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April 7, 2005

Mr. Robert J. Pellatt
Commission Secretary
British Columbia Utilities Commission
Sixth Floor – 900 Howe Street
Vancouver, BC V6Z 2N3

Dear Mr. Pellatt:

**RE: British Columbia Hydro and Power Authority (BC Hydro)
2004/05 to 2005/06 Revenue Requirements Application
British Columbia Utilities Commission (Commission)
Decision – October 29, 2004
Directive 66 (page 197), Directive 69 (page 201)**

This letter informs the Commission of BC Hydro's compliance with Directive 66, and the first part of Directive 69:

Directive 66: The Commission directs BC Hydro to file the executive summaries of its milestone evaluation reports and the full final evaluation reports of all its Power Smart programs.

Directive 69: BC Hydro is directed to provide information to the Commission for on-going review of Power Smart performance through:

Executive Summaries of milestone evaluation reports and full final evaluation reports for each program.

Attached are milestone evaluation summaries for six energy efficiency demand side management programs that were completed in F2004. These complement milestone evaluation summaries provided in the F2004/05 to F2005/06 Revenue Requirements Application. BC Hydro intends to file with the Commission executive summaries, and full evaluation reports, for each Power Smart program as, and when, each is completed.

BC Hydro continues to work on the semi-annual reports on demand side management activities.

Yours sincerely,


Richard Stout
Chief Regulatory Officer

Enclosure (20)



BC hydro
POWER SMART

**DSM Milestone
Evaluation Summaries
F2004**

FINAL

December 2004

BC Hydro

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1.0 Introduction

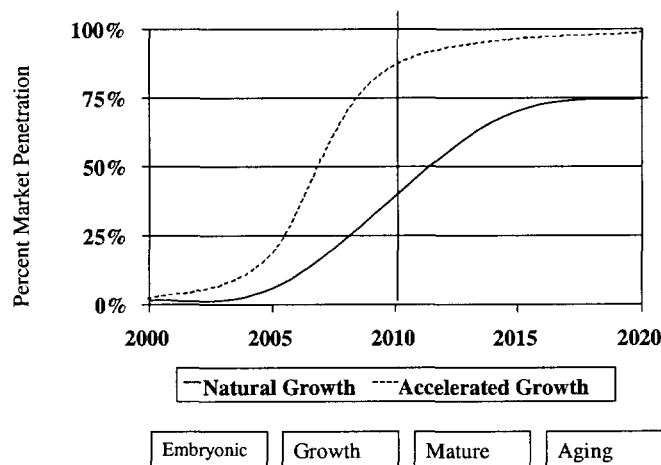
Power Smart was officially launched in March 1989 as a demand-side management (DSM) or energy efficiency initiative designed to encourage customers to use electricity as efficiently as possible and defer the need for new, more expensive power generation projects. The year following its inception, eleven programs were launched and in 1992 an Evaluation department was formed to verify savings and improve operations. By 1995 twenty-five completed evaluation reports were submitted to the BC Utilities Commission (BCUC) and more were underway. Following the completion of the October 1995 evaluation plan, Business Power Smart programs were phased out, and Residential Program investment was curtailed. As a result evaluation activities were suspended.

In late 2000, a small number of new DSM initiatives were launched, and in November 2001 the corporation prepared a new ten-year plan for DSM. As a result of the new emphasis on Power Smart, the Evaluation department was re-established in March 2002. Power Smart programs require verification of energy savings, identification of process improvements, and determination of programs enhancements to ensure customers' needs are met and energy savings are maximized in a cost effective manner.

1.1 Market Barriers

The current generation of Power Smart involves a combination of energy acquisition and market transformation programs. Market transformation programs are designed to accelerate the adoption of energy efficient technologies and practices, resulting in market transformation or lasting change in the structure of the market, such that adoption of energy efficient technologies becomes normal or standard practice. These programs strive to accelerate the natural growth of a technology and can increase overall market size, as depicted in the figure below.

Figure 1.1: Market Transformation on the Technology S-Curve



Programs that provide lasting solutions to market barriers generally address some or all of the following barriers:

- The commercial **availability** of energy efficient technologies;

- **Awareness** of energy efficient technologies (by manufacturers, distributors, retailers, trade allies, customers);
- **Accessibility** of energy efficient technologies (product distribution, stocking, displays, sales team training, educational & promotional information);
- **Affordability** (generally energy efficient technologies are more expensive than standard technologies when introduced to the market place); and
- **Acceptance** by customers and trade allies (if the energy efficient technology provides acceptable service to customers in terms of reliability, ease of installation, operational and maintenance costs).

2.0 Evaluation Purposes and Objectives

Evaluation of energy efficiency programs provides internal and external accountability by (1) reducing uncertainty in the estimates of energy savings, demand savings, and reductions in greenhouse gas emissions attributable to the program, and (2) determining the cost effectiveness of these programs compared to other energy resource options.

Evaluation of DSM or energy efficiency programs involves:

- Measuring program operations and performance objectively and systematically;
- Utilizing social-science and engineering data and methods;
- Estimating actual (achieved) energy and demand savings, and reductions in greenhouse gas emissions attributable to the program;
- Estimating permanent changes to the market penetration of energy efficient technologies attributable to the program; and
- Focusing on future decisions regarding the modification, expansion, or discontinuation of a program or a portfolio of programs.

Evaluations rely on data collected from:

- Program participants and non-participants (interviews, surveys, audits, electrical billing data, end-use metered data, building simulation modeling);
- Trade allies involved in the production, distribution or installation of energy efficient measures (equipment or processes);
- Pre-existing laboratory research and federal, provincial and municipal statistical information;
- Program designers and implementers; and
- Senior management responsible for programs and program results.

3.0 DSM Evaluation Categories

There are three types of DSM evaluations: process, market, and impact. Each of these evaluations have different objectives but address three related questions, as noted below.

3.1 Process Evaluations

“How efficient and effective is program delivery?”

Objectives for process evaluations include:

- Improving program implementation and delivery; and
- Increasing the satisfaction of customers, trade allies, and the utility through quality service delivery.

Areas that could be reviewed during process evaluations are:

- Reviews of incentive and rebate levels;
- Communication and promotional initiatives;
- Program operations and implementation;
- Customer awareness and acceptance (satisfaction) of energy efficient technologies and measures; and
- Trade ally (production, distribution & implementation) awareness and acceptance.

