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March 31, 2014

**Via Email**  
**Original via mail**

Commission Secretary  
BC Utilities Commission  
Sixth Floor, 900 Howe Street, Box 250  
Vancouver, BC V6Z 2N3

Attention: Ms. Erica M. Hamilton, Commission Secretary

Dear Ms. Hamilton:

**Re: FortisBC Inc. Semi-Annual Demand Side Management Report for the Year  
ended December 31, 2013**

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Please find enclosed for filing FortisBC Inc.'s Semi-Annual Demand Side Management Report to December 31, 2013. Twelve copies will be couriered to the Commission.

Sincerely,

**FORTISBC INC.**

***Original signed:***

Dennis Swanson  
Director, Regulatory Affairs



**FortisBC Inc.**

**Annual DSM Report  
Year Ended December 31, 2013**

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## REPORT OBJECTIVE

This report provides highlights of FortisBC Inc.'s (FBC or the Company) Demand Side Management (DSM) programs for the year ended December 31, 2013. The report reviews the progress of FBC's PowerSense program in meeting the approved DSM Plan by educating and incenting FBC's customers to conserve energy and improve the energy efficiency of their homes and/or business. The report also provides information regarding integration and collaboration of the DSM programs with other BC Utilities<sup>1</sup>. A summary of PowerSense program activities in 2013 is presented, with a comparison of actual energy savings and costs to Plan and a statement of financial results including benefit/cost ratios is provided. A summary of historical FBC DSM costs and energy savings for the past five years is included in Appendix B. Finally, the executive summary reports of completed Monitoring & Evaluation reports are provided in Appendices C through E.

## OVERVIEW OF RESULTS FOR THE YEAR ENDED DECEMBER 31, 2013

Energy efficiency savings for the year ended December 31, 2013 were 29.5 GWh, or 94 percent of the 31.5 GWh Plan. Company costs incurred were \$6,855,000 or 87 percent of the \$7,878,000 approved Plan. Adding customer costs to the Company's program costs yields a total resource cost (TRC) of \$14,701,000 with an overall TRC benefit/cost ratio of 1.6. The method used to determine benefits is provided in the Financial Results section.

## OVERVIEW OF POWERSENSE ACTIVITIES

PowerSense experienced a year of significant change and challenge in 2013. From integration of program offers with FortisBC Energy's (FEI) Energy Efficiency and Conservation (EEC) initiatives, to introducing new programs to underserved customers, to making process and evaluation improvements, the PowerSense team worked persistently to achieve its goals.

The following provides a brief description of the energy efficiency programs PowerSense offered in 2013, including key outcomes and changes made to program delivery. A summary of portfolio level Supporting Initiatives and Planning and Evaluation activities is included as well.

## RESIDENTIAL SECTOR

The number and type of residential sector programs offered in 2013 were similar to those offered in 2012. The following outlines program enhancements and highlights of program activities:

- PowerSense continued to collaborate with the Ministry of Energy and Mines (MEM), BC Hydro and the FortisBC Energy Utilities (FEU) to provide a "one-stop shop" retrofit rebate offer through the LiveSmart BC program. By focusing on the most cost-effective retrofit measures and using a "whole house" approach, the utility partners continued to support the program with rebates for insulation and air sealing measures after MEM

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<sup>1</sup> British Columbia Utilities Commission (BCUC or the Commission) Order G-110-12, Directive 51.

ceased incentive funding in 2013. The utility partners continued to collaborate on the BC Hydro Evaluation of the LiveSmart BC Efficiency Incentive Program and also had research conducted to develop a BC Home Energy Performance Industry strategy and a BC Standards of Practice Guide for Air Sealing and Insulation Retrofits.

- The residential Home Improvement and New Home programs' offers remained the same as 2012. However, marketing efforts were integrated with EEC natural gas rebate offers. Customers applying for either retrofit or new construction rebates accessed joint program information, while those applying for new construction rebates experienced a single application process for gas and electric measures.
- The Energy Star Appliance rebate program experienced some changes in model qualifications; dishwashers were no longer eligible for rebates and more stringent requirements for clothes washers were adopted. The program closed at year-end, having significantly supported market transformation, as evidenced by MEM phasing in Energy Star performance tiers for four major household appliances in 2014-15.
- The Energy Star lighting list of rebate-qualified products was revised to reflect market transformation for CFL lighting. Although customers could continue to apply for rebates as part of the Home Improvement and New Home programs, the majority of rebates were provided through semi-annual retail point-of-purchase promotions with lighting and building supply retailers. These two promotions were in collaboration with BC Hydro's lighting program offers to provide continuity to customers and lighting retailers across the BC market.
- The Kootenay Energy Diet was launched in early 2013 with funding from NRCan (Natural Resources Canada) and the Columbia Basin Trust, based on the success of the 2011-2012 Rossland Energy Diet pilot project. The Okanagan Energy Diet was launched in mid-2013 for the Okanagan region. Implemented in partnership with the EEC group, the two marketing campaigns proved particularly successful in promoting home energy assessments and deeper retrofit improvements.
  - Of note, approximately half of all the home energy assessments completed in BC in 2013 were conducted in the Okanagan and Kootenay regions through the Energy Diet programs.
- The Reduce Your Use program, which provided rebates for the cost of a home energy assessment for high-use customers, was offered throughout the year. Customer participation diminished in the later part of the year as customers opted to participate in the Energy Diets instead.
- Three low-interest, long-amortization energy efficiency loan programs were offered in combination with the Energy Diet promotions and Air Source Heat Pump rebate program. The pilot Residential Efficiency Loan Program (RELP), an on-bill financing program, was offered to natural gas and electricity customers in the South Okanagan. A third-party financing program, conducted in collaboration with 11 credit unions, was introduced to customers in the Kootenay area. The long-standing air source heat pump

loan was continued for electrically-heated customers within the FBC electric service territory. None of the loan programs had significant levels of participation.

- A direct installation program for multi-family rental buildings was piloted in the Central Okanagan. Installations included low-cost energy efficiency household measures (screw-in energy efficient lighting, low-flow showerheads, tap aerators, and simple draft proofing). The pilot project continued to the end of the year, with installations in 1,339 apartment units being completed in 45 buildings.
- The Low Income direct installation program for multi-family residences, which was started in 2012 in collaboration with BC Non-Profit Housing Association and the Ministry of Energy and Mines, was completed in December. More than 150 multi-family low-income residences received free walk-through audits, common area lighting upgrades and the installation of household energy efficiency measures. Planning for an Energy Conservation and Assistance Program (ECAP) for low income customers continued.
- Household energy assessments were conducted and energy efficient household measures were installed in 150 detached homes with high electricity usage on the Penticton and Lower and Upper Similkameen Indian Bands. The assessment findings were used to inform an RFP, which will be issued in early 2014 to conduct insulation and heating system upgrades where they will have the greatest energy conservation impact. The retrofit portion of this initiative is co-funded with the Ministry of Energy and Mines.
- PowerSense collaborated with the Penticton Indian Band on the Eco-Sage housing project. Eight super-efficient houses were completed in 2013, six of which achieved EnerGuide rating of 88, one is pursuing a LEED Platinum rating, and one is a certified PassiveHouse. Other partners involved in the project included the provincial Ministry of Energy and Mines, Solar BC, Canadian Mortgage and Housing Corporation, and Aboriginal Affairs and Northern Development Canada.

## COMMERCIAL AND INDUSTRIAL SECTORS

Although the commercial and industrial sector program offers did not change substantively in 2013, there were many process improvements that resulted in increased program participation and greater clarity and simplicity for customers. The following illustrates the improvements and highlights program activities:

- In late 2012, PowerSense, in partnership with EEC, launched an on-line prescribed rebate program for commercial lighting, HVAC, refrigeration, commercial kitchen, natural gas boilers and hot water heaters. In 2013, program marketing started, which included sector specific advertising (i.e. commercial kitchens). In mid-2013, the Energy Rebate Centre (ERC) for business program's application process was revised for energy efficient lighting to include pre-approved point-of-purchase rebates with qualified wholesale lighting companies, to better meet customers' needs. The program is fully integrated with FEI EEC prescriptive programs and is experiencing on-going increases in program participation. The program also supported the MEM Business Energy Assessment program with rebate offers and on-going advice and assistance.

- The entire application and approval process for the Custom Business Efficiency Program<sup>2</sup> was revised in 2013. Although the new process was only in place for the latter half of the year, customers and staff are pleased with the improved certainty and transparency of the process.
- PowerSense worked collaboratively with the EEC team to offer low-cost comprehensive energy walk-through assessments and some direct installation of low-flow water and Energy Star lighting measures for medium size businesses. This initiative was prepared for launch in January 2014.
- The FortisBC Lighting Incentive Program (FLIP), a direct install lighting program for small businesses, wrapped up in March. The MEM jointly funded program was hugely successful, achieving 10 million kWh in savings over the 3 year program cycle.

### SUPPORTIVE INITIATIVES

The Supporting Initiatives projects endeavoured to meet all regulatory requirements, as well as meet PowerSense's goals to engage and support customers and help them understand energy and how to reduce usage. Programs and promotions were conducted in collaboration with the EEC group whenever possible in an effort to maximize cost-effectiveness and efficiency. The following is a brief overview of Supporting Initiatives activities:

- Education Programs (elementary and secondary) – Energy is Awesome (curriculum-based education packages for educators and volunteer presenters), Destination Conservation, Beyond Recycling/Wildsight, British Columbia Sustainable Energy Association (BCSEA) Climate Change Showdown, Greenbricks;
- Education Programs (post-secondary) – University of BC Okanagan (UBCO) Power of You, financial support for trades training through the British Columbia Electrical Association (BCEA);
- Community Outreach – participation in local home and garden shows, trade shows, community events, farmers' markets, Energy Diet information sessions, and hockey game sponsorships;
- Community Energy Efficiency Education and Awareness – Earth Hour promotion, Energy Diet information sessions, improved website (case studies, residential energy calculator, on-line contest);
- Community Event sponsorships – Canadian Home Builders' Association (CHBA) Tommie Awards, Building Sustainable Communities conference, Fresh Air Cinema, City of Grand Forks Solar Car Competition;

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<sup>2</sup> Marketing name for Commercial Building Improvement – New and Retrofit and Industrial Efficiency Programs



- Trade Ally Program – PowerSense worked closely with EEC to expand trades participation in the joint program, as well as enhanced the on-line reference customer experience.

## PLANNING AND EVALUATION

The Planning and Evaluation activities in 2013 included completing customer surveys and reports necessary for program planning and conducting program evaluations. The 2013 the joint gas/electric residential end-use survey was completed in partnership with EEC. The Electric Conservation Potential Report was updated to support the five year DSM plan submitted as part FortisBC's Application for Approval of a Multi-Year Performance Based Ratemaking Plan for 2014 through 2018 (FBC 2014-2018 Multi-Year PBR Plan).

