Evaluation of the Residential Inclining Block Rate

F2009-F2012

Revision 2

June 2014

Prepared by:

BC Hydro
Power Smart Evaluation

Table of Contents

Executive Summary

Introduction

The Residential Inclining Block ("RIB") rate is a two-step rate structure, where BC Hydro's residential customers pay a lower per-unit rate for electricity consumption below a 1350 kWh bi-monthly threshold, and a higher per-unit rate for electricity consumption above the kWh threshold.

In August 2008 the British Columbia Utilities Commission ("BCUC") determined that it was in the public interest for BC Hydro to implement the new RIB rate and required the new RIB rate structure go into effect October 1, 2008 for approximately 1.6 million residential customers. The Step 1 to Step 2 threshold was set at 1,350 kWh per billing period, which was approximately 90 per cent of the median consumption of BC Hydro's residential customers. The Step 2 rate was established at BC Hydro's current estimate of the cost of new energy supply, grossed up for losses and the Step 1 rate was calculated to achieve revenue neutrality for the residential class.

This study is an evaluation of the impacts and customer response to the RIB rate structure, net of Power Smart and natural conservation over the first four years. The evaluation period covers BC Hydro's Fiscal Year 2009 through Fiscal Year 2012.

Approach

The individual evaluation objectives and a summary of the methodology for each are listed below.

Evaluation Objective 1: Estimate Price Elasticity. Price elasticity was estimated with econometric models that explain how electricity consumption per account might have changed in response to the RIB rate, after controlling for the effects of factors such as weather, region, electric heating, and income. These models were based on linear regression specifications commonly used in the residential electricity demand literature.

Evaluation Objective 2: Estimate the Conservation Impacts of the RIB Rate. Energy and peak demand savings due to the RIB Rate were estimated using the following steps:

1. Estimate total conservation, measured by the change in total Step 1 and Step 2 consumption using estimates of the RIB price elasticity, the change in Step 1 and Step 2 prices and the previous year's Step 1 and Step 2 consumption levels.
2. Estimate natural conservation (the baseline scenario) using a class average price elasticity for general rate increases, the change in the equivalent flat rate price (Rate schedule 1151), and the total consumption for the entire RIB rate class.
3. Estimate structural conservation of the RIB rate as the difference between total and natural conservation.
4. Multiply total energy savings by a load shape factor to estimate peak demand savings.

Evaluation Objective 3: Analyze Differences in Price Elasticity by Customer Characteristics. The data used to estimate Step 1 and Step 2 elasticity was partitioned by region, heating and dwelling type to enable estimates the price elasticity of the different groups. To analyze elasticity by consumption level, customers were divided into five size categories based on their average bi-monthly consumption levels. Consumption level elasticity estimates were then found by estimating a separate per-account consumption regression for each size category.

Evaluation Objective 4: Evaluate the Customer Response and Understanding of the RIB Rate. Examination of the customer response and understanding of the RIB relied on the customer survey data and billing data.

Customer surveys were used to collect information on customer awareness, understanding and decision making related to the RIB rate, opinions on electricity pricing, and behaviours around energy use, along with additional demographic and housing parameters to inform the evaluation.

The table below summarizes the data sources and methods employed in this study for each evaluation objective.

Table E.1. Summary of Evaluation Objectives, Data Sources and Methodology

#	Evaluation Objective	Main Data Sources	Methods
1.	Estimate price elasticity	a. Aggregate BC Hydro bi-monthly billing data from April 2004 to March 2012, including consumption, heating type, region and dwelling type by account b. BC Hydro Residential Rate Tariffs (historical prices) c. BC Hydro Power Smart records of expenditures on Demand Side Management from April 2004 to March 2012 d. Statistics Canada Consumer Price Index data from April 2004 to March 2012 e. BC Stats records of personal real disposable income from April 2004 to March 2012 f. BC Hydro records of heating and cooling degree days by region from April 2004 to March 2012	Econometric models - linear regression using Ordinary Least Squares.
2.	Estimate the conservation impacts of the RIB Rate	a. Data and results from Objective 1 b. BC Hydro rate class load shape	Arithmetic
3.	Analyze differences in price elasticity by customer characteristics	Same as Objective 1	Same as Objective 1
4.	Evaluate the customer response and understanding of the RIB Rate	a. Customer Surveys (n = 2,831) b. BC Hydro monthly billing data from April 2011 to March 2012	• Cross Tabulations of Survey Responses • Linking of survey responses to respondent billing history • Difference of Means Tests using Analysis of Variance

Results

Price Elasticity

An estimate of Step 1 elasticity could not be precisely estimated due to the limited variation in the flat rate price prior to the RIB rate implementation and the Step 1 price after the RIB after adjusting for inflation over the time period analyzed.

Three different econometric models, all plausible and selected based on theoretical and statistical merit, estimated a range of Step 2 price elasticity between -0.08 to -0.13. Step 2 price elasticity estimates were very sensitive to the inclusion of weather and economic variable specifications; hence it was prudent that the evaluation adopted a range estimate of price elasticity rather than a single definitive value.

Absent conclusive results to reject the original assumption of -0.05 for class average price elasticity, the evaluation used the same assumption for estimating the baseline rate impacts (natural conservation) in the scenario of general price increases under a flat rate.

Conservation

Since the modeling to estimate Step 2 price elasticity resulted in a range of plausible elasticities, the RIB rate structure impacts derived from them are also presented as a range estimate. The following table compares reported and evaluated incremental annual savings from the RIB rate structure. The low estimate and high estimates assume a Step 2 elasticity of -0.08 and -0.13 respectively.

Table E.3. Reported versus Evaluated Impacts

Fiscal Year	Reported Energy Savings (GWh)	Evaluated Incremental Annual Energy Savings (GWh)		Reported Demand Savings (MW)	Evaluated Incremental Annual Peak Demand Savings (MW)	
		Low	High		Low	High
F09	92	57	94	20	12	20
F10	230	94	202	49	20	43
F11	26	11	41	6	2	9
F12	101	33	86	22	7	18

The evaluated incremental annual conservation impacts as a result of the RIB rate structure ranged from a low of 11 GWh in F2011 to a high of 202 GWh in F2010. The average total impacts per BC Hydro customer account ranged between 7 kWh and 124 kWh for the four year period. The range of the RIB rate's structural conservation impacts represent approximately 0.1% - 1.2% of the total annual residential class consumption during the time period evaluated.

The annual peak demand savings were estimated at between 2 MW and 43 MW assuming an average residential sector peak-to-energy ratio (capacity factor) of 0.214 MW/GWh across the four years based on the residential rate class load shape.

Price Elasticity by Customer Characteristics.

Based on the results from the three different models, the low and high estimates for Step 2 price elasticity associated with different types of customer segments are summarized in the following table. While these estimates show that Step 2 price elasticity varies by region, dwelling type, space heating type and total consumption, the estimated ranges suggest that customer Step 2 price responsiveness is reasonably close to

the initial assumption of an average Step 2 price elasticity of -0.10, except for customers on Vancouver Island and the North, those living in row/townhouses or apartments, or those with consumption above 2400 kWh.

Table E.4. Step 2 Price Elasticity by Customer Characteristics

Customer Segment	Step 2 Elasticity – Low Estimate	Step 2 Elasticity – High Estimate
Region		
Lower Mainland	-0.11	-0.13
North	-0.12	-0.15
Southern Interior	-0.08	-0.12
Vancouver Island	-0.15	-0.15
Dwelling Type		
Single Family Dwelling	-0.08	-0.14
Row/Townhouse	-0.06	-0.07
Apartment	-0.03	-0.04
Mobile Home	-0.10	-0.10
Other	-0.05	0.09
Space Heating		
Electric	-0.10	-0.14
Non-Electric	-0.08	-0.09
Consumption		
1350 kWh –2400 kWh	-0.13	-0.13
2400 kWh and above	-0.16	-0.18

Customer Understanding and Response

In total, 35 per cent of all customer households in the survey sample 'never' (0 months) incurred Step 2 consumption in F2012, 40 per cent 'sometimes' (1-11 months) incurred Step 2 consumption, and 25 per cent 'always' (12 months) incurred Step 2 consumption. This distribution – based on actual consumption – very closely reflected the actual distribution of all RIB qualified accounts in the billing system.

Regionally, households on Vancouver Island were the most likely to have incurred Step 2 consumption in F2012. Considering space heating, the incidence of any Step 2 consumption measured 72 per cent among households with electric space heating and compared to 61 per cent among those with non-electric heat. Considering water heating, the incidence of any Step 2 consumption measured 85 per cent among households with electric hot water heaters, 66 per cent among those with non-electric hot water heaters, and just 28 per cent among those who rely on hot water from a central system.

The total amount of their bills emerged to be assessed by customers as being a greater incentive to manage electricity than electricity prices. Over nine in ten customers reported that the total dollar amount of their electricity bills serves as either a 'major incentive' (48%) or a 'minor incentive' (42%) to manage their household's consumption rather than 'no incentive at all'. This compares to just over eight in ten customers who indicated that they believe BC Hydro's electricity prices serve as either a 'major incentive' (41%) or a 'minor incentive' (43%). Customer households that 'always' or 'sometimes' incurred Step 2 consumption in F2012 were more likely than those that 'never' did so to view both price and the total bill amount as having a 'major incentive' on their management of electricity.

A total of 50 per cent of customers demonstrated that they were previously aware they were charged for electricity on an inclining block rate. A total of 31 per cent of customers believed their household's use of electricity was charged on a flat rate (as it was for many years prior to October 2008) while 2 per cent of

customers believed that their consumption was charged on a declining block rate (a rate structure not used since the early 1990's). A total of 17 per cent reported not knowing how they were charged for their consumption of electricity. Statistical analysis showed that awareness of the inclining block rate does not directly lead households to having lower consumption as strictly compared to households unaware of the rate.

For customers who identified that their household's consumption of electricity was charged on an inclining block rate, when asked what they perceive to be their price of electricity under the RIB, 43 per cent considered each of the Step 1 and Step 2 prices as being their household's price of electricity, depending on the point in time in the billing period and/or their consumption in the billing period.

Customers who correctly identified that their household's consumption of electricity was charged on an inclining block rate were no more likely to have participated in BC Hydro's Power Smart programs, and were less likely to have purchased and installed energy-efficient lamps – such as CFLs and LEDs. Customers previously aware of the inclining block rate did outperform all other customers on behaviours related to space heating, laundry, dishwashing, lighting and other plug-load behaviours.

Findings and Recommendations

Evaluation Objective 1: Estimate Price Elasticity

1. The estimated range of Step 2 price elasticity (-0.08 to -0.13) encompasses the Step 2 elasticity assumption for in the BC Hydro 2008 RIB application of -0.10 for forecasting the RIB impacts.
2. Price elasticity for BC Hydro's small residential customers with only Step 1 consumption was not able to be measured due to the limited variation in real prices over time.
3. The class average elasticity due to general price increases under a flat rate was not able to be estimated using empirical data. The evaluation used the assumption of -0.05 as the class average price elasticity to determine the natural conservation baseline.
4. Price elasticity is very sensitive to various factors affecting electricity consumption that were included in the econometric models, including weather, disposable income, dwelling type, space heating fuel and total account consumption.

Evaluation Objective 2: Estimate Conservation of the RIB

1. The evaluated incremental energy savings of the RIB rate structure from F2009 to F2012 ranged between 11 GWh and 202 GWh during the four years evaluated.
2. The evaluated peak demand savings ranged between 2 MW and 43 MW during the four years evaluated.

Evaluation Objective 3: Differences in Price Elasticity by Customer Characteristics

1. Price elasticity was generally higher for customer segments with higher consumption.
    - Price elasticity was higher on Vancouver Island and the Northern region than the overall average.
    - Price elasticity was higher for single family dwellings compared to other dwelling types.
    - Price elasticity was higher for households with electric heat versus non-electric heat.
2. Large residential users consuming more than 2,400 kWh bi-monthly show a substantially higher than average response to higher prices.

Evaluation Objective 4: Customer Response, Awareness, and Understanding

1. The approximate proportions of residential customers that 'never', 'sometimes' or 'always' saw the Step 2 price in fiscal 2012 were 35 per cent, 40 per cent and 25 per cent, respectively.
2. A total of 50 per cent of residential customers appear to be aware of the RIB as of February 2012.
3. The total amount of the household electricity bill serves as the greatest incentive to manage electricity consumption among residential customers, followed by electricity prices.
4. A total of 79 per cent of residential customers aware of the RIB believed it serves as an incentive to manage electricity consumption.
5. There are small but statistically significant differences in the prevalence of energy conservation behaviors among customers who are aware of the RIB compared to those who are not.
6. Awareness of the RIB does not appear to have significant influence on customer investments in energy-efficient equipment or participation in Power Smart programs.
7. Higher consumption is correlated with both higher awareness of the RIB and higher price elasticity, however no firm conclusions can be drawn about how RIB awareness is related to the customer price response.

Recommendations

1. **Continue to attempt to estimate Step 1 and the class average price elasticity.** Future evaluations will likely be improved by accumulation of empirical data and price variation over time and the exploration of alternative methods to estimate the class average elasticity.

2. **Future RIB rate evaluation may benefit from the complementary econometric analysis of a select sample of customers.** This would require additional data collection on changes (stock turnover) in major household energy end-uses (e.g. appliance replacements, heating system upgrades), changes in economic and demographic circumstances (e.g. occupancy) and participation in other DSM programs to attempt to further isolate the effects of electricity prices on consumption.

3. **Consider ways to increase awareness of the RIB, particularly targeted at customer segments that have shown the largest response to price.** The evaluation results indicate there are correlations between RIB awareness and energy conservation behaviours. While causation is unclear, this could mean that increasing RIB awareness will lead to increases in energy conservation behaviours and corresponding energy savings.

Conclusions

The RIB rate appears to be achieving its overall objective of encouraging conservation through the customer response to higher marginal prices – particularly amongst the customer with the highest consumption.

1. Introduction

The Residential Inclining Block ("RIB") rate is a two-step rate, where BC Hydro's residential customers pay a lower per-unit rate for electricity consumption below a 1350 kWh bi-monthly threshold, and a higher per-unit rate for electricity consumption above the kWh threshold.

1.1. Evaluation Scope

In March 2011 the British Columbia Utilities Commission ("BCUC") directed BC Hydro to file "a RIB Report with an overview of the results over the first five years, including information relating to customer response to the two tier structure since its implementation". This study is an evaluation of the impacts and customer response to the RIB rate over the first four years. The evaluation period covers BC Hydro's Fiscal Year 2009 through Fiscal Year 2012.

