Evaluating Industrial Market Transformation

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ABSTRACT

The purpose of this paper is to report on the process, market and impact evaluation of BC Hydro's Industrial Power Smart Partners Program. This program provided utility partners with energy studies, workshops, energy managers and financial incentives to help customers overcome the main barriers to investment and realize energy savings. The basic evaluation design was a quasi-experiment with a treatment group of 59 program participant sites and a comparison group of 65 program non-participant sites. Data was collected through on-site engineering audits, end-use metering and surveys with sample sizes designed to provide precision at the ± 10% level, 19 times out of 20. Proven engineering techniques, including engineering algorithms and computer simulations, were used to determine gross energy and demand savings. Survey-based information was used to determine net energy and demand savings.

Introduction

Over the past decade there has been increased interest in industrial energy efficiency for two main reasons. First, as movement towards market deregulation has stalled in many jurisdictions, state and provincial regulators and utilities have re-examined mechanisms to place demand side and supply side energy options on an equal footing. To some extent, this is a return to the integrated resource-planning paradigm of the 1990s. Second, as concern with the impacts of higher atmospheric concentrations of greenhouse gases has increased, state and provincial governments have begun to explore additional options for reducing emissions. These new initiatives have been bolstered by perceptions that neither the American nor the Canadian federal government has a meaningful policy on global warming, so that action needs to come from more junior levels of government, from the private sector, and from concerned citizens.

Both of these reasons for increased interest in energy efficiency have been at play in British Columbia. BC Hydro, the largest electric utility in British Columbia, launched its first major energy conservation initiative or demand side management (DSM) initiative Power Smart I some twenty years ago. Power Smart I included a wide range of information, and implemented promotional, training and incentive activities aimed at making energy efficiency a way of life in British Columbia. Power Smart I's Programs included residential appliances and lighting, residential shell retrofits, space heating, water heating, commercial retrofits, fans, pumps, compression, high efficiency motors and a variety of specialized industrial processes, particularly in the sawmilling, pulp and paper and mining sectors. BC Hydro began to wind down these DSM activities in the mid-1990s. But in 2001, concerns about a looming demand-supply imbalance led to the launch of Power Smart II, which included an aggressive demand side bidding program for large industrial customers, in addition to traditional energy conservation activities. This revitalized utility DSM initiative was reinforced by the ambitious Energy Plan of the BC Provincial Government, which was unveiled in November 2002.

The Power Smart Partners Industrial Program (PSP or PS Partners Industrial Program) was launched in April 2002. The basic concept was that BC Hydro's largest business customers (who purchase at least $50,000 worth of electricity annually) have the most to gain from implementing long-term energy-saving strategies, not just one-time projects. BC Hydro partnered with these companies, and it contributed matching funding and other resources to help them overcome barriers to realizing energy savings opportunities. Power Smart Partners had to commit to improve overall electrical energy efficiency, sign a Power Smart Partner agreement outlining their commitment and energy-efficiency target, and commit to match utility dollars to identify and implement energy-saving opportunities. BC Hydro in turn provided: energy savings opportunity identification; matching funds for businesses to identify electrical energy savings opportunities which may be used towards an energy manager, electrical energy audit, and building re-commissioning; education and training to help in developing the company's pool of energy management skills; and financial incentives.

The purpose of this paper is to report on the results of a process, market and impact study of the Power Smart Partners Industrial Program for the four years ending March 31, 2006. The next section outlines the data and method used for the evaluation. The next three sections summarize the process, market impact results. The final section provides a summary and conclusions.

Data and Method

For the period covered by this study (2002-2006), there were 151 facilities that participated in PSP, with 233 projects and total expected savings of 497.3 GWh. Participating facilities were divided into three groups: (a) projects that received only incentives; (b) projects that received only consultative services; and (c) projects that received both incentives and consultative services. A survey was administered to a sample of decision makers from participating facilities, which provided the information used to estimate free ridership and spillover impacts for projects in the PS Partners Industrial Program, as well as information on customer satisfaction and decision making related to energy use and energy efficiency. Each participant was interviewed using a common survey instrument. For those sites in the sample that received on-site visits, the interviews were conducted during the visits. For sites not visited, the interviews were conducted by telephone. During the interview, a participant was asked questions about: general decision making regarding purchasing and installing energy efficient equipment, knowledge of and satisfaction with PSP, and influence that PSP had on his/her decision to install energy efficiency measures.