3.2 Market Evaluations

“How effective is the program at increasing the market penetration (market share) of energy efficient technologies and measures?”

Objectives for market evaluations include:

- Measuring increases in market penetration of energy efficient technologies; and
- Determining measures that are directly attributable to the program.

Areas that could be reviewed during market evaluations include:

- Assessments of the market potential and the market penetration over time by reviewing the availability, accessibility, and affordability of energy efficient technologies and measures.

3.3 Impact Evaluations

“What are the energy savings (change in energy consumption and for some programs, demand/capacity and greenhouse gas (GHG) emissions) that are directly attributable to the program?”

Objectives for impact evaluations include:

- Measuring decreases in energy consumption or gross energy savings;
- Estimating energy savings and reductions in GHG emissions directly attributable to the program (net energy savings, energy savings over and above natural change or what would have happened in the absence of the program);

- Determining the cost effectiveness of the program relative to other energy resource options. This involves total resource, utility, rate impact and participant cost/benefit tests.

3.3.1 Quasi-Experimental Design

Impact evaluations measure the quantitative results of programs, the energy and demand effects, and persistence, which are necessary for a cost-effectiveness analysis. With supply side projects, the primary uncertainty usually lies with the cost and timing, rather than with the estimates of energy (kWh) or demand (kW).

With the demand side, however, the greatest uncertainty is in determining the actual load impact. This uncertainty occurs in three general areas:

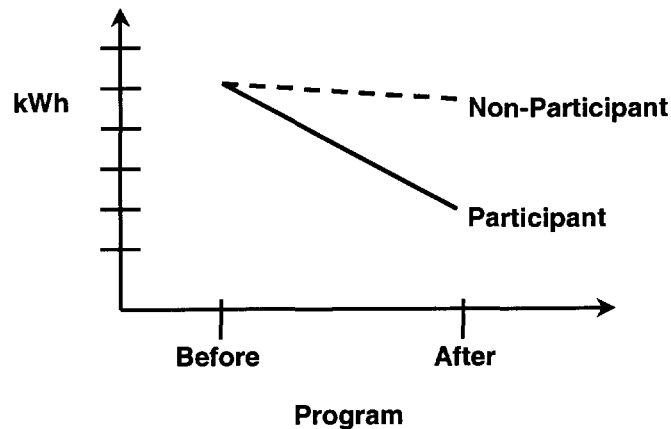
- What would have occurred if there was no program?
- What load impact did the program induce?
- How long will the load impact persist?

The Power Smart evaluation process is designed to address the areas of uncertainty for DSM energy acquisition in a comprehensive and systematic way. Evaluation findings will result in historical program savings being restated, and forward forecasts adjusted. Impact evaluations can use several different methodologies to deal with the attribution of savings and the assessment of the influence of external factors. More than one methodology can be used in the evaluation to measure program impacts, and the results can be compared or used as upper and lower bounds for cost-effectiveness analysis. Multiple lines of evidence must be assembled to assess these complex programs. The methodologies vary with the maturity of the program and the resultant availability of information. To accommodate for weather, economic, and some natural changes in energy usage, a minimum of twelve months consumption history is required after the installation of an energy efficient technology or measure.

The basic objective of the Power Smart programs is to increase the efficient use of energy relative to what would have happened had there been no program. Therefore, for each program or end-use, a projection is required regarding the trends in efficiency improvements occurring naturally in BC. Called the 'status quo' or natural conservation, this projection of natural conservation must be consistent with the load forecast. In order to deal with the issue of measuring what the customer would have done without the program, quasi-experimental design techniques have been adapted from educational, agricultural, medical, and social science research.

The preferred quasi-experimental design to determine energy savings involves pre and post measurements with comparison group(s). This design includes measurement of the energy consumption before (baseline) and after program implementation for participants, which is then compared to the energy consumption before (baseline) and after program implementation of a comparison group of non-participants in the same time period. The change in consumption is compared to the estimated or projected rate of natural conservation or product adoption.

Figure 3.1: Quasi-Experimental Design



The above approach allows for the determination of impact at the evaluation's specific point in time, while accommodating weather differences, economic changes, rate changes and some natural changes in energy use. However, to meet BC Hydro's long-term energy needs, these efficiency improvements must persist over time. Therefore, evaluation also addresses the expected life of the savings. The impact on energy and demand savings, along with the expected life of those savings, is multiplied by the number of participants and the cost. These are then compared to the utility's estimate of the avoided cost of energy for that time frame.

4.0 DSM Evaluation Stages

As the available information and the inherent risks (uncertainty) in energy savings estimates vary over time, it is necessary to have several stages in the evaluation plan of a DSM program. The current plan includes pilot evaluations, process evaluations, market evaluations and impact evaluations. As programs continue to evolve, evaluation staff can build on previous evaluation experience and conduct less formal, more timely assessments based on a mix of techniques appropriate to the technology, market, customer needs, risks to BC Hydro, and available information.

4.1 Pilot Evaluations

Before the launch of province-wide programs, pilot projects are often run on a regional basis or within a specific segment of the market. The purpose of the pilot is to learn more about the technology, the associated savings, and potential program delivery issues in a low risk situation.

Pilot evaluations are usually conducted during and immediately after a pilot project, and generally consist of a process study and an assessment of the energy and demand savings. The process study in the pilot evaluation cannot be as complete as one held twelve months or more after program implementation, but a good deal of information can be obtained, including a preliminary check to determine the potential risks in the energy savings estimates, thereby clarifying the requirements for the full impact evaluation.

4.2 Process Evaluations

Process evaluations are generally conducted six to eighteen months following the program launch and often include a market assessment. Full process evaluations focus on customers, with a secondary focus on the staff/contractors and trade allies.

4.3 Market and Impact Evaluations

Impact and market evaluations are generally conducted twenty-four to thirty-six months after program launch, when sufficient information becomes available. Initially, they focus on savings per unit and hours-of-use, while later impact and market evaluations tend to focus on rated life (hours) of the technology, persistence issues (e.g. early removal, replacement when energy efficient technology fails), and peak coincidence.

Impact evaluations focus on energy savings reported for specific incentive and rebate programs, while market evaluations examine the energy savings reported for a portfolio of programs, including programs designed to increase awareness, educate customers, or help customers identify energy savings opportunities.

