shift to hybrid vehicle fleets and help retrofit diesel vehicles.
- Commit to making new investments in expanded rapid transit, support for fuel cell vehicles and other innovations.

Industrial Energy Efficiency Program

Government will establish an Industrial Energy Efficiency Program for British Columbia to address challenges and issues faced by the B.C. industrial sector and support the Canada wide industrial energy efficiency initiatives. The program will encourage industry driven investments in energy efficient technologies and processes; reduce emissions and greenhouse gases; promote self generation of power; and reduce funding barriers that discourage energy efficiency in the industrial sector. Some specific strategies include developing a results based pilot program with industry to improve energy efficiency and reduce overall power consumption and promote the generation of renewable energy within the industrial sector.



The 2010 Olympic and Paralympics Games: Sustainability in Action

In 2010 Vancouver and Whistler will host the Winter Olympic and Paralympic Games. The 2010 Olympic Games are the first that have been organized based on the principles of sustainability.

All new buildings for the Olympics will be designed and built to conserve both water and materials, minimize waste, maximize air quality, protect surrounding areas and continue to provide environmental and community benefits over their lifetimes. Existing venues will be upgraded to showcase energy conservation and efficiency and demonstrate the use of alternative heating/cooling technologies. Wherever possible, renewable energy sources such as wind, solar, micro hydro, and geothermal energy will be used to power and heat all Games facilities.

Transportation for the 2010 Games will be based on public transit. This system – which will tie event tickets to transit use – will help reduce traffic congestion, minimize local air pollution and limit greenhouse gas emissions.

POLICY ACTIONS

BUILDING STANDARDS, COMMUNITY ACTION AND INDUSTRIAL EFFICIENCY

- **Implement Energy Efficiency Standards for Buildings by 2010.**
- **Undertake a pilot project for energy performance labelling of homes and buildings in coordination with local and federal governments, First Nations and industry associations.**
- **New provincial public sector buildings will be required to integrate environmental design to achieve the highest standards for greenhouse gas emission reductions, water conservation and other building performance results such as a certified standard.**
- **Develop an Industrial Energy Efficiency Program for British Columbia to address specific challenges faced by British Columbia's industrial sector.**
- **Increase the participation of local governments in the Community Action on Energy Efficiency Program and expand the First Nations and Remote Community Clean Energy Program.**

British Columbia benefits from the public ownership of BC Hydro and the BC Transmission Corporation.

POLICY ACTIONS

SELF-SUFFICIENCY BY 2016

- **Ensure self-sufficiency to meet electricity needs, including "insurance."**
- **Establish a standing offer for clean electricity projects up to 10 megawatts.**
- **The BC Transmission Corporation is to ensure that British Columbia's transmission technology and infrastructure remains at the leading edge and has the capacity to deliver power efficiently and reliably to meet growing demand.**
- **Ensure adequate transmission system capacity by developing and implementing a transmission congestion relief policy.**
- **Ensure that the province remains consistent with North American transmission reliability standards.**

Electricity Security

Electricity, while often taken for granted, is the lifeblood of our modern economy and key to our entire way of life. Fortunately, British Columbia has been blessed with an abundant supply of clean, affordable and renewable electricity. But today, as British Columbia's population has grown, so too has our demand for electricity. We are now dependent on other jurisdictions for up to 10 per cent of our electricity supply. BC Hydro estimates demand for electricity to grow by up to 45 per cent over the next 20 years.

We must address this ever increasing demand to maintain our secure supply of electricity and the competitive advantage in electricity rates that all British Columbians have enjoyed for the last 20 years. There are no simple solutions or answers. We have an obligation to future generations to chart a course that will ensure a secure, environmentally and socially responsible electricity supply.

To close this electricity gap, and for our province to become electricity self-sufficient, will require an innovative electricity industry and the real commitment of all British Columbians to conservation and energy efficiency.

The New Relationship and Electricity

The Government of British Columbia is working with First Nations to restore, revitalize and strengthen First Nations communities. The goal is to build strong and healthy relationships with First Nations people guided by the principles of trust and collaboration. First Nations share many of the concerns of other British Columbians in how the development of energy resources may impact as well as benefit their communities. In addition, First Nations have concerns with regard to the recognition and respect of Aboriginal rights and title.

By focusing on building partnerships between First Nations, industry and government, tangible social and economic benefits will flow to First Nations communities across the province and assist in eliminating the gap between First Nations people and other British Columbians.

Government is working every day to ensure that energy resource management includes First Nations' interests, knowledge and values. By continuing to engage First Nations in energy related issues, we have the opportunity to share information and look for opportunities to facilitate First Nations' employment and participation in the electricity sectors to ensure that First Nations people benefit from the continued growth and development of British Columbia's resources. The BC Energy Plan provides British Columbia with a blueprint for facing the many energy challenges and opportunities that lay ahead. It provides an opportunity to build on First Nations success stories such as:

- First Nations involvement in independent power projects, such as the Squamish First Nation's participation in the Furry Creek and Ashlu hydro projects.

- Almost $4 million will flow to approximately 10 First Nations communities across British Columbia to support the implementation of Community Energy Action Plans as part of the First Nation and Remote Community Clean Energy Program.
- The China Creek independent power project was developed by the Hupacasath First Nation on Vancouver Island.

Achieve Electricity Self-Sufficiency by 2016

Achieving electricity self-sufficiency is fundamental to our future energy security and will allow our province to achieve a reliable, clean and affordable supply of electricity. It also represents a lasting legacy for future generations of British Columbians. That's why government has committed that British Columbia will be electricity self-sufficient within the decade ahead.

Through The BC Energy Plan, government will set policies to guide BC Hydro in producing and acquiring enough electricity in advance of future need. However, electricity generation and transmission infrastructure require long lead times. This means that over the next two decades, BC Hydro must acquire an additional supply of "insurance power" beyond the projected increases in demand to minimize the risk and implications of having to rely on electricity imports.

Small Power Standing Offer

Achieving electricity self-sufficiency in British Columbia will require a range of new power sources to be brought on line. To help make this happen, this policy will direct BC Hydro to establish a Standing Offer Program with no quota to encourage small and clean electricity producers. Under the Standing Offer Program, BC Hydro will purchase directly from suppliers at a set price. Eligible projects must be less than 10 megawatts in size and be clean electricity or high efficiency electricity cogeneration. The price offered in the standing offer contract would be based on the prices paid in the most recent BC Hydro energy call. This will provide small electricity suppliers with more certainty, bring small power projects into the system more quickly, and help achieve government's goal of maintaining a secure electricity supply. As well, BC Hydro will offer the same price to those in BC Hydro's Net Metering Program who have a surplus of generation at the end of the year.

Ensuring a Reliable Transmission Network

An important part of meeting the goal of self-sufficiency is ensuring a reliable transmission infrastructure is in place as additional power is brought on line. Transmission is a critical part of the solution as often new clean sources of electricity are located away from where the demand is. In addition, transmission investment is required to support economic growth in the province and must be planned and started in anticipation of future electricity needs given the long lead times required for transmission development. New and upgraded transmission infrastructure will be required to avoid congestion and to efficiently move the electricity across the entire power grid. Because our transmission system is part of a much larger, interconnected grid, we need to work with other jurisdictions to maximize the benefit of interconnection, remain consistent with evolving North American reliability standards, and ensure British Columbia's infrastructure remains capable of meeting customer needs.

BC HYDRO'S NET METERING PROGRAM: PEOPLE PRODUCING POWER

BC Hydro's Net Metering Program was established as a result of Energy Plan 2002. It is designed for customers with small generating facilities, who may sometimes generate more electricity than they require for their own use. A net metering customer's electricity meter will run backwards when they produce more electricity than they consume and run forward when they produce less than they consume.

The customer is only billed for their "net consumption"; the total amount of electricity used minus the total produced.

Net metering allows customers to lower their environmental impact and take responsibility for their own power production. It helps to move the province towards electricity self-sufficiency and expands clean electricity generation, making B.C.'s electricity supply more environmentally sustainable.

In order for British Columbia to ensure the development of a secure and reliable supply of electricity, **The BC Energy Plan** provides policy direction to the BC Transmission Corporation to ensure that our transmission technology and infrastructure remains at the leading edge and has the capacity to deliver power efficiently and reliably to meet growing demand. This will include ensuring there is adequate transmission capacity, ongoing investments in technology and infrastructure and remaining consistent with evolving North American reliability standards.

BC Transmission Corporation Innovation and Technology

As the manager of a complex and high-value transmission grid, BC Transmission Corporation is introducing technology innovations that provide improvements to the performance of the system and allow for a greater utilization of existing assets, ensuring B.C. continues to benefit from one of the most advanced energy networks in the world. BC Transmission Corporation's innovation program focuses on increasing the power transfer capability of existing assets, extending the life of assets and improving system reliability and security. Initiatives include:

- System Control Centre Modernization Project: This project is consolidating system operations into a new control center and backup site and upgrading operating technologies with a modern management system that includes enhancements to existing applications to ensure the electric grid is operating reliably and efficiently. The backup site will take over complete operation of the electric grid if the main site is unavailable.
- Real-Time Phasors: British Columbia is among the first North American jurisdictions to incorporate phasor measurement into control centre operations. Phasors are highly accurate voltage, current and phase angle "snapshots" of the real-time state of the transmission system that enable system operators to monitor system conditions and identify any impending problems.
- Real-Time Rating: This is a temperature monitoring system which enables the operation of two 500 kilovolt submarine cable circuits at maximum capacity without overloading. The resulting increase in capacity is estimated to be up to 10 per cent, saving millions of dollars.
- Electronic Temperature Monitor Upgrades for Station Transformers: In this program, existing mechanical temperature monitors will be replaced with newer, more accurate electronic monitors on station transformers that allow transformers to operate to maximum capacity without overheating. In addition to improving performance, BC Transmission Corporation will realize reduced maintenance costs as the monitors are "self-checking."
- Life Extension of Transmission Towers: BC Transmission Corporation maintains over 22,000 steel lattice towers and is applying a special composite corrosion protection coating to some existing steel towers to extend their life by about 25 years.

Public Ownership

Public Ownership of BC Hydro and the BC Transmission Corporation

BC Hydro and the BC Transmission Corporation are publicly-owned crown corporations and will remain that way now and into the future. BC Hydro is responsible for generating, purchasing and distributing electricity. The BC Transmission Corporation operates, maintains, and plans BC Hydro's transmission assets and is responsible for providing fair, open access to the power grid for all customers. Both crowns are subject to the review and approvals of the independent regulator, the BC Utilities Commission.

BC Hydro owns the heritage assets, which include historic electricity facilities such as those on the Peace and Columbia Rivers that provide a secure, reliable supply of low-cost power for British Columbians. These heritage assets require maintenance and upgrades over time to ensure they continue to operate reliably and efficiently. Potential improvements to these assets, such as capacity additions at the Mica and Revelstoke generating stations, can make important contributions for the benefit of British Columbians.

Confirming the Heritage Contract in Perpetuity

Under the 2002 Energy Plan, a legislated heritage contract was established for an initial term of 10 years to ensure BC Hydro customers benefit from its existing low-cost resources. With The BC Energy Plan, government confirms the heritage contract in perpetuity to ensure ratepayers will continue to receive the benefits of this low-cost electricity for generations to come.

British Columbia's Leadership in Clean Energy

The BC Energy Plan will continue to ensure British Columbia has an environmentally and socially responsible electricity supply with a focus on conservation and energy efficiency.

British Columbia is already a world leader in the use of clean and renewable electricity, due in part to the foresight of previous generations who built our province's hydroelectric dams. These dams - now British Columbians' 'heritage assets' - today help us to enjoy 90 per cent clean electricity, one of the highest levels in North America.

All New Electricity Generation Projects Will Have Zero Net Greenhouse Gas Emissions

The B.C. government is a leader in North America when it comes to environmental standards. While British Columbia is a province rich in energy resources such as hydro electricity, natural gas and coal, the use of these resources needs to be balanced through effective use, preserving our environmental standards, while upholding our quality of life for generations to come. The government has made a commitment that all new electricity generation projects developed in British Columbia and connected to the grid will have zero net greenhouse gas emissions. In addition, any new electricity generated from coal must meet the more stringent standard of zero greenhouse gas emissions.

POLICY ACTIONS

PUBLIC OWNERSHIP

- **Continue public ownership of BC Hydro and its heritage assets, and the BC Transmission Corporation.**
- **Establish the existing heritage contract in perpetuity.**
- **Invest in upgrading and maintaining the heritage asset power plants and the transmission lines to retain the ongoing competitive advantage these assets provide to the province.**

POLICY ACTIONS

REDUCING GREENHOUSE GAS EMISSIONS FROM ELECTRICITY

- **All new electricity generation projects will have zero net greenhouse gas emissions.**
- **Zero net greenhouse gas emissions from existing thermal generation power plants by 2016.**
- **Require zero greenhouse gas emissions from any coal thermal electricity facilities.**
- **Ensure clean or renewable electricity generation continues to account for at least 90 per cent of total generation.**
- **Government supports BC Hydro's proposal to replace the firm energy supply from the Burrard Thermal plant with other resources. BC Hydro may choose to retain Burrard for capacity purposes after 2014.**
- **No nuclear power.**

Zero Net Greenhouse Gas Emissions from Existing Thermal Generation Power Plants by 2016

Setting a requirement for zero net emissions over this time period encourages power producers to invest in new or upgraded technology. For existing plants the government will set policy around reaching zero net emissions through carbon offsets from other activities in British Columbia. It clearly signals the government's intention to continue to have one of the lowest greenhouse gas emission electricity sectors in the world.

Ensure Clean or Renewable Electricity Generation Continues to Account For at Least 90 per cent of Total Generation

Currently in B.C., 90 per cent of electricity is from clean or renewable resources. The BC Energy Plan commits to maintaining this high standard which places us among the top jurisdictions in the world. Clean or renewable resources include sources of energy that are constantly renewed by natural processes, such as water power, solar energy, wind energy, tidal energy, geothermal energy, wood residue energy, and energy from organic municipal waste.

Zero Greenhouse Gas Emissions from Coal

The government is committed to ensuring that British Columbia's electricity sector remains one of the cleanest in the world and will allow coal as a resource for electricity generation when it can reach zero greenhouse gas emissions. Clean-coal technology with carbon sequestration is expected to become commercially available in the next decade. Therefore, the province will require zero greenhouse gas emissions from any coal thermal electricity facilities which can be met through capture and sequestration technology. British Columbia is the first Canadian jurisdiction to commit to using only clean coal technology for any electricity generated from coal.

Burrard Thermal Generating Station

A decision regarding the Burrard Thermal Natural Gas Generating Station is another action that is related to environmentally responsible electricity generation in British Columbia.

Even though it could generate electricity from Burrard Thermal, BC Hydro imports power primarily because the plant is outdated, inefficient and costly to run. However, Burrard Thermal still provides significant benefits to BC Hydro as it acts as a "battery" close to the Lower Mainland, and provides extra capacity or "reliability insurance" for the province's electricity supply. It also provides transmission system benefits that would otherwise have to be supplied through the addition of new equipment at Lower Mainland sub-stations.

By 2014, BC Hydro plans to have firm electricity to replace what would have been produced at the plant. Government supports BC Hydro's proposal to replace the firm energy supply from Burrard Thermal with other resources by 2014. However, BC Hydro may choose to retain the plant for "reliability insurance" should the need arise.

No Nuclear Power

As first outlined in Energy Plan 2002, government will not allow production of nuclear power in British Columbia.

Benefits to British Columbians

Clean or renewable electricity comes from sources that replenish over a reasonable time or have minimal environmental impacts. Today, demand for economically viable, clean, renewable and alternative energy is growing along with the world's population and economies. Consumers are looking for power that is not only affordable but creates minimal environmental impacts. Fortunately, British Columbia has abundant hydroelectric resources, and plenty of other potential energy sources.

Maintain our Electricity Competitive Advantage

British Columbians require a secure, reliable supply of competitively priced electricity now and in the future. Competitively priced power is also an incentive for investors to locate in British Columbia. It provides an advantage over other jurisdictions and helps sustain economic growth. We are fortunate that historic investments in hydroelectric assets provide electricity that is readily available, reliable, clean and inexpensive. By ensuring public ownership of BC Hydro, the heritage assets and the BC Transmission Corporation and confirming the heritage contract in perpetuity, we will ensure that ratepayers continue to receive the benefits of this low cost generation. Due to load growth and aging infrastructure, new investments will be required. Investments in maintenance and in some cases expansions can be a cost effective way to meet growth and reduce future rate increases.

CARBON OFFSETS AND HOW THEY REDUCE EMISSIONS

A carbon offset is an action taken directly, outside of normal operations, which results in reduced greenhouse gas emissions or removal of greenhouse gases from the atmosphere. Here's how it works: if a project adds greenhouse gases to the atmosphere, it can effectively subtract them by purchasing carbon offsets which are reductions from another activity. Government regulations to reduce greenhouse gases, including offsets, demonstrate leadership on climate change and support a move to clean and renewable energy.

*Government will establish a $25 million **Innovative Clean Energy Fund.***

POLICY ACTIONS

BENEFITS TO BRITISH COLUMBIANS

- **Review BC Utilities Commissions' role in considering social and environmental costs and benefits.**
- **Ensure the procurement of electricity appropriately recognizes the value of aggregated intermittent resources.**
- **Work with BC Hydro and parties involved to continue to improve the procurement process for electricity.**
- **Pursue Government and BC Hydro's planned Remote Community Electrification Program to expand or take over electricity service to remote communities in British Columbia.**
- **Ensure BC Hydro considers alternative electricity sources and energy efficiency measures in its energy planning for remote communities.**

British Columbia must look for new, innovative ways to stay competitive. New technologies must be identified and nurtured, from both new and existing industries. By diversifying and strengthening our energy sector through the development of new and alternative energy sources, we can help ensure the province's economy remains vibrant for years to come.

Ensure Electricity is Secured at Competitive Prices

One practical way to keep rates down is to ensure utilities have effective processes for securing competitively priced power. As part of The BC Energy Plan, government will work with BC Hydro and parties involved to continue to improve the Call for Tender process for acquiring new generation. Fair treatment of both buyers and sellers of electricity will facilitate a robust and competitive procurement process. Government and BC Hydro will also look for ways to further recognize the value of intermittent resources, such as run-of- river and wind, in the acquisition process – which means that BC Hydro will examine ways to value separate projects together to increase the amount of firm energy calculated from the resources.

Rates Kept Low Through Powerex Trading of Electricity

Profits from electricity trade also contribute to keeping our electricity rates competitive. BC Hydro, through its subsidiary, Powerex, buys and sells electricity when it is advantageous to British Columbia's ratepayers. Government will continue to support capitalizing on electricity trading opportunities and will continue to allocate trade revenue to BC Hydro ratepayers to keep electricity rates low for all British Columbians.

BC Utilities Commissions' Role in Social and Environmental Costs and Benefits

The BC Energy Plan clarifies that social, economic and environmental costs are important for ensuring a suitable electricity supply in British Columbia. Government will review the BC Utilities Commissions' role in considering social, environmental and economic costs and benefits, and will determine how best to ensure these are appropriately considered within the regulatory framework.

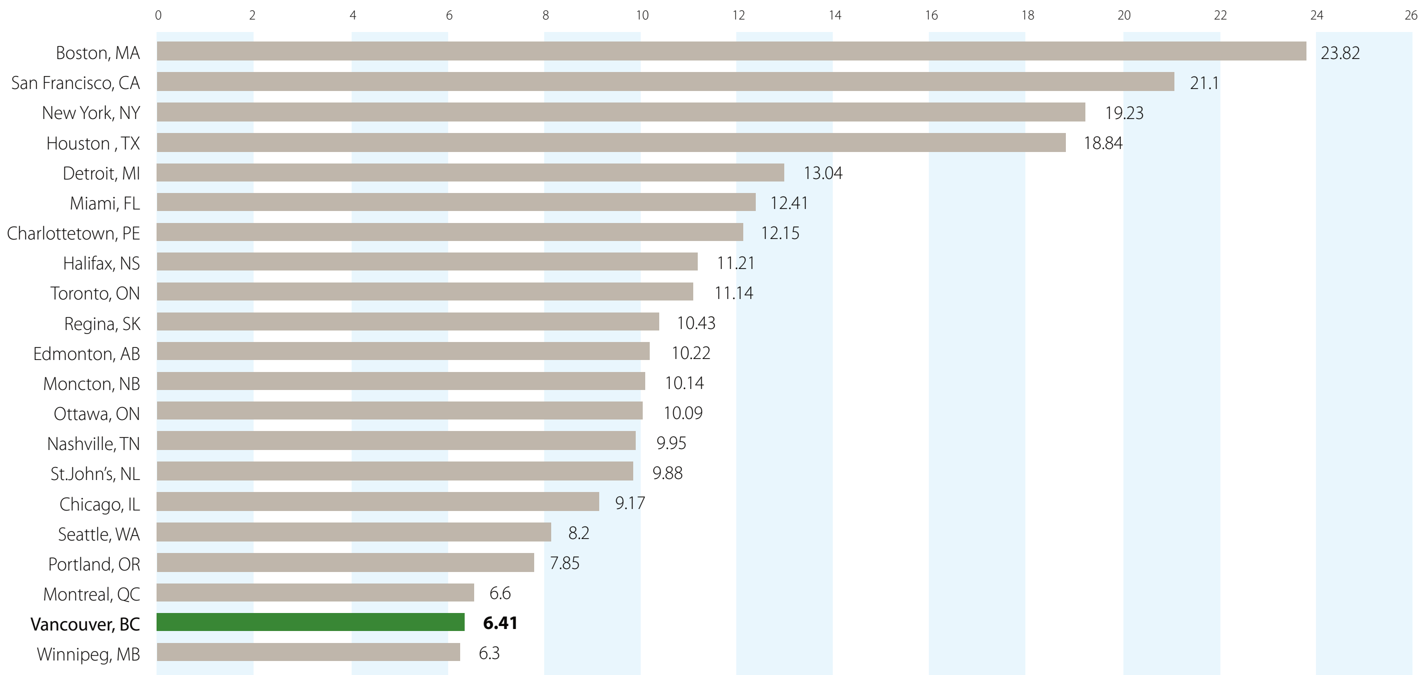
Bring Clean Power to Communities

British Columbia's electricity industry supports thousands of well-paying jobs, helps drive the economy and provides revenues to sustain public services. British Columbia's electricity industry already fosters economic development by implementing cost effective and reliable energy solutions in communities around the province. However, British Columbia covers almost one million square kilometres and electrification does not extend to all parts of our vast province.

Government and BC Hydro have established First Nation and remote community energy programs to implement alternative energy, energy efficiency, conservation and skills training solutions in a number of communities. The program focuses on expanding electrification services to as many as 50 remote and First Nations communities in British Columbia, enabling them to share in the benefits of a stable and secure supply of electricity. Government will put the policy framework in place and BC Hydro will implement the program over the next 10 years. The **Innovative Clean Energy Fund** can also support technological advancements to address the issue of providing a clean and secure supply of electricity to remote communities.

2006 Average Residential Electricity Price

Price (Canadian cents per kilowatt hour)



Source: Hydro Quebec comparison of Electricity Prices in Major North American Cities, April 2006

BRINGING CLEAN POWER TO ATLIN

Electricity in the remote community of Atlin in northwestern British Columbia is currently supplied by diesel generators. The First Nations and Remote Community Clean Energy Program is bringing clean power to Atlin.

The Taku Land Corporation, solely owned by the Taku River Tlingit First Nation will construct a two megawatt run-of-river hydroelectric project on Pine Creek, generating local economic benefits and providing clean power for Atlin. The Taku Land Corporation has entered into a 25 year Electricity Purchase Agreement with BC Hydro to supply electricity from the project to Atlin's grid. Over the course of the agreement, this will reduce greenhouse gas emissions by up to 150,000 tonnes as the town's diesel generators stand by.

The province is contributing $1.4 million to this $10 million project. This is the first payment from a $3.9 million federal contribution to British Columbia's First Nations and Remote Community Clean Energy Program. Criteria for federal funding included demonstrating greenhouse gas emissions reductions, cost-effectiveness, and partnerships with communities and industry.

Government will work with other agencies to maximize opportunities to develop, deploy and export British Columbia clean and alternative energy technologies.

POLICY ACTIONS

INVESTING IN INNOVATION

- **Establish the Innovative Clean Energy Fund to support the development of clean power and energy efficiency technologies in the electricity, alternative energy, transportation and oil and gas sectors.**
- **Implement a provincial Bioenergy Strategy which will build upon British Columbia's natural bioenergy resource advantages.**
- **Issue an expression of interest followed by a call for proposals for electricity from sawmill residues, logging debris and beetle-killed timber to help mitigate impacts from the provincial mountain pine beetle infestation.**

Innovative Clean Energy Fund

British Columbia's increasing energy requirements and our ambitious greenhouse gas emission reduction and clean energy targets require greater investment and innovation in the area of alternative energy by both the public and private sector.

To lead this effort, the government will establish an **Innovative Clean Energy Fund** of $25 million to help promising clean power technology projects succeed. The fund will be established through a small charge on energy utilities. The Minister of Energy, Mines and Petroleum Resources will consult with the energy utilities on the implementation of this charge.

Proponents of projects that will be supported through the fund will be encouraged to seek additional contributions from other sources. Government's new **Innovative Clean Energy Fund** will help make British Columbia a world leader in alternative energy and power technology. It will solve some of B.C.'s pressing energy challenges, protect our environment, help grow the economy, position the province as the place international customers turn to for key energy and environmental solutions, and assist B.C. based companies to showcase their products to world wide markets.

Following the advice of the Premier's Technology Council and the Alternative Energy and Power Technology Task Force, the fund will focus strictly on projects that:

- Address specific British Columbia energy and environmental problems that have been identified by government.
- Showcase B.C. technologies that have a strong potential for international market demand in other jurisdictions because they solve problems that exist both in B.C. and other jurisdictions.
- Support pre-commercial energy technology that is new, or commercial technologies not currently used in British Columbia.
- Demonstrate commercial success for new energy technologies.

Some problems that the fund could focus on include:

- Developing reliable power solutions for remote communities-particularly helping First Nations communities reduce their reliance on diesel generation for electricity.
- Advance conservation technologies to commercial application.
- Finding ways to convert vehicles to cleaner alternative fuels.
- Increasing the efficiency of power transmission through future grid technologies.
- Expanding the opportunities to generate power using alternative fuels (e.g.mountain pine beetle wood).

The British Columbia Bioenergy Strategy: Growing Our Natural Energy Advantage

Currently, British Columbia is leading Canada in the use of biomass for energy. The province has 50 per cent of Canada's biomass electricity generating capacity. In 2005, British Columbia's forest industry self-generated the equivalent of $150 million in electricity and roughly $1.5 billion in the form of heat energy. The use of biomass has displaced some natural gas consumption in the pulp and paper sector. The British Columbia wood pellet industry also enjoys a one-sixth share of the growing European Union market for bioenergy feedstock. The province will shortly release a bioenergy strategy that will build upon British Columbia's natural bioenergy resource advantages, industry capabilities and academic strength to establish British Columbia as a world leader in bioenergy development.

British Columbia's plan is to lead the bioeconomy in Western Canada with a strong and sustainable bioenergy sector. This vision is built on two guiding principles:

- Competitive, diversified forest and agriculture sectors.
- Strengthening regions and communities.

The provincial Bioenergy Strategy is aimed at:

- Enhancing British Columbia's ability to become electricity self-sufficient.
- Fostering the development of a sustainable bioenergy sector.
- Creating new jobs.
- Supporting improvements in air quality.
- Promoting opportunities to create power from mountain pine beetle-impacted timber.
- Positioning British Columbia for world leadership in the development and commercial adoption of wood energy technology.
- Advancing innovative solutions to agricultural and other waste management challenges.
- Encouraging diversification in the forestry and agriculture industries.
- Producing liquid biofuels to meet Renewable Fuel Standards and displace conventional fossil fuels.

Generating Electricity from Mountain Pine Beetle Wood: Turning Wood Waste into Energy

British Columbia is experiencing an unprecedented mountain pine beetle infestation that has affected several million hectares of trees throughout the province. This infestation is having a significant impact on forestry-based communities and industries, and heightens forest fire risk. There is a great opportunity to convert the affected timber to bioenergy, such as wood pellets and wood-fired electricity generation and cogeneration.

Through The BC Energy Plan, BC Hydro will issue a call for proposals for electricity from sawmill residues, logging debris and beetle-killed timber to help mitigate impacts from the provincial mountain pine beetle infestation.

MOUNTAIN PINE BEETLE INFESTATION: TURNING WOOD WASTE INTO ENERGY

British Columbia is experiencing an unprecedented mountain pine beetle infestation that has affected several million hectares of trees throughout the province. This infestation is having a significant economic impact on B.C.'s forestry industry and the many communities it helps to support and sustain. The forest fire risk to these communities has also risen as a result of their proximity to large stands of "beetle-killed" wood.

B.C. has developed a bioenergy strategy to promote new sources of sustainable and renewable energy in order to take advantage of the vast amounts of pine beetle-infested timber and other biomass resources. In the future, bioenergy will help meet our electricity needs, supplement conventional natural gas and petroleum supplies, maximize job and economic opportunities, and protect our health and environment.

The production of wood pellets is already a mature industry in British Columbia. Industry has produced over 500,000 tonnes of pellets and exported about 90 per cent of this product overseas in 2005, primarily to the European thermal power industry. Through The BC Energy Plan, BC Hydro will issue a call for proposals for further electricity generation from wood residue and mountain pine beetle-infested timber.

GOVERNMENT TO USE HYBRID VEHICLES ONLY

The provincial government is continuing the effort to reduce greenhouse gas emissions and overall energy consumption.

As part of this effort, government has more than tripled the size of its hybrid fleet since 2005 to become one of the leaders in public sector use of hybrid cars.

Hybrids emit much less pollution than conventional gas and diesel powered vehicles and thus help to reduce greenhouse gases in our environment. They can also be more cost-effective as fuel savings offset the higher initial cost.

As of 2007, all new cars purchased or leased by the B.C. government are to be hybrid vehicles. The province also has new financial incentives to help local governments shift to hybrid vehicle fleets and help retrofit diesel vehicles.

Addressing Greenhouse Gas Emissions from Transportation

The BC Energy Plan: A Vision for Clean Energy Leadership takes a first step to incorporate transportation issues into provincial energy policy. Transportation is a major contributor to climate change and air quality problems. It presents other issues such as traffic congestion that slows the movement of goods and people. The fuel we use to travel around the province accounts for about 40 per cent of British Columbia's greenhouse gas emissions. Every time we drive or take a vehicle that runs on fossil fuels, we add to the problem, whether it's a train, boat, plane or automobile. Cars and trucks are the biggest source of greenhouse gas emissions and contribute to reduced air quality in urban areas.

The government is committed to reducing greenhouse gas emissions from the transportation sector and has committed to adopting California's tailpipe emission standards from greenhouse gas emissions and champion the national adoption of these standards.

British Columbians want a range of energy options for use at home, on the road and in day-to-day life. Most people use gasoline or diesel to keep their vehicles moving, but there are other options that improve our air quality and reduce greenhouse gas emissions.

Natural gas burns cleaner than either gasoline or propane, resulting in less air pollution. Fuel cell vehicles are propelled by electric motors powered by fuel cells, devices that produce electricity from hydrogen without combustion.

GO GREEN

Cars that run on blends of renewable biofuels like ethanol and biodiesel emit lower levels of greenhouse gases and air pollutants. Electricity can provide an alternative to gasoline vehicles when used in hybrids and electric cars.

By working with businesses, educational institutions, non-profit organizations and governments, new and emerging transportation technologies can be deployed more rapidly at home and around the world. British Columbia will focus on research and development, demonstration projects, and marketing strategies to promote British Columbia's technologies to the world.

Implementing a Five Per Cent Renewable Fuel Standard for Diesel and Gasoline

The BC Energy Plan demonstrates British Columbia's commitment to environmental sustainability and economic growth by taking a lead role in promoting innovation in the transportation sector to reduce greenhouse gas emissions, improve air quality and help improve British Columbians' health and quality of life in the future. The plan will implement a five per cent average renewable fuel standard for diesel by 2010 to help reduce emissions and advance the domestic renewable fuel industry. It will further support the federal action of increasing the ethanol content of gasoline to five per cent by 2010. The plan will also see the adoption of quality parameters for all renewable fuels and fuel blends that are appropriate for Canadian weather conditions in cooperation with North American jurisdictions. These renewable fuel standards are a major component and first step towards government's goal of reducing the carbon intensity of all passenger vehicles by 10 per cent by 2020.

Government will implement a five per cent average renewable fuel standard for diesel by 2010 to help reduce emissions and advance the domestic renewable fuel industry.

A Commitment to Extend British Columbia's Ground-breaking Hydrogen Highway

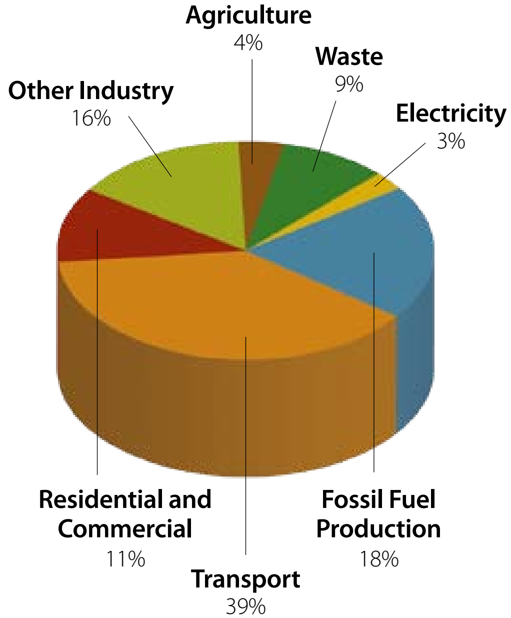
British Columbia is a world leader in transportation applications of the Hydrogen Highway, including the design, construction and safe operation of advanced hydrogen vehicle fuelling station technology. The Hydrogen Highway is a large scale, coordinated demonstration and deployment program for hydrogen and fuel cell technologies.

Vancouver's Powertech Labs established the world's first fast-fill, high pressure hydrogen fuelling station. The station anchors the Hydrogen Highway, which runs from Victoria through Surrey to Vancouver, North Vancouver, Squamish, and Whistler. Additional hydrogen fuelling stations are now in operation in Victoria and at the University of British Columbia.

The goal is to demonstrate and deploy various technologies and to one day see hydrogen filling stations around the province, serving drivers of consumer and commercial cars, trucks, and buses.

The unifying vision of the province's hydrogen and fuel cell strategy is to promote fuel cells and hydrogen technologies as a means of moving towards a sustainable energy future, increasing energy efficiency and reducing air pollutants and greenhouse gases. The Hydrogen Highway is targeted for full implementation by 2010. Canadian hydrogen and fuel cell companies have invested over $1 billion over the last five years, most of that in B.C. A federal-provincial partnership will be investing $89 million for fuelling stations and the world's first fleet of 20 fuel cell buses.

British Columbia will continue to be a leader in the new hydrogen economy by taking actions such as a fuel cell bus fleet deployment, developing a regulatory framework for micro-hydrogen applications, collaborating with neighbouring jurisdictions on hydrogen, and, in the long term, establishing a regulatory framework for hydrogen production, vehicles and fuelling stations.



B.C. Greenhouse Gas Emissions by Sector

(Based on 2004 data)
Source: Ministry of Environment

Cars and trucks are the biggest source of greenhouse gas emissions and reduce the quality of air in urban areas.

POLICY ACTIONS

ADDRESSING GREENHOUSE GAS EMISSIONS FROM TRANSPORTATION AND INCREASING INNOVATION

- **Implement a five per cent average renewable fuel standard for diesel by 2010 to help reduce emissions and advance the domestic renewable fuel industry.**
- **Support the federal action of increasing the ethanol content of gasoline to five per cent by 2010 and adopt quality parameters for all renewable fuels and fuel blends that are appropriate for Canadian weather conditions in cooperation with North American jurisdictions.**
- **Develop a leading hydrogen economy by continuing to support the Hydrogen and Fuel Cell Strategy for British Columbia.**
- **Establish a new, harmonized regulatory framework by 2010 for hydrogen by working with governments, industry and hydrogen alliances.**

Vehicles that run on electricity, hydrogen and blends of renewable biofuels like ethanol and biodiesel emit lower levels of greenhouse gases and air pollutants.

LOCALMOTION FUND: REDUCING AIR POLLUTION IN YOUR COMMUNITY

The province has committed $40 million over four years to help build cycling and pedestrian pathways, improve safety and accessibility, and support children's activity programs in playgrounds.

This fund will help local government shift to hybrid vehicle fleets and help retrofit diesel vehicles which will help reduce air pollution and ensure vibrant and environmentally sustainable communities. This investment will also include expansion of rapid transit and support fuel cell vehicles.

Promote Energy Efficiency and Alternative Energy

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. Combinations of alternative energy sources with natural gas include solar thermal and geothermal. Working with municipalities, utilities and other stakeholders the provincial government will promote energy efficiency and alternative energy systems, such as solar thermal and geothermal throughout the province.

Environmental Leadership in Action

The BC Energy Plan: A Vision for Clean Energy Leadership complements other related cross-government initiatives that include supporting transportation demand management, reducing traffic congestion and better integrating land use and transportation planning. These plans include actions across a broad range of activities. Some key initiatives and recent announcements include:

- Extending the tax break on hybrid vehicle purchases beyond the current March 2008 deadline.
- Government to purchase hybrid vehicles exclusively.
- Reducing diesel emissions through new financial incentives to help municipalities shift to hybrid vehicle fleets and retrofit diesel vehicles with cleaner technologies.
- Green Ports:
  - Working with ports and the shipping sector to reduce emissions from their activities and marine vessels.
  - The Port of Vancouver has established idle reduction zones and has reduced truck emissions with its container reservation system which has reduced average wait times from two hours to approximately 20 minutes.
  - The port is also evaluating port-side electrification which would see vessels using shore-side electrical power while berthed rather than diesel power.
- Improving upon the monitoring and reporting of air quality information.
- Highway Infrastructure and Rapid Transit Infrastructure funding including the Gateway Program, the Border Infrastructure Program, high occupancy vehicle lanes, construction of the Rapid Transit Canada Line linking Richmond, the Vancouver International Airport and Vancouver, and the Rapid Transit Evergreen Line linking Burnaby to Coquitlam.
- Expanding the AirCare on the Road Program to the Lower Fraser Valley and other communities.
- Implementing the LocalMotion Program for capital projects to improve physical fitness and safety, reduce air pollution and meet the diverse needs of British Columbians.

A Choice of Electricity Options

The range of supply options, both large and small, for British Columbia include:

Bioenergy: Bioenergy is derived from organic biomass sources such as wood residue, agricultural waste, municipal solid waste and other biomass and may be considered a carbon-neutral form of energy, because the carbon dioxide released by the biomass when converted to energy is equivalent to the amount absorbed during its lifetime.

A number of bioenergy facilities operate in British Columbia today. Many of these are "cogeneration" plants that create both electricity and heat for on-site use and in some cases, sell surplus electricity to BC Hydro.

Reliability[1]: FIRM
Estimated Cost[5]: $75 – $91

Coal Thermal Power: The BC Energy Plan establishes a zero emission standard for greenhouse gas emissions from coal-fired plants. This will require proponents of new coal facilities to employ clean coal technology with carbon capture and sequestration to ensure there are no greenhouse gas emissions.

Reliability[1]: FIRM
Estimated Cost[5,6]: $67– $82

Geothermal: Geothermal power is electricity generated from the earth. Geothermal power production involves tapping into pockets of superheated water and steam deep underground, bringing them to the surface and using the heat to produce steam to drive a turbine and produce electricity. British Columbia has potential high temperature (the water is heated to more than 200 degrees Celsius) geothermal resources in the coastal mountains and lower temperature resources in the interior, in northeast British Columbia and in a belt down the Rocky Mountains. Geothermal energy's two main advantages are its consistent supply, and the fact that it is a clean, renewable source of energy.

Reliability[1]: FIRM
Estimated Cost[2]: $44 - $60

Hydrogen and Fuel Cell Technology:
British Columbia companies are recognized globally for being leaders in hydrogen and fuel cell technology for mobile, stationary and micro applications. For example, BC Transit's fuel cell buses are planned for deployment in Whistler in 2009.

Reliability[1]: FIRM
Estimated Cost[2]: n/a

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1 Reliability refers to energy that can be depended on to be available whenever required

2 Source: BC Hydro's 2006 IEP Volume 1 of 2 page 5-6

3 Based on a 500 MW super ciritcal pulverized coal combustion unit. The BC Energy Plan requires coal power to meet zero GHG emissions

4 Based on a 250 MW combined cycle gas turbine plant. The BC Energy Plan requires coal power to meet zero GHG emissions

5 Source: BC Hydro's F2006 Open Call for Power Report

6 These costs do not reflect the costs of zero GHG emissions for coal thermal power

GOVERNMENT'S COMMITMENT TO THE ENVIRONMENT – THE ENVIRONMENTAL ASSESSMENT PROCESS

The environmental assessment process in British Columbia is an integrated review process for major projects that looks at potential environmental, community and First Nation, health and safety, and socioeconomic impacts. Through the environmental assessment process, the potential effects of a project are identified and evaluated early, resulting in improved project design and helping to avoid costly mistakes for proponents, governments, local communities and the environment.

An assessment is begun when a proposed project that meets certain criteria under the *Environmental Assessment Act* makes an application for an environmental assessment certificate. Each assessment will usually include an opportunity for all interested parties to identify issues and provide input; technical studies of the relevant environmental, social, economic, heritage and/or health effects of the proposed project; identification of ways to prevent or minimize undesirable effects and enhance desirable effects; and consideration of the input of all interested parties in compiling the assessment findings and making decisions about project acceptability. The review is concluded when a decision is made to issue or not issue an environmental assessment certificate. Industrial, mining, energy, water management, waste disposal, food processing, transportation and tourist destination resort projects are generally subject to an environmental assessment.

WHAT IS THE DIFFERENCE BETWEEN FIRM AND INTERMITTENT ELECTRICITY?

Firm electricity refers to electricity that is available at all times even in adverse conditions. The main sources of reliable electricity in British Columbia include large hydroelectric dams, and natural gas. This differs from intermittent electricity, which is limited or is not available at all times. An example of intermittent electricity would be wind which only produces power when the wind is blowing.

Large Hydroelectric Dams: The chief advantage of a hydro system is that it provides a reliable supply with both dependable capacity and energy, and a renewable and clean source of energy. Hydropower produces essentially no carbon dioxide.

Site C is one of many resource options that can help meet BC Hydro's customers' electricity needs. No preferred option has been selected at this time; however; it is recognized that the Province will need to examine opportunities for some large projects to meet growing demand.

As part of The BC Energy Plan, BC Hydro and the Province will enter into initial discussions with First Nations, the Province of Alberta and communities to discuss Site C to ensure that communications regarding the potential project and the processes being followed are well known. The purpose of this step is to engage the various parties up front to obtain input for the proposed engagement process. The decision-making process on Site C includes public consultation, environmental impact assessments, obtaining a Certificate of Public Convenience and Necessity, obtaining an Environmental Assessment Certificate and necessary environmental approvals, and approval by Cabinet.

Reliability[1]: FIRM
Estimated Cost[2]: $43 - $62

Natural Gas: Natural gas is converted into electricity through the use of gas fired turbines in medium to large generating stations; particularly high efficiencies can be achieved through combining gas turbines with steam turbines in the combined cycle and through reciprocating engines and mini and macro turbines. Combined cycle power generation using natural gas is the cleanest source of power available using fossil fuels. Natural gas provides a reliable supply with both dependable capacity and firm energy.

Reliability[1]: FIRM
Estimated Cost[2,6]: $48 - $100

Small Hydro: This includes run-of-river and micro Hydro. These generate electricity without altering seasonal flow characteristics. Water is diverted from a natural watercourse through an intake channel and pipeline to a powerhouse where a turbine and generator convert the kinetic energy in the moving water to electrical energy.

Twenty-nine electricity purchase agreements were awarded to small waterpower producers by BC Hydro in 2006. These projects will generate approximately 2,851 gigawatt hours of electricity annually (equivalent to electricity consumed by 285,000 homes in British Columbia). There are also 32 existing small hydro projects in British Columbia that generate 3,500 gigawatt hours (equivalent to electricity consumed by 350,000 homes in British Columbia).

Reliability[1]: INTERMITTENT
Estimated Cost[3]: $60 – $95

Solar: With financial support from the Ministry of Energy, Mines and Petroleum Resources, the "Solar for Schools" program has brought clean solar photovoltaic electricity to schools in Vernon, Fort Nelson, and Greater Victoria.

The BC Sustainable Energy Association is leading a project which targets installing solar water heaters on 100,000 rooftops across British Columbia.

Reliability[1]: INTERMITTENT
Estimated Cost[2]: $700 - $1700

Tidal Energy: A small demonstration project has been installed at Race Rocks located west-southwest of Victoria. The Lester B. Pearson College of the Pacific, the provincial and federal government, and industry have partnered to install and test a tidal energy demonstration turbine at Race Rocks. The project will generate about 77,000 kilowatt hours on an annual basis (equivalent to electricity consumed by approximately eight homes).

Reliability[1]: INTERMITTENT
Estimated Cost[2]: $100 - $360

Wind: British Columbia has abundant, widely distributed wind energy resources in three areas: the Peace region in the Northeast; Northern Vancouver Island; and the North Coast. Wind is a clean and renewable source that does not produce air or water pollution, greenhouse gases, solid or toxic wastes.

Three wind generation projects have been offered power purchase contracts in BC Hydro's 2006 Open Call for Power. These three projects will have a combined annual output of 979 gigawatt hours of electricity (equivalent to electricity consumed by 97,900 homes).

Reliability[1]: INTERMITTENT
Estimated Cost[5]: $71 – $74

[1] Reliability refers to energy that can be depended on to be available whenever required
[2] Source: BC Hydro's 2006 IEP Volume 1 of 2 page 5-6
[3] Based on a 500 MW super ciritcal pulverized coal combustion unit. The BC Energy Plan requires coal power to meet zero GHG emissions
[4] Based on a 250 MW combined cycle gas turbine plant.
[5] Source: BC Hydro's F2006 Open Call for Power Report
[6] These costs do not reflect the costs of zero net GHG emissions for natural gas

RACE ROCKS TIDAL ENERGY PROJECT

Announced in early 2005, this demonstration project between the provincial and federal governments, industry, and Pearson College is producing zero emission tidal power at the Race Rocks Marine Reserve on southern Vancouver Island. Using a current-driven turbine submerged below the ocean surface, the project is producing about 77,000 kilowatt hours of electricity per year, enough to meet the needs of approximately eight households. The knowledge gained about tidal energy will help our province remain at the forefront of clean energy generation technology.

Table 1: Summary of Resource Options

Description	Estimated Cost [1] $ /megawatt hour	Reliable[2]	Greenhouse gas emissions[3] tonnes per gigawatt hour
Energy conservation/ efficiency	32 – 76	Yes	0
Large hydroelectric	43 – 62	Yes	0
Natural gas	48 – 100[8]	Yes	0 – 350[4,8]
Coal	67 – 82[9,10]	Yes	0 – 855[5,9]
Biomass	75 – 91[10]	Yes	0 – 500[6]
Geothermal	44 – 60	Yes	0 – 10
Wind	71 – 74[10]	Depends on the availability and speed of wind	0
Run-of-river small hydro	60 – 95[10]	Depends on the flow of water, which varies throughout the year	0
Ocean (wave and tidal)	100 – 360[7]	Future supply option which has great potential for British Columbia	0
Solar	700 – 1700[7]	Depends on location, cloud cover, season, and time of day	0

1 Source: BC Hydro's 2006 Integrated Electricity Plan Volume 1 of 2, page 5-6
2 Reliability refers to energy that can be depended on to be available whenever required
3 Source: BC Hydro's 2006 Integrated Electricity Plan, Volume 2 of 2, Appendix F page 5-14 and Table 10-2
4 Based on a 250 MW combined cycle gas turbine plant
5 Based on a 500 MW supercritical pulverized coal combustion unit
6 GHG are 0 for wood residue and landfill gas. GHG is 500 tonnes per gigawatt hour for municipal solid waste
7 Source: BC Hydro's 2004 Integrated Electricity Plan, page 69
8 The BC Energy Plan requires natural gas plants to offset to zero net greenhouse gas emissions. These costs do not reflect the costs of zero net GHG emissions
9 The BC Energy Plan requires zero greenhouse gas emissions from any coal thermal electricity facilities
The costs do not include the costs of requiring zero emissions from coal thermal power
10 Source: BC Hydro's F2006 Open Call for Power Report

The majority of B.C.'s electricity requirements over the next 10 years can be achieved through increased conservation by all British Columbians and new electricity from independent power producers.

British Columbia's Strength in Electricity Diversity

British Columbia is truly fortunate to have a wide variety of future supply options available to meet our growing demand for energy. A cost effective way to meet that demand is to conserve energy and be more energy efficient. However, British Columbia will still need to bring new power on line to meet demand growth in the years ahead. In order to ensure we have this critical resource available to British Columbians when they need it, government will be looking to secure a range of made-in-B.C. power to serve British Columbians in the years ahead.

Government's goal is to encourage a diverse mix of resources that represent a variety of technologies. Some resource technologies, such as large and small hydro, thermal power, wind and geothermal provide well-established, commercially available sources of electricity. Other emerging technologies that are not yet widely used include large ocean wave and tidal power, solar, hydrogen and advanced coal technologies.

2004 Total Electricity Production by Source (% of total)

	Other Renewables	Hydro Electric	Nuclear	Waste and Biomass	Natural Gas	Diesel Oil	Coal	TOTAL
British Columbia	**0.0**	**92.8**	**0.0**	**1.0**	**6.0**	**0.2**	**0.0**	**100**
Alberta	2.3	4.4	0.0	0.0	12.0	2.6	78.7	100
Australia	0.3	6.9	0.0	0.6	12.3	0.70	79.2	100
California	10.7	17.0	14.5	0.0	37.7	0.0	20.1	100
Denmark	16.3	0.1	0.0	8.8	24.7	4.0	46.1	100
Finland	0.4	17.6	26.5	12.4	14.9	0.7	27.5	100
France	0.2	11.3	78.3	1.0	3.2	1.0	5.0	100
Germany	4.2	4.5	27.1	2.6	10.0	1.6	50.0	100
Japan	0.4	9.5	26.1	1.9	22.6	12.3	27.2	100
Norway	0.3	98.8	0.0	0.5	0.3	0.0	0.1	100
Ontario	1.8	24.8	49.7	0.0	5.2	0.5	18.0	100
Oregon	2.3	64.4	0.0	0.0	26.3	0.1	6.9	100
Quebec	0.7	94.5	3.2	0.0	0.1	1.5	0.0	100
United Kingdom	0.5	1.9	20.2	2.1	40.3	1.2	33.8	100
Washington	2.3	70.0	8.8	0.0	8.6	0.1	10.2	100

SHARING SOLUTIONS ON ELECTRICITY

The BC Energy Plan has a goal that most of B.C.'s electricity requirements over the next 10 years can be achieved through increased conservation and energy efficiency by all British Columbians, coupled with generation by independent power producers. However, these new projects take time to plan and implement. In addition, many of these sources provide limited amounts of firm supply. The province will also need to consider options for new, large scale sources to meet forecasted demand growth in the next 10 to 20 years. Large scale options could include Site C, large biomass facilities, clean coal or natural gas plants. As with all large scale undertakings, these kinds of projects will require years of lead time to allow for careful planning, analysis, consultation and construction.

Perhaps the biggest challenge facing British Columbians is simply to begin choosing our electricity future together. Demand for electricity is projected to grow by up to 45 per cent over the next 20 years. To meet this projected growth we will need to conserve more, and obtain more electricity from small power producers and large projects. Given the critical importance of public participation and stakeholder involvement in addressing the challenges and choices of meeting our future electricity needs, government and BC Hydro will seek and share solutions.

Rapid expansion of our energy sector means a growing number of permanent, well-paying employment opportunities are available.

Taking Action to Meet the Demand for Workers

The energy sector has been a major contributor to British Columbia's record economic performance since 2001. The BC Energy Plan focuses on four under-represented groups that offer excellent employment potential: Aboriginal people, immigrants, women and youth.

At the same time, the energy sector must overcome a variety of skills training and labour challenges to ensure future growth.

These challenges include:

- An aging workforce that upon retirement will leave a gap in experience and expertise.
- Competition for talent from other jurisdictions.
- Skills shortages among present and future workers.
- Labour market information gaps due to a lack of in-depth study.
- The need to coordinate immigration efforts with the federal government.
- The need for greater involvement of under-represented energy sector workers such as Aboriginal people, immigrants, women, and youth.
- A highly mobile workforce that moves with the opportunities.
- The need to improve productivity and enhance competitiveness.

Innovative, practical and timely skills training, and labour management is required to ensure the energy sector continues to thrive. As part of The BC Energy Plan, government will work collaboratively with industry, communities, Aboriginal people, education facilities, the federal government and others to define the projected demand for workers and take active measures to meet those demands.

Attract Highly Skilled Workers

Demographics show that those born at the height of the baby boom are retired or nearing retirement, leaving behind a growing gap in skills and expertise. Since this phenomenon is taking place in most western nations, attracting and retaining skilled staff is highly competitive.

To ensure continued energy sector growth, we need to attract workers from outside the province, particularly for the electricity, oil and gas, and heavy construction industries where the shortage is most keenly felt. At this time, a significant increase in annual net migration of workers from other provinces and from outside Canada is needed to complement the existing workforce.

Government and its partners are developing targeted plans to attract the necessary workers. These plans will include marketing and promoting energy sector jobs as a career choice.

Develop a Robust Talent Pool of Workers

It is vital to provide the initial training to build a job-ready talent pool in British Columbia, as well as the ongoing training employees need to adapt to changing energy sector technologies, products and requirements. We can ensure a thriving pool of talent in British Columbia by retraining skilled employees who are without work due to downturns in other industries. Displaced workers from other sectors and jurisdictions may require some retraining and new employees may need considerable skills development.

Another way to help ensure there are enough skilled energy sector workers in the years ahead is to educate and inform young people today. By letting high school students know about the opportunities, they can consider their options and make the appropriate training and career choices. Government will work to enhance information relating to energy sector activities in British Columbia's school curriculum in the years ahead.

Retain Skilled Workers

Around the world, energy facility construction and operations are booming, creating fierce, global competition for skilled workers. While British Columbia has much to offer, it is critical that our jurisdiction presents a superior opportunity to these highly skilled and mobile workers. That is why we need to ensure our workplaces are safe, fair and healthy and our communities continue to offer an unparalleled lifestyle with high quality health care and education, affordable housing, and readily available recreation opportunities in outstanding natural settings.

Inform British Columbians

To be effective in filling energy sector jobs with skilled workers, British Columbians need to be informed and educated about the outstanding opportunities available. As part of The BC Energy Plan, a comprehensive public awareness and education campaign based on sound labour market analysis will reach out to potential energy sector workers. This process will recognize and address both the potential challenges such as shift work and remote locations as well as the opportunities, such as obtaining highly marketable skills and earning excellent compensation.

POLICY ACTIONS

ENVIRONMENTALLY RESPONSIBLE OIL AND GAS DEVELOPMENT

- **Eliminate all routine flaring at oil and gas producing wells and production facilities by 2016 with an interim goal to reduce flaring by half (50 per cent) by 2011.**
- **Establish policies and measures to reduce air emissions in coordination with the Ministry of Environment.**
- **Best coalbed gas practices in North America. Companies will not be allowed to surface discharge produced water. Any re-injected produced water must be injected well below any domestic water aquifer.**
- **Enhance the Oil and Gas Environmental Stewardship Program, ensuring sound environmental, land and resource management.**

Be Among the Most Competitive Oil and Gas Jurisdictions in North America

Since 2001, British Columbia's oil and gas sector has grown to become a major force in our provincial economy, employing tens of thousands of British Columbians and helping to fuel the province's strong economic performance. In fact, investment in the oil and gas sector was $4.6 billion in 2005. The oil and gas industry contributes approximately $1.95 billion annually or seven per cent of the province's annual revenues.

The BC Energy Plan is designed to take B.C.'s oil and gas sector to the next level to enhance a sustainable, thriving and vibrant oil and gas sector in British Columbia. With a healthy, competitive oil and gas sector comes the opportunity to create jobs and build vibrant communities with increased infrastructure and services, such as schools and hospitals. Of particular importance is an expanding British Columbia-based service sector.

There is a lively debate about the peak of the world's oil and gas production and the impacts on economies, businesses and consumers. A number of countries, such as the UK, Norway and the USA, are experiencing declining fossil fuel production from conventional sources. Energy prices, especially oil prices have increased and are more volatile than in the past. As a result, the way energy is produced and consumed will change, particularly in developed countries.

The plan is aimed at enhancing the development of conventional resources and stimulating activity in relatively undeveloped areas such as the interior basins – particularly the Nechako Basin. It will also foster the development of unconventional resources such as as tight gas, shale gas, and coalbed gas. The plan will further efforts to work with the federal government, communities and First Nations to advance offshore opportunities.

The challenge for British Columbia in the future will be to continue to find the right balance of economic, environmental and social priorities to allow the oil and gas sector to succeed, while protecting our environment and improving our quality of life.

The New Relationship and Oil and Gas

Working together with local communities and First Nations, the provincial government will continue to share in the many benefits and opportunities created through the development of British Columbia's oil and gas resources.

Government is working to ensure that oil and gas resource management includes First Nations' interests, knowledge and values. Government has recently concluded consultation agreements for oil and gas resource development with First Nations in Northeast British Columbia. These agreements increase clarity in the process and will go a long way to enhancing our engagement with these First Nations.

Government will continue to pursue opportunities to share information and look for opportunities to facilitate First Nations' employment and participation in the oil and gas industry to ensure that Aboriginal people benefit from the continued growth and development of British Columbia's resources.

The BC Energy Plan adopts a triple bottom line approach to competitiveness, with an attractive investment climate, environmentally sustainable development of B.C.'s abundant resources, and by benefiting communities and First Nations.

While striving to be among the most competitive oil and gas jurisdictions in North America, the province will focus on maintaining and enhancing its strong competitive environment for the oil and gas industry. This encompasses the following components:

- A competitive investment climate.
- An abundant resource endowment.
- Environmental responsibility.
- Social responsibility.

Leading in Environmentally and Socially Responsible Oil and Gas Development

The BC Energy Plan emphasizes conservation, energy efficiency, and the environmental and socially responsible management of the province's energy resources. It outlines government's efforts to meet this objective by working collaboratively with involved and interested parties, including affected communities, landowners, environmental groups, First Nations, the regulator (the Oil and Gas Commission), industry groups and others. Policy actions will support ways to address air emissions, impacts on land and wildlife habitat, and water quality.

The oil and gas sector in British Columbia accounts for approximately 18 per cent of greenhouse gas air emissions in the province. The main sources of air emissions from the oil and gas sector are flaring, fugitive gases, gas processing and compressor stations. While these air emissions have long been part of the oil and gas sector, they have also been a source of major concern for oil and gas communities.

Eliminate Flaring from Oil and Gas Producing Wells and Production Facilities By 2016

Through The BC Energy Plan, government has committed to eliminate all routine flaring at oil and gas producing wells and production facilities by 2016 with an interim goal to reduce flaring by half (50 per cent) by 2011. In addition, government will adopt policies to reduce natural gas flaring and venting at test sites and pipelines, and encourage compressor station efficiency to cut back emissions. Government will also explore opportunities and new technologies for safe, underground disposal of carbon dioxide or sequestration from oil and gas facilities. Sequestration is considered a cost effective mitigation strategy in reducing carbon dioxide emissions.

Enhance Carbon Dioxide Sequestration in British Columbia

British Columbia is a member of the Plains CO2 Reduction (PCOR) Partnership composed of nearly 50 private and public sector groups from nine states and three Canadian provinces that is assessing the technical and economic feasibility of capturing and storing carbon dioxide emissions from stationary sources in western sedimentary basins.

B.C. is also a member of the West Coast Regional Carbon Sequestration Partnership, made up of west coast state and provincial government ministries and agencies. This partnership has been formed to pursue carbon sequestration opportunities and technologies.

To facilitate and foster innovation in sequestration, government will develop market oriented requirements with a graduated schedule. In consultation with stakeholders, a timetable will be developed along with increasing requirements for sequestration.

BRITISH COLUMBIA COMPANIES RECOGNIZED AS WORLD ENERGY TECHNOLOGY INNOVATORS

The leadership of British Columbian companies can be seen in all areas of the energy sector through innovative, industry leading technologies.

Production of a new generation of chemical injection pump for use in the oil and gas industry is beginning. The pumps, developed and built in British Columbia, are the first solar powered precision injection pumps available to the industry. They will reduce emissions by replacing traditional gas powered injection systems for pipelines.

Other solar technologies developed in British Columbia provide modular power supplies in remote locations all over the globe for marine signals, aviation lights and road signs.

Roads in B.C. and around the world are hosting demonstrations of fuel cell vehicles built with British Columbia technology. Thanks to the first high pressure hydrogen fuelling station in the world, compatible fuel cell vehicles in B.C. can carry more fuel and travel farther than ever before.

The Innovative Clean Energy Fund will help to build B.C.'s technology cluster and keep us at the forefront of energy technology development.

Government will work to improve oil and gas tenure policies as well as develop new guidelines to determine areas that require special consideration prior to tenure approval.

