

Tony Morris
Acting Chief Regulatory Officer
Phone: (604) 623-4046
Fax: (604) 623-4407

December 8, 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) and Directive 69 (page 201)**

In compliance with Directive 66 which states:

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.

and

the first part of 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

please find attached the milestone evaluation report "Market & Impact Evaluation of BC Hydro's Seasonal LED Initiative – Executive Summary" dated July 28, 2005.

Yours sincerely,



Tony Morris
Acting Chief Regulatory Officer

Enclosure (1)

**SAMPSON
RESEARCH**

Consulting Project

**MARKET & IMPACT EVALUATION OF
BC HYDRO'S SEASONAL LED INITIATIVE**

EXECUTIVE SUMMARY

Prepared for:

**Customer Care and Power Smart
BC Hydro
Burnaby, British Columbia**

By:

Sampson Research

July 28, 2005

Suite 306, 1465 Comox Street
Vancouver, British Columbia
Canada
V6G 1N9
Phone: 604.809.0382
Email: jsampson@sampsonresearch.com
www.sampsonresearch.com

Executive Summary

This evaluation assessed the direct and indirect energy and peak demand savings attributable to BC Hydro's 2004 residential seasonal Light Emitting Diode (LED) initiative. Direct effects include the savings achieved via purchases of seasonal LEDs using a BC Hydro co-sponsored rebate coupon, and spillover purchases directly related to participation in BC Hydro's seasonal LED initiative. Direct effects exclude free riders – those participants that would have purchased seasonal LEDs without an incentive. Indirect effects refer to the market transformation effect of BC Hydro's overall seasonal LED programming (market effects). Market effects capture energy and demand savings from seasonal LED sales that occurred because of BC Hydro-influenced improvements in the awareness, availability, accessibility, acceptance, and affordability of seasonal LEDs.

Energy and demand savings for both direct and market effects arise from consumers using their newly purchased seasonal LED lighting to displace lesser efficient seasonal lighting products. The direct and market effects are additive but reported separately.

The evaluation used information and data from quantitative research conducted by BC Hydro over the 2002-2005 period including annual shelf-space studies of seasonal lighting products, annual surveys of seasonal lighting use and purchase behaviours of BC Hydro residential customers, and a comparison group survey of seasonal lighting use. Interviews with market agents (retailers, wholesalers and distributors), program management, and a review of seasonal LED initiatives in Canada and the United States provided qualitative evidence to evaluate the market transformation effect attributable to BC Hydro.

E.1 Key Findings

E.1.1 Supply-Side Assessment

Compared to the baseline study conducted in 2002 (Sampson Research 2003a), there have been significant improvements in the availability, accessibility, and affordability of seasonal LEDs sold in British Columbia.

Key supply-side findings:

- The accessibility of seasonal LED lights has increased significantly since 2002, accounting for 13.1% of all linear shelf space allocated to seasonal lights in 2004, up from 4.2% in 2003, and 0.2% in 2002. The increase in seasonal LED market share has come primarily at the expense of shelf space allocated to mini-light strings and variations.
- The availability (quantity and variety) of seasonal LED product has improved. Seasonal LEDs are now sold in a variety of LED lens shapes. Variations (e.g., garlands) using LEDs were also available for the first time in 2004. Eleven LED brands were found on store shelves in 2004, up from six in 2003, and one in 2002.
- Affordability of seasonal LED strings has improved. Compared to 2003, average prices for 35 and 75 LED strings declined by 5.6% and 11.4% respectively.
- Supply-side agents gave partial credit to BC Hydro for helping raise awareness of seasonal LED product. While market agents argued the decision to carry and promote seasonal LED product was theirs, resistance to the product was clearly apparent among many of the same retailers and distributors during interviews conducted as part of the 2002 baseline study.
- Market agents expect sales of seasonal LEDs to increase between 20% to 50% nationwide in 2005. They expect sales growth to moderate somewhat in 2006 and 2007.
- There is limited programming dedicated to seasonal LEDs by utilities and governments in other jurisdictions – mostly in the form of modest public displays and information bulletins designed to

raise awareness of seasonal LEDs among consumers. Only one utility outside of British Columbia (Mason County PUD, Washington) has offered incentives (2004), and two jurisdictions in Ontario conducted small scale exchange events (Toronto and Guelph) (2004).

- Awareness and availability of seasonal LED product in many other jurisdictions appears comparable to that which existed in British Columbia prior to 2002 with market agents describing the awareness and sales of seasonal LED product in the United States as “very low” to “virtually none”.