A three year Monitoring and Evaluation plan was completed early in 2013. The Monitoring and Evaluation activities in 2013 included the comprehensive evaluation of the Residential Heat Pump program and the Residential Lighting and Appliances programs and a process review of the Commercial Building Improvement program. The executive summaries of these evaluation reports are included in Appendices C through E.

In early 2013, the requirements and internal business case were prepared for a new DSM tracking and reporting system. The purchase of the "cloud" software was completed and program configuration started in early December.

## POWERSENSE PROGRAMS OFFERED IN 2013

The following tables summarize the PowerSense program offerings and indicate program status and progress of integration with FEU's EEC programs.

**Table 1 - Residential Programs 2013**

Program and Measures	Status	Integrated with FortisBC Energy Utilities for combined offer
Energy Star Appliances	Closed at year-end	Yes <sup>3</sup> (clothes washers)
Energy Star Retail Lighting Rebate	Ongoing	No (electricity only)
Heat Pump (Air Source and Geo-Exchange)	Ongoing (Air Source) Closed at year-end (Geo-Exchange)	No (electricity only)
TLC Heat Pump Maintenance	Ongoing	No (electricity only)
New Home	Ongoing	Yes (Marketing and Application Process)

<sup>3</sup> Based on fuel source of hot water tank.

Program and Measures	Status	Integrated with FortisBC Energy Utilities for combined offer
Home Improvement (Retrofit)	Ongoing	Yes (Marketing)
LiveSmart BC (Retrofit)	Ongoing	Yes
Reduce Your Use (energy assessments)	Closed at year-end	No (electricity only)
On-Bill Financing	Pilot Project	Yes
Low Income – Direct Installation Lighting	Completed at year-end	No (electricity only)
Low Income – Direct Installation Household Measures	New	Yes
Low Income – Energy Savings Kits	Ongoing	Yes
Rental and Low-Income Housing	New	Yes (where appropriate)
Supporting Initiatives	Ongoing	Yes (where appropriate)
Contractor program	Enhanced	Yes (where appropriate)
WaterSavers	Enhanced	Yes

Table 2 - Commercial and Industrial Programs 2013

Program and Measures	Status	Integrated with FortisBC Energy Utilities for combined offer
Product Rebate Program (marketed as Energy Rebate Centre)	Ongoing	Yes
FLIP – Direct Installation of Lighting for Small Business	Completed (March 31, 2013)	No (electricity only)
Building Improvement (New)	Ongoing	In progress
Building Improvement (Retrofit)	Ongoing	No
Building Optimization	Closed at year-end to new participants	Yes
Partners in Energy	Ongoing	No
Energy Efficiency Studies	Ongoing	In progress
Industrial Efficiency	Ongoing	No
Irrigation Pumping	Ongoing	No (electricity only)
Green Motors (motor rewinds)	Closed at year-end	No (electricity only)

## ENERGY SAVINGS BY SECTOR

The energy savings that PowerSense achieved in the year ended December 31, 2013 are shown in the table below.

**Table 3 - Energy Savings by Sector**

SECTOR	Plan	Actual	% of Plan
	GWh		Achieved
Residential	16.9	16.1	95%
Commercial	12.0	10.9	91%
Industrial	2.6	2.5	98%
Total Savings (GWh)	31.5	29.5	94%

*Note: Differences due to rounding*

Overall PowerSense achieved 94 percent of the Plan goal of 31.5 GWh savings in 2013. Residential and Commercial sector energy savings were just below Plan at 95 and 91 percent of Plan savings. Industrial sector energy savings were close to Plan at 98 percent. These results are discussed in more detail in the following sections.

## DETAIL OF ENERGY SAVINGS

The following tables provide details on the DSM energy savings in each sector, including DSM activities in the service territories of the Municipal Wholesale customers.

**Table 4 - Residential Energy Savings**

RESIDENTIAL	Plan	Actual	% of Plan
	GWh		Achieved
Home Improvement Program	9.4	5.8	62%
Low Income	1.6	2.0	126%
Residential Lighting	2.5	3.3	133%
Heat Pumps	3.4	2.1	60%
New Home Program	0.09	3.0	3209%
Total Savings (GWh)	16.9	16.1	95%

*Note: Differences due to rounding*

In the year ended December 31, 2013, the energy savings results from Residential programs were 95 percent of Plan. The Low Income and Residential Lighting programs exceeded Plan with savings of 126 and 133 percent. The point-of-purchase incentive campaigns in March-April and October were effective and contributed to the success in Residential Lighting. The Heat Pump and Home Improvement programs fell short of forecast with 60 and 62 percent of savings. The LiveSmart BC collaboration resulted in 1.6 GWh of retrofit energy savings, which are recorded in the Heat Pump and Home Improvement (HIP) programs. The provincial incentives ended March 31, 2014 following in the steps of the federal government a year earlier, which likely was a factor in the reduced uptake and results in corresponding PowerSense

programs. Customer (and builder) participation in the New Home program continues to exceed plan expectations.

PowerSense continued to provide energy savings kits containing energy efficient measures for low-income households. 580 kits were distributed via community outreach activities with low-income service providers and through direct mail to low-income customers who applied for kits. The program was implemented in partnership with the EEC group.

**Table 5 - Commercial Energy Savings**

COMMERCIAL	Plan	Actual	% of Plan Achieved
	GWh		
Lighting	7.4	7.6	103%
Building and Process Improvement	3.5	2.6	74%
Water Handling and Infrastructure	1.1	0.7	63%
Total Savings (GWh)	12.0	10.9	91%

The Commercial sector recorded savings of 10.9 GWh, or 91 percent of the 2013 Plan. The majority of these savings were realized through the Commercial lighting programs, including the FLIP direct install, “at the counter” product rebates and custom lighting retrofits, such as those installed at a supermarket in the Kootenays, producing 0.2 GWh of savings. The FLIP direct installation program, a collaborative effort with the LiveSmart BC Business program continued to be very popular until the program ended in the first quarter of 2013 and it contributed 1.8 GWh of savings in 2013.

BIP energy savings were 2.6 GWh or 74% of Plan. An example of a Building and Process Improvement (BIP) custom project is a refrigeration upgrade at a supermarket in the Okanagan, contributing 0.15 GWh of savings.

In 2013, there was one large water infrastructure project in the Kootenay region that resulted in 0.6 GWh savings. The pilot phase of the Irrigation program, which closed April 30, 2013, had a small number of applicants; however none of the applicants were eligible for incentives based on the upgrades proposed.

**Table 6 - Industrial Energy Savings**

INDUSTRIAL	Plan	Actual	% of Plan
	GWh		Achieved
Industrial Efficiency	2.3	2.5	110%
Integrated EMIS	0.3	0.0	0%
Total Savings (GWh)	2.6	2.5	98%

The Industrial Programs achieved savings of 2.5 GWh, or 98 percent of the 2.6 GWh Plan for 2013. Several lumber mills made significant efficiency improvements in 2013, including the installation of variable speed drives on process equipment which resulted in 0.6 GWh of energy savings.

The table below disaggregates the Wholesale DSM savings, which are included in the sector tables above.

**Table 7 - Wholesale Energy Savings by Municipality**

WHOLESALE ACTIVITY	GWh	MW	% of GWh*
Penticton	1.2	0.3	47%
Summerland	0.4	0.1	15%
Grand Forks	0.1	0.02	5%
Nelson	0.8	0.1	32%
<b>Total Savings (Wholesale)</b>	<b>2.6</b>	<b>0.5</b>	<b>100%</b>

*\*Of savings attributable to the Wholesale class*

*Note: Differences due to rounding.*

The total Wholesale energy savings, which were acquired within the service areas of the four municipal electric utilities<sup>4</sup> served by FBC, were 2.6 GWh and 0.5 MW in 2013. The largest DSM savings results occurred within Penticton and Nelson municipal utility service areas (the municipalities with the largest number of customers).

<sup>4</sup> As of March 31, 2013, FBC purchased the utility assets of the City of Kelowna. Former City of Kelowna customers are now direct customers of FortisBC.

## PROGRAM COSTS BY SECTOR

Table 8 presents the actual costs incurred in the year ended December 31, 2013, compared to the approved Plan. The percent of plan savings achieved by sector is shown for comparison purposes.

**Table 8 - Costs by Sector/Component**

SECTOR/COMPONENT	Plan	Actual	% of Plan	% of Plan
	(\$000s)		Costs	Savings
Residential	3,944	3,168	80%	95%
Commercial	2,085	1,909	92%	91%
Industrial	364	324	89%	98%
Supporting Initiatives	725	706	97%	-
Monitoring & Evaluation	312	306	98%	-
Planning & Admin	448	442	99%	-
Total	7,878	6,855	87%	94%

Costs amounted to \$6,855,000 or 87 percent of the 2013 Plan, commensurate with overall savings. A breakdown of utility program costs per sector or program component follows. The table in Appendix A contains an additional breakdown of total program costs, including the customer portion of incremental project costs.

## DETAIL OF COSTS

The following tables provide details on the DSM program costs for each sector and component in the PowerSense portfolio.

**Table 9 - Residential Costs**

RESIDENTIAL	Plan	Actual	% of Plan
	(\$000s)		Achieved
Home Improvement Program	2,228	966	43%
Low Income	660	415	63%
Residential Lighting	313	473	151%
Heat Pumps	698	532	76%
New Home Program	45	782	1738%
Total	3,944	3,168	80%

The utility cost of the Residential programs was \$3,168,000 or 80 percent of Plan for 2013. The New Home program continues to be very successful and while the costs are over budget, they are commensurate with savings. The Home Improvement program was underspent corresponding with savings. The Low Income program was also underspent, since the Energy Conservation Assistance Program (ECAP) will not be launched until 2014. The Residential

Lighting program expenditures are over budget, but are matched by the savings achieved in the program.

**Table 10 - Commercial Costs**

COMMERCIAL	Plan	Actual	% of Plan
	(\$000s)		Achieved
Lighting	1,212	1,235	102%
Building and Process Improvement	696	594	85%
Water Handling and Infrastructure	177	80	45%
Total	2,085	1,909	92%

Commercial sector costs in 2013 amounted to \$1,909,000 or 92 percent of Plan. The largest cost component of Commercial programs was the Lighting program, which includes incentives paid through the LiveSmart BC FLIP collaboration. The expenditures for Water Handling and Infrastructure are under budget, partially because it incorporates the Irrigation program which had low uptake.

**Table 11 - Industrial Costs**

INDUSTRIAL	Plan	Actual	% of Plan Achieved
	(\$000s)		
Industrial Efficiency	323	307	95%
Integrated EMIS	41	17	41%
Total	364	324	89%

Industrial sector costs incurred by the Company were \$324,000 for 2013, or 89 percent of Plan. The Industrial sector is characterized by large projects that generally occur less frequently than in other sectors. Energy Management Information System (EMIS) software is a long-term program with up-front costs and savings that will be realized later in the process. There has been low participant uptake in the EMIS program, which was closed at the end of 2013.