5.0 Measurement and Verification (M&V)

Measurement and verification (M&V) allows BC Hydro's Power Smart to be more accountable for the energy savings that arise from its DSM initiatives. It is the process of verifying the results of the implemented energy conservation measures. Subsequently, each Power Smart project must be verified for energy savings.

The following documents form the basis of BC Hydro's M&V efforts:

- The International Performance Measurement & Verification Protocol (IPMVP) (http://www.ipmvp.org/ipmvp_det.html); and
- M&V Guidelines: Measurement and Verification for Federal Energy Projects (FEMP).

The IPMVP and FEMP documents outline four general approaches for verifying savings. Each option has its strengths and weaknesses, and therefore is applicable in differing circumstances, as dictated by the project energy conservation measures. The range of options allows BC Hydro to tailor its M&V effort to appropriately manage the associated risk in terms of allocating resources (e.g. metering equipment, labour), cost, the technology of the energy conservation measure, the amount of the BC Hydro incentive, and the amount of savings.

M&V activities are designed and managed by the PS Technology Solutions department. For instance, at the completion of a project involving Power Smart Partner incentives, the customer provides a signed Installation Document and paid invoices to initiate the second incentive payment of 50%. At this time, Technology Solutions schedules a site inspection to ensure that the project was completed as specified in the Incentive Agreement. The third incentive payment of 25% is initiated when Technology Solutions completes a M&V report (a minimum of 12 months after the retrofit is completed), which verifies the energy savings realized and recommends payment.

6.0 EVALUATION SUMMARIES

The following evaluation profiles are intended to provide an overview of the program, objectives, methodology, findings, and recommendations of the evaluation studies that were undertaken during fiscal 2004. The studies are categorized by sector and end use in the table below.

Table 6.1: List of Evaluation Studies undertaken during 2003/04

RESIDENTIAL
<p>Appliances</p> <ul style="list-style-type: none"> • BC Hydro Energy Star Appliances Impact Report – March 2004 <p>Lighting</p> <ul style="list-style-type: none"> • Evaluation of the Power Smart Residential Compact Fluorescent Lighting Program: Phase II Vancouver Island – March 2004 • Residential CFL Initiatives: Summary Report – March 2004 <p>Retrofits</p> <ul style="list-style-type: none"> • High Efficiency Furnace Blower Motors Market Baseline Assessment – March 2004
COMMERCIAL
<p>Lighting</p> <ul style="list-style-type: none"> • Baseline Research for the CFL Coupon Rebate Program – December 2003 <p>Retrofits</p> <ul style="list-style-type: none"> • e.Points (Old Program) Review & Calibration of Energy Savings Calculation – October 2003

6.1 Energy Star Appliances Impact Report

(Component of New Home Program)

6.1.1 Background and Objectives

The Energy Star Appliance Program encouraged the use of energy efficient appliances through the promotion of Energy Star compliant refrigerators, clothes washers and dishwashers by offering salesperson incentives. The promotion lasted from October 2001 to March 2002 and is anticipated to continue for the next several years in order to reduce growth in energy consumption and peak demand. Habart and Associates Consulting was commissioned to prepare a report on the program as a baseline against which to measure the impact of future promotional activities.

Key Program Dates	
Pilot Launch	October 2001
Pilot Completion	March 2002
Process Evaluation	May 2002
Impact Evaluation	May 2002
Baseline Assessment	March 2004

The study has two main objectives as follows:

- Develop a baseline for sales of Energy Star compliant products in BC Hydro's service territory. In particular, estimate recent historical and projected future trends for sales of refrigerators, clothes washers and dishwashers, including sales of Energy Star compliant products, in a form that can be readily updated over time.
- Capture low cost information for program design and evaluation purposes. In particular, estimate the impact of BC Hydro's Energy Star promotional activities on sales of Energy Star compliant products and on energy savings due to increased sales of Energy Star compliant products.

6.1.2 Methodology

To assess the impact of the program, the following methodologies were used:

- Trend analysis to review trends in energy consumption for refrigerators, clothes washers and dishwashers using data from Natural Resources Canada (NRCAN)
- Ratio analysis of Canadian Appliance Manufacturers Association (CAMA) residential end-use (REUS) surveys to estimate recent historical sales of refrigerators, clothes washers and dishwashers
- Market share analysis of CAMA residential end-use surveys to estimate market share of Energy Star compliant refrigerators, clothes washers and dishwashers
- Regression analysis of CAMA residential end-use surveys to forecast future sales of both total and Energy Star compliant refrigerators, clothes washers and dishwashers
- Engineering algorithms on data from program interviews and literature reviews to evaluate the impact of BC Hydro's promotional program on sales of Energy Star compliant appliances and electricity consumption

6.1.3 Findings

- *Trends in Energy Consumption:* A substantial reduction in the energy consumption of major household appliances was found over the 1990s. Average annual energy consumption from 1990 to 2000 fell from 956 to 640 kWh per year for refrigerators, from 1218 to 838 kWh per year for clothes washers and from 1026 to 637 kWh per year for dishwashers.
- *Sales of Appliances:* Based on the adjusted Residential End Use Survey data, quarterly sales for total refrigerators and clothes washers appear to be growing, with

seasonal patterns peaking in the fourth quarter for refrigerators and in the first quarter for clothes washers. Sales of Energy Star refrigerators followed the trend of total refrigerator sales. Energy Star clothes washer sales, on the other hand, have followed a more erratic pattern than that of all clothes washers, maintaining steady growth but with a shift of peak sales quarters.

- **Market Share of Energy Star Appliances:** Regressions developed based on the 2002 retailer survey and the Energy Star market data reveal that Energy Star appliances are expected to have a larger market share by the end of 2006, with refrigerators increasing to about 90% of the retail market and 73% of the total market, clothes washers to 57% of the retail market and 50% of the total market, and dishwashers to 85% of the retail market and 75% of the total market. The rapid increase of Energy Star refrigerators in 2003 was also noted, reflecting the introduction of new models in the popular 17 to 19 cubic foot sizes.
- **Baseline Forecast Sales:** Using the preferred maximum likelihood estimates, baseline sales are forecasted to increase from about 21,100 in 2004:Q1 to about 26,300 in 2006:Q4 for total refrigerators, from 10,100 to 23,500 for Energy Star refrigerators, from 17,000 to 19,500 for total clothes washers and from 6,400 to 11,000 for Energy Star dishwashers.
- **Program Impact:** According to econometric models, there was an increase in sales of Energy Star compliant appliances during the period of the salesperson incentives and promotion.