On-site data collection was used to collect information with which to validate savings for installed measures. Data on saturations of energy efficiency technologies were available for a sample of 59 participant facilities out of a population of 151 facilities. Baseline data was collected for all high efficiency technology implemented at a site. To complement the data collected from program participants, data pertaining to saturations of energy efficiency technologies were also collected at a sample of 65 non-participant sites.

For on-site verification analysis, samples of facilities were selected from each intervention type: (a) projects that received only incentives; (b) projects that received only consultative services; and (c) projects that received both incentives and consultative services. BC Hydro data on expected savings for the industrial projects were used to prepare the sampling plan. Although data on project savings showed a high degree of variability in savings across the projects, a relatively small number of projects accounted for a high percentage of the estimated savings. Expected saving for the sample facilities were verified by: (a) reviewing the documentation for the projects at a facility and (b) visiting the facilities to verify that the energy efficiency measures had been installed and the conditions under which the measures were operating. Project documentation was collected and reviewed for each facility that was selected for the evaluation sample.

Calculations of energy savings for the projects at the various facilities were also reviewed. For each facility, the savings calculation on the program documentation were reviewed to determine (1) whether the methodology used for the calculation was appropriate, (2) whether assumptions used were reasonable and appropriate, and (3) whether savings calculations were done correctly. The review of the calculations of energy savings and peak demand reductions associated with lighting, motor, and other direct, pre-calculated savings measures focused on the main factors that determine energy use. For example, operating hours and usage patterns are important factors in determining energy use for end-use equipment.

Normally, the weakest part of any engineering calculation of energy savings relates to the characterization of the operational schedules of a facility's energy using equipment. Metered data were used to verify operating conditions, where appropriate. For some facilities, data on operating hours was available through the BC Hydro Monitoring and Verification data. For other sample facilities, additional monitoring was conducted. On-site inspections of the sample facilities were made to verify the installation of the energy efficiency improvements and to collect information on the operating characteristics of the facilities. Data from several sources were collected during the on-site visit.

- Data were first collected through interviews with the staff of the site. Interviews with a facility engineer or other knowledgeable personnel provided information on occupancy schedules, lighting schedules, ventilation schedules, equipment schedules, and operational and maintenance practices.
- Documents or records at the site were reviewed. This included reviewing basic building plans and architectural drawings. Other data reviewed included information on process equipment, HVAC systems and equipment, on lighting and on hot water systems from mechanical, electrical and plumbing plans.
- Visual inspections were undertaken. These included control settings, lighting levels, inventory of end use equipment, ventilation rates, building population, occupancy level, and other parameters.

To verify that measures have been installed and that the installation has been done correctly, the field staff examined the following:

- Process measures. For process improvement measures, including refrigeration equipment and boilers, the installation of any energy efficient process equipment, any removal of process equipment, reduction in building or equipment energy use due to reduced production, or any other process measurement measures as indicated by the program documentation for the facility were checked and verified.
- Lighting measures. For lighting measures, the installation of lamps, ballasts, reflectors, and controls was checked and verified.
- Motor systems. For motors, pumps, and fans, information pertaining to efficiency was obtained from name plates. Motors with adjustable speed drives (e.g., as used in variable air volume distribution systems, distribution pumps, or industrial processes) are connected to a controller box, which varies the speed according to the load requirements. Changes in speed cause changes in the noise level, which can be heard, or a clamp-on voltage meter can be used to measure the variation in the voltage provided by the controller box to the motor.