Portfolio level costs, which are not specifically associated with individual programs, include the following components: Supporting Initiatives, Monitoring and Evaluation, and Planning and Administration. These costs are summarized in the table below.

**Table 12 - Portfolio Costs by Component**

COMPONENT	Plan	Actual	% of Plan
	(\$000s)		Achieved
Supporting Initiatives	725	706	97%
Monitoring & Evaluation	312	306	98%
Planning & Administration	448	442	99%
<b>Total</b>	<b>1,485</b>	<b>1,455</b>	<b>98%</b>

The Supporting Initiative costs for 2013 were \$706,000 or 97 percent of the \$725,000 Plan. Supporting Initiatives spending continued to drive community outreach and direct customer communication, which is a strong component of PowerSense programming. The three community ambassadors attended more than 180 community events in over 40 communities. At some of these events, energy savings kits were distributed to low income customers and low-flow showerheads were distributed to customers with natural gas or electrically heated water. Whenever possible, outreach and community event sponsorship was done in collaboration with EEC.

The Earth Hour promotion was expanded to include pledges from businesses in 2013, and was once again well received. As part of Earth Hour, customers across the FBC service area sent in approximately 1,500 pledges, each committing to turn their lights off for one hour. The majority of these customers also committed to at least one further action to reduce energy. Approximately 200 businesses pledged to turn their lights off for Earth Hour and 20 made commitments to take further action to reduce energy consumption.

The Planning and Evaluation (P&E) budget is separated into two main components: Monitoring and Evaluation (M&E), and Planning and Administration. Both were just under budget compared to Plan. One of the main expenditures under P&E is on program evaluations and reports conducted by third party consultants. The executive summaries of the evaluation reports completed in 2013 are included in Appendices C through E. The 2013 CPR Update was filed with the FBC 2014-18 Multi-Year PBR Plan, and the 2013 Residential End Use Study (REUS) findings, including a Conditional Demand Analysis, will provide useful planning data on an ongoing basis.

## FINANCIAL RESULTS

This section provides the financial and benefit/cost test results for 2013 and includes information about how the benefits were calculated for the total resource cost test (TRC) and for the modified total resource cost test (mTRC)<sup>5</sup>.

The table below presents the financial and benefit cost tests by program. It also includes the Planning and Evaluation costs, which are allocated to the programs by savings achieved.

**Table 13 - Financial Results for Year ended December 31, 2013 by Program**

Program	Program Benefits	Utility Program Costs	Planning & Evaluation		Customer Incurred Costs	Total Resource Costs	Total Resource Benefit/Cost Ratio	
	(\$000s)						TRC	mTRC
Residential								
Home Improvement	4,544	966	87	60	1,307	2,420	1.7	1.8*
Low Income	700	415	30	21	117	582	1.2	1.6**
Residential Lighting	1,176	473	49	34	103	659	1.4	1.4
Heat Pumps	1,922	532	31	21	1,654	2,239	1.3	1.9*
New Home Program	3,272	782	45	31	892	1,750	1.9	1.9
Residential Total	11,614	3,168	242	167	4,073	7,650	1.6	1.8
Commercial								
Lighting	4,146	1,235	114	79	1,189	2,617	2.0	2.0
Building and Process Improvement	2,246	594	38	27	1,021	1,680	1.6	1.6
Water Handling Infrastructure	580	80	10	7	331	428	1.4	1.4
Commercial Total	6,972	1,909	163	113	2,541	4,725	1.8	1.8
Industrial								
Industrial Efficiency	1,462	307	38	26	1,232	1,603	1.0	1.0
Integrated EMIS	-	17	-	-	-	17	-	- *
Industrial Total	1,462	324	38	26	1,232	1,620	1.0	1.0
Supporting Initiatives		706				706	-	-
Total	20,048	6,107	442	306	7,846	14,701	1.6	1.7

Note: Minor differences due to rounding

\* mTRC benefits applied to certain program measures

\*\* Low Income benefits increased by 30 percent

An overall total resource benefit/cost ratio of 1.6 was achieved in 2013. The benefit/cost ratios for the individual programs are also detailed in the table above. The Residential sector program performance resulted in a benefit/cost ratio of 1.6 and the Commercial sector achieved a benefit/cost ratio of 1.8 and the Industrial sector benefit/cost ratio was 1.0.

The Low Income program attained a benefit/cost ratio of 1.2 and with the 30 percent benefits lift as per the DSM Regulation, s4(2)(b), the benefit/cost ratio increased to 1.6.

Program benefits are primarily based on the present value of avoided power purchase costs. For the TRC test, the present value of avoided power purchase costs is calculated using the

<sup>5</sup> As described in the Demand Side Management Regulation (326/2008 as amended in December 2011) of the Utilities Commission Act.

long-term avoided power purchase cost<sup>6</sup> over the measure lifespan, plus a deferred construction expenditure factor. Total resource costs shown in Table 13 are a total of Company costs and customer costs. The customer costs are the customers' portion of incremental costs for new construction measures and the energy efficiency portion of retrofit measure costs. In the calculation of the TRC and mTRC tests the incremental portion of cost is adjusted by the program NTG (net-to-gross) ratios.

The modified total resource benefit/cost ratio (mTRC) is also shown in Table 13. The benefits used in the mTRC were estimated using a long-term avoided power purchase cost<sup>7</sup> plus a fifteen percent adder for non-energy benefits (NEB). The mTRC benefits were estimated based on the following measures that were subject to the mTRC in the 2012-2013 Revenue Requirements Application (2012-13 RRA):

- Residential:
  - Building Envelope – windows;
  - Heat Pumps – geo exchange, air source conversion, and ductless; and
  - Appliances – freezers.
- Industrial:
  - Integrated – EMIS.

The mTRC benefits estimation excludes the controls measure in the commercial lighting program, as it was not feasible to separate it from the other commercial lighting measures in the program results.

The mTRC results do not differ substantially from the TRC results. Overall, the benefit/cost ratio increased from 1.6 to 1.7 using the prescribed mTRC method. The Residential benefit/cost ratio increased from 1.6 to 1.8. Most notably, the heat pump benefit/cost ratio increased from 1.3 to 1.9 with the use of the mTRC. Commercial and Industrial benefit/cost ratios were unaffected by incorporation of the mTRC.

The Company's DSM program expenditure related to the measures that are subject to the mTRC was estimated to be \$599,000 or 8.7 percent of the 2013 DSM expenditure, which is within the regulated mTRC impact cap.

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<sup>6</sup> As per the 2012-2013 Long Term Demand Side Management (DSM) Plan, approved by BCUC Order G-110-12, the long-term avoided power purchase cost is \$84.94/MWh.

<sup>7</sup> As per the 2012-2013 Long Term Demand Side Management (DSM) Plan, approved by BCUC Order G-110-12, the long-term avoided power purchase cost is \$111.96/MWh, for BC "clean" new resources.

## **ON-BILL FINANCING PILOT PROGRAM**

The On-Bill Financing (OBF) pilot program, which is marketed as the Residential Energy Efficiency Loan Program, was mandated by the provincial government and provides loans of up to \$10,000 to residential customers in the South Okanagan to make energy efficiency improvements to their homes. The loans are to be repaid on the customers' electricity bills over the next 10 years. This pilot program was launched on November 1, 2012 and is slated to run until the end of 2014.

The OBF pilot program costs are separate from the DSM budget and in accordance with BCUC Order G-163-12, FBC created a non-rate base deferral account to capture the OBF pilot program costs. In 2013, the FBC portion of the OBF pilot program costs were \$25,000.

## APPENDIX A - DSM SUMMARY REPORT IN BCUC FORMAT

**Table 14 - FBC Demand Side Management Summary Report for Year ended December 31, 2013**

Sector/Program	Utility Program Costs				Planning & Evaluation		Total	Customer	Total	Program	Energy	Benefit/Cost Ratios				Levelised
	Direct	Direct	Program	Program	Planning	Monitoring	Utility	Incurred	Resource			Total	Modified Total	Rate	Utility	
	Incentives	Information	Labour	Dev.	& Admin.	& Eval.	Costs	Cost	Cost	Benefits*	Savings	Resource*	Resource**	Impact	Cost	Cost
	(\$000s)										MWh					¢/kWh
<b>Residential</b>																
Home Improvements Program	574	79	241	71	87	60	1,113	1,307	2,420	4,544	5,811	1.7	1.8	0.8	4.1	5.2
Low Income	323	20	40	32	30	21	465	117	582	700	1,981	1.2	1.6	0.6	1.5	7.4
Residential Lighting	398	29	33	13	49	34	557	103	659	1,176	3,290	1.4	1.4	0.6	2.1	5.0
Heat Pumps	428	27	70	7	31	21	584	1,654	2,239	1,922	2,055	1.3	1.9	0.7	3.3	10.6
New Home Program	671	58	44	9	45	31	858	892	1,750	3,272	2,985	1.9	1.9	0.8	3.8	5.2
<b>Residential Total</b>	<b>2,394</b>	<b>214</b>	<b>427</b>	<b>133</b>	<b>242</b>	<b>167</b>	<b>3,576</b>	<b>4,073</b>	<b>7,650</b>	<b>11,614</b>	<b>16,122</b>	<b>1.6</b>	<b>1.8</b>	<b>0.8</b>	<b>3.2</b>	<b>6.7</b>
<b>Commercial</b>																
Lighting	819	64	249	103	114	79	1,428	1,189	2,617	4,146	7,632	2.0	2.0	0.6	2.9	4.6
Building and Process Improvement	329	28	156	81	38	27	659	1,021	1,680	2,246	2,558	1.6	1.6	0.8	3.4	6.7
Water Handling Infrastructure	61	2	7	10	10	7	98	331	428	580	695	1.4	1.4	0.8	5.9	6.3
<b>Commercial Total</b>	<b>1,209</b>	<b>94</b>	<b>411</b>	<b>194</b>	<b>163</b>	<b>113</b>	<b>2,185</b>	<b>2,541</b>	<b>4,725</b>	<b>6,972</b>	<b>10,885</b>	<b>1.8</b>	<b>1.8</b>	<b>0.7</b>	<b>3.2</b>	<b>5.3</b>
<b>Industrial</b>																
Industrial Efficiency	251	4	41	11	38	26	371	1,232	1,603	1,462	2,520	1.0	1.0	0.8	3.9	9.5
Integrated EMIS	10	-	3	4	-	-	17	-	17	-	-	0.0	0.0	0.0	0.0	-
<b>Industrial Total</b>	<b>261</b>	<b>4</b>	<b>44</b>	<b>15</b>	<b>38</b>	<b>26</b>	<b>388</b>	<b>1,232</b>	<b>1,620</b>	<b>1,462</b>	<b>2,520</b>	<b>1.0</b>	<b>1.0</b>	<b>0.8</b>	<b>3.8</b>	<b>9.6</b>
Supporting Initiatives	-	430	276	-	-	-	706	-	706	-	-	-	-	-	-	-
<b>TOTAL</b>	<b>3,865</b>	<b>742</b>	<b>1,159</b>	<b>341</b>	<b>442</b>	<b>306</b>	<b>6,855</b>	<b>7,846</b>	<b>14,701</b>	<b>20,048</b>	<b>29,526</b>	<b>1.6</b>	<b>1.7</b>	<b>0.7</b>	<b>2.9</b>	<b>6.7</b>

Note: Minor differences due to rounding

\* Benefits calculated using the long-term avoided power purchase cost of \$84.94/MWh.