POLICY ACTIONS

OFFSHORE OIL AND GAS DEVELOPMENT

- **Continue to work to lift the federal moratorium on offshore exploration and development and reiterate the intention to simultaneously lift the provincial moratorium.**
- **Work with the federal government to ensure that offshore oil and gas resources are developed in a scientifically sound and environmentally responsible way.**
- **Participate in marine and environmental planning to effectively manage marine areas and offshore oil and gas basins.**
- **Develop and implement a comprehensive community engagement program to establish a framework for a benefits sharing agreement resulting from offshore oil and gas development for communities, including First Nations.**

Environmental Stewardship Program

In 2004, the Ministry of Energy, Mines and Petroleum Resources initiated the Oil and Gas Environmental Stewardship Program having two components: the Environmental Policy Program and the Environmental Resource Information Project. The Environmental Policy Program identifies and mitigates environmental issues in the petroleum sector focusing on policy development in areas such as environmental waste management, habitat enhancement, planning initiatives, wildlife studies for oil and gas priority areas and government best management practices. Some key program achievements include the completion of guidelines for regulatory dispersion modeling, research leading to the development of soil quality guidelines for soluble barium, a key to northern grasses and their restorative properties for remediated well sites, and moose and caribou inventories in Northeast British Columbia.

The Environmental Resource Information Project is dedicated to increasing opportunities for oil and gas development, through the collection of necessary environmental baseline information. These projects are delivered in partnership with other agencies, industry, communities and First Nations.

The BC Energy Plan enhances the important Oil and Gas Environmental Stewardship Program. This will improve existing efforts to manage waste and preserve habitat, and will establish baseline data as well as development and risk mitigation plans for environmentally sensitive areas. Barriers need to be identified and steps taken for remediation, progressive reclamation, and waste management.

Best Coalbed Gas Practices in North America

Government will continue to encourage coalbed gas development with the intent of demonstrating that British Columbia is a leading socially and environmentally responsible coalbed gas developing jurisdiction. Coalbed gas, also known as coalbed methane, is natural gas found in coal seams. It is one of the cleanest burning of all fossil fuels. Proponents wanting to develop coalbed gas must adopt the following best practices:

- Fully engage local communities and First Nations in all stages of development.
- Use the most advanced technology and practices that are commercially viable to minimize land and aesthetic disturbances.
- Companies will not be allowed to surface discharge produced water. Any re-injected produced water must be injected well below any domestic water aquifer.
- Meet any other conditions the Oil and Gas Commission may apply.
- Demonstrate the company's previous experience with coalbed gas development, and information must be made publicly available as to how the company plans to meet and be accountable for these best practices.

Ensuring Offshore Oil and Gas Resources are Developed in a Scientifically Sound and Environmentally Responsible Way

The BC Energy Plan includes actions related to the province's offshore oil and gas resources. Since 1972, Canada and British Columbia have each had a moratorium in place on offshore oil and gas exploration and development. With advanced technology and

British Columbia's oil and gas industry supports thousands of well-paying jobs, helps drive the economy and provides revenues to sustain public services.

positive experiences in other jurisdictions, a compelling case exists for assessing British Columbia's offshore resource potential.

Government will work with coastal communities, First Nations, the federal government, environmental organizations, and others to ascertain the benefits and address the concerns associated with offshore oil and gas development.

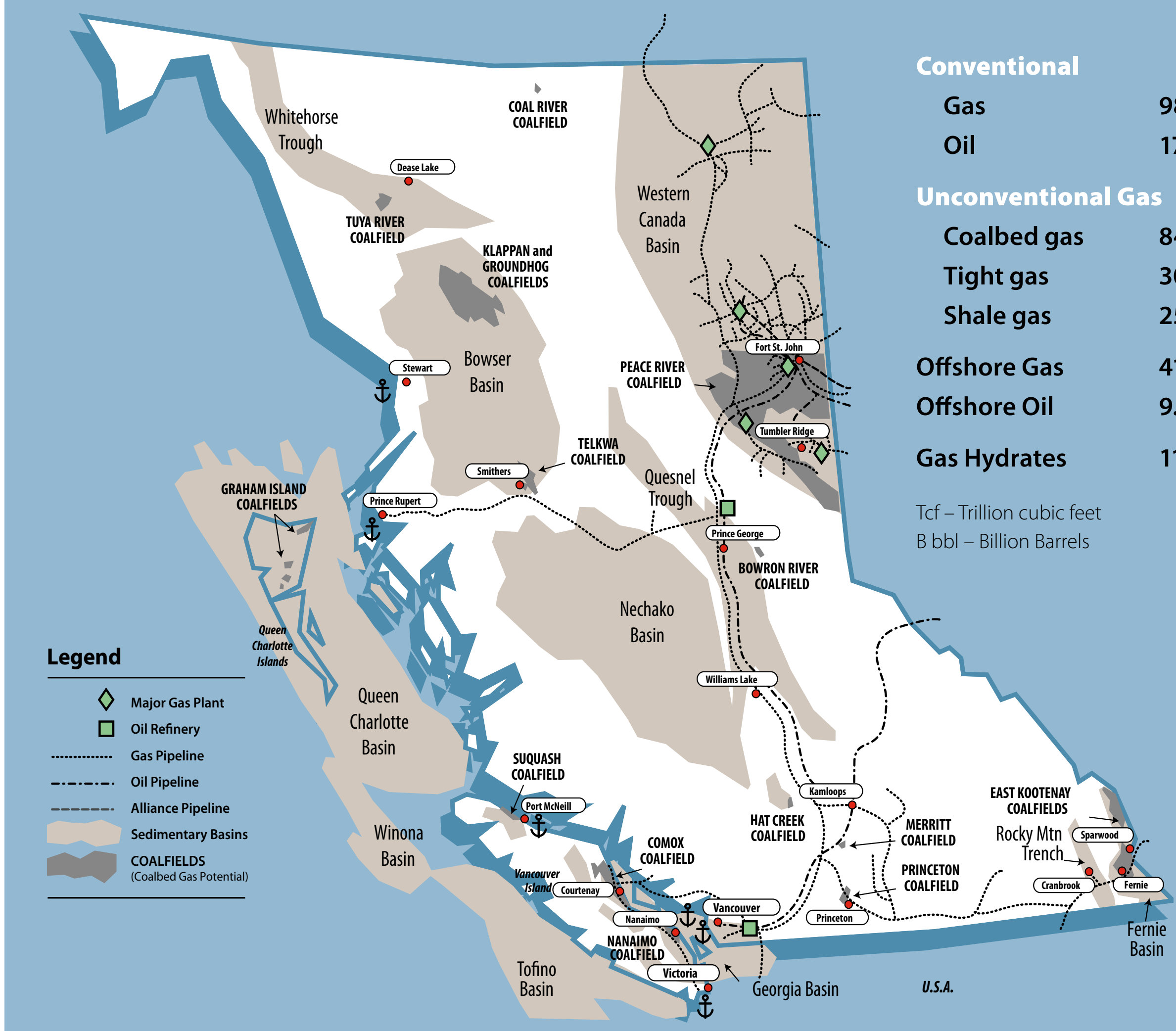
Maintaining B.C.'s Competitive Advantage as an Oil and Gas Jurisdiction

British Columbia's oil and gas industry is thriving thanks to high resource potential, industry and service sector expertise, and a competitive investment climate that includes a streamlined regulatory environment. To attract additional investment in British Columbia's oil and gas industry, we need to compete aggressively with other jurisdictions that may offer lower taxes or other investment incentives.

Another key way to be more competitive is by spurring activity in underdeveloped areas while heightening activity in the northeast, where our natural gas industry thrives. The province will work with industry to develop new policies and technologies for enhanced resource recovery making, it more cost-effective to develop British Columbia's resources.

By increasing our competitiveness, British Columbians can continue to benefit from well-paying jobs, high quality social infrastructure and a thriving economy.

BC OIL AND GAS UNDISCOVERED RESOURCE ESTIMATES



Conventional	
Gas	98.0 Tcf
Oil	17.6 B bbl
Unconventional Gas	
Coalbed gas	84.0 Tcf
Tight gas	300 Tcf
Shale gas	250 Tcf
Offshore Gas	41.8 Tcf
Offshore Oil	9.8 B bbl
Gas Hydrates	113-847 Tcf

Tcf – Trillion cubic feet
B bbl – Billion Barrels

British Columbia's Enormous Natural Gas Potential

The oil and gas sector will continue to play an important role in British Columbia's future energy security. Our province has enormous natural gas resource potential and opportunities for significant growth. The BC Energy Plan facilitates the development of B.C.'s resources.

British Columbia has numerous sedimentary basins, which contain petroleum and natural gas resources. In north-eastern British Columbia, the Western Canada Sedimentary Basin is the focus of our thriving natural gas industry. The potential resources in the central and northern interior of the province, the Nechako and Bowser Basins and Whitehorse Trough, have gone untapped.

The delayed evaluation and potential development of these areas is largely due to geological and physical obstructions that make it difficult to explore in the area. Volcanic rocks that overlay the sedimentary package combined with complex basin structures, have hindered development.

The BC Energy Plan is aimed at enhancing the development of conventional resources and stimulating activity in undeveloped areas such as the interior basins – particularly the Nechako Basin. It will also foster the development of unconventional resources and take a more stringent approach on coalbed gas to meet higher environmental standards.

Attracting Investment and Developing our Oil and Gas Resources

The BC Energy Plan promotes competitiveness by setting out a number of important regulatory and fiscal measures including: monitoring British Columbia's competitive ranking, considering a Net Profit Royalty Program, promoting a B.C. service sector, harmonizing and streamlining regulations, and developing a Petroleum Registry to examine royalty and tenure incentives, and undertaking geoscience programs.

Establishment of a Petroleum Registry

The establishment of a petroleum registry that functions as a central database will improve the quality and management of key volumetric, royalty and infrastructure information associated with British Columbia's oil and gas industry and promote competition while providing transparency around oil and gas activity.

NEEMAC: SUCCESS THROUGH COMMUNICATION

As energy, mining and petroleum resource development increases in northeast B.C., so too does the need for input from local governments, First Nations, community groups, landowners and other key stakeholders. In 2006, the Northeast Energy and Mines Advisory Committee (NEEMAC) was created to provide an inclusive forum for representative organizations to build relationships with each other, industry and government to provide input on Ministry policy, and recommend innovative solutions to stakeholder concerns.

Since its creation, NEEMAC has identified and explored priority concerns, and is beginning to find balanced solutions related to environmental, surface disturbance, access and landowner rights issues. The Ministry is committed to implementing recommendations that represent the broad interests of community, industry and government and expects that the committee will continue to provide advice on energy, mining and petroleum development issues in support of The BC Energy Plan.

An opportunity to increase competitiveness exists in British Columbia's Interior Basins – namely the Nechako, Bowser and Whitehorse Basins – where considerable resource potential is known to exist.

Increasing Access

In addition to regulatory and fiscal mechanisms, the plan addresses the need for improving access to resources. Pipelines and road infrastructure are critical factors in development and competitiveness. The BC Energy Plan calls for new investment in public roads and other infrastructure. It will see government establish a clear, structured infrastructure royalty program, combining road and pipeline initiatives and increasing development in under-explored areas that have little or no existing infrastructure.

Developing Conventional and Unconventional Oil and Gas Resources

To support investment in exploration, The BC Energy Plan calls for partnerships in research and development to establish reliable regional data, as well as royalty and tenure incentives. The goal is to attract investment, create well-paying jobs, boost the regional economy and produce economic benefits for all British Columbians. We can be more competitive by spurring activity in underdeveloped areas while heightening activity in the northeast where our natural gas industry thrives. The plan advocates working with industry to develop new policies and technology to enhance resource recovery, including oil in British Columbia.

Improve Regulations and Research

The province remains committed to continuous improvement in the regulatory regime and environmental management of conventional and unconventional oil and gas resources. The opportunities for enhancing exploration and production of tight gas, shale gas, and coalbed gas will also be assessed and supported by geoscience research and programs. The BC Energy Plan calls for collaboration with other government ministries, agencies, industry, communities and First Nations to develop the oil and gas resources in British Columbia.

Focus on Innovation and Technology Development

The BC Energy Plan also calls for supporting the development of new oil and gas technologies. This plan will lead British Columbia to become an internationally recognized centre for technological advancements and commercialization, particularly in environmental management, flaring, carbon sequestration and hydrogeology. The service sector has noted it can play an important role in developing and commercializing new technologies; however, the issue for companies is accessing the necessary funds.

THE HUB OF B.C.'S OIL AND GAS SECTOR

Oil and gas is benefiting all British Columbians - not just those living in major centres. Nowhere is this more apparent than in booming Fort St. John, which has rapidly become the oil and gas hub of the province. Since 2001, more than 1,400 people have moved to the community, an increase of 6.3 per cent and two per cent faster growth than the provincial average. Construction permits are way up - from $48.7 million in 2004, to $50.6 million in 2005, to over $123 million in 2006. In the past five years, over 1,000 new companies have been incorporated in Fort St. John, as young families, experienced professionals, skilled trades-people and many others move here from across the country.

POLICY ACTIONS

BE AMONG THE MOST COMPETITIVE OIL AND GAS JURISDICTIONS IN NORTH AMERICA

- **Pursue regulatory and fiscal competitiveness in support of being among the most competitive oil and gas jurisdictions in North America.**
- **Enhance infrastructure to support the development of oil and gas in British Columbia and address impediments to economic development such as transportation and labour shortages.**
- **Encourage the development of conventional and unconventional resources.**
- **Support the growth of British Columbia's oil and gas service sector.**
- **Promote exploration and development of the Interior basins with a priority focus on the Nechako Basin.**
- **Encourage the development of new technologies.**
- **Add value to British Columbia's oil and gas industry by assessing and promoting the development of additional gas processing facilities in the province.**

Technology Transfer Incentive Program

A new Oil and Gas Technology Transfer Incentive Program will be considered to encourage the research, development and use of innovative technologies to increase recoveries from existing reserves and encourage responsible development of new oil and gas reserves. The program could recover program costs over time through increased royalties generated by expanded development and production of British Columbia's petroleum resources.

Scientific Research and Experimental Development

The BC Energy Plan supports the British Columbia Scientific Research and Experimental Development Program, which provides financial support for research and development leading to new or improved products and processes. Through credits or refunds, the expanded program could cover project costs directly related to commercially applicable research, and development or demonstration of new or improved technologies conducted in British Columbia that facilitate expanded oil and gas production.

Research and Development

The BC Energy Plan calls for using new or existing research and development programs for the oil and gas sector. Government will develop a program targeting areas in which British Columbia has an advantage such as well completion technology and hydrogeology.

A program to encourage oil and gas innovation and research in British Columbia's post-secondary institutions will be explored. These opportunities will be explored in partnership with the Petroleum Technology Alliance Canada and as part of the April 2006 Memorandum of Understanding between British Columbia and Alberta on Energy Research, Technology Development and Innovation.

Together with the Oil and Gas Centre of Excellence in Fort St. John, an oil and gas technology incubator, a site which provides innovators with space to build prototypes and carry out testing as well as providing business infrastructure and assistance accessing additional support will be established, allowing entrepreneurs to develop and test new innovations and commercialize new, innovative technologies and processes.

Nechako Initiative

The BC Energy Plan calls for government to partner with industry, the federal government, and Geoscience BC to undertake comprehensive research in the Nechako Basin and establish new data of the resource potential. It will include active engagement of communities and the development and implementation of a comprehensive pre-tenure engagement initiative for First Nations in the region. Specific tenures and royalties will be explored to encourage investment, as well as a comprehensive Environmental Information Program to identify baseline information needs in the area through consultations with government, industry, communities and First Nations.

By increasing our oil and gas industry's competitiveness, British Columbians can continue to benefit from well-paying jobs, high quality social infrastructure and a thriving economy.

Value-Added Opportunities

To improve competitiveness, The BC Energy Plan calls for a review of value-added opportunities in British Columbia. This will include a thorough assessment of the potential for processing facilities and petroleum refineries as well as petrochemical industry opportunities. The Ministry of Energy, Mines and Petroleum Resources will conduct an analysis to identify and address barriers and explore incentives required to encourage investment in gas processing in British Columbia. A working group of industry and government will develop business cases and report to the Minister by January 2008 with recommendations on the viability of a new petroleum refinery and petrochemical industry and measures, if any, to encourage investment.

Oil and Gas Service Sector

British Columbia's oil and gas service sector can also help establish our province as one of the most competitive jurisdictions in North America. The service sector has grown over the past four years and with increased activity, additional summer drilling, and the security of supply, opportunities for local companies will continue. Government can help maximize the benefits derived from the service sector by:

- Promoting British Columbia's service sector to the oil and gas industry through participation at trade shows and providing information to the business community.
- Identifying areas where British Columbian companies can play a larger role, expand into other provinces, and through procurement strategies.

The government also supports the Oil and Gas Centre of Excellence at the Fort St. John Northern Lights College campus, which will provide oil and gas, related vocational, trades, career and technical programs.

Improving Oil and Gas Tenures

Government will work to improve oil and gas tenure issuance policies as well as develop new guidelines to determine areas that require special consideration prior to tenure approval by the end of 2007. This will provide clear parameters for industry regarding areas where special or enhanced management practices are required. These measures will strike the important balance between providing industry with clarity and access to resources and the desire of local government, communities, landowners, stakeholders and First Nations for input into the oil and gas development process.

Create Opportunities for Communities and First Nations

Benefits for British Columbians from the Oil and Gas Sector

The oil and gas sector offers enormous benefits to all British Columbians through enhanced energy security, tens of thousands of good, well-paying jobs and tax revenues used to help fund our hospitals and schools. However, the day-to-day impact of the sector has largely been felt on communities and First Nations in British Columbia's northeast. Community organizations, First Nations, and landowners have communicated a desire for greater input into the pace and scope of oil and gas development in British Columbia.

Together with the Oil and Gas Centre of Excellence in Fort St. John, an oil and gas technology incubator will be established, allowing entrepreneurs to develop and test new innovations.

POLICY ACTIONS

WORKING WITH COMMUNITIES AND FIRST NATIONS

- **Provide information about local oil and gas activities to local governments, First Nations, education and health service providers to inform and support the development of necessary social infrastructure.**
- **Work with First Nations to identify opportunities to participate in and benefit from oil and gas development.**
- **Support First Nations in providing cross-cultural training to agencies and industry.**
- **Improve working relationships among industry and local communities and landowners by clarifying and simplifying processes, enhancing dispute resolution methods, and offering more support and information.**
- **Examine oil and gas tenure policies and develop guidelines to determine areas that require special consideration prior to tenure approval.**

Through The BC Energy Plan, government intends to develop stronger relationships with those affected by oil and gas development, including communities and First Nations. The aim is to work cooperatively to maximize benefits and minimize impacts. The plan supports improved working relationships among industry, local communities and landowners by increased and improved communication to clarify and simplify processes, enhancing dispute resolution methods, and offering more support and information.

The government will also continue to improve communications with local governments and agencies. Specifically, The BC Energy Plan calls for efforts to provide information about increased local oil and gas activities to local governments, education and health service providers to improve their ability to make timely decisions on infrastructure, such as schools, housing, and health and recreational facilities. By providing local communities and service providers with regular reports of trends and industry activities, they can more effectively plan for growth in required services and infrastructure.

Building Better Relationships with Landowners

The BC Energy Plan: A Vision for Clean Energy Leadership also supports improved working relationships between industry, local communities and landowners and First Nations. Landowners will be notified in a more timely way of sales of oil and gas rights on private land. Plain language information materials, including standardized lease agreements will be made available to help landowners deal with subsurface tenures and activity. There will be a review of the dispute resolution process between landowners and industry by the end of 2007. The existing setback requirements, the allowed distance of a well site from a residence, school or other public place, will also be examined. These measures seek to strike the important balance between providing industry with clarity and access to resources and the desire of local government, communities, landowners, stakeholders and First Nations for input into oil and gas development.

Working in Partnership with First Nations and Communities

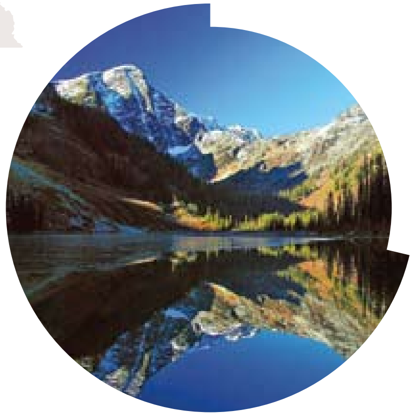
Government will work with First Nations communities to identify opportunities to benefit from oil and gas development. By developing a greater ability to participate in and benefit from oil and gas development, First Nations can play a much more active role in the industry. The BC Energy Plan also supports increasing First Nations role in the development of cross-cultural training initiatives for agencies and industry.

Conclusion

The BC Energy Plan: A Vision for Clean Energy Leadership sets the standard for proactively addressing the opportunities and challenges that lie ahead in meeting the energy needs for all the citizens of the province, now and in the future. Appendix A provides a detailed listing of the policy actions of the plan.

The BC Energy Plan will attract new investments, help develop and commercialize new technology, build partnerships with First Nations, and ensures a strong environmental focus.

British Columbia has a proud history of innovation that has resulted in 90 per cent of our power generation coming from clean sources. This plan builds on that foundation and ensures B.C. will be at the forefront of environmental and economic leadership for years to come.



ENERGY CONSERVATION AND EFFICIENCY

1. Set an ambitious conservation target, to acquire 50 per cent of BC Hydro's incremental resource needs through conservation by 2020.
2. Ensure a coordinated approach to conservation and efficiency is actively pursued in British Columbia.
3. Encourage utilities to pursue cost effective and competitive demand side management opportunities.
4. Explore with B.C. utilities new rate structures that encourage energy efficiency and conservation.
5. Implement Energy Efficiency Standards for Buildings by 2010.
6. Undertake a pilot project for energy performance labeling of homes and buildings in coordination with local and federal governments, First Nations, and industry associations.
7. New provincial public sector buildings will be required to integrate environmental design to achieve the highest standards for greenhouse gas emission reductions, water conservation and other building performance results such as a certified standard.
8. Develop an Industrial Energy Efficiency Program for British Columbia to address specific challenges faced by British Columbia's industrial sector.
9. Increase the participation of local governments in the Community Action on Energy Efficiency Program and expand the First Nations and Remote Community Clean Energy Program.

ELECTRICITY

10. Ensure self-sufficiency to meet electricity needs, including "insurance" by 2016.
11. Establish a standing offer for clean electricity projects up to 10 megawatts.
12. The BC Transmission Corporation is to ensure that British Columbia's transmission technology and infrastructure remains at the leading edge and has the capacity to deliver power efficiently and reliably to meet growing demand.
13. Ensure adequate transmission system capacity by developing and implementing a transmission congestion relief policy.
14. Ensure that the province remains consistent with North American transmission reliability standards.
15. Continue public ownership of BC Hydro and its heritage assets, and the BC Transmission Corporation.
16. Establish the existing heritage contract in perpetuity.
17. Invest in upgrading and maintaining the heritage asset power plants and the transmission lines to retain the ongoing competitive advantage these assets provide to the province.
18. All new electricity generation projects will have zero net greenhouse gas emissions.
19. Zero net greenhouse gas emissions from existing thermal generation power plants by 2016.
20. Require zero greenhouse gas emissions from any coal thermal electricity facilities.
21. Ensure clean or renewable electricity generation continues to account for at least 90 per cent of total generation.
22. Government supports BC Hydro's proposal to replace the firm energy supply from the Burrard Thermal plant with other resources. BC Hydro may choose to retain Burrard for capacity purposes after 2014.
23. No nuclear power.
24. Review BC Utilities Commissions' role in considering social and environmental costs and benefits.
25. Ensure the procurement of electricity appropriately recognizes the value of aggregated intermittent resources.
26. Work with BC Hydro and parties involved to continue to improve the procurement process for electricity.
27. Pursue Government and BC Hydro's planned Remote Community Electrification Program to expand or take over electricity service to remote communities in British Columbia.
28. Ensure BC Hydro considers alternative electricity sources and energy efficiency measures in its energy planning for remote communities.

ALTERNATIVE ENERGY

29. Establish the Innovative Clean Energy Fund to support the development of clean power and energy efficiency technologies in the electricity, alternative energy, transportation and oil and gas sectors.
30. Implement a provincial Bioenergy Strategy which will build upon British Columbia's natural bioenergy resource advantages.
31. Issue an expression of interest followed by a call for proposals for electricity from sawmill residues, logging debris and beetle-killed timber to help mitigate impacts from the provincial mountain pine beetle infestation.
32. Implement a five per cent average renewable fuel standard for diesel by 2010 to help reduce emissions and advance the domestic renewable fuel industry.
33. Support the federal action of increasing the ethanol content of gasoline to five per cent by 2010 and adopt quality parameters for all renewable fuels and fuel blends that are appropriate for Canadian weather conditions in cooperation with North American jurisdictions.
34. Develop a leading hydrogen economy by continuing to support the Hydrogen and Fuel Cell Strategy for British Columbia.
35. Establish a new, harmonized regulatory framework by 2010 for hydrogen by working with governments, industry and hydrogen alliances.

OIL AND GAS

36. Eliminate all routine flaring at oil and gas producing wells and production facilities by 2016 with an interim goal to reduce flaring by half (50 per cent) by 2011.
37. Establish policies and measures to reduce air emissions in coordination with the Ministry of Environment.
38. Best coalbed gas practices in North America. Companies will not be allowed to surface discharge produced water. Any re-injected produced water must be injected well below any domestic water aquifer.
39. Enhance the Oil and Gas Environmental Stewardship Program, ensuring sound environmental, land and resource management.
40. Continue to work to lift the federal moratorium on offshore exploration and development and reiterate the intention to simultaneously lift the provincial moratorium.
41. Work with the federal government to ensure that offshore oil and gas resources are developed in a scientifically sound and environmentally responsible way.
42. Participate in marine and environmental planning to effectively manage marine areas and offshore oil and gas basins.
43. Develop and implement a comprehensive community engagement program to establish a framework for a benefits sharing agreement resulting from offshore oil and gas development for communities, including First Nations.
44. Pursue regulatory and fiscal competitiveness in support of being among the most competitive oil and gas jurisdictions in North America.
45. Enhance infrastructure to support the development of oil and gas in British Columbia and address impediments to economic development such as transportation and labour shortages.
46. Encourage the development of conventional and unconventional resources.
47. Support the growth of British Columbia's oil and gas service sector.
48. Promote exploration and development of the Interior basins with a priority focus on the Nechako Basin.
49. Encourage the development of new technologies.
50. Add value to British Columbia's oil and gas industry by assessing and promoting the development of additional gas processing facilities in the province.
51. Provide information about local oil and gas activities to local governments, education and health service providers to inform and support the development of necessary social infrastructure.
52. Work with First Nations to identify opportunities to participate in and benefit from oil and gas development.
53. Support First Nations in providing cross-cultural training to agencies and industry.
54. Improve working relationships among industry and local communities and landowners by clarifying and simplifying processes, enhancing dispute resolution methods, and offering more support and information.
55. Examine oil and gas tenure policies and develop guidelines to determine areas that require special consideration prior to tenure approval.

Energy in Action

POWERSMART
BC Hydro offers a variety of incentives to adopt energy saving technologies. Incentives such as rebates on efficient lighting or windows encourages British Columbians to improve the energy efficiency of their homes and businesses.

PROVINCIAL SALES TAX EXEMPTIONS
Tax breaks are offered for a wide variety of energy efficient items, making it easier to conserve energy. Tax concessions are in place for alternative fuel and hybrid vehicles as well as some alternative fuels. Bicycles and some bicycle parts are exempt from provincial sales tax, as are a variety of materials, such as Energy Star® qualified windows, that can make homes more energy efficient.

NET METERING
The Net Metering program offered by BC Hydro for customers with small generating facilities, allows customers to lower their environmental impact and take responsibility for their own power production. The customer is only billed for their "net consumption"; the total amount of electricity used minus the total produced. Net Metering helps to move the province towards electricity self sufficiency and expands clean electricity generation.

POWERING THE ECONOMY
The Oil and Gas sector invested $4.6 billion in B.C. in 2005 and contributed more to the provincial treasury than any other resource in 2005/06. In 2006 1,416 oil and gas wells were drilled in the province and between 2002 and 2005, summer drilling increased 242 per cent.

FRIDGE BUY-BACK PROGRAM
This program offers customers $30 in cash and no-cost pickup and disposal of an old, inefficient second fridge. If all second operating fridges in B.C. were recycled, we would save enough energy to power all the homes in the city of Chilliwack for an entire year.

LIGHTING REBATES
This program offers instant rebate coupons for the retail purchase of Energy Star® light fixtures and Energy Star® CFLs (Compact Fluorescent Lights).

WINDOWS REBATE
The Windows Rebate Program offers rebates for the installation of Energy Star® windows in new, renovated or upgraded single-family homes, duplexes, townhouses or apartments.

PRODUCT INCENTIVE PROGRAM
The Product Incentive Program provides financial incentives to organizations which replace inefficient products with energy efficient technologies or add on products to existing systems to make them more efficient.

HIGH-PERFORMANCE BUILDING PROGRAM FOR LARGE COMMERCIAL BUILDINGS
Financial incentives, resources, and technical assistance are available to help qualified projects identify energy saving strategies early in the design process; evaluate alternative design options and make a business case for the high-performance design; and, offset the incremental costs, if any, of the energy-efficient measures in the high-performance design.

HIGH-PERFORMANCE BUILDING PROGRAM FOR SMALL TO MEDIUM COMMERCIAL BUILDINGS
Incentives and tools are offered to help owners and their design teams create and install more effective and energy-efficient lighting in new commercial development projects.

NEW HOME PROGRAM
Builders and developers are encouraged to build energy efficient homes by offering financial incentives and Power Smart branding for homes that achieve energy efficient ratings.

ANALYZE MY HOME
BC Hydro offers an online tool that provides a free, personalized breakdown of a customer's home energy use and recommendations on where improvements can be made to lower consumption.

CONSERVATION RESEARCH INITIATIVE
A 12-month study in six communities that examines how adjusting the price of electricity at different times of day influences energy use by residential customers, and how individual British Columbians can make a difference in conserving power in their homes and help meet the growing demand for electricity in B.C.

THE GREEN BUILDINGS PROGRAM
Provides tools and resources to support school districts, universities, colleges, and health authorities to improve the energy efficiency of their buildings across the province.

ATTRACTING WORKERS
The Ministry of Energy, Mines and Petroleum Resources hosts job fairs across B.C. to attract workers to the highly lucrative oil and gas sector. Job fairs were held in 14 communities in 2005 and 16 communities in 2006 attracting thousands of people and resulting in hundreds of job offers. Centre of Excellence Government is partnering with industry and the Northern Lights College in Fort St. John to build a centre for oil and gas excellence, more than doubling the number of students training for jobs in the oil and gas industry.

CENTRE OF EXCELLENCE
Government is partnering with industry and the Northern Lights College in Fort St. John to build a centre for oil and gas excellence, more than doubling the number of students training for jobs in the oil and gas industry.

100,000 SOLAR ROOFS FOR B.C.
The Ministers of Environment, and Energy, Mines and Petroleum Resources are sponsoring the development of a plan that will see the aggressive adoption of solar technology in B.C. The goal of the project is to see the installation of solar roofs and walls for hot water heating and photovoltaic electricity generation on 100,000 buildings around B.C.

PARTNERING FOR SUCCESS
Since 2003, the Province of B.C. has partnered in the construction of $158 million in new oil and gas road and pipeline infrastructure. The Sierra Yoyo Desan Road public private partnership improved the road allowing year round drilling activity in the Greater Sierra natural gas play. The project was recognized with the Gold Award for Innovation and Excellence from the Canadian Council for Public Private Partnerships in 2004.

ENERGY EFFICIENT BUILDINGS: A PLAN FOR BC
This strategy will lower energy costs for new and existing buildings by $127 million in 2010 and $474 million in 2020, and reduce greenhouse gas emissions by 2.3 million tonnes in 2020. The Province is implementing ten policy and market measures in partnership with the building industry, energy consumer groups, utilities, non-governmental organizations, and the federal government.

Appendix 7

DSM for Affordable Housing Working Group
Membership
February 25, 2008

Terasen Gas, Sarah Smith
BC Hydro, Margo Longland
Ministry of Energy Mines and Petroleum Resources, Erik Kaye
Public Interest Advocacy Centre, Eugene Kung
BC Housing, Craig Edwards/Domenico Lepri
Homeworks, Liz Kelly
City Green, Peter Sundberg
City of Vancouver, Mark Hartman
Canada Mortgage and Housing Corporation, Lance Jakubec
Canada Mortgage and Housing Corporation, Jabeen Janmohamed
Canada Mortgage and Housing Corporation, Cliff Grant
Indian and Northern Affairs Canada, John Dwyer
FortisBC, Keith Veerman
Fraser Basin Council, Elizabeth Henry
BC Apartment Owners and Managers Association, Brenda Binnie
BC Non-Profit Housing Association, Karen Stone

Appendix 8

1. Connecting with Consumers

The fragmentation of media in concert with the on-demand universe created by broadband Internet has evolved the way people consume messages. Although mass media advertising is still the most cost efficient way of communicating with an audience, multiple communication avenues are needed to ensure adequate reach and recall. This is known as Connection Planning. Connection Planning examines all potential touch points to determine the most effective way of reaching a target audience.

Connection Planning involves developing a deep understanding of how to best deliver a consistent message amongst the target audience through the strategic deployment of multiple tactics. These tactics may include (but are not limited to):

- Mass Media Advertising (Including online)
- Social Media (Blogs, Social Networks, Social Bookmarking)
- Public Relations
- Events
- Field Team Activities
- Promotions
- Corporate Partnerships
- Website
- Internal Employee Communications

As the Conservation Public Education Campaign features several messaging objectives, a Connection Plan is vital. Planned messaging will educate the public about the following:

- Terasen Gas' conservation activity
- The importance of using energy wisely – supporting the provincial goal of "creating a conservation culture"
- The important role natural gas plays in British Columbia's energy sector as well as in environmental conservation and the economy
- Specific actions customers can take to conserve natural gas in particular, and energy in general

The Connection Plan will allow for the management of these four messages by identifying communication channels and outlining how each one of these channels will address both the broad awareness objectives as well as multiple tactical messages. The Connection Plan will incorporate a layered approach to the Conservation Public Education Campaign, in order to build a broad base of awareness of the Conservation message as well as to provide opportunities to engage the target audiences with more specific tactical messages. The goal is to have all touch points work together, while each message is concise and easy to digest.

1.1 Research

The first step in developing the Conservation Public Education campaign will be to undertake consumer research to learn about attitudes and beliefs with respect to natural gas conservation and to explore how best to communicate the core messages. The research will explore which audiences are most receptive to conservation messaging and seek insights about how best to communicate with them to increase awareness and effect changes in attitude and behaviour.

Based on the consumer research, a communications strategy will be developed and campaign platforms will be created. A second stage of consumer testing will then be required to test consumer response to the creative direction and comprehension of messaging.

Once the campaign has launched, ongoing research in the form of advertising tracking will be implemented. This will ensure that the advertising is meeting the desired objectives set out prior to the launch of the campaign. Results from the research will help determine whether factors, such as messaging, need to be adjusted in order to achieve the objectives.

1.2 Connection Plan

The Connection Plan will seek to develop audience reach and understanding through five major initiatives.

1.2.1 Mass Media Advertising

A multi media advertising approach will be used to create a broad base of messaging awareness. Multi media is recommended to provide multiple points of contact between the audience and the Conservation Education campaign.

Media planned for use are:

- Television to build reach
- Print to provide detail
- Radio to provide frequency
- Online to build reach and provide detail

Although each one of these planned media will provide certain levels of reach, detail, frequency, each medium has strength in a particular area that will be its focus. These strengths will also be utilized on a messaging level as some media will be better suited for broad awareness while other better suited for tactical messaging.

Television

The role of television will be to supply broad audience reach cost efficiently. Across British Columbia, television reaches more people than any other medium and, on a per thousand basis, does so at a lower cost. Due to this expansive reach, television would be used to communicate a broad awareness message.

Television advertising is intrusive and, although commercial break skipping is a concern, we have seen through Terasen Brand advertising as well as through

Customer Choice that this intrusiveness is still very effective when it comes to message recall.

Although all programming will be considered, the execution of the television schedule will focus on news programming, as well as higher rated programming to ensure reach is maximized. Further, programming will be selected based on its ability to provide an appropriate environment for messaging (i.e. an extremely serious execution would be best placed in news or drama programming rather than in a situation comedy).

Print (Newspapers and Magazines)

The role of print will be to supply detail. Print media such as newspapers and magazines provide a permanent format in which to communicate messaging and, as such, create a better opportunity to provide more information than can be communicated through a :30 second broadcast spot. Further, the editorial environment of print publications can lend credibility to the messaging.

This detail will provide an opportunity to speak to broad awareness objectives, but can also effectively communicate tactical messaging as well.

A combination of daily newspapers, community newspapers, regional magazines and regional editions of national magazines is recommended.

Radio

The role of radio will be to supply message frequency. Although listening audiences have declined over the years, radio still reaches the majority of British Columbians due to its local content and easy access.

Radio will utilize the affinity driven through television and provide a deeper understanding of messaging through high repetition. The high frequency nature of radio would provide an opportunity to drive understanding of tactical messaging.

Online

Although all media would ultimately work to drive web site traffic, online media provides the most direct connection between an impression and website visit whether it is via direct clickthroughs or awareness leading to URL connection.

Online media would be hyper targeted to optimize exposure by utilizing a wide variety of qualifiers such as geography, demographics, psychographics and user behaviour. In addition, specific pages within web sites featuring content that complements messaging would be targeted.

Formats will be based on creative execution. Due to the dynamic nature of the medium, execution may include rich media advertising and placement within websites and email newsletters.

1.2.2 Events

In order to communicate a deeper understanding of messages, the audience needs to be engaged in the conversation. This conversation can take place in the form of community level Events. Events also provide a forum where the target audience can ask questions and have their point of view heard. In addition, this level of interaction may provide some interesting insights that can be integrated into the overall campaign.

The nature of the Events executed will depend largely on the theme of the campaign and the final budget allocated. It can be as simple as sponsoring existing events where there is an opportunity for a conversation to take place or as involved as launching a Terasen Gas branded event, such as seminars for the general public aimed at educating them about specific steps that they can take to conserve natural gas and energy in general within their homes.

1.2.3 Public Relations

Public Relations tactics would exist on several levels. The traditional practice of submitting press releases to relevant media outlets (both online and offline) is planned. These releases would be scheduled ahead of time in concert with all other Connection Plan tactics to maximize message retention and understanding. Releases would be augmented with opportunities for press to interview Terasen Gas staff.

Online PR extends beyond online publications and websites of offline publishers into citizen journalism and the influence of social networks. The influence of bloggers and other forms of social media is the result of changing attitudes that have been growing significantly over the past few years as confidence in traditional media channels has decreased.

The online PR strategy would seek to monitor and participate in these conversations in a transparent and informational way. Tactically, this can involve tracking popular blogs that are editorially appropriate and commenting on entries. It may also involve a corporate blog which would position a group of Terasen Gas employees as “thought leaders”. With all of these tactics, it is vital that the audience be able to interact with content, whether it be via commenting, trackbacking or tagging.

1.2.4 Website

A dedicated space on terasengas.com would be a key hub of the Public Education Campaign. The website would serve as a central source for all information and would provide greater depth on messaging.

The website would also be an important resource for people who are searching for information on the efficient use of natural gas in particular, and energy in general. To that end, functionality should skew to educating people about not only the merits of conservation, but also tips on how they can be a part of an environmental movement.

1.2.5 Employee Launch

An internal launch to communicate the purpose of the campaign to Terasen Gas employees will be a critical component of the campaign. The goal would be not only to explain the campaign purpose and execution to employees, but to generate employee enthusiasm to become messaging ambassadors when interacting with the public at large. The employee launch could include an internal launch event, a multimedia presentation which could reside on the employee intranet, tangible takeaways for future reminders, and reference materials explaining the launch.

1.3 Production

Yearly production is recommended for the campaign. In the launch year, the target audience will be introduced to the new campaign, and subsequent years will build the campaign. By creating new advertising on an ongoing basis, wearout is minimized, and messaging can be altered to address specific issues and opportunities.

1.4 Budget

Year One

Element	Budget
1.4.1 Research	
Consumer Research	$75,000.00
Creative and Message Testing	$70,000.00
Tracking and Analysis	$150,000.00
Subtotal	*$295,000.00*
1.4.2 Mass Media Advertising	
Television	$1,300,000.00
Magazine	$250,000.00
Newspaper	$1,250,000.00
Radio	$800,000.00
Online	$85,000.00
Subtotal	*$3,685,000.00*
1.4.3 Events	
Development and Execution	$350,000.00
Subtotal	*$350,000.00*
1.4.4 PR	
Monitoring / Management	$100,000.00
Subtotal	*$100,000.00*
1.4.5 Website	
Design & Development	$200,000.00
Subtotal	*$200,000.00*
1.4.6 Internal Launch	
Materials/Event	$150,000.00
Subtotal	*$150,000.00*
1.4.7 Mass Media Production	
Television (2 Spots)	$350,000.00
Photography	$25,000.00
Print (3 Ads)	$25,000.00
Radio (2 Spots)	$15,000.00
Online (2 Ads)	$50,000.00
Subtotal	$465,000.00
TOTAL	**$5,245,000.00**

Year Two

Element	Budget
1.4.1 Research	
Creative and Message Testing	$70,000.00
Tracking and Analysis	$150,000.00
Subtotal	*$220,000.00*
1.4.2 Mass Media Advertising	
Television	$1,300,000.00
Magazine	$250,000.00
Newspaper	$1,000,000.00
Radio	$600,000.00
Online	$85,000.00
Subtotal	*$3,235,000.00*
1.4.3 Events	
Development	$250,000.00
Subtotal	*$250,000.00*
1.4.4 PR	
Monitoring / Management	$100,000.00
Subtotal	*$100,000.00*
1.4.5 Website	
Content Updates	$25,000.00
Subtotal	*$25,000.00*
1.4.6 Mass Media Production	
Television (2 Spots)	$350,000.00
Photography	$25,000.00
Print (3 Ads)	$25,000.00
Radio (2 Spots)	$15,000.00
Online (2 Ads)	$50,000.00
Subtotal	*$465,000.00*
TOTAL	**$4,295,000.00**

Year Three

Element	Budget
1.4.1 Research	
Creative and Message Testing	$70,000.00
Tracking and Analysis	$150,000.00
Subtotal	*$220,000.00*
1.4.2 Mass Media Advertising	
Television	$1,300,000.00
Magazine	$250,000.00
Newspaper	$1,000,000.00
Radio	$600,000.00
Online	$85,000.00
Subtotal	*$3,235,000.00*
1.4.3 Event	
Development	$250,000.00
Subtotal	*$250,000.00*
1.4.4 Online PR	
Monitoring / Management	$100,000.00
Subtotal	*$100,000.00*
1.4.5 Website	
Content Updates	$25,000.00
Subtotal	*$25,000.00*
1.4.6 Mass Media Production	
Television (2 Spots)	$350,000.00
Photography	$25,000.00
Print (3 Ads)	$25,000.00
Radio (2 Spots)	$15,000.00
Online (2 Ads)	$50,000.00
Subtotal	*$465,000.00*
TOTAL	**$4, 295,000.00**

Appendix 9

Terasen Gas

Review of Conservation Potential

Prepared for: **Sarah Smith**
Michelle Petrusevich

Prepared by:

Habart & Associates Consulting Inc.

September 14, 2007

Table of Contents

1. Introduction

1.1 Background

Terasen Gas undertook a Conservation Potential Review (CPR) in 2006 in order to get a better understanding of the potential for natural gas related Demand Side Management (DSM) in British Columbia[1]. Terasen Gas intends to apply to the BCUC for additional funding such that they can support programming to increase the scope of their Energy Efficiency and Fuel Substitution activities and comply with the BC Energy Plan that requires utilities to pursue DSM[2].

This project builds on the foundation of the CPR and develops the measure[3] analysis through to a DSM strategy, program concept designs and then program cost and impact estimates. Specific steps in the process included:

- Review and update of the CPR cost and impact assumptions for key measures.
- Update of marginal cost estimates and rates for both natural gas and electricity
- Re-Screen all of the CPR measures to determine which measures appear to be the most beneficial for including in programs.
- For each candidate measure, develop estimates of incentives and uptake rates.
- Combine the measures into logical programs and estimating the program development costs, marketing costs, ongoing program management and program evaluation for a three year program.
- Screen the program concepts to determine the benefit cost ratios in accordance with the California Standard tests.
- Develop concept plan write-ups to document the assumptions behind the program estimates.

This project covers both Terasen Gas Inc. (TGI) service territory and the Terasen Gas Vancouver Island (TGVI) service territory.

1.2 Organization of the Report

The report is divided into 8 Sections. Section 2 covers Terasen Gas' objectives for DSM as well as the objectives of this project. Section 3 reviews the results of the re-screening of the CPR measures with updated assumptions while Section 4 reviews the external considerations that will affect DSM programs. Section 5 provides an overview of the DSM programs and measures while Section 6 reviews the forecast impact of these programs. Section 7 reviews the financial requirements associated with the DSM plan while Section 8 provides a brief project summary.

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[1] Demand Side Management is defined as including both energy efficiency and fuel substitution.

[2] The BC Energy Plan: A vision for Clean Energy Leadership, 2007

[3] A "measure" is a piece of equipment that is more efficient than the "standard" product, such as an EnerChoice Fireplace or an ENERGY STAR appliance.

2. Objectives

2.1 Terasen Gas Objectives for DSM

Terasen Gas has a number of corporate objectives that DSM programs will help achieve. These include:

- Continuing to build upon Terasen Gas's solid record of environmental protection, and making the public aware of Terasen's environment-related activity
- Support socially responsible load growth
  - British Columbians have a history of supporting environmental issues, which is only becoming stronger with the concern about Green House Gas (GHG) emissions and Climate Change. While natural gas has the lowest carbon content of fossil fuels, supporting energy efficiency minimizes the GHG impact of natural gas use.
  - Terasen Gas has the objective of growing their customer base from the current 897,000 to about 1 million by 2010. Meeting this goal will require support from the government and the public. Both the perception and reality of energy efficiency will be required to maintain public support for increasing the usage of natural gas in British Columbia.
- Provide contact with and value to customers
  - DSM opportunities will be used to build the relationship with, and provide value to, Terasen's customer base.
- Support the Provincial Energy Plan
  - The Provincial Energy Plan requires all utilities to pursue cost effective DSM opportunities.
- Maintain fuel share balance with electricity
  - Electricity is priced advantageously in BC due to our "Heritage Assets". DSM programs, including both energy efficiency and fuel substitution are necessary to maintain a fuel share balance in B.C., especially in the new construction market.
- Develop capacity and relationships with trades and suppliers

2.2 Project Objectives

In 2006 Terasen Gas completed a Conservation Potential Review (CPR) to determine the scope of cost effective energy efficiency and fuel substitution which may be available in their service territory. However before proceeding with a Regulatory filing to the BCUC for increased Demand Side Management (DSM) funding, Terasen Gas required a third party review of some of the key assumptions in the CPR, and to re-screen the potential initiatives with more current natural gas and electricity marginal costs and rates.

Habart & Associates Consulting Inc was retained to assist with the review and re-screen as noted above, and to help Terasen Gas develop a menu of cost effective potential programs that could be developed once BCUC approval and funding was obtained. Specific tasks included:

1. Review data assumptions used in the CPR
2. Re-screen measures in the CPR with updated assumptions.
3. Determine the impact of planned legislative changes.
4. Agree on measures to be included in potential programs[4].
5. Develop and review conceptual programs including assumptions for program development, program management, incentive levels and participation rates.
6. Assist Terasen Gas staff in the documentation of the conceptual programs
7. Document project.

Tasks 1 and 2 were completed by February 2007, and are documented in a separate report "Terasen Gas CPR Measures Update"[5]. The Terasen Gas CPR Measures Update report summarizes the revised assumptions from the original CPR report[6], and then lists measures that pass the re-screen. A copy of the Measures Update report has been included as Appendix F.

This report represents Task 7 and documents the balance of the project.

[4] A program typically consists of one or more measures targeted at the same customers and using the save delivery channels. For example, ENERGY STAR dishwashers and clothes washers would be logical measures to combine into an ENERGY STAR appliance program.

[5] "Terasen Gas CPR Measures Update", Marbek Resource Consultants Ltd. Prepared for Habart & Associates Consulting inc., March 2, 2007. Copy attached as Appendix.

[6] "Terasen Gas Conservation Potential Review", Marbek Resource Consultants Ltd., April 2006. Report includes separate documents for Residential Sector Report, Commercial Sector Report and associated appendices.

3. Re-Screen of CPR Results

3.1 Residential Energy Efficiency

Measures from the Conservation Potential Review (CPR) that were expected to be cost effective and provide significant savings were reviewed and re-screened.

Exhibit 3.1 and 3.2 below summarizes the benefit / cost results of the Re-Screening of the Residential Measures for new construction and retrofit. This screening is done at the level of individual measures, and only considers the incremental cost of the technology and its associated energy impacts. It does not consider the costs associated with developing and managing programs to increase the usage of these measures.

In the case of some measures, for example ENERGY STAR (E*) Furnaces, the measure does not have a positive benefit / cost ratio in all applications. However the overall program would have a positive benefit / cost.

Exhibit 3.1 – Residential New Construction – Energy Efficiency[7]

	Vancouver Island		Lower Mainland		Interior	
	SFD	RH	SFD	RH	SFD	RH
Air Sealing	0.8	0.6	1.2	0.9	1.0	0.7
High Perf. Windows	1.2	1.2	1.2	1.2	1.3	1.4
E* Furnace	1.0	0.8	1.6	1.2	1.2	0.9
Showerhead / Faucets	na	na	na	na	na	na
Pipe Insulation	1.8	1.8	1.8	1.8	1.8	1.8
E* Dishwashers	3.3	2.7	3.9	3.1	3.2	2.6
E* Clothes Washers	2.2	1.8	2.6	2.1	2.2	1.7
Pool Cover	3.0	na	3.4	na	3.6	na
EE Fireplaces	1.7	1.7	1.7	1.7	1.7	1.7
EGNH 80	1.3	4.6	1.3	1.1	1.5	1.1

[7] Abbreviations used in the tables:
- SFD – Single Family Dwelling. This also typically includes Duplexes
- RH – Row House
- na – Not Applicable. Not all measures are applicable in both new construction and retrofit or in all housing detachments.

Exhibit 3.2 – Residential Retrofit – Energy Efficiency

	Vancouver Island		Lower Mainland		Interior	
	SFD	RH	SFD	RH	SFD	RH
Air Sealing	0.8	0.5	1.2	0.7	1.0	0.5
High Perf. Windows	1.0	1.1	1.0	1.1	1.2	1.2
E* Furnace	1.3	0.8	2.1	1.1	1.6	0.8
Showerhead / Faucets	5.1	4.3	6.2	4.9	5.1	4.0
Pipe Insulation	1.8	1.8	1.8	1.8	1.8	1.8
E* Dishwashers	3.4	2.8	4.1	3.2	3.4	2.7
E* Clothes Washers	2.3	1.9	2.7	2.1	2.3	1.7
Pool Cover	3.0	na	3.4	na	3.6	na
EE Fireplaces	1.7	1.7	1.7	1.7	1.7	1.7
EGNH 80	na	na	na	na	na	na

Not all of the eligible measures have been included in programs. Following is a summary of the rationale for measures not included in programs:

- The Air Sealing initiative modelled was based on a contractor delivered, blower-door test based program. This approach provides more reliable results than the "do it yourself" (DIY) programs where the utility provides materials for the home-owners. However this was not considered as a candidate for a program at this time because the logistics associated with this program would be cumbersome.
- High Performance Windows provide a positive benefit / cost, but the Provincial regulations noted in the next section, combined with a PST exemption, have addressed this opportunity.
- Low flow shower heads, faucet aerators and pipe insulation have been reviewed as a program. However the shower heads provide the largest savings, and as the 2.1 gal / min. showerheads have been required since the mid 1990's, it was decided not to proceed with a program as it would be too difficult to target households with older showerheads.
- Pool Covers were not considered for a program as they are a common product and it was thought that the free rider rate for any program would be too high to make this cost effective.
- The new construction program was considered. Currently the EGNH80 (and 77) standards are being supported by CHBA (Built Green) and Power Smart. However about 2/3 of the energy savings are related to the requirement for an E* furnace which is now required by regulations. The additional savings from shell measures and their associated costs do not provide a positive TRC Benefit/Cost ratio.

If solutions to the challenges of program delivery in the case of Air Sealing, and program eligibility in the case of Low flow shower heads can be found, these measures would be re-considered. However they are not included in the analysis of potential that follows.

3.2 Residential Fuel Substitution

Exhibit 3.3 summarizes the results of the Re-Screening on the fuel substitution options for new construction. The screening shows that all these fuel substitution options have a positive benefit / cost ratio based on the marginal costs of electricity and natural gas. However care should be taken during the program design phase, as these measures may not provide a positive cashflow to participating customers.

Exhibit 3.3 – Residential New Construction – Fuel Substitution

	Vancouver Island		Lower Mainland		Interior	
	SFD	RH	SFD	RH	SFD	RH
Furnace Fuel Choice	2.0	1.8	2.3	2.1	2.0	1.8
DHW Fuel Choice	1.3	1.2	1.3	1.3	1.2	1.1
Range Fuel Choice	1.3	1.3	1.3	1.3	1.2	1.2
Dryer Fuel Choice	2.4	2.4	2.4	2.4	2.2	2.2

Exhibit 3.4 summarizes the results of the Re-Screening on the fuel substitution options for retrofit, where an existing electric appliance is replaced with a natural gas appliance upon replacement of electric appliance. The screening shows that all measures except DWH pass the screening. The incremental cost of adding a flue when replacing electric DHW is a major factor in the failure of the DHW as a standalone measure.

Exhibit 3.4 – Residential Retrofit – Fuel Substitution

	Vancouver Island		Lower Mainland		Interior	
	SFD	RH	SFD	RH	SFD	RH
Furnace Fuel Choice	3.4	3.5	3.3	3.4	3.1	3.2
DHW Fuel Choice	0.8	0.7	0.9	0.8	0.7	0.6
Range Fuel Choice	1.0	1.0	1.1	1.0	1.0	0.9
Dryer Fuel Choice	1.6	1.5	1.7	1.5	1.4	1.3

3.3 Commercial Energy Efficiency

Exhibit 3.5 summarizes the results of the Re-Screening of the commercial measures, and shows the results for both New Construction and Retrofit. All Commercial measures that passed the Re-Screen, except for the pre-rinse spray valves and the Commercial Food preparation have been included in the potential programs.

The pre-rinse spray valves are currently being tested on a pilot basis in conjunction with the City of Vancouver. However they have not been included in this analysis as an evaluation of a similar program in California found them to be not cost effective. They will be re-considered once the pilot program has been evaluated. The food service products have been deferred for further study.

Exhibit 3.5 – Commercial – Energy Efficiency

	New Construction	Retrofit
New Building Construction – 30%	2.7	na
New Building Construction – 60%	2.5	na
High Performance Glazing – HIT	1.3	na
HE Boilers – Near Condensing	1.6	1.8
HE Boilers – Condensing	1.4	1.5
Building Recommissioning	na	5.3
Next Generation BAS	na	2.1
Demand Ctl Ventilation (interior)	na	1.1 -3.9
HE Roof Top Units	na	1.5
Instantaneous DHW Heaters	2.4	2.4
HE Condensing DHW Boiler	6.2	6.2
HE Condensing DHW Heater	3.0	3.0
Drainwater Heat Recovery	2.5	1.7
Pre-Rinse Spray Valves	25.5	16.6
Commercial Food Prep – Gas Range	5.7	5.7
Commercial Food Prep – Gas Broiler	15.9	15.9
Commercial Food Prep – Gas Fryer	1.0	1.0

4. External Considerations

Terasen Gas DSM programs will operate within a context of government efficiency regulations and other energy efficiency programs. Task 3 of this project included a review of recent Provincial and Federal regulations that will affect the DSM programs, as well a Power Smart programs that will overlap with Terasen.

4.1.1 Regulations

1. ***Commercial Boilers:*** As of January 1 2007, all natural gas fired hot water and low pressure steam boilers with an input firing rating equal to or greater than 99kW (300,000 Btu/hr) must have a combustion efficiency of 80% or greater.
   Impact : None, as this level of efficiency was the assumed baseline level used for the analysis.

2. ***Gas Fireplaces:*** As of January 1 2007, all natural gas fireplaces including inserts and free-standing stoves, but excluding log-sets and sand-pans, must be tested, rated and labelled.
   Impact: This regulation closes a loop-hole in the Federal Government legislation that allows products which are manufactured and sold within a province to avoid testing, rating and labelling. The Hearth, Patio and BBQ Association of Canada has developed the "Enerchoice" brand which identifies more efficient modesl. The fireplace labelling and Enerchoice brand will facilitate the operation of a natural gas fireplace program.

3. ***Gas Forced Air Furnaces – New Construction:*** As of January 1 2008, all gas fired forced air furnaces with an input rating of less than 66 kW (225,000 Btu) used in new construction will require an AFUE of 90% or greater.
   Impact: This regulation essentially transforms the new construction market to the Energy Star efficiency level. The major concerns for Terasen Gas are:
   - The higher costs for ENERGY STAR furnaces may motivate some developers to install electric space heating rather than natural gas due to the lower first cost.
   - As ENERGY STAR furnaces have different venting requirements than natural gas hot water tanks, the developer will have to bear the cost of the flue (thought to be in the range of $ 350 to $ 450) as well as the higher cost of a natural gas hot water tank relative to an electric hot water tank. This may result in a significant loss of market share for natural gas hot water in new construction, and the resulting load shift to electricity would further tax BC Hydro's electricity system.

4. ***Gas Forced Air Furnaces – Retrofit.*** Natural Resources Canada have started the process to require all gas fired forced air furnaces with an input rating of less than 66 kW (225,000 Btu) to have an AFUE of 90% or greater. They expect that the regulation will be enacted for December 31, 2009.
   Impact: This regulation will have the effect of requiring high efficiency furnaces for all retrofit applications as well as for new construction. Any

Terasen ENERGY STAR retrofit programs should be completed prior to this date. This regulation is unlikely to affect the continued use of natural gas water heating in retrofit applications, as the flue is already in place.

4. ***Manufactured Fenestration (Window & Door) Products:*** As of January 1 2009, all fenestration products must not exceed an overall heat loss coefficient of 2.0 watts per sq. meter (U-Value 2.0). This level is the same as NRCan's Zone A standard which applies to the Lower Mainland and Southern Vancouver Island.
   Impact: This will transform the market for windows and doors in BC to the "economically optimum" level for the warmer parts of the province[8]. This will also increase the level of fenestration for the colder interior, but not to the economically optimal level. While it is conceptually possible to design a program to move windows to a higher level in the interior, it is not likely to pass the cost effectiveness tests.

5. ***PST Sales Tax:*** In February 2007 the BC Government exempted from PST the purchase of:
   - Double Glazed Windows
   - Insulation
   - Draft reducing materials
   - Small scale renewable energy measures
   - Energy Star rated furnaces, boilers and heat pumps.

   These exemptions are in place until March 31 2009 except for ENERGY STAR heating where the PST exemption will be dropped in January 2008 when this equipment becomes mandatory in new construction.

6. ***Heat Traps:*** In 2004, changes to energy standards for gas fired domestic hot water tanks made the inclusion of heat traps as a standard part of the design essentially mandatory.
   Impact: Assuming a typical life of a natural gas hot water tank to be between 7 and 12 years, this means that by between 2011 and 2016, essentially all installed tanks will have this feature. For any heat trap retrofit program, the effective life will be the remaining life of the tank, as of 2007 this would be between 4 and 9 years. It was concluded that Terasen would not pursue any initiatives that included heat traps.

4.1.2 Power Smart Programs

Power Smart operates a range of DSM programs, some of which will overlap with the proposed Terasen Gas programs. These include:

- Energy Star Dishwashers and Clothes Washers
- Commercial New Building Design
- Power Smart Partners

In these areas, the programs are targeted at the same consumers or decision

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[8] *Note: while the wording of the regulation appears to apply to both residential and commercial buildings, the intent is for this regulation to apply only to part 9 buildings (wood frame, less than 600 m², three stories or less). A interpretation letter is expected which will clarify this.*

makers as the Power Smart programs, so at a conceptual level it would make sense for the two utilities to offer joint programs both for economies of scale for program delivery and to simplify program participation for customers. However, until such time as BCUC approval is received, detailed discussions about joint programs will not take place.

1. Energy Star Appliances. At the time of writing (June 2007), Power Smart was pursuing a strategy of incenting only the most efficient models of Energy Star Dishwashers and Clothes Washers, with efficiency levels set consistent with the Consortium for Energy Efficiency (CEE) Tier 2 & 3 efficiency levels. However sales volumes for these levels of efficiency were not yet determined, so Terasen forecast sales volumes were set at a level approximately the same as Hydro's. A joint program may include sharing the program delivery and administration costs and then having each utility provide the incentive depending on the fuel used to provide the hot water.
2. Commercial New Building Design. BC Hydro has operated a High Efficiency Buildings program since 2005. A new manager has been hired for this program and a business case is being developed to extend the program beyond its initial two years. The program is based on funding energy efficiency design options early in the development process and then providing incentives to help cover the additional "up front" costs for efficient construction. Again the concept would be to share the additional design costs, perhaps based on the relative energy savings for each fuel, and then providing the relevant product incentives.
3. Power Smart Partners. The Power Smart Partners program is based on detailed audits of customer buildings, which result in recommendations to change out equipment and possibly change operating practices. Again the utilities would share the cost of the audit and then provide incentives to bring down the incremental costs of the more efficient equipment. In a joint program, the utilities would likely share the costs of the audit and then each would provide the incentives for their products.