E.1.2 Demand-Side Assessment

Information collected from BC Hydro’s residential customers indicates that awareness of seasonal LEDs and their share of total seasonal lighting purchases has increased significantly since 2002. The research also indicates that seasonal LEDs are displacing some of the least efficient seasonal lighting styles.

Key demand-side findings:

- Eighty-one percent (81%) of BC Hydro’s residential customers were aware of seasonal LEDs when contacted in January 2005, up from 71% in 2004, and up significantly from the 20% recorded in the December 2002 baseline survey.
- Eighteen percent (18%) of BC Hydro residential customers purchased seasonal LED strings or variations in 2004, compared to 8% of BC Hydro households in 2003 – the first year seasonal LED product was available for sale.
- Seasonal LEDs represented 54% of all seasonal lighting purchases in 2004, up from 28% in 2003. The increase in market share has come at the expense of mini-lights, and to a lesser degree, C9 and C7 strings.
- BC Hydro households purchased an average of 4.2 strings each – with and without a BC Hydro coupon. This is comparable to the average per-person purchases in 2003 (4.4 strings).
- Overwhelmingly, saving energy / money was the most frequently mentioned reason for purchasing LED holiday lights in 2004 (mentioned by 70% of all purchasers). Appearance and being something new / different were the second and third most common reasons.
- A total of 28,584 strings were traded-in at BC Hydro in-store exchange events. Fifty-nine percent (59%) used 7 watt bulbs, 16% used 5 watt bulbs, and 25% used the 0.4 watt mini-light bulbs. Households surveyed in February 2005 indicated that the majority (79%) of the strings traded-in were used in 2003.
- Exchange event participants used \$5 coupons to offset the purchase cost of an average of 2.9 seasonal LEDs each. Three-quarters (75%) of in-store participants who redeemed at least one \$5 in-store coupon reported also using \$3 mail-in rebate coupons during the 2004 season.
- The average user of the \$3 mail-in rebate coupon used these coupons to reduce the cost of 2.8 LED strings purchased in 2004.
- Those who used only \$5 rebate coupons purchased an average of 3.9 seasonal LEDs with or without a coupon. Those using only \$3 mail-in coupons purchased an average of 4.9 LED strings with or without the coupon. Those who used both coupons purchased an average of 6.8 LED strings each.
- Ninety-five percent (95%) of the LED strings acquired by participants in 2004 were used during the 2004 holiday season.
- Eighty-five percent (85%) of participants used their seasonal LED purchases in 2004 to replace existing seasonal lighting product. C9 and C7 strings represented 65% of all product displaced. Notably, 19% of all seasonal LEDs purchased in 2004 were used to replace seasonal LEDs purchased in previous years.

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- Almost half (48%) of all BC Hydro participants who used their 2004 seasonal LED purchases to displace existing product left the displaced in storage, rather than dispose of them or trade them.
- Eighty-seven percent (87%) of seasonal LED users are satisfied (very or somewhat satisfied) with their lights. Nine percent (9%) are dissatisfied (very or somewhat dissatisfied). The most common reasons for dissatisfaction include product failure, insufficient LED brightness, and LED colour.
- Thirty-four percent (34%) of BC Hydro households surveyed in January 2005 indicated they would definitely or probably purchase seasonal LEDs in 2005, suggesting that demand for the product will remain strong for the upcoming season.
- In comparison to BC Hydro residents, awareness of seasonal LEDs among comparison group respondents (Saskatchewan households) was lower (67% of Saskatchewan households versus 81% of BC Hydro households), proportionately fewer households purchased seasonal LEDs in 2004 (12% versus 18%), purchase quantities were smaller (average of 0.5 strings per capita versus 0.7 per capita), and there were fewer repeat purchasers (1% versus 5%).

E.1.4 Direct and Market Effects Program Impact

It is unlikely that retailers in British Columbia would have carried seasonal LEDs during the past two years in any substantive manner without the intervention of BC Hydro. This conclusion is supported by qualitative evidence from jurisdictions outside of BC Hydro's service territory, most importantly in the United States. The market penetration of seasonal LED product in the United States is still at a very low level – comparable to what existed in British Columbia prior to 2002. The presence of seasonal LED product for sale elsewhere in Canada is attributed to BC Hydro's efforts in convincing national retailers to carry and promote the seasonal lighting product for the 2003 and 2004 seasons.

E.1.4.1 Direct Program Impact

Total energy savings from seasonal LEDs purchased in 2004 via coupons and associated spillover, and net of free riders and replacement purchases, are estimated at 0.861 GWh (Table E-1). Total peak demand savings are estimated at 5.2 MW. The net-to-gross ratio for demand and energy savings is 87%. No credit is given for LED purchases not used during the 2004 holiday season. Similarly, no claim is made on seasonal LEDs purchased and installed outside of BC Hydro's service territory. The estimates of demand and energy savings have been adjusted for cross effects (4%).