\*\* Benefits for some measures calculated using BC clean power levelized price of \$111.xy/MWh plus 15% NEBs.

## APPENDIX B - HISTORICAL SUMMARY OF FBC'S DSM COSTS AND ENERGY SAVINGS

**Table 15 - Historical FBC DSM Costs and Energy Savings 2008- 2009**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	<b>2008 (Actual)</b>							<b>2009 (Actual)</b>						
	Spend (\$000s)			Energy Savings (MWh)			TRC <sup>3</sup>	Spend (\$000s)			Energy Savings (MWh)			TRC <sup>3</sup>
	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)
<b>Residential</b>														
Home Improvements	135	62	73	385	331	(54)	0.8	273	145	128	1,024	1,032	8	1.4
Building Envelope <sup>1</sup>														
Heat Pumps	446	682	(236)	4,889	8,444	3,555	1.4	515	677	(162)	5,642	3,188	(2,454)	0.7
Residential Lighting	156	151	5	1,796	2,562	766	4.1	263	306	(44)	2,822	3,349	526	2.8
New Home Program	286	340	(54)	1,332	1,596	265	2.8	341	496	(155)	1,216	1,735	518	2.2
Appliances <sup>1</sup>														
Electronics <sup>1</sup>														
Water Heating <sup>1</sup>														
Low Income <sup>1</sup>														
Behavioural <sup>1</sup>														
<b>Residential Total</b>	<b>1,023</b>	<b>1,236</b>	<b>(213)</b>	<b>8,401</b>	<b>12,933</b>	<b>4,531</b>	<b>1.7</b>	<b>1,391</b>	<b>1,624</b>	<b>(233)</b>	<b>10,705</b>	<b>9,304</b>	<b>(1,401)</b>	<b>1.3</b>
<b>Commercial</b>														
Lighting	257	375	(118)	3,000	5,960	2,960	2.4	724	422	302	5,505	7,638	2,133	3.0
Building and Process Improvements	497	506	(9)	6,103	5,081	(1,022)	1.6	563	639	(75)	6,095	8,713	2,618	1.8
Computers														
Municipal (Water Handling) <sup>2</sup>														
Irrigation <sup>2</sup>														
<b>Commercial Total</b>	<b>754</b>	<b>881</b>	<b>(127)</b>	<b>9,103</b>	<b>11,042</b>	<b>1,939</b>	<b>1.9</b>	<b>1,287</b>	<b>1,060</b>	<b>227</b>	<b>11,600</b>	<b>16,351</b>	<b>4,751</b>	<b>2.2</b>
<b>Industrial</b>														
Compressed Air	58	22	36	700	210	(490)	1.2	71	41	30	811	398	(413)	0.9
EMIS														
Industrial Efficiencies	142	124	18	1,285	3,083	1,798	2.3	274	195	79	2,189	2,305	116	1.6
<b>Industrial Total</b>	<b>200</b>	<b>147</b>	<b>53</b>	<b>1,985</b>	<b>3,294</b>	<b>1,309</b>	<b>2.3</b>	<b>345</b>	<b>236</b>	<b>109</b>	<b>3,000</b>	<b>2,703</b>	<b>(297)</b>	<b>1.5</b>
<b>Programs Total</b>	<b>1,977</b>	<b>2,264</b>	<b>(287)</b>	<b>19,489</b>	<b>27,268</b>	<b>7,779</b>	<b>-</b>	<b>3,023</b>	<b>2,920</b>	<b>103</b>	<b>25,305</b>	<b>28,358</b>	<b>3,053</b>	<b>-</b>
Supporting Initiatives	-	-	-	-	-	-	-	141	141	0	-	-	-	-
Planning & Evaluation	378	419	(41)	-	-	-	-	503	402	101	-	-	-	-
<b>Total</b>	<b>2,355</b>	<b>2,683</b>	<b>(328)</b>	<b>19,489</b>	<b>27,268</b>	<b>7,779</b>	<b>1.8</b>	<b>3,667</b>	<b>3,464</b>	<b>204</b>	<b>25,305</b>	<b>28,358</b>	<b>3,053</b>	<b>1.7</b>

<sup>1</sup> These programs were included in Home Improvements program

<sup>2</sup> Water Treatment and Wastewater Handling infrastructure were part of Building and Process Improvement

<sup>3</sup> Benefits calculated using RS3808 applicable at the time

Table 16 - Historical FBC DSM Costs and Energy Savings 2010

	1	2	3	4	5	6	7
	2010 (Actual)						
	Spend (\$000s)			Energy Savings (MWh)			TRC <sup>3</sup>
	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)
<b>Residential</b>							
Home Improvements	294	434	(140)	953	4,948	3,995	3.1
Building Envelope <sup>1</sup>							
Heat Pumps	624	749	(125)	6,377	3,239	(3,138)	1.2
Residential Lighting	243	278	(35)	2,383	2,589	206	2.4
New Home Program	254	247	7	1,392	477	(915)	1.1
Appliances <sup>1</sup>							
Electronics <sup>1</sup>							
Water Heating <sup>1</sup>							
Low Income <sup>1</sup>	100	131	(31)	1,000	385	615	0.7
Behavioural <sup>1</sup>							
<b>Residential Total</b>	<b>1,515</b>	<b>1,838</b>	<b>(323)</b>	<b>12,105</b>	<b>11,638</b>	<b>764</b>	<b>1.9</b>
<b>Commercial</b>							
Lighting	722	526	196	5,304	7,971	2,667	3.5
Building and Process Improvements	658	597	61	6,751	6,685	(67)	1.5
Computers							
Municipal (Water Handling) <sup>2</sup>							
Irrigation <sup>2</sup>							
<b>Commercial Total</b>	<b>1,380</b>	<b>1,123</b>	<b>257</b>	<b>12,055</b>	<b>14,655</b>	<b>2,600</b>	<b>2.1</b>
<b>Industrial</b>							
Compressed Air	87	25	62	938	114	(823)	0.7
EMIS							
Industrial Efficiencies	302	216	86	2,412	2,853	441	2.1
<b>Industrial Total</b>	<b>389</b>	<b>241</b>	<b>148</b>	<b>3,350</b>	<b>2,967</b>	<b>(383)</b>	<b>2.0</b>
<b>Programs Total</b>	<b>3,284</b>	<b>3,203</b>	<b>81</b>	<b>27,510</b>	<b>29,261</b>	<b>2,981</b>	<b>2.1</b>
Supporting Initiatives	148	155	(7)	-	-	-	-
Planning & Evaluation	519	354	165	-	-	-	-
<b>Total</b>	<b>3,951</b>	<b>3,712</b>	<b>239</b>	<b>27,510</b>	<b>29,261</b>	<b>2,981</b>	<b>2.0</b>

<sup>1</sup> These programs were included in Home Improvements program

<sup>2</sup> Water Treatment and Wastewater Handling infrastructure were part of Building and Process Improvement

<sup>3</sup> Benefits calculated using RS3808 applicable at the time

**Table 17 - Historical FBC DSM Costs and Energy Savings 2011-2012**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	<b>2011 (Actual)</b>							<b>2012 (Actual)</b>						
	Spend (\$000s)			Energy Savings (MWh)			TRC <sup>3</sup>	Spend (\$000s)			Energy Savings (MWh)			TRC
	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)
<b>Residential</b>														
Home Improvements	2,145	479	1,666	8,960	3,692	(5,268)	1.6	1,719	637	1,082	7,620	4,656	(2,964)	1.7
Building Envelope <sup>1</sup>														
Heat Pumps	694	532	162	3,397	2,257	(1,140)	1.0	703	636	67	3,397	2,161	(1,236)	1.0
Residential Lighting	438	239	199	3,420	3,308	(112)	2.2	328	337	(9)	2,530	2,599	69	1.8
New Home Program	54	205	(151)	105	689	584	1.0	43	314	(271)	90	1,040	950	1.4
Appliances <sup>1</sup>								247	332	(85)	690	1,248	558	
Electronics <sup>1</sup>														
Water Heating <sup>1</sup>														
Low Income	305	245	60	540	1,447	(907)	1.0	677	308	369	1,774	1,054	(720)	1.3
Behavioural <sup>1</sup>														
<b>Residential Total</b>	<b>3,636</b>	<b>1,700</b>	<b>1,936</b>	<b>16,422</b>	<b>11,393</b>	<b>(6,843)</b>	<b>1.3</b>	<b>3,717</b>	<b>2,564</b>	<b>1,153</b>	<b>16,101</b>	<b>12,758</b>	<b>(3,343)</b>	<b>1.5</b>
<b>Commercial</b>														
Lighting	1,114	1,995	(881)	7,370	20,577	13,207	2.3	1,157	2,152	(995)	7,390	14,256	6,866	2.2
Building and Process Improvements	572	606	(34)	3,010	1,386	(1,624)	0.7	659	612	47	3,410	1,959	(1,451)	1.3
Computers														
Municipal (Water Handling)	432	231	201	3,560	2,199	(1,361)	1.6	383	255	128	2,580	1,677	(903)	2.6
Irrigation <sup>2</sup>														
<b>Commercial Total</b>	<b>2,118</b>	<b>2,832</b>	<b>(714)</b>	<b>13,940</b>	<b>24,162</b>	<b>10,222</b>	<b>1.9</b>	<b>2,199</b>	<b>3,019</b>	<b>(820)</b>	<b>13,380</b>	<b>17,892</b>	<b>4,512</b>	<b>2.0</b>
<b>Industrial</b>														
Compressed Air														
EMIS	10	9	1	80	-	(80)	-	27	10	17	190	-	(190)	2.0
Industrial Efficiencies	603	128	475	9,280	794	(8,486)	2.5	323	163	160	2,290	937	(1,353)	-
<b>Industrial Total</b>	<b>613</b>	<b>137</b>	<b>476</b>	<b>9,360</b>	<b>794</b>	<b>(8,566)</b>	<b>2.4</b>	<b>350</b>	<b>173</b>	<b>177</b>	<b>2,480</b>	<b>937</b>	<b>(1,543)</b>	<b>1.9</b>
<b>Programs Total</b>	<b>6,367</b>	<b>4,669</b>	<b>1,698</b>	<b>39,722</b>	<b>36,349</b>	<b>(5,187)</b>	<b>1.8</b>	<b>6,266</b>	<b>5,756</b>	<b>510</b>	<b>31,961</b>	<b>31,587</b>	<b>(374)</b>	<b>1.8</b>
Supporting Initiatives	725	658	67	-	-	-	-	725	816	(91)	-	-	-	-
Planning & Evaluation	750	590	160	-	-	-	-	740	728	12	-	-	-	-
<b>Total</b>	<b>7,842</b>	<b>5,918</b>	<b>1,924</b>	<b>39,722</b>	<b>36,349</b>	<b>(5,187)</b>	<b>1.6</b>	<b>7,731</b>	<b>7,300</b>	<b>431</b>	<b>31,961</b>	<b>31,587</b>	<b>(374)</b>	<b>1.6</b>