Table 6.2: Program Impact on Sales

	Refrigerato r	Clothes Washer	Dishwashe r	Total
Sales (units)	542	550	0	1092

Table 6.3: Program Impact on Energy Savings

	Refrigerato r	Clothes Washer	Dishwashe r	Total
Unit electricity savings (kWh)	102	199	42	-
Unit gas savings (kWh)	-	195	21	-
Incremental units	542	550	-	1092
Electricity savings (MWh)	55.3	109.5	-	164.8
Gas savings (MWh)	-	107.3	-	107.3
Total savings (MWh)	55.3	216.8	-	272.1

Savings are estimated as the product of average consumption for new appliances times incremental savings for Energy Star qualifying products times program savings.

- **Salesperson Incentives:** The only major program difference between the dishwasher and the other two appliances was the lack of salesperson incentives. Given that no measurable increase in dishwasher sales over the period of the promotion was

recorded while there was for the other two appliances, this is an indication of the effectiveness of the salesperson incentive.

6.1.4 Recommendations

1. Recalibrate the Energy Star appliance shares against the CAMA Energy Star data as it becomes available.
2. Consider the econometric approach of using interrupted time series analysis when evaluating other projects. While this does not cover the issue of attribution, it eliminates the issues of free riders and free drivers.
3. Use the recently available CAMA quarterly Energy Star data, available for BC and for a number of other regions across Canada, as it can provide a powerful basis for the analysis of any future promotions. It can also be combined with statistical techniques such as "Seemingly Unrelated Regressions" (SUR) to allow program impact estimation at a reasonable cost.
4. Include the savings in natural gas usage for heating in the total resource cost test. Further, to the extent that GHG reductions are included in the program evaluation, the GHG impacts for reduced burning of natural gas should be included.
5. Continue the data collection of quarterly appliance purchases and Energy Star statistics in the bi-annual REUS surveys. Consideration should be given to expanding the definition of Energy Star ratings to explain that it differs from the EnerGuide label.
6. Investigate the level of Energy Star sales in builder sector. It is expected that the penetration in this sector will be much lower than the retail sector and may provide an opportunity for a cost-effective program.

Halbart & Associates Consulting Inc. completed this baseline assessment and impact report in March 2004.

6.2 Residential Compact Fluorescent Lighting Program

6.2.1 Background and Objectives

The Power Smart Residential Compact Fluorescent Lighting (CFL) Program is an electricity acquisition and market transformation program. From October 2002 to March 2003, Power Smart rolled out the CFL Program involving bulk purchases of compact fluorescent light bulbs (CFLs) and, in partnership with retailers, distributed two free CFLs to utility customers on Vancouver Island (phase II). The campaign included direct mail, regular publicity on local radio stations and in local newspapers, point-of-sale materials, and inclusion in retail flyers. This followed a pilot program (phase I) in two small communities: Courtenay, Comox Valley and Quesnel (CCQ), which was deemed a success. The program has since been expanded to the Lower Mainland (phase III) and to the rest of the province (phase IV).

Key Program Dates	
CCQ Offer Launch	March 2002
CCQ Offer Completion	May 2002
Vancouver Island Offer Launch	October 2002
Vancouver Island Offer Completion	March 2003
Lower Mainland Offer Launch	October 2003
Lower Mainland Offer Completion	March 2004
Evaluation – Vancouver Island	March 2004
Market Assessment	March 2004
Northern & Southern Offer Launch	June 2004
Northern & Southern Offer Completion	August 2004

The objectives of this evaluation are to:

- assess phase II awareness and acceptance levels for CFLs; and,
- determine the direct energy and demand savings associated with the phase II Vancouver Island CFL program

Indirect or market effects are examined separately in the succeeding report.¹

6.2.2 Methodology

The evaluation used a cross-sectional quasi-experimental time-series design involving surveys of residential customers at two different points in time with participants, and most recently, with non-participants as well. In addition, as a baseline, 133 residential customers on Vancouver Island were surveyed in 2002 before the program was launched. The table below indicates the samples for the residential telephone surveys conducted in 2002 and 2003.

Table6.4: Residential Survey Samples

	June 2002 ¹	June 2003 ²	November 2003 ³
Baseline	133		
Participants		600	302
Non Participants		0	302
Total		600	604

¹ Sampson Research. *Market Effects of BC Hydro's Residential CFL Initiative*. March 2004. (see page 15)

Source:¹Marktrend, June 2002 (Vancouver Island region only)

² Pollara, June 2003 ³ Pollara, December 2003

6.2.3 Findings

- The initiative achieved increased awareness of CFLs from 70% (baseline) to 88% in approximately eight months to one year after the program.
- Overall satisfaction with CFLs was also relatively high for participants (average rating of approximately 4 out of 5).
- The initiative on Vancouver Island was responsible for distribution of 289,446 CFLs, in addition to a further 33,357 CFLs purchased by consumers with a discount coupon. Calculation of the evaluated energy and demand savings for the initiative involved re-calibration of engineering estimates based on data and information collected during the evaluation, as well as on program tracking.
- The initiative achieved cumulative run rate savings of 19.36 GWh/year as of March 2004 and 6.05 MW for the fiscal year. These findings for energy savings are 24% higher than original program estimates.
- The Vancouver Island program results indicate that bulk purchase and distribution of free CFLs by BC Hydro can accelerate transformation of the CFL market in BC.

6.2.4 Recommendations

1. Improve estimates of persistence, hours of use and peak coincidence through time-of-use metering of installed CFLs (by use areas within the household) and through medium and long-term verification of installation and use (small samples).
2. Incorporate research studies on cross-effects of CFLs in future evaluations.
3. Adjust program savings to reflect the evaluated direct energy and demand savings.
4. Include evaluated estimates of algorithm variables in planning documents for future phases of CFL give-aways, except where program modifications would result in more conservative estimates.
5. Examine and verify customer account data early in the planning process for future phases to ensure a more accurate estimate of market size.
6. Continue phased efforts to promote CFLs and transform the market through bulk purchases and distribution of CFLs to utility customers.

6.2.5 Program Manager's Response

- Savings estimates for the Vancouver Island phase of the program will be adjusted to reflect evaluation savings.

