Delivering cost effective savings in the commercial sector

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Abstract

BC Hydro's Product Incentive Program (PIP) utilizes financial incentives to encourage business customers to complete a variety of retrofit installations of lighting and mechanical products, and it is administered primarily via the Internet through an online application site. The purpose of PIP is to capture cost effective energy savings in commercial building retrofits. This report provides an evaluation of the PIP. The research design was a quasi-experiment with a treatment group of 62 participants and a comparison group of 202 non-participants, with comparisons based primarily on z-test for differences in sample proportions. Selected study results included the following. (1) The principal facility types are strata units and hotels, office building and elementary schools, and the average project saves 50,000 kWh per year. (2) Standard T8s, energy saver T8s, CFLs and LED exit signs represent more than 96 % of all products installed and all product savings. (2) Treatment group are statistically significantly more likely than the comparison group to have purchased these four products. (3) Participant satisfaction averaged over 4.0 for ten dimensions examined while non-participant satisfaction averaged closer to 3.0. (4)Detailed on-site monitoring data yielded a weighted average of 4,560 hours of use per year compared to program algorithm assumptions that yielded a weighted average of 5,886 hours of use per year. (6) The evaluated energy savings impact of 18.7 GWh per year is larger than the planned energy savings of 17.1 GWh per year for this period.

Introduction

BC Hydro is a major electric utility in the Canadian province of British Columbia. More than 80 % of generation capacity is from large scale hydro-electric installations. In recent years, increases in the forecast electricity load have been met through aggressive demand side management programs (DSM), conservation rates, purchases from Independent Power Producers, and imports from other jurisdictions. DSM and conservation rates have often been the most cost effective supply options for BC Hydro. Various aspects of BC Hydro's operations are regulated by the BC Utilities Commission (BCUC). BCUC has mandated BC Hydro to pursue all cost effective DSM. A similar regulatory framework exists in some other provinces, and Ontario and Quebec, for example, are also aggressively pursuing energy savings through DSM.

BC Hydro Power Smart's Product Incentive Program was launched in November 2003. The program utilises financial incentives to encourage customers to complete a variety of simple retrofit or add-on installations of energy efficient products and is administered primarily via the Internet through an online application site. According to the latest PIP business case (Intihar 2004), the PIP program is designed to reach a net run rate of 38.1 GWh per year by mid 2007 and 713 GWh cumulative energy savings in 20 years. PIP II is primarily an energy acquisition program, with less emphasis on market transformation. The goals of the program are to: (1) Generate energy savings for BC Hydro by replacing inefficient technologies with newer energy efficient products; (2) Increase energy efficiency awareness by actively communicating product options and educating customers on the benefits, contributing to market transformation; and (3) Better meet the needs of the historically under-served small and medium business and provide them

with education, information and a means to increase their own energy efficiency and reduce costs, resulting in increased customer satisfaction.

Background and study objectives

PIP II is targeted at Tier 1 through Tier 3 commercial customers. However, customers in all sectors and tiers may participate in the program if they meet the program eligibility requirements. PIP allows small and medium businesses to become more energy efficient through quick and easy retrofit projects. Larger businesses also benefit from the opportunity to undertake smaller projects that are not eligible for other Power Smart funding. The Product Incentive Program complements BC Hydro's larger Power Smart Partners (PSP) program in a number of ways. First, it is accessible to smaller business customers who are below the PSP threshold, but are still interested in the benefits of energy conservation. Second, PIP appeals to BC Hydro's larger customers (who may already be Power Smart Partners) because it can be used for smaller projects or smaller sites.

To date, there have been two program phases: PIP I, which was launched in November 2003, focused on primarily lighting technologies, and PIP II, which was launched in November 2004, and included an expanded product line. In addition, process changes in March 2007 changed the PIP program and removed the pre-approval requirement, which changed the program structure to rebate style model. Phase 1. PIP I included five types of pre-approved technologies: T8 linear fluorescent lamps and linear fluorescent efficient ballasts, compact fluorescent lamps (CFLs), LED exit signs (both new and retrofit), energy efficient exterior lighting (metal halide and high pressure sodium), and vending machine sensors. All of these products can be used in simple one-to-one replacements of existing conventional technologies. Phase 2. PIP II replaced PIP I in November 2004. PIP II is essentially the same program as PIP I with an expanded product line to appeal to a wider variety of customers including additional fluorescent lighting options, additional high intensity lamps, pulse start metal halide lamps, lighting controls, pony pumps, adjustable speed drives, and synchronous belts.