<sup>1</sup> These programs were included in Home Improvements program

<sup>2</sup> Irrigation was included in Municipal (Water Handling)

<sup>3</sup> Benefits calculated using RS3808 applicable at the time



## **APPENDIX C - EXECUTIVE SUMMARY OF RESIDENTIAL HEAT PUMP PROGRAM EVALUATION REPORT**

# Executive Summary of the FortisBC Residential Heat Pump Program

February 27, 2014



Dr. Phil Willems / PWP





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# 1 Executive Summary

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## 1.1 Introduction

This report presents the findings of the impact and process evaluation of the FortisBC 2010-2012 Residential Heat Pump Program. A brief summary of this program is as follows:

**Air Source and Ground Source Heat Pumps.** The FortisBC Residential Heat Pump Program is a rebate and loan program that pays incentives of \$200-300 per ton for an air source heat pump and \$500 per ton for ground source heat pumps. Alternatively, loans are available for up to \$6,500 at 4.9 percent over 10 years. To qualify, customers must install eligible heat pumps and their back-up heating system must be electric.

## 1.2 Evaluation Methods

The evaluation relied on several analysis methods to derive gross and net impacts:

- **Engineering Review.** For the heat pump program, the background information and technical assumptions used to determine the individual project savings were reviewed. Additionally, the tracking system data were reviewed to ensure that the savings claimed were consistent with the savings outlined by the program.
- **Participant phone survey.** Phone surveys were conducted on a sample (n=150) of participants. These surveys were used to collect feedback on the program experience for the process evaluation as well as customer and equipment information used for the impact evaluation.
- **Self-report free-ridership and participant spillover analysis.** A separate component of the phone survey was a battery of questions asking what equipment would have been installed if the FortisBC program had not been available and what additional energy savings purchases participants made. Responses for these questions were scored and used to create an estimate of program free-ridership and participant spillover.

## 1.3 Evaluation Results

### 1.3.1 Impact Evaluation

The results of the impact evaluation are summarized in Table 1, with additional detail on how these numbers are derived provided below:

**Table 1: Summary of Gross and Net Energy Savings**

	<i>Ex Ante</i> Savings (kWh)	Gross Realization Rate (%)	Gross Savings (kWh)	Net-to-Gross Ratio	Net Savings (kWh)
Electricity (kWh)	7,246,769	97.5%	7,067,300	0.51	3,604,323
Demand (kW)	2,546.4	98.8%	2,515.9	0.51	1,283

Source: Analysis by Evergreen Economics of impact evaluation results combined with participation data provided by FortisBC

### 1.3.2 Engineering Review

The electricity (kWh) and demand (kW) savings claimed by FortisBC for the Heat Pump program were calculated using two different methods over the 2010-2012 analysis period. During 2010 and 2011, the savings for each customer were calculated using a customizable calculation tool. However, beginning in 2012, this method was replaced with a strict deemed savings approach. The evaluation engineering review involved a detailed and thorough review of both methods of determining the savings, and provided a verified gross savings value for all three program years.

During 2010 and 2011, the electricity and demand savings for the heat pump program were calculated using one of two calculation templates: one for air source heat pumps (ASHP), and one for ground source heat pumps (GSHP). The calculation templates are spreadsheet-based tools that utilize inputs from the customer applications in order to determine a semi-customized savings value for each heat pump installation. Overall the calculation tools were very well thought through. The equations used are all consistent with engineering fundamentals, and the methodology is reasonable. The specificity of the calculation tool allowed the particular weather conditions, design temperatures, home size, and unit efficiencies for 2010-11 participants to be included in every analysis.

Beginning in 2012, the savings claimed for the program were changed to deemed savings values, which differ depending on the type of heat pump that is installed. A conventional ASHP is assumed to save 1,900 kWh and 0.53 kW per ton<sup>1</sup>. Customers who install a mini-ductless system are assumed to save 2,300 kWh and 0.64 kW per ton. Finally, customers who installed a GSHP were assumed to save 4,200 kWh and 1.83 kW per ton. A literature review was conducted and determined that the savings values claimed by the program are reasonable and consistent with similar jurisdictions that offer heat pump programs.

The gross savings results were determined separately for the two different calculation methods. The 2010 and 2011 results were examined together due to savings being claimed using the calculation tool, and 2012 results were examined separately because of the deemed values approach.

There were a total of 406 individual installations completed in 2010 and 2011. The tracking system contained complete data for 367 of those.<sup>2</sup> Only those records with complete data were used in the

<sup>1</sup> Ton of capacity = 12,000 Btu/hour (~3.5 kW)

<sup>2</sup> The 39 records with missing information in 2010/2011 were missing one or more of the following: unit size, heating efficiency, cooling efficiency, make, or model.

sample to determine the gross savings realization rate. During this review, 13 homes were found to have an incorrect baseline – a home with a heat pump (HSPF  $\approx 7.7$ ) and not electric resistance heating (HSPF  $\approx 3.4$ ) as assumed in the calculation tool. Likewise, a winter peak demand savings was included. After these adjustments, the realization rate (98.3 percent) was then applied to the total claimed savings for 2010 and 2011 projects.

A total of 171 projects claimed in the heat pump program during 2012. There were 139<sup>3</sup> records from 2012 that contained complete information and were used in the sample. Similar to the 2010 and 2011 data, 5 homes were found to have an incorrect baseline – a home with a heat pump (HSPF  $\approx 7.7$ ) and not electric resistance heating (HSPF  $\approx 3.4$ ) as assumed in the calculation tool. A second adjustment was made to 22 projects where the savings were not consistent with the deemed values. Combining the two adjustments produces a realization rate of 94.6 percent for 2012 program savings.

### 1.3.3 Net-to-Gross Calculation

Table 2 shows the participant free-ridership, spillover, and net-to-gross results for the Heat Pump program. Details on how these rates were estimated are provided below.

**Table 2: Net-to-Gross Results**

	Free-Ridership	Participant Spillover	Net-to-Gross Ratio
Heat Pumps	0.51	0.02	0.51

Source: Analysis by Evergreen Economics of data collected through an in-store intercept and phone survey of Heat Pump program participants.

#### 1.3.3.1 Free-Ridership Rate

A key goal of the participant survey was to collect information needed to support the calculation of a free-ridership rate. The free-ridership rate reflects the extent to which program participants would have installed the same program-qualifying equipment or taken the same action (e.g., installed energy efficient lighting) in the absence of the Heat Pump program. For this evaluation, we utilized the self-report approach, which, despite its recognized shortcomings, remains a widely used and a cost-effective method for estimating net program savings.

For customers, each project was assigned a Free-Ridership Score ranging from 0 to 1.0 based on response to phone survey questions relating to what equipment they would have purchased had the Heat Pump program not existed. Based on participant survey responses, the estimated free-ridership rate is 51 percent for heat pumps.

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<sup>3</sup> The 32 records with missing information in 2012 were also missing similar parameters as in 2010/2011 (e.g., unit size, heating/cooling efficiency, make, model).

### 1.3.3.2 Participant Spillover

In contrast to free-ridership, participant spillover accounts for extra savings that can be attributed to the program but not explicitly included in the original savings estimates. While numerous benefits could be attributed to this program – environmental, health, non-participant – this report only takes into account those additional energy benefits that were directly attained by participants.

Similar to the free-ridership calculations, a self-report method using responses from the heat pump phone survey was implemented to calculate participant spillover, which resulted in a spillover estimate of 2 percent of the original gross program savings. The participant spillover rate (0.02) is then combined with the free-ridership rate (0.51) to calculate a final net-to-gross ratio (0.51) using the following formula:

$$\text{Net to Gross Ratio} = 1 - \text{Free Ridership Score} + \text{Participant Spillover}$$

### 1.3.4 Total Program Impacts

Realized savings for the program is calculated from the various analysis components discussed above. Specific calculations are as follows. First, the original *Ex Ante* Savings values (estimated by FortisBC) are adjusted by the Gross Realization Rate based on an engineering review of the underlying savings calculations. The resulting Gross Savings are then adjusted by the Net-to-Gross ratio to produce the final Net Savings numbers. The combined effect of these adjustments is shown in the table below. As stated previously, only those records where complete data were available were included in the samples.

**Table 3: Summary of Gross and Net Energy Savings**

	<i>Ex Ante</i> Savings (kWh)	Gross Realization Rate (%)	Gross Savings (kWh)	Net-to-Gross Ratio	Net Savings (kWh)
Electricity (kWh)	7,246,769	97.5%	7,067,300	0.51	3,604,323
Demand (kW)	2,546.4	98.8%	2,515.9	0.51	1,283

Source: Analysis by Evergreen Economics of impact evaluation results combined with participation data provided by FortisBC

## 1.4 Process Evaluation

### 1.4.1 Participant Phone Surveys

Among all FortisBC and LiveSmart rebate program participants responding to the phone survey, a high level of satisfaction was expressed for the installation contractors, new heat pump equipment, loan program, and the rebate program as a whole – over 74 percent of participants saying they were satisfied or very satisfied with these aspects of the heat pump program.

The most common types of heat pumps installed were air source ducted systems (50 percent), air source ductless split systems (29 percent), and ground source heat pumps (11 percent). The most influential features on all participants' heat pump selection decisions were reducing energy use and



the capability to cool, as well as heat, their home. Overall, the rebate or loan was not influential at all for 41 percent of participants.

About 85 percent of participants confirmed that they had purchased the heat pump in order to cool their homes during summer. Of these, 43 percent said that they would have purchased a separate cooling system if they had not installed a heat pump. When asked to identify their primary source of heating before installing their new heat pump, only 6 percent claimed to use a heat pump as their primary source. After installing the new heat pumps, 75 percent used either an air- or ground-source heat pump as their primary source of heating.

Nearly all participants (98 percent) claimed that energy efficiency is either a high or medium priority when they are deciding on equipment installations or retrofits.