- Findings from this evaluation will be adopted for current and future phases of the program, where appropriate, to reflect a more conservative savings estimate and thereby reduce risk to BC Hydro.
- Reported savings from previously evaluated CFL programs such as CCQ phase and CFL Multifamily programs will be downgraded to include a factor for cross-effects. The same approach to estimating cross-effects outlined in the evaluation will be used. The percentage of electrically heated homes will be adjusted accordingly based on market data.
- Once finalised, Residential Marketing will provide the Evaluation team with the results of its third-party experiment investigating the impact of cross-effects from lighting on the heating system.
- Hours of use and peak demand results from Evaluation's upcoming time-of-use metering results will be incorporated into future program estimates as appropriate.

This evaluation and report was prepared by Diane Fielding in March 2004.

6.3 Market Effects of BC Hydro's Residential CFL Initiatives

6.3.1 Background and Objectives

Over the past several years, BC Hydro's Power Smart has promoted and encouraged the use of screw-based integrated CFLs by conducting CFL initiatives. These have included promotional and awareness building campaigns, home show giveaways, a pilot program with the communities of Courtenay-Comox and Quesnel, and broad-based initiatives (CFL giveaways and coupons) on Vancouver Island, the Lower Mainland, South Interior and Northern regions. Sampson Research was commissioned to conduct a study on the market effects directly attributable to these CFL initiatives conducted during fiscal years 2001-02, 2002-03, and the first ten months of 2003-04.

Key Program Dates	
CCQ Offer Launch	March 2002
CCQ Offer Completion	May 2002
Vancouver Island Offer Launch	October 2002
Vancouver Island Offer Completion	March 2003
Lower Mainland Offer Launch	October 2003
Lower Mainland Offer Completion	March 2004
Evaluation - Vancouver Island	March 2004
Market Assessment	March 2004
Northern & Southern Offer Launch	June 2004
Northern & Southern Offer Completion	August 2004

The objectives of this report are to:

- Assess the degree to which the availability, accessibility, affordability, awareness and acceptance of CFL technology have changed over the past three years
- Determine the size of the market effect attributable to BC Hydro's CFL programming.

6.3.2 Methodology

To characterize market and baseline conditions, the following data-gathering techniques were used:

- an in-store survey of residential lighting displays with 55 stores across BC Hydro's service territory
- a telephone survey of 802 BC Hydro residential customers.

Information collected was compared to the baseline study conducted in 2002 (XENERGY 2002) and to two previous telephone surveys conducted in 2002 and 2003.

6.3.3 Findings

6.3.3.1 Supply-Side Assessment

- CFLs now occupy 8.9% of total household lighting shelf space, up from 6.1% in September 2002.
- Comparable increases in relative market share were observed in the South Interior and Northern regions despite limited BC Hydro CFL programming in these areas.
- The majority of the increase in total shelf space for CFLs has been stocked with spiral CFL product. Spiral CFLs now represent 54% of all CFLs for sale, up from 22% in 2002.
- Blister packs containing two, three and four CFLs account for an estimated 52% of all CFLs for sale.
- Over 170 different CFL models are now available, an increase of 92% since 2002.
- CFLs rated at 6,000 and 10,000 hours account for nine out of every ten CFLs for sale. Since 2002, there has been a modest shift to 6,000 hour product.
- Products priced at \$6 or less account for 48% of all CFLs for sale. The majority of CFL products (84%) are priced below \$10 per bulb.
- CFL purchase costs amortized over the life of the lamp have declined by as much as 76% since September 2002.

6.3.3.2 Demand-Side Assessment

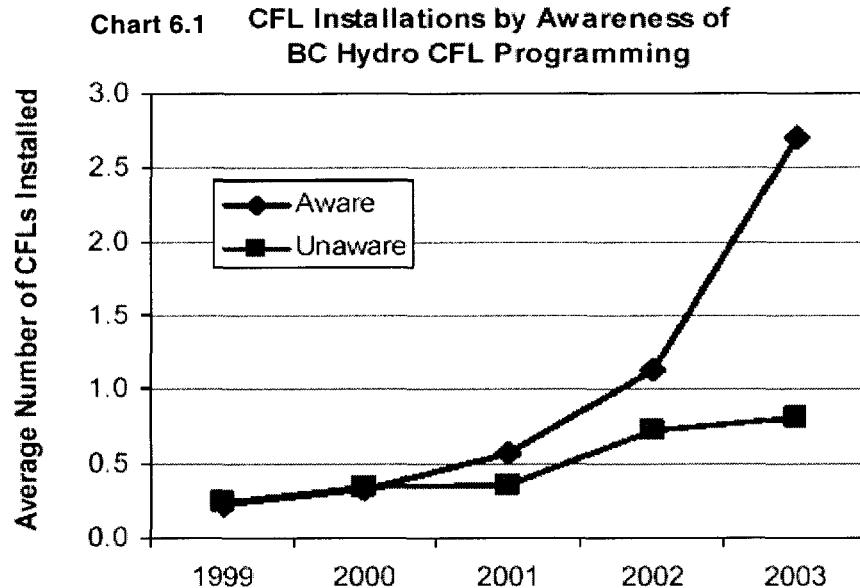
- Awareness of CFL technology is now at 90%, up from 83% in May 2003 and 74% in May 2002.
- The percentage of households that recall information, advertising or promotions regarding CFLs from BC Hydro has increased from 22% to 65% since 2002. Recall is the highest in the Lower Mainland (71%) and on

Vancouver Island (76%), and lowest in the South Interior (42%) and Northern (37%) regions.

- The percentage of homes using CFLs has increased from 23% in May 2002 to 55% in January 2004.
- Households using CFLs have installed an average of 5.2 CFLs each, an increase of 53% since May 2002.
- An estimated 4.2 million CFLs are installed in BC Hydro customer homes, up from 1.1 million in 2002. Sixty-four percent of all CFLs currently in use were installed in the past year.
- Thirty-seven percent of all BC Hydro residential customers have received a free bulb from BC Hydro.
- Nearly four out of every ten households (39%) who acquired a free CFL went on to purchase additional CFLs. While most purchasers in the Lower Mainland acquired four additional CFLs each, a number of households purchased quantities of 15 and 20 CFLs each.
- The proportion of BC Hydro sponsored CFLs eventually installed for Vancouver Island residents varied from 76% to 100% depending on the out-of-pocket expense of acquiring the CFL product.
- As of mid-January 2004, Lower Mainland residents had installed 68% of all CFLs acquired through BC Hydro initiatives (giveaways or BC Hydro coupons).