The procedures described above were used to calculate gross realization rates for the incentive, consultative and both (incentive and consultative) savings groups. Gross savings were then calculated as follows:

(1) Gross Program Savings =Realization rate*Program estimated savings by group

A major objective of this evaluation of a program was to determine those energy savings and gains in efficiency, which were solely attributable to the program or the program's net savings impact. The net savings impact of a program is determined as follows:

(2) Net Program Savings = Gross Program Savings – Free ridership Impacts + Spillover Impacts

Gross program savings represent the energy savings attributable to the installation of energy-efficiency measures by program participants that change their energy use. Free ridership refers to the extent to which participants in a program would have adopted energy-efficiency measures and achieved the observed energy changes even in the absence of the program. The energy savings associated with free ridership can be taken to represent naturally occurring conservation, which is calculated as a free ridership rate weighted by energy savings. Spillover refers to savings that are due to the program for which no incentive was received. This can be of two main types: first, participants may take additional actions as a direct result of the program, but beyond those taken through the program; second, non-participants may adopt measures promoted by the program as a direct result of the program but do so outside of the program. Only the first type of spillover was estimated in this study. The goal of the net-to-gross analysis was to estimate the impacts of PSP net of free ridership and spillover impacts. Information collected through a survey of a sample of facility managers was used for the net-to-gross analysis. Several criteria were used to determine what portion of a customer's savings for a particular project should be attributed to free ridership. The first criterion was based on the response to the question: "Would you have been financially able to install the equipment or measures without the financial incentive from the PS Partners Industrial Program?" If a customer answered "No" a free ridership score of 0 was assigned to the project. For sites that indicated that they were able to undertake energy efficiency projects without financial assistance from the PS Partners Industrial Program, three criteria were applied to determine what percentage of savings should be attributed to free ridership. The three criteria applied are associated with the following factors that appear important as explainers of free ridership: (a) previous experience of a firm with a measure installed under PS Partners Industrial Program, (b) plans and intentions of firm to install a measure even without support from PS Partners Industrial Program, and (c) influence that the PS Partners Industrial Program had on the decision to install a measure.

Process Evaluation

This process evaluation focused on four main issues as follows.

- Determine initial source of program awareness of PSP.
- Determine the most influential source of information on energy efficiency.
- Determine the decision factors for the undertaking of energy efficient investments.
- Determine the level of customer satisfaction with key program elements.

Table 1 shows the initial source of program participant information on PSP. The most important initial sources of information were contact by a BC Hydro Key Account Manager and a call to BC Hydro. The four other sources cited each had a share of less than five percent, so that these other sources were relatively unimportant.

Table 1. Initial Source of Information on Power Smart Partners

	Share of respondents (%)	Share of savings (%)
Called BC Hydro	10.4	18.8
Contacted by BC Hydro Key Account Man.	74.3	73.6
Presentation by BC Hydro staff/consultant	4.3	1.3
Equipment vendor or consultant mentioned it	4.5	4.2
Heard from friend or colleague	4.3	1.0
Don't remember	2.1	0.9

Table 2 shows the most influential source of energy efficiency. The most influential sources of information were contact by a BC Hydro representative, contact by an architect, engineer or energy consultant, contact with an owner or engineer of a firm like theirs, other sources and a knowledgeable colleague or friend.

Table 2. Most Influential Source of Information on Energy Efficiency

	Share of respondents (%)	Share of savings (%)
BC Hydro representative	40.8	39.6
Knowledgeable colleague or friend	5.8	1.6
BC hydro brochure or advertisement	2.2	0.5
Owners or engineer with firms like yours	9.3	1.8
Architect, engineer, energy consultant	29.1	32.1
Equipment vendor	1.4	2.7
Contractor	4.5	5.8
Other sources	7.0	15.9

Table 3 shows the main determinants of energy efficient investment. The most important determinants were incentives from BC Hydro, energy cost savings, other benefits (such as improved reliability, better product quality, enhanced productivity or reduced waste), a recommendation from a BC Hydro report or consultant, past success with energy efficient equipment, past experience with energy efficient programs, and concern for corporate responsibility.

Table 4 shows customer satisfaction with key elements of PSP. The percentages are shown for the top scores, that is those who indicate that they are somewhat satisfied or very satisfied (they score a 4 or a 5 on a 5-point scale). The most favourable areas include overall project results, operation of equipment, quality of installation work, and information from BC Hydro. Middle areas in terms of customer satisfaction include estimates of costs, estimates of savings, ease of completing paperwork, support and information from vendor or consultant and the amount of the incentive. The least favourable areas include ease of understanding the program process, actual project savings, post project inspection, time to receive inspection and the amount of paperwork.