Application Process. To be eligible for PIP, a participant must be a BC Hydro customer in the general commercial rate class 12XX, 1111, 1121, 1131 or the transmission rate class 18XX and have a good credit standing with Hydro. In addition, all projects must qualify for a minimum incentive of $200. To qualify for incentives under the PIP program, customers complete the following steps. Program process changes came into effect on March 15, 2007 that eliminate the requirement for program pre-approval.

Deemed Energy Savings and Incentive Payments. The savings estimates for each technology are based on formulas and parameters originally approved by BC Hydro's Technology Solutions Department now Power Smart Engineering (Intihar, 2004). For each technology, incentive rates for each product configuration are set to provide a payback within the range of $.006 - $.009/kWh for BC Hydro. Savings estimates are calculated automatically by the PIP online application program when customers enter information about the products they are installing, the products they are replacing, and the area type where the product is installed (e.g. office).

The objectives for this evaluation of the PIP program are as follows.

- Provide a summary of program activity and customer characteristics to date.
- Determine program awareness, program satisfaction, non participant conservation activities, stated spillover and freerider rates.
- Estimate realisation rates on the gross (deemed) energy savings associated with PIP projects completed as of December 31, 2005.
- Determine the net program energy savings.

Method

The evaluation approach is organized around the main evaluation objectives from the previous section.

Program Activities to Date. Updated data extracts containing information on all the PIP projects in the system were obtained in December 2006. The extract contained a variety of information on existing PIP projects including program dates, application status, types and quantities of products installed, estimated energy savings, and incentives awarded. This database was analysed to provide an overview of PIP program activity.

Customer Awareness, Satisfaction, Program Experiences, and Free Rider Rates. Customer awareness, satisfaction, program experiences, and stated free rider and spillover rates were summarized from a telephone survey of program participants and non-participants conducted in May 2006 through July 2006. Participant respondents were recruited from 229 PIP applications that were completed between February 9, 2004 (earliest record) and July 31, 2005. Non-participants were drawn from a mailing list of customers who had received information about the program. This list was supplemented with information for strata accounts who had also been contacted about the program.

Gross and Net Energy Savings. Gross and net energy savings were estimated for program activity in the period January 1, 2004 through March, 2006. Gross savings are the basic estimate of program savings and are usually based on an engineering study and/or technical calculations. Gross savings generally do not account for factors external to the program that could impact energy savings and may therefore include energy savings that are not attributable to the program. In contrast, net savings are estimated by adjusting the initial gross savings estimates by the expected influences of non-Program related factors including free-ridership, spillover, and naturally occurring conservation. Gross savings estimates for the PIP program are calculated automatically when the customer enters the project information into the online application and rely on deemed savings algorithms for each technology type.

Gross savings were estimated using the following algorithm, where W_{pre} and W_{post} are the wattages of the original and replacement products, hours refers to hour of use for the relevant space type, area refers to the area of the relevant space type and the summation is over areas:

$$kWh_{savings} = \Sigma\ (W_{pre} - W_{post}) * \text{hours of use}_{area} / 1000 \qquad (1)$$

Since the program applications provided these calculations with assumed hours of use, the major calculation here was to correct the assumed hours of use by space-weighted actual hours of use based on metering data.

Gross peak demand was estimated by using the ratio of average kWh to peak kWh from the previous Power Smart Partners evaluation.

Net savings were estimated using the following algorithm, W and W are the wattages of the original and replacement products, hours refers to hour so fuse for the relevant space type and are refers to the area of the relevant space type and the summation is over areas:

$$kWh_{savings} = \Sigma (W_{pre} - W_{post}) * \text{hours of use}_{area} /1000$$
$$*(1 - \text{free rider rate} + \text{spillover rate}) \quad (2)$$

Again, net peak demand was estimated by using the ratio of average kWh to peak kWh from the previous Power Smart Partners evaluation.

Data Sources and Development. In preparation for the analysis, data were compiled from three main sources for each of the predictor variables for each site, i, in each month, t: (1) BC Hydro PIP Online Application Database (participant application data including products installed, energy savings, and application dates); (2) BC Hydro Customer Information System (customer and account information, consumption histories); (3) Meteorological Data from 4 regional weather stations in British Columbia (HDD and CDD).