For all customers, Terasen would not rely solely on partnerships with BC Hydro. For those customers, especially in the Commercial Sector, who would prefer to work directly with Terasen Gas, Terasen will continue to do so. For example, Terasen would continue to offer our Commercial Energy Assessment program to customers that did not wish to participate in the Power Smart Partners program.

5. DSM Plan

Once the measures were Re-Screened, they were combined into programs. A program is a logical bundle of measures which typically are focused on the same customer and use the same delivery channel.

5.1 Programs

Exhibits 5.1 to 5.4 show the proposed programs and the measures that would be included in each program, and it also shows the differences in measures that expected to be offered in the TGI or TGVI service territory.

For the Residential sector (Exhibits 5.1 and 5.2) the major difference in the programs for TGI and TGVI is that Fuel Substitution programs are not expected to be offered in the retrofit market in the TGI service territory as the bulk of the potential has already been addressed.

Exhibit 5.1: Residential New Construction

Program	Components	TGI	TGVI
DSM			
Fireplace	EnerChoice Fireplace	X	X
ENERGY STAR Appliances	Clothes Washer	X	X
	Dish Washer	X	X
Fuel Substitution			
Natural Gas Water Heating	NG DHW		X
Natural Gas Appliances	FS Range	X	X
	FS Dryer	X	X

Exhibit 5.2: Residential Retrofit

Program	Components	TGI	TGVI
DSM			
E* Furnace Upgrade	Furnace Upgrade	X	X
EnerChoice Fireplace	Fireplace	X	X
ENERGY STAR Appliances	Clothes Washer	X	X
	Dish Washer	X	X
Fuel Substitution			
Natural Gas Appliances	FS Range		X
	FS Dryer		X
Furnace Fuel Substitution	Furnace		X
Fireplace Fuel Substitution	EnerChoice Fireplace		X

For the Commercial Sector (Exhibits 5.3 and 5.4), the major difference in the programs for TGI and TGVI is for Demand Control Ventilation. This measure is only cost effective in the Interior region of TGI, and will not be offered to the other regions.

Exhibit 5.3: Commercial New Construction

Program	Components	TGI	TGVI
Efficient New Construction	Efficient Design – 30% Large	X	X
	Efficient Design – 30% Medium	X	X
	Efficient Design – 60%	X	X
	HIT Windows	X	X
Boilers	Near Condensing Boilers	X	X
	Condensing Boilers	X	X
Water Heating	Instantaneous DHW Heaters	X	X
	Condensing DHW Boilers	X	X
	Condensing DHW Heaters	X	X
	Drainwater Heat Recovers	X	X

Exhibit 5.4: Commercial Retrofit

Program	Components	TGI	TGVI
Boilers	Near Condensing Boilers	X	X
	Condensing Boilers	X	X
Building Recomissioning		X	X
Next Generation BAS		X	X
Demand Control Ventilation	Demand Ctl Vent. – Large	X	
	Demand Ctl Vent. - Med	X	
HE Rooftop Units	HE Rooftop units	X	X
Water Heating	Instantaneous DHW Heaters	X	X
	Condensing DHW Boilers	X	X
	Condensing DHW Heaters	X	X

5.2 Estimating Program Parameters

Developing the program concepts for benefit / cost testing requires combining the estimates of incremental cost and energy savings for each technology from the Re-Screening report with estimates of the costs to develop and operate a program and the expected number of participants.

5.2.1 Estimating Program Costs

Program costs include:

- Program development
- Incentive costs
- Incentive processing
- Ongoing program management
- Periodic program evaluation
- Contractor costs
    - Program mailouts
    - Seminars & training
- Marketing costs
    - Printed collateral such as bill inserts

- o Advertising
- o Promotion

These costs were developed by Terasen Gas and the consultant, and take into consideration the costs associated with the operation of past programs. Incentives were estimated at 50% of the incremental costs, which is the approach Terasen Gas has used in previous programs. Program costs were estimated based on Terasen's previous experience with programs. A planning assumption sheet was developed for each measure.

5.2.2 ESTIMATING PROGRAM PARTICIPATION

Program participation estimates include:

- The number of participants expected by year over the three year planning horizon.
- Estimating the Free Rider Rate (FRR) or Net to Gross Ratio. The FRR is the number of people who would have installed the target technology if the program had not existed, but now receive an incentive and are counted as program participants. In order to determine the net impact of the program, these people must be removed from the program estimates.

Different methodologies were used in different markets, as briefly discussed below.

Residential New Construction

For Residential New Construction, the number of new accounts was derived from the CMHC completions for 2005. For appliance programs, the key questions are:

- How many developers are installing each of the various measures of interest, such as appliances?
- For each measure installed by the developers, what is the fuel choice and level of efficiency. For example, of those developers installing ranges, how many of the ranges are natural gas?

Information on the rate of installation of appliances and efficiency levels was obtained from Terasen Gas field representatives and from MPC Intelligence (J. Podmore) who provides field intelligence on new construction projects in B.C. Information on fuel choice for appliances was obtained from a Terasen Gas study[9].

A number of different approaches were used to estimate the uptake for various programs. In areas where Terasen Gas had experience, such as furnaces or fireplaces, this information was used to inform the estimates. In other cases information from other utility programs such as BC Hydro Power Smart was used. Where no other data was available, estimates were made by looking at the estimated level of installations and the level of sales required to achieve a reasonable FRR.

The FRR estimate is then determined by estimating the share of efficient measures that were sold prior to the program, and the total sales expected with

9 "New Construction Fuel Choice", Habart & Associates Consulting inc, July 12, 2005.

the program and then determining the share of program participants who would likely have purchased the measure had the program not existed.

Residential Retrofit

Information on the population of appliances installed in Terasen Gas customer dwellings was obtained from the most recent End Use Study[10]. Based on this population, an estimate is made of the number of appliances that become eligible for replacement each year. Then information from Canadian Appliance Manufacturers' Association (CAMA) is used to determine the share of appliances likely to be energy efficient.

Commercial New Construction and Retrofit

For Commercial New Construction and Retrofit, energy savings for electricity and natural gas, product life, incremental costs and incentive information were taken from the Re-Screen report. These numbers were then compiled into planning sheets and discussed in a series of internal meetings and conference calls. Terasen's Technical Support Services Group and Key Account Managers were involved in the discussion to determine the ramp-up and free rider rates as well as administration costs. The boiler program was used as a model to inform and estimate the measures for commercial new construction programs.

TGI and TGVI estimates

For TGVI residential new construction, the same approach was taken as for TGI, and the estimates reflect the lower penetration of natural gas on Vancouver Island. The 2003 Residential End Use study did not include Vancouver Island as Centra Gas had not yet been integrated into Terasen at that time. Therefore estimates for TGVI were primarily based on a ratio of the number of natural gas customers, but reduced by 30 to 60%, depending on the measure to allow for a newer population of natural gas appliances on VI.

Less data was available about TGVI commercial, so uptake rates were estimated to be approximately 10% of TGI, as this is the approximate ratio of the number of natural gas accounts.

[10] "Residential End Use Survey Results", Habart & Associates Consulting inc.. December 2003

6. DSM Impact Summary

Willis Energy Services Ltd. was contracted by Terasen Gas to develop a screening model for DSM programs[11]. The screens are based on the California Standard Practice tests, which are the norm in the utility industry and are accepted by the BCUC.

Once the program parameters have been estimated, they were run through the model. The following two sections summarize the results

6.1 Overall Summary

Exhibit 6.1 summarizes the overall impact expected from the Terasen Gas DSM programs. The energy efficiency programs are expected to reduce consumption by about 9,958 Terajoules (TJ) of natural gas and 625 GWh of electricity[12]. The fuel substitution programs are expected to add almost 2,278 TJ of natural gas while displacing over 550 GWh of electricity. Taken together the net impact is to reduce natural gas load by almost 7,680 TJ and electrical load by over 1,174 GWh.

The table also shows that the Total Resource Cost (TRC) benefit / cost ratio of 4.0 while the benefit to the Utility is 2.2 and the benefit to program participants is over 9. The overall Ratepayer Impact Test (RIM) impact is 0.6.

The total investment required to support these programs is about $ 35 million in 2007 dollars. However it should be noted that part of the incentives could be provided by BC Hydro Power Smart to fund electricity savings, and by other partners such as the provincial and federal governments. Budget numbers, included in the next section, are slightly higher.

[11] Data in this report extracted from model run: 2008 DSM Plan V. 070912

[12] 1 GJ = 277.8 kWh of electricity

Exhibit 6.1: Overall DSM Plan - 2008 - 2010[13]

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)[14]	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Total Residential	5,686	2,499	8,185	2,268	45	2.4	0.5	2.6	17.6
Total Commercial	17,928	5,178	23,106	7,690	580	3.7	0.6	3.3	8.2
Total Energy Efficiency	23,614	7,677	31,291	9,958	625				
Fuel Substitution									
Total Residential	2,180	1,059	3,239	(2,278)	550	2.5	1.5	n/a	0.9
Total Project	25.794	8,736	34,530	7,681	1,174	4.0	0.6	2.2	9.2

Tables 6.2 and 6.3 show the results separately for TGI and TGVI. The tables show that TGI is expected to provide almost 90% of the impact for energy efficiency, but only about 35% of the fuel substitution. TGI has 85% of the budget while TGVI has the balance.

Exhibit 6.2: TGI DSM Plan - 2008 - 2010

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)[15]	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Total Residential	5,243	2,300	7,543	2,087	41	2.4	0.5	2.6	16.8
Total Commercial	15,904	4,746	20,650	6,858	511	3.7	0.6	3.3	8.2
Total Energy Efficiency	21,147	7,046	28,193	8,945	552				
Fuel Substitution									
Total Residential	703	457	1,160	(831)	174	1.7	1.7	n/a	0.7
Total	21,850	7,503	29,353	8,113	726	3.6	0.6	2.7	9.3

[13] Benefit / Cost tests.

- TRC – Total Resource Cost represents the benefits to the overall economy. Test includes both natural gas and electricity impacts.
- RIM – Rate Payer Impact Test represents the potential impact on rates. A B/C ratio of less than one indicates that the program will produce upward pressure on rates. Test reflects natural gas impact only
- Utility – Represents the benefit to the utility. For Terasen this largely reflects the impact on natural gas purchases, with energy efficiency programs reducing the need to purchase gas and fuel substitution programs increasing the need for purchases. Test reflects natural gas impact only.
- Participant – represents the benefit to the program participants. Test reflects impact of both fuels.

[14] Note: Some Commercial Sector incentives for new construction will not be paid out until the buildings are complete in the 2011 – 12 periods.

[15] Note: Some Commercial Sector incentives for new construction will not be paid out until the buildings are complete in the 2011 – 12 period.

Exhibit 6.3: TGVI DSM Plan - 2008 - 2010

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)[16]	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Total Residential	443	198	642	181	4	2.7	0.4	2.6	37.5
Total Commercial	2,024	431	2,456	833	69	3.8	0.6	3.2	8.2
Total Energy Efficiency	2,467	629	3,098	1,014	73				
Fuel Substitution									
Total Residential	1,477	602	2,079	(1,446)	376	3.0	1.4	n/a	1.1
Total	3,944	1,232	5,176	(433)	448	5.0	0.8	n/a	2.9

6.2 TGI

Exhibits 6.4 to 6.7 summarize the costs and impacts for the programs in TGI. The residential energy efficiency programs will result in a savings of 2,087 TJ of natural gas while the fuel substitution programs will result in an increase of 831 TJ from new customers or new applications. The commercial programs will result in a reduction of about 6,858 TJ of natural gas.

Exhibit 6.4: Residential New Construction

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
EnerChoice Fireplace	850	215	1,065	346	1	3.2	0.6	3.1	∞*
E* Appliances	324	360	684	179	11	2.9	0.4	2.5	19.3
Sub-Total	**1,174**	**575**	**1,749**	**525**	**12**	**3.1**	**0.5**	**2.8**	**41.6**
Fuel Substitution									
N.G. Appliances	703	457	1,160	(831)	174	1.7	1.7	n/a	0.7

*If there is no customer incremental cost, the payback approaches infinity.

Exhibit 6.5: Residential Retrofit

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
E* Furnace	2,177	683	2,861	814	-	1.8	0.5	2.7	8.6
EnerChoice Fireplace	1,307	589	1,895	438	2	2.3	0.5	2.2	∞*
E* Appliances	585	453	1,038	310	28	3.7	0.5	2.8	18.4
Sub-Total	**4,069**	**1,725**	**5,794**	**1,562**	**30**	**2.3**	**0.5**	**2.6**	**14.1**

*If there is no customer incremental cost, the payback approaches infinity

[16] Note: Some Commercial Sector incentives for new construction will not be paid out until the buildings are complete in the 2011 – 12 period.

Exhibit 6.6: Commercial New Construction

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Effic. New Const.	3,937	609	4,546	419	249	4.0	0.4	0.9	4.5
Boilers	1,278	397	1,676	487	-	1.8	0.6	3.0	6.5
Water Heating	544	423	967	654	-	4.4	0.8	6.8	14.3
Sub-total	**5,759**	**1,430**	**7,189**	**1,561**	**249**	**3.6**	**0.6**	**2.2**	**5.7**

Exhibit 6.7: Commercial Retrofit

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Boilers	5,867	587	6,454	2,750	-	2.5	0.6	4.3	8.1
Building Re-commis.	1,932	738	2,670	461	232	7.3	0.5	1.6	10.0
Next Generation BAS	624	215	839	59	30	2.9	0.4	0.6	4.0
Demand/Ctl Vent.	783	762	1,545	570	-	2.5	0.5	3.5	14.5
HE Roof Top Units	70	138	208	34	-	1.2	0.6	1.6	5.6
Water Heating	869	877	1,747	1,423	-	5.6	0.8	8.2	20.9
Sub-total	**10,145**	**3,317**	**13,462**	**5,297**	**262**	**3.8**	**0.6**	**3.9**	**9.9**

6.3 TGVI

Exhibits 6.8 to 6.11 summarize the costs and impacts for the programs in TGVI. The residential energy efficiency programs are much smaller than TGI and will result in a savings of 181 TJ of natural gas as a result of the relatively young age of the utility and lower penetration for natural gas. The fuel substitution programs are larger and will result in an increase almost 1,447 TJ from new customers or new applications. The commercial programs will result in a reduction of almost 832 TJ of natural gas.

Exhibit 6.8: Residential New Construction

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
EnerChoice Fireplace	291	54	345	119	0.4	3.3	0.5	3.1	∞
E* Appliances	34	73	107	16	1	1.9	0.3	1.4	19.6
Sub-total	**325**	**127**	**452**	**135**	**2**	**2.9**	**0.5**	**2.7**	**105.3**
Fuel Substitution									
N.G. Water Heating	469	138	607	(188)	32	1.7	1.3	n/a	0.7
N.G. Appliances	35	42	77	(30)	7	2.0	1.7	n/a	0.8
Sub-total	**504**	**181**	**684**	**(218)**	**39**	**1.7**	**1.3**	**n/a**	**0.7**

Exhibit 6.9: Residential Retrofit

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
E* Furnace	47	3	50	14	-	1.6	0.4	2.6	8.2
EnerChoice Fireplace	21	2	23	8	0	3.5	0.5	3.4	∞
E* Appliances	50	66	117	24	2	2.7	0.3	1.8	18.8
Sub-total	**118**	**71**	**189**	**46**	**2**	**2.4**	**0.4**	**2.2**	**15.5**
Fuel Substitution									
N.G. Appliances	351	77	428	(109)	22	1.5	1.5	n/a	0.6
Furnace	478	203	681	(1,008)	292	3.6	1.4	n/a	1.3
Fireplace	144	142	286	(112)	22	2.0	1.3	n/a	0.8
Sub-total	**973**	**422**	**1,395**	**(1,229)**	**337**	**3.2**	**1.4**	**n/a**	**1.1**

Exhibit 6.10: Commercial New Construction

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Effic. New Const.	556	48	604	59	39	4.5	0.4	0.9	4.9
Boilers	169	27	197	64	-	1.8	0.5	3.2	6.9
Water Heating	72	18	90	89	-	5.3	0.7	9.4	15.7
Sub-total	**797**	**94**	**891**	**212**	**39**	**4.0**	**0.5**	**2.3**	**6.2**

Exhibit 6.11: Commercial Retrofit

	Costs			Net Savings		Benefit / Cost Tests			
	Incentive ($'000)	Admin ($'000)	Total ($'000)	N. Gas (TJ)	Elec. (GWh)	TRC	RIM	Utility	Part.
Energy Efficiency									
Boilers	833	106	939	396	-	2.3	0.6	4.1	8.4
Building Recommis.	223	86	309	54	26	7.2	0.5	1.5	10.2
Next Generation BAS	69	13	82	7	3	3.2	0.4	0.7	4.1
HE Roof Top Units	8	6	14	3	-	1.2	0.5	1.8	4.3
Water Heating	95	126	221	161	-	5.0	0.7	7.0	23.2
Sub-total	**1,227**	**338**	**1,565**	**620**	**30**	**3.6**	**0.6**	**3.8**	**9.7**

7. Budget Summary

Exhibit 7.1 summarizes the necessary program budget. As noted previously, the budget numbers differ slightly from the economic analysis for two reasons:

- The economic analysis incentives include the portion of incentives that could be paid by BC Hydro Power Smart for joint programs.
- The costs in the economic analysis are discounted to 2007.

The total DSM program as outlined herein will require budget funding from Terasen Gas of about $35 million over the 3 years.

Exhibit 7.1: Total Budget - Summary

	Costs		
	Incentive ($'000)	Admin ($'000)	Total ($'000)
Total Residential	8,961	4,024	12,985
Total Commercial	21,383	5,979	27,362
- Less Power Smart Contribution	5,572		
- Net Commercial	15,812	5,979	21,791
Total Terasen Budget	24,774	10,003	34,776

Exhibit 7.2 shows the breakdown of the administration budget by the cost categories used in developing the program assumptions.

Exhibit 7.2: Administrative Budget - Residential

	2008 ($'000)	2009 ($'000)	2010 ($'000)	Total ($'000)
Program Development	75	-	-	75
Program Administration	543	645	727	1,916
Contractor Training & Liaison	254	154	79	487
Project Consulting	n/a	n/a	n/a	n/a
Program Evaluation	60	0	220	280
Marketing & Promotion	586	466	216	1,267
Total Budget	1,518	1,265	1,242	4,024

Exhibit 7.3: Administrative Budget - Commercial

	2008 ($'000)	2009 ($'000)	2010 ($'000)	Total ($'000)
Program Development & Admin	91	-	-	91
Program Administration	425	641	923	1,989
Contractor Training & Liaison	209	208	208	624
Project Consulting	414	729	1,183	2,325
Program Evaluation	15	10	295	320
Marketing & Promotion	247	192	192	630
Total Budget	1,400	1,779	2,800	5,979

Exhibit 7.4 summarizes the person years (py) of staffing implicit in the budget estimates[17]. It is anticipated that Terasen will develop a core staff to support the programs on an ongoing basis, but that services such as ABSU, contract staff and consultants will provide some of the necessary labour to support the programs.

Exhibit 7.4: Implicit Staffing - Summary

	2008 (py)	2009 (py)	2010 (py)	Total (py)
Program Development	1.6	0	0	1.6
Program Operations	9.6	12.9	16.5	39.1
Evaluation	0.8	0.1	5.2	6.0
Total Staffing	12.0	13.0	21.7	46.7

[17] A conversion factor of $100,000 per person year was used in these estimates.

8. Summary

This project builds on the Conservation Potential Review (CPR) undertaken by Terasen Gas in 2006. The CPR took a broad look at the uses of natural gas in the residential and business sections (excluding industrial process usage) and outlined the scope for energy efficiency and fuel substitution in Terasen Gas' service territory. The current project encompassed a review and update of the assumptions in the CPR and then selected the most promising measures for both energy efficiency and fuel substitution. These measures were combined into programs. Assuming a three year program life, program related costs such as marketing and promotion, contractor training and program management were estimated. The resulting program concepts and cost estimates were screened with an economic model to confirm the cost effectiveness of the programs.

The energy efficiency programs are estimated to save about 9,958 Terajoules (TJ) of natural gas and 625 GWh of electricity. The fuel substitution programs are expected to add almost 2,278 TJ of load while displacing over 550 GWh of electricity. Taken together, these DSM programs are expected to reduce natural gas consumption by about 7,680 TJ and decrease electricity consumption by about 1,174 GWh.

While the total cost of these programs are about $40 million, it is expected that contribution from partners such as Power Smart, the federal government and the provincial government will reduce the Terasen Gas costs to about $ 35 million.

The economic screening suggests that these programs will provide an overall benefit / cost ratio of 4.0:1 while the impact for participants will be over 9:1 and to the utility will be about 2.2:1. These programs may provide some upward pressure on rates, as the ratepayer impact ratio is 0.6:1. However this is typical for DSM programs.

9. Appendix A – Terasen Gas CPR Measure Update

MARBEK
Resource Consultants Ltd.

Terasen Gas CPR Measures Update

Prepared for:

Habart & Associates Consulting Inc.

Prepared by:

Marbek Resource Consultants Ltd.

March 2, 2007

Marbek Resource Consultants
300-222 Somerset Street West
Ottawa, Ontario K2P 2G3
Tel: 613.523.0784 • Fax: 613.523.0717 • www.marbek.ca

Table of Contents

1. INTRODUCTION

1.1 BACKGROUND

In 2005, Marbek Resource Consultants was retained by Terasen Gas to prepare a review of the potential for demand side management programs (DSM) and fuel substitution, called the Conservation Potential Review (CPR).

Terasen now intends to move towards a regulatory filing. As part of this process, Terasen Gas requested that Habart & Associates Consulting provide assistance in reviewing the CPR output and preparing for the regulatory filing. As part of the Habart review, Marbek Resource Consultants was asked to re-run the measures included in the original CPR with the following changes:

- For all of the measures, use the revised avoided cost and rate data for both natural gas and electricity

- For selected measures, also revise cost and performance data to reflect current conditions.

Habart and Associates provided Marbek with both the revised avoided cost data and the updated measure cost and performance data. Marbek incorporated the new input into our CPR measures model and produced the updated set of outputs. As applicable, this process also included re-running of our building simulation models to establish the revised energy saving impacts.

1.2 THIS REPORT

This remainder of this report is presented in two sections:

- Section 2 presents a summary of the residential sector revisions
- Section 3 presents a summary of the commercial sector revisions.

Appendices A and B provide a summary or results and the detailed measure tables for, respectively, the residential and commercial sectors.

2. RESIDENTIAL MEASURES

2.1 INTRODUCTION

The revised energy efficiency measure and fuel choice results are presented in Appendix A. Highlights of the revisions applied to the energy efficiency and fuel choice assumptions are provided below.

2.2 ENERGY EFFICIENCY MEASURES

The following inputs were modified:

- Avoided cost data were revised to reflect current estimates from Terasen Gas and BC Hydro. Exhibit 2.1 shows the natural gas marginal costs while Exhibit 2.2 shows electricity marginal costs.

Exhibit 2.1: Marginal Costs – Natural Gas

Measure Life (Yrs)	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ
Service Area				
Vancouver Island	$8.42	$8.14	$8.03	$7.94
Lower Mainland	$8.42	$8.14	$8.03	$7.94
Interior	$8.42	$8.14	$8.03	$7.94

Exhibit 2.2 : Marginal Costs – Electricity

Measure Life (Yrs)	10	15	20	25
Unit Price	$/GJ	$/GJ	$/GJ	$/GJ
Service Area				
Vancouver Island	$0.0264	$0.0264	$0.0264	$0.0264
Lower Mainland	$0.0262	$0.0262	$0.0262	$0.0262
Interior	$0.0244	$0.0244	$0.0244	$0.0244

- Rate data was updated to reflect current rates. Exhibit 2.3 summarizes this data.

Exhibit 2.3: Residential Rates

	Residential	
Customer Energy Prices	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0137	$ 0.0176
Lower Mainland	$0.0113	$ 0.0176
Interior	$0.0113	$ 0.0176

- The savings from Heat trap was reduced to reflect that, since 2003, most new natural gas hot water tanks were supplied with heat traps from the manufacturer. This restricts the market to tanks installed before that date, and restricts the life of the product to the remaining life of the installed tanks.

- Tankless water heater incremental costs for retrofit applications was increase from $700 to $900 to reflect the additional work required for venting on retrofit installations.

- Efficient Fireplace incremental costs were increased from $150 to $200 based on conversations with BC based manufacturers.

- Integrated space and water heating system incremental costs increased from $500 to $1000. The eKOCOMFORT type product is currently in beta test. The price increase was based on discussions with manufacturers. Savings estimates were not revised as actual performance data is not yet available.

- Dishwasher regulations and ENERGY STAR qualifying levels changed on January 1 2007. This has resulted in a savings increased to 41% and an estimated incremental cost increase to $50.

- ENERGY STAR window assumptions were revised as per the tables shown below. Cost estimates were based on data from the BC Hydro ENERGY STAR Windows incentive program while the savings estimates were develop through HOT2000 modelling.

Exhibit 2.4: ENERGY STAR Windows – Cost Estimates

	Retrofit	New
SFD	$600	$900
RH	$240	$360

Exhibit 2.5: ENERGY STAR Windows – Savings Estimates.

SFD (MJ)	Retrofit	New
VI	6,488	9,732
LM	6,358	9,536
Int.	7,510	11,264
RH (MJ)		
VI	2,594	3,892
LM	2,544	3,816
Int.	3,005	4,507

- An EnerGuide 80 home was modeled using the assumptions listed below. These assumptions are consistent with MEMPR estimates and the Power Smart Residential New Home Program.

Exhibit 2.5: EGNH80 – MEMPR / Power Smart Assumptions

Region & Dwelling Type	Incremental Cost	Gas Reduction (MJ)	Electricity Reduction (MJ)
VI -Single Family Dwelling	$4,836	49,714	6,178
VI-Row	$228	6,498	1,610
LM -Single Family Dwelling	$3,606	34,946	5,568
LM -Row	$793	4,397	1,687
Int -Single Family Dwelling	$3,716	39,954	6,960
Int -Row	$3,157	26,073	3,969

2.3 ENERGY EFFICIENCY MEASURES RE-SCREEN SUMMARY

Exhibit 2.6 below summarizes the results of the re-screening. The shaded rows show the re-screened results while the unshaded rows show the original results. Highlighted cells show measures with a benefit / cost ratio greater than one.

Exhibit 2.6: Residential Energy Efficiency Measure - Re-Screen Summary

#	Measure		Vancouver Island Retrofit SFD	Vancouver Island Retrofit RH	Vancouver Island New SFD	Vancouver Island New RH	Lower Mainland Retrofit SFD	Lower Mainland Retrofit RH	Lower Mainland New SFD	Lower Mainland New RH	Interior Retrofit SFD	Interior Retrofit RH	Interior New SFD	Interior New RH
1	Air Sealing	Revised	0.8	0.5	0.8	0.6	1.2	0.7	1.2	0.9	1.0	0.5	1.0	0.7
		Old	0.6	0.3	0.6	0.4	1.1	0.6	1.0	1.8	0.8	0.4	0.9	0.8
2	Attic Insulation	Revised	0.4	0.2	na	na	0.0	0.0	na	na	0.5	0.2	na	na
		Old	0.3	0.2	na	na	0.0	0.0	na	na	0.4	0.2	na	na
3	Wall Insulation	Revised	0.3	0.2	na	na	0.0	0.0	na	na	0.4	0.2	na	na
		Old	0.2	0.1	na	na	0.0	0.0	na	na	0.3	0.2	na	na
4	Foundation Insulation	Revised	0.1	0.1	na	na	0.0	0.0	na	na	0.3	0.2	na	na
		Old	0.1	0.1	na	na	0.0	0.0	na	na	0.3	0.2	na	na
5	Crawl-space	Revised	0.1	0.0	na	na	0.0	0.0	na	na	0.1	0.0	na	na
		Old	0.0	0.0	na	na	0.0	0.0	na	na	0.1	0.0	na	na
6	Vacuum Panel	Revised	0.2	0.1	0.1	0.1	0.3	0.1	0.2	0.1	0.2	0.1	0.2	0.1
		Old	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.1	0.1
7	High Performance Windows	Revised	1.0	1.1	1.2	1.2	1.0	1.1	1.2	1.2	1.2	1.2	1.3	1.4
		Old	0.1	0.1	0.9	0.6	0.2	0.1	1.3	0.9	0.2	0.1	1.0	0.8
8	Super HP Windows	Revised	0.1	0.1	0.3	0.2	0.2	0.1	0.4	0.3	0.2	0.1	0.4	0.3
		Old	0.1	0.1	0.3	0.2	0.2	0.1	0.4	0.3	0.1	0.1	0.3	0.2
9	R2000 Construction	Revised	na	na	0.2	0.2	na	na	0.0	0.0	na	na	0.3	0.2
		Old	na	na	0.2	0.1	na	na	0.0	0.0	na	na	0.2	0.2
10	EGNH 80 Construction	Revised	na	na	0.4	0.3	na	na	0.0	0.0	na	na	0.5	3.0
		Old	na	na	0.3	0.2	na	na	0.0	0.0	na	na	0.4	0.3
11	Furnace Efficiency	Revised	1.3	0.8	1.0	0.8	2.1	1.1	1.6	1.2	1.6	0.8	1.2	0.9
		Old	0.9	0.5	0.6	0.5	1.6	0.9	1.2	0.9	1.3	0.7	0.9	0.7
12	Boiler Efficiency	Revised	0.2	0.1	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.1
		Old	0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.1
13	HE HRV	Revised	0.4	0.3	0.3	0.3	0.7	0.4	0.5	0.4	0.5	0.3	0.4	0.3
		Old	0.3	0.2	0.2	0.2	0.6	0.3	0.4	0.3	0.5	0.2	0.3	0.3
14	Integrated Heat & DWH	Revised	0.8	0.5	0.6	0.5	1.5	0.9	1.2	0.9	1.0	0.6	0.8	0.6
		Old	0.9	0.6	0.7	0.6	2.1	1.3	1.8	1.3	1.5	0.9	1.2	0.9
15	Gas Fired Heat Pump	Revised	0.3	0.2	0.2	0.2	0.5	0.3	0.4	0.3	0.4	0.2	0.3	0.2
		Old	0.2	0.1	0.2	0.1	0.4	0.2	0.3	0.2	0.3	0.2	0.2	0.2
16	Showerheads & Faucets	Revised	5.1	4.3	na	na	6.2	4.9	na	na	5.1	4.0	na	na
		Old	3.1	2.6	na	na	4.3	3.4	na	na	3.5	2.8	na	na
17	DHW Heat Trap	Revised	0.4	0.3	na	na	0.5	0.4	na	na	0.4	0.3	na	na
		Old	1.3	1.1	1.2	1.0	1.7	1.4	1.7	1.4	1.4	1.1	1.4	1.1
18	condensing Water Heater	Revised	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.2
		Old	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1
19	Pipe Insulation	Revised	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
		Old	3.4	2.8	3.3	2.8	4.7	3.7	4.6	3.7	3.8	3.0	3.8	3.0
20	Inst. Water Heater	Revised	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
		Old	0.4	0.3	0.4	0.3	0.5	0.4	0.5	0.4	0.4	0.3	0.4	0.3
21	Waste Water Heat Recovery	Revised	0.4	0.3	0.4	0.3	0.4	0.4	0.4	0.3	0.4	0.3	0.4	0.3
		Old	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2
22	Solar Orphans	Revised	0.9	0.7	na	na	1.1	0.8	na	na	0.9	0.7	na	na
		Old	0.5	0.4	na	na	0.7	0.6	na	na	0.6	0.5	na	na
23	ES Dishwasher	Revised	3.4	2.8	3.3	2.7	4.1	3.2	3.9	3.1	3.4	2.7	3.2	2.6
		Old	na	na	na	na	na	na	na	na	na	na	na	na
24	Best Avail. Dishwasher	Revised	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2
		Old	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.1
25	TL ES Clothes Washer	Revised	2.3	1.9	2.2	1.8	2.7	2.1	2.6	2.1	2.3	1.7	2.2	1.7
		Old	1.4	1.2	1.4	1.1	1.8	1.4	1.8	1.4	1.6	1.2	1.5	1.2
26	FL ES Clothes Washer	Revised	0.6	0.5	0.6	0.5	0.7	0.6	0.7	0.6	0.6	0.5	0.6	0.5
		Old	0.4	0.3	0.4	0.3	0.5	0.4	0.5	0.4	0.4	0.3	0.4	0.3
27	Pool Cover	Revised	3.0	na	3.0	na	3.4	na	3.4	na	3.6	na	3.6	na
		Old	1.8	na	1.8	na	2.3	na	2.3	na	2.5	na	2.5	na
28	HE Pool Heater	Revised	0.2	na	0.2	na	0.2	na	0.2	na	0.2	na	0.2	na
		Old	0.1	na	0.1	na	0.1	na	0.1	na	0.1	na	0.1	na
29	Solar Pool Heater	Revised	0.4	na	0.4	na	0.4	na	0.4	na	0.4	na	0.4	na
		Old	0.2	na	0.2	na	0.3	na	0.3	na	0.3	na	0.3	na
30	EE Fireplaces	Revised	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
		Old	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
31	EGNH 80 (PS Estimates)	Revised	na	na	1.3	4.6	na	na	1.3	1.1	na	na	1.5	1.1

2.4 FUEL CHOICE MEASURES

The following inputs were modified:

- Avoided cost data were revised as noted in Exhibit 2.1 above.
- Rate data was revised as noted in Exhibit 2.2 above.

2.5 FUEL CHOICE MEASURES RE-SCREEN SUMMARY

Exhibit 2.7 below summarizes the results of the re-screening. The shaded rows show the re-screened results while the unshaded rows show the original results. Highlighted cells show measures with a benefit / cost ratio greater than one.

Exhibit 2.8: Residential Energy Efficiency Measure - Re-Screen Summary

		Vancouver Island				Lower Mainland				Interior			
Measure		Retrofit		New		Retrofit		New		Retrofit		New	
#		SFD	RH	SFD	RH	SFD	RH	SFD	RH	SFD	RH	SFD	RH
FC1 Furnace Fuel Choice	Revised	3.4	3.5	2.0	1.8	3.3	3.4	2.3	2.1	3.1	3.2	2.0	1.8
	Old	3.4	3.5	1.7	1.5	2.8	2.9	1.8	1.8	2.8	2.9	1.7	1.5
FC2 DHW Fuel Choice	Revised	0.8	0.7	1.3	1.2	0.9	0.8	1.3	1.3	0.7	0.6	1.2	1.1
	Old	0.6	0.6	1.2	1.1	0.7	0.6	1.2	1.1	0.6	0.5	1.1	1.0
FC3 Range Fuel Choice	Revised	1.0	1.0	1.3	1.3	1.1	1.0	1.3	1.3	1.0	0.9	1.2	1.2
	Old	1.0	0.9	1.3	1.3	0.9	0.8	1.1	1.1	0.8	0.8	1.1	1.1
FC4 Dryer Fuel Choice	Revised	1.6	1.5	2.4	2.4	1.7	1.5	2.4	2.4	1.4	1.3	2.2	2.2
	Old	1.4	1.3	2.4	2.4	1.3	1.2	2.0	2.0	1.2	1.1	2.0	2.0

3 COMMERCIAL SECTOR MEASURES

3.1 INTRODUCTION

The revised energy efficiency measure and fuel choice results are presented in Appendix B, including summary sheets and detailed tables for individual measures. Highlights of the revisions applied to the energy efficiency and fuel choice assumptions are provided below.

3.2 ENERGY EFFICIENCY MEASURES

The following inputs were modified:

- Avoided cost data were revised as show in Exhibits 2.1 and 2.2 in the previous section.
- Rate data was updated to reflect current rates. Exhibit 3.1 summarizes this data.

Exhibit 3.1: Commercial Rates

	Commercial	
Customer Energy Prices	Natural Gas $/MJ	Electricity $/MJ
Vancouver Island	$0.0118	$0.0155
Lower Mainland	$0.0107	$0.0155
Interior	$0.0108	$0.0155

- The incremental cost for Energy Efficient Building Design (60%) was increased from $1 sq. ft to $5 sq. ft. based on local experience modeling design alternatives.
- The Building Recommissioning costs were reduced from a range of $ 0.40 - $ 0.80 to $ 0.32 per sq ft and savings were reduced from 25% to 15%. These changes were based on results of a “meta” evaluation conducted by LBL.
- High Efficiency Roof Top Units were modeled as “make up air” units (MAU).
- The incremental cost for drain water heat recovery was reduced from $8,000 to $7,500 per unit, based on local costing estimates.

3.3 ENERGY EFFICIENCY MEASURES RE-SCREEN SUMMARY

Exhibit 3.2 below summarizes the results of the re-screening. The shaded rows show the re-screened results while the unshaded rows show the original results. Highlighted cells show measures with a benefit / cost ratio greater than one.

Exhibit 3.2: Commercial Energy Efficiency Measure - Re-Screen Summary

#	Measure		Retrofit	New
1	Increased roof insulation	Revised	0.1	
		Old	0.3	
2/3	High performance glazing - Energy Star	Revised	0.4	
		Old	0.3	
2/3	High performance glazing - HIT	Revised	0.3	1.3
		Old	0.3	1.0
4	H. P building envelop - gas panels	Revised		0.3
		Old		0.3
4	H. P building envelop - vacuum panels	Revised		0.1
		Old		0.1
5	New building construction - 30%	Revised		2.7
		Old		2.0
6	New builidng construction - 60%	Revised		2.5
		Old		9.2
7/8	H. E. Boilers - Near Condensing	Revised	1.8	1.6
		Old	6.1	5.1
7/8	H. E. Boilers - Condensing	Revised	1.5	1.4
		Old	1.8	1.4
9	Building recommissioning	Revised	5.3	
		Old	1.2	
9	Next Generation BAS	Revised	2.1	
		Old	1.6	
10	Demand control ventilation (Interior)	Revised	1.1 - 3.9	
		Old	0.9 - 3.3	
11	HE Roof Top Units	Revised	1.5	
		Old	0.5	
12	Instantaneous DHW Heaters	Revised	2.4	2.4
		Old	1.7	1.7
13	HE Condensing DHW Boiler	Revised	6.2	6.2
		Old	5.4	5.4
14	HE Condensing DHW Heater	Revised	3.0	3.0
		Old	2.5	2.5
15	Pre-Rinse Spray Valves	Revised	16.6	25.5
		Old	11.4	17.5
16	Drainwater heat recovery	Revised	1.7	2.5
		Old	1.0	1.4
17	Commercial Food Prep - Gas Range	Revised	5.7	5.7
		Old	3.0	3.9
17	Commercial Food Prep - Gas Broiler	Revised	15.9	15.9
		Old	10.9	10.9
17	Commercial Food Prep - Gas Fryer	Revised	1.0	1.0
		Old	0.7	0.7

3.4 FUEL CHOICE MEASURES

The following inputs were modified:

- Avoided cost data were revised as noted in Exhibit 2.1
- Rate data were revised as per Exhibit 3.1.

3.5 FUEL CHOICE MEASURES RE-SCREEN SUMMARY

Exhibit 3.3 below summarizes the results of the re-screening. The shaded rows show the re-screened results while the unshaded rows show the original results. Highlighted cells show measures with a benefit / cost ratio greater than one.

Exhibit 3.3: Commercial Energy Efficiency Measure - Re-Screen Summary

#	Measure		Retrofit	New
FC1/2	DHW - Electric to Gas - Single	Revised	2.0	2.0
		Old	1.9	1.9
FC1/2	DHW - Electric to Gas - Multiple	Revised	1.9	1.9
		Old	1.7	1.7
FC1/2	Instantaneous DHW Heaters - Food Retail	Revised	1.8	1.5
		Old	1.5	1.2
FC2/3	Space Htg - Electric to Gas - Hydronic	Revised	0.5	0.5
		Old	0.4	0.4
FC2/3	Space Htg - Electric to Gas - Forced Air	Revised	1.4	1.4
		Old	1.1	1.1

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APPENDIX A

Residential Measures

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Integrated Heating and DHW

	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	**Existing Pre-76 Single Detached Home -** Baseline: mid-efficiency furnace	82,724	2,160	72,797	2,160	I	$1,000	$0	18	9,927	0	9,927	$136.00	7.4	-$243	0.8
2	**Existing Pre-76 Attached Home -** Baseline: mid-efficiency furnace	53,814	1,440	47,356	1,440	I	$1,000	$0	18	6,458	0	6,458	$88.47	11.3	-$507	0.5
3	**New Single Detached Home -** Baseline: mid-efficiency furnace	65,231	2,880	57,404	2,880	I	$1,000	$0	18	7,828	0	7,828	$107.24	9.3	-$403	0.6
4	**New Attached Home -** Baseline: mid-efficiency furnace	52,765	1,440	46,433	1,440	I	$1,000	$0	18	6,332	0	6,332	$86.75	11.5	-$517	0.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Integrated Heating and DHW

	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	**Existing Pre-76 Single Detached Home -** Baseline: mid-efficiency furnace	123,667	2,160	108,827	1,620	I	$1,000	$0	30	14,840	540	15,380	$177.20	5.6	$486	1.5
2	**Existing Pre-76 Attached Home -** Baseline: mid-efficiency furnace	72,910	1,440	64,161	1,080	I	$1,000	$0	30	8,749	360	9,109	$105.20	9.5	-$112	0.9
3	**New Single Detached Home -** Baseline: mid-efficiency furnace	96,683	2,880	85,081	2,160	I	$1,000	$0	30	11,602	720	12,322	$143.77	7.0	$249	1.2
4	**New Attached Home -** Baseline: mid-efficiency furnace	74,419	1,440	65,489	1,080	I	$1,000	$0	30	8,930	360	9,290	$107.25	9.3	-$96	0.9

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Integrated Heating and DHW

	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	**Existing Pre-76 Single Detached Home -** Baseline: mid-efficiency furnace	97,568	2,160	85,860	2,160	I	$1,000	$0	30	11,708	0	11,708	$132.30	7.6	$47	1.0
2	**Existing Pre-76 Attached Home -** Baseline: mid-efficiency furnace	56,049	1,440	49,323	1,440	I	$1,000	$0	30	6,726	0	6,726	$76.00	13.2	-$399	0.6
3	**New Single Detached Home -** Baseline: mid-efficiency furnace	77,615	2,880	68,301	2,880	I	$1,000	$0	30	9,314	0	9,314	$105.25	9.5	-$167	0.8
4	**New Attached Home -** Baseline: mid-efficiency furnace	58,739	1,440	51,690	1,440	I	$1,000	$0	30	7,049	0	7,049	$79.65	12.6	-$370	0.6

** *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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	17,030	212	I	$50	$0	13	2,120	147	2,267	$31.64	1.6	$122	3.4
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	16,000	278	14,229	164	I	$50	$0	13	1,771	114	1,885	$26.27	1.9	$92	2.8
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	16,710	177	I	$50	$0	13	2,080	123	2,203	$30.67	1.6	$114	3.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	233	13,961	137	I	$50	$0	13	1,738	95	1,833	$25.49	2.0	$86	2.7

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	23,358	359	20,772	212	I	$50	$0	13	2,586	147	2,733	$31.81	1.6	$153	4.1
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	18,567	278	16,512	164	I	$50	$0	13	2,055	114	2,169	$25.23	2.0	$110	3.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	301	20,357	177	I	$50	$0	13	2,534	123	2,657	$30.80	1.6	$144	3.9
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	233	16,181	137	I	$50	$0	13	2,014	95	2,110	$24.44	2.0	$104	3.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	17,030	212	I	$50	$0	13	2,120	147	2,267	$26.55	1.9	$120	3.4
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	15,112	278	13,439	164	I	$50	$0	13	1,673	114	1,787	$20.91	2.4	$83	2.7
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	16,710	177	I	$50	$0	13	2,080	123	2,203	$25.67	1.9	$112	3.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	233	13,186	137	I	$50	$0	13	1,641	95	1,737	$20.23	2.5	$78	2.6

** *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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

	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	**Existing Pre-76 Single Detached Home -** Baseline 1: Current average installed windows	63,573	2,160	57,085	2,030	I	$600	$0	30	6,488	130	6,618	$91.17	6.6	$18	1.0
2	**Existing Pre-76 Attached Home -** Baseline 1: Current average installed windows	37,814	1,440	35,220	1,354	I	$240	$0	30	2,594	86	2,680	$37.06	6.5	$18	1.1
3	**New Single Detached Home -** Baseline 1: Low Efficiency	46,442	2,880	36,710	2,246	I	$900	$0	30	9,732	634	10,366	$121.12	7.4	$157	1.2
4	**New Attached Home -** Baseline 1: Low Efficiency	37,067	1,440	33,175	1,123	I	$360	$0	30	3,892	317	4,209	$49.56	7.3	$81	1.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	100,309	2,160	93,951	2,030	I	$600	$0	30	6,358	130	6,488	$74.13	8.1	$7	1.0
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	54,343	1,440	51,799	1,354	I	$240	$0	30	2,544	86	2,630	$30.27	7.9	$13	1.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	73,792	2,880	64,256	2,246	I	$900	$0	30	9,536	634	10,170	$118.91	7.6	$139	1.2
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	56,224	1,440	52,408	1,123	I	$360	$0	30	3,816	317	4,133	$48.70	7.4	$75	1.2

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Windows

	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	78,417	2,160	70,907	2,030	I	$600	$0	30	7,510	130	7,640	$87.14	6.9	$107	1.2
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	40,937	1,440	37,932	1,354	I	$240	$0	30	3,005	86	3,091	$35.48	6.8	$52	1.2
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	58,825	2,880	47,561	2,246	I	$900	$0	30	11,264	634	11,898	$138.43	6.5	$294	1.3
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	43,912	1,440	39,405	1,123	I	$360	$0	30	4,507	317	4,824	$56.50	6.4	$136	1.4

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Efficient Fireplace

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$67.01	3.0	$141	1.7
2	**Existing Pre-76 Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$67.01	3.0	$141	1.7
3	**New Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$67.01	3.0	$141	1.7
4	**New Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$67.01	3.0	$141	1.7

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Efficient Fireplace

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7
2	**Existing Pre-76 Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7
3	**New Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7
4	**New Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Efficient Fireplace

	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	**Existing Pre-76 Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7
2	**Existing Pre-76 Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7
3	**New Single Detached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7
4	**New Attached Home -** Baseline: Average Fireplace (35% Eff.)	16,304	-	11,413	0	I	$200	$0	15	4,891	0	4,891	$55.27	3.6	$141	1.7

** *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*

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	63,573	2,160	53,243	2,160	I	$600	$0	18	10,331	0	10,331	$141.53	4.2	$188	1.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	37,814	1,440	31,669	1,440	I	$600	$0	18	6,145	0	6,145	$84.18	7.1	-$131	0.8
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	46,442	2,880	38,732	2,880	I	$600	$0	18	7,709	0	7,709	$105.62	5.7	-$12	1.0
4	**New Attached Home -** Baseline: Mid-efficiency furnace	37,067	1,440	30,914	1,440	I	$600	$0	18	6,153	0	6,153	$84.30	7.1	-$131	0.8

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	100,309	2,160	84,009	2,160	I	$600	$0	18	16,300	0	16,300	$184.19	3.3	$643	2.1
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	54,343	1,440	45,513	1,440	I	$600	$0	18	8,831	0	8,831	$99.79	6.0	$74	1.1
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	73,792	2,880	61,543	2,880	I	$600	$0	18	12,249	0	12,249	$138.42	4.3	$334	1.6
4	**New Attached Home -** Baseline: Mid-efficiency furnace	56,224	1,440	46,891	1,440	I	$600	$0	18	9,333	0	9,333	$105.46	5.7	$112	1.2

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	78,417	2,160	65,675	2,160	I	$600	$0	18	12,743	0	12,743	$143.99	4.2	$372	1.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	40,937	1,440	34,285	1,440	I	$600	$0	18	6,652	0	6,652	$75.17	8.0	-$93	0.8
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	58,825	2,880	49,060	2,880	I	$600	$0	18	9,765	0	9,765	$110.34	5.4	$145	1.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	43,912	1,440	36,622	1,440	I	$600	$0	18	7,289	0	7,289	$82.37	7.3	-$44	0.9

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous (in-line) Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,788	0	I	$900	$0	20	5,362	0	5,362	$73.46	12.3	-$477	0.5
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	16,000	-	11,520	0	I	$700	$0	20	4,480	0	4,480	$61.38	11.4	-$347	0.5
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,529	0	I	$900	$0	20	5,261	0	5,261	$72.08	12.5	-$485	0.5
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	-	11,303	0	I	$700	$0	20	4,396	0	4,396	$60.22	11.6	-$353	0.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous (in-line) Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	23,358	-	16,818	0	I	$900	$0	20	6,540	0	6,540	$73.90	12.2	-$384	0.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	18,567	-	13,368	0	I	$700	$0	20	5,199	0	5,199	$58.75	11.9	-$290	0.6
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	-	16,481	0	I	$900	$0	20	6,409	0	6,409	$72.43	12.4	-$395	0.6
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	-	13,101	0	I	$700	$0	20	5,095	0	5,095	$57.57	12.2	-$298	0.6

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous (in-line) Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,788	0	I	$900	$0	20	5,362	0	5,362	$60.59	14.9	-$477	0.5
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	15,112	-	10,880	0	I	$700	$0	20	4,231	0	4,231	$47.81	14.6	-$366	0.5
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,529	0	I	$900	$0	20	5,261	0	5,261	$59.45	15.1	-$485	0.5
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	-	10,676	0	I	$700	$0	20	4,152	0	4,152	$46.91	14.9	-$373	0.5

** *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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Air Sealing

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	63,573	2,160	55,945	1,901	F	$900	$0	25	7,629	259	7,888	$109.08	8.3	-$180	0.8
2	**Existing Pre-76 Attached Home -** Baseline: No action	37,814	1,440	33,276	1,267	F	$900	$0	25	4,538	173	4,711	$65.21	13.8	-$467	0.5
3	**New Single Detached Home -** Baseline: Standard construction	46,442	2,880	40,869	2,534	I	$700	$0	25	5,573	346	5,919	$82.43	8.5	-$130	0.8
4	**New Attached Home** - Baseline: Standard construction	37,067	1,440	32,619	1,267	I	$700	$0	25	4,448	173	4,621	$63.98	10.9	-$274	0.6

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Air Sealing

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	100,309	2,160	88,272	1,901	F	$900	$0	25	12,037	259	12,296	$140.58	6.4	$193	1.2
2	**Existing Pre-76 Attached Home -** Baseline: No action	54,343	1,440	47,822	1,267	F	$900	$0	25	6,521	173	6,694	$76.73	11.7	-$299	0.7
3	**New Single Detached Home -** Baseline: Standard construction	73,792	2,880	64,937	2,534	I	$700	$0	25	8,855	346	9,201	$106.14	6.6	$147	1.2
4	**New Attached Home** - Baseline: Standard construction	56,224	1,440	49,477	1,267	I	$700	$0	25	6,747	173	6,920	$79.28	8.8	-$80	0.9

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Air Sealing

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	78,417	2,160	69,007	1,901	F	$900	$0	25	9,410	259	9,669	$110.90	8.1	-$35	1.0
2	**Existing Pre-76 Attached Home -** Baseline: No action	40,937	1,440	36,025	1,267	F	$900	$0	25	4,912	173	5,085	$58.55	15.4	-$439	0.5
3	**New Single Detached Home -** Baseline: Standard construction	58,825	2,880	51,766	2,534	I	$700	$0	25	7,059	346	7,405	$85.85	8.2	-$12	1.0
4	**New Attached Home** - Baseline: Standard construction	43,912	1,440	38,642	1,267	I	$700	$0	25	5,269	173	5,442	$62.59	11.2	-$208	0.7

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Attic 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	**Existing Pre-76 Single Detached Home -** Baseline: Average attic insulation levels	63,573	2,160	59,759	2,030	F	$1,000	$0	30	3,814	130	3,944	$54.54	18.3	-$621	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Average attic insulation levels	37,814	1,440	35,545	1,354	F	$1,000	$0	30	2,269	86	2,355	$32.60	30.7	-$772	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Attic 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	**Existing Pre-76 Single Detached Home -** Baseline: Average attic insulation levels	100,309	2,160	94,291	2,030	F	$1,000	$0	30	6,019	130	6,148	$70.29	14.2	-$988	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average attic insulation levels	54,343	1,440	51,083	1,354	F	$1,000	$0	30	3,261	86	3,347	$38.37	26.1	-$992	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Attic 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	**Existing Pre-76 Single Detached Home -** Baseline: Average attic insulation levels	78,417	2,160	73,712	2,030	F	$1,000	$0	30	4,705	130	4,835	$55.45	18.0	-$544	0.5
2	**Existing Pre-76 Attached Home -** Baseline: Average attic insulation levels	40,937	1,440	38,481	1,354	F	$1,000	$0	30	2,456	86	2,543	$29.28	34.2	-$757	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Best Available Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	17,341	234	I	$600	$0	13	1,810	126	1,936	$27.01	22.2	-$453	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	16,000	278	14,488	181	I	$600	$0	13	1,512	97	1,609	$22.43	26.8	-$479	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	17,014	195	I	$600	$0	13	1,776	105	1,881	$26.18	22.9	-$460	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	233	14,215	151	I	$600	$0	13	1,484	81	1,565	$21.76	27.6	-$484	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Best Available Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	23,358	359	21,151	234	I	$600	$0	13	2,207	126	2,333	$27.16	22.1	-$427	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	18,567	278	16,812	181	I	$600	$0	13	1,755	97	1,852	$21.54	27.9	-$463	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	301	20,728	195	I	$600	$0	13	2,163	105	2,268	$26.30	22.8	-$434	0.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	233	16,476	151	I	$600	$0	13	1,719	81	1,801	$20.86	28.8	-$469	0.2

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Best Available Dishwasher

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Dishwasher	19,150	359	17,341	234	I	$600	$0	13	1,810	126	1,936	$22.66	26.5	-$455	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard Dishwasher	15,112	278	13,684	181	I	$600	$0	13	1,428	97	1,525	$17.85	33.6	-$486	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	301	17,014	195	I	$600	$0	13	1,776	105	1,881	$21.92	27.4	-$462	0.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	233	13,426	151	I	$600	$0	13	1,401	81	1,483	$17.27	34.8	-$491	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Boiler Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency boiler	63,573	2,160	55,627	2,145	I	$3,200	$0	18	7,947	15	7,962	$109.14	29.3	-$2,590	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency boiler	37,814	1,440	33,087	1,430	I	$3,200	$0	18	4,727	10	4,737	$64.93	49.3	-$2,837	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency boiler	46,442	2,880	40,636	2,860	I	$3,200	$0	18	5,805	20	5,825	$79.89	40.1	-$2,752	0.1
4	**New Attached Home -** Baseline: Mid-efficiency boiler	37,067	1,440	32,433	1,430	I	$3,200	$0	18	4,633	10	4,643	$63.65	50.3	-$2,844	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Boiler Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency boiler	100,309	2,160	87,771	2,145	I	$3,200	$0	18	12,539	15	12,554	$141.95	22.5	-$2,240	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency boiler	54,343	1,440	47,550	1,430	I	$3,200	$0	18	6,793	10	6,803	$76.94	41.6	-$2,679	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency boiler	73,792	2,880	64,568	2,860	I	$3,200	$0	18	9,224	20	9,244	$104.59	30.6	-$2,491	0.2
4	**New Attached Home -** Baseline: Mid-efficiency boiler	56,224	1,440	49,196	1,430	I	$3,200	$0	18	7,028	10	7,038	$79.59	40.2	-$2,661	0.2

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Boiler Efficiency 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency boiler	78,417	2,160	68,615	2,145	I	$3,200	$0	18	9,802	15	9,817	$111.03	28.8	-$2,449	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency boiler	40,937	1,440	35,820	1,430	I	$3,200	$0	18	5,117	10	5,127	$58.00	55.2	-$2,807	0.1
3	**New Single Detached Home -** Baseline: Mid-efficiency boiler	58,825	2,880	51,472	2,860	I	$3,200	$0	18	7,353	20	7,373	$83.45	38.3	-$2,634	0.2
4	**New Attached Home -** Baseline: Mid-efficiency boiler	43,912	1,440	38,423	1,430	I	$3,200	$0	18	5,489	10	5,499	$62.20	51.4	-$2,779	0.1

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Condensing Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,405	0	I	$1,250	$0	10	5,745	0	5,745	$78.71	15.9	-$925	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	16,000	-	11,200	0	I	$1,250	$0	10	4,800	0	4,800	$65.76	19.0	-$979	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,153	0	I	$1,250	$0	10	5,637	0	5,637	$77.23	16.2	-$932	0.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	15,699	-	10,989	0	I	$1,250	$0	10	4,710	0	4,710	$64.52	19.4	-$984	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Condensing Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	23,358	-	16,350	0	I	$1,250	$0	10	7,007	0	7,007	$79.18	15.8	-$854	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	18,567	-	12,997	0	I	$1,250	$0	10	5,570	0	5,570	$62.94	19.9	-$935	0.3
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	22,891	-	16,023	0	I	$1,250	$0	10	6,867	0	6,867	$77.60	16.1	-$862	0.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	18,196	-	12,737	0	I	$1,250	$0	10	5,459	0	5,459	$61.68	20.3	-$942	0.2

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Condensing Water Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	13,405	0	I	$1,250	$0	10	5,745	0	5,745	$64.92	19.3	-$925	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	15,112	-	10,578	0	I	$1,250	$0	10	4,533	0	4,533	$51.23	24.4	-$994	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	18,790	-	13,153	0	I	$1,250	$0	10	5,637	0	5,637	$63.70	19.6	-$932	0.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	14,827	-	10,379	0	I	$1,250	$0	10	4,448	0	4,448	$50.26	24.9	-$999	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Crawl-space 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	**Existing Pre-76 Single Detached Home -** Baseline: Average crawl-space insulation levels	63,573	2,160	63,001	2,141	F	$1,100	$0	30	572	19	592	$8.18	134.5	-$1,043	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Average crawl-space insulation levels	37,814	1,440	37,474	1,427	F	$1,100	$0	30	340	13	353	$4.89	224.9	-$1,066	0.0

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Crawl-space 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	**Existing Pre-76 Single Detached Home -** Baseline: Average crawl-space insulation levels	100,309	2,160	99,406	2,141	F	$1,100	$0	30	903	19	922	$10.54	104.3	-$1,098	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average crawl-space insulation levels	54,343	1,440	53,854	1,427	F	$1,100	$0	30	489	13	502	$5.75	191.1	-$1,099	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Crawl-space 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	**Existing Pre-76 Single Detached Home -** Baseline: Average crawl-space insulation levels	78,417	2,160	77,712	2,141	F	$1,100	$0	30	706	19	725	$8.32	132.3	-$1,032	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Average crawl-space insulation levels	40,937	1,440	40,569	1,427	F	$1,100	$0	30	368	13	381	$4.39	250.5	-$1,064	0.0

** *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*

Assumptions:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Heat Trap

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	18,193	0	F	$65	$0	4	958	0	958	$13.12	5.0	-$38	0.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	15,200	0	F	$65	$0	4	800	0	800	$10.96	5.9	-$43	0.3
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	17,850	0	F	$65	$0	4	939	0	939	$12.87	5.1	-$39	0.4
4	**New Attached Home -** Baseline: standard construction	15,699	-	14,914	0	F	$65	$0	4	785	0	785	$10.75	6.0	-$43	0.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Heat Trap

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	22,190	0	F	$65	$0	4	1,168	0	1,168	$13.20	4.9	-$32	0.5
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	17,639	0	F	$65	$0	4	928	0	928	$10.49	6.2	-$39	0.4
3	**New Single Detached Home -** Baseline: standard construction	22,891	-	21,746	0	F	$65	$0	4	1,145	0	1,145	$12.93	5.0	-$33	0.5
4	**New Attached Home -** Baseline: standard construction	18,196	-	17,286	0	F	$65	$0	4	910	0	910	$10.28	6.3	-$40	0.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Heat Trap

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	18,193	0	F	$65	$0	4	958	0	958	$10.82	6.0	-$38	0.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	14,356	0	F	$65	$0	4	756	0	756	$8.54	7.6	-$44	0.3
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	17,850	0	F	$65	$0	4	939	0	939	$10.62	6.1	-$39	0.4
4	**New Attached Home -** Baseline: standard construction	14,827	-	14,086	0	F	$65	$0	4	741	0	741	$8.38	7.8	-$44	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Dryer Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,244	3,816	417	I	$150	$0	18	-3,816	2,827	-990	-$2.53	-59.2	$258	1.6
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,607	3,067	335	I	$150	$0	18	-3,067	2,272	-795	-$2.03	-73.7	$178	1.5
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,192	3,756	410	I	$0	$0	18	-3,756	2,782	-974	-$2.49	0.0	$402	2.4
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,565	3,018	330	I	$0	$0	18	-3,018	2,236	-783	-$2.00	0.0	$323	2.4