Table E-1
Energy and Peak Demand Savings – 2004 Seasonal LED Initiative
Summary of Direct Effects – Gross and Net Savings

	Peak Demand (MW)	Energy Savings (GWh)
Gross Savings ¹	6.0	0.994
Net Savings ²	5.2	0.861
Net-to-Gross Ratio	87%	87%

¹ Includes savings due to redeemed coupons, spillover purchases, less LEDs purchased to replace LEDs

² Defined as gross program impacts net of free riders and associated free rider spillover purchases

Energy and demand savings from participants deemed free riders during the 2004 seasonal LED campaign were reallocated to the program's broader market effects based on the conclusion that seasonal LEDs would not have been for sale in British Columbia during 2004 if BC Hydro had not undertaken its seasonal LED initiative. Thus, even though they remain free riders, their purchases still occurred because of BC Hydro's seasonal LED initiative. Correspondingly, the savings impact of their purchases is credited to BC Hydro's overall program impact.

Direct program savings exclude the proportion of seasonal LEDs purchased with a coupon that were used to replace seasonal LEDs acquired prior to 2004 (i.e., assumed to be purchased in 2003 as LEDs were not available prior to this year). The energy and demand savings for these purchases for 2004 and beyond has not been counted as it is assumed that the savings were captured by BC Hydro's 2003 impact estimates.

E.1.4.2 Market Effects Impact

The peak demand savings in 2004 attributable to the market effects of BC Hydro's seasonal LED initiative are estimated at 76.5 MW (Table E-2). Total energy attributable to the market effects of BC Hydro's seasonal LED initiative is estimated at 13.001 GWh. Demand and energy impacts have been adjusted for cross effects (4%). Market effects account for an estimated 753,000 seasonal LEDs purchased and installed during 2004, and are net of replacement purchases.

Table E-2
Energy and Peak Demand Savings – 2004 Seasonal LED Initiative
Summary of Market Effects

	Number of Installed LED Strings	Peak Demand Savings (MW)	Energy Savings (GWh)
Total Effect – All 2004 Installed LEDs Purchases Less Replacements, Less Baseline	803,855	81.7	13.862
Less Direct Effects	51,336	5.2	0.861
Market Effects	752,520	76.5	13.001

Totals may not sum due to rounding

E.1.4.2 Total Program Impact

Total peak demand and energy savings achieved by BC Hydro's 2004 seasonal LED initiative are estimated at 81.7 MW and 13.862 GWh respectively (Table E-3).

Table E-3
Energy and Peak Demand Savings – 2004 Seasonal LED Initiative
Sum of Direct and Market Effects

	Peak Demand Savings (MW)	Energy Savings (GWh)
Direct Effects	5.2	0.861
Market Effects	76.5	13.001
Total Program Effects	81.7	13.862

The peak demand reduction for seasonal LEDs may or may not coincide with BC Hydro's winter system peak due to factors unrelated to seasonal lighting use (e.g., seasonal temperatures, industrial load, etc.).

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E.2 Summary and Recommendations

E.2.1 Summary

Seasonal LEDs have made significant in-roads into British Columbia in just three seasons. Product selection and choice has improved in terms of string lengths, number of brands, and the variety of LED shapes. The most recent year also saw the introduction of the first variations based on LED technology. On average, prices for all LED string colours declined in 2004.

Supply-side developments for seasonal LEDs have been accompanied by increased demand for the product by BC Hydro's residential customers who are estimated to have purchased 1.1 million LED strings in 2004. Seasonal LEDs made up 54% of all seasonal lighting purchases in 2004, up from 28% in 2003. Important to the claims of peak demand and energy savings, a significant percentage of LED purchasers have used their new product to displace lesser efficient seasonal lighting styles, most notably C9 strings and, to a lesser degree, C7 strings. Conversely, a large proportion of seasonal LEDs purchased were to replace LED products acquired in previous seasons. Some replacement purchases were expected by BC Hydro program management because some 2003 LED product failed prematurely. However, these quantities are surprisingly large.