Results

The results section is divided into five subsections: (1) the analysis of the PIP program database including product types installed, energy savings, and the characteristics of participating customers, (2) findings of the site inspections, (3) survey results including awareness, program satisfaction, free rider rates and spill over, (4) impact analysis, and (5) reported and planned energy savings.

PIP Project Summary. The projects summaries described in this section are for projects completed by December 31, 2005 – the time period covered by this analysis.

Exhibit 1 shows the tier, sector, and facility type of the companies and sites associated with PIP applications completed by December 31, 2007. The majority of completed projects are associated with Tier 1 customers. In addition, commercial customers are the dominate sector followed by residential customers. The dominant facility types for project installations are strata units/hotels, office buildings, and elementary schools.

Completed PIP applications are further analysed by total and average savings, and average annual consumption in Exhibit 4.

Exhibit 1. PIP Applications by Tier.

Tier	Number of Applications	Percent
1	224	59%
2	62	16%
3	23	6%
4	65	17%
NULL	5	1%
Total	379	100%

Exhibit 2. PIP Applications by Sector.

Sector	Number of Applications	Percent
Commercial	190	50%
Government	10	3%
SUCH	52	14%
Residential	101	27%
Manuf/HighTech	21	6%
NULL	5	1%
Grand Total	379	100%

Exhibit 3. PIP Applications by Facility Type.

Facility Type	Number of Applications	Percent
Strata Units / Hotels	186	47.9%
Office Buildings	77	19.8%
Elementary School	28	7.2%
Industrial	17	4.4%
Secondary School	16	4.1%
Retail (food)	14	3.6%
Retail (non food)	12	3.1%
Recreation Centre	9	2.3%
Shopping Mall	9	2.3%
Hospitals	7	1.8%
Warehouses	7	1.8%
Restaurants	3	0.8%
College / University	1	0.3%
Office Buildings Low-rise	1	0.3%
Parking Garages	1	0.3%
Grand Total	388	

Exhibit 4. Energy Savings and Consumption for PIP Applications by Tier.

Tier	Number of Applications	Sum of Estimated kWh Savings (all applic.)	Average of application kWh Savings	Average of applic. annual kWh consumption	Savings/Cons (average)
1	224	11,44 7,581	51,105	3,602,486	0.014
2	62	3,439,086	55,469	1,157,923	0.048
3	23	1,071,109	46,570	462,229	0.101
4	65	1,995,149	30,695	211,347	0.145
NULL	5	309,769	61,954	12,285,581	0.005
Total	379	18,262,694	48,187	2,544,973	

Exhibit 5. Count of Products Installed by Product Type.

Product Type	Count of Installed Product (all applications)	Percent of Total
All T8 products	71,396	53.6%
- Energy Saver T8 lamps	49,160	36.9%
- Standard T8 with standard efficiency ballast	17,939	13.5%
- Energy Saver T8 with standard efficiency ballast	2,712	2.0%
- Energy Saver T8 with energy efficient ballast	1,184	0.9%
- Standard T8 with energy efficient ballast	401	0.3%
CFLs	43,882	32.9%
LED Exit Signs	13,905	10.4%
EE metal halide	2,083	1.6%
Halogen Infrared Lamps	910	0.7%
High Bay Fluorescent	345	0.3%
Occupancy Sensor	266	0.2%
HVAC Occupancy Sensor	259	0.2%
Pulse start metal halide	83	0.1%
Metal Halide	82	0.1%
High Pressure Sodium	17	0.0%
Vending Machine Sensor	7	0.0%
Pony Pump	4	0.0%
Synchronous belt drive	2	0.0%
Adjustable Speed Drive	1	0.0%
Switch Plate Mounted Timer	1	0.0%
Total	133243	

Exhibit 6. Summary of Inspection Reports.

	Number	%	Primary Reasons for Failure
Total Projects	1468		
Pre Inspections	89	6.1%	
Failed Pre-Inspection	8	10%	Mostly due to inability to verify original fixture counts
Post Inspections	61	4.2%	
Failed Post Inspection	3	5%	One for a minor variation, one passed after application revised , and one for significant variation.

Exhibit 7. Survey Completions by Tier.

Sector	Participants	Non-Participants
Tier 1	30	28
Tier 2,3,4	32	174
Total	62	202

Exhibit 8. Sources of Initiative Awareness for Participants and Non-participants.