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Dryer Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,772	4,438	485	I	$150	$0	18	-4,438	3,287	-1,151	$7.71	19.5	$319	1.7
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,946	3,466	379	I	$150	$0	18	-3,466	2,567	-899	$6.02	24.9	$216	1.5
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,713	4,368	477	I	$0	$0	18	-4,368	3,235	-1,133	$7.58	0.0	$461	2.4
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,900	3,411	373	I	$0	$0	18	-3,411	2,527	-884	$5.92	0.0	$360	2.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Dryer Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,114	3,663	400	I	$150	$0	18	-3,663	2,713	-950	$6.36	23.6	$191	1.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,335	2,747	300	I	$150	$0	18	-2,747	2,035	-712	$4.77	31.4	$106	1.3
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,064	3,605	394	I	$0	$0	18	-3,605	2,670	-935	$6.26	0.0	$336	2.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,298	2,704	295	I	$0	$0	18	-2,704	2,003	-701	$4.70	0.0	$252	2.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energuide 80 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	46,442	2,880	32,509	2,016	I	$3,800	$0	30	13,932	864	14,796	$206.08	18.4	-$2,298	0.4
2	**New Attached Home -** Baseline: Current Average House Construction	37,067	1,440	25,947	1,008	I	$3,800	$0	30	11,120	432	11,552	$159.95	23.8	-$2,678	0.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energuide 80 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	73,792	2,880	51,654	2,016	I	$3,800	$0	30	22,138	864	23,002	$265.36	14.3	-$3,723	0.0
2	**New Attached Home -** Baseline: Current Average House Construction	56,224	1,440	39,357	1,008	I	$3,800	$0	30	16,867	432	17,299	$198.20	19.2	-$3,761	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energuide 80 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	58,825	2,880	41,178	2,016	I	$3,800	$0	30	17,648	864	18,512	$214.62	17.7	-$1,985	0.5
2	**New Attached Home -** Baseline: Current Average House Construction	43,912	1,440	30,738	1,008	I	$3,800	$0	30	13,173	432	13,605	$156.46	24.3	-$2,504	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Clothes Washer

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Clotheswasher	22,967	300	20,089	150	I	$100	$0	14	2,877	150	3,027	$42.06	2.4	$132	2.3
2	**Existing Pre-76 Attached Home -** Baseline: Standard Clotheswasher	19,066	226	16,705	113	I	$100	$0	14	2,361	113	2,474	$34.34	2.9	$88	1.9
3	**New Single Detached Home -** Baseline: Standard Clotheswasher	22,546	259	19,719	130	I	$100	$0	14	2,827	130	2,957	$41.01	2.4	$124	2.2
4	**New Attached Home -** Baseline: Standard Clotheswasher	18,717	195	16,397	98	I	$100	$0	14	2,320	98	2,418	$33.50	3.0	$82	1.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,796	300	24,362	150	I	$100	$0	14	3,434	150	3,584	$41.44	2.4	$171	2.7
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	22,033	226	19,325	113	I	$100	$0	14	2,708	113	2,821	$32.58	3.1	$112	2.1
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,258	259	23,887	130	I	$100	$0	14	3,371	130	3,501	$40.38	2.5	$162	2.6
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	21,607	195	18,948	98	I	$100	$0	14	2,659	98	2,756	$31.76	3.1	$106	2.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Energy Star Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,813	300	19,990	150	I	$100	$0	14	2,824	150	2,973	$34.54	2.9	$126	2.3
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,859	226	15,681	113	I	$100	$0	14	2,178	113	2,291	$26.60	3.8	$74	1.7
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,395	259	19,620	130	I	$100	$0	14	2,774	130	2,904	$33.63	3.0	$119	2.2
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,531	195	15,391	98	I	$100	$0	14	2,140	98	2,237	$25.90	3.9	$68	1.7

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Foundation 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	**Existing Pre-76 Single Detached Home -** Baseline: Average foundation insulation levels	63,573	2,160	56,580	1,922	F	$4,700	$0	30	6,993	238	7,231	$99.99	47.0	-$4,004	0.1
2	**Existing Pre-76 Attached Home -** Baseline: Average foundation insulation levels	37,814	1,440	33,655	1,282	F	$4,700	$0	30	4,160	158	4,318	$59.77	78.6	-$4,281	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Foundation 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	**Existing Pre-76 Single Detached Home -** Baseline: Average foundation insulation levels	100,309	2,160	89,275	1,922	F	$2,500	$0	30	11,034	238	11,272	$128.87	19.4	-$2,479	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average foundation insulation levels	54,343	1,440	48,366	1,282	F	$2,500	$0	30	5,978	158	6,136	$70.34	35.5	-$2,486	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Foundation 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	**Existing Pre-76 Single Detached Home -** Baseline: Average foundation insulation levels	78,417	2,160	69,792	1,922	F	$2,500	$0	30	8,626	238	8,864	$101.65	24.6	-$1,664	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Average foundation insulation levels	40,937	1,440	36,434	1,282	F	$2,500	$0	30	4,503	158	4,662	$53.67	46.6	-$2,054	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	56,197	53,243	2,160	I	-$400	$0	18	-53,243	54,037	795	$221.63	-1.8	$9,708	3.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	33,582	31,669	1,440	I	-$400	$0	18	-31,669	32,142	473	$131.83	-3.0	$5,937	3.5
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	42,355	38,732	2,880	I	$2,050	$0	18	-38,732	39,475	743	$164.13	12.5	$4,762	2.0
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	32,947	30,914	1,440	I	$2,050	$0	18	-30,914	31,507	593	$131.00	15.6	$3,387	1.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	87,423	84,009	2,160	I	-$400	$0	18	-84,009	85,263	1,254	$551.32	-0.7	$14,927	3.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	47,632	45,513	1,440	I	-$400	$0	18	-45,513	46,192	679	$298.69	-1.3	$8,270	3.4
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	65,603	61,543	2,880	I	$2,050	$0	18	-61,543	62,723	1,181	$408.50	5.0	$8,656	2.3
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	49,230	46,891	1,440	I	$2,050	$0	18	-46,891	47,790	900	$311.24	6.6	$6,107	2.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Furnace Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	68,815	65,675	2,160	I	-$400	$0	18	-65,675	66,655	980	$431.00	-0.9	$10,632	3.1
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	36,237	34,285	1,440	I	-$400	$0	18	-34,285	34,797	512	$225.00	-1.8	$5,742	3.2
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	52,881	49,060	2,880	I	$2,050	$0	18	-49,060	50,001	941	$325.64	6.3	$5,641	2.0
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	38,765	36,622	1,440	I	$2,050	$0	18	-36,622	37,325	703	$243.09	8.4	$3,691	1.8

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Gas-fired Heat Pump

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	63,573	2,160	42,594	2,160	I	$5,000	$0	18	20,979	0	20,979	$287.42	17.4	-$3,400	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	37,814	1,440	25,336	1,440	I	$5,000	$0	18	12,479	0	12,479	$170.96	29.2	-$4,048	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	46,442	2,880	31,116	2,880	I	$5,000	$0	18	15,326	0	15,326	$209.96	23.8	-$3,831	0.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	37,067	1,440	24,835	1,440	I	$5,000	$0	18	12,232	0	12,232	$167.58	29.8	-$4,067	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Gas-fired Heat Pump

1

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	100,309	2,160	67,207	2,160	I	$5,000	$0	18	33,102	0	33,102	$374.05	13.4	-$2,475	0.5
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	54,343	1,440	36,410	1,440	I	$5,000	$0	18	17,933	0	17,933	$202.65	24.7	-$3,632	0.3
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	73,792	2,880	49,441	2,880	I	$5,000	$0	18	24,351	0	24,351	$275.17	18.2	-$3,142	0.4
4	**New Attached Home -** Baseline: Mid-efficiency furnace	56,224	1,440	37,670	1,440	I	$5,000	$0	18	18,554	0	18,554	$209.66	23.8	-$3,585	0.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Gas-fired Heat Pump

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	78,417	2,160	52,540	2,160	I	$5,000	$0	18	25,878	0	25,878	$292.42	17.1	-$3,026	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	40,937	1,440	27,428	1,440	I	$5,000	$0	18	13,509	0	13,509	$152.66	32.8	-$3,969	0.2
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	58,825	2,880	39,413	2,880	I	$5,000	$0	18	19,412	0	19,412	$219.36	22.8	-$3,519	0.3
4	**New Attached Home -** Baseline: Mid-efficiency furnace	43,912	1,440	29,421	1,440	I	$5,000	$0	18	14,491	0	14,491	$163.75	30.5	-$3,895	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	39,563	0	I	$2,900	$0	15	6,272	0	6,272	$85.93	33.7	-$2,463	0.2
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	39,563	0	I	$2,900	$0	15	6,272	0	6,272	$85.93	33.7	-$2,463	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Pool Heater

	Measure Description	Baseline Energy Use (MJ/yr)		Upgrade Energy Use (MJ/yr)		Measure Capital & Installation Cost F = full I=Incremental		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	45,331	0	I	$2,900	$0	15	7,187	0	7,187	$81.21	35.7	-$2,399	0.2
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	45,331	0	I	$2,900	$0	15	7,187	0	7,187	$81.21	35.7	-$2,399	0.2

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Pool Heater

	Measure Description	Baseline Energy Use (MJ/yr)		Upgrade Energy Use (MJ/yr)		Measure Capital & Installation Cost F = full I=Incremental		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	48,361	0	I	$2,900	$0	15	7,667	0	7,667	$86.64	33.5	-$2,366	0.2
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	48,361	0	I	$2,900	$0	15	7,667	0	7,667	$86.64	33.5	-$2,366	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Heat Recovery Ventilator

#	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	**Existing Pre-76 Single Detached Home -** Baseline: standard	63,573	2,160	59,441	2,160	I	$650	$0	15	4,132	0	4,132	$56.61	11.5	-$362	0.4
2	**Existing Pre-76 Attached Home -** Baseline: standard	37,814	1,440	35,356	1,440	I	$650	$0	15	2,458	0	2,458	$33.67	19.3	-$479	0.3
3	**New Single Detached Home -** Baseline: standard	46,442	2,880	43,423	2,880	I	$650	$0	15	3,019	0	3,019	$41.36	15.7	-$440	0.3
4	**New Attached Home** - Baseline: standard	37,067	1,440	34,657	1,440	I	$650	$0	15	2,409	0	2,409	$33.01	19.7	-$482	0.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Heat Recovery Ventilator

#	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	**Existing Pre-76 Single Detached Home -** Baseline: standard	100,309	2,160	93,789	2,160	I	$650	$0	15	6,520	0	6,520	$73.68	8.8	-$196	0.7
2	**Existing Pre-76 Attached Home -** Baseline: standard	54,343	1,440	50,811	1,440	I	$650	$0	15	3,532	0	3,532	$39.92	16.3	-$404	0.4
3	**New Single Detached Home -** Baseline: standard	73,792	2,880	68,996	2,880	I	$650	$0	15	4,796	0	4,796	$54.20	12.0	-$316	0.5
4	**New Attached Home** - Baseline: standard	56,224	1,440	52,569	1,440	I	$650	$0	15	3,655	0	3,655	$41.30	15.7	-$395	0.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Heat Recovery Ventilator

#	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	**Existing Pre-76 Single Detached Home -** Baseline: standard	78,417	2,160	73,320	2,160	I	$650	$0	15	5,097	0	5,097	$57.60	11.3	-$295	0.5
2	**Existing Pre-76 Attached Home -** Baseline: standard	40,937	1,440	38,276	1,440	I	$650	$0	15	2,661	0	2,661	$30.07	21.6	-$465	0.3
3	**New Single Detached Home -** Baseline: standard	58,825	2,880	55,002	2,880	I	$650	$0	15	3,824	0	3,824	$43.21	15.0	-$384	0.4
4	**New Attached Home** - Baseline: standard	43,912	1,440	41,057	1,440	I	$650	$0	15	2,854	0	2,854	$32.25	20.2	-$451	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Horizontal Axis Clothes Washer

	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	**Existing Pre-76 Single Detached Home -** Baseline: Standard Clotheswasher	22,967	300	18,988	150	I	$500	$0	14	3,978	150	4,128	$57.14	8.8	-$191	0.6
2	**Existing Pre-76 Attached Home -** Baseline: Standard Clotheswasher	19,066	226	15,785	113	I	$500	$0	14	3,281	113	3,394	$46.94	10.7	-$248	0.5
3	**New Single Detached Home -** Baseline: Standard Clotheswasher	22,546	259	18,638	130	I	$500	$0	14	3,908	130	4,037	$55.81	9.0	-$201	0.6
4	**New Attached Home -** Baseline: Standard Clotheswasher	18,717	195	15,494	98	I	$500	$0	14	3,223	98	3,320	$45.87	10.9	-$255	0.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Horizontal Axis Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,796	300	23,019	150	I	$500	$0	14	4,777	150	4,927	$56.61	8.8	-$136	0.7
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	22,033	226	18,258	113	I	$500	$0	14	3,775	113	3,888	$44.65	11.2	-$214	0.6
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	27,258	259	22,571	130	I	$500	$0	14	4,688	130	4,817	$55.25	9.0	-$147	0.7
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	21,607	195	17,902	98	I	$500	$0	14	3,705	98	3,802	$43.58	11.5	-$222	0.6

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Horizontal Axis Clothes Washer

	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	**Existing Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,813	300	18,889	150	I	$500	$0	14	3,925	150	4,075	$46.99	10.6	-$197	0.6
2	**Existing Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,859	226	14,812	113	I	$500	$0	14	3,047	113	3,160	$36.42	13.7	-$266	0.5
3	**New Single Detached Home - Region 1 -** Baseline: Standard Clotheswasher	22,395	259	18,540	130	I	$500	$0	14	3,855	130	3,984	$45.84	10.9	-$206	0.6
4	**New Attached Home - Region 1 -** Baseline: Standard Clotheswasher	17,531	195	14,538	98	I	$500	$0	14	2,992	98	3,090	$35.53	14.1	-$273	0.5

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Insulating Pool Cover

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	27,501	0	F	$350	$0	10	18,334	0	18,334	$251.18	1.4	$686	3.0
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	27,501	0	F	$350	$0	10	18,334	0	18,334	$251.18	1.4	$686	3.0

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Insulating Pool Cover

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	31,510	0	F	$350	$0	10	21,007	0	21,007	$237.38	1.5	$837	3.4
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	31,510	0	F	$350	$0	10	21,007	0	21,007	$237.38	1.5	$837	3.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Insulating Pool Cover

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	33,617	0	F	$350	$0	10	22,411	0	22,411	$253.25	1.4	$916	3.6
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	33,617	0	F	$350	$0	10	22,411	0	22,411	$253.25	1.4	$916	3.6

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Low-Flow Showerheads and Faucets

#	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	17,140	0	F	$25	$0	12	2,011	0	2,011	$27.55	0.9	$103	5.1
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	14,320	0	F	$25	$0	12	1,680	0	1,680	$23.02	1.1	$82	4.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Low-Flow Showerheads and Faucets

#	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	20,905	0	F	$25	$0	12	2,453	0	2,453	$27.71	0.9	$131	6.2
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	16,617	0	F	$25	$0	12	1,950	0	1,950	$22.03	1.1	$99	4.9

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Low-Flow Showerheads and Faucets

#	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	17,140	0	F	$25	$0	12	2,011	0	2,011	$22.72	1.1	$103	5.1
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	13,525	0	F	$25	$0	12	1,587	0	1,587	$17.93	1.4	$76	4.0

** *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*

Assumptions:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: R2000 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	46,442	2,880	32,509	2,016	I	$6,500	$0	30	13,932	864	14,796	$206.08	31.5	-$4,998	0.2
2	**New Attached Home -** Baseline: Current Average House Construction	37,067	1,440	25,947	1,008	I	$6,500	$0	30	11,120	432	11,552	$159.95	40.6	-$5,378	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: R2000 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	73,792	2,880	51,654	2,016	I	$6,500	$0	30	22,138	864	23,002	$265.36	24.5	-$6,423	0.0
2	**New Attached Home -** Baseline: Current Average House Construction	56,224	1,440	39,357	1,008	I	$6,500	$0	30	16,867	432	17,299	$198.20	32.8	-$6,461	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: R2000 Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	58,825	2,880	41,178	2,016	I	$6,500	$0	30	17,648	864	18,512	$214.62	30.3	-$4,685	0.3
2	**New Attached Home -** Baseline: Current Average House Construction	43,912	1,440	30,738	1,008	I	$6,500	$0	30	13,173	432	13,605	$156.46	41.5	-$5,204	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Range Fuel Choice

#	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,114	7,786	0	I	$150	$0	18	-7,786	3,114	-4,672	-$51.85	-2.9	$27	1.0
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,535	6,338	0	I	$150	$0	18	-6,338	2,535	-3,803	-$42.21	-3.6	-$6	1.0
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,039	7,598	0	I	$0	$0	18	-7,598	3,039	-4,559	-$50.60	0.0	$172	1.3
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,474	6,185	0	I	$0	$0	18	-6,185	2,474	-3,711	-$41.19	0.0	$140	1.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Range Fuel Choice

#	Measure Description	Baseline Energy Use (MJ/yr)		Upgrade Energy Use (MJ/yr)		Measure Capital & Installation Cost F = full I=Incremental		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,796	9,489	0	I	$150	$0	18	-9,489	3,796	-5,693	-$40.42	-3.7	$58	1.1
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,944	7,360	0	I	$150	$0	18	-7,360	2,944	-4,416	-$31.35	-4.8	$11	1.0
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,704	9,260	0	I	$0	$0	18	-9,260	3,704	-5,556	-$39.45	0.0	$203	1.3
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,873	7,182	0	I	$0	$0	18	-7,182	2,873	-4,309	-$30.60	0.0	$158	1.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Range Fuel Choice

#	Measure Description	Baseline Energy Use (MJ/yr)		Upgrade Energy Use (MJ/yr)		Measure Capital & Installation Cost F = full I=Incremental		O Incremental & 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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,114	7,786	0	I	$150	$0	18	-7,786	3,114	-4,672	-$33.17	-4.5	-$32	1.0
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency furnace	-	2,394	5,985	0	I	$150	$0	18	-5,985	2,394	-3,591	-$25.50	-5.9	-$59	0.9
3	**New Single Detached Home -** Baseline: Mid-efficiency furnace	-	3,039	7,598	0	I	$0	$0	18	-7,598	3,039	-4,559	-$32.37	0.0	$115	1.2
4	**New Attached Home -** Baseline: Mid-efficiency furnace	-	2,336	5,841	0	I	$0	$0	18	-5,841	2,336	-3,505	-$24.88	0.0	$89	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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Orphans Program

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	11,490	0	F	$500	$0	10	7,660	0	7,660	$104.94	4.8	-$67	0.9
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	16,000	-	9,600	0	F	$500	$0	10	6,400	0	6,400	$87.68	5.7	-$138	0.7

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Orphans Program

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	23,358	-	14,015	0	F	$500	$0	10	9,343	0	9,343	$105.58	4.7	$28	1.1
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	18,567	-	11,140	0	F	$500	$0	10	7,427	0	7,427	$83.92	6.0	-$80	0.8

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Orphans Program

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	19,150	-	11,490	0	F	$500	$0	10	7,660	0	7,660	$86.56	5.8	-$67	0.9
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	15,112	-	9,067	0	F	$500	$0	10	6,045	0	6,045	$68.30	7.3	-$158	0.7

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	22,918	0	I	$3,500	$0	10	22,918	0	22,918	$313.97	11.1	-$2,205	0.4
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	45,835	-	22,918	0	I	$3,500	$0	10	22,918	0	22,918	$313.97	11.1	-$2,205	0.4

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	26,259	0	I	$3,500	$0	10	26,259	0	26,259	$296.72	11.8	-$2,016	0.4
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	52,517	-	26,259	0	I	$3,500	$0	10	26,259	0	26,259	$296.72	11.8	-$2,016	0.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Solar Pool Heater

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	28,014	0	I	$3,500	$0	10	28,014	0	28,014	$316.56	11.1	-$1,917	0.5
2	**New Single Detached Home -** Baseline: Mid-efficiency pool heater	56,028	-	28,014	0	I	$3,500	$0	10	28,014	0	28,014	$316.56	11.1	-$1,917	0.5

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Vacuum Panel 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	**Existing Pre-76 Single Detached Home -** Baseline: Standard wall insulation	63,573	2,160	47,680	1,620	F	$9,300	$0	30	15,893	540	16,433	$227.24	40.9	-$7,719	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard wall insulation	37,814	1,440	28,361	1,080	F	$9,300	$0	30	9,454	360	9,814	$135.85	68.5	-$8,348	0.1
3	**New Single Detached Home -** Baseline: Standard construction and wall insulation	46,442	2,880	34,831	2,160	I	$9,300	$0	30	11,610	720	12,330	$171.73	54.2	-$8,048	0.1
4	**New Attached Home -** Baseline: Standard construction and wall insulation	37,067	1,440	27,800	1,080	I	$9,300	$0	30	9,267	360	9,627	$133.29	69.8	-$8,365	0.1

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Vacuum Panel 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	**Existing Pre-76 Single Detached Home -** Baseline: Standard wall insulation	100,309	2,160	75,232	1,620	F	$9,300	$0	30	25,077	540	25,617	$292.88	31.8	-$6,899	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Standard wall insulation	54,343	1,440	40,758	1,080	F	$9,300	$0	30	13,586	360	13,946	$159.86	58.2	-$7,979	0.1
3	**New Single Detached Home -** Baseline: Standard construction and wall insulation	73,792	2,880	55,344	2,160	I	$9,300	$0	30	18,448	720	19,168	$221.13	42.1	-$7,439	0.2
4	**New Attached Home -** Baseline: Standard construction and wall insulation	56,224	1,440	42,168	1,080	I	$9,300	$0	30	14,056	360	14,416	$165.17	56.3	-$7,937	0.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Vacuum Panel 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	**Existing Pre-76 Single Detached Home -** Baseline: Standard wall insulation	78,417	2,160	58,813	1,620	F	$9,300	$0	30	19,604	540	20,144	$231.03	40.3	-$7,399	0.2
2	**Existing Pre-76 Attached Home -** Baseline: Standard wall insulation	40,937	1,440	30,703	1,080	F	$9,300	$0	30	10,234	360	10,594	$121.98	76.2	-$8,286	0.1
3	**New Single Detached Home -** Baseline: Standard construction and wall insulation	58,825	2,880	44,119	2,160	I	$9,300	$0	30	14,706	720	15,426	$178.85	52.0	-$7,788	0.2
4	**New Attached Home -** Baseline: Standard construction and wall insulation	43,912	1,440	32,934	1,080	I	$9,300	$0	30	10,978	360	11,338	$130.39	71.3	-$8,220	0.1

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Wall 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	**Existing Pre-76 Single Detached Home -** Baseline: Average wall insulation levels	63,573	2,160	55,309	1,879	F	$2,500	$0	30	8,265	281	8,545	$118.17	21.2	-$1,678	0.3
2	**Existing Pre-76 Attached Home -** Baseline: Average wall insulation levels	37,814	1,440	32,898	1,253	F	$2,500	$0	30	4,916	187	5,103	$70.64	35.4	-$2,005	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Wall 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	**Existing Pre-76 Single Detached Home -** Baseline: Average wall insulation levels	100,309	2,160	87,269	1,879	F	$2,500	$0	30	13,040	281	13,321	$152.30	16.4	-$2,475	0.0
2	**Existing Pre-76 Attached Home -** Baseline: Average wall insulation levels	54,343	1,440	47,279	1,253	F	$2,500	$0	30	7,065	187	7,252	$83.13	30.1	-$2,483	0.0

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Wall 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	**Existing Pre-76 Single Detached Home -** Baseline: Average wall insulation levels	78,417	2,160	68,223	1,879	F	$2,500	$0	30	10,194	281	10,475	$120.14	20.8	-$1,512	0.4
2	**Existing Pre-76 Attached Home -** Baseline: Average wall insulation levels	40,937	1,440	35,615	1,253	F	$2,500	$0	30	5,322	187	5,509	$63.43	39.4	-$1,973	0.2

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Waste Water Heat Recovery

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	16,134	0	F	$625	$0	18	3,016	0	3,016	$41.32	15.1	-$395	0.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	13,480	0	F	$625	$0	18	2,520	0	2,520	$34.52	18.1	-$433	0.3
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	15,830	0	F	$625	$0	18	2,959	0	2,959	$40.54	15.4	-$399	0.4
4	**New Attached Home -** Baseline: standard construction	15,699	-	13,226	0	F	$625	$0	18	2,473	0	2,473	$33.87	18.5	-$436	0.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Waste Water Heat Recovery

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	19,679	0	F	$625	$0	18	3,679	0	3,679	$41.57	15.0	-$344	0.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	15,643	0	F	$625	$0	18	2,924	0	2,924	$33.04	18.9	-$402	0.4
3	**New Single Detached Home -** Baseline: standard construction	22,891	-	19,285	0	F	$625	$0	18	3,605	0	3,605	$40.74	15.3	-$350	0.4
4	**New Attached Home -** Baseline: standard construction	18,196	-	15,330	0	F	$625	$0	18	2,866	0	2,866	$32.38	19.3	-$406	0.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Waste Water Heat Recovery

	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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	16,134	0	F	$625	$0	18	3,016	0	3,016	$34.08	18.3	-$395	0.4
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	12,731	0	F	$625	$0	18	2,380	0	2,380	$26.89	23.2	-$443	0.3
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	15,830	0	F	$625	$0	18	2,959	0	2,959	$33.44	18.7	-$399	0.4
4	**New Attached Home -** Baseline: standard construction	14,827	-	12,492	0	F	$625	$0	18	2,335	0	2,335	$26.39	23.7	-$447	0.3

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW 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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	18,970	0	F	$4	$0	6	180	0	180	$2.47	1.6	$3	1.8
2	**Existing Pre-76 Attached Home -** Baseline: No action	16,000	-	15,820	0	F	$4	$0	6	180	0	180	$2.47	1.6	$3	1.8
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	18,610	0	F	$4	$0	6	180	0	180	$2.47	1.6	$3	1.8
4	**New Attached Home -** Baseline: standard construction	15,699	-	15,519	0	F	$4	$0	6	180	0	180	$2.47	1.6	$3	1.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW 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	**Existing Pre-76 Single Detached Home -** Baseline: No action	23,358	-	23,178	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8
2	**Existing Pre-76 Attached Home -** Baseline: No action	18,567	-	18,387	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8
3	**New Single Detached Home -** Baseline: standard construction	22,891	-	22,711	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8
4	**New Attached Home -** Baseline: standard construction	18,196	-	18,016	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW 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	**Existing Pre-76 Single Detached Home -** Baseline: No action	19,150	-	18,970	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8
2	**Existing Pre-76 Attached Home -** Baseline: No action	15,112	-	14,932	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8
3	**New Single Detached Home -** Baseline: standard construction	18,790	-	18,610	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8
4	**New Attached Home -** Baseline: standard construction	14,827	-	14,647	0	F	$4	$0	6	180	0	180	$2.03	2.0	$3	1.8

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Super High Performance Windows

	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	**Existing Pre-76 Single Detached Home -** Baseline 1: Current average installed windows	63,573	2,160	57,216	1,944	I	$5,000	$0	30	6,357	216	6,573	$90.90	55.0	-$4,368	0.1
2	**Existing Pre-76 Attached Home -** Baseline 1: Current average installed windows	37,814	1,440	34,033	1,296	I	$5,000	$0	30	3,781	144	3,925	$54.34	92.0	-$4,619	0.1
3	**New Single Detached Home -** Baseline 1: Low Efficiency	46,442	2,880	32,509	2,016	I	$5,000	$0	30	13,932	864	14,796	$172.64	29.0	-$3,500	0.3
4	**New Attached Home -** Baseline 1: Low Efficiency	37,067	1,440	25,947	1,008	I	$5,000	$0	30	11,120	432	11,552	$133.26	37.5	-$3,879	0.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Super High Performance Windows

	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	100,309	2,160	90,278	1,944	I	$5,000	$0	30	10,031	216	10,247	$117.15	42.7	-$4,040	0.2
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	54,343	1,440	48,909	1,296	I	$5,000	$0	30	5,434	144	5,578	$63.94	78.2	-$4,472	0.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	73,792	2,880	51,654	2,016	I	$5,000	$0	30	22,138	864	23,002	$265.36	18.8	-$2,766	0.4
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	56,224	1,440	39,357	1,008	I	$5,000	$0	30	16,867	432	17,299	$198.20	25.2	-$3,365	0.3

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Super High Performance Windows

	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	**Existing Single Detached Home - Region 1 -** Baseline 1: Current average installed windows	78,417	2,160	70,576	1,944	I	$5,000	$0	30	7,842	216	8,058	$92.41	54.1	-$4,240	0.2
2	**Existing Attached Home - Region 1 -** Baseline 1: Current average installed windows	40,937	1,440	36,844	1,296	I	$5,000	$0	30	4,094	144	4,238	$48.79	102.5	-$4,595	0.1
3	**New Single Detached Home - Region 1 -** Baseline 1: Low Efficiency	58,825	2,880	41,178	2,016	I	$5,000	$0	30	17,648	864	18,512	$214.62	23.3	-$3,168	0.4
4	**New Attached Home - Region 1 -** Baseline 1: Low Efficiency	43,912	1,440	30,738	1,008	I	$5,000	$0	30	13,173	432	13,605	$156.46	32.0	-$3,695	0.3

** *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:

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,533	19,150	0	I	$1,250	$0	10	-19,150	10,533	-8,618	-$76.98	-16.2	-$466	0.8
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	-	8,800	16,000	0	I	$1,250	$0	10	-16,000	8,800	-7,200	-$64.32	-19.4	-$595	0.7
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,334	18,790	0	I	$350	$0	10	-18,790	10,334	-8,455	-$75.54	-4.6	$419	1.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	-	8,634	15,699	0	I	$350	$0	10	-15,699	8,634	-7,064	-$63.11	-5.5	$293	1.2

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	-	12,847	23,358	0	I	$1,250	$0	10	-23,358	12,847	-10,511	-$37.84	-33.0	-$311	0.9
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	-	10,212	18,567	0	I	$1,250	$0	10	-18,567	10,212	-8,355	-$30.08	-41.6	-$504	0.8
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	-	12,590	22,891	0	I	$350	$0	10	-22,891	12,590	-10,301	-$37.08	-9.4	$570	1.3
4	**New Attached Home -** Baseline: Mid-efficiency water heater	-	10,008	18,196	0	I	$350	$0	10	-18,196	10,008	-8,188	-$29.48	-11.9	$381	1.3

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: DHW Fuel Choice

	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	**Existing Pre-76 Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,533	19,150	0	I	$1,250	$0	10	-19,150	10,533	-8,618	-$31.02	-40.3	-$608	0.7
2	**Existing Pre-76 Attached Home -** Baseline: Mid-efficiency water heater	-	8,311	15,112	0	I	$1,250	$0	10	-15,112	8,311	-6,800	-$24.48	-51.1	-$743	0.6
3	**New Single Detached Home -** Baseline: Mid-efficiency water heater	-	10,334	18,790	0	I	$350	$0	10	-18,790	10,334	-8,455	-$30.44	-11.5	$280	1.2
4	**New Attached Home -** Baseline: Mid-efficiency water heater	-	8,155	14,827	0	I	$350	$0	10	-14,827	8,155	-6,672	-$24.02	-14.6	$147	1.1

** *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:

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.014
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: EGNH80 (PS) Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	100,000	15,000	50,286	8,822	I	$4,836	$0	30	49,714	6,178	55,892	$789.81	6.1	$1,444	1.3
2	**New Attached Home -** Baseline: Current Average House Construction	37,067	5,000	30,569	3,390	I	$228	$0	30	6,498	1,610	8,108	$117.36	1.9	$831	4.6

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: EGNH80 (PS) Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	100,000	15,000	65,054	9,432	I	$3,606	$0	30	34,946	5,568	40,514	$492.89	7.3	$1,173	1.3
2	**New Attached Home -** Baseline: Current Average House Construction	56,224	5,000	51,827	3,313	I	$793	$0	30	4,397	1,687	6,084	$79.38	10.0	$101	1.1

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.018
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: EGNH80 (PS) Construction

	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	**New Single Detached Home -** Baseline: Current Average House Construction	100,000	15,000	60,046	8,040	I	$3,716	$0	30	39,954	6,960	46,914	$573.98	6.5	$1,767	1.5
2	**New Attached Home -** Baseline: Current Average House Construction	43,912	5,000	17,839	1,031	I	$3,157	$0	30	26,073	3,969	30,042	$364.48	8.7	$264	1.1

** *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*

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Resource Consultants Ltd.

APPENDIX B

Commercial Measures

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Increased Insulation For Flat Roofs

- Add Additional Roof Insulation to Existing Low Rise Commercial Buildings at Time of Roof 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)		
1	**Medium Commercial (78,500 m³/year)**	2,634,525	-	2,436,936	0	I	$140,000	$0	25	197,589	0	197,589	$2,331.55	60.0	-$123,253	0.1
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Increased Insulation For Flat Roofs

- Add Additional Roof Insulation to Existing Low Rise Commercial Buildings at Time of Roof 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)		
1	**Medium Commercial (78,500 m³/year)**	2,634,525	-	2,436,936	0	I	$140,000	$0	25	197,589	0	197,589	$2,114.21	66.2	-$123,253	0.1
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Increased Insulation For Flat Roofs

- Add Additional Roof Insulation to Existing Low Rise Commercial Buildings at Time of Roof 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)		
1	**Medium Commercial (78,500 m³/year)**	2,634,525	-	2,436,936	0	I	$140,000	$0	25	197,589	0	197,589	$2,133.97	65.6	-$123,253	0.1
2															$0	
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazings (Existing)

- Replacing Glazing in High WWR Buildings with HP Glazing at Time of Replacement in Existing Buildings

	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	**Existing Large Commercial (193,000 m³/year) *Upgrade 1 Double low e-+ argon + Ins spacer - Uvalue 0.36 (R2.8)***	6,497,750	-	6,042,908	0	I	$100,000	$0	25	454,843	0	454,843	$5,367.14	18.6	-$61,449	0.4
2	**Existing Large Commercial (193,000) m³/year) *Upgrade 2 HIT window Uvalue 0.25 (R4)***	6,497,750	-	5,523,088	0	I	$320,000	$0	25	974,663	0	974,663	$11,501.02	27.8	-$237,390	0.3
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazings (Existing)

- Replacing Glazing in High WWR Buildings with HP Glazing at Time of Replacement in Existing Buildings

	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	**Existing Large Commercial (193,000 m³/year) *Upgrade 1 Double low e-+ argon + Ins spacer - Uvalue 0.36 (R2.8)***	6,497,750	-	6,042,908	0	I	$100,000	$0	25	454,843	0	454,843	$4,866.81	20.5	-$61,449	0.4
2	**Existing Large Commercial (193,000) m³/year) *Upgrade 2 HIT window Uvalue 0.25 (R4)***	6,497,750	-	5,523,088	0	I	$320,000	$0	25	974,663	0	974,663	$10,428.89	30.7	-$237,390	0.3
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazings (Existing)

- Replacing Glazing in High WWR Buildings with HP Glazing at Time of Replacement in Existing Buildings

	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	**Existing Large Commercial (193,000 m³/year) *Upgrade 1 Double low e-+ argon + Ins spacer - Uvalue 0.36 (R2.8)***	6,497,750	-	6,042,908	0	I	$100,000	$0	25	454,843	0	454,843	$4,912.30	20.4	-$61,449	0.4
2	**Existing Large Commercial (193,000) m³/year) *Upgrade 2 HIT window Uvalue 0.25 (R4)***	6,497,750	-	5,523,088	0	I	$320,000	$0	25	974,663	0	974,663	$10,526.36	30.4	-$237,390	0.3
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazing (New)

- HIT Windows Option as an Upgrade in High WWR Buildings for New Construction -

	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	**New Large Commercial (135,000 m³/year)** ***Upgrade 2 HIT window Uvalue 0.25 (R4)***	4,269,950	10,800,000	3,629,458	10,260,000	I	$160,000	$0	25	640,493	540,000	1,180,493	$15,927.81	10.0	$46,466	1.3
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazing (New)

- HIT Windows Option as an Upgrade in High WWR Buildings for New Construction -

	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	**New Large Commercial (135,000 m³/year)** ***Upgrade 2 HIT window Uvalue 0.25 (R4)***	4,269,950	10,800,000	3,629,458	10,260,000	I	$160,000	$0	25	640,493	540,000	1,180,493	$15,927.81	10.0	$45,313	1.3
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Glazing (New)

- HIT Windows Option as an Upgrade in High WWR Buildings for New Construction -

	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	**New Large Commercial (135,000 m³/year)** ***Upgrade 2 HIT window Uvalue 0.25 (R4)***	4,269,950	10,800,000	3,629,458	10,260,000	I	$160,000	$0	25	640,493	540,000	1,180,493	$15,927.81	10.0	$34,938	1.3
2															$0	
3	etc														$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

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Building Envelopes

- High Performance Building Envelopes for New Commercial Construction -

	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	**New Large Commercial (135,000 m³/year)** ***Upgrade 1 Gas Filled Panels to R30***	4,269,950	-	3,842,955	0	I	$120,000	$0	25	426,995	0	426,995	$5,038.54	23.8	-$83,809	0.3
2	**New Large Commercial (135,000 m³/year)** ***Upgrade 2 Vacuum Panel Insulation to R40***	4,269,950	-	3,757,556	0	I	$600,000	$0	25	512,394	0	512,394	$6,046.25	99.2	-$556,571	0.1
3																

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Building Envelopes

- High Performance Building Envelopes for New Commercial Construction -

	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	**New Large Commercial (135,000 m³/year)** ***Upgrade 1 Gas Filled Panels to R30***	4,269,950	-	3,842,955	0	I	$120,000	$0	25	426,995	0	426,995	$4,568.85	26.3	-$83,809	0.3
2	**New Large Commercial (135,000 m³/year)** ***Upgrade 2 Vacuum Panel Insulation to R40***	4,269,950	-	3,757,556	0	I	$600,000	$0	25	512,394	0	512,394	$5,482.62	109.4	-$556,571	0.1
3															$0	

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Performance Building Envelopes

- High Performance Building Envelopes for New Commercial Construction -

	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	**New Large Commercial (135,000 m³/year)** ***Upgrade 1 Gas Filled Panels to R30***	4,269,950	-	3,842,955	0	I	$120,000	$0	25	426,995	0	426,995	$4,611.55	26.0	-$83,809	0.3
2	**New Large Commercial (135,000 m³/year)** ***Upgrade 2 Vacuum Panel Insulation to R40***	4,269,950	-	3,757,556	0	I	$600,000	$0	25	512,394	0	512,394	$5,533.86	108.4	-$556,571	0.1
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 30% Below Current Practice

- New Building Construction 30% Below Current Practice -

#	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	**New Large Office (135,000 m³/year)**	5,012,550	13,536,000	3,508,785	11,505,600	I	$259,910	$0	25	1,503,765	2,030,400	3,534,165	$49,215.63	5.3	$439,741	2.7
2	**New Medium Office (50,000 m³/year)**	1,829,250	4,723,920	1,280,475	4,015,332	I	$94,850	$0	25	548,775	708,588	1,257,363	$17,458.66	5.4	$151,353	2.6
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 30% Below Current Practice

- New Building Construction 30% Below Current Practice -

#	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	**New Large Office (135,000 m³/year)**	5,012,550	13,536,000	3,508,785	11,505,600	I	$259,910	$0	25	1,503,765	2,030,400	3,534,165	$49,215.63	5.3	$435,406	2.7
2	**New Medium Office (50,000 m³/year)**	1,829,250	4,723,920	1,280,475	4,015,332	I	$94,850	$0	25	548,775	708,588	1,257,363	$17,458.66	5.4	$149,840	2.6
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 30% Below Current Practice

- New Building Construction 30% Below Current Practice -

#	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	**New Large Office (135,000 m³/year)**	5,012,550	13,536,000	3,508,785	11,505,600	I	$259,910	$0	25	1,503,765	2,030,400	3,534,165	$49,215.63	5.3	$396,393	2.7
2	**New Medium Office (50,000 m³/year)**	1,829,250	4,723,920	1,280,475	4,015,332	I	$94,850	$0	25	548,775	708,588	1,257,363	$17,458.66	5.4	$136,225	2.6
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 60% Below Current Practice

- Ultra High Performance New Building Construction 60% Below Current Practice -

	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	**New Large Office (135,000 m³/year)**	5,012,550	13,536,000	2,005,020	5,414,400	I	$1,000,000	$0	25	3,007,530	8,121,600	11,129,130	$161,373.65	6.2	$1,543,693	2.5
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 60% Below Current Practice

- Ultra High Performance New Building Construction 60% Below Current Practice -

	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	**New Large Office (135,000 m³/year)**	5,012,550	13,536,000	2,005,020	5,414,400	I	$1,000,000	$0	25	3,007,530	8,121,600	11,129,130	$161,373.65	6.2	$1,526,353	2.5
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: New Building Construction 60% Below Current Practice

- Ultra High Performance New Building Construction 60% Below Current Practice -

	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	**New Large Office (135,000 m³/year)**	5,012,550	13,536,000	2,005,020	5,414,400	I	$1,000,000	$0	25	3,007,530	8,121,600	11,129,130	$161,373.65	6.2	$1,370,300	2.5
2															$0	
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (Existing)

- Existing Standard Efficiency Atmospheric Boiler Replacement with High Efficiency and Condensing 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	**Large Commercial (193,000 m³/year)** ***Upgrade 1 High Efficiency Boiler 85% Et*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency boiler 85% Et (80% seasonal efficiency)	6,497,750	-	5,523,088	0	I	$44,900	$0	25	974,663	0	974,663	$11,501.02	3.9	$37,710	1.8
2	**Large Commercial (193,000 m³/year)** ***Upgrade 2 Condensing Boiler 94% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency condensing boiler 94% Et (89% seasonal efficiency)	6,497,750	-	4,964,573	0	I	$86,500	$0	25	1,533,177	0	1,533,177	$18,091.49	4.8	$43,449	1.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (Existing)

- Existing Standard Efficiency Atmospheric Boiler Replacement with High Efficiency and Condensing 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	**Large Commercial (193,000 m³/year)** ***Upgrade 1 High Efficiency Boiler 85% Et*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency boiler 85% Et (80% seasonal efficiency)	6,497,750	-	5,523,088	0	I	$44,900	$0	25	974,663	0	974,663	$10,428.89	4.3	$37,710	1.8
2	**Large Commercial (193,000 m³/year)** ***Upgrade 2 Condensing Boiler 94% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency condensing boiler 94% Et (89% seasonal efficiency)	6,497,750	-	4,964,573	0	I	$86,500	$0	25	1,533,177	0	1,533,177	$16,404.99	5.3	$43,449	1.5

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (Existing)

- Existing Standard Efficiency Atmospheric Boiler Replacement with High Efficiency and Condensing 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	**Large Commercial (193,000 m³/year)** ***Upgrade 1 High Efficiency Boiler 85% Et*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency boiler 85% Et (80% seasonal efficiency)	6,497,750	-	5,523,088	0	I	$44,900	$0	25	974,663	0	974,663	$10,526.36	4.3	$37,710	1.8
2	**Large Commercial (193,000 m³/year)** ***Upgrade 2 Condensing Boiler 94% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) - High efficiency condensing boiler 94% Et (89% seasonal efficiency)	6,497,750	-	4,964,573	0	I	$86,500	$0	25	1,533,177	0	1,533,177	$16,558.31	5.2	$43,449	1.5

** *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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (New)

- High Efficiency and Condensing Boiler Options for New Construction -

	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	**Large Commercial (135,000 m³/year)** ***Upgrade 1 High Efficiency Boiler 85% Et*** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency boiler 85% Et (80% seasonal efficiency)	4,269,950	-	3,629,458	0	I	$36,600	$0	25	640,493	0	640,493	$7,557.81	4.8	$17,687	1.5
2	**Large Commercial (135,000 m³/year)** ***Upgrade 2 Condensing Boiler 90% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency condensing boiler 94% Et (92% seasonal efficiency)	4,269,950	-	3,156,050	0	I	$69,200	$0	25	1,113,900	0	1,113,900	$13,144.02	5.3	$25,212	1.4

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (New)

- High Efficiency and Condensing Boiler Options for New Construction -

	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	**Large Commercial (135,000 m³/year)** ***Upgrade 1 High Efficiency Boiler 85% Et*** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency boiler 85% Et (81% seasonal efficiency)	4,269,950	-	3,584,649	0	I	$36,600	$0	25	685,301	0	685,301	$7,332.72	5.0	$21,485	1.6
2	**Large Commercial (135,000 m³/year)** ***Upgrade 2 Condensing Boiler 90% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency condensing boiler 94% Et (92% seasonal efficiency)	4,269,950	-	3,156,050	0	I	$69,200	$0	25	1,113,900	0	1,113,900	$11,918.73	5.8	$25,212	1.4

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Boilers (New)

- High Efficiency and Condensing Boiler Options for New Construction -

	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	**Large Commercial (135,000 m³/year)** ***Upgrade 1 High Efficiency Boiler 85% Et*** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency boiler 85% Et (81% seasonal efficiency)	4,269,950	-	3,584,649	0	I	$36,600	$0	25	685,301	0	685,301	$7,401.25	4.9	$21,485	1.6
2	**Large Commercial (135,000 m³/year)** ***Upgrade 2 Condensing Boiler 90% Et -*** Baseline boiler 80% Et (68% seasonal efficiency) High efficiency condensing boiler 94% Et (92% seasonal efficiency)	4,269,950	-	3,156,050	0	I	$69,200	$0	25	1,113,900	0	1,113,900	$12,030.12	5.8	$25,212	1.4

** *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*

Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Improved Building Operations

- Recommissioning and Next Generation BAS in Existing Buildings -

#	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	**Large Commercial (193,000 m³/year)** ***Upgrade 1 - Building Recommissioning***	6,497,750	10,800,000	5,523,088	9,180,000	F	$64,000	$0	10	974,663	1,620,000	2,594,663	$36,611.02	1.7	$278,044	5.3
2	**Large Commercial (193,000 m³/year)** ***Upgrade 2 - Next Generation BAS***	6,497,750	10,800,000	6,010,419	9,990,000	F	$80,000	$0	10	487,331	810,000	1,297,331	$18,305.51	4.4	$91,022	2.1
3																

Lower Mainland

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Improved Building Operations

- Recommissioning and Next Generation BAS in Existing Buildings

#	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	**Large Commercial (193,000 m³/year)** ***Upgrade 1 - Building Recommissioning***	6,497,750	10,800,000	5,523,088	9,180,000	F	$64,000	$0	10	974,663	1,620,000	2,594,663	$36,611.02	1.7	$275,870	5.3
2	**Large Commercial (193,000 m³/year)** ***Upgrade 2 - Next Generation BAS***	6,497,750	10,800,000	6,010,419	9,990,000	F	$80,000	$0	10	487,331	810,000	1,297,331	$18,305.51	4.4	$89,935	2.1
3															$0	

Interior

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Improved Building Operations

- Recommissioning and Next Generation BAS in Existing Buildings -

#	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	**Large Commercial (193,000 m³/year)** ***Upgrade 1 - Building Recommissioning***	6,497,750	10,800,000	5,523,088	9,180,000	F	$64,000	$0	10	974,663	1,620,000	2,594,663	$36,611.02	1.7	$256,303	5.3
2	**Large Commercial (193,000 m³/year)** ***Upgrade 2 - Next Generation BAS***	6,497,750	10,800,000	6,010,419	9,990,000	F	$80,000	$0	10	487,331	810,000	1,297,331	$18,305.51	4.4	$80,152	2.1
3	etc														$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Demand Controlled Ventilation

- Demand Controlled Ventilation for Existing Buildings -

	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)		
									15	0	0	0	$0.00	#DIV/0!	$0	#DIV/0!
										0	0	0	$0.00	#DIV/0!	$0	#DIV/0!

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Demand Controlled Ventilation

- Demand Controlled Ventilation for Existing Buildings -

	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)		
									15	0	0	0	$0.00	#DIV/0!	$0	#DIV/0!
										0	0	0	$0.00	#DIV/0!	$0	#DIV/0!
															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Demand Controlled Ventilation

- Demand Controlled Ventilation for Existing Buildings -

	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	**Large Commercial (193,000 m³/year)**	6,497,750	-	6,010,419	0	F	$5,850	$325	15	487,331	0	487,331	$5,425.51	1.1	$25,323	3.9
2	**Medium Commercial (78,500 m³/year)**	2,634,525	-	2,436,936	0	F	$9,600	$400	15	197,589	0	197,589	$1,931.55	5.0	$743	1.1
															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Modulating Rooftop Units

Existing Rooftop Heating Only Unit Replacement with High Efficiency Modulating Roof Top Units

	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Modulating RTU 83% Et*** - Baseline RTU 80% Et (70% seasonal efficiency) Modulating RTU 83% Et (80% seasonal efficiency)	1,159,200		1,037,400		I	$8,996	$0	20	121,800	0	121,800	$1,437.24	6.3	$606	1.1
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Modulating Rooftop Units

Existing Rooftop Heating Only Unit Replacement with High Efficiency Modulating Roof Top Units

	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Modulating RTU 83% Et*** - Baseline RTU 80% Et (70% seasonal efficiency) Modulating RTU 83% Et (80% seasonal efficiency)	1,134,000		957,600		I	$8,996	$0	20	176,400	0	176,400	$2,081.52	4.3	$4,911	1.5
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Modulating Rooftop Units

Existing Rooftop Heating Only Unit Replacement with High Efficiency Modulating Roof Top Units

	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Modulating RTU 83% Et*** - Baseline RTU 80% Et (70% seasonal efficiency) Modulating RTU 83% Et (80% seasonal efficiency)	1,360,800		1,134,000		I	$8,996	$0	20	226,800	0	226,800	$2,676.24	3.4	$8,884	2.0
2															$0	
3	etc														$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous DHW Heaters

- Instantaneous Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Instantaneous Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Instantaneous 80% Et	292,725	-	219,544	0	I	$2,100	$0	15	73,181	0	73,181	$863.54	2.4	$2,999	2.4
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous DHW Heaters

- Instantaneous Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Instantaneous Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Instantaneous 80% Et	292,725	-	219,544	0	I	$2,100	$0	15	73,181	0	73,181	$783.04	2.7	$2,999	2.4
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Instantaneous DHW Heaters

- Instantaneous Water Heaters for Medium Commercial DHW Use -

	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Instantaneous Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Instantaneous 80% Et	292,725	-	219,544	0	I	$2,100	$0	15	73,181	0	73,181	$790.36	2.7	$2,999	2.4
2															$0	
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Condensing DHW Boiler

- High Efficiency Condensing Boilers for Existing Customers with Large DHW Use -

	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	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Condensing DHW Boiler*** - Baseline boiler 75% Et - Condensing boiler 90% Et	7,426,000	-	6,188,333	0	I	$17,000	$0	25	1,237,667	0	1,237,667	$14,604.47	1.2	$87,902	6.2
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Condensing DHW Boiler

- High Efficiency Condensing Boilers for Existing Customers with Large DHW Use -

	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	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Condensing DHW Boiler*** - Baseline boiler 75% Et - Condensing boiler 90% Et	7,426,000	-	6,188,333	0	I	$17,000	$0	25	1,237,667	0	1,237,667	$13,243.03	1.3	$87,902	6.2
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: High Efficiency Condensing DHW Boiler

- High Efficiency Condensing Boilers for Existing Customers with Large DHW Use -

	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	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Condensing DHW Boiler*** - Baseline boiler 75% Et - Condensing boiler 90% Et	7,426,000	-	6,188,333	0	I	$17,000	$0	25	1,237,667	0	1,237,667	$13,366.80	1.3	$87,902	6.2
2															$0	
3	etc														$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: HE Condensing DHW Heaters

- Condensing Water Heaters for Medium Commercial DHW Use -

#	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Condensing Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Condensing DHW Heater 95% Et	292,725	-	184,879	0	I	$2,000	$0	10	107,846	0	107,846	$1,272.58	1.6	$4,093	3.0
2																
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: HE Condensing DHW Heaters

- Condensing Water Heaters for Medium Commercial DHW Use -

#	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Condensing Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Condensing DHW Heater 95% Et	292,725	-	184,879	0	I	$2,000	$0	10	107,846	0	107,846	$1,153.95	1.7	$4,093	3.0
2															$0	
3															$0	

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: HE Condensing DHW Heaters

- Condensing Water Heaters for Medium Commercial DHW Use -

#	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	**Medium Commercial (78,500 m³/year)** ***Upgrade 1 Condensing Water Heater*** - Baseline Induced-Draft Heater 0.6 Ef - Condensing DHW Heater 95% Et	292,725	-	184,879	0	I	$2,000	$0	10	107,846	0	107,846	$1,164.74	1.7	$4,093	3.0
2															$0	
3															$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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Pre-Rinse Spray Valve

- Pre-Rinse Spray Valve For Existing and New Restaurants and Kitchens

	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	**Existing Restaurant/Tavern** ***Upgrade 1 Pre-Rinse Spray Valve (Existing)*** - Baseline: 15 Lpm	57,000		27,672		F	$100	$0	10	29,328	0	29,328	$346.08	0.3	$1,557	16.6
2	**New Restarant/Tavern** ***Upgrade 1 Pre-Rinse Spray Valve (New)*** - Baseline: 15 Lpm	57,000		27,672		I	$65	$0	10	29,328	0	29,328	$346.08	0.2	$1,592	25.5
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Pre-Rinse Spray Valve

- Pre-Rinse Spray Valve For Existing and New Restaurants and Kitchens

	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	**Existing Restaurant/Tavern** ***Upgrade 1 Pre-Rinse Spray Valve (Existing)*** - Baseline: 15 Lpm	57,000		27,672		F	$100	$0	10	29,328	0	29,328	$313.81	0.3	$1,557	16.6
2	**New Restarant/Tavern** ***Upgrade 1 Pre-Rinse Spray Valve (New)*** - Baseline: 15 Lpm	57,000		27,672		I	$65	$0	10	29,328	0	29,328	$313.81	0.2	$1,592	25.5
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Pre-Rinse Spray Valve

- Pre-Rinse Spray Valve For Existing and New Restaurants and Kitchens

	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	**Existing Restaurant/Tavern** ***Upgrade 1 Pre-Rinse Spray Valve (Existing)*** - Baseline: 15 Lpm	57,000		27,672		F	$100	$0	10	29,328	0	29,328	$316.75	0.3	$1,557	16.6
2	**New Restarant/Tavern** ***Upgrade 1 Pre-Rinse Spray Valve (New)*** - Baseline: 15 Lpm	57,000		27,672		I	$65	$0	10	29,328	0	29,328	$316.75	0.2	$1,592	25.5
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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Drainwater Heat Recovery

Drainwater Heat Recovery for Laundries and Kitchens

	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	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Drainwater Heat Recovery (Existing Hotel Laundry)***	7,426,000	-	6,982,945	0	F	$21,000	$0	20	443,055	0	443,055	$5,228.05	4.0	$13,930	1.7
2	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Drainwater Heat Recovery (New Hotel Laundry)***	7,426,000	-	6,982,945	0	I	$17,500	$0	20	443,055	0	443,055	$5,228.05	3.3	$17,430	2.0
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Drainwater Heat Recovery

Drainwater Heat Recovery for Laundries and Kitchens

	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	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Drainwater Heat Recovery (Existing Hotel Laundry)***	7,426,000	-	6,982,945	0	F	$21,000	$0	20	443,055	0	443,055	$4,740.69	4.4	$13,930	1.7
2	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Drainwater Heat Recovery (New Hotel Laundry)***	7,426,000	-	6,982,945	0	I	$17,500	$0	20	443,055	0	443,055	$4,740.69	3.7	$17,430	2.0
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Drainwater Heat Recovery

Drainwater Heat Recovery for Laundries and Kitchens

	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	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Drainwater Heat Recovery (Existing Hotel Laundry)***	7,426,000	-	6,982,945	0	F	$21,000	$0	20	443,055	0	443,055	$4,784.99	4.4	$13,930	1.7
2	**Large Hotel (395,000 m³/year)** ***Upgrade 1 Drainwater Heat Recovery (New Hotel Laundry)***	7,426,000	-	6,982,945	0	I	$17,500	$0	20	443,055	0	443,055	$4,784.99	3.7	$17,430	2.0
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*

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Commercial Food Preparation

- Efficient Commercial Food Preparation Equipment -

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

	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	**Commercial Gas Range (160,000 kBtu/year)** Baseline gas range: 25 to 30% efficient - High efficiency product: 45 to 60%	168,766	-	88,401	0	I	$800	$0	10	80,365	0	80,365	$948.31	0.8	$3,741	5.7
2	**Commercial Gas Broiler (160,000 kBtu/year)** Baseline gas range: 20% efficient - High efficiency product: 30%	168,766	-	112,511	0	I	$200	$0	10	56,255	0	56,255	$663.81	0.3	$2,978	15.9
3	**Commercial Gas Fryers (75,000 kBtu/year)** Baseline gas range: 25 to 50% efficient - High efficiency product: 50 to 65%	79,109	-	56,507	0	I	$1,300	$0	10	22,603	0	22,603	$266.71	4.9	-$23	1.0

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Commercial Food Preparation

- Efficient Commercial Food Preparation Equipment -

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

	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	**Commercial Gas Range (160,000 kBtu/year)** Baseline gas range: 25 to 30% efficient - High efficiency product: 45 to 60%	168,766	-	88,401	0	I	$800	$0	10	80,365	0	80,365	$948.31	0.8	$3,741	5.7
2	**Commercial Gas Broiler (160,000 kBtu/year)** Baseline gas range: 20% efficient - High efficiency product: 30%	168,766	-	112,511	0	I	$200	$0	10	56,255	0	56,255	$663.81	0.3	$2,978	15.9
3	**Commercial Gas Fryers (75,000 kBtu/year)** Baseline gas range: 25 to 50% efficient - High efficiency product: 50 to 65%	79,109	-	56,507	0	I	$1,300	$0	10	22,603	0	22,603	$266.71	4.9	-$23	1.0

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Commercial Food Preparation

- Efficient Commercial Food Preparation Equipment -

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

	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	**Commercial Gas Range (160,000 kBtu/year)** Baseline gas range: 25 to 30% efficient - High efficiency product: 45 to 60%	168,766	-	88,401	0	I	$800	$0	10	80,365	0	80,365	$948.31	0.8	$3,741	5.7
2	**Commercial Gas Broiler (160,000 kBtu/year)** Baseline gas range: 20% efficient - High efficiency product: 30%	168,766	-	112,511	0	I	$200	$0	10	56,255	0	56,255	$663.81	0.3	$2,978	15.9
3	**Commercial Gas Fryers (75,000 kBtu/year)** Baseline gas range: 25 to 50% efficient - High efficiency product: 50 to 65%	79,109	-	56,507	0	I	$1,300	$0	10	22,603	0	22,603	$266.71	4.9	-$23	1.0

** *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	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - New Buildings

- Electric DHW to Natural Gas for New Small, Medium and Large Commercial Buidings

	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	**New Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$463.50	-0.4	$16,833	2.0
2	**New Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$571.30	-1.4	$15,609	1.9
3	**New Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		50,186	56,373	648	I	$2,300	$50	10	-56,373	49,538	-6,835	$52.63	43.7	$2,955	1.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - New Buildings

- Electric DHW to Natural Gas for New Small, Medium and Large Commercial Buiding

	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	**New Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$150.03	-1.3	$16,582	2.0
2	**New Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$249.30	-3.2	$15,359	1.9
3	**New Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		50,186	56,373	648	I	$2,300	$50	10	-56,373	49,538	-6,835	$114.64	20.1	$2,888	1.5

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - New Buildings

- Electric DHW to Natural Gas for New Small, Medium and Large Commercial Buidings

	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	**New Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$178.53	-1.1	$14,323	1.9
2	**New Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$278.57	-2.9	$13,113	1.8
3	**New Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		50,186	56,373	648	I	$2,300	$50	10	-56,373	49,538	-6,835	$109.01	21.1	$2,290	1.4

** *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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - Existing Buildings

- Electric DHW to Natural Gas for Existing Small, Medium and Large Commercial Buidings

	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	**Existing Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$463.50	-0.4	$16,833	2.0
2	**Existing Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$571.30	-1.4	$15,609	1.9
3	**Existing Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		79,660	89,481	648	I	$2,300	$50	10	-89,481	79,012	-10,469	$118.81	19.4	$6,306	1.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - Existing Buildings

- Electric DHW to Natural Gas for Existing Small, Medium and Large Commercial Buiding

	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	**Existing Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$150.03	-1.3	$16,582	2.0
2	**Existing Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$249.30	-3.2	$15,359	1.9
3	**Existing Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		79,660	89,481	648	I	$2,300	$50	10	-89,481	79,012	-10,469	$217.24	10.6	$6,200	1.8

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric DHW to Natural Gas - Existing Buildings

- Electric DHW to Natural Gas for Existing Small, Medium and Large Commercial Buidings

	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	**Existing Medium Office** ***Upgrade 1 Natural Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Natural Gas Water Heater EF 0.6		187,892	284,970	851	I	$200	$0	10	-284,970	187,042	-97,928	-$178.53	-1.1	$14,323	2.0
2	**Existing Medium Office** ***Upgrade 2 Multiple Natural Gas Water Heaters*** - Baseline: Four 50 USG Electric Water Heater EF 0.91 - Four Equivalent Natural Gas Water Heaters EF 0.6		187,892	292,725	1,902	I	$800	$0	10	-292,725	185,991	-106,734	-$278.57	-2.9	$13,113	1.9
3	**Existing Food Retail** ***Upgrade 3 Instantaneous Gas Water Heater*** - Baseline: 85 USG Electric Water Heater EF 0.91 - Equivalent Instantaneous Gas Water Heaters EF 0.81		79,660	89,481	648	I	$2,300	$50	10	-89,481	79,012	-10,469	$208.29	11.0	$5,245	1.8

** *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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**New Medium Hotel (93,000 m³/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	-$629.91	-515.9	-$196,643	0.5
2	**New Food Retail (74,500 m³/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	-$250.59	-87.1	$25,889	1.4
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Building

	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	**New Medium Hotel (93,000 m³/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	$491.43	661.3	-$198,351	0.5
2	**New Food Retail (74,500 m³/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	$260.56	83.8	$25,256	1.4
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**New Medium Hotel (93,000 m³/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	$389.49	834.4	-$213,722	0.5
2	**New Food Retail (74,500 m³/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	$214.10	101.9	$19,558	1.4
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*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.012
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - Existing Buildings

- Electric Space Heating to Natural gas for Existing Small, Medium and Large Commercial Buildings

	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	**Existing Medium Hotel** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		1,208,178	1,480,019	32,227	I	$390,000	$1,000	25	-1,480,019	1,175,951	-304,067	-$236.98	-1645.7	-$194,718	0.6
2	**Existing Food Retail** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		240,403	302,045	0	I	$21,825	$500	15	-302,045	240,403	-61,642	-$337.88	-64.6	$7,692	1.2
3																

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.026	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Building

	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	**New Medium Hotel (93,000 m^3/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	$491.43	661.3	-$198,351	0.5
2	**New Food Retail (74,500 m^3/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	$260.56	83.8	$25,256	1.4
3																

Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.024	$0.016
Natural Gas	$0.008	$0.011
Discount Rate	8.00%	

Financial & Economic Analysis - Energy Efficiency Measures

Measure Name: Electric Space Heating to Natural Gas - New Buildings

- Electric Space Heating to Natural gas for New Small, Medium and Large Commercial Buildings

	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	**New Medium Hotel (93,000 m^3/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Perimeter electric heating (98% efficiency) - Upgrade: high efficiency boiler 85% Et (80% seasonal efficiency)		832,164	1,019,401	32,227	I	$325,000	$1,000	25	-1,019,401	799,937	-219,464	$389.49	834.4	-$213,722	0.5
2	**New Food Retail (74,500 m^3/year)** ***Upgrade 1 Electric Space Heating to Natural Gas*** Baseline:Packaged Rooftop Units w/ electric heating (98% efficiency) - Upgrade: Equivalent Rooftop Units w/ gas heating 82% Et (78% seasonal efficiency)		369,851	464,684	0	I	$21,825	$500	15	-464,684	369,851	-94,833	$214.10	101.9	$19,558	1.4
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*

Appendix 10

DSM best practices

IndEco In association with B. Vernon & Associates

Canadian natural gas distribution utilities' best practices in demand side management

IndEco

&

B. Vernon & Associates

This document was prepared for Canadian Gas Association by IndEco Strategic Consulting Inc. and B. Vernon & Associates.