1.2. Organization of Report

Section 2 summarizes the evaluation objectives, approach and methodology, Section 3 presents the results, Section 4 summarizes the findings and recommendations and Section 5 presents the conclusions. The appendices document the supporting materials for the evaluation approach and results.

1.3. RIB Rate Overview

The use of conservation rate structures is one of three tools used in BC Hydro's Demand Side Management ("DSM") Plan, the other two being the use of Power Smart programs and support for government codes & standards. The over-arching objective of the RIB rate was to encourage additional electricity conservation relative to what was achievable through a flat rate structure.

In August 2008 the BCUC determined that it was in the public interest for BC Hydro to implement the new RIB rate and required the new RIB rate structure go into effect October 1, 2008 for approximately 1.6 million residential customers. The Step 1 to Step 2 threshold was set at 1,350 kWh per billing period, approximately 90 per cent of the median consumption of BC Hydro's residential customers. The Step 2 rate was established at BC Hydro's current estimate of the cost of new energy supply, grossed up for losses and both the Step 1 rate and the Basic Charge were calculated residually to achieve revenue neutrality for the residential class.

The table below summarizes the rate schedule revisions since the implementation of the RIB.

Table 1.1. Residential Rate Schedule by Activation Date and Charge Type (Nominal Dollars)

	Rate Schedule Activation Date					
Bi-Monthly Charge	**Apr 1, 2008**	**Oct 1, 2008**	**Apr 1, 2009**	**Apr 1, 2010**	**May 1, 2011**	**April 1, 2012**
Step 1 Price (¢/kWh)	6.29	5.46	5.91	6.27	6.67	6.80
Step 2 Price (¢/kWh)	6.29	7.21	8.27	8.78	9.62	10.19

In the approach used to forecast energy conservation from the RIB, BC Hydro assumed two customer types: (a) 'large' customers whose consumption exceeds the Step 2 threshold, and (b) 'small' customers whose consumption is below the Step 2 threshold.

As part of the 2008 Long-Term Acquisition Plan proceeding, BC Hydro submitted evidence concerning elasticities. An independent consultant recommended that BC Hydro adopt a price elasticity estimate of -0.1 to estimate the aggregate impact of an average rate increase and rate design change from a flat rate to an

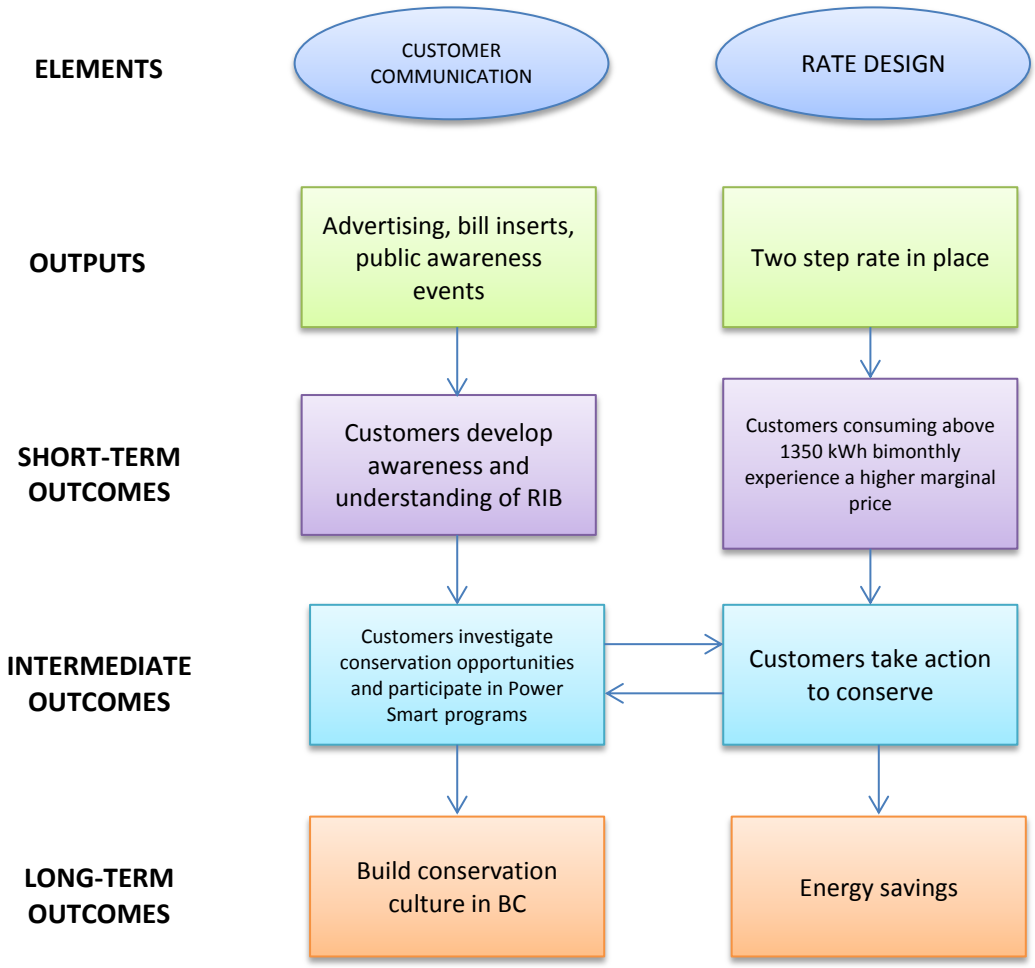
inclining block tariff for residential and commercial customers. The consultant also opined that it was reasonable for BC Hydro to use -0.05 as the price elasticity estimate for decomposing the total rate-induced conservation impact into rate level-induced and rate structure-induced conservation. The use of -0.1 price elasticity estimate was supported by the results found in other low-cost winter-peaking jurisdictions. More specifically, the -0.1 elasticity estimate was based on a review of published studies of measured price response results from jurisdictions most comparable to B.C. and on the elasticity values used in the most current Integrated Resource Plans of two electric utilities in the U.S. Pacific Northwest. These studies were drawn from a comprehensive, industry-wide review of over 100 residential and 60 non-residential price elasticity studies. Relative to the previous flat rate, the RIB rate was assumed to have a conservation effect, described in detail in the 2008 RIB Application. This total conservation effect comprised: (a) natural conservation that would have occurred in the absence of the RIB rate; and (b) conservation due to the RIB structure. To find (a), BC Hydro applied the price elasticity of -0.05 to estimate the reduction in consumption for the entire rate class due to the annual average (general) rate increase had the flat rate remained in existence. The induced conservation attributable to the RIB structure is the total conservation effect of the Step 1 and Step 2 rates on the small and large customer groups respectively, less the natural conservation.

The RIB operates in parallel with many other BC Hydro DSM activities targeted at the residential sector. Power Smart programs deliver information and financial incentives to customers; BC Hydro provides technical and financial support for changes to codes and standards and enabling activities to support the energy efficiency industry in B.C. In addition, BC Hydro supports public awareness and education activities to foster a conservation culture in B.C. BC Hydro also provides direct customer service through its call centre and website to support residential customers in their conservation efforts.

The RIB rate, through its price signals was intended to encourage the adoption of conservation actions and encourage participation in Power Smart programs by improving the payback on conservation investments. Conversely, the presence of Power Smart programs and educational initiatives was expected to elevate customers' awareness and understanding of the RIB rate, and enhance their response to the price signal.

Building a logic model is a straightforward way to understand a DSM initiative and prepare for an evaluation. A logic model divides the initiative into its basic elements, and then examines the chain of the various outputs and the desired short, intermediate and long-term outcomes. The following figure displays a simple logic model for the RIB and describes the basic criteria that need to be satisfied in order for the conservation rate to be effective.

Figure 1. RIB Logic Model



2. Approach

2.1. Evaluation Objectives

The overall objective of this study is to evaluate the customer response to the RIB rate and to estimate energy and peak demand savings resulting from the rate. Table 2.1 below summarizes BC Hydro's evaluation objectives and research questions to be addressed.

Table 2.1. Evaluation Objectives and Research Questions

Evaluation Objective	Research Questions
1. Estimate price elasticity.	1. What is the price elasticity of Step 1 and Step 2 consumption? 2. What is the price elasticity of the class average in response to general rate increases?
2. Estimate the conservation impacts of the RIB.	1. What were the energy savings due to BC Hydro's RIB Rate structure from F2009 to F2012? 2. What were the peak demand savings due to BC Hydro's RIB rate structure from F2009 to F2012?
3. Analyze differences in price elasticity by customer characteristics.	1. Are there differences in price elasticity by region? 2. Are there differences in price elasticity dwelling type? 3. Are there differences in price elasticity by space heating type? 4. Are there differences in price elasticity by consumption level?
4. Evaluate the customer response and understanding of the RIB Rate.	1. Are there differences in the characteristics or demographics of customers who are never billed in Step 2 compared to those who are sometimes or always billed in Step 2? 2. What is the level of customer awareness and understanding of the RIB rate? 3. To what degree do electricity prices provide an incentive to manage electricity consumption? 4. To what extent does the total electricity bill amount provide an incentive to manage electricity consumption? 5. What is customers' understanding of their prevailing electricity price under the RIB rate structure? 6. To what extent does the RIB provide an incentive to manage electricity consumption? 7. Did the RIB Rate encourage customers to modify their energy-use behaviours? 8. Did the RIB Rate encourage customers to make investments in energy efficient equipment? 9. Did the RIB Rate encourage customers to increase participation in Power Smart programs?

2.2. Methodology Review

A literature review of electricity rate evaluations was conducted to understand the methodologies adopted for evaluation of electricity rate design. The review covered seventeen electricity rate evaluation studies of price elasticity analysis for residential customers in different jurisdictions as well as prior BC Hydro evaluation reports of the RIB rate. This section briefly discusses these methodologies found in the evaluation literature and the reasons why certain methodologies were selected for this evaluation. Refer to Appendix B for a detailed review of evaluation literature and examples of each methodology discussed in this section.

The methodologies for evaluating rate design take different approaches in terms of data construction and evaluation methods. They are diverse but can be classified broadly into three types: qualitative study through customer surveys, quantitative evaluation of rate impacts through estimation of price elasticity, and experimental or quasi-experimental design.

The first type of methodology is designed to conduct qualitative evaluation of the electricity price impacts such as customer's perception and behavioural response to electricity rate design. This type of evaluation is usually conducted through customer surveys of a sample of select customers.

The second type of methodology involves quantitative study of rate impacts on electricity consumption. Such studies mainly entail econometric analysis to estimate price elasticity—the most commonly used measure in the electricity industry when analyzing consumption changes due to rate adjustments. It provides a straightforward and easy-to-compare means to measure the price impacts on electricity consumption and the magnitude of customers' price sensitivity.

Econometric analysis to estimate price elasticity can rely on several different approaches to data construction. Some studies use the aggregated data of the entire customer class under analysis—when such data are available to the researcher. Other studies rely on analyzing a sample of customers with rich and detailed customer information incorporated into analysis and then extend the results from the sample to the entire population.

Econometric methods used in the studies of price elasticity are mainly comprised of regression modeling and market simulation techniques (this latter and some other less often used techniques are discussed in Appendix B). Regression modeling is a suitable and convenient modeling approach for evaluation when electricity demand can be fitted in a linear functional form to be estimated with such techniques as Ordinary Least Square (OLS), Maximum Likelihood (ML) method or Generalized Linear Regression.

It may also be possible to use a third type of methodology: experimental or quasi-experimental design. These methods rely on comparative analysis between a comparison or control group and the customer segment that participated in the initiative. This method is infrequently used for estimating the impacts of rate design and no formal evaluations of rate initiatives using this method were noted in the literature, since it requires careful selection of control or comparison groups prior to the implementation of the rate or initiative. Section 2.4.2 discusses the exploration of a comparison group for the RIB, and why the method was ultimately rejected.

2.3. Methodology

The methodology adopted to evaluate the customer response to the RIB rate and rate-induced conservation actions has two parts. The first part is an estimation of the conservation impacts of the RIB rate via econometric modeling of the price elasticity for each price step. Econometric models were selected as they provide a straightforward way to measure customers' price sensitivity and the resulting impacts on electricity consumption. The resulting elasticity estimates also allowed a direct comparison with the original BC Hydro elasticity assumptions from the RIB application. The second part is a qualitative assessment using surveys of a sample of residential customers.

Table 2.2 summarizes the data sources and methods employed in this study for each evaluation objective. Further description of the proposed methodology is provided in the subsequent sections, in order of evaluation objective. Alternative methodologies considered are presented in Section 2.4.

The methodology employed ultimately provides an estimate of evaluated net savings. Electricity cross effects, free ridership and participant spillover are accounted for within the evaluated savings results, to the extent that they exist. The method is not able to provide an estimate of the magnitude of electricity cross effects, free ridership, participant spillover or the persistence of energy savings over time. Natural gas cross effects were not evaluated.

Table 2.2. Summary of Evaluation Objectives, Data Sources and Methodology

#	Evaluation Objective	Main Data Sources	Methods
1.	Estimate price elasticity.	a. Aggregate BC Hydro bi-monthly billing data from April 2004 to March 2012, including consumption, heating type, region and dwelling type by account b. BC Hydro Residential Rate Tariffs (historical prices) c. BC Hydro Power Smart records of expenditures on DSM from April 2004 to March 2012 d. Statistics Canada Consumer Price Index data from April 2004 to March 2012 e. BC Stats records of personal real disposable income from April 2004 to March 2012 f. BC Hydro records of heating and cooling degree days by region from April 2004 to March 2012	Econometric models - linear regression using Ordinary Least Squares (OLS).
2.	Estimate the conservation impacts of the RIB.	a. Data and results from Objective 1 b. BC Hydro rate class load shape	Arithmetic
3.	Analyze differences in price elasticity by customer characteristics.	Same as Objective 1	Same as Objective 1
4.	Evaluate the customer response and understanding of the RIB Rate.	a. Customer Surveys (n = 2,831) b. BC Hydro monthly billing data from April 2011 to March 2012	• Cross Tabulations of Survey Responses • Linking of survey responses to respondent billing history • Difference of Means Tests using Analysis of Variance

2.3.1. Methodology to Estimate Price Elasticity

Estimating conservation of the RIB rate first required estimates of price elasticity that measured customers' responsiveness to changes in price on their consumption. Price elasticity was estimated with econometric models using linear regression with the per account consumption for all BC Hydro RIB customers as the

dependent variable. Aggregate data were selected instead of customer-level data of a representative sample of customers to avoid any potential selection bias coming from the sample selection. Further, using customer level data of a sample was not feasible because BC Hydro did not maintain detailed customer information for the entire population over the analysis period.