6.3.3.3 Market Effects

- Energy savings attributable to BC Hydro's market effect as of January 2004, are estimated at 46.8 GWh per year.
- Peak demand savings are estimated at 19.5 MW.
- Total energy savings achieved to January 2004 are estimated at 61.3 GWh.



6.3.4 Recommendations

6.3.4.1 Program Issues and Recommendations

1. **Review and adjust program planning estimates, since high levels of CFL awareness and use, combined with a significant reduction in the price barrier for CFL products, may result in a larger proportion of free riders than experienced in regions.**
2. Continue BC Hydro's efforts to educate consumers on the optimum areas and uses for CFLs.
3. Continue to encourage participants to install their CFL product for at least six months following completion of any program phase.

6.3.4.2 Evaluation Issues and Recommendations

1. Implement a one-year follow-up shelf-space survey to assess the degree of change and to monitor persistence of supply-side developments, given the rapid pace of change in the CFL market occurring in the retail CFL market.

2. Consider conducting a survey of retail CFL products, accompanied by interviews with wholesalers and other market players, in a region outside of BC Hydro service territory.
3. Periodically update estimates on energy and peak demand savings, incorporating updated statistics on program activity and updated estimates of installation rates, hours-of-use, incremental purchase behaviours and persistence. This is due to the fact that energy and peak demand savings from this analysis do not capture market effects extending beyond January 2004. The evaluation unit should use this information to develop a forecast of the market effect as it diffuses over time.
4. Seek to quantify the persistence of market and program effects in future surveys of residential customers.
5. Augment future market effects surveys with questions that allow for the estimation of installation percentages for free and purchased CFLs at one, three, six and twelve month intervals. This would improve the accuracy of run rates used to distribute energy savings by month and fiscal year.

6.3.5 Program Manager's Response

- Residential Marketing supports the findings presented in this evaluation with the exception of one assumption. Future evaluation methodologies must be designed to quantify the benefit derived by the program for unaware customers, who in this evaluation are assumed to be part of the baseline and not impacted by the program's efforts.
- The evaluation findings of 56.2 GWh for fiscal 2003/04 will be reported as market effects in the CFL program. Revised savings estimates of 3.7 GWh for 2001/02 and 10.8 GWh for 2002/03 will be reported in the CFL program as market effects in the appropriate fiscal years.
- Residential Marketing will consider decreasing hours of use estimates and increasing free rider estimates for savings estimates in future phases of the program where appropriate.
- The customer communication around the importance of installing CFLs will continue until the end of the Lower Mainland CFL campaign and ramp up again in approximately 6-7 months after the end of that phase. The install message will also be included in the advertising strategy for the Southern and Northern Interior phase of the program.

Sampson Research completed this market assessment. Research efforts began in November 2003, concluding in the final report on March 2004.

6.4 High Efficiency Furnace Blower Motors Market Baseline Assessment

6.4.1 Background and Objectives

To further understand the issues surrounding the furnace market and the more efficient variable speed motors (VSMs), BC Hydro partnered with Terasen Gas to offer an incentive program for energy efficient furnace fan motors in high efficiency furnaces for

the retrofit market. This program operated between September and December 2003 and appears to have been successful, with over 50% of the furnaces installed through the program including a VSM.

Key Program Dates	
Pilot Launch	September 2003
Pilot Completion	December 2003
Baseline Assessment	March 2004

The objectives of this study are:

- To understand the current market penetration of high efficiency furnace blower motors in new gas-fired and electric forced air furnace installations (either as complete furnace replacements in existing homes or as new furnace installations in new homes) in residential dwellings.
- To determine how the consumer decision process can be influenced in favour of high efficiency furnace blower motors.

6.4.2 Methodology

Information for this assessment was gathered from a range of primary research, secondary research and survey of industry representatives through a telephone interview and structured survey process. Specific groups targeted in the survey included:

- Motor and appliance manufacturers
- Furnace distributors
- Heating contractors
- Developers and homebuilders

6.4.3 Findings

- There is a growing trend towards installation of furnaces equipped with Direct Current Permanent Magnet (DCPM) motors. Current market share is estimated at 24% and is projected to increase to 36% in the next two years and to 58% over the next five years. Based on the industry estimate of growth in the DCPM market, electricity savings of 84 GWh per year is projected for 2015.

Table 6.5 Savings Potential of DCPM Motors

Year	New Energy Savings [GWh]	Retrofit Energy Savings [GWh]	Total Energy Savings [GWh]	Peak Demand Savings [MW]
2004	10	5	15	1
2009	47	20	67	4
2015	66	18	84	5

- In new housing, 45% of installations run furnace fans as the principal ventilation fan. A further 25% to 30% of homes run the furnace fans continuously. For new construction, the largest potential savings are for DCPM motors that include ventilation usage, followed by those used for continuous ventilation.
- It is estimated that furnaces are being set to run continuously in 30% of the installations in the retrofit market; thus, the most significant savings opportunities for DCPM motors in this market are for continuous ventilation.
- Current incremental costs of DCPM motors approach \$100 (for a two-stage furnace equipped with a DCPM motor). The cost-effectiveness of installing the units depends on how the furnaces are being run and is at its peak if the fan is being run continuously. If the incremental cost drops to \$750, then it is cost-effective to address the use of furnace fans as the principal ventilation fan in new construction.

6.4.4 Recommendations

1. Encourage builders to provide optional heating packages which include DCPM equipped furnaces to capture the market for DCPM motors in the new market.
2. Continue to work with Terasen Gas through the incentive program to capture the market for DCPM motors in the retrofit market to the extent that it is cost effective.
3. Support both new and retrofit programs with a strong educational component for consumers.
4. Work within ongoing initiatives related to updating energy efficiency of furnace fan motors to provide a regulatory backstop as part of a larger market transformation strategy. These include the BC Ministry of Energy Mines' current review of its standards and the Canadian Electricity Association's (CEA) current drafts on (a) the standard 832-XX dealing with domestic furnace blowers and (b) the standard on test methods for measuring the Annual Fuel Utilization Efficiency (AFUE) of residential furnaces and boilers.

The Sheltair Group, in association with Halbart & Associates Consulting Inc., completed this market baseline assessment in March 2004.