Source of Initiative Awareness (Aware non-participants, n = 107)	Number	% citing source (multiple responses allowed)
BC Hydro Promotional Mailings, bill inserts, etc.	31	30
BC Hydro account manager or customer care representative	20	19
Distributor, contractor or other service firms	17	16
Other media or advertisements	10	9
BC Hydro website	9	8
Trade publications or trade shows	7	7
Colleagues or word of mouth	7	7
Other/Don't Know	6	6
Total	107	100%

Exhibit 9. Reasons for Participating in the PIP program – Participant Ratings.

Reasons for participating in the initiative (n=64)	Average rating	% 4 or 5
Advice and recommendation from BC Hydro representative	3.6	49%
Advice and recommendation from Distributor or Contractor	3.7	57%
Expected incentive from BC Hydro	3.9	66%
Saving energy to save money on utility bills	4.5	87%
Saving energy to help the environment	4.3	79%

Tier 1 customers are associated with more than 50 % of program savings, which is unsurprising given that Tier 1 customers have completed the most projects. On average, PIP projects save 48,187 kWh/year.

PIP projects were analysed by number and type of product installed (Exhibit 5). T8 lighting products are the dominant technology, with over 71,000 units installed under the program, representing over 50 % of all installed product. CFLs are the second most popular product followed by LED exit signs. T8 lighting products, CFLs, and LED exit signs represent more than 96 % of all products installed under the program as of December 31, 2005.

Customer Site Inspections. The following exhibit provides a summary of inspection activity on projects in the PIP system as of April 17, 2007.

On average, the inspection reports completed for PIP projects suggest that product is generally installed as specified in the applications with some relatively minor discrepancies associated with counts and the location of the product installed within the facility.

Customer Survey Results: Awareness and Participation. Overall, 53 % of the non-participant population surveyed (107 out of 202) is aware of the BC Hydro's Product Incentive Program. BC Hydro promotional mailings and bill inserts were the primary drivers of awareness, followed by BC Hydro account managers or other Customer Care representatives, then by external distributors, contractors or other service firms

Participants were asked to rate the importance of five potential reasons for participating in the PIP program Each element was rated on a scale of 1 to 5 where 1 is not at all important and 5 is very important. In general, participants appear to be highly motivated by saving energy on their utility bills.

Those non-participants who were aware of the initiative were asked why they did not participate in the program (Exhibit 10). The reasons most often mentioned included needing more information, being too busy, perceptions that the participation requirements were too much of a hassle, and cost.

Program Satisfaction and Suggestions for Improvement. Participants rated their satisfaction with program elements on scale of 1 to 5 where one is not at all satisfied and five is very satisfied. Overall, satisfaction with the program is quite high and no particular sub-element stands out as a cause of dissatisfaction, although the level of incentives and variety of products rate the lowest overall. In addition, when asked if they would

Exhibit 10. Reasons for Not Participating in the Program – Aware Non-Participants.

Reason for not participating (Aware non-participants, n = 107)	Number	% mentioning
Need more information	23	21.5
Too busy/No Time/Not a priority	19	17.8
Too mush hassle/paperwork/administrative effort	19	17.8
Cost	15	14.0
Rewards are not appealing enough	6	5.6
Not necessary/Already efficient	5	4.7
Other reasons/Don't Know	20	18.6
Total	107	100.0

Exhibit 11. Participant Satisfaction with Program Elements.

Participant satisfaction with program elements (n=64)	*Average rating*	*% 4 or 5*
Program information from direct mail	4.4	85%
Program information in the internet	4.7	94%
Service by BC Hydro personnel	4.8	96%
Service by Distributor	4.7	92%
Service by Contractor	4.7	92%
Level of Incentives	4.2	82%
Variety of Products	4.3	85%
Usability of the Online Application	4.5	85%
The Overall Application Process	4.5	88%
Overall Program Experience	4.8	100%

Exhibit 12. Non-Participant Satisfaction with Program Elements.

Non-Participant satisfaction with program elements (n=49 overall)	Average rating	% 4 or 5 (excluding Don't know and N/A responses)
Program information from direct mail (n=33)	3.3	42%
Program information in the internet (28)	3.6	54%
Service by BC Hydro personnel (35)	3.6	54%
Level of Incentives (42)	2.9	26%
Variety of Products (41)	3.4	37%

recommend PIP to another customer, 70 % of participants said they would recommend the program.