## 1.5 Conclusions and Recommendations

The following are conclusions derived from the FortisBC Heat Pump Program Impact Evaluation. Additional discussion along with findings from the process evaluation are included in the full evaluation report.

General conclusions include the following:

**2010 and 2011 Demand Savings were Likely Underestimated.** Based on the information in the participant tracking system, the demand savings for 2010 and 2011 were calculated for summer peak, but likely underestimated the savings slightly for winter peak.

Recommendation: Due to the program switching to a deemed demand savings value, this problem has been corrected since 2012.

**Reduced Savings for Replacement Systems.** Based on our review of the savings, there are a small number of instances where heat pumps are installed replacing an existing heat pump. The calculation tool used in 2010-2011, and the deemed savings estimates used in 2012 do not take this into account and therefore overestimate savings in such cases. Currently these are only a small percentage of the program, however, over time their share will likely continue to grow.

Recommendation: Consider adding an additional measure to account for replacement heat pumps in the future.

**Some Savings Deviate from the Deemed Values.** While the deemed savings values used in 2012 were generally found to be reasonable, 22 projects did not have claimed savings that were consistent with the deemed values.

Recommendation: Any projects that are going to have savings claimed that are inconsistent with the deemed savings values should have at a minimum a detailed description, reasoning behind the adjustment, and a calculation included with the project documentation.

**Inadequate Supporting Documentation.** There currently is not sufficient supporting documentation for the deemed savings values.

Recommendation: The engineering equations and technical assumptions used to derive the deemed savings values should be thoroughly documented and updated as needed in future program years.

**Free-Ridership Varies for Different Types of Installations.** Existing homeowners and those who received loans had lower rates of free-ridership than those who installed heat pumps in new homes and did not use the program's loan provision.

Recommendation: Target those markets with lower levels of free-ridership to maximize net program impacts.

## **APPENDIX D - EXECUTIVE SUMMARY OF RESIDENTIAL LIGHTING AND APPLIANCE PROGRAMS EVALUATION REPORT**



# Evaluation of the FortisBC Residential Lighting & Appliance Programs

February 27, 2014



Dr. Phil Willems / PWP





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# 1 Executive Summary

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## 1.1 Introduction

This report presents the findings of the impact and process evaluation of the FortisBC 2012-2013 Residential Lighting and Appliance Programs. As part of this effort, both programs were evaluated:

1. **Lighting.** The FortisBC Residential Lighting Program is a two-part lighting campaign that includes an instant rebate for purchases made in the spring and fall at qualifying stores as well as a mail-in rebate available the entire year<sup>1</sup>. Customers are eligible for this program if they purchase qualifying lighting equipment. Rebate amounts can be up to 50 percent of the purchase cost.<sup>2</sup>
2. **Appliance.** The FortisBC Residential Appliance Program includes incentives for the purchase of a clothes washer, refrigerator, dishwasher and/or freezer, as well as a fridge take-back program. Through this program, a rebate of between \$25 and \$75 is provided to help cover the incremental costs of eligible high efficiency equipment and to encourage the recycling of old refrigerators.

## 1.2 Evaluation Methods

The evaluation relied on several analysis methods to collect information and derive gross and net impacts:

- **Engineering analysis.** For the Residential Lighting program, the background information and technical assumptions used to determine the individual bulb savings were reviewed. Additionally, the tracking system data were reviewed in conjunction with the supplied invoices from the participating stores to ensure that the savings claimed were consistent with the savings outlined by the program. For the Residential Appliance program, the Evergreen team reviewed the claimed energy usage (kWh) and demand (kW) savings values as well as the provided supporting calculations and documentation.
- **Participant in-store intercept and phone survey.** A phone survey was conducted on a sample of Appliance (n = 202) participants. Likewise, an in-store intercept survey of Lighting (n=174) customers was performed. These surveys were used to collect feedback on the program experience for the process evaluation as well as customer and equipment information used for the impact evaluation.
- **Self-report free-ridership and participant spillover analysis.** A separate component of the phone and intercept surveys for both the Lighting and Appliance programs was a battery of questions asking what equipment would have been installed if the FortisBC program had not been available. Responses for these questions were scored and used to create an estimate of program free-ridership and participant spillover.

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<sup>1</sup> Mail-in rebates have been discontinued

<sup>2</sup> <http://www.fortisbc.com/About/Newsletters/Powerlines/Pages/Rebates-and-offers-ending-December-31-2013.aspx>

## 1.3 Impact Evaluation Results

### 1.3.1 Engineering Review – Lighting Point of Sale Program

For the Residential Lighting Point of Sale program, the Evergreen team reviewed the tracking system and compared the claimed quantities and electricity (kWh) and demand (kW) savings to the applicants' supplied invoices and rebate summary sheets. The evaluation only examined the invoices and rebate summary sheets where we had sufficient information. There were 29 percent of the program savings where the summary sheets detailing the savings were not provided and could not be verified, however the quantities of purchased lamps was verified with the supplied invoices. Additionally, 4 percent of the program savings could not be supported by any documentation provided to the evaluation team. Therefore, the sample used to determine the gross savings realization rate comprised 67 percent of the total claimed savings. The realization rate determined from this analysis was applied to the remaining 33 percent that could not be verified.

Table 1 displays the findings from the engineering review. The realization rate for the evaluated projects was found to be 11.2 percent for the morning winter peak demand (kW), 15.5 percent for the evening winter peak demand (kW) and 53.6 percent for the electricity (kWh) savings. The two main reasons for the adjustment were the hours of operation assumed in the savings analysis, and the application of a coincident factor in the evaluation results.

**Table 1: Summary of Engineering Desk Review for the Residential Point of Sale Program**

Year	<i>Ex Ante</i> <sup>3</sup> Savings			<i>Ex Post</i> <sup>4</sup> Savings			Realization Rate	
	kW	kWh	kW (7-9AM)	kW (5PM)	kWh	kW (7-9AM)	kW (5PM)	kWh
2012	595.7	1,943,645	72.5	100.0	1,097,199	12.2%	16.8%	56.5%
2013	606.6	2,008,847	62.7	86.4	1,022,051	10.3%	14.3%	50.9%
<b>Total</b>	<b>1,202.3</b>	<b>3,952,492</b>	<b>135.2</b>	<b>186.4</b>	<b>2,119,250</b>	<b>11.2%</b>	<b>15.5%</b>	<b>53.6%</b>

Source: Analysis by Michaels Energy of data provided by FortisBC

### 1.3.2 Engineering Review – Lighting Mail-In Rebate Program

For the Residential Lighting Mail-In Rebate program, the Evergreen team reviewed the tracking system and the documents supplied to support the deemed savings values. Two documents were provided to support the deemed energy savings based upon bulb type. The first is the "Details behind Incentive Database Savings\_2012" Word document. This document lists the assumptions behind the energy savings (kWh) for CFL and LED lamps. The second document is the "HIP calc sheet" from 2012 and 2013 that provides a table of deemed values that are used in the tracking system. This table provides demand (kW) and energy (kWh) savings but does not provide the assumptions used to calculate these savings. It is important to note that the deemed values presented in this document are not consistent with the assumptions given in the "details" document described above.

<sup>3</sup> Deemed savings by FortisBC, prior to engineering analysis.

<sup>4</sup> Estimated savings after engineering analysis of the deemed values is completed.



Without any further documentation, the evaluation team assumed that the demand savings are the full wattage reduction and, furthermore, the operating hours assumed vary based on lamp type. FortisBC does apply a 0.75 diversity factor to the demand savings before they report the savings.

Table 2 displays the findings from the engineering review. The realization rate for the evaluated projects was found to be 9.2 percent for the morning winter peak demand (kW), 12.7 percent for the evening winter peak demand (kW) and 85.2 percent for the electricity (kWh) savings. The two main reasons for the adjustment were the hours of operation assumed in the savings analysis, and the application of a coincident factor in the evaluation results.

**Table 2: Summary of Engineering Desk Review for the Residential Mail-In Rebate Program**

<i>Ex Ante</i> Savings		<i>Ex Post</i> Savings			Realization Rate		
kW	kWh	kW (7-9AM)	kW (5PM)	kWh	kW (7-9AM)	kW (5PM)	kWh
187.5	350,896	17.3	23.9	298,860	9.2%	12.7%	85.2%

Source: Analysis by Michaels Energy of data provided by FortisBC

### 1.3.3 Engineering Review – Appliance Program

For the Residential Appliance program, the Evergreen team reviewed the claimed electric usage (kWh) and demand (kW) savings values as well as the provided supporting calculations and documentation.

The results of the Appliance engineering review are summarized in Table 3:

**Table 3: Summary of Appliance Program Gross and Net Energy Savings**

	<i>Ex Ante</i> Savings (kWh)	Gross Realization Rate (%)	Gross Savings (kWh)	Net-to- Gross Ratio	Net Savings (kWh)
Appliances	1,322,719	99%	1,315,783	0.82	1,078,942

Source: Analysis by Evergreen Economics of impact evaluation results combined with participation data provided by FortisBC

#### 1.3.3.1 Heat Pump Tune Up

The *ex ante* program savings for this measure were based on a deemed savings per tune-up of 360 kWh and 0.1 kW per tune up. The program energy savings were consistent with this report; however, no documentation for the demand savings value was found. Due to the lack of existing information, the evaluation relied on a review of secondary sources from other jurisdictions to assess the reasonableness of the current estimates. Specifically, the *ex ante* savings values were compared against the savings values from technical reference manuals from other jurisdictions, and adjusted for differences in weather. Based on this review, the claimed *ex ante* savings are consistent with the savings found in other sources, and no changes were made to the savings estimates.

### 1.3.3.2 Energy Star Clothes Washer

FortisBC staff provided a version of the Energy Star calculator used to calculate savings for the program. The Energy Star calculator is a well-recognized method for determining savings for this measure; therefore, the evaluation focused primarily on verifying the inputs used in the Energy Star calculator, rather than by verifying the calculator itself or the resulting savings values. As a result of this review, several changes were made to the inputs Modified Energy Factor (MEF) and loads per week used to calculate savings.

The *ex ante* and adjusted savings levels are shown in Table 4 below.

**Table 4: Summary of Savings Estimates for Energy Star Clothes Washers**

Source	Demand (kW)	Energy (kWh)
<i>Ex Ante</i>	266.1	567,160
Adjusted	226.7	474,407
Realization Rate	85%	84%

Source: Analysis by Michaels Energy of data provided by FortisBC

### 1.3.3.3 Energy Star Dish Washer

Similar to Energy Star clothes washers, FortisBC staff provided a version of the Energy Star calculator, used to calculate savings for the Dish Washer measure in the Appliances program. Through the evaluation process, only one change was made to the inputs: loads per week.