The ability to generalize results to the population for the selected methodology (the external validity of the model) was considered good since the models used the actual per account consumption for the entire population. However, the ability to attribute conservation effects directly to the RIB (the internal validity of the model), was considered moderate, since econometric models can not completely account for every variable that drives electricity consumption. The 'Limitations' portion of this report (section 3.6) expand on this discussion and the Recommendations (Section 4.2) provides a suggestion to improve the internal validity for future evaluations.

The following steps were employed to create econometric models:

1. Determine the explanatory variables expected to influence electricity consumption and obtain applicable data series;
2. Develop a basic functional form of the regression model;
3. Develop and test alternative forms of the regression model;
4. Estimate the overall price elasticity for Step 1 consumption;
5. Estimate the overall price elasticity for Step 2 consumption;
6. Estimate the price elasticity for the baseline scenario.

These steps are further described below.

Step 1: Determine the Explanatory Variables Impacting Electricity Consumption and Obtain Data

Many factors influence variations in electricity consumption. It is important to capture the major factors in the regression models in order to isolate the relationship between price and consumption. Factors considered as explanatory variables include electricity prices, weather, seasonality, space heating fuel, dwelling type, region and economic factors. As discussed later, various interactions between some of the variables were also considered.

To explicitly control for the influence of parallel BC Hydro DSM initiatives in the models, BC Hydro's expenditures on residential sector DSM programs and DSM supporting initiatives (including community outreach and advertising on conservation-related messaging) were included. Bi-monthly expenditures from F2005 to F2012 were allocated across the various account sub-groups (region, dwelling type, heating type) based on the number of accounts in each group and each group's share of electricity consumption over the total residential consumption. The DSM expenditures by agencies other than BC Hydro, for example FortisBC Inc. or the B.C. Ministry of Energy and Mines, were not included because they either target different customer groups or energy fuels, they were expected to be too small to be measured, or they were already reflected in the relative changes in BC Hydro's expenditures over time.

Refer to Appendix B for further discussion on the methodology and each of the expected drivers of consumption.

Step 2: Develop the Basic Functional Form of the Regression Model

The overall goal was to create a simple and transparent model that reasonably explained the changes in electricity consumption over the time period of analysis. The basic model postulates that electricity consumption is a function of electricity price, space heating fuel, dwelling type, billing period, weather, BC Hydro DSM program expenditures and disposable income.

Equation 1 portrays the per account consumption regression estimated using OLS[1]. The basic form was a double-log regression with the explanatory variables expected to affect electricity consumption.

Equation 1

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \delta \cdot BillingPeriod + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \text{ʒ} \cdot$$

$$Region + \theta \cdot ln\left(DSM_{Expenditure}\right) + \cdot ln\left(Price\right) + \sigma \cdot$$

$$ln\left(Disposable\_Income\right) + \varphi \cdot C + \mu$$

Where,

ln() denotes natural logarithm; natural logarithm was used for convenience, because when it is used for both the consumption and price variables it results in a regression coefficient on the price variable that can be interpreted as an elasticity without additional calculation.

Consumption is bimonthly per account electricity consumption in kWh;

Heat is a binary indicator (dummy variable) whose value is one to indicate the presence or zero to indicate absence of electric heat as the primary space heating fuel;

Premise consists of dummy variables that indicate different residential dwelling type;

BillingPeriod consists of dummy variables that represents the bi-monthly billing periods to capture non-weather related seasonal effects;

CDD and *HDD* represent cooling and heating degree days used to represent weather impacts;

Region are dummy variables to represent the four regions in BC Hydro's service territory: Lower Mainland, Vancouver Island, Southern Interior and North;

DSM_Expenditure is the real (CPI deflated) spending on BC Hydro's DSM initiatives (programs, rates and other supporting initiatives) on the residential sector;

Price is the real electricity price charged to residential customers. It was a single flat rate before RIB and the applicable marginal rate in the RIB period; price elasticity is represented by the coefficient ( ) for the price variable;

Disposable_Income: per capita real disposable income (CPI deflated);

C is a correction term to account for sample selection bias caused by the fact that the Step 1 regression's sample only contains "small" users and Step 2 regression's sample only contains "large" users.

[1] The 'PROC REG' procedure in the SAS statistical software package.

μ is the error term.

Per account electricity consumption was drawn from BC Hydro bi-monthly billing records for all residential accounts covering from April 2004 to March 2012 (F2005 through F2012). The evaluation study commenced in late calendar 2012. Since there is a 2-3 month lag between the billing month and the availability of bi-monthly billing data[2], the billing data did not cover residential sector consumption for F2013.

The electricity consumption data was set up in a panel format consisting of the four regions, five dwelling types, and two space heating fuel types described above. This produced a total of 40 observations per billing period and 1,920 observations in total covering eight years of data. The first four years of consumption was under the flat rate schedule and the second four years was under the RIB rate.

Step 3: Develop and Test Alternative Forms of the Regression Model

Alternative forms of the basic model were also constructed to test and compare the modeling results. The alternative forms explored the effect of adding or removing explanatory variables not included in the basic form. Adding interaction terms to the regression model were also considered. For example, the relationship between weather and heating fuel are expected to have a strong influence on overall consumption since households with electric heat would have higher consumption in colder weather compared to households with non-electric heat. The alternative models explored the effects of including and/or excluding variables for:

- Billing period;
- Interactions between space heating fuel and weather; and
- Interactions between dwelling type and weather.

Selection of the alternative forms of the model was based on tested economic theories of drivers of residential electricity consumption and appropriate statistical and diagnostic tests. See Appendix B for additional details on the regression models and Appendix C for the full output of regression results.

Steps 4 and 5: Estimate the Price Elasticity for Step 1 and Step 2 Consumption

To obtain separate Step 1 and Step 2 price elasticity estimates, models were created for Step 1 and Step 2 consumption by separating customers into two groups based on their bi-monthly consumption. All residential accounts with consumption below 1,350 kWh in a given bi-monthly billing period were analyzed as the Step 1 group. All accounts with consumption above the 1,350 kWh Step 2 threshold in a given bi-monthly billing period were separately analyzed as the Step 2 group. Since the Step 1 regression sample only contains the aggregate consumption of "small" users and Step 2 regression's sample only contains "large" users in a given bi-monthly billing period, each of the two regression models contained a correction term (as shown in Equation 1) to correct for the sample selection bias of an individual account being included in the aggregate consumption of one group or the other. Refer to Appendix B for additional details on the regression models and Appendix C for the full output of regression results.

Step 6: Estimate the Price Elasticity for the Baseline Scenario

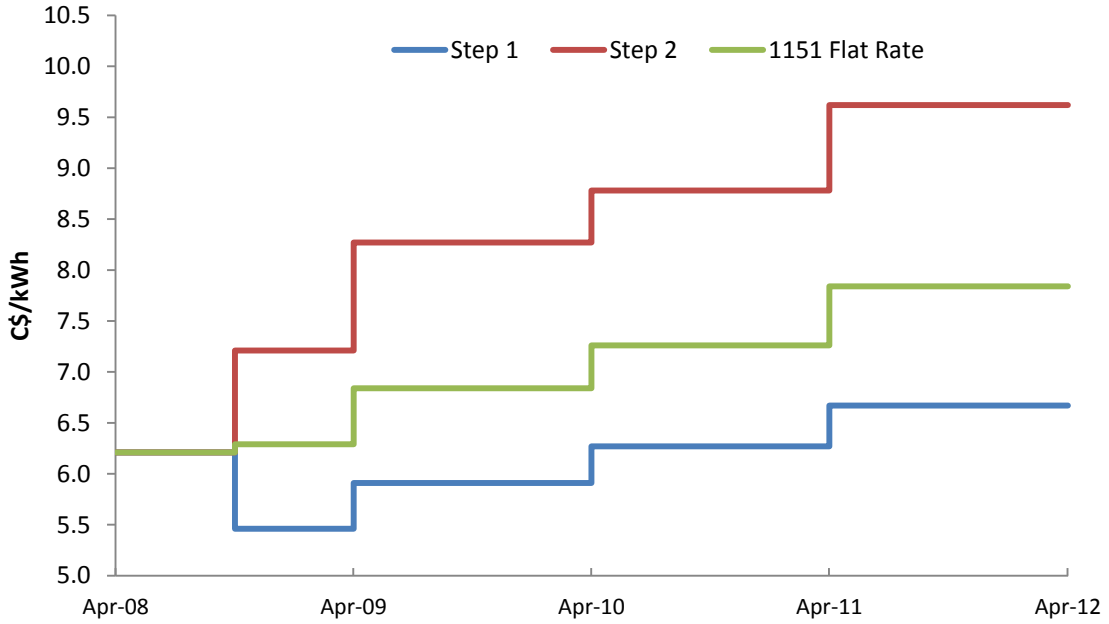
To establish a baseline for the RIB Rate, BC Hydro considered a flat rate with general price increases. BC Hydro's residential rate structure was switched from the flat rate to the RIB rate in October 2008 and the flat rate has been applied only to special customer groups under the 1151 Rate Schedule. The 1151 flat rate price was considered a proxy for what the customers on the RIB rate would have experienced without the implementation of the RIB from F2009 through F2012. Estimation of the class average elasticity under a flat

[2] Prior to the introduction of smart meters.

rate was required in order to estimate the consumption impacts due to the general price increases that would have occurred without the RIB rate structure.

Figure 2 shows the nominal price changes in Step 1, Step 2 and the flat rate from April 2007 (F2008) through to April 2012 (F2012).

Figure 2. Price Changes in the RIB and Equivalent Flat Rates, F2008-F2012



One method considered to estimate a class average elasticity was to use a weighted average elasticity of the "small" (Step 1) and "large" (Step 2) customer groups. However, a weighted average elasticity derived from consumption data from the stepped rate regime would require meaningful estimates of both the Step 1 and Step 2 elasticities. As will be discussed further in Section 3.1, the Step 1 price elasticity could not be precisely estimated; notwithstanding that the Step 1 customers could have a small and negative price elasticity that was not empirically observable based on the Step 1 consumption data. Also, the weighted average elasticity is at best only an approximation of the elasticity of general price increases under a flat rate, based on an imperfect assumption that small and large residential customers will respond to flat rate price changes in the same manner as under a two stepped rate structure. Another method considered and rejected was to use a Seemingly Unrelated Regressions (SUR) model, discussed further in the Alternative Methodologies section (2.4.4).

In the absence of a suitable method to arrive at conclusive empirical results for class average price elasticity under a flat rate scenario, this evaluation used the BC Hydro assumption from the 2008 RIB Application of -0.05.

2.3.2. Methodology to Estimate Energy and Peak Demand Savings of the RIB Rate

Energy and demand savings due to the RIB Rate were calculated separately for Step 1 and Step 2 consumption, using the following steps:

1. Estimate total conservation for Step 1 and Step 2 consumption.
2. Estimate conservation for the baseline scenario (natural conservation).

3. Estimate structural conservation of the RIB rate as the difference between total and natural conservation.
4. Multiply total energy savings by a load shape factor to estimate peak demand savings.

Step 1: Estimate Total Conservation

By definition, price elasticity multiplied by a percentage change in price yields the percentage change in consumption. The percentage change in consumption multiplied by the base year consumption gives the total change in consumption from the base year to current year. For the evaluation, the percentage change in both Step 1 and Step 2 prices were defined as the percentage change in price relative to the previous year. The method described in the 2008 RIB application was designed to reflect estimated conservation over a phase-in period where the Step 2 rate was gradually increased and assumed that customer decisions were made relative to a price anchored in F2008. However, now that the rate has been in place for more than 4 years, it is more reasonable to expect customers to adjust consumption based on the most recent price changes they experienced rather than the price change from the flat rate that they were charged at prior to the implementation of the RIB rate.

The impact of each step's price on electricity consumption was calculated separately with the inputs of price elasticity and the previous year's consumption, as specified in the following equation, run separately for Step 1 and Step 2 consumption.

Equation 2

$$\Delta\, kWh_t = \varepsilon_{price} \cdot \%\, \Delta price \cdot \ Electricity\ Consumption_{\ t-1}$$

Where:

$\Delta\, kWh_t$ is the consumption change (impact) in year t due to the change in price;

ε_{price} is the estimated price elasticity from the econometric models;

$\%\, \Delta price$ is the percentage change in the price relative to the previous year; and

ElectricityConsumption$_{t-1}$ is the Step 1 or Step 2 portion of electricity consumption of the previous year.

Total conservation is calculated as the sum of Step 1 and Step 2 impacts.

Equation 3

$$Total\ (RIB) Conservation\ Impacts = Step\ 1\ Impacts + Step\ 2\ Impacts$$

Step 2: Estimate Natural Conservation

Calculations of the natural conservation were based on Equation 2 with inputs of total (actual) residential class sales, the changes in the price for the 1151 Rate Schedule, and the assumption of -0.05 for the class average price elasticity to estimate the price elasticity for the baseline scenario.

Step 3: Estimate Structural Conservation

The natural conservation impacts were subtracted from the total conservation as a result of the RIB rate to arrive at the consumption impacts attributable to the structure of the RIB rate.

Equation 4

$$RIB\ Structure\ Impacts = Total\ Conservation\ Impacts - Natural\ Conservation\ Impacts$$

Step 4: Estimate Peak Demand Savings

Demand savings for the RIB were estimated from RIB structure impacts changes multiplied by a derived average peak-to-energy ratio based on the overall load shape for the residential rate class.

2.3.3. Methodology for Analysis of Elasticity

To further understand price responsiveness of different groups of customers, the data were partitioned by region, heating and dwelling type. The regression models (Equation 1) for Step 1 and Step 2 consumption used the different subsets of data to evaluate the price elasticity of different groups.

To analyze elasticity by consumption level, customers were divided into five categories based on the different consumption levels as shown in the table below.