6.5 Baseline Research for the CFL Coupon Rebate Program for Small Business Customers

6.5.1 Background and Objectives

Since Spring 2001, BC Hydro has featured CFLs heavily in Power Smart promotional messages targeted at residential consumers. While past promotions have not targeted the small business sector, BC Hydro recently introduced a CFL coupon rebate program targeted specifically at Tier 3 and Tier 4 businesses in January 2004. The program is intended to motivate small business customers to obtain the best long term value from their choice of lighting and to shift customer behaviour and the lighting market so that efficient usage becomes a way of life. Coupons and educational materials are distributed to customers to encourage the adoption of CFLs and to inform customers of their benefits.

Key Program Dates	
Baseline Assessment	December 2003
Campaign Launch	January 2004
Campaign Completion	August 2004

The purpose of this study is to provide baseline information that will assist in conducting a future assessment of the impact of promotional programs targeted at the small business sector. More specifically, the objectives of the study are to:

- Develop a profile of the small business segment served by BC Hydro
- Determine the current level of market penetration of CFLs within this segment
- Provide information that may be useful in developing and assessing energy-efficiency programs targeted at the small business segment.

6.5.2 Methodology

The study involved two related surveys.

- Primary survey: conducted with a sample of 600 small and medium sized businesses, including 200 BC Hydro customers from each of the Lower Mainland, Vancouver Island, and the Interior. These interviews were conducted in October before the recent residential campaign was implemented in the Lower Mainland.
- Secondary survey: consisted of interviews with 75 businesses located in the Lower Mainland to provide a stronger basis for interpreting the results of the larger-scale primary survey.

6.5.3 Findings

6.5.3.1 Characteristics of Tier 3 and 4 Businesses

- Tier 3 and Tier 4 businesses are drawn from a wide range of sectors, with the retailer and accommodation & food services sectors accounting for almost one-half.
- Over three-quarters of the businesses employ nine or fewer people and one-half have been located in their currently facility for more than 10 years.
- Most of the premises are less than 2,000 square feet in size (55%) and are heated by natural gas (56%). Less than one-third of businesses (32%) own their premises.
- Most businesses (92%) open and close at the same time each day during the week (most commonly operating from about 9:00 to 5:00). On average, the businesses are open 10 hours per day, of which about 12% occurs between 5:00 PM and 9:00 PM.
- Most lights are on when the business is open (87%) and most lights are off when the business is closed (87%).

6.5.3.2 *Use of CFLs*

- Most small business do not perceive that electricity costs have a major impact on profitability and do not place a major emphasis on energy-efficiency in the purchase of their fixtures or bulbs.
- Almost three-quarters of small businesses (74%) are aware of CFLs and this percentage likely increased with the recent promotion in the Lower Mainland.
- While awareness of CFLs is high, fewer than one in five businesses (18%) have installed CFLs at their premises. Perceptions regarding the cost, brightness, and size of the bulbs are cited as the major constraints to adoption. Constraints related to characteristics of the bulbs are identified more frequently by non-users than users, suggesting that these issues may relate more to perceptions of the product than to true product characteristics.
- Satisfaction with the CFLs that have been installed is high, reflecting the long life, energy efficiency and resulting cost savings of the bulbs.
- An average of 2.4 CFLs are installed per premise surveyed, of which most are installed in areas where customers are normally served and in washrooms, storage areas and other areas. The average number of CFL bulbs installed at these businesses is estimated to have increased from 2.1 CFLs at the beginning of 2003 and will increase to 2.7 in 2004.
- CFLs bulbs are installed in about 14% of the screw-based lighting (e.g. excluding fluorescent tubes) in the premises surveyed, with the penetration rates tending to be higher in the areas normally reserved for staff and in washrooms, storage areas and hallways. Penetration rates tend to be lowest amongst outdoor lighting. Most of the remaining screw-based light fixtures contain conventional incandescent bulbs.
- About 10% of the screw-based bulbs are on a dimmer and 5% are on a timer.
- Most of the CFLs installed so far this year (an average of 0.7 bulbs per premises) were purchased at full price.

6.5.3.3 *Drivers of Future Sales*

Three drivers of future sales are uncovered:

- Rate at which non-users try the product;
- Rate at which existing users install new CFLs to replace existing CFL bulbs that have burned-out;
- Rate at which existing users increase the number of applications in their business by replacing other types of bulbs with CFLs and using CFLs in new fixtures.

Of the three drivers, replacement of burned-out CFLs has been the largest contributor accounting for 45% of CFL sales in the year 2003. Thirty-three percent of bulbs were installed by existing users in new fixtures or to replace other types of bulbs, and 22% of the CFLs were installed by new users.

6.5.4 Recommendations

1. Offer rebates and coupons to induce trial and enable people to become more familiar with the product.
2. Explore other options for inducing CFL use in business premises. Most respondents who are aware of CFLs expect that they would redeem a coupon for a free CFL (the average probability was 64%). However, if redeemed, there is only a 44% probability that the bulbs would be installed at the business premises rather than at another location.
3. Provide strong consumer education programs to both create awareness of and reinforce the key product benefits in the minds of existing and potential users. These should focus on CFLs' long operating life, eventual cost savings and on the wide range of CFL applications.

This report was prepared by Ference Weicker & Company for BC Hydro Research Services. Research efforts began in September 2003; the report was finalised in December 2003.

6.6 E-Points (Old Program) Review & Calibration of Energy Savings Calculation

(Component of Power Smart Partners)

6.6.1 Background and Objectives

A pilot project, the e-Points (Old) program rewarded the effort and commitment that eligible business customers² made to energy management during their one-year earning period on the program. When participating customers saved at least 3% on their annual electricity bill (dollar savings), they were rewarded with e-Points to match the value of the dollar savings. Participating customers have twelve months to redeem their accumulated e-Points, which can be used to fund capital investments in Power Smart approved energy efficiency solutions.

Key Program Dates	
Pilot Program Launch	July 2001
Pilot Program Completion	November 2002
Impact Evaluation	February 2003
Process Evaluation	October 2003

BC Hydro is the first to introduce a customer loyalty/reward program within the utility energy efficiency industry, and such innovation presents a number of challenges in terms of reporting and evaluation of energy savings attributable. This report aims to review the energy savings calculations presented by previous reports³.