Non-participants were also asked to rate their satisfaction with five main program elements. In general, non-participant ratings for the same program elements were lower than those given by participants and particular dissatisfaction was focused on the level of program incentives; however, as indicated by the small sub sample sizes shown in brackets for each program element, many non-participants did not feel they were qualified to give a response for many of the program elements.

Suggestions for Program Improvement. Participants and non-participants also had a number of suggestions for program improvement. For participants, the recommendations most often cited include higher incentives and increased product flexibility (more products and greater variety of qualifying manufacturers). Non-participants who were aware of the program, suggested having an in-person visit or consultation (almost 20 % of aware non-participants suggested this approach), including a wider variety of products in the program offer, and providing more information by mail to eligible customers.

Exhibit 13. PIP Technologies Installed by Non-Participants during the Program Period.

	Total Sample	Installed N	% of sample
Compact Fluorescent Lights	202	69	34%
LED Exit Signs	202	35	17%
Energy Efficient Metal Halide Lights	202	32	16%
T8 linear fluorescent lights	202	31	15%
High Bay fluorescent lights	202	14	6.9%
Occupancy Sensors for Lighting or Air conditioning systems	202	13	6.4%
Halogen Infrared Lamps	202	8	3.9%

Exhibit 14. Free Rider Rates Estimated from Stated Survey Results.

Technology	% Free Riders	N
CFLs	17.2%	32
Energy Saver T8s	10.7%	14
Standard T8s	19.3%	22
LED Exit signs	21.3%	40
Overall Free Rider Rate:	19.0%	62

Exhibit 15. Overall Participant Spillover Rate Estimated from Stated Survey Results.

Spillover Rate (% of projects)	N
14%	62

Non-participant incidence of installing energy efficient products. Non-participants were asked if they had installed technologies similar to those funded under the PIP program during the program period. Compact fluorescent lights were installed by 34 % of respondents. Other products that were commonly installed included LED exit signs, Energy Efficient Metal Halide lights, and T8s.

Free Rider Rates. Estimates of free rider rates were derived from the participant survey. For each technology installed, participants were asked to rate the importance of participating in the PIP program on their organization's decision to implement the energy efficiency improvement. The rating scale was from one to five where 1 is 'not at all important' and 5 is 'very important'. A customer was identified as a free rider if an answer of '1', '2', or '3' was given on the 5-point scale. Free rider rates were also calculated using the 'weight' method. To use the weight method, the 5-point scale responses are converted into influence weights (1 = 0, 2 = 0.25, 3 = 0.5, 4 = 0.75 and 5 = 1), then the overall average weight (or attribution) is calculated by taking the average of the re-scaled responses. The free rider rate is calculated as 1 – attribution rate. The free rider rates calculated at the technology level are only shown for four primary technology types, namely CFLs, Energy Saver and Standard T8s, and LED exit signs, since the cell counts for the other technologies were very small. The overall free rider rate was derived by aggregating the responses across product categories. In the case where a customer installed more than one technology type, the average response over all technology types was used in the analysis.

Participant Spill Over. Estimates of spill over rates were also derived from the participant survey. For each technology type, participants were asked if they had installed additional energy efficient products at the same sites at which the PIP project occurred or at other sites in BC Hydro's service territory. Respondents were also asked if the program had an influence on their decision to install additional products (simple yes/no). The Exhibit 15 summarizes the results of the participant spill over analysis. Although the survey questions were asked at the technology level, only the aggregate spill over results are shown, since the cell counts for individual technologies were judged too small to be reliable. In addition, readers should note that although the spill over rate refers to the percentage of projects and not the percentage of products, we have interpreted this metric as being comparable to the free rider metric so that a net to gross ratio can be calculated.

Gross and Net Energy Savings. For the purposes of tracking gross energy savings, the Product Incentive Program uses deemed savings algorithms and pre-determined values for key parameters such as installed and replaced wattage and hours of use (HOU). When a customer submits an application online, the gross savings are calculated automatically based on the number and type of product installed, pre-existing technologies, and the facility/area type associated with the installation area. The majority of products installed under the PIP program during the period of this current evaluation were lighting products (CFLs, T8s, and LED exit signs). For most lighting products, savings are calculated using the basic formula (1) above.

A key uncertain parameter in this equation is the area hours of use (HOUarea), since the average pre and post wattages can be determined with reasonable accuracy based on the detailed descriptions required by the program application for the product replaced and the new product installed. For example, for

Exhibit 16. Distribution of PIP Program Area Types with Program and M&V HOU estimates.