For additional information about this document, please contact:

IndEco Strategic Consulting Inc.
77 Mowat Avenue, Suite 412
Toronto, ON, Canada
M6K 3E3

Tel: 416 532-4333
E-mail: **info@indeco.com**

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Contents

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- Chuck Farmer, Union Gas Limited (chairman)
- Graeme Feltham, ATCO Gas
- Michael Brophy, Enbridge Gas Distribution Inc.
- Sylvain Audette, Société en Commandite Gaz Métro
- Kim Cooper, Manitoba Hydro
- Jacquie Kerr, SaskEnergy
- Mark Hartman, Terasen Gas Inc.

Sincere thanks are also extended to the many individuals, throughout these LDCs, that provided input to the data collection and interviewing process.

Executive summary

Canadian natural gas local distribution companies (LDCs) have long been active proponents of energy conservation both in their own utility operations, and, since the early 1990's in many cases, through formal initiatives to encourage their customers to utilize natural gas wisely.

Over time LDCs have developed a sophisticated approach to DSM, utilizing market research, engineering analysis and statistical modelling to identify and evaluate conservation and efficiency opportunities. Customers have come to value the subject matter expertise that LDCs have developed and to trust the utility's recommendations of measures that should be adopted.

This study examines DSM practices among the CGA's Canadian natural gas utility members between 2000 and 2004 and, based on the research conducted and the advice from these LDC DSM practitioners, identifies those practices that should be considered 'best in class'. Best in class is the concept of 'Best Practice' that is defined in this study as "documented strategies and tactics employed by successful organizations and programs" [1].

Study approach

To complete this study a team was formed by the Canadian Gas Association (CGA) under the auspices of members of CGA's DSM Task Force:

- Atco Gas (Atco)
- Enbridge Gas Distribution (also representing Enbridge Gas New Brunswick) (Enbridge)
- Société en Commandite Gaz Métro (Gaz Métro)
- Manitoba Hydro

[1] The definition of best practice that was adopted for this study was taken from the U.S. National Energy Efficiency Best Practices Study. Source: www.eebestpractices.com

- SaskEnergy (also representing Heritage Gas)
- Union Gas Limited (Union)
- Terasen Gas Inc. (also representing Terasen Gas Vancouver Island) (Terasen)

Financial support for the study has been provided by CGA member companies and by CGA under a Letter of Cooperation with Natural Resources Canada. This study forms part of a broader federal-provincial-industry (includes gas and electricity energy industries) DSM initiative that includes: DSM potential, regulatory frameworks, and monitoring / reporting.

The study team also includes IndEco Strategic Consulting Inc. of Toronto (as lead consultant) and B. Vernon & Associates of Vancouver. Work on the study was conducted between March and June 2005.

This report has been organized around core DSM activities and processes that have been identified by the study team. These are:

- Organization and management
- Program planning
- Program delivery
- Monitoring, verification and reporting

Methodology

The data requirements for this study were addressed in two phases: a quantitative phase comprised of a written request for information from the participating LDCs and a qualitative phase comprised of a series of face to face and telephone participant interviews.

The study team used two main criteria to select the best practices:

- **Actionable.** To be included as a best practice, the practice has to be practical and achievable by other LDCs.
- **Results Oriented.** Such practices must materially contribute to the objective of reducing customer energy use.

On examination it became clear that the suggested best practices were of two types:

- **Industry wide** - those that have already been adopted by four or more Canadian gas LDCs.

- **Leading edge** – those practices that are not in widespread use, i.e. by fewer than four Canadian gas LDCs.

This distinction does not suggest that leading edge best practices are in some sense more important than those that are characterized as industry wide. It suggests only that some practices are more broadly adopted than others and therefore, that some may be more difficult to adopt (because of cost or other barriers), or that the lack of adoption more broadly of some practices may be a reflection of the maturity of the DSM industry.

Findings – DSM organization and management

Organization and management of DSM is an important determinant of DSM success. Integration of DSM as a core business practice is key. Five best practices in DSM organization and management were identified:

- BP1 Integrate DSM throughout the company as a part of routine business practice (leading edge)

- BP2 Create a defined process for external stakeholder involvement in DSM outside of the formal regulatory process (leading edge)

- BP 3 Develop appropriate, effective shareholder performance incentives to motivate DSM excellence (leading edge)

- BP4 Instil a corporate culture of innovation (leading edge)

The leading edge best practices in DSM organization and management reflect the maturity of the DSM programs of these organizations and the ability of the regulatory environments to support them. It is anticipated that other natural gas utilities in Canada will adopt these leading edge best practices as their programs mature. Regulators need to be encouraged to continue to support and foster innovation in DSM organization and management in the utilities they regulate.

The CGA can play a role in supporting DSM innovation across Canada. Research and development into innovative technologies and the development and piloting of new programs can be resource intensive, potentially making it difficult for some of the smaller LDCs. There would be a benefit to having increased collaboration and information sharing among the Canadian natural gas companies with respect to R&D and program development. It would likely be more cost-effective and would avoid duplication of effort. The facilitation of such information sharing and collaboration is a potential role for the Canadian Gas Association.

Findings- DSM planning

Good planning is critical to successful DSM. The study team has identified five best practices in planning.

- BP5 Minimize planning uncertainty through multi-year approach (industry wide)
- BP6 Develop programs that minimize lost opportunities (industry wide)
- BP7 Design programs in collaboration with industry (leading edge)
- BP8 Assess market as part of program design (leading edge)
- BP9 Provide programs for 'hard to reach' customers (leading edge)
- BP10 Extend DSM efforts beyond natural gas conservation/ efficiency (leading edge)

While DSM planning has been one of the strengths within the industry, significant opportunities remain to achieve additional customer savings through new approaches to collaboration with industry, to composition of the DSM portfolio, and to understanding customer needs. Multi-year planning and budgeting of DSM increases the ability of LDCs to capture these significant opportunities.

The CGA could facilitate the sharing of information and best practices on DSM planning, among its members. Utilities should be encouraged by their regulators to cooperate with their electric utility counterparts on achieving net energy savings and efficient load building.

Findings – DSM program delivery

Canadian natural gas LDCs are experienced and effective deliverers of DSM programs. Program delivery is the only DSM activity directly seen by customers and prospective participants. The method of program delivery, how it is positioned and how it is branded helps determine the success of programs. Three existing best practices in program delivery were identified in this study.

- BP11 Deliver programs in partnership with other agencies and stakeholders (industry wide)
- BP12 Position LDC as a provider of unbiased energy solutions (industry wide)
- BP13 Brand DSM (leading edge)

Currently, LDCs approach the issue of partnerships on an independent basis, even though many of their potential partners are national in scope (e.g. retailers, appliance manufacturers). There is an opportunity for development of collaborative approaches to establish these types of partnerships. The CGA DSM taskforce could potentially act as a catalyst for this purpose.

Findings – DSM monitoring, evaluation and reporting

Monitoring and evaluating the results of DSM is essential to the continual improvement of these programs. DSM reporting has uses beyond regulatory compliance, including stakeholder buy-in and stimulating internal management support for DSM. The best practices identified with respect to monitoring, evaluation and reporting are:

- BP14 Ensure there is an effective feedback loop between monitoring & verification and program design (industry wide)
- BP15 Develop a formal methodology for verifying energy savings (industry wide)
- BP16 Create a concise annual report on DSM activities and results that is available and easily accessible to the public (leading edge)

While the cost-benefit tests used by various LDCs may be similar, the input assumptions often differ, making it hard to compare program results. The values used for input assumptions can also be a very contentious issue with stakeholders, particularly where there is a utility incentive.

There is value in having a consistent industry wide approach for determining the value of input assumptions to cost-benefit tests. The CGA DSM task group may be able to facilitate the development of this approach.

1 Introduction

1.1 Background to the Study

Canadian natural gas local distribution companies (LDCs) have long been active proponents of energy conservation both in their own utility operations, and, since the early 1990's in many cases, through formal initiatives to encourage their customers to utilize natural gas wisely.

Under the characterization of DSM (Demand Side Management) customer programs were designed and launched[2]. DSM was defined as any action that would affect customer demand, whether conservation and efficiency or load addition, although in general most LDCs and their regulators began to view DSM solely as a gas usage reduction exercise. Initial programs concentrated on consumer education and awareness with communication to customers about the types of measures that could be taken to reduce their consumption. Subsequent efforts looked at adding more direct ways of influencing customer actions, often with the provision of financial incentives. As DSM has matured, some utilities have added market transformation programs to their DSM program offerings.

Early success in helping to reduce customer demand for natural gas led to a view within LDCs that these demand side efforts could be an important offset to growing supply side requirements (and perhaps as a method of avoiding or delaying the need for certain utility distribution facility upgrades), and as a means of customer retention. More recently, DSM has found a following among customers as a way of reducing operating costs, dampening the effect of rising natural gas prices, improving competitiveness (in the case of commercial and industrial customers), and reducing emissions.

Over time LDCs have developed a sophisticated approach to DSM, utilizing market research, engineering analysis and statistical modelling to identify and evaluate conservation and efficiency opportunities. Customers have come to value the subject matter expertise that LDCs have developed and to trust the utility's recommendations of measures that should be adopted.

---

[2] Terasen's DSM activities are part of an Integrated Resource Planning framework. In Ontario, DSM was intended to be part of a similar IRP framework; however, the integration portion has yet to be determined by the Ontario Energy Board.

This has been a significant effort: since 2000, Canadian gas LDC customers have achieved 705 million m^3 (27 million GJ) in first year natural gas reductions directly attributable to gas utility efforts, enough energy to provide heat and hot water to about 222,000 Canadian single family dwellings. To achieve this, utilities across the country between 2000 and 2004 have spent $119 million on these efforts[3]. The total lifetime energy savings and benefits of these DSM initiatives are significantly greater.

In 2004, the CGA and NRCan signed a Letter of Cooperation on Energy Efficiency which provided a framework for enhanced collaboration and coordination with respect to conducting activities to further energy efficiency and renewable energy in Canada. The development and implementation of collaborative action under the LOC is executed through a federal-provincial-industry initiative which aims to create conditions favourable to accelerating EE/DSM activity in Canada. The identification of institutional barriers and information gaps and working towards their resolution is a key element of the federal-provincial-industry initiative, which also includes the electricity distribution sector. This report, consisting of primary research into the best practices in natural gas demand-side management, will augment the information on: EE/DSM potential in Canada; DSM regulatory frameworks; performance measurement and reporting; and best practices in EE/DSM, that is currently under development through the broader government-industry initiative.

This report presents the findings of a primary research project into DSM best practices among CGA's natural gas utility members across Canada.

1.2 Study Objectives

While LDC DSM efforts have increased each year since 2000 and significant progress has been made, there remains an imperative for additional customer energy reductions (to help meet the country's greenhouse gas reduction targets, for example, or specific utility regulated conservation targets). Toward this end, Canadian gas LDCs recognize the need to ensure their DSM practices are both current and optimized.

This study examines DSM practices among the CGA's Canadian natural gas utility members between 2000 and 2004 and, based on the research conducted and the advice from these LDC DSM practitioners, identifies

[3] This expenditure refers to the aggregate of the LDCs' DSM budgets, and excludes government, customer and other partner expenditures.

those that should be considered 'best in class'. Best in class is the concept of 'Best Practice' that is defined in this study as "documented strategies and tactics employed by successful organizations and programs. The objective is not, however, to identify best organizations or best programs; only to identify best practices that exist within organizations and programs" [4].

An ultimate objective of this work is to engage CGA member companies and other stakeholders in a discussion of how customer energy savings might be increased. The study terms of reference relate to energy efficiency and conservation and therefore, this work does not address in depth those activities of LDCs that might be described as fuel choice or fuel switching or load building, except to the extent that such activities may have an energy efficiency element.

1.3 Study Approach

This report is based on the results of Requests for Information (RFIs) to each of the Canadian gas LDCs actively pursuing DSM and a series of face to face and telephone interviews conducted with them, along with secondary research conducted by the study team. While DSM programs have been offered by several utilities over the last decade, most current programs have been in place for five years or less. To simplify the data collection and in recognition of the difficulty obtaining data for the entire program life, the focus of the data collection was on a five year period, from 2000 to 2004.

To complete this study a team was formed by the Canadian Gas Association (CGA) under the auspices of members of CGA's DSM Task Force:

- Atco Gas (Atco)
- Enbridge Gas Distribution (also representing Enbridge Gas New Brunswick) (Enbridge)
- Société en Commandite Gaz Métro (Gaz Métro)
- Manitoba Hydro

[4] The definition of best practice that was adopted for this study was taken from the U.S. National Energy Efficiency Best Practices Study. Source: www.eebestpractices.com

- SaskEnergy (also representing Heritage Gas)
- Union Gas Limited (Union)
- Terasen Gas Inc. (also representing Terasen Gas Vancouver Island) (Terasen)

Financial support for the study has been provided by CGA member companies and by CGA under a Letter of Cooperation with Natural Resources Canada. This study forms part of a broader federal-provincial-industry (includes gas and electricity energy industries) DSM initiative that includes: DSM potential, regulatory frameworks, and monitoring / reporting.

The study team also includes IndEco Strategic Consulting Inc. of Toronto (as lead consultant) and B. Vernon & Associates of Vancouver.

Work on the study, including preparation and response to the RFIs and the interviews, was conducted between March and June 2005.

1.4 Report Structure

This report has been organized around core DSM activities and processes that have been identified by the study team. Following a description of the historical perspective and current situation regarding natural gas DSM in Canada and a review of the methodology adopted by the study team for this work, this report examines these DSM core activities and processes:

- Organization and management
- Program planning
- Program delivery
- Monitoring, verification and reporting

In each case the report identifies and discusses those DSM practices that have been described as:

- Industry wide best practice (that have been adopted by four or more gas LDCs in Canada)

- Leading edge best practice (that have been less widely adopted in Canada)

An emphasis has been placed by the study team on those best practices (whether industry wide or leading edge) that are practical, useful, and suitable for adoption by others. The best practices are numbered, for easy reference only. The numbering is not indicative of either the relative priority or importance of each best practice.

2 State of natural gas DSM in Canada

This chapter presents a brief overview of the historical perspective and current state of demand side management (DSM) initiatives by natural gas utilities in Canada. It is important to set the context for the ensuing discussion of 'best practices' in DSM in chapters 4 through 7 by providing some background information on the companies, the environments in which they operate and their existing DSM efforts. This will help to provide a better understanding of the best practices that were selected and the rationale for the choices made.

2.1 Comparing natural gas companies

The companies included in this study are all unique organizations, with individual corporate structures, goals and policies. As seen below in Table 1, the companies vary with respect to their ownership, throughput and customer base. The majority of companies are investor-owned utilities, while Manitoba Hydro and SaskEnergy are crown corporations. The ownership structure may influence how a company implements and manages its DSM activities. For example, shareholder incentive mechanisms for DSM performance have not historically been made available to publicly owned natural gas utilities. However, vertically integrated LDCs, including crown corporations, may have the incentive of increased revenues where energy saved through DSM can be exported on the open market for a profit. Effective for 2005 in Ontario, however, a DSM incentive mechanism has been made available to all electric distribution companies, including those that are owned by municipalities or the province or the private sector.

Other important factors to consider when comparing DSM programs and results across utilities are the size of the utility (e.g. throughput of gas per year and number of customers) as well as the breakdown of customers by sector. For example, Gaz Métro has a significantly smaller proportion of residential customers in their total customer base, compared to the other utilities. This reflects the fact that electricity is the dominant residential heating fuel in Quebec. SaskEnergy's proportion of residential customers is also slightly lower than the other utilities, but not to the same extent as Gaz Métro. Having a smaller proportion of residential customers will 'skew' certain DSM performance metrics, such as 'DSM expenditures per customer' or 'energy savings per customer', when comparing companies.

Table 1 General characteristics of natural gas utilities in Canada (2004)

LDC	Owner	Annual throughput[1] $10^6 m^3$	10^6 GJ	Customers Total	Residential
Atco	Investor	4,937	187	906,550	92%
Enbridge	Investor	11,838	448	1,671,442	92%
Gaz Métro	Investor	5,312	201	158,527	66%
Manitoba Hydro	Crown	2,148	81	258,713	90%
SaskEnergy	Crown	3,827	145	326,985	82%
Terasen	Investor	6,035	229	885,200	90%
Union	Investor	14,135	535	1,223,584	91%

1. Based on RFI responses.

There are also significant differences among the provinces with respect to the provincial fuel mix available, the dominant residential heating fuel and the relative price of natural gas and electricity. The average residential tariffs for natural gas are quite similar across the companies, with the exception of SaskEnergy and Atco, which are somewhat lower due in part to low transportation and storage costs[5].

All of the above factors – size, ownership, customer base and provincial fuel issues - influence the objectives the companies have for pursuing DSM and the strategies that they adopt. For example, SaskEnergy voluntarily developed its DSM program as a customer service and customer retention initiative when natural gas prices rose in Saskatchewan. These types of influences will be discussed throughout the report.

2.2 Overview of company approaches to DSM

With the exception of Enbridge and Union, every company in this study is located in a different province, meaning that nearly all companies face different energy regulations and energy efficiency policies (Table 2). Enbridge, Gaz Métro, Terasen and Union all operate in a 'regulated-DSM' environment, where DSM is expected by the regulator, DSM plans are approved by provincial regulators and DSM is funded through ratepayers. SaskEnergy's expenditure on DSM program incentives is taken off of its dividend payment to the Provincial Government and is approved by the Crown Investment Corporation. While SaskEnergy's

[5] Residential average tariff rates range from 0.29 $/m3 to 0.42 $/m3.

DSM activities are not approved by an 'arms-length' regulator, as in Ontario, BC and Quebec, it is still considered 'regulated DSM' for the purposes of this study. Atco's EnergySense program is the only example of non-regulated DSM in this study, as it is conducted as a quasi 'non-utility' program. Table 2 summarizes the DSM regulatory environment of these companies.

Table 2 Regulatory environment of natural gas companies conducting DSM in Canada

LDC	DSM approval agency	DSM since
Atco	n/a	2002
Enbridge	Ontario Energy Board	1995
Gaz Métro	Régié de l'énergie Québec	2001
Manitoba Hydro	Manitoba Public Utilities Board	n/a
SaskEnergy	Crown Investment Corporation	2001
Terasen	British Columbia Utilities Commission	1997
Union	Ontario Energy Board	1997

The DSM regulatory environment influences the primary drivers for DSM, the programs that are selected for implementation and the preferred outcome of DSM activities. In jurisdictions with DSM regulated by an arms-length agency, the primary driver for DSM tends to be achieving cost effective energy savings. The Total Resource Cost (TRC) test is used to screen programs and to calculate total societal benefits from the programs. At SaskEnergy, on the other hand, the primary driver for its DSM program is residential customer satisfaction and retention. As such, programs are screened based on the cost and benefits to individual program participants (i.e. the Participant Cost Test).

Overall, natural gas DSM in Canada is a maturing enterprise. As seen in the Table 2 above, some utilities have a decade of experience delivering DSM programs while others have only a few years of experience. Additionally, some companies have focused their efforts to a single program or to a single customer sector, while others have developed a broad range of programs covering all sectors over time (discussed in more detail in section 2.3).

A brief description of each LDC's DSM program follows.

Atco

Atco's Energy Management Services department was formed in 2001, as a customer service and retention initiative in response to high energy prices. Soon after formation, Atco adopted the brand of EnergySense™ for its energy conservation and efficiency programs. Atco offers three areas of service within EnergySense: a customer toll free number for general energy efficiency advice; the residential EnerGuide for Houses program; and a commercial energy audit service. Apart from the toll free number, EnergySense's programs are delivered on a fee for service basis. EnergySense is funded jointly by Atco Gas and Atco Electric.

Enbridge

Enbridge has delivered DSM programs, regulated by the Ontario Energy Board, since 1995. Over the past decade, Enbridge's DSM programs have delivered approximately 1.8 billion m^3 in natural gas savings and net energy savings for customers of approximately $865 million[6]. Enbridge offers a comprehensive suite of cost effective programs to all sectors and customer types. The company is continuing to grow both the existing suite of programs and develop new program offerings to replace programs that have reached their sunset. Major new areas of focus include market transformation, lost opportunities and further enhancements around strategic partnerships.

Enbridge Gas New Brunswick provides natural gas distribution services in five areas of New Brunswick (Fredericton, Moncton, Oromocto, St.John and St.George). The company does not have a regulated DSM plan similar to other LDCs in the study, however it does offer rebates, in cooperation with NRCan, to natural gas customers who upgrade their heating system to (or build a new home with) an ENERGY STAR® natural gas furnace or boiler. The company also provides additional incentives for the installation of both central heat and hot-water natural gas systems[7].

Gaz Métro

Gaz Métro launched its DSM program in the spring of 2000. The company currently offers 20 DSM programs to its customers. More than 17,000 residential customers and more than 800 business customers have participated in Gaz Métro's programs to date. The company delivers three main types of DSM programs – awareness programs;

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[6] Enbridge Gas Distribution. 2006-2008 Demand Side Management Strategic Plan.

[7] http://www.amazingenergy.ca/rebates.php

replacement and acquisition programs for energy efficiency equipment; and feasibility study & implementation programs. Since inception, Gaz Métro's DSM portfolio has saved more than 47 million m^3 of natural gas.

Gaz Métro also supports energy conservation and efficiency through its Energy Efficiency Fund. Funded by a portion of the customers' share of the utility's productivity savings, the Energy Efficiency Fund's two priorities are low income programs and innovative technology programs.

Manitoba Hydro

Manitoba Hydro has been providing regulated DSM on the electric side since 1989. In 1999, Manitoba Hydro acquired Centra Gas. Since 2001, residential natural gas customers have received 'piggybacked natural gas savings' via customer service and cost recovery programs provided on the electric DSM side. Manitoba Hydro is currently in the conceptual stage of proposing a natural gas program to its local public utility board, but at the moment does not have any standalone natural gas DSM programs. The natural gas savings and DSM expenditures attributed to Manitoba Hydro in this report reflect the company's estimation of the portions of its existing electric DSM programs that are related to natural gas.

SaskEnergy

In July 2001, SaskEnergy, a crown corporation, began offering prime rate loans to encourage residential customers to use more energy efficient natural gas appliances. In 2002, Natural Resources Canada became a partner and the focus of the program was narrowed to ENERGY STAR® furnaces and boilers. Under the ENERGY STAR® loan program, customers are eligible for a prime rate loan from the TD Bank for the installation of an ENERGY STAR® high efficiency furnace. SaskEnergy, with funding support from NRCan, pays down the interest rate for the 5-year loan to prime rate. The program is delivered through the SaskEnergy Network of 135 natural gas retailers and contractors.

SaskEnergy also owns Heritage Gas, in Nova Scotia, along with Scotia Investments and AltaGas Services. Natural gas distribution has only been available very recently in the province. Heritage Gas has been providing natural gas distribution services since December 2003. The company does not have a regulated DSM plan similar to other LDCs in the study, however it is pursuing programs, in cooperation with NRCan and the Provincial Government, to encourage residential and commercial customers to convert to natural gas use and to install the highest efficiency equipment available when doing so. These programs have only recently been started and as such were outside of the period of scope for this report (2000 -2004).

Terasen

Terasen has been conducting DSM programs as part of its integrated resource planning efforts since the mid-1990's. The company has offered a variety of programs to its residential, commercial and institutional customers, including initiatives to encourage the installation of high efficiency furnaces, boilers, fireplaces and water heaters. During the period 2000 – 2004, Terasen customers reduced their annual demand by a cumulative 750,000 GJ as a result of the company's DSM programs.

In 2002, Terasen completed the acquisition of Centra's gas distribution business on Vancouver Island. Recently Terasen Gas Vancouver Island initiated a program in partnership with BC Hydro and NRCan to offer an incentive for the purchase of high efficiency heating systems combined with an incentive to install natural gas in new residential construction.

Union

Union has undertaken DSM activities, regulated by the Ontario Energy Board, since 1997. The company achieved more than 322 million m^3 of first-year energy savings from program inception through 2004, at an investment of more than $33 million. Union delivers a wide range of programs types (education, equipment replacement, building retrofit, new construction, audit etc) across all sectors – residential, commercial, industrial, and distribution contract customers. Union operated under a 5-year DSM plan from 1999 through 2004. Currently the company is developing a three year strategic plan (2006-2008) that is consistent with emerging energy policy direction in Ontario.

2.3 DSM activities 2000-2004

From 2000 through 2004, there was a total of 119 million dollars invested in DSM by natural gas utilities in Canada (Figure 1). Annual DSM expenditures have increased steadily over this period, with the total expenditure in 2004 ($30.9M) being nearly twice that of 2000 ($16.6M). This growth is due to both an increase in the number of companies participating in DSM over the time period, as well as an increase in DSM budgets within individual companies over the period (namely, ATCO, Enbridge and Gaz Métro).

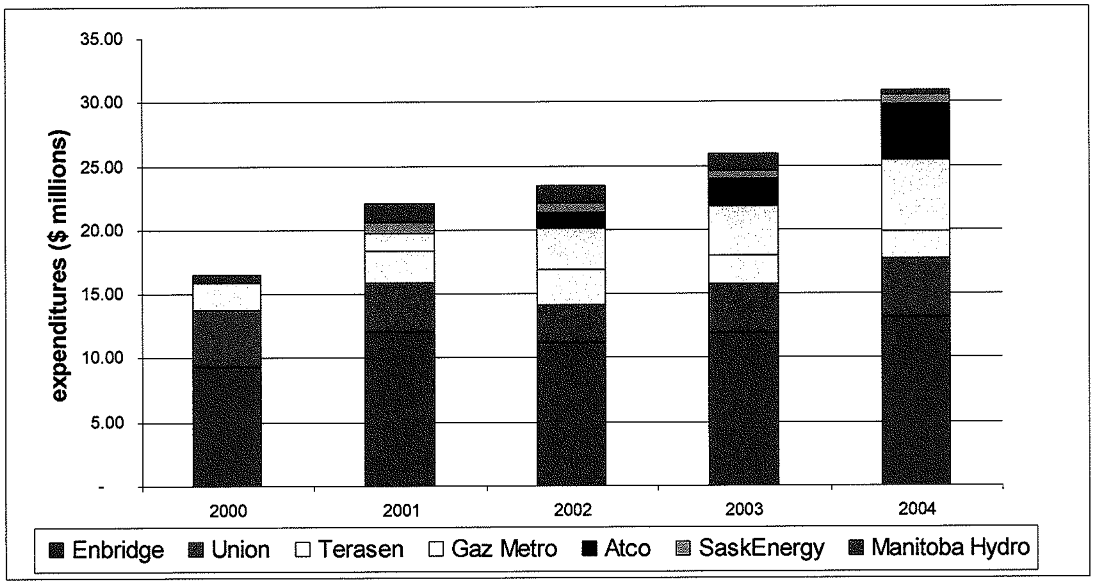

Figure 1 DSM expenditures by company (2000 - 2004)

The first-year annual energy savings from these DSM investments is summarized in Table 3. This table clearly illustrates that while annual DSM expenditures and energy savings have been increasing since 2000, the cost per cubic metre of natural gas savings has been very stable throughout the entire period.

Table 3 DSM expenditures and energy savings (2000-2004)

	2000	2001	2002	2003	2004
Number of utilities with DSM programs	4	6	7	7	7
LDC DSM expenditures (millions of $)	$ 16.6	$ 22.1	$ 23.4	$ 26.0	$ 30.9
Natural gas annual end-use savings from LDC DSM programs (millions of m^3/yr)	91.8	138.2	150.2	153.4	170.9
Cost per m^3	$ 0.18	$ 0.16	$ 0.16	$ 0.17	$ 0.18
Natural gas annual end-use savings from LDC DSM programs (millions of GJ/yr)	3.48	5.24	5.69	5.81	6.47
Cost per GJ	$ 4.76	$ 4.22	$ 4.12	$ 4.47	$ 4.78

In 2004, the natural gas distribution companies invested a total of more than 30 million dollars in DSM. Table 4, below, shows the 2004 DSM expenditure of each company and the percent of the company's gas revenue it represents (both including and excluding commodity costs). While the largest DSM budget is more than 15 times that of the smallest DSM expenditure, the percent of revenue that DSM expenditures represent is much more consistent across the companies, suggesting that much of the variance in DSM budgets is explained by variance in company size.

Table 4 2004 DSM expenditures, by company, as a proportion of revenue

LDC	DSM expenditure[1] ($ millions)	Total utility revenue ($ millions)	% of total utility revenue	Utility revenue less cost of gas ($ millions)	% of utility revenue less cost of gas
Atco	$ 4.30	1,550[2]	0.28%	407[2]	1.06%
Enbridge	$ 13.09	2,408[1]	0.54%	987[3]	1.33%
Gaz Métro	$ 5.55	1,783[4]	0.31%	555[4]	1.00%
Manitoba Hydro	$ 0.46	494[5]	0.09%	119[5]	0.39%
SaskEnergy	$ 0.73	317[6]	0.23%	167[1]	0.43%
Terasen	$ 2.20	1494[7]	0.15%	609[7]	0.36%
Union	$ 4.60	1,791[8]	0.26%	885[8]	0.52%

1. Based on RFI responses.
2. www.atcogas.com/Regulatory/03-04_AG_GRA/APPL_UPDATED/SCH_REV.xls
3. www.cgc.enbridge.com 2004 Annual Report.
4. http://www.gazmetro.com/english/surveiller/faits.htm
5. http://www.hydro.mb.ca/about_us/ar_2003/ar_2003_report.shtml
6. http://www.saskenergy.com/about_saskenergy/annual_report/2004AnnualReport.pdf
7. http://www.terasen.com/reports/2004/pdf/finanStatements.pdf
8. RP-2003-0063 Statement of utility income. http://www.oebdocs.oeb.gov.on.ca/pdf/Schedules_19March2004.pdf

As mentioned in the previous section, the portfolio of programs offered by each LDC differs. Figure 2 provides an overview of the types of programs offered by natural gas utilities in 2004. The programs have been categorized according to customer sector (residential, commercial/institutional or industrial), as well as by the type of measure that is the basis of the program (e.g. equipment replacement, education). It should be noted that the total number of 'check marks' does not necessarily represent the total number of programs for each LDC, as there may be several programs within one category or one program may cover several categories. The purpose of this table is to provide a snapshot of the LDCs' DSM portfolios.

All seven companies offer residential programs, five of them offer commercial/institutional programs and only three offer industrial programs. Equipment replacement (e.g. upgrading to a high efficiency furnace) is the most common type of residential program, while energy audits and feasibility studies are among the most common commercial/institutional program. Industrial programs are predominantly 'custom projects', where the specific energy efficiency measures installed are identified based on the individual needs of each customer.

	Atco	Enbridge*	Gaz Métro	Manitoba Hydro	SaskEnergy	Terasen	Union**
Residential							
Audit/assessment	✓	✓	✓	✓			
Building retrofit		✓		✓		✓	✓
Equipment replacement		✓	✓		✓	✓	✓
New construction - envelope		✓		✓			✓
New construction - equipment		✓	✓			✓	✓
Education				✓	✓		✓
Commercial/Institutional							
Audit/assessment	✓	✓	✓			✓	✓
Building retrofit		✓					✓
Equipment replacement		✓	✓			✓	✓
New construction - envelope		✓	✓				
New construction - equipment		✓	✓				✓
Custom projects		✓	✓				✓
Education		✓				✓	✓
Industrial							
Equipment replacement		✓	✓				
New construction - equipment			✓				
Custom projects		✓	✓				✓
Education		✓					✓

Figure 2 Types of DSM programs offered in 2004, by company

*BASED ON 2002 M&E REPORT
** BASED ON 2003 M&E REPORT

3 Methodology

3.1 Definition of best practice

At the initiation of the study, the following definition of best practice was adopted by the study team:

"The term 'Best Practice' refers to the business practice that, when compared to other business practices that are used to address a similar business process, produces superior results.

Best practices are documented strategies and tactics employed by successful organizations and programs. Note, however, that rarely is an organization or program "best-in-class" in every area. Our focus is not on identifying best programs or best organizations but, rather, best practices that exist within and across programs."[8]

3.2 Data collection

The data requirements for this study were addressed in two phases:

1. **Quantitative.** This consisted of a written Request for Information (RFI) issued by the study consultants to the seven (7)[9] participating LDCs. Additional materials provided by the participants (program summaries, reports) and identified by the consultants (information from other jurisdictions) was also collected in this phase.

2. **Qualitative.** This consisted of a series of face to face and telephone interviews conducted by the study consultants with the participating seven (7) LDCs. In addition to supplementing information included in the Phase 1 RFI responses, the interviews proved to be a useful mechanism to elicit candid views on which DSM practices have

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[8] Source: www.eebestpractices.com U.S. National Energy Efficiency Best Practices Study, December, 2004, Quantum Consulting Inc., for the California Best Practice Project Advisory Committee

[9] While seven CGA member LDCs participated directly, the responses from SaskEnergy, Enbridge, and Terasen also reflected the activities of Heritage Gas (Nova Scotia), Enbridge New Brunswick, and Terasen Gas Vancouver Island, respectively. Collectively this group of distribution utilities represents the majority of gas distribution (by volume) in Canada. Organizations not participating include the network of rural natural gas co-operatives in Alberta, Pacific Northern Gas of British Columbia and a small number of municipally-owned utilities in other provinces.

worked well within interviewee organizations, which have not worked well and recommendations they suggest for improvement.

The period under study is between 2000 and 2004 (5 years). This was done to simplify data collection and in recognition that while most DSM programs have been offered by several utilities over the last decade, most current programs have been in place for five years or less. An emphasis has been placed on recent activity. Annual data for some utilities are based on calendar year reporting (January through December). For other utilities it is based on a fiscal year beginning in April or October. It was anticipated from the outset that the quantitative data collected (revenues, costs, numbers of customer participants, and so forth) would be approximate in any case because of differing allocations of customers between sectors, categorization of costs and methods of determining energy savings. In addition, rather than providing simply a historical perspective, the study team also identified existing trends and potential future developments.

The study team acknowledges all LDC participants for their active and enthusiastic assistance in both the completion of the RFI responses and in the interview phase. A total of seven responses to the RFI were received and seven interviews were completed (100% of participants in each instance).

The Request for Information

The RFI was in two parts: Section 1 requested general information about LDC DSM activities, and Section 2 requested specific data about DSM programs. Table 5 and Table 6 summarize the categories and type of information collected in Part 1 and Part 2 of the RFI, respectively.

Section 2 of the RFI was completed by each participant for each major program on offer between 2000 and 2004. A total of 33 individual program responses were received.

Table 5 Categories and examples of data collected in RFI part 1

RFI section	Category	Examples	Comparative assessment (rationale)
1.1	Company & market	Revenues, customers, rates	LDC size, tariff rate impact
1.2	Resources, planning & results	DSM expenditures, energy savings	Cost effectiveness
1.3	Channel resources	Types of channel partners, tools	Techniques utilized
1.4	General information for customers	Communications tools	Techniques utilized
1.5	Portfolio and program screening	Tests deployed, pass/fail criteria	Degree of adoption
1.6	Stakeholder consultation	Type of input, influence	Stakeholder mechanisms
1.7	Performance indicators	Availability, type	Value of shareholder incentive
1.8	Emission reductions & electricity savings	Tracking, reporting methodology	Relative values
1.9	Reporting	Frequency, type	complexity

Table 6 Categories and examples of data collected in RFI part 2

RFI section	Category	Examples	Comparative assessment (rationale)
2.1	Market information	Program description, sector applicability	Program types
2.2	Marketing	Media, channels, incentives used	Techniques utilized
2.3	Expenditures	Marketing, promotion costs	Cost-effectiveness
2.4	Targets	Savings, number of participants	Planning effectiveness
2.6	Results	Savings, number of participants	Overall effectiveness

The interviews

Based on feedback received from the participants through the RFI, an interview was conducted by the consulting team with each participating LDC. Seven interviews were conducted. The interviews included sections on:

- Organization and management
- Planning
- Implementation and program delivery

- Tracking and verification
- Reporting

Participants were asked in each section to identify perceptions of their own best practices, challenges faced, and recommended changes.

Participants were also asked to identify exemplary programs that they have conducted, providing views on program rationale, key success factors, and advice they would give to others contemplating similar initiatives.

3.3 Limitations to data collected

While the responses to the information request were very complete in most respects, and the study team is appreciative of the significant time and effort applied to their completion, there are a few limitations that are worthy of note:

- Some responses to the RFI included program information in the aggregate (grouped by program type or sector) by virtue of the large number of programs offered during the study period. Although this is not a major concern (given that the objective of this study is not to provide a 'best program' determination), it has made calculation of certain program metrics problematic.
- Energy saving and cost data have been utilized on an 'as-provided' basis. Only a simple test of reasonableness has been applied to verify responses.
- Portions of the information received are unavailable or partially incomplete, most notably annual target data by program.
- Certain requested information received is not characterized the same way by each LDC. For example, the distinction between categories of commercial customers is not uniform across all LDCs. Therefore portions of the data do not allow for an 'apples to apples' comparison.

3.4 Identification of best practices

Criteria used by the study team to select the best from those practices that were described in the interview phase of the data collection are as follows:

- **Actionable.** To be included as a best practice, the practice has to be practical and achievable by other LDCs.

- **Results Oriented.** Such practices must materially contribute to the objective of reducing customer energy use.

On examination it became clear that the suggested best practices were of two types:

- **Industry wide** - those that have already been adopted by four or more Canadian gas LDCs.

- **Leading edge** – those practices that are not in widespread use, i.e. by fewer than four Canadian gas LDCs.

This distinction does not suggest that leading edge best practices are in some sense more important than those that are characterized as industry wide. It suggests only that some practices are more broadly adopted than others and therefore, that some may be more difficult to adopt (because of cost or other barriers), or that the lack of adoption more broadly of some practices may be a reflection of the maturity of the DSM industry.

One determinant of best practice is the relative performance (for example energy savings achieved per participant or DSM cost per customer) of utility DSM organizations and programs. This performance can be estimated by comparing data provided by LDCs in the RFI responses and linked to the practices of each LDC[10].

From a practical perspective, there are very consistent results among LDCs regarding the quantitative metrics and therefore these results offer little in the way of assistance in differentiating among practices. As well, it was not possible to quantitatively justify each selection. Therefore the study team has depended to a large degree on the professional judgment of the LDC participants and the consultants. In general, the practices that are included here are based on the notion that if generally adopted, the industry would benefit.

[10] A compilation of industry metrics was provided in chapter 2.

4 Organization and management

The category of DSM 'organization and management' refers to the corporate strategies, management structure and regulatory processes that provide a framework for DSM activities within a company, including:

- Corporate vision related to DSM
- Senior management level goals
- Scope/type of activities that are considered DSM
- Mandate and structure of DSM staff/group within the company
- Role of external stakeholders
- Nature of incentives to pursue DSM
- Nature of links with 'like-minded' organizations

4.1 *Industry overview*

The companies reviewed in this study started pursuing DSM for different reasons. In some cases, it was as a customer service response to rising natural gas prices; in other cases it was in response to regulatory requirements; and in others it was seen as a business opportunity. Today, all of the companies interviewed agree that DSM is a positive customer service tool and thus a business opportunity. There are differing views, however, on whether DSM is viewed as revenue-neutral or potentially profit-making. Three companies[11] – Gaz Métro, Enbridge and Terasen – had shareholder incentive mechanisms for at least one year during the study period. These mechanisms provided the opportunity for the generation of profit from DSM activities, based on TRC. In 2005, Enbridge and Terasen still have an incentive mechanism, however Gaz Métro does not. Union did not have an incentive mechanism during the years covered by this study, but recently received approval for one in 2005.

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[11] Gaz Metro had an incentive mechanism for 2003 and 2004. Both Enbridge and Terasen had incentive mechanisms through the entire period of the study (2000-2004).

All of the companies have in-house staff working on DSM, but the configuration within the organization and the size of the group varies. The DSM group is often located within the sales and marketing group or within the customer service group. Most of the companies surveyed also contract out some DSM work to contractors or consultants. Table 7 depicts the staffing and location within the organization of the DSM group.

Table 7 DSM structure within the utility, by company

	Staff (full time equivalents)	Location in organization
ATCO	22	Stand alone unit
Enbridge	26.5	Planning & evaluation; marketing; sales; energy technology
Gaz Métro	4	Marketing
Manitoba Hydro	5.14	Customer service
SaskEnergy	1.5	Marketing & sales
Terasen	3.6	Marketing & forecasting
Union	30	Sales & marketing/channel

When asked about existing challenges associated with DSM organization and management, several companies indicated that acquiring and/or allocating sufficient resources (both human and capital) for DSM programs is a challenge. One company suggested that there was a need to have senior management 'send down' the message of DSM throughout the company. On the topic of emerging opportunities, several utilities indicated that the introduction of incentive mechanisms (either shareholder mechanisms or employee performance incentives) represents a significant opportunity to improve DSM performance.

4.2 *Best practices*

Four best practices in DSM organization and management were identified:

- BP1 Integrate DSM throughout the company as a part of routine business practice
- BP2 Create a defined process for external stakeholder involvement in DSM outside of the formal regulatory process
- BP 3 Develop appropriate, effective shareholder performance incentives to motivate DSM excellence
- BP4 Instil a corporate culture of innovation

A detailed description of each best practice follows. The best practices are numbered, for easy reference only. The numbering is not indicative of either the relative priority or importance of each best practice.

BP1 Leading edge — Integrate DSM throughout the company as part of routine business practice

This best practice refers to the extent to which DSM is perceived and pursued as an on-going routine business activity of the company, rather than as a 'side-bar' or temporary activity. In practice, integration is not an absolute (i.e. suggesting a company's DSM is completely integrated or not). It is more useful to think of integration as a spectrum, where the characteristics of 'fully integrated' DSM would include the following:

- DSM is included as a senior management goal
- All employees are aware of the company's DSM programs and performance
- Sales staff promote DSM programs equally and jointly with load building, depending on customer needs
- DSM programs and/or resources are available to all customer segments
- DSM planning & delivery is integrated into all aspects of the company – finance, accounting, strategic planning, systems planning, marketing, sales, customer service
- DSM activities are included in both short- and long-term load forecasting
- There is a mix of market transformation, prescriptive measure, custom and education-based DSM programs, indicating that the company is striving for continual improvement in energy efficiency standards and creating opportunities for customers to save energy
- Company resources are mobilized effectively to optimize attainment of incentives for excellence in DSM
- Company receives the same or greater return on investment from DSM as from capital expenditures that are rate-based

No company in the study has completely integrated DSM throughout their organization and business practices, in the manner suggested above; however, some are significantly further along the spectrum than others. Enbridge and Union are among the most integrated and achieve this leading edge best practice.

Enbridge has staff working on DSM within four groups in its organization: planning & evaluation, marketing, sales and energy technology. The company ensures that all employees are aware of its DSM programs and performance through internal communications. Enbridge successfully mobilizes its resources within these groups to improve its DSM performance and attain its shareholder incentives.

At Union, there are team performance goals for DSM in the sales & marketing and channel departments which are tied to employees' bonuses. The weighting of DSM within these balanced scorecards has increased over time. Union has also embedded DSM as a sales tool with their front line sales staff.

Both companies view the role of sales as meeting the energy needs of the customer. DSM allows the companies to take a comprehensive approach to energy use within the customers' organizations.

Integrating DSM throughout the company is a 'best practice' for several reasons. It solidifies DSM as a core business activity which is pursued with the same effort and efficiency as other core business areas and helps to avoid different parts of the company working for goals contrary to DSM.

Additionally, it uses human and capital resources within the company more efficiently (e.g. two different sales people are not calling one customer) and leverages existing relationships that company staff have with customers (e.g. key account reps). Integrating DSM activities throughout a company makes DSM more sustainable within the corporation and helps it to become part of the company culture.

While the organizational and management structures vary between companies, integration of DSM as a core business practice is a tangible and appropriate goal for all natural gas companies. However, there clearly must be senior management support and a broad willingness to accept this type of integration.

BP2 Leading edge

Create a defined process for stakeholder involvement in DSM outside of the formal regulatory process

In cases where DSM plans are approved by an arms-length regulator (Terasen, Manitoba Hydro, Enbridge, Union & Gaz Métro), external stakeholders have an opportunity to provide input to DSM plans and programs, during the regulatory approvals process.

Three of these companies– Gaz Métro, Enbridge and Union – also have a defined process, which is used as a mechanism for involving external stakeholders outside of the formal regulatory process, and therefore have demonstrated a leading edge best practice. Stakeholders (representing industry groups, environmental groups, consumer groups, etc.) participate in a consultative on all aspects of DSM process (i.e. in program design, program selection, delivery, monitoring & evaluation). Gaz Métro's stakeholder consultative consists of stakeholders that represent environmental groups, residential sector, small/medium business and the municipal sector. Gaz Métro meets quarterly with the stakeholders to solicit input on its programs. Enbridge and Union's consultatives, consisting of the major stakeholders that participate in their rates cases (e.g. environmental groups, consumer groups, and industrial associations), meet at least quarterly with their stakeholder consultatives.

A defined process for involving stakeholders, outside of the regulatory process, is a 'best practice' since it:

- encourages input from stakeholders *early* in the planning process,
- leverages the utility's capabilities with respect to DSM planning, program design and monitoring & evaluation
- reduces the number of issues that must be adjudicated in formal regulatory hearings, as many, if not all, issues can be agreed upon in settlement agreements
- may lead to improved DSM program design and evaluation, based on feedback and input obtained
- provides opportunity to educate stakeholders about the benefits of DSM programs
- Improves buy-in and support from stakeholders

While there are many benefits to involving stakeholders through the DSM planning and implementation process, there may also be some limitations. Intense, frequent stakeholder consultation can be time consuming and there is no guarantee that an agreement among all parties will be achieved.

BP3 Leading edge — Develop appropriate, effective shareholder performance incentives to motivate DSM excellence

Another 'leading edge' best practice in natural gas DSM is the use of appropriate, effective shareholder performance incentives to motivate DSM excellence. From 2000 to 2004, three of the companies surveyed – Gaz Métro, Enbridge and Terasen – had a shareholder incentive mechanism available to them for at least one year, demonstrating this leading edge best practice. Of the three, Enbridge's has proven to be most successful with regard to motivating the utility toward excellence in DSM.

To be successful, an incentive mechanism needs to be designed in such a way that it provides a potential financial reward which is large enough to encourage the company to try to maximize/optimize its reward. Terasen has had a shareholder incentive mechanism since 1997, yet has never claimed a reward. In 2002, Terasen was eligible for a small incentive of less than $50,000. Because the amount was small, Terasen did not seek approval from the BCUC to obtain the incentive. At Enbridge, on the other hand, the shareholder incentive provides a potential incentive which is large enough to act as a 'carrot'. Enbridge has proposed refinements to its incentive mechanism to reflect the evolution of its DSM portfolio.

The effectiveness of the incentive mechanism depends on more than just the size of the potential reward. The mechanism must also be appropriate to the program results that are being targeted. For example, while most DSM programs strive to achieve direct energy savings, market transformation programs seek to increase the market share of energy efficient technologies, indirectly achieving energy savings. Enbridge has separate incentives for market transformation programs, in recognition of this intrinsic difference.

Having an appropriate, effective shareholder incentive mechanism is a best practice since it helps to integrate DSM as a core business activity by putting DSM on the same level as other profit-generating activities within the company. It encourages cost-effective investment in DSM.

There are several possible limitations to the use of shareholder incentive mechanisms. In the case of regulated DSM, the incentive mechanism will have to be approved by the regulator. This can be a time consuming and expensive process. Stakeholder opposition to the use of shareholder incentives may also be a limitation. Gaz Métro had a performance incentive for shareholders in 2003 and 2004, but it was recently taken away due to intervention by stakeholders. Another potential limitation is that when incentives are quite lucrative, there is likely to be increased involvement and scrutiny of stakeholders to ensure that the level of reward achieved is appropriate (e.g. greater emphasis on verification of energy savings).

BP4 Leading edge — Instil a corporate culture of innovation

The final best practice identified in the category of 'DSM organization and management' is having a corporate culture of innovation. It is a best practice since it encourages leadership and sustainability in DSM. For the purposes of this report, a corporate culture of innovation, with respect to DSM, includes:

- a commitment to research and development of new and alternative technologies
- development and implementation of new programs
- development and use of innovative strategies and mechanisms for improving DSM performance

Both Gaz Métro and Enbridge have a best practice in this category.

There is a need to invest in program development and technology research in order to keep identifying new opportunities for energy savings as market saturation is achieved from more mature programs or as energy efficiency standards transform marketplaces and eliminate the need for certain DSM programs. However, since R&D investments do not yield direct, immediate energy savings, companies may be dissuaded from investing significant amounts of the DSM budget in R&D as it may affect the overall cost-effectiveness of their DSM portfolio. This is not the case for Gaz Métro, however, where R&D into innovative technologies is funded through an Energy Efficiency Fund (EEF) that is separate from the 'regular' DSM budget. The research and feasibility studies funded through the EEF are not subject to the same cost-effectiveness tests as the equipment replacement and building retrofit programs.

There is also a need to develop and implement new programs. As DSM in the natural gas sector matures and markets are transformed, there will be less and less 'low hanging fruit'. A program can be 'new' with respect to the type of participant it targets, the energy savings measure or technology it promotes, the type of participant incentive that is offered or the manner in which the program is packaged and delivered. A successful pilot program can benefit not only the company that tests the pilot, but other utilities as well. For example, the EnerGuide for Houses program, which is promoted or delivered by several LDCs across Canada, was developed from a pilot program Enbridge delivered with the Green Communities Association. Enbridge was also the first company to develop a program for high efficiency furnaces with a variable speed motor.

4.3 Comments & recommendations

Organization and management of DSM is an important determinant of DSM success. Integration of DSM as a core business practice is key.

The leading edge best practices in DSM organization and management reflect the maturity of the DSM programs of these organizations and the ability of the regulatory environments to support them. It is anticipated that other natural gas utilities in Canada will adopt these leading edge best practices as their programs mature. Regulators need to be encouraged to continue to support and foster innovation in DSM organization and management in the utilities they regulate.

The CGA can play a role in supporting DSM innovation across Canada. Research and development into innovative technologies and the development and piloting of new programs can be resource intensive, potentially making it difficult for some of the smaller LDCs. There would be a benefit to having increased collaboration and information sharing among the Canadian natural gas companies with respect to R&D and program development. It would likely be more cost-effective and would avoid duplication of effort. The facilitation of such information sharing and collaboration is a potential role for the Canadian Gas Association.

5 Planning

DSM planning encompasses a range of activities and processes that may be necessary prior to launching an initiative or program, and may be expected to include:

- Market assessment
- Measure identification
- Stakeholder and partner negotiation
- Portfolio and program cost/benefit testing
- Detailed program design
- Marketing, sales and support activities
- Management approval

5.1 *Industry overview*

Given the imperatives of safety, reliability, and cost efficiency inherent in the delivery of natural gas, it should not come as a surprise that planning is seen as an important and necessary business process by Canadian gas LDCs. These utilities have well defined, sophisticated capabilities in this regard and have universally applied these skills in their DSM practice and programs.

The following common practices have been identified with respect to DSM planning:

- All of the LDCs included in this study engage in regular market research and have a quantified, documented understanding of their customer base and natural gas demand by sector and often, by sub-sector.
- Many of the LDCs have close relationships with certain market sectors; for example, through commercial sales departments (e.g. Terasen) and subject matter experts (e.g. Enbridge's steam boiler engineering capability).

- Most LDCs subject their proposed programs and program portfolios to industry-standard cost/benefit tests such as the Total Cost Resource (TRC) Test, and in some cases to the Societal Cost Test (SCT), Participant Cost Test (PCT), and Ratepayer Impact Measure (RIM) Test.

- All of the LDCs have well developed marketing campaign planning capability, either in-house or through an external agency or both.

- All LDCs, including those that are not regulated by an external regulatory agency, have a formal process for budget determination and program approval

In addition to these common practices, a number of trends and challenges in DSM planning have been identified.

Partnerships with non-utility entities are on the increase. Governments (e.g. Natural Resources Canada, the provincial governments of British Columbia and Nova Scotia), manufacturers (e.g. of water heaters, furnaces, boilers, fireplaces and infrared heaters), retailers (e.g. Home Depot working with Union and Terasen), financial institutions (e.g. the Toronto Dominion Bank finance plan offered through SaskEnergy) and equipment installers amongst others perceive value in working with utilities. The result is a proliferation of co-operative arrangements for financial support, marketing and delivery of DSM programs across the country. While this is generally viewed as very positive, the challenge for LDCs is in maintaining their direction and independence, while taking advantage of the opportunities for leverage through partnerships.

Maintaining or increasing program performance is also becoming more difficult over time. Enbridge advises that many of the easier, low cost opportunities for conservation and efficiency (i.e. the 'low hanging fruit') have been exhausted by the utility over the last ten years and that future DSM will be more costly on a unit basis. Union and Terasen note as well the negative impact of increasing free-ridership levels on program economics (reducing TRC net benefits) relative to when measures are first introduced. The challenge is to secure adequate resources to go beyond the harvesting of the 'low hanging fruit', into more difficult savings opportunities and to capture these opportunities in a practical and effective manner.

A challenge for DSM planning is that senior level support for DSM may not be in line with external aspirations for DSM (among certain governments and NGOs). Most LDCs (perhaps with the exception of Manitoba Hydro and Enbridge) do not have DSM as an explicit goal of senior management, listed on their performance scorecard.

5.2 *Best practices*

The study team has identified six best practices in planning. Two have been determined to be 'Industry Wide'; they have been observed in four or more LDCs; four are 'Leading Edge' and, hence, have not been adopted widely.

- BP5 Minimize planning uncertainty through multi-year approach
- BP6 Develop programs that minimize lost opportunities
- BP7 Design programs in collaboration with industry
- BP8 Assess market as part of program design
- BP9 Provide programs for 'hard to reach' customers
- BP10 Extend DSM efforts beyond natural gas conservation/efficiency

A detailed description of each best practice follows.

BP5 Industry wide — **Minimize planning uncertainty through a multi-year approach**

This 'Industry wide' best practice has become more common in recent years, but has not been adopted universally. Five of seven utilities are reporting a DSM planning horizon of three years or more. Manitoba Hydro has a 12yr plan (integrated with their electricity planning timeframe); Terasen has a 3 year plan (matching its Performance Based Regulation settlement timeframe); Union had a 5 year plan, and is now preparing a 3 year plan for 2006 - 2008; Enbridge is introducing a 3 year plan beginning 2006; and, Gaz Métro has a 3 year plan in place.

A planning horizon of more than one year more closely matches the requirements of utility customers – for example, the time required for adoption of measures by industrial, large commercial and institutional customers can easily be 2 or more years. With longer term plans, LDCs wishing to offer multi-year incentive-based programs do not have to incorporate provisions to cancel programs on short notice, allowing for more certainty (and therefore of more interest) for prospective customers. Longer terms are also much more suitable for market transformation programs.

Three year or longer planning periods provide utilities with a greater opportunity to do market research and program design before launching a particular program. An added advantage is that it often takes considerable time to design, pilot and roll-out a new program. A longer planning horizon allows for a smoother transition from pilot to roll-out. Some programs may have a useful life of several years – with a longer planning period and matching budget period, LDCs can continue to run such a program over an optimum time period to get economies of scale.

Longer planning timeframes can also allow a more strategic approach to planning and budgeting and allow for a portfolio of programs with differing durations. Certain costs such as those for R &D can be applied to programs over longer time periods. Similarly, administrative and personnel costs associated with planning may also be distributed over longer timeframes.

While, as outlined above, there are significant potential benefits for both the LDC and the customer, one limitation may be the potential to remove the time imperative ('act now before it's over') from a customer perspective if program availability is indefinite. Therefore even with a multi-year plan in place, LDCs may be well advised to incorporate some artificial time restrictions on certain programs.

Although not strictly speaking a limitation, multi-year planning and budgeting is most applicable to larger customer segment programming and to the development and launch of complex programs (multiple offers, partners, funding parties).

BP6 Industry wide — Develop programs that minimize lost opportunities

Although not in evidence in all jurisdictions, a number of LDCs have developed initiatives to address the new construction market to minimize lost opportunities for DSM. It is therefore considered an 'Industry wide' best practice.

New construction, while generally built to higher standards of efficiency than existing building stock, represents a long term lost opportunity if it is built to minimum current standard. For example, condensing gas furnaces are not required in any Canadian jurisdiction, yet are ideal in new construction: over the expected 20 year life of a mid efficiency unit (current minimum standard), a condensing furnace should yield between 10 and 15% energy savings.

LDCs that operate new construction DSM programs include: Union, Enbridge, Gaz Métro, and Terasen. Union's program is of note since it includes a comprehensive set of measures. Since 2000, Union has offered its Build Comfort Program. This program offers homebuilders a set of incentives bundled in discrete packages from which the homebuilder can choose (i.e. a window package, a basement package and a mechanical systems package).

Some LDCs (Gaz Métro; Terasen Vancouver Island) have incorporated energy efficiency measures as a component of strategic load building in markets not traditionally served by natural gas. Areas served by Gaz Métro and Terasen Gas Vancouver Island are examples of service territories that have lower than average market penetration of gas in the residential market. These LDCs provide builders with a combined incentive that includes both a 'new load' incentive and high efficiency furnace or boiler incentive. Terasen Gas Vancouver Island currently offers $1000 per home for participating new customers.

In general, programs that target new construction have lower unit energy savings potential than those that target retrofit applications, making them less interesting from a cost/benefit perspective. Yet new construction initiatives may offer the benefit of lower per unit acquisition costs (scale), ease of installation and administration.

Regulators and utility intervenors may perceive the application of utility DSM funds for the purpose of building 'efficient' new gas load to be controversial, particularly if fuel choice issues are involved (e.g. gas versus electricity). In the case of Vancouver Island, electricity supply is constrained which created a unique condition for the promotion of gas to a market that has traditionally been built with electric space and domestic hot water heat. In this instance the incentive offered to builders has been funded by Terasen Gas, BC Hydro and NRCan. Terasen is exploring other similar opportunities for collaboration with BC Hydro.

BP7
Leading edge

Programs are designed in collaboration with industry

This 'Leading Edge' practice is not widespread, but is worthy of consideration. In concept, industry partners (for example, heating contractors), participate with the LDC early in the program creation phase.

SaskEnergy's Industry Dialogue Table demonstrates this best practice. Many other LDCs consult with industry members on program design, though it is generally in a much less formal setting and often later in the design phase. SaskEnergy has formalized the process with quarterly meetings to develop products and services. The residential Industry Dialogue Group consists of:

- 3 Mechanical Contractor Association representatives
- 3 Natural Gas Appliance & Equipment Dealer representatives
- 3 Independents
- 3 SaskEnergy representatives

Programs are approved by the Industry Dialogue Table prior to launch by the utility. SaskEnergy advises they are currently establishing a second such group to address commercial sector initiatives.

Historically the process of involvement with industry and other partners occurs at a later stage, often after the program concept is well advanced and some form of industry and partner involvement is seen by the LDC as positive for marketing or financial reasons.

Very early involvement at the development of the program concept might be expected to yield more buy-in and a more appropriate set of measures reflecting local market conditions and greater participation rate/savings achieved by program participants. In some jurisdictions that have experienced friction with industry associations, often as intervenors in regulatory proceedings, this dialogue table concept may also act to help defray industry criticism of LDC decisions concerning DSM.