² To be eligible for the e-Points (Old) program the customer had to consume a minimum of \$ 300,000 (CAD) worth of electricity annually.

³ Grant Thornton. *Estimating Electricity Savings Arising from Participation in BC Hydro's e-Points Program*. February 2003.

6.6.2 Methodology

To estimate the electricity savings that an individual customer realizes through its participation in an energy conservation program, the following methods were used:

- obtaining customers' monthly historical electricity consumption and monthly historical weather data on an account level
- application of a statistical regression equation on pre-enrolment data to determine the accuracy of the model with actual post-enrolment electricity consumption
- if found to adequately model the electricity consumption, the regression was used to project what the customer's post-enrolment electricity consumption would have been in the absence of the program; and
- comparison of projected with actual post-enrolment electricity consumption data.

Telephone interviews with 40 randomly selected participants and detailed 'walk-through' audits of 10/40 of the participant facilities were also performed to obtain information regarding facility specific increases/decreases to the electrical load. Unfortunately, these yielded biased results when a ratio estimation approach was applied and was therefore not pursued.

6.6.3 Findings

- Annual gross energy savings for all 2,231 participants were estimated to be 53.2 GWh/year
- Average annual gross energy savings per account was 23,853 kWh/year or 1.5% of the total annual consumption of participating accounts.
- Evaluated gross energy savings for all participants include energy savings due to:
 - hard-wired retrofit projects provided monetary support by the PS Partners Incentive programs (8.1 GWh/year);
 - hard-wired retrofit projects implemented independently by the customer (consultative energy savings, 8.1 GWh/year); and
 - the remaining energy savings, attributed to behavioural, operational and maintenance (BOM) activities (BOM energy savings, 37.1 GWh/year).
- BOM and consultative gross energy savings of 45.2 GWh/year are presumably due to the ongoing interaction between Power Smart Key Account Managers and customers, and are therefore attributable to the e-Points (Old) pilot project. Average annual gross energy savings attributable to the pilot project were 20,260 kWh/year per participating account or 1.3% of the total annual consumption of participating accounts.
- To approximate net energy savings, gross BOM/Consultative energy savings attributed to the program (45.2 GWh/year) were discounted by 12% (5.4 GWh/year) to account for free riders. Attributed net energy savings for the e-Points (Old) program are 39.8 GWh/year, or 55% of the 71.8 GWh energy savings reported by the e-Points (Old) program. Average annual net energy savings per participating account

were 17,840 kWh/year or 1.1% of the total annual consumption of participating accounts.

6.6.4 Recommendations and Management Responses

1. Adjust reported energy savings for the e-Points (Old) program by replacing the 71.8 GWh with the estimates based on 39.8 GWh net (BOM & consultative) energy savings, or 17,840 kWh per participating account.

Program Manager's Response:

Dennis Nelson was notified of the need to recast the BOM savings claimed by e-Points.

2. Examine reported energy savings for the PS Partners Incentive programs to determine how to treat the 8.1 GWh in consultative gross energy savings and/or the appropriate net consultative energy savings and to ensure that energy savings are not being double counted.

Program Manager's Response:

A meeting involving Quality Assurance, Marketing, Technology Solutions and Sales was held to initiate the process of determining the best way to address consultative savings. Reporting and tracking of consultative energy savings will ensure double counting does not occur and that resources are not needlessly wasted verifying consultative projects if they will not be claimed once Power Smart net savings are calculated. Recommendation 2 will be implemented by the end of October.

3. Deem 1.1% of the monthly-normalised consumption of participating accounts net energy savings for the e-Points Bonus Award commercial/institutional and industrial programs.

Program Manager's Response:

As of October 31, monthly BOM Savings, since the start of the fiscal year, are calculated based on the noted formula below.

Monthly BOM Savings = Annual Baseline kWh consumption of all customers on e-Points Bonus for the month multiplied by 1.1% divided by 12 months

4. Investigate the cost to evaluate net energy savings for the e-Points Bonus Award program utilising samples of participating and non-participating **commercial/institutional** customers and the **industrial** e-Points Bonus Award program.

Program Manager's Response:

Program and staff will provide support for Evaluation to implement this recommendation.

Iris Sulyma of BC Hydro prepared this report in October 2003.

7.0 DSM Evaluation Plan Summary

	Program Launch Date	Program Completion Date	Major Evaluations				
			2002/03	2003/04	2004/05	2005/06	2006/07
RESIDENTIAL							
Compact Fluorescent Lighting (CFL)							
Courtenay-Comox and Quesnel (CCQ)	March 2002	May 2002	Process Impact				
Multifamily (Closed)	July 2002	August 2002	Process Impact				
Vancouver Island	October 2002	March 2003	Process Impact	Impact			Market
Lower Mainland	October 2003	March 2004			Impact	Impact Market	Market
Northern & Southern Interior	June 2004	August 2004				Impact	Market
New Home Program	September 2003						Process Impact Market
Refrigerator Buy-Back (RBB) Program							
Courtenay-Comox and Quesnel (CCQ)	March 2002	May 2002	Process Impact				
Vancouver Island	October 2002	March 2003					
Province-wide	September 2003				Impact		
Renovation Rebate Program (HEU)							
Courtenay-Comox and Quesnel (CCQ) - HEA	March 2002	May 2002	Process Impact				
Vancouver Island - HEU	October 2002	March 2003					
Province-wide - RRP	October 2003						Process & Impact
Seasonal Light Emitting Diode (SLED)							
Baseline	November 2002	December 2002	Baseline				
Year 1	November 2003	December 2003		Market			
Year 2	November 2004	December 2004			Market	Market	
Variable Speed Furnace Blower Motors Program	September 2003	December 2003'		Market			
COMMERCIAL							
Commercial and Government Power Smart Partners	April 2002		Process	Process	Impact	Impact Market	
Product Incentive Program (PIP)	November 2003	March 2006			Process Baseline	Impact	Market
Colleges and Hospitals (SUCH)	April 2002						
Small Business CFL	January 2004	March 2004			Impact		
Traffic Light Program (TLP)	April 2001	March 2004			Process Impact		Market
High Performance Buildings	March 2005	--			Baseline	Process	
INDUSTRIAL							
Industrial Power Smart Partners (& Load Displacement) Program	April 2002					Process Impact	

APPENDIX A: CHRONOLOGICAL LIST OF EVALUATION PUBLICATIONS

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