PIP Area Name	Total Installed Areas	Proportion of Total Areas	Program HOU	M&V HOU
24 hour Industrial	8	0.7%	8760	8760
Classroom	25	2.3%	2350	1706
Club house	1	0.1%	800	800
Common Areas	384	34.6%	8760	5959
Corridors / Gymnasiums	67	6.0%	3000	2843
Curling Rink	1	0.1%	5680	2843
Exterior Lighting	47	4.2%	4380	4869
Guest room	81	7.3%	1500	1107
High rise office	33	3.0%	4000	4396
Hospitals	14	1.3%	8760	3401
Ice Rink	1	0.1%	5680	2843
Industrial Interior	23	2.1%	6000	4782
Industrial Outside	1	0.1%	4380	4869
Low Rise Office	182	16.4%	3800	3220
Office	3	0.3%	3900	1919
Offices	13	1.2%	3900	1919
Parkade	2	0.2%	8760	6363
Parking Garages	96	8.6%	8760	6363
Recreation Centre	6	0.5%	5680	2843
Restaurants	5	0.5%	4000	4479
Retail (food)	21	1.9%	5800	5800
Retail (non food)	39	3.5%	4500	5854
Shopping Mall	18	1.6%	4800	4800
Storage Rooms	29	2.6%	600	2186
Warehouses	10	0.9%	3600	5756
Grand Total	1110	100.0%	5886	4560
Ratio M&V to assumed				77%

T8 lighting, wattage differential assumptions vary depending on the ballast type, the fixture configuration, and the length of the lamps.

In recent years, evaluations of other similar 'PIP type' programs have revealed significant discrepancies between program assumed and field realized HOU values, which resulted in discounting of tracked program savings in the order of 42 to 74 % (associated realization rates of 0.36-0.58) (Quantum, 2005a; ECONorthwest, 2006a). The field realised HOU estimates were often lower than standard accepted assumptions from reference manuals such as the California Reference Database for Energy Efficiency Resources (DEER) (ECONorthwest, 2006b). BC Hydro M&V HOU data was summarized from an analysis of 2,575 individual light logger data points. Although these measurements were conducted for projects completed under the Power Smart Partner program, it is believed that they reasonably represent HOU data for PIP projects. The hOU estiamtes used by BC Hydro's PIP program tend to be high when compared to both the PSP field derived and reference HOU information for similar area types. An overall average HOU estimate for the PIP program was calculated using the program area type HOU estimates and the actual distribution of area types based on completed projects. On average, the M&V field based estimates are 77 % of the PIP HOU data assumptions.

Since the M&V HOU data was measured at the facilities of large commercial customers and PIP caters to both small and large customers, it is possible that the actual HOU for PIP projects could be different than the average calculated using the M&V data. In particular, the HOU may be lower for smaller commercial customers. This possibility is supported

Exhibit 17. Comparison of HOU field results for Similar Programs in the United States.

Source	Program	Method	Product	Sample Size	HOU - All Facility Types
BC Hydro	Product Incentive Program	Deemed	All	n/a	5886
BC Hydro	Power Smart Partners	Logger – M&V	All	N = 2575	4560
RLW Analytics 2007	California Statewide Express Efficiency Program	Logger	CFL	N = 62	3878
RLW Analytics 2007	California Statewide Express Efficiency Program	Logger	T8/T5	N = 78	3925
Quantum 2005	California Statewide Express Efficiency Program	Logger	CFL	N= 60	2709
ECO Northwest In program	SCE Nonresidential Hard-to-Reach Program	Logger	CFL	N= 25	1941
ECO Northwest In Program	SCE Nonresidential Hard-to-Reach Program	Logger	T8/T5	N=25	2613
ECO Northwest 2006	Small Business Energy Efficiency Program (SDG&E)	Onsite Audit	CFL	N=100	1872
ECO Northwest 2006	Small Business Energy Efficiency Program (SDG&E)	Onsite Audit	T8/T5	N=100	2572

Exhibit 18. Gross and Net Program Savings with Recalculated and Realized Values.

Energy Savings Type	Savings (GWh/year)
Program Estimated Gross Savings for Projects Closed by Mar 31, 2005	24.3
Net Savings with Revised HOU estimates, Free Riders, Spill Over	18.7

Exhibit 19. Summary of PIP Impact Evaluation Results with Planned and Reported Results.