Table 3. Determinants of Energy Efficient Investments

	Share of respondents (%)	Share of savings (%)
Recommendation from BC Hydro	84.6	63.2
Your company policy	56.8	78.4
Past success with energy efficient equipment	84.2	95.2
Past experience with energy efficiency	73.9	78.9
Energy cost savings	95.5	95.7
Recommendation from consultant or vendor	52.0	69.6
Recommendation by architect or engineer	65.8	74.9
Promote environmentally friendly image	67.9	78.8
Corporate responsibility	71.4	83.0
Incentives from BC Hydro	97.7	92.2
Competitors or other firms are doing it	28.9	64.2
Want firm to e viewed as a leader	54.7	66.5
Other benefits	85.2	82.5

Table 4. Customer Satisfaction (percentage of top box scores)

	Share of respondents (%)	Share of savings (%)
Overall result of project	85.4	73.0
Support and information form BC Hydro	81.7	73.5
Support and information from vendor	63.0	51.8
Ease of understanding process	57.3	66.6
Ease of completing process	63.6	66.4
Estimates of savings	66.2	64.9
Estimates of costs	71.6	74.4
Actual project savings	57.1	72.7
Amount of incentive	60.5	59.2
Time to receive incentive	51.3	61.1
Post-installation inspection	54.7	48.8
Amount of paperwork	50.0	52.2
Quality of installation work	83.3	81.1
Operation of equipment	84.0	80.8

Market Evaluation

This market evaluation focused on a comparison of participant and non-participant penetration rates for a number of key energy efficient technologies. We view the market as substantially transformed if penetration rates for a given technology are over 40 percent for both participants and non-participants.

- Lighting technologies including dimming controls, energy management systems, T8 lamps, CFLs, high-pressure sodium, metal halide, LEDs and electronic ballasts.
- Fan and blower technologies including adjustable speed drives, cog belts, appropriate motor sizing, and high efficiency motors.
- Pump system technologies including efficient pumps, appropriate pump sizing, appropriate pipe sizing, adjustable speed drives, appropriate motor sizing and high efficiency motors.
- Compressor system technologies including air inlet temperature controls, system controls, heat recovery, adjustable speed drives, appropriate motor sizing and high efficiency motors.
- Other motor systems including appropriate motor sizing, high efficiency motors, power factor correction and adjustable speed drives.

Lighting systems typically include lighting fixtures, lamps, ballasts and controls. Many lighting systems have efficiencies of twenty-five percent or less, with the electrical energy which is not converted to lighting converted instead to waste heat. Key methods of reducing lighting consumption include using more efficient lighting sources and installing appropriate lighting controls to reduce annual hours of use for a given light source. Table 5 shows the penetration rates for program participants and program non-participants for six energy efficient lighting technologies: dimming controls, energy management systems (EMS), T8 fluorescent lamps, compact fluorescent lamps, high pressure sodium lamps, metal halide lamps, LED lamps, and electronic ballasts. Differences between penetration rates for participants and non-participants and associated t-tests are also shown, with a t-value of 1.96 or greater being significant at the 95% level and a t-value of 1.67 or greater being significant at the 90% level. The differences are significant at the 95% level for T8 lamps, CFLs, LEDs and electronic ballasts and at the 10% level for EMS.