Early involvement in the concept planning stage will invariably limit flexibility on the part of the LDC. This approach may also lengthen the planning cycle for new programs (in SaskEnergy's case, the group meets at least four times a year[12]), and potentially could become unwieldy if large numbers of programs covering multiple market sectors are planned.

BP8 Leading edge — Assess market as part of program design

There appears to be a surprising lack of evidence of routine and detailed market assessment by LDCs before or during program design. Therefore, this best practice is considered 'Leading edge'.

[12] The Industry Table meets at a minimum 4 times per year. When working on new initiatives, the Table meets as often as necessary.

While all participating LDCs engage in market research in support of their utility activities, few include a market assessment during the process of program design. An exception is Gaz Métro which routinely completes both a formal market evaluation and a technical evaluation prior to the launch of any initiative and therefore demonstrates this best practice. The market evaluation is performed by the market research team within the marketing department and the technical evaluation by the research team within the engineering department.

A detailed market assessment would help determine applicability of the proposed measure(s) by sector, current measure costs and current market penetration, as well as prospective take-up.

Large scale programs are expensive to implement. Formal market assessments will help weed out programs having limited market interest and help 'tune' program designs (incentive levels, delivery methods, and advertising media).

The principal limitation is the extra cost that doing these market assessments routinely will entail. For example, customer focus groups for concept testing may cost several thousand dollars each, depending on the sector. With limited DSM budgets and an increasing focus on savings to be achieved, this additional effort may place a strain on the limited DSM resources available.

BP9 Leading edge — Provide programs for 'hard to reach' customers

DSM initiatives offered by LDCs may be prohibitively expensive or complex for certain customer groups, even though they may be excellent target markets in other respects. Included would be DSM programs for low-income, first-nation and other hard to reach consumers, such as those in remote communities. Few utilities are addressing these 'hard to reach' customers, making this a 'Leading edge' best practice. Gaz Métro has funded[13] a low-income energy conservation program since 2003, demonstrating this best practice.

Gaz Métro's low income program provides incentives and financing mechanisms for social housing building envelope retrofits. The program

[13]This funding results from a portion of the Gaz Métro utility productivity savings that would otherwise have been returned to ratepayers. While management of these funds and the EEF is independent of Gaz Métro, utility DSM staff act in an advisory capacity.

covers two-thirds of the total cost of the retrofit, while the remaining third is paid through zero-interest on-bill financing. Co-op housing units within the Quebec housing authority and non-profit organizations that service low-income and homeless people are eligible for the program.

Also of note, Enbridge, in partnership with Toronto Hydro, introduced its low income initiative in 2005 comprising an educational outreach program, and direct installation of energy efficiency measures. Gas saving measures include programmable thermostats, faucet aerators, water-heater pipe-wrap and low-flow showerheads.

These types of initiatives demonstrate leadership and add an element of balance to the LDC's portfolio of programs. In concept, they would increase equity & accessibility of DSM programs by providing DSM programs for customers that may otherwise be unable to access conservation and efficiency measures.

Programs of this type might be expected to be expensive, with the utility or other sponsoring entities having to contribute a disproportionate amount of the measure cost. In the case of Gaz Métro, these costs have been addressed through a novel regulatory agreement to utilize a portion of the ratepayers' LDC productivity savings rather than to reduce rates. Such programs may be difficult and costly to administer (for example, qualifying applicants on the basis of financial need). Gas utilities, historically, in Canada[14], have not considered 'hard to reach' customers a utility issue except from the point of view of providing gas service to new customers; this has been treated as a social issue.

BP10
Leading edge

DSM efforts extend beyond natural gas conservation/efficiency

The second 'leading edge' best practice in this category is the extension of DSM efforts beyond natural gas conservation and efficiency. This includes considering the *net* energy savings of a particular measure or program, not just natural gas savings. For example, when a natural gas furnace is upgraded, electricity use for the furnace fan can increase or decrease depending on the situation. This best practice also includes fuel switching programs which lead to a net energy use reduction.

Using an energy-based, rather than a fuel-based, approach to DSM is a best practice as it better reflects the total benefits and total costs of DSM

[14] Low income programs have been offered in the US by natural gas and electric utilities for more than 10 years.

programs and encourages the adoption of measures that are most beneficial to society, from a total energy perspective. Natural gas LDCs are currently viewed as an authoritative source on natural gas energy efficiency. This could be extended to other resources (e.g. electricity, water).

Enbridge has the leading best practice in this regard. Enbridge includes the avoided costs of water and electricity, in addition to the avoided costs of natural gas, when calculating the cost effectiveness of a DSM program. This approach better reflects the total program benefits for the participant. Also of note, ATCO and Terasen track the electricity savings from their natural gas DSM programs, however these savings are not included in the cost effectiveness testing. Conversely, but using the same approach, Manitoba Hydro estimates natural gas savings from its general customer service programs within its electric DSM portfolio.

None of the LDCs interviewed for this study had DSM programs that were exclusively fuel switching programs in the years 2000-2004, however several utilities indicated that they see these programs as a significant opportunity and are pursuing them. In Ontario, residential fuel switching programs have not historically been included in natural gas LDC's DSM portfolios, however electric LDC DSM was introduced in 2004 and the Minister of Energy is encouraging fuel switching. Both Enbridge and Union have indicated, in their recent filings with the Ontario Energy Board, that they will pursue fuel switching initiatives where appropriate. Terasen also views fuel switching as a significant opportunity and has entered into discussions with BC Hydro.

Depending on the jurisdiction, there may be regulatory/policy restrictions or incentives related to encouraging fuel switching.

5.3 Comments & recommendations

Good planning is critical to successful DSM. While DSM planning has been one of the strengths within the industry, significant opportunities remain to achieve additional customer savings through new approaches to collaboration with industry, to composition of the DSM portfolio, and to understanding customer needs. Multi-year planning and budgeting of DSM increases the ability of LDCs to capture these significant opportunities.

The CGA could facilitate the sharing of information and best practices on DSM planning, among its members. Utilities should be encouraged by their regulators to cooperate with their electric utility counterparts on achieving net energy savings and efficient load building.

6 Program delivery

DSM delivery includes those processes and activities that are necessary to bring programs and initiatives to prospective participants, including:

- Marketing and sales: outreach, advertising, media relations, web communications, direct sales, sales through third parties.

- Fulfillment: provision of incentives to participating customers, delivery and installation of measures.

- Administration of programs: customer enquiry, processing of applications, quality control.

- Partnerships: management of partners involved in marketing, sales, fulfillment, administration and program financing.

6.1 Industry overview

Early DSM programs were usually based on the promotion of specific measures to specific customer sectors. While such programs are still present, there has been a gradual evolution toward more complex programs with multiple partners and funding agencies.

The following common practices and trends were identified:

- Natural gas LDCs are proficient at and comfortable with the delivery of their DSM programs to their customers. Program delivery is customer-focused and efficient.

- More third parties are expressing interest in assisting with gas utility conservation and efficiency programs. These include federal government departments, provincial governments, municipalities, equipment and appliance manufacturers, distributors and retailers, as well as (to a modest extent) certain electrical utilities.

- Natural gas DSM is not the exclusive domain of gas LDCs: the increased amounts of funds being made available by governments and non-government agencies to promote DSM are being pursued by non-utility entities with earnest. An example in British Columbia would be Homeworks Inc., now a unit of a

British-based social marketing organization that has sought and received government funding to offer DSM programs in the province (gas, electricity and water).

The following issues were identified:

- The proliferation of agencies and organizations offering energy efficiency advice and/or programs has the potential to be confusing for customers. It also provides competition for LDC budgets and government funding. For example, Alberta's Climate Change Central offers provincial and federally funded DSM programs throughout the province; Atco Gas efforts are limited to delivering programs that produce revenue, such as the Energuide for Houses program. Quebec has taken a different approach with the recent establishment of the Energy Efficiency Fund with revenues from Gaz Métro ratepayers. In Ontario the government has reaffirmed its commitment to DSM delivery by the LDC, both on the natural gas and electricity side.

- Increased interest in conservation and efficiency and an increase in DSM funding, generally, presents an opportunity for leveraging and partnership by Canadian Gas LDCs.

- The challenge will be to continue to carve out an appropriate delivery role for the LDC that leverages and enhances non-LDC DSM in a way that optimizes the benefits to customers.

6.2 Best practices

The study team has identified three best practices in delivery of DSM: two are categorized as 'Industry wide' and one as 'leading edge'

- BP11 Deliver programs in partnership with other agencies and stakeholders

- BP12 Position LDC as a provider of unbiased energy solutions

- BP13 Brand DSM

A detailed description of each best practice follows.

BP11 Industry wide — Deliver programs in partnership with other agencies and stakeholders

Canadian Gas LDCs without exception have embraced partnerships with enthusiasm. Therefore this is an 'Industry wide' best practice.

Partnerships have been formed with various entities and to varying degrees across the country. Agreements have been made to co-fund and co-market with government, equipment suppliers and service providers. There are numerous examples of this practice, such as EnerGuide for Houses; NRCan subsidized furnace and boiler upgrades; Commercial Building Incentive Program (CBIP) and NRCan Energy Retrofit Assistance (ERA) program, to name a few and as illustrated in the table below.

Table 8 Selected partnership examples

LDC	Partner	Program
Atco	Natural Resources Canada	EnerGuide for Houses
Enbridge	City of Toronto	'Spray n Save' (food services sector)
Gaz Métro	Certified heating contractors	ENERGY STAR® boilers (residential)
Manitoba Hydro	Manitoba Society of Seniors	W.I.S.E. (home energy checkups for seniors)
SaskEnergy	TD Bank	ENERGY STAR® furnace (low interest loans)
Terasen	BC Hydro	Variable speed motor (furnace incentive)
Union	Water heater manufacturers	Water heater procurement & setback

Partnering in program delivery is a best practice since it leverages utility capabilities, both financial (co-funding with governments and suppliers) and in increasing market reach (e.g. delivery of programs through trade channels: equipment specifiers, suppliers, retailers, installers and contractors).

Utilities should reasonably expect as a result of this partnering an improvement in cost performance, program quality and number of customer participants.

It is noted that to be effective partnering often requires identification of a champion in the prospective partner organization. As might be expected, adding one or more partners adds complexity in organization and communications and can result in longer lead times to develop and to implement programs.

BP12 Industry wide — Position LDC as provider of unbiased energy solutions

In recent years Canadian gas LDCs have reverted to the provision of distribution services and have ceased or spun off competitive downstream activities such as appliance sales and rentals. Most, albeit slowly perhaps, have begun to reposition themselves as unbiased sources of energy solutions and advice. This has been deemed to be an 'industry wide' best practice.

Because of this best practice, natural gas distribution organizations are typically being seen by their customers as not having a bias toward specific conservation and efficiency solutions nor toward specific equipment suppliers or service providers. This is consistent with fact that many utilities are now moving from only offering 'prescriptive measures' programs to including programs that offer incentives based on savings, not on technologies (e.g. choose from a suite of options (EGH program); industry custom programs).

Distribution utilities are generally not perceived to be fuel neutral from a corporate perspective (except, perhaps, in the case of a combined utility). However, being a provider of unbiased natural gas energy solutions is a best practice because the perception of being neutral enhances the credibility of the measures and the offer presented to the customer by the utility.

This neutral positioning can produce positive perceptions of the service being offered to customers, will increase customer trust in the utility and uptake in the program. It also has the advantage of reducing the degree of 'sell' required. As well, it is consistent with DSM efforts that are screened and in some cases rewarded, based on the level of net societal benefits produced. Five of the seven LDCs participating in this study (Enbridge, Gaz Métro, Manitoba Hydro, Terasen and Union) screen programs based on SCT or TRC, and three (Terasen, Gaz Métro, Enbridge) have or had incentives based on the TRC.

Increasing partnerships, for example, with a limited number of equipment suppliers or service providers, may erode this perception of utility neutrality. The partnerships also present a market entry barrier to new contractors/equipment suppliers/ measures.

BP13 Leading edge — Brand DSM

While there are several examples of individual program branding, there are relatively few Canadian 'umbrella' DSM brands in evidence except for two LDCs: Atco and Manitoba Hydro. As a result, these companies demonstrate a 'leading edge' best practice.

Atco organizes its programs under the brand 'EnergySense' and Manitoba Hydro is extending its 'Power Smart' brand to its natural gas program activities. 'Leveraging the Power Smart brand' is one of 11 key strategies in Manitoba Hydro's 2005-2017 Power Smart Plan. In the Plan, the company "recognizes that having an identifiable, trusted and positive brand image adds value to a product or service". Manitoba Hydro has seen the positive impact that branding has had on customer recognition of their electric DSM programs. As of March 2004[15],

- 89% of all Manitoba Hydro customers are aware of the Manitoba Hydro Power Smart brand; and
- 79% of all Manitoba Hydro customers believe that Manitoba Hydro encourages or strongly encourages energy efficiency.

Manitoba Hydro's Plan indicates that they will build on the success of the Power Smart brand through its electric and natural gas DSM activities.

In concept, this practice presents DSM as a branded product which can be readily identified by customers and interpreted to mean conservation and efficiency. This is not to suggest that branding individual programs is inappropriate: if an umbrella brand cannot be created or promoted then most brand marketers would argue that a sub-brand is likely to be better than none.

An appropriate brand can help crystallize customer perceptions of conservation and efficiency offered by the LDC. A brand is often defined as a promise, and in this instance, should convey the nature of that promise to its customers.

A brand can increase the effectiveness of the marketing message and proposition to the customer. It can add 'instant credibility' to new programs as there is immediate recognition that it is related to the other

[15] Manitoba Hydro 2005-17 PowerSmart Plan.

programs. Branding can help cut through market clutter of energy efficiency programs and set these programs apart from others.

A brand name has customer recognition value. Therefore it has value as a marketing tool and for delivering a positive public message– for customers that have participated in DSM programs in the past and those considering participation in future. Recognition also sends a positive message to external and internal stakeholders that the company is actively pursuing DSM.

The biggest drawback is the cost of developing and communicating the brand. It also needs to be complementary to the utility's overall branding.

6.3 Comments & recommendations

Canadian natural gas LDCs are experienced and effective deliverers of DSM programs. Program delivery is the only DSM activity directly seen by customers and prospective participants. The method of program delivery, how it is positioned and how it is branded helps determine the success of programs.

Currently, LDCs approach the issue of partnerships on an independent basis, even though many of their potential partners are national in scope (e.g. retailers, appliance manufacturers). There is an opportunity for development of collaborative approaches to establish these types of partnerships. The CGA DSM taskforce could potentially act as a catalyst for this purpose.

7 Monitoring, evaluation and reporting

This chapter includes a discussion of the current industry practices and the best practices in the monitoring, verification and reporting of DSM programs and activities. Monitoring refers to the tracking of program results (e.g. energy savings, number of participants) while verification refers to the processes used to confirm that the monitored and calculated results are accurate. Reporting includes internal, regulatory and public reports on DSM program results.

7.1 Industry overview

All of companies reviewed in this study have established systems in place for monitoring and evaluating the success of their DSM programs. The level of detail included in these monitoring and evaluation systems varies among the LDCs. There tends to be more focus on monitoring and evaluation in private companies with regulated DSM, as they are required to screen and evaluate programs using tests such as the Total Resource Cost test and are generally required to report the results of evaluations to the provincial regulator.

The components of these cost-benefit tests include variables where the value is determined based on direct monitoring (e.g. number of participants or number of measures installed) as well as variables where the assumed value is determined. Typical 'input assumptions' include measure cost, energy savings per measure (generally based on engineering estimates), measure life, and free-ridership.

Not all LDCs use the same input assumptions for the same types of programs, which makes comparisons of program success difficult. For example, SaskEnergy assumes a free-ridership of 0% for its ENERGY STAR® Loan program for high efficiency furnaces, while Union assumes a free-ridership of 60% for its high efficiency furnace replacement programs[16]. Four companies provided data in their RFIs on the number of participants and total annual energy savings from high efficiency furnace replacement programs in 2004. Based on this data, the energy savings per participant for these programs ranged from 160 m^3 per year to just over 1000 m^3 per year.

[16] 2003 M&E Report, Appendix C.

While some variation of input assumptions is expected among companies due to differences between jurisdictions (market share of technology, housing stock, annual heating days, etc.), assumptions of free riders, free drivers, and the net efficiency gain - of the new versus old appliance - might be expected to account for much of the difference.

LDCs that have a performance incentive mechanism tend to face greater scrutiny from stakeholders regarding the methodology and input assumptions used to determine energy savings.

Reporting practices also vary among the companies. This is primarily a reflection of the fact that they are operating in different regulatory environments. Gaz Métro, Enbridge, Terasen and Union all report annually to their provincial regulators on DSM activities. All four companies report on program results – planned versus actual – as well as program expenditures. Total program benefits (TRC test), incentives earned and program evaluations are reported by most of the companies.

7.2 Best practices

The best practices identified with respect to monitoring, evaluation and reporting are:

- BP14 Ensure there is an effective feedback loop between monitoring & verification and program design
- BP15 Develop a formal methodology for verifying energy savings
- BP16 Create a concise annual report on DSM activities and results that is available and easily accessible to the public

A detailed description of each best practice follows.

BP14 Industry wide — **Ensure there is an effective feedback loop between monitoring & evaluation and program design**

Using monitoring and evaluation as an effective feedback mechanism for program design is a common best practice within the industry. Characteristics and examples of an effective feedback loop between monitoring and evaluation and program design include:

- The monitoring & evaluation strategy is developed as part of program design, rather than mid-way or at the end of program implementation. Manitoba Hydro is currently developing program designs for its new natural gas DSM programs. An evaluation plan is developed for each program as part of the design process.

- Feedback is sought from industry/channel partners on an ongoing basis to improve program design/delivery. This is common practice among the LDCs.

- There is frequent monitoring of program uptake and success throughout the implementation period, so that mid-course modifications can be made if necessary. Enbridge, for example, reviews program results and feedback monthly.

- Program designs are modified based on feedback. This is also common practice among the LDCs. For example, Gaz Métro discontinued delivering its energy efficiency kits program after monitoring revealed that the market for low-flow showerheads had been transformed.

This type of feedback loop is a best practice since it provides a mechanism for continual improvement of program design/delivery which will lead to improved results (e.g. energy savings achieved, cost efficiencies). It provides valuable information on how a program is performing and how it can be improved.

Developing a monitoring and verification plan during the program design phase is critical as it ensures that the success of the program can be effectively measured. Frequently monitoring and assessing the progress of programs is also a best practice as it allows for mid-course changes to the programs if needed.

BP15 Develop a formal methodology for verifying energy savings
Industry wide

Another industry wide best practice identified in this study was the use of a formal methodology for verifying energy savings. Having a formal methodology for estimating energy savings and program benefits is a best practice since it increases the validity of the estimated program results and makes for easier comparisons among companies and between programs.

The majority of LDCs surveyed estimate energy savings using engineering estimates for each measure. These estimates are normally based on an understanding of pre-existent conditions prior to the adoption of the measure together with an understanding of the likely impact of the measure. In the case where the measure is a more efficient appliance, such as a furnace or a boiler, an estimate of the efficiency level of the unit being replaced along with nameplate or tested efficiency of the new unit yields (in the absence of any other factors) is taken as a reasonable approximation of the efficiency gain to be expected. In other cases, where, for example, appliances are not changed, but rather there is a measure added such as new controls or methods of heat recovery, DSM practitioners estimate the impact of the addition based on engineering calculations (of heat transfer) and industry experience. Program energy savings impacts are then calculated based on the number of participants, free rider-ship, free drivers and other factors.

Program costs and benefits are calculated using standardized protocols. The California standard tests are commonly used by Canadian gas LDCs[17].

The verification approach depends on the particular DSM program. The number of participants and the number and type of measures installed or adopted are readily verified through a numerical count (e.g. number of coupons rebated) or, in some mass market programs, through customer surveys (e.g. education and awareness campaign).

Some LDCs (e.g. Terasen) have attempted to utilize actual customer meter throughput data (often called 'billing analysis') to verify savings impacts. In concept, gas usage after the installation of a measure is compared to usage before the installation or through comparison to a control group. In cases where the measure might be expected to yield significant savings (such as in an industrial application) it might warrant the installation of a sub-meter at the point where the measure is to be located and then gas throughput would be recorded prior to and after the installation of the measure. Unfortunately such sub-metering is costly and potentially disruptive (in the case of an industrial process application) and therefore is not used extensively.

Billing analysis, on the other hand, has the potential for wide application. Its usefulness depends on the sample sizes (to minimize extraneous effects) and the percentage change anticipated – relatively small impacts, from water saver measures in the residential sector, for example, are inherently difficult to measure. Terasen has had success measuring the savings associated with more significant measures, such as residential furnace and boiler replacements using this method.

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[17] The approach and the input assumptions for calculating the standard tests may differ among utilities and across jurisdictions.

BP16 Leading edge — Create a concise annual report on DSM activities and results that is available and easily accessible to the public

This best practice refers to a report which describes the LDC's annual DSM activities, includes the results achieved in each program, and provides a forward view (planned or recommended programs). Such an annual report is intended to supplement, but not necessarily replace, the variety of detailed reports that may be required to support internal management requirements, regulatory filings for new programs, or to answer specific concerns expressed by intervenors or others. Rather, the purpose of the report is to act as an executive summary of the LDC's DSM portfolio, its programs, and results. The report is publicly available and easily accessible. This leading edge best practice is demonstrated by Terasen.

Terasen's annual fall review report submitted to the BCUC and intervenors provides a clear, easy to read summary of its annual DSM results (DSM is one part of the fall review report). It is available on the BCUC website as well as on Terasen's website.

A concise, easy to read annual report on DSM can be used to promote an LDC's DSM programs both internally and externally to the company. It can increase employee, shareholder, regulator, intervenor and customer buy-in for DSM activities. It can also be a useful tool for developing partnerships with private companies, government agencies and other utilities.

The annual report provides a multi-purpose 'snapshot' that is easily and quickly read. Once a format is established it can be easily published annually. The report provides intervenors and other interested parties with pertinent information to answer most common questions: what is the utility doing in DSM, how is it performing, what it is costing, and where the utility is headed. It identifies past performance, issues and future prospects, sufficient for many intended audiences. For those that require more detail, the report acts as a summary.

The principal limitation of this type of report is its brevity. Important detail may be sacrificed, meaning that some audiences may seek additional information.

7.3 Comments & recommendations

Monitoring and evaluating the results of DSM is essential to the continual improvement of these programs. DSM reporting has uses beyond regulatory compliance, including stakeholder buy-in and stimulating internal management support for DSM.

While the cost-benefit tests used by various LDCs may be similar, the input assumptions often differ, making it hard to compare program results, as illustrated above with respect to the furnace replacement programs. The values used for input assumptions can also be a very contentious issue with stakeholders, particularly where there is a utility incentive.

There is value in having a consistent industry wide approach for determining the value of input assumptions to cost-benefit tests. The CGA DSM task group may be able to facilitate the development of this approach.

8 Conclusions

The objective of this study has been to review the practice of Demand Side Management by Canadian natural gas local distribution utilities, and to identify those practices that are 'best in class'- practices that best exemplify the strategies and tactics incorporated into successful DSM organizations and programs. The findings clearly indicate that the participating LDCs in this study are progressive, responsive and effective proponents of conservation and efficiency. In the five years leading up to 2004 these LDCs have researched, planned, delivered and measured the impact of programs and initiatives and invested in excess of $119 million during that period, effecting a combined 705 million m^3 (27 million GJ) of first-year annual customer natural gas savings.

As interest in energy conservation continues to escalate in Canada it is imperative that LDCs share their extensive knowledge, experience and techniques. This will serve to increase the capability of the energy industry as a whole and ensure that more recent entrants as well as seasoned practitioners benefit from an understanding of what works best in DSM.

The best practices that have been identified in this study include those that have been adopted by the majority of gas LDCs (termed 'industry wide') and those that are less in evidence (termed 'leading edge'). No order of importance or priority has been assigned to these best practices and not every practice listed may be appropriate for every LDC.

In each section of the report a number of conclusions and recommendations have been drawn. Generally there is an underlying theme that LDCs together with the CGA and other key stakeholders should continue to collaborate on DSM issues and opportunities.

8.1 Organization and management

Organization and management of DSM is an important determinant of DSM success. Integration of DSM as a core business practice is key. Five best practices in DSM organization and management were identified:

- BP1 Integrate DSM throughout the company as a part of routine business practice (leading edge)

- BP2 Create a defined process for external stakeholder involvement in DSM outside of the formal regulatory process (leading edge)

- BP 3 Develop appropriate, effective shareholder performance incentives to motivate DSM excellence (leading edge)

- BP4 Instil a corporate culture of innovation (leading edge)

The leading edge best practices in DSM organization and management reflect the maturity of the DSM programs of these organizations and the ability of the regulatory environments to support them. It is anticipated that other natural gas utilities in Canada will adopt these leading edge best practices as their programs mature. Regulators need to be encouraged to continue to support and foster innovation in DSM organization and management in the utilities they regulate.

The CGA can play a role in supporting DSM innovation across Canada. Research and development into innovative technologies and the development and piloting of new programs can be resource intensive, potentially making it difficult for some of the smaller LDCs. There would be a benefit to having increased collaboration and information sharing among the Canadian natural gas companies with respect to R&D and program development. It would likely be more cost-effective and would avoid duplication of effort. The facilitation of such information sharing and collaboration is a potential role for the Canadian Gas Association.

8.2 Planning

Good planning is critical to successful DSM. The study team has identified five best practices in planning.

- BP5 Minimize planning uncertainty through multi-year approach (industry wide)

- BP6 Develop programs that minimize lost opportunities (industry wide)

- BP7 Design programs in collaboration with industry (leading edge)

- BP8 Assess market as part of program design (leading edge)

- BP9 Provide programs for 'hard to reach' customers (leading edge)

- BP10 Extend DSM efforts beyond natural gas conservation/ efficiency (leading edge)

While DSM planning has been one of the strengths within the industry, significant opportunities remain to achieve additional customer savings through new approaches to collaboration with industry, to composition of the DSM portfolio, and to understanding customer needs. Multi-year planning and budgeting of DSM increases the ability of LDCs to capture these significant opportunities.

The CGA could facilitate the sharing of information and best practices on DSM planning, among its members. Utilities should be encouraged by their regulators to cooperate with their electric utility counterparts on achieving net energy savings and efficient load building.

8.3 Program delivery

Canadian natural gas LDCs are experienced and effective deliverers of DSM programs. Program delivery is the only DSM activity directly seen by customers and prospective participants. The method of program delivery, how it is positioned and how it is branded helps determine the success of programs. Three existing best practices in program delivery were identified in this study.

- BP11 Deliver programs in partnership with other agencies and stakeholders (industry wide)

- BP12 Position LDC as a provider of unbiased energy solutions (industry wide)

- BP13 Brand DSM (leading edge)

Currently, LDCs approach the issue of partnerships on an independent basis, even though many of their potential partners are national in scope (e.g. retailers, appliance manufacturers). There is an opportunity for development of collaborative approaches to establish these types of partnerships. The CGA DSM taskforce could potentially act as a catalyst for this purpose.

8.4 Monitoring, evaluation and reporting

Monitoring and evaluating the results of DSM is essential to the continual improvement of these programs. DSM reporting has uses beyond regulatory compliance, including stakeholder buy-in and stimulating internal management support for DSM. The best practices identified with respect to monitoring, evaluation and reporting are:

- BP14 Ensure there is an effective feedback loop between monitoring & verification and program design (industry wide)
- BP15 Develop a formal methodology for verifying energy savings (industry wide)
- BP16 Create a concise annual report on DSM activities and results that is available and easily accessible to the public (leading edge)

While the cost-benefit tests used by various LDCs may be similar, the input assumptions often differ, making it hard to compare program results, as illustrated above with respect to the furnace replacement programs. The values used for input assumptions can also be a very contentious issue with stakeholders, particularly where there is an incentive.

There is value in having a consistent industry wide approach for determining the value of input assumptions to cost-benefit tests. The CGA DSM task group may be able to facilitate the development of this approach.

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IndEco Strategic Consulting Inc

77 Mowat Avenue Suite 412 Toronto ON M6K 3E3

416 532 4333 fax: 416 532 5485 ***info@indeco.com indeco.com***

Appendix 11 A

Portfolio Including Free Riders

2008 DSM PLAN VERSION 080328 w <100% NTG

	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Participant Benefits (Costs)			Program Net Savings				Participant					
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity	Natural Gas	Total Costs	Total Benefits	Benefit/Cost	Natural Gas		TRC Net Benefits
	Incentives	Administration	Total	Participant	Total	% Utility	% Participant	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2008																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	238	302	541	52	593	91%	9%	13,709	10,403	244	-	6	885	198	1,160	123	96	93,738	1,522	-	1.6	52	1,379	26.4	0.5	1.8	490
Fuel Substitution	318	256	575	-133	441	130%	-30%	-38,673	-25,751	4,937	-	FS	-2,339	4,489	-3,040	-326	2,188	(246,787)	34,529	-	FS	3,365	2,321	0.7	1.0	1.6	1,708
Retrofit																											
Energy Efficiency	1,773	775	2,548	978	3,526	72%	28%	84,770	61,104	755	-	4	5,746	616	7,172	794	300	600,659	4,741	-	2.3	978	8,266	8.5	0.6	1.8	2,836
Fuel Substitution	278	183	461	180	641	72%	28%	-36,900	-35,918	9,785	-	FS	-3,469	13,497	-5,279	-498	6,578	(374,294)	103,821	-	FS	5,957	6,578	1.1	1.3	3.3	9,386
Subtotals																											
Residential Energy Efficiency	2,011	1,078	3,089	1,030	4,119	75%	25%	98,479	71,507	999	-	4	6,630	814	8,332	917	397	694,397	6,262	-	**2.1**	**1,030**	**9,645**	**9.4**	**0.6**	**1.8**	**3,326**
Residential Fuel Substitution	596	440	1,036	47	1,082	96%	4%	-75,573	-61,670	14,722	-	FS	-5,808	17,985	-8,319	-823	8,766	(621,082)	138,350	-	**FS**	**9,189**	**8,766**	**1.0**	**1.2**	**2.6**	**11,095**
2008 Residential Total	**2,607**	**1,518**	**4,125**	**1,077**	**5,201**	**79%**	**21%**	**22,906**	**9,837**	**15,721**	**-**	**56**	**822**	**18,800**	**13**	**93**	**9,163**	**73,316**	**144,612**	**-**							
COMMERCIAL:																											
New Construction	1,209	487	1,697	1,197	2,893	59%	41%	30,591	27,772	2,994	-	5	3,071	4,727	3,716	430	2,029	321,997	36,358	-	1.8	1,197	6,175	5.2	0.6	2.7	4,904
Retrofit	3,186	913	4,099	2,704	6,803	60%	40%	148,072	125,286	8,550	-	3	12,996	7,772	15,748	1,823	3,336	1,370,495	59,782	-	3.2	2,704	20,907	7.7	0.7	3.1	13,965
2008 Total Commercial	**4,395**	**1,400**	**5,796**	**3,901**	**9,696**	**60%**	**40%**	**178,662**	**153,058**	**11,544**	**-**	**3**	**16,066**	**12,498**	**19,465**	**2,252**	**5,365**	**1,692,492**	**96,140**	**-**	**2.8**	**3,901**	**27,081**	**6.9**	**0.6**	**2.9**	**18,868**
SUBTOTALS:																											
Energy Efficiency	6,406	2,478	8,885	4,930	13,815	64%	36%	277,142	224,565	12,542	-	3.7	22,697	13,312	27,796	3,169	5,761	2,386,890	102,403	-	2.6	4,930	36,727	7.4	0.6	2.6	22,194
Program	**7,002**	**2,918**	**9,920**	**4,977**	**14,897**	**67%**	**33%**	**201,569**	**162,895**	**27,265**	**-**	**5.6**	**16,888**	**31,298**	**19,477**	**2,346**	**14,527**	**1,765,808**	**240,752**	**-**	**1.7**	**4,977**	**36,350**	**7.3**	**0.6**	**3.2**	**33,289**
COMMUNICATIONS:																											
Conservation Education & Outreach		5,245																									
Joint Initiatives		1,000																									
Trade Relations		500																									
Innovative Technologies		1,000																									
Communications Total		**7,745**																									
2008 TOTAL	**7,002**	**10,663**	**17,665**	**4,977**	**22,642**	**78%**	**22%**	**201,569**	**162,895**	**27,265**	**-**	**10**	**16,888**	**31,298**	**19,477**	**2,346**	**14,527**	**1,765,808**	**240,752**	**-**	**1.0**	**4,977**	**36,350**	**7.3**	**0.5**	**2.1**	**25,544**
2009																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	549	173	721	87	809	89%	11%	28,851	22,855	469	-	3	1,945	388	2,558	293	189	207,714	2,981	-	2.7	87	3,039	34.7	0.6	2.9	1,524
Fuel Substitution	457	175	632	-190	442	143%	-43%	-53,784	-36,318	6,970	-	FS	-3,255	6,418	-4,284	-489	3,128	(346,782)	49,371	-	FS	4,772	3,319	0.7	1.1	1.7	2,721
Retrofit																											
Energy Efficiency	1,970	755	2,725	1,040	3,765	72%	28%	95,883	68,976	1,138	-	4	6,370	927	8,027	945	452	671,533	7,133	-	2.3	1,040	9,424	9.1	0.6	1.9	3,533
Fuel Substitution	371	162	533	180	713	75%	25%	-41,580	-39,646	10,518	-	FS	-3,773	14,265	-5,782	-579	6,953	(410,062)	109,732	-	FS	6,541	6,953	1.1	1.3	3.2	9,779
Subtotals																											
Residential Energy Efficiency	2,518	928	3,446	1,128	4,574	75%	25%	124,734	91,831	1,607	-	4	8,316	1,315	10,584	1,238	641	879,246	10,114	-	**2.4**	**1,128**	**12,463**	**11.1**	**0.6**	**2.1**	**5,057**
Residential Fuel Substitution	828	337	1,165	-10	1,155	101%	-1%	-95,364	-75,964	17,488	-	FS	-7,029	20,683	-10,066	-1,068	10,081	(756,844)	159,104	-	**FS**	**11,134**	**10,091**	**0.9**	**1.2**	**2.5**	**12,500**
2009 Total Residential	**3,346**	**1,265**	**4,611**	**1,117**	**5,728**	**80%**	**20%**	**29,370**	**15,867**	**19,095**	**-**	**38**	**1,287**	**21,998**	**518**	**171**	**10,722**	**122,402**	**169,218**	**-**							
COMMERCIAL:																											
New Construction	2,232	477	2,709	2,248	4,957	55%	45%	51,771	47,486	6,163	-	5	5,595	9,730	6,336	775	4,176	550,731	74,844	-	2.1	2,248	11,287	5.0	0.6	3.1	10,368
Retrofit	4,276	1,302	5,578	3,660	9,238	60%	40%	210,754	180,047	11,475	-	3	19,554	10,430	22,441	2,750	4,477	1,953,859	80,234	-	3.5	3,660	29,669	8.1	0.7	3.2	20,747
2009 Total Commercial	**6,508**	**1,779**	**8,287**	**5,908**	**14,195**	**58%**	**42%**	**262,525**	**227,533**	**17,638**	**-**	**3**	**25,149**	**20,160**	**28,777**	**3,525**	**8,653**	**2,504,590**	**155,079**	**-**	**3.0**	**5,908**	**40,956**	**6.9**	**0.7**	**3.2**	**31,115**
SUBTOTALS:																											
Energy Efficiency Subtotal	9,026	2,707	11,733	7,036	18,768	63%	37%	387,259	319,364	19,245	-	3.5	33,465	21,475	39,361	4,763	9,294	3,383,836	165,193	-	2.9	7,036	53,419	7.6	0.7	2.9	36,172
Program Subtotal	**9,854**	**3,044**	**12,898**	**7,025**	**19,923**	**65%**	**35%**	**291,895**	**243,400**	**36,733**	**-**	**4.9**	**26,436**	**42,159**	**29,295**	**3,696**	**19,375**	**2,626,992**	**324,296**	**-**	**2.0**	**7,025**	**52,366**	**7.5**	**0.6**	**3.4**	**48,672**
COMMUNICATIONS:																											
Conservation Education & Outreach		4,295																									
Joint Initiatives		1,000																									
Trade Relations		500																									
Innovative Technologies		1,000																									
Conservation Potential Review		500																									
Communications Total		**7,295**																									
2009 TOTAL	**9,854**	**10,339**	**20,193**	**7,025**	**27,218**	**74%**	**26%**	**291,895**	**243,400**	**36,733**	**-**	**8**	**26,436**	**42,159**	**29,295**	**3,696**	**19,375**	**2,626,992**	**324,296**	**-**	**1.3**	**7,025**	**52,366**	**7.5**	**0.5**	**2.5**	**41,377**

2008 DSM PLAN VERSION 080328 w <100% NTG

	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Participant Benefits (Costs)			Program Net Savings				Participant					
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity	Natural Gas	Total Costs	Total Benefits	Benefit/Cost	Natural Gas		TRC Net Benefits
	Incentives	Administration	Total	Participant	Total	% Utility	% Participant	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2010																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	964	324	1,288	126	1,413	91%	9%	48,479	39,258	723	-	4	3,381	604	4,392	531	294	358,166	4,647	-	2.6	126	5,217	41.5	0.6	2.8	2,571
Fuel Substitution	613	294	907	-252	656	138%	-38%	-70,158	-47,903	9,198	-	FS	-4,303	8,531	-5,650	-673	4,158	(455,489)	65,626	-	FS	6,323	4,410	0.7	1.1	1.7	3,573
Retrofit																											
Energy Efficiency	968	496	1,464	240	1,704	86%	14%	51,955	37,212	1,523	-	4	3,189	1,240	4,032	498	604	336,174	9,539	-	2.2	240	5,135	21.4	0.6	2.6	2,725
Fuel Substitution	463	128	591	180	771	77%	23%	-46,070	-43,204	11,217	-	FS	-4,116	14,996	-6,263	-656	7,309	(444,214)	115,352	-	FS	7,099	7,309	1.0	1.3	3.1	10,109
Subtotals																											
Residential Energy Efficiency	1,932	820	2,752	366	3,117	88%	12%	100,434	76,470	2,246	-	4	6,569	1,844	8,424	1,029	899	694,340	14,186	-	**2.4**	**366**	**10,352**	**28.3**	**0.6**	**2.7**	**5,296**
Residential Fuel Substitution	1,076	422	1,498	-72	1,426	105%	-5%	-116,228	-91,106	20,416	-	FS	-8,418	23,527	-11,913	-1,329	11,467	(899,703)	180,978	-	**FS**	**13,242**	**11,538**	**0.9**	**1.2**	**2.4**	**13,682**
2010 Total Residential	**3,008**	**1,242**	**4,249**	**294**	**4,544**	**94%**	**6%**	**-15,794**	**-14,637**	**22,662**	**-**	**FS**	**-1,849**	**25,371**	**-3,488**	**-301**	**12,366**	**(205,363)**	**195,164**	**-**							
COMMERCIAL:																											
New Construction	4,205	788	4,993	4,312	9,304	54%	46%	83,523	77,179	13,380	-	6	9,189	21,123	10,411	1,318	9,067	900,435	162,487	-	1.8	4,312	20,796	4.8	0.6	3.3	21,007
Retrofit	5,627	2,012	7,639	4,869	12,508	61%	39%	282,700	243,756	19,575	-	3	26,041	17,793	29,749	3,810	7,637	2,592,774	136,870	-	3.4	4,869	41,197	8.5	0.7	3.5	31,325
2010 Total Commercial	**9,832**	**2,800**	**12,632**	**9,181**	**21,813**	**58%**	**42%**	**366,223**	**320,934**	**32,955**	**-**	**4**	**35,229**	**38,916**	**40,160**	**5,129**	**16,704**	**3,493,210**	**299,357**	**-**	**2.8**	**9,181**	**61,993**	**6.8**	**0.7**	**3.4**	**52,333**
SUBTOTALS:																											
Energy Efficiency Subtotal	11,764	3,619	15,384	9,547	24,930	62%	38%	466,657	397,404	35,201	-	3.7	41,799	40,761	48,584	6,157	17,603	4,187,550	313,543	-	2.7	9,547	72,344	7.6	0.7	3.3	57,629
Program Subtotal	**12,840**	**4,042**	**16,882**	**9,475**	**26,357**	**64%**	**36%**	**350,428**	**306,297**	**55,616**	**-**	**5.1**	**33,380**	**64,288**	**36,672**	**4,828**	**29,070**	**3,287,847**	**494,521**	**-**	**2.0**	**9,475**	**70,569**	**7.4**	**0.6**	**3.7**	**71,311**
COMMUNICATIONS:																											
Conservation Education & Outreach		4,295																									
Joint Initiatives		1,000																									
Trade Relations		500																									
Innovative Technologies		1,000																									
CommunicationsTotal		**6,795**																									
2010 TOTAL	**12,840**	**10,837**	**23,677**	**9,475**	**33,152**	**71%**	**29%**	**350,428**	**306,297**	**55,616**	**-**	**7**	**33,380**	**64,288**	**36,672**	**4,828**	**29,070**	**3,287,847**	**494,521**	**-**	**1.4**	**9,475**	**70,569**	**7.4**	**0.6**	**2.9**	**64,516**

	Incentives	Administration	Total	Participant	Total	% Utility	% Participant	Gross	Net	MWh	kW	($/GJ)	Utility Program ($'000s)	Utility Alternate ($'000s)	Participant Program ($'000s)	Carbon Tax ($'000s)	Alternate ($'000s)	Natural Gas (GJ)	Alternate Energy (MWh)	Alternate Capacity (kW)	Natural Gas Utility	Total Costs ($'000s)	Total Benefits ($'000s)	Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits ($'000s)
2008 - 2010 (NPV 2007)																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	1,499	702	2,201	229	2,430	91%	9%	78,131	62,174	1,235	-	3	6,211	1,190	8,110	946	580	659,617	9,150	-	2.8	229	9,636	42.0	0.6	3.0	4,970
Fuel Substitution	1,207	637	1,844	-499	1,345	137%	-37%	-141,323	-95,567	18,337	-	FS	-9,897	19,438	-12,973	-1,488	9,474	(1,049,059)	149,526	-	FS	14,461	9,973	0.7	1.1	1.7	8,197
Retrofit																											
Energy Efficiency	4,187	1,797	5,983	2,027	8,010	75%	25%	206,314	148,397	2,959	-	4	15,305	2,784	19,231	2,237	1,357	1,608,366	21,412	-	2.6	2,027	22,825	11.3	0.6	2.3	10,078
Fuel Substitution	973	422	1,395	478	1,873	74%	26%	-109,697	-104,685	27,811	-	FS	-11,359	42,758	-17,324	-1,733	20,839	(1,228,570)	328,905	-	FS	19,535	20,839	1.1	1.4	3.2	29,526
Subtotals																											
Residential Energy Efficiency	5,686	2,499	8,185	2,256	10,441	78%	22%	284,445	210,572	4,194	-	4	21,516	3,973	27,340	3,184	1,936	2,267,984	30,563	-	**2.6**	**2,256**	**32,461**	**14.4**	**0.6**	**2.4**	**15,048**
Residential Fuel Substitution	2,180	1,059	3,239	-21	3,218	101%	-1%	-251,020	-200,252	46,148	-	FS	-21,255	62,196	-30,298	-3,220	30,313	(2,277,629)	478,431	-	**FS**	**33,518**	**30,335**	**0.9**	**1.2**	**2.5**	**37,723**
2008 - 2010 Total Residential	**7,866**	**3,558**	**11,423**	**2,235**	**13,658**	**84%**	**16%**	**52,438**	**26,301**	**53,061**	**-**	**FS**	**260**	**66,169**	**-2,957**	**-37**	**32,250**	**(9,645)**	**508,994**	**-**							
COMMERCIAL:																											
New Construction	6,556	1,523	8,080	6,646	14,725	55%	45%	142,889	131,262	19,239	-	5	17,854	35,580	20,463	2,523	15,272	1,773,164	273,689	-	2.2	6,646	38,257	5.8	0.6	3.6	38,708
Retrofit	11,372	3,654	15,027	9,756	24,783	61%	39%	556,474	476,116	34,199	-	3	58,591	35,995	67,939	8,383	15,450	5,917,128	276,886	-	3.9	9,756	91,772	9.4	0.7	3.8	69,803
2008 - 2010 Total Commercial	**17,928**	**5,178**	**23,106**	**16,402**	**39,508**	**58%**	**42%**	**699,363**	**607,378**	**53,438**	**-**	**3**	**76,445**	**71,575**	**88,402**	**10,906**	**30,722**	**7,690,292**	**550,575**	**-**	**3.3**	**16,402**	**130,030**	**7.9**	**0.7**	**3.7**	**108,512**
SUBTOTALS:																											
Energy Efficiency Subtotal	23,614	7,677	31,291	18,658	49,948	63%	37%	983,808	817,950	57,632	-	3.1	97,960	75,548	115,742	14,090	32,659	9,958,276	581,138	-	3.1	18,658	162,490	8.7	0.7	3.5	123,560
Program Subtotal	**25,794**	**8,736**	**34,530**	**18,636**	**53,166**	**65%**	**35%**	**751,801**	**633,679**	**106,499**	**-**	**4.5**	**76,705**	**137,744**	**85,444**	**10,869**	**62,972**	**7,680,647**	**1,059,569**	**-**	**2.2**	**18,636**	**159,285**	**8.5**	**0.6**	**4.0**	**161,283**
COMMUNICATIONS:																											
Conservation Education & Outreach		13,835																									
Joint Initiatives		3,000																									
Trade Relations		1,500																									
Innovative Technologies		3,000																									
Conservation Potential Review		500																									
Communications Total		**21,835**																									
2008 - 2010 TOTAL	**25,794**	**30,571**	**56,365**	**18,636**	**75,001**	**75%**	**25%**	**751,801**	**633,679**	**106,499**	**-**	**7**	**76,705**	**137,744**	**85,444**	**10,869**	**62,972**	**7,680,647**	**1,059,569**	**-**	**1.4**	**18,636**	**159,285**	**8.5**	**0.5**	**2.9**	**139,448**

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PROGRAM

	Utility Costs ($000) Incentives	Utility Costs ($000) Administration	Utility Costs ($000) Total	Costs ($000) Participant	Costs ($000) Total	% Utility	% Participant	Savings (GJ) Gross	Savings (GJ) Net
2008									
RESIDENTIAL:									
New Construction									
Energy Efficiency	175	236	411	48	458	90%	10%	10,850	7,974
Fuel Substitution	195	164	359	-129	230	156%	-56%	-31,770	-19,657
Retrofit									
Energy Efficiency	1,750	745	2,495	965	3,460	72%	28%	83,600	60,266
Fuel Substitution	-	-	-	-	-	-	-	-	-
Subtotals									
Residential Energy Efficiency	1,925	981	2,906	1,012	3,918	74%	26%	94,450	68,240
Residential Fuel Substitution	195	164	359	-129	230	156%	-56%	-31,770	-19,657
2008 Residential Total	**2,120**	**1,145**	**3,265**	**883**	**4,148**	**79%**	**21%**	**62,680**	**48,583**
COMMERCIAL:									
New Construction	1,136	471	1,607	1,133	2,741	59%	41%	26,902	24,429
Retrofit	2,878	818	3,696	2,441	6,137	60%	40%	133,951	113,125
2008 Total Commercial	**4,014**	**1,289**	**5,303**	**3,574**	**8,877**	**60%**	**40%**	**160,852**	**137,554**
2008 Total Energy Efficiency	5,939	2,270	8,209	4,586	12,796	64%	36%	255,302	205,794
2008 Total	**6,134**	**2,435**	**8,569**	**4,457**	**13,026**	**66%**	**34%**	**223,532**	**186,137**
2009									
RESIDENTIAL:									
New Construction									
Energy Efficiency	425	141	566	80	646	88%	12%	23,350	18,133
Fuel Substitution	270	139	409	-182	227	180%	-80%	-43,220	-27,043
Retrofit									
Energy Efficiency	1,925	733	2,658	1,015	3,673	72%	28%	93,650	67,373
Fuel Substitution	0	0	0	0	0	-	-	0	0
Subtotals									
Residential Energy Efficiency	2,350	874	3,224	1,095	4,319	75%	25%	117,000	85,506
Residential Fuel Substitution	270	139	409	-182	227	180%	-80%	-43,220	-27,043
2009 Residential Total	**2,620**	**1,013**	**3,633**	**913**	**4,546**	**80%**	**20%**	**73,780**	**58,463**
COMMERCIAL:									
New Construction	2,158	462	2,619	2,183	4,803	55%	45%	48,009	44,081
Retrofit	3,802	1,181	4,983	3,247	8,230	61%	39%	190,383	162,250
2009 Total Commercial	**5,960**	**1,643**	**7,602**	**5,430**	**13,033**	**58%**	**42%**	**238,392**	**206,331**
2009 Total Energy Efficiency	8,310	2,517	10,826	6,525	17,351	62%	38%	355,392	291,837
2009 Total	**8,580**	**2,656**	**11,236**	**6,343**	**17,579**	**64%**	**36%**	**312,172**	**264,793**

ALTERNATE / NET PRESENT VALUE

	Alternate Impact Energy (MWh)	Alternate Impact Capacity (kW)	Levelized Cost ($/GJ)	Utility Benefits (Costs) Program ($'000s)	Utility Benefits (Costs) Alternate ($'000s)	Participant Benefits (Costs) Program ($'000s)	Participant Benefits (Costs) Carbon Tax ($'000s)	Participant Benefits (Costs) Alternate ($'000s)	Program Net Savings Natural Gas (GJ)	Program Net Savings Alternate Energy (MWh)	Program Net Savings Alternate Capacity (kW)
2008											
RESIDENTIAL:											
New Construction											
Energy Efficiency	218	-	6	676	175	840	93	85	70,962	1,346	-
Fuel Substitution	3,883	-	FS	-1,930	3,566	-2,405	-267	1,738	-201,378	27,432	-
Retrofit											
Energy Efficiency	715	-	4	5,674	584	7,061	783	285	592,776	4,493	-
Fuel Substitution	-	-	-	-	-	0	0	0	0	-	-
Subtotals											
Residential Energy Efficiency	933	-	4	6,350	759	7,901	876	370	663,739	5,839	-
Residential Fuel Substitution	3,883	-	FS	-1,930	3,566	-2,405	-267	1,738	-201,378	27,432	-
2008 Residential Total	**4,816**	-	**7**	**4,420**	**4,325**	**5,496**	**610**	**2,108**	**462,361**	**33,271**	-
COMMERCIAL:											
New Construction	2,994	-	6	2,691	4,727	3,230	376	2,029	282,198	36,358	-
Retrofit	7,650	-	3	11,671	6,954	14,050	1,637	2,985	1,231,375	53,489	-
2008 Total Commercial	**10,644**	-	**4**	**14,361**	**11,680**	**17,281**	**2,013**	**5,013**	**1,513,573**	**89,847**	-
2008 Total Energy Efficiency	11,576	-	3.8	20,711	12,439	25,181	2,889	5,383	2,177,311	95,686	-
2008 Total	**15,460**	-	**4.3**	**18,781**	**16,005**	**22,776**	**2,623**	**7,122**	**1,975,933**	**123,118**	-
2009											
RESIDENTIAL:											
New Construction											
Energy Efficiency	420	-	3	1,544	344	1,934	230	168	163,350	2,648	-
Fuel Substitution	5,356	-	FS	-2,639	4,998	-3,309	-390	2,436	-277,050	38,443	-
Retrofit											
Energy Efficiency	1,060	-	4	6,233	864	7,814	924	421	656,393	6,648	-
Fuel Substitution	0	-	-	0	0	0	0	0	0	-	-
Subtotals											
Residential Energy Efficiency	1,480	-	4	7,777	1,208	9,748	1,154	589	819,743	9,296	-
Residential Fuel Substitution	5,356	-	FS	-2,639	4,998	-3,309	-390	2,436	-277,050	38,443	-
2009 Residential Total	**6,835**	-	**7**	**5,138**	**6,206**	**6,439**	**764**	**3,025**	**542,693**	**47,738**	-
COMMERCIAL:											
New Construction	6,163	-	5	5,211	9,730	5,842	718	4,176	510,342	74,844	-
Retrofit	10,350	-	3	17,612	9,408	19,943	2,461	4,038	1,749,147	72,368	-
2009 Total Commercial	**16,513**	-	**3**	**22,823**	**19,138**	**25,785**	**3,179**	**8,214**	**2,259,489**	**147,212**	-
2009 Total Energy Efficiency	17,993	-	3.5	30,600	20,346	35,533	4,333	8,803	3,079,232	156,508	-
2009 Total	**23,348**	-	**4.0**	**27,961**	**25,344**	**32,224**	**3,944**	**11,239**	**2,802,182**	**194,951**	-

BENEFIT/COST

	Natural Gas Utility	Participant Total Costs ($'000s)	Participant Total Benefits ($'000s)	Participant Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits ($'000s)
2008							
RESIDENTIAL:							
New Construction							
Energy Efficiency	1.6	48	1,018	21.3	0.5	1.9	393
Fuel Substitution	FS	2,672	1,867	0.7	1.1	1.7	1,406
Retrofit							
Energy Efficiency	2.3	965	8,129	8.4	0.6	1.8	2,798
Fuel Substitution	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals							
Residential Energy Efficiency	**2.2**	**1,012**	**9,147**	**9.0**	**0.6**	**1.8**	**3,191**
Residential Fuel Substitution	**FS**	**2,672**	**1,867**	**0.7**	**1.1**	**1.7**	**1,406**
2008 Residential Total							
COMMERCIAL:							
New Construction	1.7	1,133	5,635	5.0	0.6	2.7	4,677
Retrofit	3.2	2,441	18,672	7.7	0.7	3.0	12,488
2008 Total Commercial	**2.7**	**3,574**	**24,307**	**6.8**	**0.6**	**2.9**	**17,164**
2008 Total Energy Efficiency	2.5	4,586	33,454	7.3	0.6	2.6	20,355
2008 Total	**2.2**	**4,457**	**32,520**	**7.3**	**0.6**	**2.7**	**21,761**
2009							
RESIDENTIAL:							
New Construction							
Energy Efficiency	2.7	80	2,332	29.1	0.6	2.9	1,242
Fuel Substitution	FS	3,699	2,618	0.7	1.1	1.7	2,131
Retrofit							
Energy Efficiency	2.3	1,015	9,159	9.0	0.6	1.9	3,424
Fuel Substitution	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals							
Residential Energy Efficiency	**2.4**	**1,095**	**11,491**	**10.5**	**0.6**	**2.1**	**4,666**
Residential Fuel Substitution	**FS**	**3,699**	**2,618**	**0.7**	**1.1**	**1.7**	**2,131**
2009 Residential Total							
COMMERCIAL:							
New Construction	2.0	2,183	10,737	4.9	0.6	3.1	10,138
Retrofit	3.5	3,247	26,442	8.1	0.7	3.3	18,790
2009 Total Commercial	**3.0**	**5,430**	**37,179**	**6.8**	**0.7**	**3.2**	**28,928**
2009 Total Energy Efficiency	2.8	6,525	48,670	7.5	0.7	2.9	33,595
2009 Total	**2.5**	**6,343**	**47,407**	**7.5**	**0.6**	**3.0**	**35,726**

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	PROGRAM – COSTS ($000) – Utility – Incentives	Utility – Administration	Utility – Total	Participant	Total	% Utility	% Participant	SAVINGS (GJ) – Gross	SAVINGS (GJ) – Net	ALTERNATE Impact – Energy MWh	ALTERNATE Impact – Capacity kW	NET PRESENT VALUE – Levelized Cost ($/GJ)	Utility Benefits (Costs) – Program ($'000s)	Utility Benefits (Costs) – Alternate ($'000s)	Participant Benefits (Costs) – Program ($'000s)	Participant Benefits (Costs) – Carbon Tax ($'000s)	Participant Benefits (Costs) – Alternate ($'000s)	Program Net Savings – Natural Gas (GJ)	Program Net Savings – Alternate Energy (MWh)	Program Net Savings – Alternate Capacity (kW)	BENEFIT/COST – Natural Gas Utility	Participant – Total Costs ($'000s)	Participant – Total Benefits ($'000s)	Participant – Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits ($'000s)
2010																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	775	281	1,056	112	1,168	90%	10%	40,000	32,027	635	-	4	2,762	528	3,439	430	257	290,303	4,060	-	2.6	112	4,126	36.8	0.6	2.8	2,122
Fuel Substitution	345	219	564	-235	330	171%	-71%	-54,670	-34,430	6,828	-	FS	-3,390	6,429	-4,213	-519	3,133	-352,722	49,454	-	FS	4,732	3,368	0.7	1.1	1.7	2,709
Retrofit																											
Energy Efficiency	900	467	1,367	201	1,568	87%	13%	48,500	34,736	1,405	-	4	2,976	1,144	3,704	463	558	312,847	8,802	-	2.2	201	4,725	23.5	0.6	2.6	2,552
Fuel Substitution	0	0	0	0	0 -	-		0	0	0	-	-	0	0	0	0	0	0	-	-	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals																											
Residential Energy Efficiency	1,675	747	2,422	313	2,736	89%	11%	88,500	66,763	2,040	-	4	5,738	1,672	7,143	893	815	603,151	12,862	-	**2.4**	**313**	**8,851**	**28.3**	**0.6**	**2.7**	**4,674**
Residential Fuel Substitution	345	219	564	-235	330	171%	-71%	-54,670	-34,430	6,828	-	FS	-3,390	6,429	-4,213	-519	3,133	-352,722	49,454	-	**FS**	**4,732**	**3,368**	**0.7**	**1.1**	**1.7**	**2,709**
2010 Residential Total	**2,020**	**967**	**2,987**	**79**	**3,065**	**97%**	**3%**	**33,830**	**32,333**	**8,867**	-	**12**	**2,348**	**8,101**	**2,930**	**374**	**3,948**	**250,428**	**62,315**	-							
COMMERCIAL:																											
New Construction	3,408	710	4,117	3,480	7,598	54%	46%	71,755	66,241	10,336	-	5	7,919	16,318	8,797	1,125	7,004	768,386	125,520	-	1.9	3,480	16,926	4.9	0.6	3.2	16,638
Retrofit	5,002	1,841	6,843	4,318	11,162	61%	39%	255,033	219,257	17,550	-	3	23,403	15,952	26,376	3,404	6,847	2,316,289	122,711	-	3.4	4,318	36,627	8.5	0.7	3.5	28,194
2010 Total Commercial	**8,410**	**2,551**	**10,961**	**7,799**	**18,759**	**58%**	**42%**	**326,789**	**285,498**	**27,886**	-	**4**	**31,322**	**32,270**	**35,173**	**4,528**	**13,851**	**3,084,675**	**248,231**	-	**2.9**	**7,799**	**53,553**	**6.9**	**0.7**	**3.4**	**44,833**
2010 Total Energy Efficiency	10,085	3,298	13,383	8,112	21,495	62%	38%	415,289	352,261	29,925	-	3.6	37,060	33,942	42,316	5,422	14,666	3,687,825	261,093	-	2.8	8,112	62,404	7.7	0.7	3.3	49,507
2010 Total	**10,430**	**3,518**	**13,947**	**7,877**	**21,825**	**64%**	**36%**	**360,619**	**317,831**	**36,753**	-	**4.2**	**33,670**	**40,371**	**38,103**		**17,800**	**3,335,103**	**310,547**	-	**2.4**	**7,877**	**55,903**	**7.1**	**0.6**	**3.4**	**52,216**

	Incentives	Administration	Utility Total	Participant	Total	% Utility	% Participant	Gross	Net	Energy MWh	Capacity kW	Levelized Cost ($/GJ)	Utility Program	Utility Alternate	Participant Program	Carbon Tax	Participant Alternate	Natural Gas (GJ)	Alternate Energy (MWh)	Alternate Capacity (kW)	Natural Gas Utility	Total Costs	Total Benefits	Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits
2008 - 2010 (NPV 2007)																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	1,174	575	1,749	207	1,956	89%	11%	63,539	49,712	1,094	-	3	4,982	1,047	6,212	753	510	524,615	8,053	-	2.8	207	7,476	36.1	0.6	3.1	4,073
Fuel Substitution	703	457	1,160	-474	686	169%	-69%	-112,634	-70,451	13,951	-	FS	-7,959	14,993	-9,926	-1,176	7,307	-831,150	115,328	-	FS	11,102	7,781	0.7	1.1	1.7	6,347
Retrofit																											
Energy Efficiency	4,069	1,725	5,794	1,959	7,753	75%	25%	200,371	144,137	2,755	-	4	14,882	2,593	18,579	2,171	1,264	1,562,017	19,943	-	2.6	1,959	22,013	11.2	0.6	2.3	9,722
Fuel Substitution	0	0	0	0	0	-	-	0	0	0	-	-	0	0	0	0	0	0	-	-	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals																											
Residential Energy Efficiency	**5,243**	**2,300**	**7,543**	**2,166**	**9,709**	**78%**	**22%**	**263,910**	**193,849**	**3,849**	-	**4**	**19,864**	**3,639**	**24,792**	**2,924**	**1,774**	**2,086,632**	**27,996**	-	**2.6**	**2,166**	**29,489**	**13.6**	**0.6**	**2.4**	**13,794**
Residential Fuel Substitution	**703**	**457**	**1,160**	**-474**	**686**	**169%**	**-69%**	**-112,634**	**-70,451**	**13,951**	-	**FS**	**-7,959**	**14,993**	**-9,926**	**-1,176**	**7,307**	**-831,150**	**115,328**	-	**FS**	**11,102**	**7,781**	**0.7**	**1.1**	**1.7**	**6,347**
2008 - 2010 Total Residential	**5,946**	**2,757**	**8,703**	**1,693**	**10,396**	**84%**	**16%**	**170,290**	**139,379**	**20,519**	-	**7**	**11,905**	**18,632**	**14,865**	**1,748**	**9,081**	**1,255,482**	**143,324**	-							
COMMERCIAL:																											
New Construction	5,759	1,430	7,189	5,839	13,028	55%	45%	126,321	116,025	16,710	-	5	15,820	30,774	17,870	2,219	13,209	1,560,925	236,722	-	2.2	5,839	33,298	5.7	0.6	3.6	33,566
Retrofit	10,145	3,317	13,462	8,685	22,147	61%	39%	502,218	428,608	30,677	-	3	52,686	32,314	60,369	7,502	13,870	5,296,810	248,569	-	3.9	8,685	81,741	9.4	0.7	3.8	62,853
2008 - 2010 Total Commercial	**15,904**	**4,746**	**20,650**	**14,525**	**35,175**	**59%**	**41%**	**628,540**	**544,633**	**47,387**	-	**3**	**68,507**	**63,088**	**78,239**	**9,721**	**27,079**	**6,857,736**	**485,291**	-	**3.3**	**14,525**	**115,039**	**7.9**	**0.7**	**3.7**	**96,420**
2008-2010 Total Energy Efficiency	21,147	7,047	28,193	16,691	44,884	63%	37%	892,450	738,482	51,236	-	3.2	88,371	66,727	103,030	12,644	28,853	8,944,368	513,287	-	3.1	16,691	144,528	8.7	0.7	3.5	110,214
2008 - 2010 Total	**21,850**	**7,503**	**29,353**	**16,217**	**45,571**	**64%**	**36%**	**798,830**	**684,012**	**67,905**	-	**4**	**80,412**	**81,720**	**93,104**		**36,160**	**8,113,218**	**628,616**	-	**2.7**	**16,217**	**129,264**	**8.0**	**0.7**	**3.6**	**116,561**