	Planning Estimates	*Reported Estimates*	*Evaluated Results*
Spillover Rate	5%	5%	14%
Free Rider Rate	5%	5%	19%
Gross Energy (Peak) Savings (GWh/year)	17.1	24.3	19.7 (2.70)
Net Energy (Peak) Savings (GWh/year)	-	24.3	18.7 (2.57)

by the evaluation results from other similar programs in the United States, which were derived from measurement of actual projects completed by program participants. The field measurements from these program evaluations suggest overall average annual HOU for smaller business customers in the range of approximately 2,000 – 4,000 hours per year. In addition, these studies show that in general, HOUs for CFLs are lower than HOUs measured for 8s in similar applications. These results suggest that deemed savings calculated using the same HOU estimates for CFLs and T8s may tend to overestimate the savings associated with CFLs.

Gross and Net Program Savings. Gross and net program savings are calculated for the program period ending December 31, 2005 (the period covered by this analysis) using the revised HOU values (77 % realization rate) and the free rider and spill over realization (95 % realization rate).

Comparison of Evaluated Results with Planning and Reported Estimates. The next Exhibit summarizes the evaluated results for the key variables discussed in the previous sections and compares them with planning estimates.

Exhibit 20 provides information on unit installed costs, unit savings and cost of conserved energy for sixteen main technologies installed under PIP. The cost of conserved energy estimates vary quite widely across product categories. For lighting products, the cost of conserved energy varies from $0.016 per kWh for energy saver T8 fluorescent tubes to $0.048 per kWh for pulse start metal halide lamps and for photocell lighting controls. For mechanical products, the cost of conserved energy varies from $0.014 per kWh for synchronous belts to $0.060 per kWh for adjustable speed drives.

Exhibit 20. Cost-effectiveness for Selected Technologies.

Technology	Installed cost (dollars per unit)	Savings (kWh per year)	Cost of conserved energy ($/kWh)
Pulse start metal halide	104.90	296	0.048
Halogen infrared	18.50	58	0.044
Occupancy sensor for lighting	75.00	443	0.023
Photocells	60.20	173	0.048
Energy saver T8 tubes	3.00	25	0.016
Energy saver T8 tubes and ballasts	42.70	219	0.024
High bay fluorescent lamps	170.00	523	0.044
High wattage CFL	9.50	202	0.047
CFL	2.75	104	0.027
Pony pump motors	5,000.00	42,300	0.016
Adjustable Speed Drives (per horse power)	400.00	900	0.060
Synchronous belts	14.80	70	0.014
Transformers (per kVA0	27.30	135,000	0.053
Harmonizers	50,000.00	1,080	0.050
HVAC occupancy sensors	239.40	2,970	0.030
Carbon dioxide sensors	747.40	288	0.034
Switch plate timers	61.50		0.029

Conclusions

The PIP projects covered in this impact evaluation were completed from program launch to the end of December 31, 2005 and include primarily lighting products. Some key conclusions are as follows.

Program Rationale. PIP has been successful in building a high level of product awareness and purchase behaviour for energy efficient lighting products in the commercial sector and institutional sector. The program has been gaining some momentum, with increased customer applications for efficient lighting products leading to increased annual savings. Program rationale was examined using a program logic model, examining the linkages among inputs, outputs, purpose and goal for each activity. It was found that there were the program logic model made sense, and that PIP had a strong program rationale.

Customer Survey. A detailed survey was conducted with program participants, covering range of program aspects. Customers were asked how they became aware of PIP: the most important sources of customer awareness of PIP were an electrical distributor or contractor, BC Hydro Account Manager or Customer Care Representative, BC Hydro website and BC Hydro bill inserts or other promotional literature. Customers were asked about the importance of various factors in their decision to participate in PIP: the most important factors included reducing energy use to save mone and reducing energy use to save the environment

Energy Savings. Evaluated energy savings associated with PIP program of 17.8 GWh/year is 73 % of reported savings. Reasons for discrepancy between reported and evaluated savings include: (1) Based on a comparison of M&V values derived from BC Hydro logger studies and reference values from California's DEER database, HOU values used for program deemed savings calculations are too high for some area types. (2) Changes in the wattage differential for T12 to T8 change outs used in the deemed savings calculations were not reflected in reported savings for projects that had closed before the wattage changes came into effect. (3) Free ridership is higher than expected with an average rate of 19 %. Participant spillover estimated at 14 % does not compensate as expected for the effect of free riders

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