Table 2.3. Bi-monthly Consumption Interval by Customer Group

Category	Consumption	Percentage of Customer Base[3]
1st	0-400kWh	10%
2nd	400 kWh -900 kWh	21%
3rd	900 kWh -1350 kWh	18%
4th	1350 kWh -2400 kWh	28%
5th	2400 kWh and above	23%

2.3.4. Methodology to Evaluate Customer Response and Understanding

Examination of the customer response and understanding of the RIB relied on the customer survey data and billing data. Customer surveys were used to collect information on customer awareness, understanding and decision making related to the RIB rate, opinions on electricity pricing, and behaviours around energy use, along with additional demographic and housing parameters to inform the evaluation.

A self-administered, print survey methodology – with option to complete online – was selected to afford respondents the time to formulate and express well considered responses to the number of complex questions being asked of them. Specifically, all randomly sampled customers were mailed a survey with the option of either mailing it back in the business reply envelope, or completing it online.

The population of interest was defined as all households in BC Hydro's service territory with a residential (1101) account, excluding BC Hydro non-integrated areas. A representative random sample of the overall population was drawn from the BC Hydro billing system. Overall, 10,000 customers were mailed a survey.

The survey was fielded in January and February, 2012. Representing a response rate of approximately 25 per cent, a total of 2,468 surveys were completed (1,621 mail-in, 857 online) whereby respondents also granted permission for their responses to be linked to their account history – a prerequisite for the survey analysis presented herein. At the 95 per cent confidence level, the maximum margin of error for the total sample size was ± 2.0 per cent.

The profile of survey respondents was compared with the overall population distribution of BC Hydro's 1.6 million customers on the RIB rate and statistically weighted to ensure the customer survey sample closely reflected the population of all customer households on known parameters.

Refer to Appendix B for additional details on the customer surveys, Appendix C for detailed survey results and Appendix D for the survey instrument.

[3] Based on the average number of customers in each category over a year period; it fluctuates due from month to month.

2.4. Alternative Methodologies

There are other methods to estimate price elasticity and energy impacts. The following sections describe alternative methods that were rejected due to model shortcomings, incomparable data or inconclusive results.

2.4.1. Intervention Model

An intervention model is a linear regression model of bi-monthly residential sales that includes a RIB Rate indicator (dummy) variable to indicate the presence of the RIB beginning October 2008 along with all the other expected drivers of electricity consumption as described in Section 2.3.1. Theoretically, this method can yield estimates of the RIB rate's conservation impacts. Since it does not produce an estimate of price elasticity, this method did not meet all the evaluation objectives and it was not adopted. Preliminary investigation into this method was inconclusive and showed no statistical significance on the indicator variable for the RIB Rate. However, no exploration with various model specifications was conducted to test the effects of alternative functional forms on the statistical significance of the indicator variable.

2.4.2. Comparison Group

A small number of BC Hydro residential customers were excluded from the RIB Rate as part of the Conservation Research Initiative ("CRI") Pilot starting in 2006. If this group is representative of the entire population of RIB Rate customers, then a comparison of their consumption and that of the general population should be able to produce an estimate of savings from the RIB Rate. Preliminary statistical analysis of customer characteristics indicated that CRI Pilot customers were not representative of the general population of RIB Rate customers, so the method was rejected and further analysis was not pursued.

2.4.3. Estimating Price Elasticity using Customer-Level Data

A separate analysis of billing data at the level of individual customer accounts was considered for a sample of 1,000 randomly selected customers. The elasticity estimated from consumption data from a sample of customers should also be representative of the overall population.

This method was limited by the lack of detailed robust demographic, social-economic and customer end-use data at the individual customer or household level over time—a loss of the significant advantage of this approach.

2.4.4. Estimating Class Average Price Elasticity using a Seemingly Unrelated Regressions model

An attempt was made to model the class average elasticity by establishing a system of two regressions. The first regression is the basic model shown in Equation 1 applied to Step 1 consumption only. The second regression is the model applied to Step 2 consumption only. After imposing the restriction both regressions have the same price elasticity (i.e. that the Step1 and Step 2 elasticity be statistically considered equal), the SUR model[4] yielded estimates that closely matched the original RIB design assumption of -0.05 for the class average price elasticity. However, the restriction in the SUR model was decisively rejected ($p < 0.0001$) by the data. Hence, the SUR results were not used as the basis for the class average price elasticity.

[4] Using the 'PROC SYSLIN' procedure in the SAS statistical software package

3. Results

In this section results are organized in accordance with the evaluation objectives and research questions outlined in Section 2.1. Each of the research questions are answered using information derived from the data and analysis.

3.1. Evaluation Objective 1: Estimate Price Elasticity

The following sections present the results of the econometric models to estimate price elasticity.

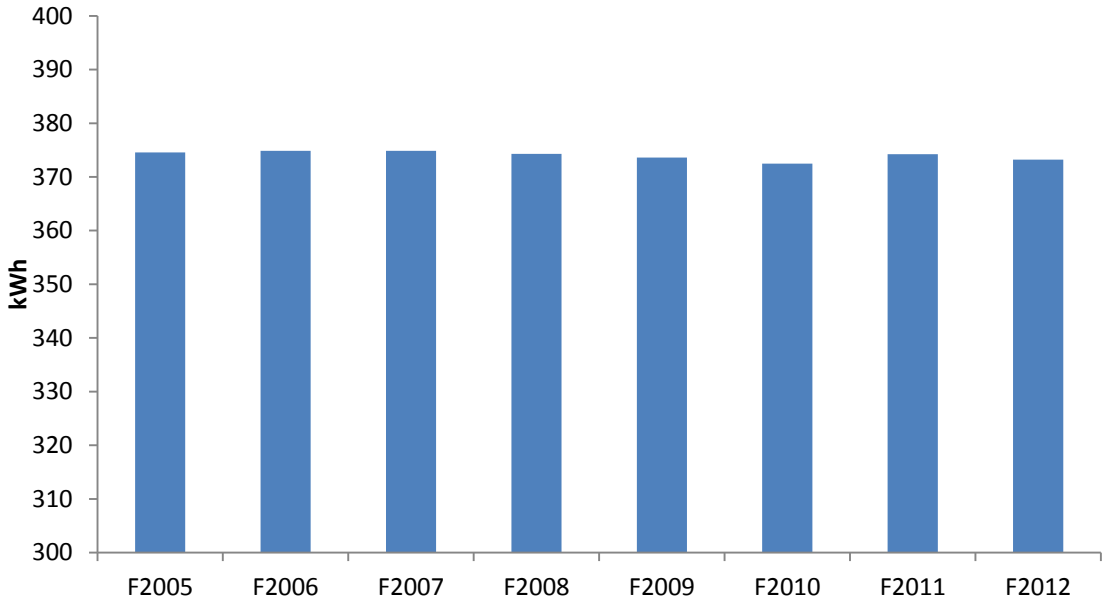
3.1.1. Price Elasticity of Step 1 and Step 2 Consumption

Step 1 Elasticity

Equation 1 from Section 2.3.1 and its alternative forms were used with the aggregate data from the "small" customers consuming only in Step 1 to attempt to obtain the Step 1 price elasticity. The resulting Step 1 elasticity estimates were not statistically significant.

Further investigation revealed that the pattern of historical Step 1 prices and associated electricity consumption were likely the major causes of the inconclusive Step 1 price elasticity estimate. Average electricity consumption of the Step 1 only customers showed little variation during the period of analysis. This could partially be due to the fact that the specification of a Step 1 customer inherently limits the upper end of the consumption range for this analysis group at 1350 kWh. In other words, if a customer has any Step 2 consumption, they are automatically included in the Step 2 group and excluded from the Step 1 bin, reducing the potential for variation. The Figure 3 shows the average monthly consumption of Step 1 customers per account over the analysis period.

Figure 3. Small Customers - Average Monthly[5] Consumption per Account, F2005-F2012

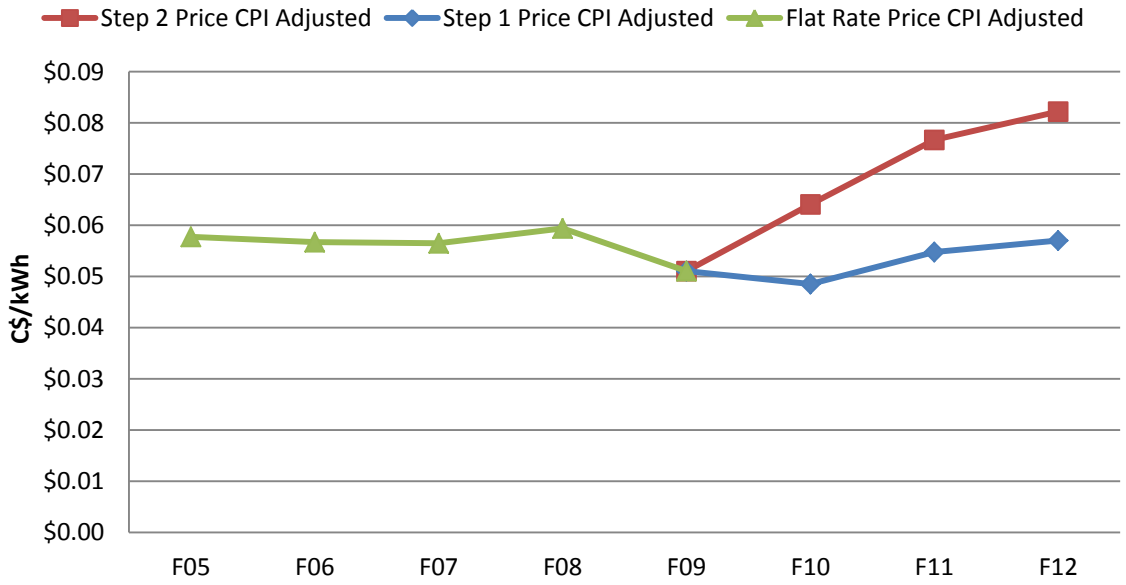


The Step 1 price, when treated as an extension of the flat rate price prior to the RIB, saw relatively little change in real terms during the period analyzed. Figure 4 shows that prior to the RIB implementation, electricity prices

[5] Typographical error, text changed from Bi-Monthly to Monthly.

in B.C. were generally flat and the Step 1 price was actually lower in terms of real prices for 2 years after the RIB implementation. Hence, it was difficult to empirically quantify elasticity when the real prices or consumption did not vary significantly during the analysis period.

Figure 4. Real Step 1 and Step 2 Prices After Inflation in 2002 $

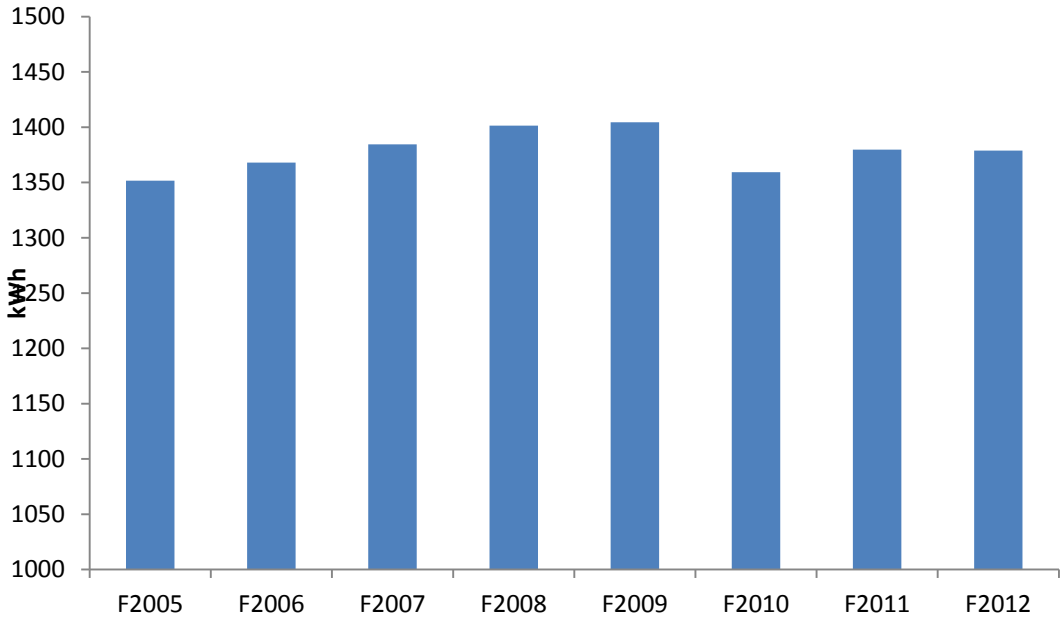


Note: The 1151 flat rate price is not shown beyond October 2008 for clarity

Step 2 Elasticity

The average per account electricity consumption of the large (consumption in Step 2) customers shows larger temporal variation than what was observed in the Step 1 group, as shown in the figure below.

Figure 5. Large Customers - Average Monthly[6] Consumption per Account, F2005-F2012



[6] Typographical error, text changed from Bi-Monthly to Monthly.

Various model specifications based on Equation 1 were used to capture the variation of residential electricity use over time. Three equally plausible models, selected based on theoretical and statistical merit, estimated a range of Step 2 price elasticities. The three models showed elasticities of Step 2 price in the range of -0.08 to -0.13. Table 3.1 lists the model specifications for the three different econometric models and the key model results. Appendix C lists the full output and results from the econometric modeling.

Table 3.1. Step 2 Price Elasticity Estimates

Econometric Model	Variables	Adj. R^2	Price Elasticity	ln (Step 2 Price) Standard Error	P-value
Common to all models	ln(Step 2 Price), Region, Dwelling, CDD, HDD, Space Heating Fuel, ln(Income), ln(DSM Expenditures), correction term				
1	+ Billing period	.897	**-.10**	.0218	< .0001
2	+ Billing period, Space Heating Fuel x HDD	.918	**-.13**	.0195	< .0001
3	+ Space Heating Fuel x HDD	. 889	**-.08**	.0223	<.0001

The variation in the elasticity estimates came largely from the different model specifications and the inclusion of various interaction terms. This demonstrated that price elasticity estimates are sensitive to the inclusion and/or the interaction of these factors. This will be again reflected in Section 3.3. Hence, it was prudent that the evaluation adopted a range estimate of price elasticity rather than a single definitive value.

3.1.2. Price Elasticity for the Baseline Scenario

As discussed in the methodology section (Section 2.3.1, Step 6), the evaluation adopted the initial BC Hydro assumption of -0.05 for the class average price elasticity used in the RIB application.