Table 5. Lighting Systems Penetration Rates

Component	Participant	Non-participant	Difference	t-test
Dimming controls	8.6	3.0	5.6	1.32
EMS	12.1	1.5	10.6	1.82
T8 lamps	65.5	30.8	34.7	4.12
CFLs	32.8	12.3	20.5	2.79
HPS	72.4	61.5	10.9	1.30
Metal halide	72.4	72.3	1.2	0.01
LEDs	29.3	10.8	18.5	2.62
Elect. ballasts	70.7	43.1	27.6	3.23

Fans and blowers provide the motive force to move air or another gas against the resistance of the air conveyance system. These systems typically include a motor, a fan or blower, a speed control, a control vane or damper and a duct system. Up to one-half of the potential energy savings in a fan or blower system can be captured though the appropriate sizing of motors, reducing unnecessary loads and minimizing motor idling. A number of energy efficient fan and blower technologies were examined. Table 6 shows the penetration rates for program participants and program non-participants for four energy efficient fan and blower technologies: adjustable speed drives, cog belts, appropriate motor sizing, and high efficiency motors. The differences between participants and non-participants are significant at the 95% level for adjustable speed drives, cog belts and high efficiency motors and at the 90% level for appropriate motor sizing.

Table 6. Fan and Blower Systems Penetration Rates

Component	Participant	Non-participant	Difference	t-test
ASD	27.1	6.2	20.9	3.21
Cog belts	35.6	6.2	29.4	4.25
Motor sizing	8.5	1.5	7.0	1.78
HEM	67.8	40.0	27.8	3.23

Pumps move liquids against the resistance of a piping system and uphill against gravity. Pumping systems typically include a motor, a pump or impellor, a speed control device, throttle or valve, and piping. Up to one-half the potential energy savings in a pumping system can be captured though appropriate sizing of the motor and its load, reducing unnecessary loads, and minimizing motor idling. A number of energy efficient pump technologies were examined. Table 7 shows the penetration rates for program participants and program non-participants for six energy efficient pump technologies: high efficiency pumps, appropriate pump sizing, correct pipe sizing, adjustable speed drives, appropriate motor sizing, and high efficiency motors. The differences between participants and non-participants are significant at the 95% level for high efficiency pumps, appropriate pump sizing, correct pipe sizing, adjustable speed drives, and high efficiency motors and at the 90% level for appropriate motor sizing.

Table 7. Pump Systems Penetration Rates

Component	Participant	Non-participant	Difference	t-test
Efficient pumps	55.9	27.7	28.2	3.31
Pump sizing	69.5	38.5	31.0	3.64
Pipe sizing	69.5	40.0	29.5	3.46
ASD	32.2	13.9	18.4	2.47
Motor sizing	8.5	1.5	7.0	1.78
HEM	67.8	40.0	27.8	3.23

Compressors increase the pressure of a gas to the point where it can do useful work, typically by increasing the pressure from 15 pounds per square inch to 100 pounds per square inch. Compressed air systems typically include a motor, a speed control device, compressor, dryer/filter unit, throttle or vane or damper, and a piping system. Key methods of saving energy in compressor systems include using as little compression as possible, minimizing air leaks, and maintaining compressor efficiency. Table 8 shows the penetration rates for program participants and program non-participants for six energy efficient compressor system technologies: reduce air inlet temperatures, compressor system controls, heat recovery for hot water, adjustable speed drives, appropriate motor sizing, and high efficiency motors. The differences are significant at the 95% level for compressor system controls, adjustable speed drives, appropriate motor sizing, and high efficiency motors and at the 90% level for appropriate motor sizing.

Table 8. Compressor Systems Penetration Rates

Component	Participant	Non-participant	Difference	t-test

Air inlet temp.	11.9	4.6	7.3	1.47
System controls	64.2	27.9	36.3	4.34
Heat recovery	10.2	3.1	7.1	1.58
ASD	27.1	6.2	20.9	3.21
Motor sizing	8.5	1.5	7.0	1.78
HEM	67.8	40.0	27.8	3.23

Other motor systems include conveyance systems, hydraulic systems, cutting, grinding and milling equipment, material shaping equipment, electro-chemical equipment and a wide variety of other specialized equipment. Many process systems include a motor, a controller, a drive and relevant end use equipment. Main opportunities for energy efficiency include proper equipment sizing, use of high efficiency motors, and use of adjustable speed drives. Table 9 shows the penetration rates for program participants and program non-participants for four process system technologies: appropriate motor sizing, high efficiency motors, power factor correction, and adjustable speed drives. The differences are significant at the 95% level for high efficiency motors and power factor correction and at the 90% level for appropriate motor sizing.