Based on the adjustments made, the savings for the dishwasher measures were decreased. The *ex ante* and adjusted savings levels are shown in Table 5 below.

**Table 5: Summary of Savings Estimates for Energy Star Dish Washers**

Source	Demand (kW)	Energy (kWh)
<i>Ex Ante</i>	29.2	58,602
Adjusted	22.5	45,064
Realization Rate	77%	77%

Source: Analysis by Michaels Energy of data provided by FortisBC

### 1.3.3.4 Energy Star Refrigerators and Freezers

Based on the reviewed documentation, no changes were made to the refrigerator savings after November 1, 2012. However, the savings for refrigerators prior to November 1, 2012 was increased to be consistent with the newer values. Based on the supplied tracking system extract, the expected savings for the installation of a program-qualifying freezer was 0.01 kW and 60 kWh prior to

November 1, 2012. After November 1, 2012, the savings values were increased to 0.011 kW and 67 kWh.

Based on the adjustments made, the savings for the refrigerator and freezer measures were increased. The *ex ante* and adjusted savings levels are shown in Table 6 below.

**Table 6: Summary of Savings Estimates for Energy Star Refrigerators and Freezers**

Source	Demand (kW)	Energy (kWh)
<i>Ex Ante</i>	18.6	127,787
Adjusted	21.2	148,192
Realization Rate	114%	116%

Source: Analysis by Michaels Energy of data provided by FortisBC

### 1.3.3.5 Refrigerator and Freezer Take Back

FortisBC did not maintain documentation on how the savings are estimated for the refrigerator and freezer take back components of the Appliance Program. As a result, the evaluation team was unable to revise savings estimates based on the specific equipment reviews, but instead was only able to review the deemed savings estimates compared to other sources.

Despite the lack of documentation, the 2013 savings values were consistent with the secondary sources reviewed for this evaluation. Savings values claimed in 2012 were lower than 2013 values, consequently the 2012 values were increased to the same level. The *ex ante* and adjusted savings levels are shown in Table 7 below.

**Table 7: Summary of Savings Estimates for Refrigerator Take-Back**

Source	Demand (kW)	Energy (kWh)
<i>Ex Ante</i>	22.4	156,250
Adjusted	33.6	235,200
Realization Rate	150%	151%

Source: Analysis by Michaels Energy of data provided by FortisBC

## 1.3.4 Net-to-Gross Calculation

The self-report survey approach used here is based on the method developed by the Energy Trust of Oregon and currently being used in other jurisdictions such as Michigan and Hawaii. The approach has the advantage of being simple and transparent, with free-ridership and participant spillover calculated based on answers to a small number of questions. This reduces the problem of developing elaborate weighting schemes for lengthy question batteries, which can lead to somewhat arbitrary estimates of free-ridership and spillover that can be influenced as much by the choice of weighting scheme as the responses to the questions themselves.

Table 8 shows the participant free-ridership, spillover, and net-to-gross results for both programs. Details on how these rates were estimated are provided below.

**Table 8: Net-to-Gross Results**

	Free-Ridership	Participant Spillover	Net-to-Gross Ratio
Lighting	0.36	0.77	1.41
Appliance	0.57	0.39	0.82

Source: Analysis by Evergreen Economics of data collected through an in-store intercept and phone survey of Lighting and Appliance program participants.

#### *1.3.4.1 Free-Ridership Rate*

A key goal of the in-store intercept and participant phone surveys was to collect information needed to support the calculation of a free-ridership rate. This free-ridership rate reflects the extent to which program participants would have installed the same program-qualifying equipment or taken the same action (e.g., installed energy efficient lighting) in the absence of either program. For this evaluation, we utilized the self-report approach, which is a widely used and a cost-effective method for estimating net program savings.

For both Lighting and Appliance customers, each project was assigned a Free-Ridership Score ranging from 0 to 1.0 based on response to in-store intercept or phone survey questions relating to what equipment they would have purchased had either program not existed. Based on participant survey responses, the estimated free-ridership rates are 36 percent for lighting and 57 percent for appliances.

#### *1.3.4.2 Participant Spillover*

In contrast to free-ridership, participant spillover accounts for extra savings that can be attributed to the program but not explicitly included in the original savings estimates. Based on data from a recent American Council for an Energy Efficient Economy (ACEEE) study, nine of the top-10 “Energy Efficiency States” include spillover savings in their net and/or gross savings figures, including: Massachusetts, New York, Oregon, Vermont, Rhode Island, Connecticut, Washington, Minnesota, and Maryland.<sup>5</sup> Still, the art of estimating spillover is evolving among these states. While numerous benefits could be attributed to this program – environmental, health, non-participant spillover or market effects – this report only takes into account those additional energy benefits that were directly attained by participants.

Similar to the free-ridership calculations, a self-report method using responses from the lighting in-store intercept survey and appliance phone survey were implemented to calculate participant spillover: 77 percent of the original gross program savings for lighting, and 39 percent for appliances.

<sup>5</sup> <http://www.aceee.org/research-report/u122>

The participant spillover rate is then combined with the free-ridership rate to calculate a final net-to-gross ratio using the following formula:

$$\text{Net to Gross Ratio} = 1 - \text{Free Ridership Score} + \text{Participant Spillover}$$

### 1.3.5 Total Program Impacts

Realized savings for the programs are calculated from the various analysis components discussed above. The combined effect of these adjustments is shown in the table below. As stated previously, only those records where complete data were available were included in the samples. The original *Ex Ante* Savings values (estimated by FortisBC) are multiplied by the Gross Realization Rate to determine Gross Savings. This is multiplied by the Net-to-Gross Ratio determined from the in-store intercept and phone survey data to estimate Net Savings.

**Table 9: Summary of Gross and Net Energy Savings By Program**

	<i>Ex Ante</i> Savings (kWh)	Gross Realization Rate (%)	Gross Savings (kWh)	Net-to-Gross Ratio	Net Savings (kWh)
Lighting Point of Sale	3,952,492	54%	2,119,250	1.41	2,988,142
Lighting Mail-In Rebate	350,896	85%	298,860	1.41	421,393
Appliances	1,322,719	99%	1,315,783	0.82	1,078,942

Source: Analysis by Evergreen Economics of impact evaluation results combined with participation data provided by FortisBC

## 1.4 Process Evaluation

### 1.4.1 2012 REUS Lighting Survey

For this evaluation, the FortisBC's 2012 Residential End-Use Study (REUS) that included 1,668 respondents was current and contained the information necessary to support our analysis. Consequently, we did not conduct an additional residential lighting survey for this evaluation. According to the survey, the average dwelling contains 12.4 CFL bulbs – nearly one-third of the total lighting in a household – and 0.9 LED bulbs – 2 percent. Of all respondents, 409 (29 percent) had purchased CFL bulbs and 64 (5 percent) had purchased LED bulbs in the 12 months prior to filling out the survey. The average purchaser of LED bulbs tended to buy more LED bulbs, 13.7, than CFLs purchased by consumers buying CFL bulbs, 7. On average, though, fewer LED bulbs replaced CFLs, 0.7, than CFL bulbs, 2.

### 1.4.2 In-store Intercept Lighting Surveys

In October 2013, 174 people participated in an in-store intercept survey pertaining to the light bulbs they purchased that day at RONA and Home Depot in Kelowna. Just over two-thirds of customers participating in the survey purchased LED bulbs. Only one-third of participants purchased CFLs and very few purchased either halogen or incandescent bulbs. However, most of the participants reported

CFL bulbs as their primary source of lighting in their household followed by incandescent bulbs then LEDs.

Nearly half of all CFL purchases were made to replace incandescent bulbs, followed closely by CFL bulbs. None of the CFL purchases were made to replace LED bulbs. On the other hand, over 40 percent of LED purchases were to replace incandescent bulbs while about one-quarter replaced halogen or CFL bulbs, respectively.

When purchasing either type of lighting, customers tended to purchase more CFLs (4.6 bulbs) than LEDs (3.6 bulbs) on average. Customers of either CFL or LED bulbs planned on installing just over three bulbs of each type immediately, with the remaining bulbs stored for future installation.

The majority of customers bought CFL bulbs to reduce their energy use. Just over 10 percent of participants purchased CFLs because of increased bulb life or simply because they needed new light bulbs. Similarly, the majority of participants that bought LEDs did so to reduce their energy use. However, nearly one-fourth most liked the longer bulb life and 10 percent stated the rebate price reduction was most responsible for them purchasing LED bulbs.

Most of the participants did not know about the price reduction before visiting the store: 41 percent saw the sign/advertising in the store aisle while 34 percent did not know until the interviewer told them about it. However, when asked how important the rebate price reduction was in their decision to purchase the type of light bulbs they bought, the overwhelming majority of participants said it was either 'important' or 'very important'.

### **1.4.3 Appliance Participant Phone Surveys**

Among 202 phone survey participants, 50 percent purchased a clothes washer, 25 percent purchased a dishwasher, and 25 percent purchased a refrigerator or freezer. Nearly all of the appliances were installed in the participants' homes, with 85 percent of those installations replacing an existing appliance – most of which were picked up by the installer, recycled, or sold / given away.

The vast majority of participants learned about FortisBC's Residential Appliance program either from sales personnel at the store of purchase or by FortisBC advertising. Additionally, 93 percent of participants felt the rebate information was very clear, with less than 1 percent indicating the information was very confusing or unclear.

All participants in the survey were asked if they had noticed any electric bill savings since installing their new appliance. The amount of energy savings observed by participants varied across the four appliances. Participants that purchased a washer were the most likely to notice energy bill savings (20 percent), while participants that purchased freezers reported no savings. Overall, only 15 percent of all participants said they noticed savings of any kind. However, 50 to 100 kWh savings could be difficult to detect with an average usage per customer of 12,800 kWh per year.

The two most influential factors in participants' purchasing decisions were the product quality and reduced energy use. However, longer equipment life, availability, style or appearance, warranty, protecting the environment, and the rebate, or price reduction, were also highly influential in the purchase of the new equipment.

Overall, a significant percentage of survey participants were very satisfied with the new appliance they purchased (84 percent), the process of applying for the rebate (86 percent), the overall rebate provided by FortisBC (92 percent), and the overall appliance program (93 percent). The main aspect of the appliance program that participants said they were dissatisfied with was that they never received a rebate for a new appliance despite thinking they had undergone the necessary steps to qualify and receive the rebate; though, this was only mentioned by less than three percent of participants and could have been due to delays in receiving their billing credit.

## 1.5 Conclusions and Recommendations

General evaluation conclusions include the following:

**The assumed operating hours of the bulbs/fixtures are too high.** It was found that the operating hours used by the program is significantly higher than operating hours identified by secondary research and the end-use survey conducted in the FortisBC territory.

Recommendation: The operating hours should be reduced to 2.34<sup>6</sup> hours per day for CFLs and 3.67 for LEDs<sup>7</sup>.