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PROGRAM / ALTERNATE

	PROGRAM – COSTS ($000) – Utility – Incentives	Utility – Administration	Utility – Total	Participant	Total	% Utility	% Participant	SAVINGS (GJ) – Gross	SAVINGS (GJ) – Net	ALTERNATE Impact – Energy (MWh)	ALTERNATE Impact – Capacity (kW)
2008											
RESIDENTIAL:											
New Construction											
Energy Efficiency	63	67	130	5	134	97%	3%	2,859	2,429	26	-
Fuel Substitution	123	92	215	-4	211	102%	-2%	-6,903	-6,095	1,054	-
Retrofit											
Energy Efficiency	23	30	53	13	66	80%	20%	1,170	838	40	-
Fuel Substitution	278	183	461	180	641	72%	28%	-36,900	-35,918	9,785	-
Subtotals											
Residential Energy Efficiency	86	97	183	18	201	91%	9%	4,029	3,267	66	-
Residential Fuel Substitution	401	276	676	176	852	79%	21%	-43,803	-42,013	10,839	-
2008 Residential Total	**487**	**372**	**859**	**193**	**1,053**	**82%**	**18%**	**-39,774**	**-38,746**	**10,905**	-
COMMERCIAL:											
New Construction	73	16	89	63	153	59%	41%	3,689	3,343	-	-
Retrofit	308	95	403	263	666	60%	40%	14,121	12,161	900	-
2008 Total Commercial	**381**	**111**	**492**	**327**	**819**	**60%**	**40%**	**17,810**	**15,504**	**900**	-
2008 Total Energy Efficiency	467	208	675	344	1,020	66%	34%	21,839	18,771	966	-
2008 Total	**868**	**483**	**1,352**	**520**	**1,872**	**72%**	**28%**	**-21,963**	**-23,242**	**11,805**	-
2009											
RESIDENTIAL:											
New Construction											
Energy Efficiency	124	32	156	7	163	95%	5%	5,501	4,722	49	-
Fuel Substitution	187	36	223	-8	214	104%	-4%	-10,564	-9,274	1,615	-
Retrofit											
Energy Efficiency	45	22	66	26	92	72%	28%	2,233	1,603	78	-
Fuel Substitution	371	162	533	180	713	75%	25%	-41,580	-39,646	10,518	-
Subtotals											
Residential Energy Efficiency	168	54	222	33	255	87%	13%	7,734	6,325	127	-
Residential Fuel Substitution	558	198	756	172	927	82%	18%	-52,144	-48,921	12,133	-
2009 Residential Total	**726**	**252**	**978**	**205**	**1,182**	**83%**	**17%**	**-44,410**	**-42,596**	**12,260**	-
COMMERCIAL:											
New Construction	74	15	90	64	154	58%	42%	3,763	3,405	0	-
Retrofit	474	121	595	414	1,008	59%	41%	20,371	17,798	1,125	-
2009 Total Commercial	**548**	**136**	**684**	**478**	**1,162**	**59%**	**41%**	**24,133**	**21,202**	**1,125**	-
2009 Total Energy Efficiency	717	190	906	511	1,417	64%	36%	31,867	27,527	1,252	-
2009 Total	**1,274**	**388**	**1,662**	**682**	**2,344**	**71%**	**29%**	**-20,277**	**-21,393**	**13,385**	-

NET PRESENT VALUE / BENEFIT/COST

	Levelized Cost ($/GJ)	Utility Benefits (Costs) – Program ($'000s)	Utility Benefits (Costs) – Alternate ($'000s)	Participant Benefits (Costs) – Program ($'000s)	Participant – Carbon Tax ($'000s)	Participant – Alternate ($'000s)	Program Net Savings – Natural Gas (GJ)	Program Net Savings – Alternate Energy (MWh)	Program Net Savings – Alternate Capacity (kW)	BENEFIT/COST – Natural Gas Utility	Participant – Total Costs ($'000s)	Participant – Total Benefits ($'000s)	Participant – Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits ($'000s)
2008																
RESIDENTIAL:																
New Construction																
Energy Efficiency	6	208	23	320	30	11	22,776	176	-	1.6	5	361	80.2	0.5	1.7	97
Fuel Substitution	FS	-409	923	-635	-59	450	-45,409	7,097	-	FS	694	454	0.7	1.0	1.5	303
Retrofit																
Energy Efficiency	7	72	32	111	10	16	7,883	248	-	1.4	13	137	10.4	0.4	1.6	38
Fuel Substitution	FS	-3,469	13,497	-5,279	-498	6,578	-374,294	103,821	-	FS	5,957	6,578	1.1	1.3	3.3	9,386
Subtotals																
Residential Energy Efficiency	6	280	55	431	41	27	30,659	424	-	**1.5**	**18**	**498**	**28.1**	**0.5**	**1.7**	**135**
Residential Fuel Substitution	FS	-3,878	14,419	-5,914	-557	7,028	-419,704	110,918	-	**FS**	**6,646**	**7,028**	**1.1**	**1.3**	**3.0**	**9,689**
2008 Residential Total	**FS**	**-3,598**	**14,474**	**-5,483**	**-516**	**7,055**	**-389,045**	**111,342**	-							
COMMERCIAL:																
New Construction	2	380	-	486	53	-	39,800	-	-	4.2	63	539	8.5	0.7	2.5	227
Retrofit	3	1,325	818	1,698	186	351	139,120	6,293	-	3.3	263	2,235	8.5	0.6	3.2	1,477
2008 Total Commercial	**3**	**1,705**	**818**	**2,184**	**239**	**351**	**178,920**	**6,293**	-	**3.5**	**327**	**2,774**	**8.5**	**0.6**	**3.1**	**1,704**
2008 Total Energy Efficiency	3.2	1,985	873	2,615	280	378	209,578	6,716	-	2.9	344	3,273	9.5	0.6	2.8	1,839
2008 Total	**FS**	**-1,892**	**15,292**	**-3,299**	**-277**	**7,406**	**-210,125**	**117,634**	-	**FS**	**4,096**	**7,406**	**1.8**	**1.0**	**4.1**	**11,528**
2009																
RESIDENTIAL:																
New Construction																
Energy Efficiency	4	402	43	623	63	21	44,364	334	-	2.6	7	707	94.8	0.5	2.7	282
Fuel Substitution	FS	-617	1,421	-975	-99	692	-69,732	10,929	-	FS	1,074	701	0.7	1.2	1.7	590
Retrofit																
Energy Efficiency	4	137	63	213	21	31	15,139	485	-	2.1	26	265	10.4	0.5	2.2	108
Fuel Substitution	FS	-3,773	14,265	-5,782	-579	6,953	-410,062	109,732	-	FS	6,541	6,953	1.1	1.3	3.2	9,779
Subtotals																
Residential Energy Efficiency	4	539	106	836	84	52	59,503	819	-	**2.4**	**33**	**972**	**29.5**	**0.5**	**2.5**	**391**
Residential Fuel Substitution	FS	-4,390	15,686	-6,757	-678	7,645	-479,794	120,661	-	**FS**	**7,606**	**7,645**	**1.0**	**1.3**	**3.0**	**10,369**
2009 Residential Total	**FS**	**-3,851**	**15,792**	**-5,921**	**-594**	**7,697**	**-420,291**	**121,479**	-							
COMMERCIAL:																
New Construction	2	384	0	493	57	0	40,389	-	-	4.3	64	550	8.6	0.7	2.5	230
Retrofit	3	1,942	1,023	2,499	289	439	204,712	7,866	-	3.3	414	3,227	7.8	0.6	2.9	1,956
2009 Total Commercial	**3**	**2,326**	**1,023**	**2,992**	**346**	**439**	**245,101**	**7,866**	-	**3.4**	**478**	**3,777**	**7.9**	**0.6**	**2.9**	**2,186**
2009 Total Energy Efficiency	3.0	2,865	1,129	3,828	430	491	304,605	8,685	-	3.2	511	4,749	9.3	0.6	2.8	2,577
2009 Total	**FS**	**-1,525**	**16,815**	**-2,929**	**-248**	**8,136**	**-175,190**	**129,346**	-	**FS**	**3,859**	**8,136**	**2.1**	**0.9**	**4.3**	**12,946**

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	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Participant Benefits (Costs)			Program Net Savings				Participant					
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity	Natural Gas	Total Costs	Total Benefits	Benefit/Cost	Natural Gas		TRC Net Benefits
	Incentives	Administration	Total	Participant	Total	% Utility	% Participant	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2010																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	189	43	232	13	245	95%	5%	8,479	7,231	88	-	3	619	76	954	101	37	67,863	588	-	2.7	13	1,092	81.6	0.5	2.8	450
Fuel Substitution	268	75	343	-17	326	105%	-5%	-15,488	-13,473	2,371	-	FS	-913	2,102	-1,437	-154	1,025	-102,767	16,172	-	FS	1,592	1,042	0.7	1.1	1.7	864
Retrofit																											
Energy Efficiency	68	29	97	39	136	71%	29%	3,455	2,476	118	-	4	213	96	328	35	47	23,327	737	-	2.2	39	409	10.5	0.5	2.3	172
Fuel Substitution	463	128	591	180	771	77%	23%	-46,070	-43,204	11,217	-	FS	-4,116	14,996	-6,263	-656	7,309	-444,214	115,352	-	FS	7,099	7,309	1.0	1.3	3.1	10,109
Subtotals																											
Residential Energy Efficiency	257	72	329	53	382	86%	14%	11,934	9,707	206	-	4	832	172	1,282	135	84	91,190	1,325	-	**2.5**	**53**	**1,501**	**28.6**	**0.5**	**2.6**	**622**
Residential Fuel Substitution	731	203	934	163	1,097	85%	15%	-61,558	-56,676	13,588	-	FS	-5,029	17,098	-7,700	-810	8,333	-546,981	131,524	-	**FS**	**8,673**	**8,333**	**1.0**	**1.3**	**2.8**	**10,973**
2010 Residential Total	**988**	**275**	**1,263**	**216**	**1,478**	**85%**	**15%**	**-49,624**	**-46,970**	**13,794**	**-**	**FS**	**-4,197**	**17,270**	**-6,419**	**-675**	**8,417**	**-455,791**	**132,848**	**-**							
COMMERCIAL:																											
New Construction	798	78	876	831	1,707	51%	49%	11,767	10,938	3,044	-	7	1,270	4,806	1,614	194	2,063	132,049	36,967	-	1.5	831	3,870	4.7	0.5	3.6	4,369
Retrofit	625	171	796	551	1,347	59%	41%	27,667	24,498	2,025	-	3	2,637	1,841	3,373	406	790	276,486	14,159	-	3.3	551	4,570	8.3	0.6	3.3	3,131
2010 Total Commercial	**1,422**	**249**	**1,671**	**1,382**	**3,054**	**55%**	**45%**	**39,434**	**35,436**	**5,069**	**-**	**4**	**3,907**	**6,646**	**4,987**	**600**	**2,853**	**408,535**	**51,125**	**-**	**2.3**	**1,382**	**8,440**	**6.1**	**0.6**	**3.5**	**7,500**
2010 Total Energy Efficiency	1,679	321	2,001	1,435	3,435	58%	42%	51,368	45,143	5,275	-	4.0	4,739	6,819	6,269	735	2,937	499,725	52,450	-	2.4	1,435	9,941	6.9	0.6	3.4	8,122
2010 Total	**2,410**	**524**	**2,934**	**1,598**	**4,532**	**65%**	**35%**	**-10,190**	**-11,534**	**18,863**	**-**	**FS**	**-290**	**23,917**	**-1,432**	**-75**	**11,270**	**-47,256**	**183,974**	**-**	**FS**	**3,104**	**11,270**	**3.6**	**0.4**	**5.0**	**19,095**

	Incentives	Administration	Utility Total	Participant	Total	% Utility	% Participant	Gross	Net	MWh	kW	($/GJ)	Utility Program	Utility Alternate	Participant Program	Carbon Tax	Participant Alternate	Natural Gas (GJ)	Alternate Energy (MWh)	Alternate Capacity (kW)	Natural Gas Utility	Total Costs	Total Benefits	Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits
2008 - 2010 (NPV 2007)																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	325	127	452	22	474	95%	5%	14,592	12,462	141	-	3	1,229	143	1,897	193	70	135,002	1,097	-	2.7	22	2,160	98.4	0.5	2.9	897
Fuel Substitution	504	181	684	-26	659	104%	-4%	-28,689	-25,115	4,386	-	FS	-1,938	4,446	-3,047	-312	2,167	-217,908	34,197	-	FS	3,359	2,192	0.7	1.2	1.7	1,849
Retrofit																											
Energy Efficiency	118	71	189	67	257	74%	26%	5,943	4,261	205	-	4	423	191	652	66	93	46,350	1,469	-	2.2	67	811	12.0	0.5	2.4	357
Fuel Substitution	973	422	1,395	478	1,873	74%	26%	-109,697	-104,685	27,811	-	FS	-11,359	42,758	-17,324	-1,733	20,839	-1,228,570	328,905	-	FS	19,535	20,839	1.1	1.4	3.2	29,526
Subtotals																											
Residential Energy Efficiency	**443**	**198**	**642**	**89**	**731**	**88%**	**12%**	**20,535**	**16,723**	**346**	**-**	**4**	**1,651**	**334**	**2,549**	**260**	**163**	**181,352**	**2,567**	**-**	**2.6**	**89**	**2,971**	**33.2**	**0.5**	**2.7**	**1,254**
Residential Fuel Substitution	**1,477**	**602**	**2,079**	**452**	**2,531**	**82%**	**18%**	**-138,387**	**-129,800**	**32,197**	**-**	**FS**	**-13,296**	**47,203**	**-20,371**	**-2,044**	**23,006**	**-1,446,479**	**363,103**	**-**	**FS**	**22,868**	**23,006**	**1.0**	**1.3**	**3.0**	**31,376**
2008 - 2010 Total Residential	**1,920**	**801**	**2,721**	**542**	**3,262**	**83%**	**17%**	**-117,852**	**-113,078**	**32,543**	**-**	**FS**	**-11,645**	**47,537**	**-17,822**	**-1,785**	**23,169**	**-1,265,127**	**365,669**	**-**							
COMMERCIAL:																											
New Construction	797	94	891	806	1,697	52%	48%	16,567	15,237	2,528	-	4	2,034	4,806	2,593	304	2,063	212,238	36,967	-	2.3	806	4,960	6.1	0.6	4.0	5,142
Retrofit	1,227	338	1,565	1,071	2,636	59%	41%	54,256	47,508	3,522	-	3	5,905	3,681	7,570	881	1,580	620,318	28,318	-	3.8	1,071	10,032	9.4	0.6	3.6	6,950
2008 - 2010 Total Commercial	**2,024**	**431**	**2,456**	**1,877**	**4,333**	**57%**	**43%**	**70,823**	**62,745**	**6,051**	**-**	**3**	**7,938**	**8,487**	**10,163**	**1,185**	**3,643**	**832,556**	**65,284**	**-**	**3.2**	**1,877**	**14,991**	**8.0**	**0.6**	**3.8**	**12,092**
2008-2010 Total Energy Efficiency	2,468	630	3,097	1,967	5,064	61%	39%	91,358	79,467	6,396	-	3.1	9,589	8,821	12,712	1,445	3,806	1,013,908	67,851	-	3.1	1,967	17,962	9.1	0.6	3.6	13,346
2008 - 2010 Total	**3,944**	**1,232**	**5,176**	**2,419**	**7,595**	**68%**	**32%**	**-47,028**	**-50,333**	**38,593**	**-**	**FS**	**-3,707**	**56,024**	**-7,660**	**-599**	**26,812**	**-432,571**	**430,954**	**-**	**FS**	**10,678**	**26,812**	**2.5**	**0.9**	**5.0**	**44,722**

TERASEN GAS INC

PORTFOLIO

NON-ENERGY

Cost Summary

ANNUAL ACTIVITY		Total	2008	2009	2010	Explanatory Notes
Utility Program Costs						
Conservation Education & Outreach		$ 13,835,000	$ 5,245,000	$ 4,295,000	$ 4,295,000	
Joint Initiatives		$ 3,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	
Trade Relations		$ 1,500,000	$ 500,000	$ 500,000	$ 500,000	
Innovative Technologies		**$ 3,000,000**	**$ 1,000,000**	$ 1,000,000	$ 1,000,000	
Conservation Potential Review		$ 500,000		$ 500,000		
	Total	$ 21,835,000	$ 7,745,000	$ 7,295,000	$ 6,795,000	

Appendix 11 B

Portfolio <u>Excluding</u> Free Riders

2008 DSM PLAN VERSION 080328 w 100% net to gross

	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Customer Benefits (Costs)			Program Net Savings				Participant					
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity	Natural Gas	Total Costs	Total Benefits	Benefit/Cost	Natural Gas		TRC Net Benefits
	Incentives	Administration	Total	Customer	Total	% Utility	% Customer	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2008																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	238	302	541	82	623	87%	13%	13,709	13,709	244	-	4.4	1,158	292	1,509	161	142	122,596	2,247	-	2.1	82	1,813	22.1	0.6	2.3	827
Fuel Substitution	318	256	575	-201	374	154%	-54%	-38,673	-38,673	4,937	-	FS	-3,587	6,516	-4,612	-498	3,176	(377,306)	50,123	-	FS	5,110	3,377	0.7	1.1	1.6	2,555
Retrofit																											
Energy Efficiency	1,773	775	2,548	1,369	3,917	65%	35%	84,770	84,770	755	-	3.1	7,967	911	9,944	1,100	444	832,885	7,009	-	3.1	1,369	11,489	8.4	0.6	2.3	4,961
Fuel Substitution	278	183	461	180	641	72%	28%	-36,900	-36,900	9,785	-	FS	-3,562	13,668	-5,420	-511	6,662	(384,299)	105,142	-	FS	6,111	6,662	1.1	1.3	3.3	9,466
Subtotals																											
Residential Energy Efficiency	2,011	1,078	3,089	1,451	4,540	68%	32%	98,479	98,479	999	-	3.2	9,125	1,203	11,454	1,262	586	955,481	9,256	-	**3.0**	**1,451**	**13,302**	**9.2**	**0.6**	**2.3**	**5,788**
Residential Fuel Substitution	596	440	1,036	-21	1,015	102%	-2%	-75,573	-75,573	14,722	-	FS	-7,149	20,184	-10,032	-1,009	9,838	(761,605)	155,265	-	**FS**	**11,042**	**9,858**	**0.9**	**1.2**	**2.5**	**12,021**
2008 Residential Total	**2,607**	**1,518**	**4,125**	**1,430**	**5,555**	**74%**	**26%**	**22,906**	**22,906**	**15,721**	**-**	**21**	**1,976**	**21,388**	**1,422**	**252**	**10,424**	**193,876**	**164,522**	**-**							
COMMERCIAL:																											
New Construction	1,209	487	1,697	1,308	3,004	56%	44%	30,591	30,591	2,994	-	4.8	3,388	4,975	4,100	474	2,136	355,186	38,271	-	2.0	1,308	6,709	5.1	0.6	2.8	5,359
Retrofit	3,186	913	4,099	3,186	7,285	56%	44%	148,072	148,072	8,550	-	2.5	15,447	8,181	18,713	2,166	3,511	1,628,348	62,929	-	3.8	3,186	24,391	7.7	0.7	3.2	16,343
2008 Total Commercial	**4,395**	**1,400**	**5,796**	**4,494**	**10,290**	**56%**	**44%**	**178,662**	**178,662**	**11,544**	**-**	**2.9**	**18,835**	**13,156**	**22,813**	**2,640**	**5,647**	**1,983,534**	**101,200**	**-**	**3.2**	**4,494**	**31,100**	**6.9**	**0.7**	**3.1**	**21,702**
SUBTOTALS:																											
Energy Efficiency	6,406	2,478	8,885	5,945	14,830	60%	40%	277,142	277,142	12,542	-	3.0	27,960	14,359	34,267	3,902	6,233	2,939,015	110,456	-	3.1	5,945	44,402	7.5	0.6	2.9	27,490
Program	**7,002**	**2,918**	**9,920**	**5,924**	**15,845**	**63%**	**37%**	**201,569**	**201,569**	**27,265**	**-**	**4.6**	**20,811**	**34,544**	**24,235**	**2,892**	**16,071**	**2,177,410**	**265,722**	**-**	**2.1**	**5,924**	**43,198**	**7.3**	**0.6**	**3.5**	**39,511**
COMMUNICATIONS:																											
Conservation Education & Outreach		5,245																									
Joint Initiatives		1,000																									
Trade Relations		500																									
Innovative Technologies		1,000																									
Communications Total		**7,745**																									
2008 TOTAL	**7,002**	**10,663**	**17,665**	**5,924**	**23,590**	**75%**	**25%**	**201,569**	**201,569**	**27,265**	**-**	**8.1**	**20,811**	**34,544**	**24,235**	**2,892**	**16,071**	**2,177,410**	**265,722**	**-**	**1.2**	**5,924**	**43,198**	**7.3**	**0.5**	**2.3**	**31,766**
2009																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	549	173	721	137	858	84%	16%	28,851	28,851	469	-	2.8	2,441	564	3,198	367	275	260,523	4,340	-	3.4	137	3,840	28.1	0.6	3.5	2,147
Fuel Substitution	457	175	632	-282	350	180%	-80%	-53,784	-53,784	6,970	-	FS	-4,927	9,166	-6,410	-737	4,467	(522,984)	70,509	-	FS	7,146	4,749	0.7	1.2	1.7	3,888
Retrofit																											
Energy Efficiency	1,970	755	2,725	1,462	4,186	65%	35%	95,883	95,883	1,138	-	2.9	8,848	1,373	11,148	1,313	669	932,725	10,561	-	3.2	1,462	13,131	9.0	0.6	2.4	6,034
Fuel Substitution	371	162	533	180	713	75%	25%	-41,580	-41,580	10,518	-	FS	-3,954	14,602	-6,060	-607	7,117	(429,787)	112,324	-	FS	6,847	7,117	1.0	1.4	3.1	9,935
Subtotals																											
Residential Energy Efficiency	2,518	928	3,446	1,598	5,044	68%	32%	124,734	124,734	1,607	-	2.9	11,289	1,937	14,346	1,680	944	1,193,248	14,901	-	**3.3**	**1,598**	**16,971**	**10.6**	**0.6**	**2.6**	**8,182**
Residential Fuel Substitution	828	337	1,165	-102	1,063	110%	-10%	-95,364	-95,364	17,488	-	FS	-8,882	23,768	-12,470	-1,343	11,584	(952,771)	182,832	-	**FS**	**13,814**	**11,686**	**0.8**	**1.2**	**2.4**	**13,823**
2009 Total Residential	**3,346**	**1,265**	**4,611**	**1,497**	**6,108**	**75%**	**25%**	**29,370**	**29,370**	**19,095**	**-**	**19**	**2,407**	**25,705**	**1,876**	**337**	**12,528**	**240,477**	**197,733**	**-**							
COMMERCIAL:																											
New Construction	2,232	477	2,709	2,435	5,144	53%	47%	51,771	51,771	6,163	-	4.5	6,107	10,242	6,915	846	4,396	601,031	78,784	-	2.3	2,435	12,157	5.0	0.6	3.2	11,205
Retrofit	4,276	1,302	5,578	4,276	9,854	57%	43%	210,754	210,754	11,475	-	2.4	22,976	10,979	26,355	3,230	4,713	2,294,736	84,457	-	4.1	4,276	34,298	8.0	0.7	3.4	24,102
2009 Total Commercial	**6,508**	**1,779**	**8,287**	**6,711**	**14,998**	**55%**	**45%**	**262,525**	**262,525**	**17,638**	**-**	**2.9**	**29,083**	**21,221**	**33,271**	**4,076**	**9,109**	**2,895,767**	**163,241**	**-**	**3.5**	**6,711**	**46,455**	**6.9**	**0.7**	**3.4**	**35,307**
SUBTOTALS:																											
Energy Efficiency Subtotal	9,026	2,707	11,733	8,309	20,042	59%	41%	387,259	387,259	19,245	-	2.9	40,372	23,158	47,617	5,756	10,053	4,089,015	178,142	-	3.4	8,309	63,426	7.6	0.7	3.2	43,488
Program Subtotal	**9,854**	**3,044**	**12,898**	**8,208**	**21,105**	**61%**	**39%**	**291,895**	**291,895**	**36,733**	**-**	**4.1**	**31,490**	**46,927**	**35,147**	**4,413**	**21,637**	**3,136,245**	**360,974**	**-**	**2.4**	**8,208**	**61,196**	**7.5**	**0.7**	**3.7**	**57,311**
COMMUNICATIONS:																											
Conservation Education & Outreach		4,295																									
Joint Initiatives		1,000																									
Trade Relations		500																									
Innovative Technologies		1,000																									
Conservation Potential Review		500																									
Communications Total		**7,295**																									
2009 TOTAL	**9,854**	**10,339**	**20,193**	**8,208**	**28,400**	**71%**	**29%**	**291,895**	**291,895**	**36,733**	**-**	**6.4**	**31,490**	**46,927**	**35,147**	**4,413**	**21,637**	**3,136,245**	**360,974**	**-**	**1.6**	**8,208**	**61,196**	**7.5**	**0.6**	**2.8**	**50,016**

2008 DSM PLAN VERSION 080328 w 100% net to gross

	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Customer Benefits (Costs)			Program Net Savings				Participant					
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity	Natural Gas	Total Costs	Total Benefits	Benefit/Cost	Natural Gas		TRC Net Benefits
	Incentives	Administration	Total	Customer	Total	% Utility	% Customer	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2010																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	964	324	1,288	196	1,484	87%	13%	48,479	48,479	723	-	2.9	4,152	871	5,383	652	425	439,817	6,701	-	3.2	196	6,459	33.0	0.6	3.4	3,539
Fuel Substitution	613	294	907	-368	539	168%	-68%	-70,158	-70,158	9,198	-	FS	-6,448	12,045	-8,363	-1,004	5,870	(679,721)	92,652	-	FS	9,367	6,239	0.7	1.1	1.7	5,058
Retrofit																											
Energy Efficiency	968	496	1,464	356	1,820	80%	20%	51,955	51,955	1,523	-	3.1	4,443	1,837	5,618	694	896	468,450	14,134	-	3.0	356	7,208	20.2	0.6	3.5	4,460
Fuel Substitution	463	128	591	180	771	77%	23%	-46,070	-46,070	11,217	-	FS	-4,387	15,494	-6,675	-699	7,551	(473,479)	119,181	-	FS	7,554	7,551	1.0	1.3	3.0	10,336
Subtotals																											
Residential Energy Efficiency	1,932	820	2,752	552	3,304	83%	17%	100,434	100,434	2,246	-	3.0	8,595	2,709	11,001	1,346	1,320	908,267	20,835	-	**3.1**	**552**	**13,667**	**24.7**	**0.6**	**3.4**	**8,000**
Residential Fuel Substitution	1,076	422	1,498	-188	1,310	114%	-14%	-116,228	-116,228	20,416	-	FS	-10,834	27,538	-15,038	-1,703	13,422	(1,153,200)	211,833	-	**FS**	**16,741**	**13,610**	**0.8**	**1.2**	**2.3**	**15,394**
2010 Total Residential	**3,008**	**1,242**	**4,249**	**364**	**4,614**	**92%**	**8%**	**-15,794**	**-15,794**	**22,662**	**-**	**FS**	**-2,239**	**30,247**	**-4,037**	**-357**	**14,742**	**(244,933)**	**232,668**	**-**							
COMMERCIAL:																											
New Construction	4,205	788	4,993	4,633	9,625	52%	48%	83,523	83,523	13,380	-	5.1	9,953	22,235	11,274	1,427	9,544	975,093	171,039	-	2.0	4,633	22,245	4.8	0.6	3.3	22,562
Retrofit	5,627	2,012	7,639	5,627	13,266	58%	42%	282,700	282,700	19,575	-	2.5	30,324	18,730	34,622	4,434	8,039	3,017,714	144,074	-	4.0	5,627	47,095	8.4	0.7	3.7	35,787
2010 Total Commercial	**9,832**	**2,800**	**12,632**	**10,260**	**22,892**	**55%**	**45%**	**366,223**	**366,223**	**32,955**	**-**	**3.2**	**40,277**	**40,965**	**45,896**	**5,862**	**17,583**	**3,992,807**	**315,112**	**-**	**3.2**	**10,260**	**69,341**	**6.8**	**0.7**	**3.5**	**58,350**
SUBTOTALS:																											
Energy Efficiency Subtotal	11,764	3,619	15,384	10,812	26,196	59%	41%	466,657	466,657	35,201	-	3.1	48,872	43,673	56,897	7,207	18,903	4,901,074	335,947	-	3.2	10,812	83,008	7.7	0.7	3.5	66,349
Program Subtotal	**12,840**	**4,042**	**16,882**	**10,624**	**27,505**	**61%**	**39%**	**350,428**	**350,428**	**55,616**	**-**	**4.5**	**38,037**	**71,212**	**41,859**	**5,504**	**32,325**	**3,747,874**	**547,781**	**-**	**2.3**	**10,624**	**79,688**	**7.5**	**0.6**	**4.0**	**81,744**
COMMUNICATIONS:																											
Conservation Education & Outreach		4,295																									
Joint Initiatives		1,000																									
Trade Relations		500																									
Innovative Technologies		1,000																									
CommunicationsTotal		**6,795**																									
2010 TOTAL	**12,840**	**10,837**	**23,677**	**10,624**	**34,300**	**69%**	**31%**	**350,428**	**350,428**	**55,616**	**-**	**6.3**	**38,037**	**71,212**	**41,859**	**5,504**	**32,325**	**3,747,874**	**547,781**	**-**	**1.6**	**10,624**	**79,688**	**7.5**	**0.6**	**3.2**	**74,949**
2008 - 2010 (NPV 2007)																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	1,499	702	2,201	358	2,559	86%	14%	78,131	78,131	1,235	-	2.7	7,751	1,727	10,090	1,180	842	822,936	13,288	-	3.5	358	12,112	33.8	0.6	3.7	6,919
Fuel Substitution	1,207	637	1,844	-738	1,106	167%	-67%	-141,323	-141,323	18,337	-	FS	-14,962	27,727	-19,385	-2,239	13,514	(1,580,010)	213,284	-	FS	21,624	14,252	0.7	1.2	1.7	11,659
Retrofit																											
Energy Efficiency	4,187	1,797	5,983	2,859	8,842	68%	32%	206,314	206,314	2,959	-	2.7	21,258	4,122	26,711	3,108	2,009	2,234,060	31,704	-	3.6	2,859	31,827	11.1	0.7	2.9	16,537
Fuel Substitution	973	422	1,395	478	1,873	74%	26%	-109,697	-109,697	27,811	-	FS	-11,903	43,764	-18,156	-1,817	21,330	(1,287,565)	336,647	-	FS	20,451	21,330	1.0	1.4	3.2	29,988
Subtotals																											
Residential Energy Efficiency	5,686	2,499	8,185	3,217	11,402	72%	28%	284,445	284,445	4,194	-	2.7	29,009	5,849	36,801	4,288	2,851	3,056,996	44,992	-	**3.5**	**3,217**	**43,940**	**13.7**	**0.6**	**3.1**	**23,456**
Residential Fuel Substitution	2,180	1,059	3,239	-260	2,978	109%	-9%	-251,020	-251,020	46,148	-	FS	-26,865	71,491	-37,541	-4,056	34,844	(2,867,576)	549,931	-	**FS**	**41,596**	**35,104**	**0.8**	**1.2**	**2.4**	**41,648**
2008 - 2010 Total Residential	**7,866**	**3,558**	**11,423**	**2,957**	**14,380**	**79%**	**21%**	**52,438**	**52,438**	**53,061**	**-**	**60**	**2,144**	**77,340**	**-739**	**232**	**37,694**	**189,421**	**594,923**	**-**							
COMMERCIAL:																											
New Construction	6,556	1,523	8,080	7,179	15,258	53%	47%	142,889	142,889	19,239	-	4.2	19,447	37,452	22,289	2,747	16,076	1,931,310	288,094	-	2.4	7,179	41,112	5.7	0.6	3.7	41,641
Retrofit	11,372	3,654	15,027	11,372	26,399	57%	43%	556,474	556,474	34,199	-	2.2	68,748	37,890	79,691	9,830	16,263	6,940,798	291,459	-	4.6	11,372	105,784	9.3	0.7	4.0	80,239
2008 - 2010 Total Commercial	**17,928**	**5,178**	**23,106**	**18,551**	**41,657**	**55%**	**45%**	**699,363**	**699,363**	**53,438**	**-**	**2.6**	**88,195**	**75,342**	**101,980**	**12,577**	**32,339**	**8,872,108**	**579,553**	**-**	**3.8**	**18,551**	**146,896**	**7.9**	**0.7**	**3.9**	**121,880**
SUBTOTALS:																											
Energy Efficiency Subtotal	23,614	7,677	31,291	21,768	53,059	59%	41%	983,808	983,808	57,632	-	2.6	117,204	81,191	138,781	16,865	35,190	11,929,105	624,545	-	3.7	21,768	190,835	8.8	0.7	3.7	145,336
Program Subtotal	**25,794**	**8,736**	**34,530**	**21,508**	**56,037**	**62%**	**38%**	**751,801**	**751,801**	**106,499**	**-**	**3.8**	**90,339**	**152,682**	**101,240**	**12,809**	**70,033**	**9,061,529**	**1,174,476**	**-**	**2.6**	**21,508**	**184,083**	**8.6**	**0.7**	**4.3**	**186,984**
COMMUNICATIONS:																											
Conservation Education & Outreach		13,835																									
Joint Initiatives		3,000																									
Trade Relations		1,500																									
Innovative Technologies		3,000																									
Conservation Potential Review		500																									
Communications Total		**21,835**																									
2008 - 2010 TOTAL	**25,794**	**30,571**	**56,365**	**21,508**	**77,872**	**72%**	**28%**	**751,801**	**751,801**	**106,499**	**-**	**6.2**	**90,339**	**152,682**	**101,240**	**12,809**	**70,033**	**9,061,529**	**1,174,476**	**-**	**1.6**	**21,508**	**184,083**	**8.6**	**0.6**	**3.1**	**165,149**

TERASEN GAS INC

2008 DSM PLAN VERSION 080328 w 100% net to gross

	PROGRAM									ALTERNATE			NET PRESENT VALUE								BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Customer Benefits (Costs)			Program Net Savings				Participant					
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity	Natural Gas	Total Costs	Total Benefits	Benefit/Cost	Natural Gas		TRC Net Benefits
	Incentives	Administration	Total	Customer	Total	% Utility	% Customer	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2008																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	175	236	411	75	486	85%	15%	10,850	10,850	218	-	4	914	260	1,134	126	127	95,893	2,003	-	2.2	75	1,387	18.5	0.6	2.4	689
Fuel Substitution	195	164	359	-195	164	219%	-119%	-31,770	-31,770	3,883	-	FS	-3,120	5,466	-3,887	-431	2,664	-325,472	42,047	-	FS	4,318	2,859	0.7	1.1	1.7	2,182
Retrofit																											
Energy Efficiency	1,750	745	2,495	1,350	3,845	65%	35%	83,600	83,600	715	-	3	7,867	863	9,790	1,086	421	821,902	6,641	-	3.2	1,350	11,297	8.4	0.6	2.3	4,885
Fuel Substitution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	-	-	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals																											
Residential Energy Efficiency	1,925	981	2,906	1,425	4,331	67%	33%	94,450	94,450	933	-	3	8,780	1,124	10,924	1,212	548	917,795	8,645	-	**3.0**	**1,425**	**12,684**	**8.9**	**0.6**	**2.3**	**5,573**
Residential Fuel Substitution	195	164	359	-195	164	219%	-119%	-31,770	-31,770	3,883	-	FS	-3,120	5,466	-3,887	-431	2,664	-325,472	42,047	-	**FS**	**4,318**	**2,859**	**0.7**	**1.1**	**1.7**	**2,182**
2008 Residential Total	**2,120**	**1,145**	**3,265**	**1,230**	**4,495**	**73%**	**27%**	**62,680**	**62,680**	**4,816**	**-**	**6**	**5,660**	**6,590**	**7,037**	**781**	**3,212**	**592,323**	**50,692**	**-**							
COMMERCIAL:																											
New Construction	1,136	471	1,607	1,234	2,842	57%	43%	26,902	26,902	2,994	-	5	2,968	4,975	3,562	415	2,136	311,186	38,271	-	1.8	1,234	6,113	5.0	0.6	2.8	5,101
Retrofit	2,878	818	3,696	2,878	6,575	56%	44%	133,951	133,951	7,650	-	3	13,896	7,320	16,727	1,949	3,142	1,465,646	56,305	-	3.8	2,878	21,818	7.6	0.7	3.2	14,642
2008 Total Commercial	**4,014**	**1,289**	**5,303**	**4,113**	**9,416**	**56%**	**44%**	**160,852**	**160,852**	**10,644**	**-**	**3**	**16,864**	**12,295**	**20,290**	**2,363**	**5,277**	**1,776,832**	**94,576**	**-**	**3.2**	**4,113**	**27,930**	**6.8**	**0.7**	**3.1**	**19,743**
2008 Total Energy Efficiency	5,939	2,270	8,209	5,538	13,747	60%	40%	255,302	255,302	11,576	-	3.0	25,645	13,419	31,214	3,575	5,825	2,694,627	103,221	-	3.1	5,538	40,614	7.3	0.7	2.8	25,316
2008 Total	**6,134**	**2,435**	**8,569**	**5,343**	**13,911**	**62%**	**38%**	**223,532**	**223,532**	**15,460**	**-**	**3.6**	**22,525**	**18,885**	**27,327**	**3,144**	**8,489**	**2,369,155**	**145,268**	**-**	**2.6**	**5,343**	**38,960**	**7.3**	**0.6**	**3.0**	**27,498**
2009																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	425	141	566	125	691	82%	18%	23,350	23,350	420	-	3	1,975	505	2,474	294	246	208,997	3,882	-	3.5	125	3,014	24.1	0.6	3.6	1,789
Fuel Substitution	270	139	409	-270	139	294%	-194%	-43,220	-43,220	5,356	-	FS	-4,217	7,538	-5,288	-623	3,674	-442,774	57,988	-	FS	5,911	3,944	0.7	1.1	1.7	3,182
Retrofit																											
Energy Efficiency	1,925	733	2,658	1,425	4,083	65%	35%	93,650	93,650	1,060	-	3	8,657	1,279	10,853	1,283	623	911,694	9,840	-	3.3	1,425	12,760	9.0	0.6	2.4	5,853
Fuel Substitution	0	0	0	0	0	-	-		0	0	-	-	0	0	0	0	0	0	-	-	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals																											
Residential Energy Efficiency	2,350	874	3,224	1,550	4,774	68%	32%	117,000	117,000	1,480	-	3	10,632	1,784	13,326	1,578	869	1,120,691	13,723	-	**3.3**	**1,550**	**15,774**	**10.2**	**0.6**	**2.6**	**7,642**
Residential Fuel Substitution	270	139	409	-270	139	294%	-194%	-43,220	-43,220	5,356	-	FS	-4,217	7,538	-5,288	-623	3,674	-442,774	57,988	-	**FS**	**5,911**	**3,944**	**0.7**	**1.1**	**1.7**	**3,182**
2009 Residential Total	**2,620**	**1,013**	**3,633**	**1,280**	**4,913**	**74%**	**26%**	**73,780**	**73,780**	**6,835**	**-**	**5**	**6,415**	**9,322**	**8,038**	**955**	**4,544**	**677,918**	**71,710**	**-**							
COMMERCIAL:																											
New Construction	2,158	462	2,619	2,361	4,980	53%	47%	48,009	48,009	6,163	-	5	5,682	10,242	6,369	783	4,396	556,337	78,784	-	2.2	2,361	11,548	4.9	0.6	3.2	10,944
Retrofit	3,802	1,181	4,983	3,802	8,785	57%	43%	190,383	190,383	10,350	-	2	20,739	9,903	23,479	2,898	4,251	2,059,100	76,177	-	4.2	3,802	30,627	8.1	0.7	3.5	21,857
2009 Total Commercial	**5,960**	**1,643**	**7,602**	**6,163**	**13,765**	**55%**	**45%**	**238,392**	**238,392**	**16,513**	**-**	**3**	**26,421**	**20,145**	**29,848**	**3,680**	**8,647**	**2,615,437**	**154,960**	**-**	**3.5**	**6,163**	**42,175**	**6.8**	**0.7**	**3.4**	**32,801**
2009 Total Energy Efficiency	8,310	2,517	10,826	7,713	18,539	58%	42%	355,392	355,392	17,993	-	2.9	37,053	21,929	43,174	5,258	9,516	3,736,128	168,683	-	3.4	7,713	57,949	7.5	0.7	3.2	40,443
2009 Total	**8,580**	**2,656**	**11,236**	**7,443**	**18,678**	**60%**	**40%**	**312,172**	**312,172**	**23,348**	**-**	**3.4**	**32,836**	**29,467**	**37,886**	**4,635**	**13,190**	**3,293,354**	**226,671**	**-**	**2.9**	**7,443**	**55,712**	**7.5**	**0.7**	**3.3**	**43,625**
2010																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	775	281	1,056	175	1,231	86%	14%	40,000	40,000	635	-	3	3,429	765	4,269	534	373	360,509	5,882	-	3.2	175	5,175	29.6	0.6	3.4	2,963
Fuel Substitution	345	219	564	-345	219	257%	-157%	-54,670	-54,670	6,828	-	FS	-5,383	9,611	-6,689	-824	4,684	-560,075	73,928	-	FS	7,513	5,029	0.7	1.1	1.7	4,009
Retrofit																											
Energy Efficiency	900	467	1,367	300	1,667	82%	18%	48,500	48,500	1,405	-	3	4,147	1,695	5,162	646	826	435,982	13,040	-	3.0	300	6,634	22.1	0.6	3.5	4,175
Fuel Substitution	0	0	0	0	0	-	-		0	0	-	-	0	0	0	0	0	0	-	-	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals																											
Residential Energy Efficiency	1,675	747	2,422	475	2,897	84%	16%	88,500	88,500	2,040	-	3	7,576	2,460	9,430	1,180	1,199	796,490	18,922	-	**3.1**	**475**	**11,809**	**24.9**	**0.6**	**3.5**	**7,138**
Residential Fuel Substitution	345	219	564	-345	219	257%	-157%	-54,670	-54,670	6,828	-	FS	-5,383	9,611	-6,689	-824	4,684	-560,075	73,928	-	**FS**	**7,513**	**5,029**	**0.7**	**1.1**	**1.7**	**4,009**
2010 Residential Total	**2,020**	**967**	**2,987**	**130**	**3,117**	**96%**	**4%**	**33,830**	**33,830**	**8,867**	**-**	**13**	**2,193**	**12,071**	**2,741**	**356**	**5,883**	**236,416**	**92,850**	**-**							
COMMERCIAL:																											
New Construction	3,408	710	4,117	3,747	7,864	52%	48%	71,755	71,755	10,336	-	5	8,586	17,176	9,537	1,219	7,373	832,961	132,127	-	2.1	3,747	18,129	4.8	0.6	3.3	17,898
Retrofit	5,002	1,841	6,843	5,002	11,846	58%	42%	255,033	255,033	17,550	-	3	27,325	16,792	30,788	3,972	7,208	2,703,560	129,170	-	4.0	5,002	41,968	8.4	0.7	3.7	32,271
2010 Total Commercial	**8,410**	**2,551**	**10,961**	**8,749**	**19,710**	**56%**	**44%**	**326,789**	**326,789**	**27,886**	**-**	**3**	**35,911**	**33,968**	**40,325**	**5,191**	**14,580**	**3,536,521**	**261,296**	**-**	**3.3**	**8,749**	**60,097**	**6.9**	**0.7**	**3.5**	**50,169**
2010 Total Energy Efficiency	10,085	3,298	13,383	9,224	22,607	59%	41%	415,289	415,289	29,925	-	3.1	43,486	36,428	49,756	6,371	15,779	4,333,011	280,218	-	3.2	9,224	71,906	7.8	0.7	3.5	57,308
2010 Total	**10,430**	**3,518**	**13,947**	**8,879**	**22,826**	**61%**	**39%**	**360,619**	**360,619**	**36,753**	**-**	**3.7**	**38,104**	**46,039**	**43,067**		**20,463**	**3,772,937**	**354,146**	**-**	**2.7**	**8,879**	**63,530**	**7.2**	**0.7**	**3.7**	**61,316**

TERASEN GAS INC

2008 DSM PLAN VERSION 080328 w 100% net to gross

2008 - 2010 (NPV 2007)	PROGRAM – COSTS ($000) – Utility – Incentives	Utility – Administration	Utility – Total	Customer	Total	% Utility	% Customer	SAVINGS (GJ) – Gross	SAVINGS (GJ) – Net	ALTERNATE Impact – Energy MWh	ALTERNATE Impact – Capacity kW	Levelized Cost ($/GJ)
RESIDENTIAL:												
New Construction												
Energy Efficiency	1,174	575	1,749	324	2,073	84%	16%	63,539	63,539	1,094	-	3
Fuel Substitution	703	457	1,160	-703	457	254%	-154%	-112,634	-112,634	13,951	-	FS
Retrofit												
Energy Efficiency	4,069	1,725	5,794	2,762	8,556	68%	32%	200,371	200,371	2,755	-	3
Fuel Substitution	0	0	0	0	0	-	-	0	0	0	-	-
Subtotals												
Residential Energy Efficiency	5,243	2,300	7,543	3,086	10,629	71%	29%	263,910	263,910	3,849	-	3
Residential Fuel Substitution	703	457	1,160	-703	457	254%	-154%	-112,634	-112,634	13,951	-	FS
2008 - 2010 Total Residential	**5,946**	**2,757**	**8,703**	**2,382**	**11,085**	**79%**	**21%**	**170,290**	**170,290**	**20,519**	**-**	**6**
COMMERCIAL:												
New Construction	5,759	1,430	7,189	6,308	13,497	53%	47%	126,321	126,321	16,710	-	4
Retrofit	10,145	3,317	13,462	10,145	23,606	57%	43%	502,218	502,218	30,677	-	2
2008 - 2010 Total Commercial	**15,904**	**4,746**	**20,650**	**16,453**	**37,104**	**56%**	**44%**	**628,540**	**628,540**	**47,387**	**-**	**3**
2008-2010 Total Energy Efficiency	21,147	7,047	28,193	19,539	47,732	59%	41%	892,450	892,450	51,236	-	2.6
2008 - 2010 Total	**21,850**	**7,503**	**29,353**	**18,836**	**48,189**	**61%**	**39%**	**798,830**	**798,830**	**67,905**	**-**	**3**

2008 - 2010 (NPV 2007)	NET PRESENT VALUE – Utility Benefits (Costs) – Program ($'000s)	Utility Benefits (Costs) – Alternate ($'000s)	Customer Benefits (Costs) – Program ($'000s)	Customer Benefits (Costs) – Carbon Tax ($'000s)	Customer Benefits (Costs) – Alternate ($'000s)	Program Net Savings – Natural Gas (GJ)	Program Net Savings – Alternate Energy (MWh)	Alternate Capacity (kW)	BENEFIT/COST – Natural Gas Utility	Participant – Total Costs ($'000s)	Participant – Total Benefits ($'000s)	Participant – Benefit/Cost	Natural Gas Rate Impact	Total Resource	TRC Net Benefits ($'000s)
RESIDENTIAL:															
New Construction															
Energy Efficiency	6,318	1,530	7,877	954	746	665,399	11,768	-	3.6	324	9,576	29.6	0.7	3.8	5,775
Fuel Substitution	-12,720	22,615	-15,864	-1,879	11,022	-1,328,321	173,964	-	FS	17,743	11,726	0.7	1.1	1.7	9,439
Retrofit															
Energy Efficiency	20,670	3,838	25,804	3,015	1,870	2,169,578	29,521	-	3.6	2,762	30,690	11.1	0.7	2.9	15,952
Fuel Substitution	0	0	0	0	0	0	-	-	N/A	-	-	N/A	N/A	N/A	N/A
Subtotals															
Residential Energy Efficiency	26,988	5,368	33,681	3,969	2,616	2,834,977	41,289	-	**3.6**	**3,086**	**40,267**	**13.0**	**0.7**	**3.0**	**21,727**
Residential Fuel Substitution	-12,720	22,615	-15,864	-1,879	11,022	-1,328,321	173,964	-	**FS**	**17,743**	**11,726**	**0.7**	**1.1**	**1.7**	**9,439**
2008 - 2010 Total Residential	**14,268**	**27,983**	**17,817**	**2,091**	**13,638**	**1,506,656**	**215,252**	**-**							
COMMERCIAL:															
New Construction	17,235	32,394	19,469	2,417	13,904	1,700,484	249,182	-	2.4	6,308	35,790	5.7	0.6	3.7	36,131
Retrofit	61,961	34,015	70,994	8,818	14,600	6,228,306	261,651	-	4.6	10,145	94,413	9.3	0.7	4.1	72,369
2008 - 2010 Total Commercial	**79,196**	**66,408**	**90,463**	**11,235**	**28,504**	**7,928,790**	**510,833**	**-**	**3.8**	**16,453**	**130,203**	**7.9**	**0.7**	**3.9**	**108,500**
2008-2010 Total Energy Efficiency	106,184	71,776	124,144	15,205	31,121	10,763,767	552,122	-	3.8	19,539	170,469	8.7	0.7	3.7	130,227
2008 - 2010 Total	**93,464**	**94,391**	**108,280**	**13,326**	**42,143**	**9,435,446**	**726,085**	**-**	**3.2**	**18,836**	**163,749**	**8.7**	**0.7**	**3.9**	**139,666**

TERASEN GAS VANCOUVER ISLAND

2008 DSM PLAN VERSION 080328 w 100% net to gross

	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Customer Benefits (Costs)			Program Net Savings			Natural Gas	Participant			Natural Gas		TRC Net Benefits
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity		Total Costs	Total Benefits	Benefit/Cost			
	Incentives	Administration	Total	Customer	Total	% Utility	% Customer	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2008																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	63	67	130	7	137	95%	5%	2,859	2,859	26	-	5	244	32	375	35	15	26,703	244	-	1.9	7	426	60.0	0.5	2.0	139
Fuel Substitution	123	92	215	-6	210	103%	-3%	-6,903	-6,903	1,054	-	FS	-467	1,050	-725	-67	512	-51,833	8,076	-	FS	792	517	0.7	1.1	1.6	374
Retrofit																											
Energy Efficiency	23	30	53	19	72	74%	26%	1,170	1,170	40	-	5	100	48	154	15	23	10,983	368	-	1.9	19	192	10.1	0.5	2.1	76
Fuel Substitution	278	183	461	180	641	72%	28%	-36,900	-36,900	9,785	-	FS	-3,562	13,668	-5,420	-511	6,662	-384,299	105,142	-	FS	6,111	6,662	1.1	1.3	3.3	9,466
Subtotals																											
Residential Energy Efficiency	86	97	183	26	209	88%	12%	4,029	4,029	66	-	5	344	80	530	50	39	37,686	612	-	**1.9**	**26**	**618**	**23.7**	**0.5**	**2.0**	**215**
Residential Fuel Substitution	401	276	676	174	851	80%	20%	-43,803	-43,803	10,839	-	FS	-4,029	14,718	-6,145	-578	7,174	-436,132	113,218	-	**FS**	**6,897**	**7,174**	**1.0**	**1.3**	**3.0**	**9,839**
2008 Residential Total	**487**	**372**	**859**	**200**	**1,060**	**81%**	**19%**	**-39,774**	**-39,774**	**10,905**	-	**FS**	**-3,684**	**14,798**	**-5,615**	**-529**	**7,212**	**-398,446**	**113,830**	-							
COMMERCIAL:																											
New Construction	73	16	89	73	163	55%	45%	3,689	3,689	-	-	2	420	-	537	59	-	44,001	-	-	4.7	73	596	8.1	0.7	2.6	257
Retrofit	308	95	403	308	711	57%	43%	14,121	14,121	900	-	2	1,551	861	1,986	218	370	162,701	6,624	-	3.9	308	2,573	8.4	0.6	3.4	1,701
2008 Total Commercial	**381**	**111**	**492**	**381**	**873**	**56%**	**44%**	**17,810**	**17,810**	**900**	-	**2**	**1,971**	**861**	**2,524**	**276**	**370**	**206,702**	**6,624**	-	**4.0**	**381**	**3,170**	**8.3**	**0.7**	**3.2**	**1,959**
2008 Total Energy Efficiency	467	208	675	407	1,083	62%	38%	21,839	21,839	966	-	2.8	2,315	941	3,053	326	408	244,388	7,236	-	3.4	407	3,788	9.3	0.6	3.0	2,174
2008 Total	**868**	**483**	**1,352**	**582**	**1,933**	**70%**	**30%**	**-21,963**	**-21,963**	**11,805**	-	**FS**	**-1,713**	**15,659**	**-3,092**	**-252**	**7,582**	**-191,745**	**120,454**	-	**FS**	**3,925**	**7,582**	**1.9**	**1.0**	**4.3**	**12,013**
2009																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	124	32	156	12	167	93%	7%	5,501	5,501	49	-	3	466	60	724	73	29	51,526	458	-	3.0	12	826	70.6	0.5	3.1	359
Fuel Substitution	187	36	223	-12	211	105%	-5%	-10,564	-10,564	1,615	-	FS	-710	1,628	-1,122	-113	793	-80,210	12,521	-	FS	1,235	805	0.7	1.2	1.8	706
Retrofit																											
Energy Efficiency	45	22	66	37	103	64%	36%	2,233	2,233	78	-	3	191	94	296	30	46	21,031	721	-	2.9	37	371	10.1	0.5	2.8	181
Fuel Substitution	371	162	533	180	713	75%	25%	-41,580	-41,580	10,518	-	FS	-3,954	14,602	-6,060	-607	7,117	-429,787	112,324	-	FS	6,847	7,117	1.0	1.4	3.1	9,935
Subtotals																											
Residential Energy Efficiency	168	54	222	48	270	82%	18%	7,734	7,734	127	-	3	657	153	1,020	102	75	72,557	1,178	-	**3.0**	**48**	**1,197**	**24.7**	**0.5**	**3.0**	**540**
Residential Fuel Substitution	558	198	756	168	924	82%	18%	-52,144	-52,144	12,133	-	FS	-4,665	16,230	-7,182	-720	7,910	-509,997	124,844	-	**FS**	**8,071**	**7,910**	**1.0**	**1.3**	**2.9**	**10,641**
2009 Residential Total	**726**	**252**	**978**	**217**	**1,195**	**82%**	**18%**	**-44,410**	**-44,410**	**12,260**	-	**FS**	**-4,008**	**16,383**	**-6,162**	**-618**	**7,985**	**-437,441**	**126,023**	-							
COMMERCIAL:																											
New Construction	74	15	90	74	164	55%	45%	3,763	3,763	0	-	2	425	0	546	63	0	44,694	-	-	4.7	74	609	8.2	0.7	2.6	261
Retrofit	474	121	595	474	1,069	56%	44%	20,371	20,371	1,125	-	3	2,237	1,076	2,877	333	462	235,637	8,280	-	3.8	474	3,671	7.7	0.6	3.1	2,245
2009 Total Commercial	**548**	**136**	**684**	**548**	**1,233**	**56%**	**44%**	**24,133**	**24,133**	**1,125**	-	**2**	**2,662**	**1,076**	**3,423**	**396**	**462**	**280,331**	**8,280**	-	**3.9**	**548**	**4,280**	**7.8**	**0.6**	**3.0**	**2,506**
2009 Total Energy Efficiency	717	190	906	597	1,503	60%	40%	31,867	31,867	1,252	-	2.6	3,319	1,230	4,442	498	537	352,887	9,459	-	3.7	597	5,477	9.2	0.6	3.0	3,046
2009 Total	**1,274**	**388**	**1,662**	**765**	**2,427**	**68%**	**32%**	**-20,277**	**-20,277**	**13,385**	-	**FS**	**-1,346**	**17,459**	**-2,740**	**-222**	**8,447**	**-157,110**	**134,303**	-	**FS**	**3,727**	**8,447**	**2.3**	**0.9**	**4.6**	**13,686**
2010																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	189	43	232	21	253	92%	8%	8,479	8,479	88	-	3	723	106	1,114	118	52	79,308	818	-	3.1	21	1,284	61.4	0.5	3.3	576
Fuel Substitution	268	75	343	-23	320	107%	-7%	-15,488	-15,488	2,371	-	FS	-1,065	2,434	-1,674	-179	1,186	-119,646	18,724	-	FS	1,854	1,209	0.7	1.2	1.8	1,049
Retrofit																											
Energy Efficiency	68	29	97	56	154	63%	37%	3,455	3,455	118	-	3	297	142	456	48	69	32,468	1,095	-	3.0	56	574	10.2	0.5	2.9	285
Fuel Substitution	463	128	591	180	771	77%	23%	-46,070	-46,070	11,217	-	FS	-4,387	15,494	-6,675	-699	7,551	-473,479	119,181	-	FS	7,554	7,551	1.0	1.3	3.0	10,336
Subtotals																											
Residential Energy Efficiency	257	72	329	77	407	81%	19%	11,934	11,934	206	-	3	1,019	249	1,571	166	121	111,776	1,913	-	**3.1**	**77**	**1,858**	**24.0**	**0.5**	**3.1**	**861**
Residential Fuel Substitution	731	203	934	157	1,090	86%	14%	-61,558	-61,558	13,588	-	FS	-5,452	17,928	-8,349	-878	8,738	-593,125	137,905	-	**FS**	**9,385**	**8,738**	**0.9**	**1.3**	**2.7**	**11,386**
2010 Residential Total	**988**	**275**	**1,263**	**234**	**1,497**	**84%**	**16%**	**-49,624**	**-49,624**	**13,794**	-	**FS**	**-4,432**	**18,176**	**-6,779**	**-713**	**8,859**	**-481,349**	**139,818**	-							
COMMERCIAL:																											
New Construction	798	78	876	886	1,761	50%	50%	11,767	11,767	3,044	-	6	1,367	5,059	1,737	208	2,171	142,131	38,912	-	1.6	886	4,117	4.6	0.5	3.6	4,664
Retrofit	625	171	796	625	1,421	56%	44%	27,667	27,667	2,025	-	3	2,999	1,938	3,833	462	832	314,155	14,904	-	3.8	625	5,127	8.2	0.6	3.5	3,516
2010 Total Commercial	**1,422**	**249**	**1,671**	**1,511**	**3,182**	**53%**	**47%**	**39,434**	**39,434**	**5,069**	-	**4**	**4,366**	**6,996**	**5,570**	**670**	**3,003**	**456,286**	**53,816**	-	**2.6**	**1,511**	**9,243**	**6.1**	**0.6**	**3.6**	**8,180**
2010 Total Energy Efficiency	1,679	321	2,001	1,588	3,588	56%	44%	51,368	51,368	5,275	-	3.5	5,385	7,245	7,141	836	3,124	568,063	55,729	-	2.7	1,588	11,101	7.0	0.6	3.5	9,042
2010 Total	**2,410**	**524**	**2,934**	**1,745**	**4,679**	**63%**	**37%**	**-10,190**	**-10,190**	**18,863**	-	**FS**	**-66**	**25,172**	**-1,208**	**-43**	**11,862**	**-25,062**	**193,634**	-	**FS**	**2,996**	**11,862**	**4.0**	**0.4**	**5.3**	**20,427**

TERASEN GAS VANCOUVER ISLAND

2008 DSM PLAN VERSION 080328 w 100% net to gross

	PROGRAM									ALTERNATE		NET PRESENT VALUE									BENEFIT/COST						
	COSTS ($000)							SAVINGS (GJ)		Impact		Levelized Cost	Utility Benefits (Costs)		Customer Benefits (Costs)			Program Net Savings			Natural Gas	Participant			Natural Gas		TRC Net Benefits
	Utility									Energy	Capacity	($/GJ)	Program	Alternate	Program	Carbon Tax	Alternate	Natural Gas	Alternate Energy	Alternate Capacity		Total Costs	Total Benefits	Benefit/Cost			
	Incentives	Administration	Total	Customer	Total	% Utility	% Customer	Gross	Net	MWh	kW		($'000s)	($'000s)	($'000s)	($'000s)	($'000s)	(GJ)	(MWh)	(kW)	Utility	($'000s)	($'000s)		Rate Impact	Total Resource	($'000s)
2008 - 2010 (NPV 2007)																											
RESIDENTIAL:																											
New Construction																											
Energy Efficiency	325	127	452	34	487	93%	7%	14,592	14,592	141	-	3	1,433	198	2,214	226	96	157,537	1,520	-	3.2	34	2,536	73.8	0.5	3.4	1,144
Fuel Substitution	504	181	684	-35	649	105%	-5%	-28,689	-28,689	4,386	-	FS	-2,242	5,112	-3,521	-360	2,491	-251,690	39,321	-	FS	3,881	2,526	0.7	1.2	1.8	2,221
Retrofit																											
Energy Efficiency	118	71	189	97	287	66%	34%	5,943	5,943	205	-	3	588	284	907	92	138	64,482	2,183	-	3.1	97	1,137	11.7	0.5	3.0	585
Fuel Substitution	973	422	1,395	478	1,873	74%	26%	-109,697	-109,697	27,811	-	FS	-11,903	43,764	-18,156	-1,817	21,330	-1,287,565	336,647	-	FS	20,451	21,330	1.0	1.4	3.2	29,988
Subtotals																											
Residential Energy Efficiency	443	198	642	132	773	83%	17%	20,535	20,535	346	-	3	2,021	481	3,120	318	235	222,019	3,703	-	**3.1**	**132**	**3,673**	**27.9**	**0.5**	**3.2**	**1,729**
Residential Fuel Substitution	1,477	602	2,079	443	2,522	82%	18%	-138,387	-138,387	32,197	-	FS	-14,145	48,876	-21,677	-2,177	23,821	-1,539,255	375,967	-	**FS**	**24,297**	**23,821**	**1.0**	**1.3**	**2.9**	**32,209**
2008 - 2010 Total Residential	**1,920**	**801**	**2,721**	**575**	**3,295**	**83%**	**17%**	**-117,852**	**-117,852**	**32,543**	**-**	**FS**	**-12,124**	**49,357**	**-18,556**	**-1,859**	**24,056**	**-1,317,236**	**379,671**	**-**							
COMMERCIAL:																											
New Construction	797	94	891	870	1,761	51%	49%	16,567	16,567	2,528	-	4	2,212	5,059	2,820	330	2,171	230,826	38,912	-	2.5	870	5,322	6.1	0.6	4.1	5,510
Retrofit	1,227	338	1,565	1,227	2,792	56%	44%	54,256	54,256	3,522	-	2	6,787	3,875	8,696	1,012	1,663	712,493	29,808	-	4.3	1,227	11,372	9.3	0.7	3.8	7,870
2008 - 2010 Total Commercial	**2,024**	**431**	**2,456**	**2,098**	**4,553**	**54%**	**46%**	**70,823**	**70,823**	**6,051**	**-**	**3**	**8,999**	**8,934**	**11,516**	**1,342**	**3,835**	**943,319**	**68,720**	**-**	**3.7**	**2,098**	**16,693**	**8.0**	**0.6**	**3.9**	**13,379**
2008-2010 Total Energy Efficiency	2,468	630	3,097	2,229	5,327	58%	42%	91,358	91,358	6,396	-	2.7	11,020	9,415	14,637	1,660	4,069	1,165,338	72,424	-	3.6	2,229	20,366	9.1	0.6	3.8	15,108
2008 - 2010 Total	**3,944**	**1,232**	**5,176**	**2,672**	**7,848**	**66%**	**34%**	**-47,028**	**-47,028**	**38,593**	**-**	**FS**	**-3,125**	**58,291**	**-7,040**	**-517**	**27,891**	**-373,917**	**448,391**	**-**	**FS**	**10,229**	**27,891**	**2.7**	**0.8**	**5.3**	**47,317**

TERASEN GAS INC

PORTFOLIO

NON-ENERGY

Cost Summary

ANNUAL ACTIVITY		Total	2008	2009	2010	Explanatory Notes
Utility Program Costs						
Conservation Education & Outreach		$ 13,835,000	$ 5,245,000	$ 4,295,000	$ 4,295,000	
Joint Initiatives		$ 3,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	
Trade Relations		$ 1,500,000	$ 500,000	$ 500,000	$ 500,000	
Innovative Technologies		$ 3,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	
Conservation Potential Review		$ 500,000		$ 500,000		
	Total	$ 21,835,000	$ 7,745,000	$ 7,295,000	$ 6,795,000	

Appendix 12

CALIFORNIA STANDARD PRACTICE MANUAL:
ECONOMIC ANALYSIS OF DEMAND-SIDE PROGRAMS AND PROJECTS

July 2002

Gray Davis, Governor

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Page

Chapter 1

Basic Methodology

Background

Since the 1970s, conservation and load management programs have been promoted by the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) as alternatives to power plant construction and gas supply options. Conservation and load management (C&LM) programs have been implemented in California by the major utilities through the use of ratepayer money and by the CEC pursuant to the CEC legislative mandate to establish energy efficiency standards for new buildings and appliances.