Table 9. Other Motor Systems Penetration Rates

Component	Participant	Non-participant	Difference	t-test
Motor sizing	8.5	1.5	7.0	1.78
HEM	84.8	61.5	27.8	3.23
Power factor	57.6	20.0	37.6	4.63
ASD	67.8	56.0	10.9	1.26

Impact Evaluation

The impact evaluation focused on a number of issues including gross energy savings and net energy savings. The gross impacts analysis focused on three main issues as follows: (1) review program saving estimates, (2) calculate realization rates by type of project, and (3) evaluate gross savings and compare to reported gross savings with a precision of +/- 10%. There were 233 projects for 151 facilities in the program database. Expected kWh savings for projects receiving different types of assistance are shown in Table 10.

Table 10. Expected Gross Savings

Type of assistance	Number of facilities	Number of projects	Expected savings (GWh per year)
Incentive	72	94	233.7
Consultative	49	60	117.9
Inc and con	30	79	145.8
Total	151	233	497.3

To verify gross kWh savings, data were collected and analyzed for a sample of 50 facilities comprising 88 energy efficiency projects that participated in the program. The data collected for the sample of verification projects were analyzed using the methods described above to verify the kWh savings and to determine realization rates by type of program assistance. There were 233 energy efficiency projects completed for 151 facilities under the program. Using the realization rates calculated for the sampled projects, estimates were developed of program-level verified kWh savings. The program-level estimates for kWh savings are reported by type of program assistance in Table 11.

Table 11. Verified Gross Savings by Project Type

Type of assistance	**Expected savings (GWh per year)**	**Verified gross savings (GWh per year)**	**Realization rate (%)**
Incentive	233.7	249.7	106.9
Consultative	117.9	111.3	94.4
Inc. and con.	145.8	152.4	104.5
Total	497.3	513.4	103.2

The net savings impacts analysis focused on three main issues as follows: (1) determine free rider rates for incentives, consultative and both projects; (2) determine spillover for incentive, consultative and both projects; and (3) evaluate net program savings. The data used to assign free ridership scores were collected through a telephone survey of 42 participants in the Power Smart Partners Industrial program. As discussed above, the first criteria in determining what proportion of kWh savings from a project should be assigned to free ridership was whether a participant was financially able to undertake the project without financial assistance from the PS Partners Industrial Program. If a respondent to the decision-makers survey answered "No" to the question of "Would you have been financially able to install the equipment or measures without the financial incentive from the PS Partners Industrial Program?", a free ridership score of 0 was assigned to the project. That is, if a participant required financial assistance from the program to undertake a project, then that participant was judged to not be a free rider. Under this criterion, the other free ridership scoring criteria were applied only to projects for participants who answered "Yes" to the question: "Would you have been financially able to install the equipment or measures without the financial incentive from the PS Partners Industrial Program?" Participants who answered "Don't know" to this question were grouped with those participants who answered "No". This free ridership scoring procedure was applied to projects categorized by two types of program assistance: incentives only and both incentives and consultative services. The procedure was not applied to customers receiving only consultative services because they did not receive any financial incentives. The results of applying the free ridership scoring procedure to kWh savings for facilities are presented in Table 12.

Table 12. Verified Savings Net of Free Riders

Type of assistance	Verified gross savings (GWh per year)	1 –free rider rate (ratio)	Achieved savings net of free riders (GWh per year)
Incentive	249.7	0.645	161.0
Consultative	111.3	1.00	111.3
Inc and con	152.4	0.706	107.6
Total	513.4	0.732	379.9

Participant spillover savings result from participants installing, without an incentive, the same kind of equipment or other energy efficiency equipment that they installed with an incentive. The magnitude of participant spillover savings were quantified by assuming that the savings that participants realize from their spillover actions are the same as the savings they realized from installing the same equipment or measures with incentives. That is, because the equipment and measures are similar, it is assumed that the savings are also the same. Participant spillover savings as shown in Table 13 were estimated by imputing to spillover the same amount of weighted net savings for customers who indicated in the survey that they had undertake similar energy efficiency projects at other facilities without receiving financial incentives.