3.2. Evaluation Objective 3: Energy and Peak Demand Savings Due to the RIB Rate Structure

3.2.1. Estimate of Total Conservation

As there were no conclusive results for Step 1 price elasticity, it was not possible to determine the Step 1 price impacts on total conservation from the data available for this study. Table 3.2 shows the evaluated annual incremental electricity savings for each fiscal year resulting from the changes of the Step 2 price.

Table 3.2. Total Conservation from the Step 2 Price

	Total Annual Savings (GWh)			Average Annual Savings per Account (kWh)			
Elasticity	-0.08	-0.10	-0.13	-0.08	-0.10	-0.13	Total Accounts
Fiscal Year							
F09	59	74	96	72	90	117	820,751
F10	173	216	281	212	265	345	814,033
F11	48	60	79	58	73	94	832,812
F12	85	106	138	101	127	165	833,803

3.2.2. Estimate of Natural Conservation

Table 3.3 presents the estimated aggregate impacts due to natural conservation (the baseline) and the average natural conservation impacts per residential account based on an assumed price elasticity of -0.05 for general price increases under a flat rate.

Table 3.3. Natural Conservation Impacts

Fiscal Year	Estimated Annual Savings due to Natural Conservation (GWh)	Savings per Account (kWh)	Total Accounts
F09	2	1	1,606,894
F10	79	48	1,632,826
F11	37	23	1,651,157
F12	51	31	1,665,907

3.2.3. Estimate of Conservation Due to the RIB Structure

Since total conservation impacts were presented as a range estimate, the RIB rate structure impacts derived from them are also presented as a range estimate. Table 3.4 summarizes the annual conservation impacts attributable to the RIB rate structure and the average impacts per residential account.

Table 3.4. Energy Saving Impacts Due to the RIB Rate Structure

	Evaluated Annual Incremental Savings (GWh)		Evaluated Savings per Account (kWh)		
Fiscal Year	Low	High	Low	High	Total Accounts
F09	57	94	35	58	1,606,894
F10	94	202	58	124	1,632,826
F11	11	41	7	25	1,651,157
F12	33	86	20	52	1,665,907

The evaluated annual conservation impacts as a result of the RIB rate structure ranged from a low of 11 GWh in F2011 to a high of 202 GWh in F2010. The average total impacts per BC Hydro customer account ranged between 7 kWh and 124 kWh for the four year period. The range of the RIB rate's structural conservation impacts represent approximately 0.1% - 1.2% of the total annual residential class consumption during the time period evaluated.

3.2.4. Estimate of Peak Demand Savings

The annual peak demand savings were estimated between 2 MW and 43 MW assuming an average residential sector peak-to-energy ratio of 0.214 MW/GWh across the four years based on the residential rate class load shape.

3.2.5. Energy and Peak Demand Savings Due to the RIB Rate Structure

The following table compares reported and evaluated savings from the RIB rate structure.

Table 3.5. Reported versus Evaluated Impacts

Fiscal Year	Reported Energy Savings (GWh)	Evaluated Incremental Annual Energy Savings (GWh)		Reported Demand Savings (MW)	Evaluated Incremental Annual Peak Demand Savings (MW)	
		Low	High		Low	High
F09	92	57	94	20	12	20
F10	230	94	202	49	20	43
F11	26	11	41	6	2	9
F12	101	33	86	22	7	18

Note that the reported (forecast) energy and demand savings for the RIB in some years were slightly higher than the upper end of the range of evaluated energy savings. This is due to the change in the way conservation was estimated - from using a reference price anchored in the base year of 2008 to using the year-over-year changes in price to estimate savings (refer to Section 2.3.2).

3.3. Evaluation Objective 3: Comprehensive Analysis of Price Elasticity

In this section, elasticity estimations by customer segment are conducted for four customer segment partitions to further investigate the price elasticity associated with different types of customer profile or different customer segments. The first three partitions are broken down by region, dwelling type, and home space heating fuel. The last analysis focuses on price responsiveness by bi-monthly consumption category. Results are shown at the 95% significant level. N/A indicates that estimates were not statistically significant

3.3.1. Price Elasticity by BC Hydro Region

Price elasticity for each of four regions was modeled using Equation 1 and its variations. The range estimates of Step 2 price are listed in the table below.

Table 3.6. Step 2 Price Elasticity by Region

Econometric Model	Lower Mainland	North	Southern Interior	Vancouver Island
1	-0.11	-0.12	-0.08	-0.15
2	-0.13	-0.15	-0.12	-0.15
3	-0.11	-0.12	N/A	-0.15

The results indicate that price elasticity estimates vary across different regions in BC Hydro's service territory. The estimates for Lower Mainland and North are between -0.11 and -0.15. Elasticity estimates for the Southern Interior are -0.08 to -0.12. Finally, all models estimated a price elasticity of -0.15 for Vancouver Island, the least variation among the different models.

3.3.2. Price Elasticity by Dwelling Type

Price elasticity for the five major dwelling types; Single Family Dwelling, Row House, Apartment, Mobile Home and Other are presented in Table 3.7. Model 2 estimates that single family dwellings have higher price elasticity than other types of households, while the other two models do not show as much variation in elasticity estimates among different housing types.

Table 3.7. Step 2 Price Elasticity by Dwelling Type

Econometric Model	Single Family Dwelling	Row/Town House	Apartment	Mobile Home	Others
1	-0.08	N/A	-0.03	N/A	0.09
2	-0.14	-0.07	-0.04	-0.10	0.01
3	N/A	-0.06	-0.04	N/A	-0.05

3.3.3. Price Elasticity by Heating Type

As expected, households with electric space heating were found to exhibit a higher Step 2 price elasticity than those with non-electric heat. This finding holds true across the entire BC Hydro service territory and all dwelling types. The estimates for price elasticity of households with electric heat indicates that customers with electric space heating exhibit an above-average response to price, likely due to the larger overall bill impacts from the Step 2 price changes.

Table 3.8. Step 2 Price Elasticity by Heating Type

Econometric Model	Electric Heat	Non-electric Heat
1	-0.14	-0.09
2	-0.14	-0.08
3	-0.10	N/A

3.3.4. Price Elasticity by Consumption Level

This section analyzes price elasticity by household consumption level. It focuses on the subgroups of households with consumption above 1350 kWh bimonthly because of the limited ability to estimate Step 1 price elasticity that were discussed previously. Two subgroups of consumers are defined by (1) electricity consumption between 1350 kWh and 2400 kWh, and (2) with consumption above 2400 kWh.

The results in Table 3.9 indicate that the customer segment above 2400 kWh has an estimated price elasticity of -0.16 to -0.18, and the price elasticity of the customer segment between 1350 kWh and 2400 kWh ranges from -0.07 to -0.13. These results are consistent with the RIB design assumptions that customers with a higher level of consumption tend to have a higher responsiveness to price.

Table 3.9. Step 2 Price Elasticity by Consumption Level

Econometric Model	0-400kWh	400 kWh – 900 kWh	900 kWh –1350 kWh	1350 kWh –2400 kWh	2400 kWh and above
1	N/A	N/A	N/A	-0.13	-0.18
2	N/A	N/A	N/A	-0.13	-0.18
3	N/A	N/A	N/A	-0.13	-0.16

3.4. Evaluation Objective 4: Customer Insights in Relation to the RIB Rate

3.4.1. Customer Exposure to Step 2 Electricity Consumption

While the econometric models to estimate elasticity grouped all residential customers into 'small' (Step 1 only) and 'large' (Step 2 only) consumption groups, the following analysis uses three consumption bins to help further profile the surveyed customers in terms of their exposure to Step 2 consumption. Table 3.10 below and Table 3.11 on the following page detail how residential customers' electricity consumption distributes into the three unique consumption bins – the percentage of surveyed customer households that 'never' (0 months) incurred Step 2 consumption in the twelve months of F2012, the percentage of customer households that 'sometimes' (1-11 months) incurred Step 2 consumption and the percentage of customer households that 'always' (12 months) incurred Step 2 consumption.

In total, 35 per cent of all customer households in the survey sample 'never' incurred Step 2 consumption in F2012, 40 per cent 'sometimes' incurred Step 2 consumption, and 25 per cent 'always' incurred Step 2 consumption. This distribution – based on actual consumption – very closely reflected the actual distribution of all RIB qualified accounts in the billing system. Refer to Appendix B for the details.

Incidence of Step 2 Consumption by Region and Dwelling Type

On a regional basis, customer households on Vancouver Island were the most likely to have incurred Step 2 consumption in F2012 – 79 per cent did so in at least one month of the year, including some 35 per cent that 'always' did so in all twelve months. As explained in more detail later, these findings likely reflect that one-half of customers on Vancouver Island rely on electricity for both their space heating and water heating needs and that these end-uses were key determinants of Step 2 consumption.

Table 3.10. Incidence of Step 2 Electricity Consumption in F2012 by Region and Dwelling Type

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	Total Sometimes + Always into Step 2
Total |100% ⇒	35%	40%	25%	65%
Region				
Lower Mainland ⇒	43%	37%	20%	57%
Vancouver Island ⇒	21%	44%	35%	79%
Southern Interior ⇒	28%	41%	30%	71%
North ⇒	25%	45%	30%	75%
Dwelling Type				
Single detached house ⇒	21%	41%	38%	79%
Duplex/Row house/townhouse ⇒	36%	47%	17%	64%
Apartment/Condominium ⇒	64%	33%	3%	36%
Mobile home/other ⇒	22%	49%	29%	78%

Distributions based on the survey sample. Row totals may not total 100% due to rounding of values and/or missing values.

Customer households in the Lower Mainland were the least likely to have incurred Step 2 consumption in F2012 – only 57 per cent did so in at least one month of the year, including 20 per cent that 'always' did so in all twelve months. This finding is due in part to the fact the Lower Mainland is comprised of a much larger share of apartments/condominiums than all other regions and the fact that these smaller dwellings – most without their own hot water heaters – are the least likely to incur any Step 2 consumption at all.

At 79 per cent and 78 per cent, respectively, customers living in single detached houses and those in mobile/other dwellings were the most likely to have incurred Step 2 consumption in F2012. This incidence decreased to 64 per cent among customers living in duplexes, row houses or townhouses and much further to just 36 per cent among those living in apartments/condominiums.

Incidence of Step 2 Consumption by Space Heating and Water Heating Fuels

The incidence of having incurred Step 2 consumption in at least one month of F2012 measured 72 per cent among households that primarily rely on electricity for space heating and lower at 61 per cent among those that rely on non-electric fuels such as natural gas, oil or propane. While the causal relationship between space heating fuel and monthly step status is strong, the relationship between water heating fuel and monthly step status is also very strong.

Specifically, the incidence of having incurred Step 2 consumption in at least one month of F2012 measured 85 per cent among households that have electric hot water heaters, 66 per cent among those that have non-electric hot water heaters, and just 28 per cent among those who rely on hot water from a central system. The relationship is underscored by the wide differences in the proportion of these three groups that 'always' incurred Step 2 consumption in all twelve months of the fiscal year, measuring 40 per cent, 25 per cent and 2 per cent, respectively.

Table 3.11. Incidence of Step 2 Electricity Consumption in F2012 by Space Heating and Water Heating Fuels

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	Total Sometimes + Always into Step 2
Total | 100% ⇒	35%	40%	25%	65%
Main Space Heating Fuel				
Electricity ⇒	28%	46%	26%	72%
Non-Electric ⇒	39%	36%	25%	61%
Main Water Heating Fuel				
Electricity ⇒	14%	46%	39%	85%
Non-Electric ⇒	34%	41%	25%	66%
No hot water tank (central) ⇒	72%	26%	2%	28%
Main Space Heating and Water Heating Fuels				
Electric Heating & Electric Water ⇒	13%	50%	37%	87%
Electric Heating & Non-Electric Water ⇒	16%	47%	37%	84%
Electric Heating & Central Water ⇒	61%	37%	2%	39%
Non-Electric Heating & Electric Water ⇒	17%	40%	43%	83%
Non-Electric Heating & Non-Electric Water ⇒	36%	40%	23%	63%
Non-Electric Heating & Central Water ⇒	89%	7%	4%	11%

Distributions based on the survey sample. Row totals may not total 100% due to rounding of values and/or missing values.

Based on the magnitude of observed differences, it may first appear that water heating fuel is a stronger determinant of Step 2 status than space heating fuel. However, there are direct and indirect interactions between the two end-uses – as well as with other housing characteristics – that must be understood.

First, electrically heated homes are comprised of a much larger share of apartments/condominiums relying on electric baseboards. These dwellings are typically much smaller in size compared to other dwellings, lower in occupancy, have shared walls, and importantly, predominantly rely on central water heating. Second, a majority of households with electric hot water heaters also have electric space heating.

When looked at in isolation, electric space heating – in the absence of electric water heating – has a similar impact on the incidence of Step 2 consumption as does the impact of electric water heating in the absence of electric space heating. In these isolated scenarios, however, the homes with electric space heating would likely incur more Step 2 consumption in the heating season – and possibly the shoulder seasons – compared to homes with electric water heating.

Note that the incidence of having incurred Step 2 consumption climbed only marginally to 87 per cent for homes that have both electric space heating and electric water heating – reason being, most of these homes would already breach the threshold with only one of the two electric end-uses. However, these homes would likely incur more Step 2 consumption than those that had just one of the two electric end-uses.

Appendix C presents the incidence of Step 2 electricity consumption by household demographics. In addition to this, it also presents consumption patterns and insights essentially in reverse of the way as presented in this section. Instead of exploring customer sub-groups as to how their consumption distributes into the three unique consumption bins, each of the three consumption bins are explored as to how customer sub-groups distribute within them.

3.4.2. Electricity Prices and Total Bill Amounts as Incentives to Manage Electricity

Extent that Electricity Prices Provide an Incentive to Manage Electricity

Having spent the first portion of the survey thinking about electricity in the context of value for money, the perceived ease of managing their household's use of electricity, as well as their current effort in this regard, just over eight in ten customers indicated that they believe BC Hydro's electricity prices serve as either a 'major incentive' (41%) or a 'minor incentive' (43%) to manage their consumption. At this time in the survey, customer respondents were reflecting on their own perception, understanding and experience with price without having been given any details about the inclining block rate – such as the Step 1 and Step 2 prices – that BC Hydro uses to charge their household for their consumption of electricity.