While cost-effectiveness procedures for the CEC standards are outlined in the Public Resources Code, no such official guidelines existed for utility-sponsored programs. With the publication of the *Standard Practice for Cost-Benefit Analysis of Conservation and Load Management Programs* in February 1983, this void was substantially filled. With the informal "adoption" one year later of an appendix that identified cost-effectiveness procedures for an "All Ratepayers" test, C&LM program cost effectiveness consisted of the application of a series of tests representing a variety of perspectives-participants, non-participants, all ratepayers, society, and the utility.

The Standard Practice Manual was revised again in 1987-88. The primary changes (relative to the 1983 version), were: (1) the renaming of the "Non-Participant Test" to the "Ratepayer Impact Test"; (2) renaming the All-Ratepayer Test" to the "Total Resource Cost Test."; (3) treating the "Societal Test" as a variant of the "Total Resource Cost Test;" and, (4) an expanded explanation of "demand-side" activities that should be subjected to standard procedures of benefit-cost analysis.

Further changes to the manual captured in this (2001) version were prompted by the cumulative effects of changes in the electric and natural gas industries and a variety of changes in California statute related to these changes. As part of the major electric industry restructuring legislation of 1996 (AB1890), for example, a public goods charge was established that ensured minimum funding levels for "cost effective conservation and energy efficiency" for the 1998-2002 period, and then (in 2000) extended through the year 2011. Additional legislation in 2000 (AB1002) established a natural gas surcharge for similar purposes. Later in that year, the Energy Security and Reliability Act of 2000 (AB970) directed the California Public Utilities Commission to establish, by the Spring of 2001, a distribution charge to provide revenues for a self generation program and a directive to consider changes to cost-effectiveness methods to better account for reliability concerns.

In the Spring of 2001, a new state agency — the Consumer Power and Conservation Financing Authority — was created. This agency is expected to provide additional revenues in the form of state revenue bonds that could supplement the amount and type of public financial resources to finance energy efficiency and self generation activities.

The modifications to the Standard Practice Manual reflect these more recent developments in several ways. First, the “Utility Cost Test” is renamed the “Program Administrator Test” to include the assessment of programs managed by other agencies. Second, a definition of self generation as a type of “demand-side” activity is included. Third, the description of the various potential elements of “externalities” in the Societal version of the TRC test is expanded. Finally the limitations section outlines the scope of this manual and elaborates upon the processes traditionally instituted by implementing agencies to adopt values for these externalities and to adopt the the policy rules that accompany this manual.

Demand-Side Management Categories and Program Definitions

One important aspect of establishing standardized procedures for cost-effectiveness evaluations is the development and use of consistent definitions of categories, programs, and program elements.

This manual employs the use of general program categories that distinguish between different types of demand-side management programs, conservation, load management, fuel substitution, load building and self-generation. Conservation programs reduce electricity and/or natural gas consumption during all or significant portions of the year. ‘Conservation’ in this context includes all ‘energy efficiency improvements’. An energy efficiency improvement can be defined as reduced energy use for a comparable level of service, resulting from the installation of an energy efficiency measure or the adoption of an energy efficiency practice. 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. Load management programs may either reduce electricity peak demand or shift demand from on peak to non-peak periods.

Fuel substitution and load building programs share the common feature of increasing annual consumption of either electricity or natural gas relative to what would have happened in the absence of the program. This effect is accomplished in significantly different ways, by inducing the choice of one fuel over another (fuel substitution), or by increasing sales of electricity, gas, or electricity and gas (load building). Self generation refers to distributed generation (DG) installed on the customer’s side of the electric utility meter, which serves some or all of the customer's electric load, that otherwise would have been provided by the central electric grid.

In some cases, self generation products are applied in a combined heat and power manner, in which case the heat produced by the self generation product is used on site to provide some or all of the customer’s thermal needs. Self generation technologies include, but are not limited to, photovoltaics, wind turbines, fuel cells, microturbines, small gas-fired turbines, and gas-fired internal combustion engines.

Fuel substitution and load building programs were relatively new to demand-side management in California in the late 1980s, born out of the convergence of several factors that translated into average rates that substantially exceeded marginal costs. Proposals by utilities to implement programs that increase sales had prompted the need for additional procedures for estimating program cost effectiveness. These procedures maybe applicable in a new context. AB 970 amended the Public Utilities Code and provided the motivation to develop a cost-effectiveness method that can be used on a common basis to evaluate all programs that will remove electric load from the centralized grid, including energy efficiency, load control/demand-responsiveness programs and self-generation. Hence, self-generation was also added to the list of demand side management programs for cost-effectiveness evaluation. In some cases, self-generation programs installed with incremental load are also included since the definition of self-generation is not necessarily confined to projects that reduce electric load on the grid. For example, suppose an industrial customer installs a new facility with a peak consumption of 1.5 MW, with an integrated on-site 1.0 MW gas fired DG unit. The combined impact of the new facility is *load building* since the new facility can draw up to 0.5 MW from the grid, even when the DG unit is running. The proper characterization of each type of demand-side management program is essential to ensure the proper treatment of inputs and the appropriate interpretation of cost-effectiveness results.

Categorizing programs is important because in many cases the same specific device can be and should be evaluated in more than one category. For example, the promotion of an electric heat pump can and should be treated as part of a conservation program if the device is installed in lieu of a less efficient electric resistance heater. If the incentive induces the installation of an electric heat pump instead of gas space heating, however, the program needs to be considered and evaluated as a fuel substitution program. Similarly, natural gas-fired self-generation, as well as self-generation units using other non-renewable fossil fuels, must be treated as fuel-substitution. In common with other types of fuel-substitution, any costs of gas transmission and distribution, and environmental externalities, must be accounted for. In addition, cost-effectiveness analyses of self-generation should account for utility interconnection costs. Similarly, a thermal energy storage device should be treated as a load management program when the predominant effect is to shift load. If the acceptance of a utility incentive by the customer to, install the energy storage device is a decisive aspect of the customer's decision to remain an electric utility customer (i.e., to reject or defer the option of installing a gas-fired cogeneration system), then the predominant effect of the thermal energy storage device has been to substitute electricity service for the natural gas service that would have occurred in the absence of the program.

In addition to Fuel Substitution and Load Building Programs, recent utility program proposals have included reference to "load retention," "sales retention," "market retention," or "customer retention" programs. In most cases, the effect of such programs is identical to either a Fuel Substitution or a Load Building program — sales of one fuel are increased relative to sales without the program. A case may be made, however, for defining a separate category of program called "load retention." One unambiguous example of a load retention program is the situation where a program keeps a customer from relocating to another utility service area. However, computationally the equations and guidelines included in this manual to accommodate Fuel Substitution and Load Building programs can also handle this special situation as well.

Basic Methods

This manual identifies the cost and benefit components and cost-effectiveness calculation procedures from four major perspectives: Participant, Ratepayer Impact Measure (RIM), Program Administrator Cost (PAC), and Total Resource Cost (TRC). A fifth perspective, the Societal, is treated as a variation on the Total Resource Cost test. The results of each perspective can be expressed in a variety of ways, but in all cases it is necessary to calculate the net present value of program impacts over the lifecycle of those impacts.

Table I summarizes the cost-effectiveness tests addressed in this manual. For each of the perspectives, the table shows the appropriate means of expressing test results. The primary unit of measurement refers to the way of expressing test results that are considered by the staffs of the two Commissions as the most useful for summarizing and comparing demand-side management (DSM) program cost-effectiveness. Secondary indicators of cost-effectiveness represent supplemental means of expressing test results that are likely to be of particular value for certain types of proceedings, reports, or programs.

This manual does not specify how the cost-effectiveness test results are to be displayed or the level at which cost-effectiveness is to be calculated (e.g., groups of programs, individual programs, and program elements for all or some programs). It is reasonable to expect different levels and types of results for different regulatory proceedings or for different phases of the process used to establish proposed program-funding levels. For example, for summary tables in general rate case proceedings at the CPUC, the most appropriate tests may be the RIM lifecycle revenue impact, Total Resource Cost, and Program Administrator Cost test results for programs or groups of programs. The analysis and review of program proposals for the same proceeding may include Participant test results and various additional indicators of cost-effectiveness from all tests for each individual program element. In the case of cost-effectiveness evaluations conducted in the context of integrated long-term resource planning activities, such detailed examination of multiple indications of costs and benefits may be impractical.

Table I
Cost-Effectiveness Tests

Participant	
Primary	Secondary
Net present value (all participants)	Discounted payback (years) Benefit-cost ratio Net present value (average participant)
Ratepayer Impact Measure	
Lifecycle revenue impact per Unit of energy (kWh or therm) or demand customer (kW) Net present value	Lifecycle revenue impact per unit Annual revenue impact (by year, per kWh, kW, therm, or customer) First-year revenue impact (per kWh, kW, therm, or customer) Benefit-cost ratio
Total Resource Cost	
Net present value (NPV)	Benefit-cost ratio (BCR) Levelized cost (cents or dollars per unit of energy or demand) Societal (NPV, BCR)
Program Administrator Cost	
Net present value	Benefit-cost ratio Levelized cost (cents or dollars per unit of energy or demand)

Rather than identify the precise requirements for reporting cost-effectiveness results for all types of proceedings or reports, the approach taken in this manual is to (a) specify the components of benefits and costs for each of the major tests, (b) identify the equations to be used to express the results in acceptable ways; and (c) indicate the relative value of the different units of measurement by designating primary and secondary test results for each test.

It should be noted that for some types of demand-side management programs, meaningful cost-effectiveness analyses cannot be performed using the tests in this manual. The following guidelines are offered to clarify the appropriated "match" of different types of programs and tests:

1. For generalized information programs (e.g., when customers are provided generic information on means of reducing utility bills without the benefit of on-site evaluations or customer billing data), cost-effectiveness tests are not expected because of the extreme difficulty in establishing meaningful estimates of load impacts.

2. For any program where more than one fuel is affected, the preferred unit of measurement for the RIM test is the lifecycle revenue impacts per customer, with gas and electric components reported separately for each fuel type and for combined fuels.

3. For load building programs, only the RIM tests are expected to be applied. The Total Resource Cost and Program Administrator Cost tests are intended to identify cost-effectiveness relative to other resource options. It is inappropriate to consider increased load as an alternative to other supply options.

4. Levelized costs may be appropriate as a supplementary indicator of cost per unit for electric conservation and load management programs relative to generation options and gas conservation programs relative to gas supply options, but the levelized cost test is not applicable to fuel substitution programs (since they combine gas and electric effects) or load building programs (which increase sales).

The delineation of the various means of expressing test results in **Table 1** is not meant to discourage the continued development of additional variations for expressing cost-effectiveness. Of particular interest is the development of indicators of program cost effectiveness that can be used to assess the appropriateness of program scope (i.e. level of funding) for General Rate Case proceedings. Additional tests, if constructed from the net present worth in conformance with the equations designated in this manual, could prove useful as a means of developing methodologies that will address issues such as the optimal timing and scope of demand-side management programs in the context of overall resource planning.

Balancing the Tests

The tests set forth in this manual are not intended to be used individually or in isolation. The results of tests that measure efficiency, such as the Total Resource Cost Test, the Societal Test, and the Program Administrator Cost Test, must be compared not only to each other but also to the Ratepayer Impact Measure Test. This multi-perspective approach will require program administrators and state agencies to consider tradeoffs between the various tests. Issues related to the precise weighting of each test relative to other tests and to developing formulas for the definitive balancing of perspectives are outside the scope of this manual. The manual, however, does provide a brief description of the strengths and weaknesses of each test (Chapters 2, 3, 4, and 5) to assist users in qualitatively weighing test results.

Limitations: Externality Values and Policy Rules

The list of externalities identified in Chapter 4, page 27, in the discussion on the Societal version of the Total Resource Cost test is broad, illustrative and by no means exhaustive. Traditionally, implementing agencies have independently determined the details such as the components of the externalities, the externality values and the policy rules which specify the contexts in which the externalities and the tests are used.

Externality Values

The values for the externalities have not been provided in the manual. There are separate studies and methodologies to arrive at these values. There are also separate processes instituted by implementing agencies before such values can be adopted formally.

Policy Rules

The appropriate choice of inputs and input components vary by program area and project. For instance, low income programs are evaluated using a broader set of non-energy benefits that have not been provided in detail in this manual. Implementing agencies traditionally have had the discretion to use or to not use these inputs and/or benefits on a project- or program-specific basis. The policy rules that specify the contexts in which it is appropriate to use the externalities, their components, and tests mentioned in this manual are an integral part of any cost-effectiveness evaluation. These policy rules are not a part of this manual.

To summarize, the manual provides the methodology and the cost-benefit calculations only. The implementing agencies (such as the California Public Utilities Commission and the California Energy Commission) have traditionally utilized open public processes to incorporate the diverse views of stakeholders before adopting externality values and policy rules which are an integral part of the cost-effectiveness evaluation.

Chapter 2

Participant Test

Definition

The Participants 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.

Benefits and Costs

The benefits of participation in a demand-side program include the reduction in the customer's utility bill(s), any incentive paid by the utility or other third parties, and any federal, state, or local tax credit received. The reductions to the utility bill(s) should be calculated using the actual retail rates that would have been charged for the energy service provided (electric demand or energy or gas). Savings estimates should be based on gross savings, as opposed to net energy savings[1].

In the case of fuel substitution programs, benefits to the participant also include the avoided capital and operating costs of the equipment/appliance not chosen. For load building programs, participant benefits include an increase in productivity and/or service, which is presumably equal to or greater than the productivity/ service without participating. The inclusion of these benefits is not required for this test, but if they are included then the societal test should also be performed.

The costs to a customer of program participation are all out-of-pocket expenses incurred as a result of participating in a program, plus any increases in the customer's utility bill(s). The out-of-pocket expenses include the cost of any equipment or materials purchased, including sales tax and installation; any ongoing operation and maintenance costs; any removal costs (less salvage value); and the value of the customer's time in arranging for the installation of the measure, if significant.

[1] Gross energy savings are considered to be the savings in energy and demand seen by the participant at the meter. These are the appropriate program impacts to calculate bill reductions for the Participant Test. Net savings are assumed to be the savings that are attributable to the program. That is, net savings are gross savings minus those changes in energy use and demand that would have happened even in the absence of the program. For fuel substitution and load building programs, gross-to-net considerations account for the impacts that would have occurred in the absence of the program.

How the Results can be Expressed

The results of this test can be expressed in four ways: through a net present value per average participant, a net present value for the total program, a benefit-cost ratio or discounted payback. The primary means of expressing test results is net present value for the total program; discounted payback, benefit-cost ratio, and per participant net present value are secondary tests.

The discounted payback is the number of years it takes until the cumulative discounted benefits equal or exceed the cumulative discounted costs. The shorter the discounted payback, the more attractive or beneficial the program is to the participants. Although "payback period" is often defined as undiscounted in the textbooks, a discounted payback period is used here to approximate more closely the consumer's perception of future benefits and costs.[2]

Net present value (NPVp) gives the net dollar benefit of the program to an average participant or to all participants discounted over some specified time period. A net present value above zero indicates that the program is beneficial to the participants under this test.

The benefit-cost ratio (BCRp) is the ratio of the total benefits of a program to the total costs discounted over some specified time period. The benefit-cost ratio gives a measure of a rough rate of return for the program to the participants and is also an indication of risk. A benefit-cost ratio above one indicates a beneficial program.

Strengths of the Participant Test

The Participants Test gives a good "first cut" of the benefit or desirability of the program to customers. This information is especially useful for voluntary programs as an indication of potential participation rates.

For programs that involve a utility incentive, the Participant Test can be used for program design considerations such as the minimum incentive level, whether incentives are really needed to induce participation, and whether changes in incentive levels will induce the desired amount of participation.

These test results can be useful for program penetration analyses and developing program participation goals, which will minimize adverse ratepayer impacts and maximize benefits.

For fuel substitution programs, the Participant Test can be used to determine whether program participation (i.e. choosing one fuel over another) will be in the long-run best interest of the customer. The primary means of establishing such assurances is the net present value, which looks at the costs and benefits of the fuel choice over the life of the equipment.

[2] It should be noted that if a demand-side program is beneficial to its participants ($NPVp \geq 0$ and $BCRp \geq 1.0$) using a particular discount rate, the program has an internal rate of return (IRR) of at least the value of the discount rate.

Weaknesses of the Participant Test

None of the Participant Test results (discounted payback, net present value, or benefit-cost ratio) accurately capture the complexities and diversity of customer decision-making processes for demand-side management investments. Until or unless more is known about customer attitudes and behavior, interpretations of Participant Test results continue to require considerable judgment. Participant Test results play only a supportive role in any assessment of conservation and load management programs as alternatives to supply projects.

Formulae

The following are the formulas for discounted payback, the net present value (NPVp) and the benefit-cost ratio (BCRp) for the Participant Test.

NPV_P	=	Bp - Cp
NPVavp	=	(Bp - Cp) / P
BCRp	=	Bp / Cp
DPp	=	Min j such that Bj > Cj

Where:

NPVp	=	Net present value to all participants
NPVavp	=	Net present value to the average participant
BCRp	=	Benefit-cost ratio to participants
DPp	=	Discounted payback in years
Bp	=	NPV of benefit to participants
Cp	=	NPV of costs to participants
Bj	=	Cumulative benefits to participants in year j
Cj	=	Cumulative costs to participants in year j
P	=	Number of program participants
J	=	First year in which cumulative benefits are cumulative costs.
d	=	Interest rate (discount)

The Benefit (Bp) and Cost (Cp) terms are further defined as follows:

$$BP = \sum_{t=1}^{N} \frac{BR_t + TC_t + INC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{AB_{at} + PA_{at}}{(1+d)^{t-1}}$$

$$C = \sum_{t=1}^{N} \frac{PC_t + BI_t}{(1+d)^{t-1}}$$

Where:

BRt	=	Bill reductions in year t

Bit	=	Bill increases in year t
TCt	=	Tax credits in year t
INCt	=	Incentives paid to the participant by the sponsoring utility in year t[3]
PCt	=	Participant costs in year t to include: • Initial capital costs, including sales tax[4] • Ongoing operation and maintenance costs include fuel cost • Removal costs, less salvage value • Value of the customer's time in arranging for installation, if significant
PACat	=	Participant avoided costs in year t for alternate fuel devices (costs of devices not chosen)
Abat	=	Avoided bill from alternate fuel in year t

The first summation in the Bp equation should be used for conservation and load management programs. For fuel substitution programs, both the first and second summations should be used for Bp.

Note that in most cases, the customer bill impact terms (BRt, BIt, and AB_{at}) are further determined by costing period to reflect load impacts and/or rate schedules, which vary substantially by time of day and season. The formulas for these variables are as follows:

$$BR_t = \sum_{i=1}^{I} (\Delta EG_{it} \times AC:E_{it} \times K_{it}) + \sum_{i=1}^{I} (\Delta DG_{it} \times AC:D_{it} \times K_{it}) + OBR_t$$

AB_{at} = (Use BRt formula, but with rates and costing periods appropriate for the alternate fuel utility)

$$BI_t = \sum_{i=1}^{I} (\Delta EG_{it} \times AC:E_{it} \times (K_{it} - 1)) + \sum_{i=1}^{I} (\Delta DG_{it} \times AC:D_{it} \times (K_{it} - 1)) + OBI_t$$

Where:

ΔEG_{it} = Reduction in gross energy use in costing period i in year t

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[3] Some difference of opinion exists as to what should be called an incentive. The term can be interpreted broadly to include almost anything. Direct rebates, interest payment subsidies, and even energy audits can be called incentives. Operationally, it is necessary to restrict the term to include only dollar benefits such as rebates or rate incentives (monthly bill credits). Information and services such as audits are not considered incentives for the purposes of these tests. If the incentive is to offset a specific participant cost, as in a rebate-type incentive, the full customer cost (before the rebate must be included in the PC_t term

[4] If money is borrowed by the customer to cover this cost, it may not be necessary to calculate the annual mortgage and discount this amount if the present worth of the mortgage payments equals the initial cost. This occurs when the discount rate used is equal to the interest rate of the mortgage. If the two rates differ (e.g., a loan offered by the utility), then the stream of mortgage payments should be discounted by the discount rate chosen.

ΔDG_{it}	=	Reduction in gross billing demand in costing period i in year t
$AC:E_{it}$	=	Rate charged for energy in costing period i in year t
$AC:D_{it}$	=	Rate charged for demand in costing period i in year t
K_{it}	=	1 when ΔEGit or ΔDGit is positive (a reduction) in costing period i in year t, and zero otherwise
OBR_t	=	Other bill reductions or avoided bill payments (e.g.,, customer charges, standby rates).
OBI_t	=	Other bill increases (i.e. customer charges, standby rates).
I	=	Number of periods of participant's participation

In load management programs such as TOU rates and air-conditioning cycling, there are often no direct customer hardware costs. However, attempts should be made to quantify indirect costs customers may incur that enable them to take advantage of TOU rates and similar programs.

If no customer hardware costs are expected or estimates of indirect costs and value of service are unavailable, it may not be possible to calculate the benefit-cost ratio and discounted payback period.

Chapter 3

The Ratepayer Impact Measure Test[5]

Definition

The Ratepayer Impact Measure (RIM) test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation are less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer bills or rate levels.

Benefits and Costs

The benefits calculated in the RIM test are the savings from avoided supply costs. These avoided costs include the reduction in transmission, distribution, generation, and capacity costs for periods when load has been reduced and the increase in revenues for any periods in which load has been increased. The avoided supply costs are a reduction in total costs or revenue requirements and are included for both fuels for a fuel substitution program. The increase in revenues are also included for both fuels for fuel substitution programs. Both the reductions in supply costs and the revenue increases should be calculated using net energy savings.

The costs for this test are the program costs incurred by the utility, *and/or other entities incurring costs and creating or administering the program,* the incentives paid to the participant, decreased revenues for any periods in which load has been decreased and increased supply costs for any periods when load has been increased. The utility program costs include initial and annual costs, such as the cost of equipment, operation and maintenance, installation, program administration, and customer dropout and removal of equipment (less salvage value). The decreases in revenues and the increases in the supply costs should be calculated for both fuels for fuel substitution programs using net savings.

How the Results can be Expressed

The results of this test can be presented in several forms: the lifecycle revenue impact (cents or dollars) per kWh, kW, therm, or customer; annual or first-year revenue impacts (cents or dollars per kWh, kW, therms, or customer); benefit-cost ratio; and net present value. The primary units of measurement are the lifecycle revenue impact, expressed as the change in rates (cents per kWh for electric energy, dollars per kW for electric capacity, cents per therm for natural gas) and the net present value. Secondary test results are the lifecycle revenue

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[5] The Ratepayer Impact Measure Test has previously been described under what was called the "Non-Participant Test." The Non-Participant Test has also been called the "Impact on Rate Levels Test."

impact per customer, first-year and annual revenue impacts, and the benefit-cost ratio. LRI_{RIM} values for programs affecting electricity and gas should be calculated for each fuel individually (cents per kWh or dollars per kW and cents per therm) and on a combined gas and electric basis (cents per customer).

The lifecycle revenue impact (LRI) is the one-time change in rates or the bill change over the life of the program needed to bring total revenues in line with revenue requirements over the life of the program. The rate increase or decrease is expected to be put into effect in the first year of the program. Any successive rate changes such as for cost escalation are made from there. The first-year revenue impact (FRI) is the change in rates in the first year of the program or the bill change needed to get total revenues to match revenue requirements only for that year. The annual revenue impact (ARI) is the series of differences between revenues and revenue requirements in each year of the program. This series shows the cumulative rate change or bill change in a year needed to match revenues to revenue requirements. Thus, the ARIRIM for year six per kWh is the estimate of the difference between present rates and the rate that would be in effect in year six due to the program. For results expressed as lifecycle, annual, or first-year revenue impacts, negative results indicate favorable effects on the bills of ratepayers or reductions in rates. Positive test result values indicate adverse bill impacts or rate increases.

Net present value (NPV_{RIM}) gives the discounted dollar net benefit of the program from the perspective of rate levels or bills over some specified time period. A net present value above zero indicates that the program will benefit (lower) rates and bills.

The benefit-cost ratio (BCR RIM) is the ratio of the total benefits of a program to the total costs discounted over some specified time period. A benefit-cost ratio above one indicates that the program will lower rates and bills.

Strengths of the Ratepayer Impact Measure (RIM) Test

In contrast to most supply options, demand-side management programs cause a direct shift in revenues. Under many conditions, revenues lost from DSM programs have to be made up by ratepayers. The RIM test is the only test that reflects this revenue shift along with the other costs and benefits associated with the program.

An additional strength of the RIM test is that the test can be used for all demand-side management programs (conservation, load management, fuel substitution, and load building). This makes the RIM test particularly useful for comparing impacts among demand-side management options.

Some of the units of measurement for the RIM test are of greater value than others, depending upon the purpose or type of evaluation. The lifecycle revenue impact per customer is the most useful unit of measurement when comparing the merits of programs with highly variable scopes (e.g.,, funding levels) and when analyzing a wide range of programs that include both electric and natural gas impacts. Benefit-cost ratios can also be very useful for program design evaluations to identify the most attractive programs or program elements.

If comparisons are being made between a program or group of conservation/load management programs and a specific resource project, lifecycle cost per unit of energy and annual and first-year net costs per unit of energy are the most useful way to express test results. Of course, this requires developing lifecycle, annual, and first-year revenue impact estimates for the supply-side project.

Weaknesses of the Ratepayer Impact Measure (RIM) Test

Results of the RIM test are probably less certain than those of other tests because the test is sensitive to the differences between long-term projections of marginal costs and long-term projections of rates, two cost streams that are difficult to quantify with certainty.

RIM test results are also sensitive to assumptions regarding the financing of program costs. Sensitivity analyses and interactive analyses that capture feedback effects between system changes, rate design options, and alternative means of financing generation and non-generation options can help overcome these limitations. However, these types of analyses may be difficult to implement.

An additional caution must be exercised in using the RIM test to evaluate a fuel substitution program with multiple end use efficiency options. For example, under conditions where marginal costs are less than average costs, a program that promotes an inefficient appliance may give a more favorable test result than a program that promotes an efficient appliance. Though the results of the RIM test accurately reflect rate impacts, the implications for long-term conservation efforts need to be considered.

Formulae: The formulae for the lifecycle revenue impact (LRI RIM)' net present value (NPV RIM), benefit-cost ratio (BCR RIM)' the first-year revenue impacts and annual revenue impacts are presented below:

LRIRIM	=	(CRIM - BRIM) / E	
FRIRIM	=	(CRIM - BRIM) / E	for t = I
ARIRIMt	=	FRIRIM	for t = I
	=	(CRIMt - BRIMt)/Et	for t=2, ………….., N
NPVRIM	=	BRIM-CRIM	

BCRRIM` = BRIM/CRIM where:

LRIRIM = Lifecycle revenue impact of the program per unit of energy (kWh or therm) or demand (kW) (the one-time change in rates) or per customer (the change in customer bills over the life of the program). (Note: An appropriate choice of kWh, therm, kW, and customer should be made)

FRIRIM = First-year revenue impact of the program per unit of energy, demand, or per customer.

ARIRIM = Stream of cumulative annual revenue impacts of the program per unit of energy, demand, or per customer. (Note: The terms in the ARI formula are not discounted; thus they are the nominal cumulative revenue impacts. Discounted cumulative revenue impacts may be calculated and submitted if they are indicated as such. Note also that the sum of the discounted stream of cumulative revenue impacts does not equal the LRI RIM')

NPVRIM = Net present value levels

BCRRIM = Benefit-cost ratio for rate levels

BRIM = Benefits to rate levels or customer bills
CRIM = Costs to rate levels or customer bills
E = Discounted stream of system energy sales (kWh or therms) or demand sales (kW) or first-year customers. (See Appendix D for a description of the derivation and use of this term in the LRIRIM test.)

The B_{RIM} and C_{RIM} terms are further defined as follows:

$$B_{RIM}\sum_{t=1}^{N}\frac{UAC_t + RG_t}{(1+d)^{t-1}} + \sum_{t=1}^{N}\frac{UAC_{at}}{(1+d)^{t-1}}$$

$$C_{RIM}\sum_{t=1}^{N}\frac{UIC_t + RL_t + PRC_t + INC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N}\frac{RL_{at}}{(1+d)^{t-1}}$$

$$E = \sum_{t=1}^{N}\frac{E_t}{(1+d)^{t-1}}$$

Where:

UACt = Utility avoided supply costs in year t
UICt = Utility increased supply costs in year t
RGt = Revenue gain from increased sales in year t
RLt = Revenue loss from reduced sales in year t
PRCt = Program Administrator program costs in year t
Et = System sales in kWh, kW or therms in year t or first year customers
UACat = Utility avoided supply costs for the alternate fuel in year t

Rlat = Revenue loss from avoided bill payments for alternate fuel in year t (i.e., device not chosen in a fuel substitution program)

For fuel substitution programs, the first term in the B RIM and C RIM equations represents the sponsoring utility (electric or gas), and the second term represents the alternate utility. The RIM test should be calculated separately for electric and gas and combined electric and gas.

The utility avoided cost terms (UAC_t, UIC_t, and UAC_{at}) are further determined by costing period to reflect time-variant costs of supply:

$$UCA_t = \sum_{i=1}^{I} (\Delta EN_{it} \times MC : E_{it} \times K_{it}) + \sum_{i=1}^{I} (\Delta DN_{it} \times MC : D_{it} \times K_{it})$$

UAC_{at} = (Use UACt formula, but with marginal costs and costing periods appropriate for the alternate fuel utility.)

$$UIC_t \sum_{i=1}^{I} (\Delta EN_{it} \times MC : E_{it} \times (K_{it} - 1)) + \sum_{i=1}^{I} (\Delta DN_{it} \times MC : D \times (K_{it} - 1))$$

Where:

[Only terms not previously defined are included here.]

ΔENit = Reduction in net energy use in costing period i in year t
ΔDNit = Reduction in net demand in costing period i in year t
MC:Eit = Marginal cost of energy in costing period i in year t
MC:Dit = Marginal cost of demand in costing period i in year t

The revenue impact terms (RG_t, RL_t, and RL_{at}) are parallel to the bill impact terms in the Participant Test. The terms are calculated exactly the same way with the exception that the net impacts are used rather than gross impacts. If a net-to-gross ratio is used to differentiate gross savings from net savings, the revenue terms and the participant's bill terms will be related as follows:

RGt = BIt * (net-to-gross ratio)
RLt = BRt * (net-to-gross ratio)
Rlat = Abat * (net-to-gross ratio)

Chapter 4

Total Resource Cost Test[6]

Definition

The Total Resource Cost Test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.

The test is applicable to conservation, load management, and fuel substitution programs. For fuel substitution programs, the test measures the net effect of the impacts from the fuel not chosen versus the impacts from the fuel that is chosen as a result of the program. TRC test results for fuel substitution programs should be viewed as a measure of the economic efficiency implications of the total energy supply system (gas and electric).

A variant on the TRC test is the Societal Test. The Societal Test differs from the TRC test in that it includes the effects of externalities (e.g.,, environmental, national security), excludes tax credit benefits, and uses a different (societal) discount rate.

Benefits and Costs: This test represents the combination of the effects of a program on both the customers participating and those not participating in a program. In a sense, it is the summation of the benefit and cost terms in the Participant and the Ratepayer Impact Measure tests, where the revenue (bill) change and the incentive terms intuitively cancel (except for the differences in net and gross savings).

The benefits calculated in the Total Resource Cost Test are the avoided supply costs, the reduction in transmission, distribution, generation, and capacity costs valued at marginal cost for the periods when there is a load reduction. The avoided supply costs should be calculated using net program savings, savings net of changes in energy use that would have happened in the absence of the program. For fuel substitution programs, benefits include the avoided device costs and avoided supply costs for the energy, using equipment not chosen by the program participant.

The costs in this test are the program costs paid by both the utility and the participants plus the increase in supply costs for the periods in which load is increased. Thus all equipment costs, installation, operation and maintenance, cost of removal (less salvage value), and administration costs, no matter who pays for them, are included in this test. Any tax credits are considered a reduction to costs in this test. For fuel substitution programs, the costs also include the increase in supply costs for the utility providing the fuel that is chosen as a result of the program.

[6] This test was previously called the All Ratepayers Test

How the Results Can be Expressed

The results of the Total Resource Cost Test can be expressed in several forms: as a net present value, a benefit-cost ratio, or as a levelized cost. The net present value is the primary unit of measurement for this test. Secondary means of expressing TRC test results are a benefit-cost ratio and levelized costs. The Societal Test expressed in terms of net present value, a benefit-cost ratio, or levelized costs is also considered a secondary means of expressing results. Levelized costs as a unit of measurement are inapplicable for fuel substitution programs, since these programs represent the net change of alternative fuels which are measured in different physical units (e.g.,, kWh or therms). Levelized costs are also not applicable for load building programs.

Net present value (NPVTRC) is the discounted value of the net benefits to this test over a specified period of time. NPVTRC is a measure of the change in the total resource costs due to the program. A net present value above zero indicates that the program is a less expensive resource than the supply option upon which the marginal costs are based.

The benefit-cost ratio (BCRTRC) is the ratio of the discounted total benefits of the program to the discounted total costs over some specified time period. It gives an indication of the rate of return of this program to the utility and its ratepayers. A benefit-cost ratio above one indicates that the program is beneficial to the utility and its ratepayers on a total resource cost basis.

The levelized cost is a measure of the total costs of the program in a form that is sometimes used to estimate costs of utility-owned supply additions. It presents the total costs of the program to the utility and its ratepayers on a per kilowatt, per kilowatt hour, or per therm basis levelized over the life of the program.

The Societal Test is structurally similar to the Total Resource Cost Test. It goes beyond the TRC test in that it attempts to quantify the change in the total resource costs to society as a whole rather than to only the service territory (the utility and its ratepayers). In taking society's perspective, the Societal Test utilizes essentially the same input variables as the TRC Test, but they are defined with a broader societal point of view. More specifically, the Societal Test differs from the TRC Test in at least one of five ways. First, the Societal Test may use higher marginal costs than the TRC test if a utility faces marginal costs that are lower than other utilities in the state or than its out-of-state suppliers. Marginal costs used in the Societal Test would reflect the cost to society of the more expensive alternative resources. Second, tax credits are treated as a transfer payment in the Societal Test, and thus are left out. Third, in the case of capital expenditures, interest payments are considered a transfer payment since society actually expends the resources in the first year. Therefore, capital costs enter the calculations in the year in which they occur. Fourth, a societal discount rate should be used[7]. Finally, Marginal costs used in the Societal Test would also contain

7 Many economists have pointed out that use of a market discount rate in social cost-benefit analysis undervalues the interests of future generations. Yet if a market discount rate is not used, comparisons with alternative investments are difficult to make.

externality costs of power generation not captured by the market system. An illustrative and by no means exhaustive list of ‘externalities and their components’ is given below (Refer to the Limitations section for elaboration.) These values are also referred to as ‘adders’ designed to capture or internalize such externalities. The list of potential adders would include for example:

1. The benefit of avoided environmental damage: The CPUC policy specifies two ‘adders’ to internalize environmental externalities, one for electricity use and one for natural gas use. Both are statewide average values. These adders are intended to help distinguish between cost-effective and non cost-effective energy-efficiency programs. They apply to an average supply mix and would not be useful in distinguishing among competing supply options. The CPUC electricity environmental adder is intended to account for the environmental damage from air pollutant emissions from power plants. The CPUC-adopted adder is intended to cover the human and material damage from sulfur oxides (SOX), nitrogen oxides (NOX), volatile organic compounds (VOC, sometimes called reactive organic gases or ROG), particulate matter at or below 10 micron diameter (PM10), and carbon. The adder for natural gas is intended to account for air pollutant emissions from the direct combustion of the gas. In the CPUC policy guidance, the adders are included in the tabulation of the benefits of energy efficiency programs. They represent reduced environmental damage from displaced electricity generation and avoided gas combustion. The environmental damage is the result of the net change in pollutant emissions in the air basins, or regions, in which there is an impact. This change is the result of direct changes in powerplant or natural gas combustion emission resulting from the efficiency measures, and changes in emissions from other sources, that result from those direct changes in emissions.

2. The benefit of avoided transmission and distribution costs – energy efficiency measures that reduce the growth in peak demand would decrease the required rate of expansion to the transmission and distribution network, eliminating costs of constructing and maintaining new or upgraded lines.

3. The benefit of avoided generation costs – energy efficiency measures reduce consumption and hence avoid the need for generation. This would include avoided energy costs, capacity costs and T&D line

4. The benefit of increased system reliability: The reductions in demand and peak loads from customers opting for self generation, provide reliability benefits to the distribution system in the forms of:
    a. Avoided costs of supply disruptions
    b. Benefits to the economy of damage and control costs avoided by customers and industries in the digital economy that need greater than 99.9 level of reliable electricity service from the central grid
    c. Marginally decreased System Operator’s costs to maintain a percentage reserve of electricity supply above the instantaneous demand
    d. Benefits to customers and the public of avoiding blackouts.

5. Non-energy benefits: Non-energy benefits might include a range of program-specific benefits such as saved water in energy-efficient washing machines or self generation units, reduced waste streams from an energy-efficient industrial process, etc.

6. Non-energy benefits for low income programs: The low income programs are social programs which have a separate list of benefits included in what is known as the 'low income public purpose test'. This test and the sepcific benefits associated with this test are outside the scope of this manual.

7. Benefits of fuel diversity include considerations of the risks of supply disruption, the effects of price volatility, and the avoided costs of risk exposure and risk management.

Strengths of the Total Resource Cost Test

The primary strength of the Total Resource Cost (TRC) test is its scope. The test includes total costs (participant plus program administrator) and also has the potential for capturing total benefits (avoided supply costs plus, in the case of the societal test variation, externalities). To the extent supply-side project evaluations also include total costs of generation and/or transmission, the TRC test provides a useful basis for comparing demand- and supply-side options.

Since this test treats incentives paid to participants and revenue shifts as transfer payments (from all ratepayers to participants through increased revenue requirements), the test results are unaffected by the uncertainties of projected average rates, thus reducing the uncertainty of the test results. Average rates and assumptions associated with how other options are financed (analogous to the issue of incentives for DSM programs) are also excluded from most supply-side cost determinations, again making the TRC test useful for comparing demand-side and supply-side options.

Weakness of the Total Resource Cost Test

The treatment of revenue shifts and incentive payments as transfer payments, identified previously as a strength, can also be considered a weakness of the TRC test. While it is true that most supply-side cost analyses do not include such financial issues, it can be argued that DSM programs should include these effects since, in contrast to most supply options, DSM programs do result in lost revenues.

In addition, the costs of the DSM "resource" in the TRC test are based on the total costs of the program, including costs incurred by the participant. Supply-side resource options are typically based only on the costs incurred by the power suppliers.

Finally, the TRC test cannot be applied meaningfully to load building programs, thereby limiting the ability to use this test to compare the full range of demand-side management options.

Formulas

The formulas for the net present value (NPV_{TRC})' the benefit-cost ratio (BCR_{TRC} and levelized costs are presented below:

NPVTRC = BTRC - CTRC
BCRTRC = BTRC /CTRC
LCTRC = LCRC / IMP

Where:

NPVTRC	=	Net present value of total costs of the resource
BCRTRC	=	Benefit-cost ratio of total costs of the resource
LCTRC	=	Levelized cost per unit of the total cost of the resource (cents per kWh for conservation programs; dollars per kW for load management programs)
BTRC	=	Benefits of the program
CTRC	=	Costs of the program
LCRC	=	Total resource costs used for levelizing
IMP	=	Total discounted load impacts of the program
PCN	=	Net Participant Costs

The B_{TRC} C_{TRC} LCRC, and IMP terms are further defined as follows:

$$BTRC = \sum_{t=1}^{N} \frac{UAC_t + TC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

$$CTRC = \sum_{t=1}^{N} \frac{PRC_t + PCN_t + UIC_t}{(1+d)^{t-1}}$$

$$LCRC = \sum_{t=1}^{N} \frac{PRC_t + PCN_t - TC_t}{(1+d)^{t-1}}$$

$$IMP = \frac{\sum_{t=1}^{n} \left[(\sum_{i=1}^{n} \Delta EN_{it}) \; or \; (\Delta DN_{it} \;\; where \; I = peak \;\; period) \right]}{(1+d)^{t-1}}$$

[All terms have been defined in previous chapters.]

The first summation in the BTRC equation should be used for conservation and load management programs. For fuel substitution programs, both the first and second summations should be used.

Chapter 5

Program Administrator Cost Test

Definition

The Program Administrator Cost Test measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly.

Benefits and Costs

The benefits for the Program Administrator Cost Test are the avoided supply costs of energy and demand, the reduction in transmission, distribution, generation, and capacity valued at marginal costs for the periods when there is a load reduction. The avoided supply costs should be calculated using net program savings, savings net of changes in energy use that would have happened in the absence of the program. For fuel substitution programs, benefits include the avoided supply costs for the energy-using equipment not chosen by the program participant only in the case of a combination utility where the utility provides both fuels.

The costs for the Program Administrator Cost Test are the program costs incurred by the administrator, the incentives paid to the customers, and the increased supply costs for the periods in which load is increased. Administrator program costs include initial and annual costs, such as the cost of utility equipment, operation and maintenance, installation, program administration, and customer dropout and removal of equipment (less salvage value). For fuel substitution programs, costs include the increased supply costs for the energy-using equipment chosen by the program participant only in the case of a combination utility, as above.

In this test, revenue shifts are viewed as a transfer payment between participants and all ratepayers. Though a shift in revenue affects rates, it does not affect revenue requirements, which are defined as the difference between the net marginal energy and capacity costs avoided and program costs. Thus, if $NPV_{pa} > 0$ and $NPV_{RIM} < 0$, the administrator's overall total costs will decrease, although rates may increase because the sales base over which revenue requirements are spread has decreased.

How the Results Can be Expressed

The results of this test can be expressed either as a net present value, benefit-cost ratio, or levelized costs. The net present value is the primary test, and the benefit-cost ratio and levelized cost are the secondary tests.

Net present value (NPVpa) is the benefit of the program minus the administrator's costs, discounted over some specified period of time. A net present value above zero indicates that this demand-side program would decrease costs to the administrator and the utility.

The benefit-cost ratio (BCRpa) is the ratio of the total discounted benefits of a program to the total discounted costs for a specified time period. A benefit-cost ratio above one indicates that the program would benefit the combined administrator and utility's total cost situation.

The levelized cost is a measure of the costs of the program to the administrator in a form that is sometimes used to estimate costs of utility-owned supply additions. It presents the costs of the program to the administrator and the utility on per kilowatt, per kilowatt-hour, or per therm basis levelized over the life of the program.

Strengths of the Program Administrator Cost Test

As with the Total Resource Cost test, the Program Administrator Cost test treats revenue shifts as transfer payments, meaning that test results are not complicated by the uncertainties associated with long-term rate projections and associated rate design assumptions. In contrast to the Total Resource Cost test, the Program Administrator Test includes only the portion of the participant's equipment costs that is paid for by the administrator in the form of an incentive. Therefore, for purposes of comparison, costs in the Program Administrator Cost Test are defined similarly to those supply-side projects which also do not include direct customer costs.

Weaknesses of the Program Administrator Cost Test

By defining device costs exclusively in terms of costs incurred by the administrator, the Program Administrator Cost test results reflect only a portion of the full costs of the resource.

The Program Administrator Cost Test shares two limitations noted previously for the Total Resource Cost test: (1) by treating revenue shifts as transfer payments, the rate impacts are not captured, and (2) the test cannot be used to evaluate load building programs.

Formulas

The formulas for the net present value, the benefit-cost ratio and levelized cost are presented below:

$$NPVpa = Bpa - Cpa$$
$$BCRpa = Bpa/Cpa$$
$$LCpa = LCpa/IMP$$

Where:

NPVpa	Net present value of Program Administrator costs
BCRpa	Benefit-cost ratio of Program Administrator costs

LCpa	Levelized cost per unit of Program Administrator cost of the resource
Bpa	Benefits of the program
Cpa	Costs of the program
LCpc	Total Program Administrator costs used for levelizing

$$B_{pa} = \sum_{t=1}^{N} \frac{UAC_t}{(1+d)^{t-1}} + \sum_{t+1}^{N} \frac{UAC_{at}}{(1+d)^{t-1}}$$

$$C_{pa} = \sum_{t=1}^{N} \frac{PRC_t + INC_t + UIC_t}{(1+d)^{t-1}}$$

$$LCpc = \sum_{t=1}^{N} \frac{PRC_t + INC_t}{(1+d)^{t-1}}$$

[All variables are defined in previous chapters.]

The first summation in the Bpa equation should be used for conservation and load management programs. For fuel substitution programs, both the first and second summations should be used.

Appendix A

Inputs to Equations and Documentation

A comprehensive review of procedures and sources for developing inputs is beyond the scope of this manual. It would also be inappropriate to attempt a complete standardization of techniques and procedures for developing inputs for such parameters as load impacts, marginal costs, or average rates. Nevertheless, a series of guidelines can help to establish acceptable procedures and improve the chances of obtaining reasonable levels of consistent and meaningful cost-effectiveness results. The following "rules" should be viewed as appropriate guidelines for developing the primary inputs for the cost-effectiveness equations contained in this manual:

1. In the past, Marginal costs for electricity were based on production cost model simulations that clearly identify key assumptions and characteristics of the existing generation system as well as the timing and nature of any generation additions and/or power purchase agreements in the future. With a deregulated market for wholesale electricity, marginal costs for electric generation energy should be based on forecast market prices, which are derived from recent transactions in California energy markets. Such transactions could include spot market purchases as well as longer term bilateral contracts and the marginal costs should be estimated based on components for energy as well as demand and/or capacity costs as is typical for these contracts.

2. In the case of submittals in conjunction with a utility rate proceeding, average rates used in DSM program cost-effectiveness evaluations should be based on proposed rates. Otherwise, average rates should be based on current rate schedules. Evaluations based on alternative rate designs are encouraged.

3. Time-differentiated inputs for electric marginal energy and capacity costs, average energy rates, and demand charges, and electric load impacts should be used for (a) load management programs, (b) any conservation program that involves a financial incentive to the customer, and (c) any Fuel Substitution or Load Building program. Costing periods used should include, at a minimum, summer and winter, on-, and off-peak; further disaggregation is encouraged.

4. When program participation includes customers with different rate schedules, the average rate inputs should represent an average weighted by the estimated mix of participation or impacts. For General Rate Case proceedings it is likely that each major rate class within each program will be considered as program elements requiring separate cost-effectiveness analyses for each measure and each rate class within each program.

5. Program administration cost estimates used in program cost-effectiveness analyses should exclude costs associated with the measurement and evaluation of program impacts unless the costs are a necessary component to administer the program.

6. For DSM programs or program elements that reduce electricity and natural gas consumption, costs and benefits from both fuels should be included.

7. The development and treatment of load impact estimates should distinguish between gross (i.e., impacts expected from the installation of a particular device, measure, appliance) and net (impacts adjusted to account for what would have happened anyway, and therefore not attributable to the program). Load impacts for the Participants test should be based on gross, whereas for all other tests the use of net is appropriate. Gross and net program impact considerations should be applied to all types of demand-side management programs, although in some instances there may be no difference between gross and net.

8. The use of sensitivity analysis, i.e. the calculation of cost-effectiveness test results using alternative input assumptions, is encouraged, particularly for the following programs: new programs, programs for which authorization to substantially change direction is being sought (e.g.,, termination, significant expansion), major programs which show marginal cost-effectiveness and/or particular sensitivity to highly uncertain input(s).

The use of many of these guidelines is illustrated with examples of program cost effectiveness contained in Appendix B.

Appendix B

Summary of Equations and Glossary of Symbols

Basic Equations

Participant Test

NPVP	=	BP - CP
NPVavp	=	(BP - CP) / P
BCRP	=	BP/CP
DPP	=	min j such that Bj > Cj

Ratepayer Impact Measure Test

LRIRIM	=	(CRIM - BRIM) / E	
FRIRIM	=	(CRIM - BRIM) / E	for t = 1
ARIRIMt	=	FRIRIM	for t = 1
	=	(CRIMt- BRIMt)/Et	for t=2,... ,N
NPVRIM	=	BRIM — CRIM	
BCRRIM	=	BRIM /CRIM	

Total Resource Cost Test

NPVTRC	=	BTRC - CTRC
BCRTRC	=	BTRC / CTRC
LCTRC	=	LCRC / IMP

Program Administrator Cost Test

NPVpa	=	Bpa - Cpa
BCRpa	=	Bpa / Cpa
LCpa	=	LCpa / IMP

Benefits and Costs

Participant Test

$$Bp = \sum_{t=1}^{N} \frac{BR_t + TC_t + INC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{AB_{at} + PAC_{at}}{(1+d)^{t-1}}$$

$$Cp \sum_{t=1}^{N} \frac{PC_t + BI_t}{(1+d)^{t-1}}$$

Ratepayer Impact Measure Test

$$B_{RIM} = \sum_{t=1}^{N} \frac{UAC_t + RG_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at}}{(1+d)^{t-1}}$$

$$C_{RIM} = \sum_{t=1}^{N} \frac{UIC_t + RL_t + PRC_t + INC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{RL_{at}}{(1+d)^{t-1}}$$

$$E = \sum_{t=1}^{N} \frac{E_t}{(1+d)^{t-1}}$$

Total Resource Cost Test

$$B_{TRC} = \sum_{t=1}^{N} \frac{UAC_t + TC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

$$C_{TRC} = \sum_{t=1}^{N} \frac{PRC_t + PCN_t + UIC_t}{(1+d)^{t-1}}$$

$$L_{TRC} = \sum_{t=1}^{N} \frac{PRC_t + PCN_t - TC_t}{(1+d)^{t-1}}$$

$$IMP = \frac{\sum_{t=1}^{n}\left[(\sum_{i=1}^{n}\Delta EN_{it})\ or\ (\Delta DN_{it}\ where\ I = peak\ period)\right]}{(1+d)^{t-1}}$$

Program Administrator Cost Test

$$B_{pa} = \sum_{t=1}^{N}\frac{UAC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N}\frac{UAC_{at}}{(1+d)^{t-1}}$$

$$C_{pa} = \sum_{t=1}^{N}\frac{PRC_t + INC_t + UIC_t}{(1+d)^{t-1}}$$

$$LCPA = \sum_{t=1}^{N}\frac{PRC_t + INC_t}{(1+d)^{t-1}}$$

Glossary of Symbols

Abat	=	Avoided bill reductions on bill from alternate fuel in year t
AC:Dit	=	Rate charged for demand in costing period i in year t
AC:Eit	=	Rate charged for energy in costing period i in year t
ARIRIM	=	Stream of cumulative annual revenue impacts of the program per unit of energy, demand, or per customer. Note that the terms in the ARI formula are not discounted, thus they are the nominal cumulative revenue impacts. Discounted cumulative revenue impacts may be calculated and submitted if they are indicated as such. Note also that the sum of the discounted stream of cumulative revenue impacts does not equal the LRIRIM*
BCRp	=	Benefit-cost ratio to participants
BCRRIM	=	Benefit-cost ratio for rate levels
BCRTRC	=	Benefit-cost ratio of total costs of the resource
BCRpa	=	Benefit-cost ratio of program administrator and utility costs
BIt	=	Bill increases in year t
Bj	=	Cumulative benefits to participants in year j
Bp	=	Benefit to participants
BRIM	=	Benefits to rate levels or customer bills
BRt	=	Bill reductions in year t
BTRC	=	Benefits of the program
Bpa	=	Benefits of the program
Cj	=	Cumulative costs to participants in year i

Cp = Costs to participants
CRIM = Costs to rate levels or customer bills
CTRC = Costs of the program
Cpa = Costs of the program
D = discount rate
ΔDgit = Reduction in gross billing demand in costing period i in year t
ΔDnit = Reduction in net demand in costing period i in year t
DPp = Discounted payback in years
E = Discounted stream of system energy sales-(kWh or therms) or demand sales (kW) or first-year customers
ΔEgit = Reduction in gross energy use in costing period i in year t
ΔEnit = Reduction in net energy use in costing period i in year t
Et = System sales in kWh, kW or therms in year t or first year customers
FRIRIM = First-year revenue impact of the program per unit of energy, demand, or per customer.
IMP = Total discounted load impacts of the program
INCt = Incentives paid to the participant by the sponsoring utility in year t First year in which cumulative benefits are > cumulative costs.
Kit = 1 when ΔEGit or ΔDGit is positive (a reduction) in costing period i in year t, and zero otherwise
LCRC = Total resource costs used for levelizing
LCTRC = Levelized cost per unit of the total cost of the resource
LCPA = Total Program Administrator costs used for levelizing
Lcpa = Levelized cost per unit of program administrator cost of the resource
LRIRIM = Lifecycle revenue impact of the program per unit of energy (kWh or therm) or demand (kW)-the one-time change in rates-or per customer-the change in customer bills over the life of the program.
MC:Dit = Marginal cost of demand in costing period i in year t
MC:Eit = Marginal cost of energy in costing period i in year t
NPVavp = Net present value to the average participant
NPVP = Net present value to all participants
NPVRIM = Net present value levels
NPVTRC = Net present value of total costs of the resource
NPVpa = Net present value of program administrator costs
OBIt = Other bill increases (i.e., customer charges, standby rates)
OBRt = Other bill reductions or avoided bill payments (e.g., customer charges, standby rates).
P = Number of program participants
PACat = Participant avoided costs in year t for alternate fuel devices

PCt = Participant costs in year t to include:

- Initial capital costs, including sales tax
- Ongoing operation and maintenance costs
- Removal costs, less salvage value
- Value of the customer's time in arranging for installation, if significant

PRCt = Program Administrator program costs in year t
PCN = Net Participant Costs
RGt = Revenue gain from increased sales in year t
RLat = Revenue loss from avoided bill payments for alternate fuel in year t (i.e., device not chosen in a fuel substitution program)
RLt = Revenue loss from reduced sales in year t
TCt = Tax credits in year t
UACat = Utility avoided supply costs for the alternate fuel in year t
UACt = Utility avoided supply costs in year t
PAt = Program Administrator costs in year t
UICt = Utility increased supply costs in year t

Appendix C.

Derivation of Rim Lifecycle Revenue Impact Formula

Most of the formulas in the manual are either self-explanatory or are explained in the text. This appendix provides additional explanation for a few specific areas where the algebra was considered to be too cumbersome to include in the text.

Rate Impact Measure

The Ratepayer Impact Measure lifecycle revenue impact test (LRIRIM) is assumed to be the one-time increase or decrease in rates that will re-equate the present valued stream of revenues and stream of revenue requirements over the life of the program.

Rates are designed to equate long-term revenues with long-term costs or revenue requirements. The implementation of a demand-side program can disrupt this equality by changing one of the assumptions upon which it is based: the sales forecast. Demand-side programs by definition change sales. This expected difference between the long-term revenues and revenue requirements is calculated in the NPVRIM The amount which present valued revenues are below present valued revenue requirements equals NPVRIM

The LRIRIM is the change in rates that creates a change in the revenue stream that, when present valued, equals the NPVRIM* If the utility raises (or lowers) its rates in the base year by the amount of the LRIRIM' revenues over the term of the program will again equal revenue requirements. (The other assumed changes in rates, implied in the escalation of the rate values, are considered to remain in effect.)

Thus, the formula for the LRIRIM is derived from the following equality where the present value change in revenues due to the rate increase or decrease is set equal to the NPVRIM or the revenue change caused by the program.

$$-NPV_{RIM} = \sum_{t=1}^{N} \frac{LRI_{RIM} \times E_t}{(1+d)^{t-1}}$$

Since the LRI_{RIM} term does not have a time subscript, it can be removed from the summation, and the formula is then:

$$-NPV_{RIM} = LRI_{RIM} \times \sum_{t=1}^{N} \frac{E_t}{(1+d)^{t-1}}$$

Rearranging terms, we then get:

$$LRI_{RIM} = -NPV_{RIM} \Big/ \sum_{t=1}^{N} \frac{E_t}{(1+d)^{t-1}}$$

Thus,

$$E = \sum_{t=1}^{N} \frac{E_t}{(1+d)^{t-1}}$$