Table 13. Participant Spill Over

Type of assistance	Verified gross savings (GWh per year)	Spill over rate (ratio)	Participant Spill over (GWh per year)
Incentive	249.7	0.170	42.5
Consultative	111.3	0.00	0
Inc and con	152.4	0.308	46.9
Total	513.4	0.174	89.4

Combining the above results, Table 14 presents a summary of the savings analysis. Total net achieved savings were 469.3 GWh per year for the four-year period ending March 2006. Table 5.16 also shows average MW and the results of applying the net ratio of average to peak demand to average MW. The net demand reduction was 64.52 MW.

Table 14. Summary Savings Analysis

	Expected savings (GWh/year)	Achieved net of free riders (GWh/year)	Participant spill over (GWh/year)	Net energy savings achieved (GWh/year)	Average demand (MW)	Net demand achieved (MW)
Incentive	233.7	161.0	42.5	203.5	23.23	27.97
Consultative	117.9	111.3	0	111.3	12.71	15.30
Inc and con	145.8	107.6	46.9	154.6	17.65	21.25
Total	497.3	379.9	89.4	469.3	53.59	64.52

Summary and Conclusions

The BC Hydro Power Smart Partners Industrial Program was launched in April 2002 with the basic concept that the utility's large industrial customers have the most to gain from implementing long-term energy-saving strategies, not just one-time projects. BC Hydro partners with industrial companies and contributes matching funding and other resources for workshops, energy managers, energy studies and capital incentives to help customers overcome barriers to realizing energy savings. The purpose of the study was to conduct a process, market and impact evaluation of the Power Smart Partners Industrial Program. Selected process study results included: (1) the most important source of information on energy efficiency was the utility representative, followed by an architect, engineer, or energy consultant; and (2) the key determinants of energy efficient investments included financial incentives, cost savings, and non-energy benefits. Selected market study results included: (1) the most important end uses in terms of consumption are industrial processes including materials handling, pumps, fans, compressors, and lighting; (2) the share of market captured by energy efficient technologies is generally high for industrial processes and pumps, but is somewhat lower for lighting, fans, pumps and compressors; and (3) the industrial market in British Columbia has been substantially transformed for these technologies: high pressure sodium lamps, metal halide lamps, appropriate pipe sizing, high efficiency motors, and adjustable speed drives. Selected impact study results included: (1) evaluated energy savings were 469.3 GWh per year compared with program estimated savings of 497.3 GWh per year; and (2) evaluated peak savings were 64.5 MW compared with program estimated peak savings of 68.3 MW.

References Consulted

ADM Associates, *Industrial Power Smart Program Milestone Evaluation*, Sacramento, CA, USA, 2007.

Innovolgie, *Industrial Executives' Perspectives*, Rockville, Ill., USA.

BC Hydro, *Conservation Potential Review*, Vancouver, Canada, 2007.

BC Hydro, *Efficient Compressed Air Systems*, Vancouver, Canada, 1991 and updates.

BC Hydro, *High-efficiency Motors*, Vancouver, Canada, 1991 and updates.

BC Hydro, *Pumping Profits*, Vancouver, Canada, 1991 and updates.

Friedman, R., California Industry and Energy Efficiency, *Proceedings of the IEPEC*, 2001.

Industry Canada, *Manufacturing Small to Medium-sized Enterprises*, Ottawa, Canada, 1998.

Jaccard, M. et al., How Big is the Energy Conservation Potential in Industry*?, Energy Journal* 14(2), 1993.

Natural Resources Canada, *Industry Energy End-use Analysis and Conservation Potential*, Ottawa, Canada, 1996.

Natural Resources Canada, *Energy Use Data Handbook*, Ottawa, Canada, 2006.

Statistics Canada, *Report on Energy Supply-Demand in Canada*, Ottawa, 2006.

Quantum Consulting, *National Energy Efficiency Best Practices Study*, Berkeley, USA, 2004.

Statistics Canada, *Report on Energy Supply-Demand in Canada*, Ottawa, 2006.

York, D. and M. Kuschler, *America's Best*, ACEEE, Washington, DC, 2003.