Table 3.12. Extent that Electricity Prices and Total Bill Amounts Provide an Incentive to Manage Electricity

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Electricity Prices					
Total | 100% ⇒	6%	10%	43%	41%	84%
Never into Step 2 (0 months) ⇒	7%	12%	46%	35%	81%
Sometimes into Step 2 (1-11 months) ⇒	5%	10%	42%	43%	85%
Always into Step 2 (12 months) ⇒	4%	9%	41%	46%	87%
Total Bill Amounts					
Total | 100% ⇒	3%	6%	42%	48%	90%
Never into Step 2 (0 months) ⇒	5%	6%	45%	44%	89%
Sometimes into Step 2 (1-11 months) ⇒	2%	6%	43%	49%	92%
Always into Step 2 (12 months) ⇒	3%	7%	40%	51%	91%

Row totals may not total 100% due to rounding of values and/or missing values.

Extent that Total Bill Amounts Provide an Incentive to Manage Electricity

Later in the survey, customers were asked about their opinions of their electricity bills. As shown in Table 3.12, nine in ten customers reported that the total dollar amount of their electricity bills serves as either a 'major incentive' (48%) or a 'minor incentive' (42%) to manage their household's consumption of electricity.

The total bill amounts emerged to be assessed by customers as being a greater incentive to manage electricity than electricity prices due to the finding that the top-box ('major incentive') and top-two box ('major incentive' + 'minor incentive') scores measured significantly higher in regards to the bills – by 6 to 7 points.

Customer households that incurred some Step 2 consumption in the twelve months of F2012 – especially those that 'always' did so – were more likely than those that 'never' did to view the dollar amount of their bills as well as price as having a 'major incentive' on their management of electricity.

3.4.3. Awareness and Opinions of BC Hydro's Residential Rate Structure

Unaided Awareness of BC Hydro's Residential Rate Structure

To measure customers' awareness of BC Hydro's residential rate structure, a series of different rate explanations were presented in the survey and questions administered to derive actual awareness prior to receiving the survey – that is, awareness uncontaminated by the survey content itself. It is also important to note that the context of interest was awareness of the rate structure in concept – not simply awareness by name such as the "Residential Inclining Block" or the "Two-Step Residential Conservation Rate".

A total of 50 per cent of customers demonstrated they were previously aware that the corporation charges their household's consumption of electricity on an inclining block rate – also described as a stepped rate in the survey. A total of 31 per cent of customers believed their household's use of electricity was charged on a flat rate (as it was for many years prior to October 2008) while 2 per cent of customers believed that their consumption was charged on a declining block rate (a rate structure not used since the early 1990's). A total of 17 per cent were categorized as not knowing how their household was charged for its consumption of electricity.

Table 3.13. Unaided Awareness of BC Hydro's Residential Rate Structure

	Inclining block rate	Flat rate	Declining block rate	Don't know
Total | 100% ⇒	50%	31%	2%	17%
Region				
Lower Mainland ⇒	45%	34%	2%	19%
Vancouver Island ⇒	66%	22%	1%	11%
Southern Interior ⇒	43%	34%	2%	20%
North ⇒	49%	30%	2%	20%
Step 2 Consumption Status in F2012				
Never into Step 2 (0 months) ⇒	43%	31%	2%	24%
Sometimes into Step 2 (1-11 months) ⇒	52%	31%	2%	15%
Always into Step 2 (12 months) ⇒	57%	30%	1%	12%

Row totals may not total 100% due to rounding of values and/or missing values.

In specific regards to the inclining block rate, awareness measured highest at 66 per cent among customers on Vancouver Island due in large part to the fact that they are substantially more likely than all others to rely on electricity for space heating and water heating. In turn, these customers are likely more cognizant of their electricity consumption and their accompanying bills. Interestingly, the results of the analysis of regional elasticities in Section 3.3.1 also that showed Vancouver Island customers were much more responsive to the Step 2 price.

Unaided awareness that BC Hydro uses an inclining block rate to charge residential customers for their use of electricity was strongly tied to household consumption. Households that 'always' incurred Step 2 consumption in the twelve months of F2012 were more likely than those that 'sometimes' incurred Step 2 consumption – and much more likely than those that 'never' incurred Step 2 consumption – to have been aware of the structure.

Refer to Appendix C for a complete accounting of rate awareness by all customer contact demographics and household sub-groups – including dwelling type, space heating fuel and water heating fuel.

The Perceived Rate Structure as an Incentive to Manage Electricity

After asking customers about the method they perceived the corporation uses for charging their household's consumption of electricity, they were asked about the extent that the method serves as an incentive to manage their use of it.

Table 3.14. Extent that the Perceived Rate Structure Provides an Incentive to Manage Electricity

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	17%	18%	37%	28%	65%
Customers contacts who believed their electricity consumption is charged on an inclining block rate					
Total | 100% ⇒	6%	16%	46%	33%	79%
Customers contacts who believed their electricity consumption is charged on a flat rate					
Total | 100% ⇒	9%	26%	35%	31%	66%
Customer contacts who believed their electricity consumption is charged on a declining block rate					
Total | 100% ⇒	10%	29%	31%	30%	61%
Customer contacts who did not know how their electricity consumption is charged					
Total | 100% ⇒	64%	9%	14%	13%	27%

Row totals may not total 100% due to rounding of values and/or missing values.

For the one-half of all customer contacts who correctly understood that their household's consumption of electricity is charged on an inclining block rate, a total of 79 per cent of them believed the method serves as either a 'major incentive' (33%) or a 'minor incentive' (46%) to their household to manage its use of electricity. The balance of these individuals were more likely to feel that the method serves 'no incentive at all' (16%) rather than to be without an opinion (6%).

Among customers who thought their household's use of electricity is charged on a flat rate, the top-two box incentive score – the percentage of individuals who said that the method serves as a 'major' or 'minor' incentive to manage the use of electricity – measured 13 points lower at 66 per cent, while for those who thought it is charged on a declining block rate, the score measured 18 points lower at 61 per cent. Note that the three customer groups were by and large similar in the proportion of them who reflected upon their perceived rate structure as serving a 'major incentive' to manage their consumption of electricity. Instead, the notable differences were in the proportion of customers who felt that the rate structure serves as a 'minor incentive'.

After consolidating their responses, a total of 65 per cent of customers felt that their perceived rate structure serves as either a 'major incentive' (28%) or a 'minor incentive' (37%) to their household to manage its use of electricity. This top-two box incentive score of 65 per cent measured 19 points lower than the 84 per cent incentive score in regards to electricity prices, and 23 points lower than the 90 per cent incentive score in regards to the total dollar amount of electricity bills.

Customer Opinion of the Price of Electricity in Relation to the RIB Rate

Customers who correctly identified that their household's use of electricity is charged on an inclining block rate may not necessarily consider or differentiate the price of electricity – as it pertains to their own household – by the Step 1 and Step 2 prices. Having been reminded that they are charged the Step 1 price for their consumption of electricity up to 1,350 kWh in an average two-month billing period and the Step 2 price for any additional consumption, these particular customers were queried as to what they considered to be their electricity price as it relates to their own household's use of it.

The single largest segment of these customers – 43 per cent – considered each of the Step 1 and Step 2 prices as being their household's price of electricity, depending on the point in time in the billing period and/or their consumption in the billing period. This is especially true for households that either 'sometimes' or 'always' incurred Step 2 consumption in the twelve months of F2012.

Table 3.15. Customer Opinion of the Price of Electricity in Relation to the RIB Rate
- among customers previously aware of the RIB Rate -

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	Total
	100%	100%	100%	100%
	⇓	⇓	⇓	⇓
I would say that I consider the lower, Step 1 price as being my household's price of electricity in a billing period	50%	22%	8%	26%
I would say that I consider the higher, Step 2 price as being my household's price of electricity in a billing period	3%	7%	11%	7%
I would say that I consider each of the Step 1 and Step 2 prices as being my household's price of electricity, depending on the point in time in the billing period and/or our consumption in the billing period	25%	49%	51%	43%
I do not think about my household's price of electricity in any of these particular ways	12%	18%	26%	19%
Don't know	11%	4%	4%	6%

Column totals may not total 100% due to rounding of values and/or missing values.

A total of 26 per cent of customer contacts who correctly understood that their household's consumption of electricity is charged on an inclining block rate considered the lower, Step 1 price as being their household's price of electricity in a billing period. This sentiment increased substantially to 50 per cent strictly among households that proved to have 'never' incurred Step 2 consumption in F2012. Only a small minority of customers – 7 per cent – considered the higher, Step 2 price as being their household's price of electricity in a billing period. The balance of most other customers – 19 per cent – revealed that they do not think about their household's price of electricity in any of the three given ways.

A very broad view of these findings suggests that most of these customers – those who correctly identified that their household is on an inclining block rate – have a logical understanding and view of the price of electricity.

How the RIB Rate Provides an Incentive to Manage Electricity

Customers who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's consumption of electricity and said it serves as an incentive to manage their use of it were further queried as to just how the rate acts as a motivator.

Among these customers, the single largest segment of them – 33 per cent – reported that the difference between the Step 1 and Step 2 prices acts as an incentive to their household to manage its consumption of electricity. These customers indicated that if they can manage their use of electricity effectively in a billing period, then they can have most of it charged at the lower, Step 1 price, perhaps even avoiding Step 2 consumption and the higher, Step 2 price altogether.

Table 3.16. How the RIB Rate Provides an Incentive to Manage Electricity
- among customers previously aware of the RIB Rate and who said it serves as an incentive -

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	Total
	100%	100%	100%	100%
	⇓	⇓	⇓	⇓
The lower, Step 1 price on its own incents our household.	37%	19%	9%	21%
The higher, Step 2 price on its own incents our household.	8%	18%	21%	16%
The difference between the Step 1 and Step 2 prices incents our household.	30%	32%	36%	33%
The consumption threshold on its own incents our household.	16%	16%	14%	16%
The stepped rate does not incent my household in any of these particular ways.	5%	10%	17%	11%
Don't know	4%	5%	4%	4%

Column totals may not total 100% due to rounding of values and/or missing values.

The proportion of customers who said that the difference between the Step 1 and Step 2 prices acts as an incentive to their household to manage its use of electricity was similar among the three sub-groups relating to Step 2 status in F2012 – including those households that 'never' had Step 2 consumption in the year. However, the single largest segment of these 'never' households – 37 per cent – said that the lower, Step 1 price on its own acts as an incentive to their household. They consider the lower, Step 1 price as being the price applicable to all of their electricity consumption in a billing period, and they try to manage their consumption of electricity on that basis.

Just 16 per cent of customers with proven awareness of the inclining block rate felt that the higher, Step 2 price on its own serves as an incentive to their household to manage its use of electricity. These customers consider the higher, Step 2 price as being the price applicable to the part of electricity consumption in a billing period that they have control over, and they try to manage their use of electricity on that basis.

For 16 per cent of these customers, price does not manifest itself in any of these ways as an incentive to them to manage their use of electricity; instead, they point to the consumption threshold. For these customers, regardless of the difference in the Step 1 and 2 prices and the amount they pay on their bill, they compare their household's consumption to the Step 1 to Step 2 threshold simply because they like to keep their consumption as low as possible compared to it.

Although they understood that their household's consumption of electricity is charged on an inclining block rate and they said that the rate serves as an incentive to their household to manage its use of it, 11 per cent of customers subsequently reported that the rate does not incent their household to manage its consumption of electricity in any of the four ways as presented. It is not clear if these particular customers are indeed incented by the rate in some different way, or if they were inconsistent in their responses. Refer to Table 3.16 for the completed findings.

3.4.4. Observations of Customer Behaviour in Relation to Awareness of the RIB Rate

Electricity Consumption by RIB Rate Awareness

Statistical analysis showed that awareness of the inclining block rate does not directly lead households to having lower consumption as strictly compared to households unaware of the rate. Instead, the relationship appears to be that higher consumption leads to a greater likelihood of being aware of the RIB rate. Refer to Appendix C for the details.

Table 3.17. ANOVA Tests: Mean Electricity Consumption in F2012 by RIB Rate Awareness

	Customers aware of the RIB Rate	Customers not aware of the RIB Rate	Difference between groups
All Customers			
Total F2012 consumption ⇒	10,495 kWh	9,017 kWh	1,478 kWh*
Total Step 1 consumption ⇒	6,469 kWh	6,071 kWh	398 kWh*
Total Step 2 consumption ⇒	4,027 kWh	2,946 kWh	1,081 kWh*

* The difference between mean consumption levels is statically significant at the 95% level of confidence.

However, when comparing their consumption over time, households aware of the RIB rate may have higher energy savings in F2012 than if had they not been aware of the rate and/or higher savings than in periods prior to becoming aware of the rate. To investigate this, a much larger dataset of customer accounts would be required, including a long time series of consumption history both before and after households became aware of the rate as disaggregated by a finely specified awareness date variable.

Program Participation by RIB Rate Awareness

BC Hydro offers several Power Smart programs to its residential customers to encourage them to improve energy efficiency and to adopt more energy conscious behaviours in their homes. Customers who correctly identified that their household's consumption of electricity is charged on an inclining block rate emerged to be no more likely to have participated in any of these programs after becoming aware of the rate than all other customers. Refer to Appendix C for the complete findings.

Investments in Home Energy Efficiency by RIB Rate Awareness

Customers were queried on their purchases of Compact Fluorescent Lamps ("CFLs") and Light-Emitting Diode ("LED") lamps in an effort to understand whether some investments in home energy efficiency differ by awareness of the RIB rate. Findings suggest that those who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's use of electricity were no more likely than all others to indicate that they either 'always' or 'usually' purchase and install energy-efficient light bulbs – such as CFLs and LEDs – when replacing burnt-out lamps.

In-Home Behaviours by RIB Rate Awareness

The self-reported in-home behaviours around energy use and conservation among customers who correctly understood that their household's use of electricity is charged on an inclining block rate were compared and contrasted to those among all others.

As revealed by their higher top-box ('always') or top-two box scores ('always' + 'usually'), customers previously aware of the inclining block rate emerged to outperform all other customers on many of the behaviours related to space heating, laundry, dishwashing, lighting and other plug-load behaviours.