The review of programming in other jurisdictions in Canada and the United States confirmed that BC Hydro has been the predominant utility promoting seasonal LEDs since 2002. BC Hydro's model of building awareness and demand for the product prior to commercial availability, and approaching and/or partnering with retailers and suppliers to ensure product was available to satisfy the pent-up demand, appears to be unique in the area of seasonal lighting. Programs of comparable scale and scope were not found outside British Columbia, and most importantly, not found in the United States. Market penetration of LEDs in the U.S. is comparable to that experienced in British Columbia prior to 2002. This situation is not expected to persist beyond the next few years. However, this evaluation concludes that without the presence of BC Hydro's seasonal LED initiative, seasonal LED product would not have been available for sale in British Columbia during the past two years. Consequently, with the exception of purchases used to replace previously acquired LED product, the direct and market effects of BC Hydro's 2004 seasonal LED initiative capture the majority of seasonal LEDs sold during the 2004 season.

Summarized, the findings from this evaluation include:

- **Direct effects** – energy and peak demand savings for 2004 attributed to purchases of seasonal LEDs made with BC Hydro coupons, spillover purchases, less free riders and replacement purchases, of 0.861 GWh and 5.2 MW respectively.
- **Market Effects** – energy and peak demand savings attributable to BC Hydro's broader effects on the British Columbia market place for seasonal LEDs of 13.001 GWh and 76.5 MW. These savings are incremental to direct program savings.
- **Free Riders** – Free riders were estimated at 13.4% of couponed purchases. Free rider purchases, while excluded from direct program effects, are counted under the program's broader indirect (market) effects as it was concluded that seasonal LEDs would not have been sold in British Columbia in 2004 without BC Hydro's initiative (baseline equals zero).
- **Spillover Purchases** – purchases above and beyond coupon limits were estimated at 25% of total couponed purchases.
- **LED Replacement Purchases** – an estimated 19% of all seasonal LEDs purchased in 2004 by BC Hydro residential customers were acquired to replace existing LEDs. The energy and demand savings from these purchases are excluding the estimates of direct and market effect program savings.

E.2.1 Recommendations

- Use future market research opportunities with residential customers to understand why such a large percentage of 2004 LED purchases displaced previously acquired LEDs, and what was done with

the old LED product. Further to this, continue efforts to improve the quality of LED product sold by British Columbia retailers.

- Future evaluations should explore the shift in the overall efficiency of seasonal lighting stock since the 2002 baseline. This should include quantifying the energy and demand savings attributable to new entrants to the seasonal lighting market (e.g., newly formed households and other new users choosing seasonal LEDs as their first purchases rather than traditional seasonal lighting styles), and the effect of older households (with their older seasonal lighting styles) exiting the seasonal lighting market (e.g., seniors).
- Monitor customer satisfaction with their seasonal LEDs and whether the product remains in use during the upcoming holiday lighting season.
- Consider repeating trade-in events as a way to ensure traditional seasonal lighting product displaced by LEDs is permanently removed from circulation.
- Adjust 2003 program demand and energy savings to reflect the improved understanding of the diversity factor associated with seasonal lighting use (79.1%).
- Continue to monitor market developments in Canada and the United States for seasonal LEDs with an emphasis on gauging the awareness and penetration (sales) of the product (i.e., changes to baseline). Use this information to qualify the longevity of the claims to market effects (i.e., the number of years, and degree to which seasonal LEDs would not have been sold in British Columbia without BC Hydro's seasonal LED program).

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E3. Program Manager's Response

Inter-office memo

TO: Margo Longland Sept. 1, 2005

FROM: Patrick Mathot
Residential Sector Manager

SUBJECT: Response to Market & Impact Evaluation of BC Hydro's Seasonal LED Initiative

Response to Recommendations for the Marketing Group:

1. Residential Power Smart will use future market research opportunities to understand why customers replace existing LED product with new LED product. This research will also determine what was done with the old LED product, to understand if it will be used in future. BC Hydro will continue to work with manufacturer and government partners to improve the quality of LED product sold in BC and ensure that the entire product category is not jeopardized.
2. Residential Power Smart will ensure that future SLED market evaluations quantify the savings attributable to new entrants and exiting households.
3. As part of ongoing efforts to improve the SLED product category and ensure that poor quality product does not negatively impact customer satisfaction with SLED technology, BC Hydro will monitor customer satisfaction with SLEDs.
4. Residential Power Smart will continue to develop programs that increase the penetration of SLED technology into the BC market, while displacing traditional incandescent lights. As such, different opportunities will be analyzed to determine the most cost effective means of convincing customers to permanently remove incandescent holiday lights from circulation.
5. Both 2003 and 2004 demand and energy savings will be adjusted to reflect the improved understanding of the diversity factor associated with seasonal lighting use.
6. Future evaluations commissioned by Residential Power Smart will be used to qualify the longevity of savings claims associated market effects.

Sampson Research

Economic research that matters to communities and business

☎ 604.809.0382

✉ jsampson@sampsonresearch.com

www.sampsonresearch.com