**The demand (kW) savings did not account for winter peak hours.** The savings claimed in the tracking system did not account for the percentage of lights that are operating on average during the winter peak hours.

Recommendation: A diversity factor of 0.0725 for the morning peak and 0.1 for the afternoon peak should be applied to the demand savings based on secondary research. Alternatively, research could be conducted in the FortisBC territory to determine a diversity factor specific to this region.

**An installation rate was not included for all purchased bulbs/fixtures.** The tracking system savings does not include an installation rate factor for the purchased bulbs. Secondary research as well as research performed in the FortisBC territory identifies that not all bulbs are installed at the time of purchase, i.e. some are set aside for later installation.

Recommendation: An installation rate of 96 percent is recommended based on a literature review. Alternatively, additional research could be conducted in the FortisBC territory to determine an installation rate specific to its region.

**Minor issues were found within the Rebate Summary form.** Based on the review of the Rebate Summary form, it was found that the calculation used to calculate the demand savings does not include the number of bulbs per package/fixture resulting in fewer demand savings being claimed. It was also found that the Rebate Summary form only calculates motion sensor savings if the wattage is

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<sup>6</sup> KEMA, Inc. CFL Metering Study. February 25, 2005. Page 46.

<sup>7</sup> The 2012 FBC Residential End-Use Study, which looked at self-reported operating hours, found that LEDs operate on average 5.5 hours per day. Secondary research did not yield any metering studies that specifically looked at LED operating hours. A comparison of CFL metering studies and self-report studies from 1991 to 2010 found that self-report numbers are on average 33.3 percent higher than metered operating hours.



the same for both the baseline and proposed bulb. It was found that some of the qualifying fixtures include a motion sensor and either CFL or LED bulbs.

Recommendation: The Rebate Summary form should be updated to correct these errors.

**Several Rebate Summary forms were used with incorrect inputs/formulas.** During the review of the supplied savings calculations it was found that several stores used their own version of the Rebate Summary form. Some of these versions had errors with the inputs and the formulas used to calculate the savings. The largest of these errors was an invoice that was counted twice, which is 0.55 percent of the reviewed kW savings and 1.79 percent of the reviewed kWh savings.

Recommendation: A single form should be used for all stores to reduce the risk of calculation errors.

**The baseline lamp wattage is still using incandescent bulbs for the baseline.** As discussed in the engineering review, the analysis revealed that the program is using incandescent light bulbs for the baseline.

Recommendation: Due to new legislation banning the sale of certain types of incandescent bulbs in the coming year, as well as research conducted in both the 2013 FortisBC In-Store and Mail-In surveys, it is suggested that an appropriate blend of incandescent and other lamp types be used to determine the baseline wattage.

**The tracking system for the Mail-In Rebate program does not track lighting measure type.** The tracking system does not identify the savings for each entry type by the specific measure (i.e. CFL or LED) claimed. In addition some entries may include a blend of several measures.

Recommendation: Create a marker that identifies which deemed value is being used for each entry. Each entry should only include the savings for one measure type.



## **APPENDIX E - EXECUTIVE SUMMARY OF PROCESS REVIEW: CUSTOM BUILDING IMPROVEMENT PROGRAM**

# Process Review

## Custom Building Improvement Program

### Executive Summary

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#### **Disclaimer**

The opinions expressed in this report are the responsibility of the authors, Sampson Research and Enerficiency Consulting, and do not necessarily represent the views of FortisBC.

#### **Currency Units**

All dollar figures presented in this report, unless stated otherwise, are expressed in Canadian funds.



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# 1 EXECUTIVE SUMMARY

## 1.1 Introduction

This report summarizes the findings from a process review of FortisBC's Custom Building Improvement Program (BIP), now marketed as the Custom Business Efficiency (CBE) Program, for program years 2011-13. During this study period, the retrofit and new construction streams of the program collectively issued \$0.992 million in rebates and claimed gross energy and demand savings of 11.4 GWh and 2.0 MW respectively.

## 1.2 Evaluation Objectives and Methodology

The objectives of the evaluation included (i) updating the program's logic model, (ii) assessing the list of qualifying technologies, approval processes, and methods and assumptions used to calculate energy savings, (iii) reviewing industry best practices in commercial DSM program design, and (iv) providing recommendations to improve the program's overall cost effectiveness. Particular emphasis was placed on recommendations to improve the program's gross savings realization rate and overall net-to-gross (NTG) ratio.

The evaluation objectives were met through interviews with program management, technical "desk" reviews of program records (n=40), and an industry scan of best practices in commercial DSM program design.

## 1.3 Evaluation Findings

### 1.3.1 Recent Changes

New application procedures and documentation requirements for BIP participants were implemented in mid-2013. Many of these changes were made in response to recommendations from earlier evaluations of the program. As no participants had yet to complete their projects from start to finish under the new program procedures, evaluation results presented below reflect projects completed under the older system. Many of the findings, however, are relevant to the restructured program.

### 1.3.2 Documentation

While the quantity and quality of program documentation has improved since evaluations completed in 2011 and 2012, gaps in the documentation persist. Deficiencies were observed in project descriptions and in the documentation of calculations and assumptions used to calculate energy savings, incentives and total resource costs (TRC).

### 1.3.3 Qualifying Technologies

The majority of the technologies that were rebated under the 2011-13 BIP program are typical of commercial DSM initiatives. Fewer examples of rebates issued to "one-off" projects were found than in earlier evaluations.



### 1.3.4 Approval processes and methods

The program is adequately following its approval processes. Project requiring measurement and verification were sometimes lacking appropriate documentation of the M&V plan and results.

### 1.3.5 Energy Savings Estimates

Technical review of the assumptions and methods used by the program to calculate project savings and incentive payouts found instances of questionable assumptions and decision making. Some estimates of savings could not be assessed due to incomplete documentation.

Retrofit BIP applications did not consistently document whether the rebated equipment was replacing or incremental to existing equipment. Similarly, information was lacking as to whether replaced equipment was worn out or had remaining life. For retrofit projects, this information affects both the choice of baseline and allocation of project costs.

Minimal guidelines and documentation are required for allocating project costs to non-energy factors (e.g., depreciation, process improvements, etc.) when calculating project-specific total resource costs (TRC). There were projects with allocations as high as 95%, casting doubt on the role of the incentive in the customer's decision process.

### 1.3.6 Industry Scan – Net-to-Gross Ratios & Best Practices

A literature review of commercial DSM program evaluations completed since 2000, plus two compendium studies, found free rider percentages for commercial DSM programs range from 8% to 44%. Spillover percentages, if estimated, range from 2% to 106%. Many factors influenced program attribution (free riders and spillover), including markets, delivery channels, qualifying technologies, and incentive levels.

The literature review identified a series of best practices in the design, implementation, and operation of commercial DSM programs. The Building Improvement Program is following many of these, including customer-tailored solutions, the use of fixed (product option) variable (custom) incentives; program marketing leveraged by trade allies; long-term consistency in program design and delivery personnel; and regular program evaluations. Areas for improvement in the program are included under program recommendations.

## 1.4 Recommendations

The majority of the recommendations address ways to improve gross realized savings, net-to-gross ratios, and the general cost-effectiveness of the Building Improvement Program. These recommendations are organized under program design and targeting, program marketing, tracking and documentation, project assessment and approval, measurement and verification, and program evaluation.

### 1.4.1 Program Design & Targeting

- Segment the market and the qualifying list of technologies to customers that have the greatest energy savings potential.

- Conduct periodic reviews of market baselines for qualifying technologies and processes.
- Simplify the process by which smaller commercial customers can access the program and its incentives. Suggestions include self-serve options via the program's product option.
- Continue to shift measures with well-defined baselines and proven energy savings to the product option stream of the program. Measure suggestions include HVAC equipment, commercial kitchen and refrigeration equipment, variable frequency drives, and motors.
- Require pre-inspections of larger retrofit projects to reduce uncertainty in baseline and operating condition assumptions.
- Orient the strategic focus of the program's custom option to whole building assessments and retrofits. Consider increasing the incentive amounts for whole building assessments and multiple measure retrofits.
- Review the cost-effectiveness of participating in publically-funded projects in the SUCH sector (schools, universities, colleges and hospitals). Consider transferring these projects to an advanced or innovative building program design stream and/or justifying participation using indirect (spillover) benefits.

### 1.4.2 Program Marketing

- Conduct periodic assessments of market barriers among the target population. Address issues of awareness, payback periods, and other barriers or market opportunities. Use results to make for program design adjustments and to refresh the marketing plan.
- Use examples of non-energy benefits (e.g., improved light levels, improved customer comfort, etc.) in program marketing.
- Assign marketing priorities to customer segments based on their energy savings potential. Build and maintain relationships with customers and trade allies in these segments.

### 1.4.3 Program tracking & Documentation

- Manage all program participation (product option, custom option) so that projects are easily cross-referenced with the customer and vice versa.
- Conduct periodic assessments of the incidence of repeat participation to ensure the program is achieving its marketing goals.
- Continue to set and monitor standards for collecting, managing, and verifying project data. Document the sources and rationale of all assumptions used in energy savings and incentive calculations.

### 1.4.4 Project Assessment & Approval

- Continue efforts to improve the quality of decisions affecting project eligibility and incentive payouts in the custom option of the program. Set and periodically review the criteria for allowing unusual or other "one-off" technologies and projects.
- Develop and enforce guidelines for allocating non-energy costs when assessing total resource costs and project eligibility. Guidelines should be based, in part, on whether the energy efficiency

## Executive Summary

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measures are incremental, being used to retrofit operational measures, or replacing equipment that is obsolete or inoperable.

- Set incentive levels and/or minimum payback thresholds for projects or technologies based on market baseline (e.g., higher incentives for riskier technologies with low rates of natural adoption, lower incentives for measures with higher natural adoption rates).
- Discourage program personnel from biasing participant statements of program attribution.

### 1.4.5 Measurement & Verification

- Ex-ante site visits and/or some other form of follow-up contact should be required for custom option projects that fall below the mandatory M&V threshold. The post-participation follow-ups should confirm installation (and commissioning) of incented measures and collect participant feedback. All follow-ups and their findings should be documented in the project file.
- Expand the pre-approval application form to include unbiased, non-leading question(s) about the influence of BIP on the decision to implement the energy efficient measures. Use these questions to monitor free ridership.

### 1.4.6 Program Evaluation

- Complete market and impact evaluations at regular intervals. Allocate sufficient resources for completing these evaluations.

## 1.5 Report Organization

Including this Executive Summary, this evaluation report is organized into seven sections and one appendix:


Section 1 – Executive Summary  
Section 2 – Background and Methodology  
Section 3 – Program Logic Models  
Section 4 – Program Operations Review  
Section 5 – Best Practices  
Section 6 – Recommendations  
Section 7 – Bibliography  
  
Appendix A – File Reviews


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