Table 3.18. Selected Energy Conservation Behaviours and RIB Awareness

	Never	Occasionally	Usually	Always	Total Always + Usually
Draw window coverings at night to keep in heat					
Previously aware of the inclining block rate ⇒	11%	10%	20%	59%*	79%
Not previously aware ⇒	14%	10%	22%	54%	76%
Use a programmable thermostat or manually turn down the heat at night					
Previously aware of the inclining block rate ⇒	20%	6%	13%	61%*	74%**
Not previously aware ⇒	21%	9%	14%	56%	70%
Reduce temperature in unused rooms by closing vents or turning down thermostats					
Previously aware of the inclining block rate ⇒	21%	11%	20%	48%*	68%
Not previously aware ⇒	25%	10%	21%	44%	65%
Only do laundry with full loads					
Previously aware of the inclining block rate ⇒	1%	3%	47%	49%	96%**
Not previously aware ⇒	1%	6%	41%	51%	92%
Use the temperature/moisture sensor to turn off the dryer rather than use the timer					
Previously aware of the inclining block rate ⇒	28%	10%	22%	40%	62%**
Not previously aware ⇒	30%	13%	23%	34%	57%
Turn off computer and printer when not in use OR use the power-save mode					
Previously aware of the inclining block rate ⇒	2%	8%	23%	67%*	90%**
Not previously aware ⇒	4%	10%	26%	60%	86%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
* Statistically significant difference between the two groups' top-box score ('always') at the 95% level of confidence.
** Statistically significant difference between the two groups' top-two box score ('always' + 'usually') at the 95% level of confidence.

It is important to note that due to the complexity of the many causal pathways linking customer demographics, awareness, influences, attitudes and behaviours, the behavioural differences between the two groups in this study have not proven to be attributable to the difference in rate awareness.

Table 3.18 details some of the in-home behaviours for which the statistically significant differences between the two groups were believed to have potential impacts on electricity consumption. Appendix C details the comprehensive list of in-home behaviours investigated in the survey, including the behavioural scores disaggregated by customers previously aware of the inclining block rate and all others.

RIB Rate Awareness and the Price Response

The relationship between RIB awareness and the price response was investigated by assessing differences in RIB awareness and price elasticity between regions. Awareness of the RIB on Vancouver Island was 66 per cent, compared to awareness in the other three BC Hydro regions below 50 per cent. Customers on Vancouver Island had the highest exposure to the Step 2 price at some point during the F2012 (79%), compared to all RIB

rate customers (65%), and Vancouver Island customers also showed one of the highest responsiveness to the Step 2 price - with a range of price elasticity estimated between -0.13 and -0.15 compared to -0.08 to -0.13 for the overall population. It is difficult to determine the exact causal relationships that lead to the response observed on Vancouver Island, since it was likely a combination of multiple factors, including customer demographics, the higher prevalence of electric heat and single family dwellings, and increased exposure to the Step 2 price. In comparison, the Northern region also showed a high elasticity of the Step 2 price (-0.12 to -0.16), but awareness of the RIB was no higher than the overall average.

3.5. Confidence and Precision

The RIB conservation estimates are anchored on the estimation of price elasticity, therefore the accuracy and confidence of the savings estimates depends on the statistical significance of the elasticity estimates. The evaluated conservation impacts are largely based on highly statistically significant results of the Step 2 price elasticity estimates (confidence level of $p < 0.001$ on the Step 2 price parameter). They are not based on the statistically insignificant estimates of Step 1 price elasticity.

As an additional check, studies of the literature have shown that electricity price elasticity varies by different customer segments and geographic locations. The elasticity estimates from this evaluation in general agree with the results from other studies of jurisdictions with a similar climate as British Columbia (see a discussion in Appendix B - Methodology and Literature Review).

3.6. Limitations

The approaches for estimating price elasticity were limited due to the constrained granularity of the available aggregate-level data. A better understanding of price elasticity variation over time and among customer groups could be gained from customer-level economic data and enhanced data on end-use profiles and appliance energy efficiency standards over the analysis period. This approach was currently not feasible due to the lack of data at the population level for customer end-uses, efficiency indicators, and personal economic data. The omission of trend variables that may explain additional variance in consumption over time, such as changes in attitudes and in codes and standards may also affect the price elasticity estimates.

While the estimates of Step 2 price elasticity are highly statistically significant, the fact that Step 1 price elasticity was not able to be successfully estimated adds some uncertainty to the evaluated conservation from the RIB structure. The continued reliance on the assumption of -0.05 as the class average price elasticity to estimate natural conservation also adds uncertainty to the evaluated conservation from the RIB structure. While the price elasticity of general price increases under a flat rate was not able to be estimated empirically, the investigation using the SUR model did provide directional support for an elasticity of -0.05.

Another limitation of the study is how it addresses the interactions between DSM programs, energy efficiency codes and standards, and conservation rates. Attempts to control for overlapping DSM initiatives are included in the econometric models, but the models were designed to be simple and transparent, and therefore include only the actual expenditures on DSM by BC Hydro in a given period. This neglects the influence of numerous other organizations acting to improve efficiency and conservation in the marketplace.

Finally, the use of an average peak-to-energy ratio (capacity factor) based on the residential class load shape adds uncertainty to the estimates of peak demand savings. It is difficult to determine exactly how the customer response to the RIB rate Step 2 price directly translates into actions taken (e.g., reduction in energy used for lighting, heating, appliances) during the short time frame that defines the overall system peak.

4. Findings and Recommendations

4.1. Findings

Price Elasticity

1. **The estimated range of Step 2 price elasticity (-0.08 to -0.13) encompasses the initial elasticity assumption of -0.10 for forecasting the RIB impacts.** The range is also comparable to the results of elasticity studies for jurisdictions similar to British Columbia.

2. **The data available was insufficient for estimating the price elasticity from the small residential customers with only Step 1 consumption.** This group experienced much smaller price increases and changes in consumption compared to the customers with Step 2 consumption over the four-year period.

3. **The class average elasticity to general price increases under a flat rate was not able to be estimated using empirical data.** The evaluation used the assumption of -0.05 as the class average price elasticity to determine the natural conservation baseline.

4. **Price elasticity is very sensitive to various other factors affecting electricity consumption included in the econometric models.** It was considered prudent that this evaluation adopt a range estimate of price elasticity rather than a single definitive value since each model produced a statistically highly significant estimate of price elasticity.

Conservation

1. **The evaluated incremental annual energy savings of the RIB rate structure ranged between 11 GWh and 202 GWh from F2009 to F2012.** For some years, the upper end of the range of the RIB rate structure conservation is slightly lower than the forecast energy savings.

2. **The evaluated annual peak demand savings ranged between 2 and 43 MW from F2009 to F2012.** For some years, the upper end of the range of the RIB rate structure conservation is slightly lower than the forecast energy savings.

Differences in Price Elasticity by Customer Characteristics

1. **Price elasticity was generally higher for the customer segments with higher consumption.**

   - Price elasticity was higher on Vancouver Island and the Northern region than the overall average.
   - Price elasticity was higher for single family dwellings compared to other dwelling types.
   - Price elasticity was higher for households with electric heat versus non-electric heat.

2. **Large residential users consuming more than 2,400 kWh bi-monthly show a substantially higher than average response to higher prices.** Compared to the range of average Step 2 elasticity (-0.08 to -0.13), the largest residential users had a price elasticity estimated in the range of -0.16 to -0.18.

Customer Response, Awareness, and Understanding

1. **The approximate proportions of residential customers that 'never', 'sometimes' or 'always' saw the Step 2 price (in F2012) were 35 per cent, 40 per cent, and 25 per cent, respectively.** The greatest percentage of customers who 'sometimes' or 'always' saw the Step 2 price were those in single family (detached) dwellings and those with electric space heating and/or electric water heating.

2. **50 per cent of residential customers appear to have been aware of the RIB as of February 2012.** A total of 31 per cent believed they were on a flat rate and 17 per cent did not know the mechanics of how they are charged. Among customers who pay the Step 2 price in every billing period, only 57 per cent were aware of RIB.

3. **The total amount of the household electricity bill serves as the greatest incentive to manage electricity consumption among residential customers, followed by electricity prices.** Over 90 per cent of customers reported that the total dollar amount of their electricity bills serves as either a 'major incentive' (48%) or a 'minor incentive' (43%) to manage their household's consumption of electricity, compared to 84 per cent for electricity prices (41% 'major' and 43% 'minor').

4. **A total of 79 per cent of residential customers aware of the RIB believe it serves as an incentive to manage electricity consumption.** For the one-half of all customers who correctly understood that they are charged on an inclining block rate, a total of 33 per cent of them believed it serves as a 'major incentive' and 46 per cent believe it to be a 'minor incentive' for their household to manage its use of electricity.

5. **There are small but statistically significant differences in the prevalence of energy conserving behavior among customers that are aware of the RIB compared to those that aren't.** It is also important to note that due to the complexity of the many relationships linking customer demographics, awareness, attitudes and behaviours, the differences between the two groups in this study have not proven to be directly attributable to RIB awareness.

6. **Awareness of the RIB does not appear to have significant influence on customer investments in energy-efficient equipment or participation in Power Smart programs.** Customers who correctly identified that their household's consumption of electricity was charged on an inclining block rate were no more likely to have participated in BC Hydro's Power Smart programs, and were less likely to have purchased and installed energy-efficient lamps – such as CFLs and LEDs.

7. **Higher consumption is correlated with both higher awareness of the RIB and higher price elasticity, however no firm conclusions can be drawn about how RIB awareness is related to the customer price response.** To investigate this further would require a large dataset of customer accounts that includes an accurate estimate of when each customer became aware of the rate, which is difficult to measure for a rate first implemented in 2008.

4.2. Recommendations

1. **Continue to attempt to estimate Step 1 price elasticity and the class average price elasticity.** Future evaluations may have improved results with accumulation of empirical data and price variation over time.

2. **Future RIB rate evaluation may benefit from the complementary econometric analysis of a select sample of customers.** This would require additional data collection on changes in major household energy end-uses (e.g. appliance replacements, heating system upgrades), changes in economic and demographic factors (e.g. occupancy) and participation in other DSM programs to attempt to further isolate the effects of electricity prices on consumption.

4. **Consider ways to increase awareness of the RIB, particularly targeted at customer segments that have shown the largest response to price.** The evaluation results indicate there are correlations between RIB awareness and energy conservation behaviours. While causation is unclear, this could mean that increasing RIB awareness will lead to increases in customers undertaking energy conservation behaviours and corresponding energy savings.

5. Conclusions

The RIB rate appears to be achieving its overall objective of encouraging conservation through the customer response to higher marginal prices – particularly amongst the customers with the highest consumption.

EOC Signoff

BC Hydro's Evaluation Oversight Committee is made up of DSM stakeholders from various parts of the company and is mandated to ensure that BC Hydro's DSM evaluations are objective, unbiased and of sufficient quality.

The F2009-F2012 RIB evaluation meets the following criteria for approval by the Evaluation Oversight Committee:

1. The evaluation complied with the defined scope.
2. The evaluation methodology is appropriate given the available resources at the time of the evaluation.
3. The evaluation results are reasonable given the available data and resources at the time of the evaluation.

Original Signature on File

_____

Magdalena Rucker, Sr. Planner, Resource Planning
Evaluation Oversight Committee Chair

References

Barnes, R., R. Gillingham, et al. (1981) "The Short-Run Residential Demand for Electricity." The Review of Economics and Statistics 63(4): 541-552.

Bernstein M., Griffin, J. (2005) “Regional Differences in the Price-Elasticity of Demand for Energy.” Rand Corp. Santa Monica, California.

BCUC. (2010) “BCUC Order G-45-11.” British Columbia Utilities Commission, Vancouver, British Columbia.

Charles River Associates. (2005) “Impact Evaluation of the California Statewide Pricing Pilot.” Cambridge, Massachusetts.

DEFG (2013). Consumer Preferences and the Elusive Magic of Dynamic Pricing”, DEFG, Washington, DC.

Espey, J. A., Espey, M. (2004) “Turning on the Lights: A Meta-Analysis of Residential Electricity Demand Elasticities.” Journal of Agricultural and Applied Economicis, 36 (1): 65-81.

Faruqui, A., Sergici, S. (2009) “Household Response to Dynamic Pricing of Electricity-a Survey of the Experimental Evidence.” Brattle Group. San Francisco, California.

EPRI (2010) “Trends in Regional U.S. Electricity and Natural Gas Price Elasticity”, Electric Power Research Institute, Palo Alto, California.

Hartman, R. S. (1983) "The Estimation of Short-Run Household Electricity Demand Using Pooled Aggregate Data." Journal of Business & Economic Statistics 1(2): 127-135.

Henson, S. E., (1984) “Electricity Demand Estimates under Increasing-Block Rates,” Southern Economic Journal 51(1): 147-156.

Herriges, J. A. and K. K. King (1994) "Residential Demand for Electricity under Inverted Block Rates: Evidence from a Controlled Experiment." Journal of Business & Economic Statistics 12(4): 419-430.

Hsiao C. and D.C. Mountain (1994) “A Framework for Regional Modeling and Impact Analysis: An Analysis for the Demand for Electricity by Large Municipalities in Ontario, Canada,” Journal of Regional Science, 34(3): 361-385.

Ito, Koichiro. (2012) “Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Price”. Energy Institute at Hass, working paper 210R.

Lai, J., DeForest, N, et al. (2010) “Evaluation of Evolving Residential Electricity Tariffs”, Lawrence Berkeley National Laboratory, California.

Maruejols, L., Ryan, D. L., (2010) CBEEDAC Survey of Electricity Price Awareness: a preliminary examination of survey responses.” The Canadian Building Energy End-use Data and Analysis Centre(CBEEDAC), Alberta.

Navigant Consulting Inc. (2010) “The Effects of Time-of-Use Rates on Residential Electricity Consumption.” Toronto.

Paul, A. C., E. C. Myers, et al. (2009) "A Partial Adjustment Model of U.S. Electricity Demand by Region, Season, and Sector." RFF Discussion Paper No. 08-50.

Reiss, P. C. and M. W. White (2005) "Household Electricity Demand, Revisited." The Review of Economic Studies 72(3): 853-883.

Sharon Bernstein, M. (1987) "The Econometrics of Piecewise-Linear Budget Constraints: A Monte Carlo Study." Journal of Business & Economic Statistics 5(2): 243-248.

Abbreviations and Glossary

BCUC	British Columbia Utilities Commission
CDD	Cooling Degree Days. A measurement to reflect the amount of energy required to cool a building derived from outdoor air temperature. Cooling degree days are defined relative to a base temperature (18°C).
CRI	Conservation Research Initiative – A pilot project started in November 2006 to investigate the capabilities of smart meters including critical peak pricing and load control components.
DSM	Demand Side Management
Experimental Design	Also known as a randomized controlled experiment where participants in the experiment are randomly assigned to either the treatment or control group to attempt to isolate the effects of the treatment itself from all other (unknown) sources of variation.
HDD	Heating Degree Days. A measurement to reflect the amount of energy required to heat a building derived from outdoor air temperature. Heating degree days are defined relative to a base temperature (18°C).
OLS	Ordinary Least Squares - a method for estimating the unknown parameters in a linear regression model. This method minimizes the sum of squared vertical distances between the observed responses in the dataset and the responses predicted by the linear approximation.
RIB	Residential Inclining Block
Quasi-experiment	In a quasi-experimental design, there is no random assignment to a treatment or control group. Treatment and comparison group members are matched on relevant characteristic(s).

Appendix A - Results Summary

Table A.1. Estimated Price Elasticity

Customer Group	Price Elasticity Estimate Low	High
Step 1 Consumption	N/A	N/A
Step 2 Consumption - Overall	-0.08	-0.13
1350 kWh < Bi-Monthly Consumption < 2400 kWh	-0.07	-0.13
Bi-Monthly Consumption > 2400 kWh	-0.16	-0.18
Class Average Elasticity (assumed -0.05)	N/A	N/A

Table A.2. Reported versus Evaluated Impacts

Fiscal Year	Reported Energy Savings (GWh/year)	Evaluated Incremental Annual Energy Savings (GWh/year) Low	High	Reported Demand Savings (MW)	Evaluated Incremental Annual Peak Demand Savings (MW) Low	High
F09	92	57	94	20	10	20
F10	230	94	202	49	20	43
F11	26	11	41	6	2	9
F12	101	33	86	22	7	18

Appendix B - Approach Details

B.1. Econometric Modeling

The estimation of Step 2 price elasticity was derived from three residential electricity demand models. These models were selected based on residential electricity demand theories and the validity of the econometric modeling results. The basic functional form was:

Model (1) Specification:

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \delta \cdot BillingPeriod + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \text{ʒ} \cdot Region + \theta \cdot ln\left(DSM_{Expenditure}\right) + \cdot ln\,(Price) + \sigma \cdot ln\,(Disposable\_Income) + \varphi \cdot C + \mu$$

Where,

ln() denotes natural logarithm; natural logarithm was used for convenience, when it is used for both consumption and price variables it results in a regression coefficients on the price variable that can be interpreted as an elasticity without additional calculation.

Consumption is bimonthly per account electricity consumption in kWh;

Heat is a binary indicator (dummy variable) whose value is one to indicate the presence or zero the absence of electric heat as the primary space heating source;

Premise consists of dummy variables that indicate different residential dwelling type: mobile home(*D_MOB*), apartment(*D_APT*), row house(*D_ROW*), single family dwelling (*D_SFD*) and Other (represented by setting all the previous dummy variables to 0) ;

BillingPeriod consists of dummy variables that represents the 6 bi-monthly periods in which residential customers are billed and is used to represent non-weather related seasonal effects*;* June-July *(BP_2),* Aug-Sept *(BP_3),* Oct-Nov *(BP_4),* Dec-Jan *(BP5)* and Feb-Mar *(BP6).* April-May is represented by setting the previous five dummy variables to 0.

CDD and *HDD* represent cooling and heating degree days used to represent weather impacts;

Region are dummy variables to represent the four regions in BC Hydro's service territory: Lower Mainland(*D_Reg_LM*), North(D_Reg_N), Southern Interior(D_Reg_SI) and Vancouver Island (represented by the value of the first three variables when they are all set to 0)

DSM_Expenditure is the real (CPI deflated) spending of BC Hydro's DSM initiatives (program, Codes and Standards development and other supporting initiatives) on the residential sector;

Price is the real electricity price charged to residential customers. It was a single flat rate before RIB and the applicable marginal rate in the RIB period; price elasticity is represented by the coefficient ( ) for the price variable;

Disposable_Income: per capita real disposable income (CPI deflated);

C is a correction term to account for sample selection bias caused by the fact that the Step 1 regression's sample only contains "small" users and Step 2 regression's sample only contains "large" users.

μ is the error term.

Bi-Monthly Billing Data. During the timeframe evaluated, residential customers were billed once every two months on a non-uniform cycle. To facilitate analysis, consumption data was assigned into six consistent bi-monthly time periods, as follows: December-January; February-March; etc.

Electricity Price. Economic theory holds that price impacts consumption. Historical electricity prices for residential customers were obtained from BC Hydro Tariff documents.

Adjusting Historical Prices using the CPI. Table B.1. presents a schedule of the historical prices for the Step 1, Step 2 and equivalent flat rates. The table also shows the percentage change in the real price year over year by adjusting the nominal prices for inflation, based on the consumer price index ("CPI") shown in the far-right column.

Table B.1. Historical Prices vs. Consumer Price Index

	Nominal Price (cents/kWh)			Percentage Change in Real Price			
Fiscal Year	Step 1	Step 2	Flat Rate (1151)	Step 1 % Change from previous year	Step 2 % Change from previous year	Flat Rate % Change from previous year	Consumer Price Index (base year of 2002)
F2008	-	-	6.14	-	-	-	110.3
F2009	5.46	7.21	6.29	-5%	26%	-1%	112.5
F2010	5.91	8.27	6.84	8%	15%	9%	112.5
F2011	6.27	8.78	7.26	4%	4%	4%	114.5
F2012	6.67	9.62	7.84	4%	7%	6%	117.0
F2013	6.80	10.19	8.15	1%	5%	3%	118.0

Weather. Weather affects electricity consumption through space heating, water heating and air conditioning loads. Heating Degree Days (HDD) and Cooling Degree Days (CDD) representing bi-monthly temperature variations were used to control for weather impacts on electricity consumption. Plots of HDD and CDD for the four BC regions over time are shown below.

Figure B.1. Heating Degree Days by BC Hydro Region – F2008-F2012

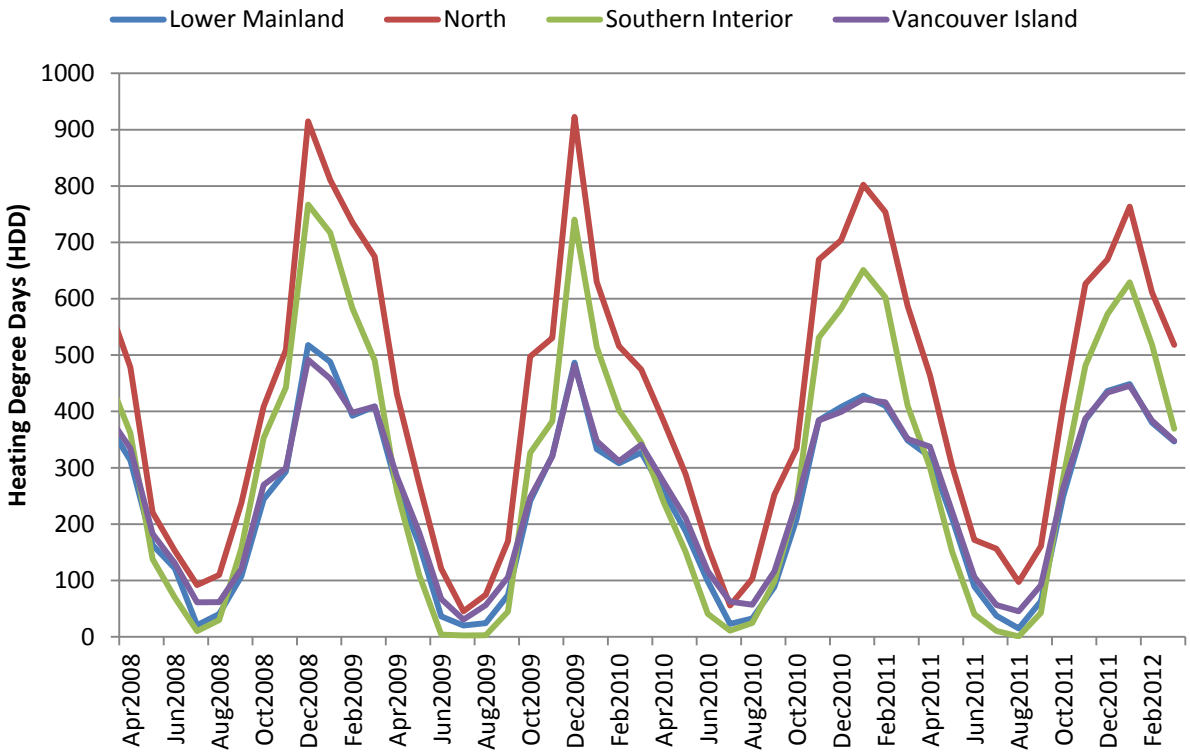
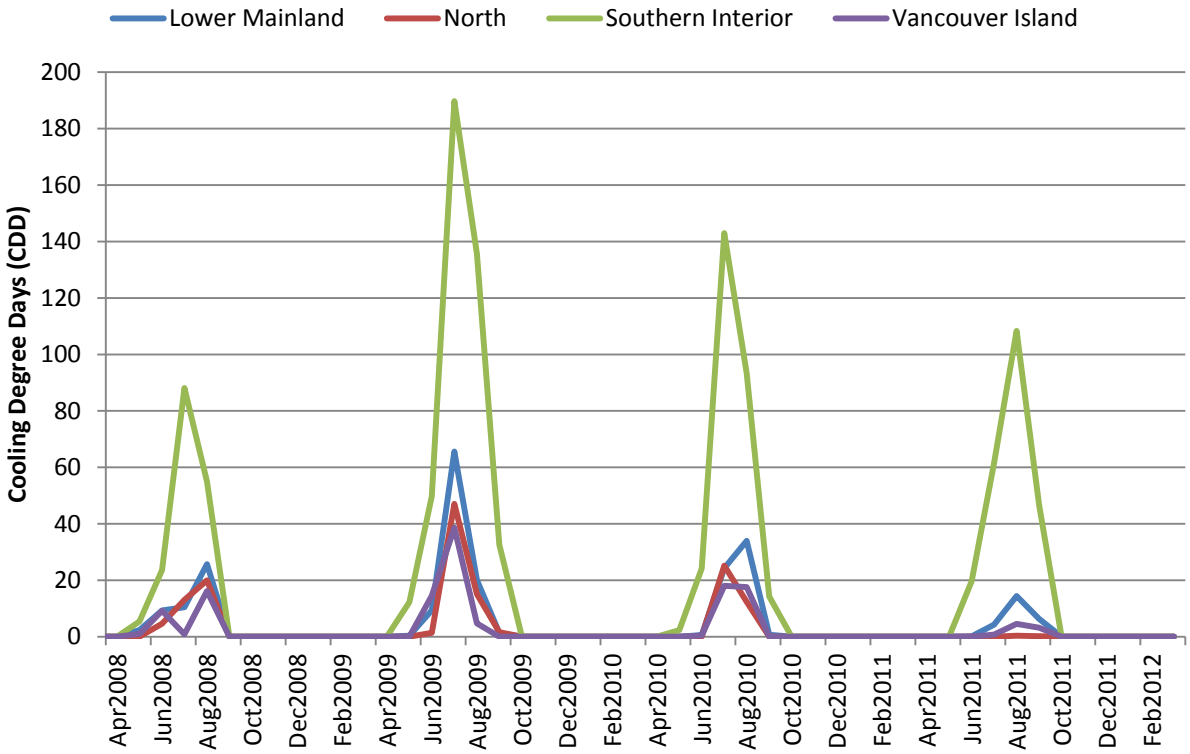


Figure B.2. Cooling Degree Days by BC Hydro Region – F2008-F2012



Seasonality. Seasonality impacts electricity use through changes to the hours of day light, seasonal holidays and other general changes in the mix of electricity end-uses based on a given time of year. Six bimonthly billing periods were used to control for seasonal impacts beyond those associated with weather.

Space heating fuel. Space heating is a large consumer of energy for BC Hydro's residential customers. Space heating in British Columbia most commonly uses natural gas or electricity. Primary space heating fuel type is tracked at the account level in the BC Hydro billing system.

Dwelling type. Dwelling type impacts electricity consumption though factors such as overall heating demand, number of appliances, number of occupants, and construction material. Dwelling type is assigned to residential accounts in the BC billing system using the following classifications: single family detached, row house, apartment, mobile home, others (cottage, seasonal homes, etc.)

DSM Expenditures. BC Hydro's expenditures on DSM programs, and DSM supporting initiatives (including community outreach and advertising on conservation-related messaging) impacts electricity consumption by providing information and incentives for electricity conservation. Bi-monthly expenditures from F2005 to F2012 were obtained and allocated across the various account sub-groups (region, dwelling type, heating type) based on the number of accounts in each group and each group's share of electricity consumption over the total residential consumption. The impact of expenditures on DSM by agencies other than BC Hydro, were not included because they either target different customer groups or were expected to be too small to be measured using the aggregate analysis of demand models employed.

Economic Factors. Economic theory holds that income impacts consumption. Annual personal real disposable income in British Columbia was obtained through BC Stats. Adjustments for the impact of inflation were done using monthly Consumer Price Index (CPI) form Statistics Canada.

Region. The BC Hydro service territory is divided into four regions: Lower Mainland, Vancouver Island, Southern Interior and North. Region impacts electricity consumption through differences in demographics and lifestyle of their residents.

Interactions between variables. Adding interaction terms to the regression model may help additionally explain the relationships between some of the variables. For example, the relationship between weather and heating fuel type are expected to have a strong influence on overall consumption since households with electric heat would have higher consumption in colder weather compared to households with non-electric heat.

Correction Term. The bias correction term is based on the construction of a log odd regression whose dependent variable is $Y = \ln[S / (1-S)]$, with S = large user share of total accounts. Since the small user share will be (1-S), the correction term for the small user regression is based on the same log odd regression. The coefficient estimate on the correction term for the Step 2 regression is expected to be negative, based on an assumption that if a random factor causes more accounts to be in the large user group, the same factor also tends to enlarge the per account consumption. Conversely, the correction term's coefficient estimate for the small user regression is expected to be positive. The assumption is that a random factor that cause more accounts to be in the small user group, the same factor also tends to decrease the per account consumption.

Testing the models. Each of the econometric models was assessed for validity through:

- Statistics of the adjusted R-squared for overall regression model validity;
- Expected signs (or values) of individual independent variables and their statistical significance;

Seemingly Unrelated Regressions (SUR) Model. An attempt was made to estimate an overall class average response to a general price increases under a flat rate structure by establishing a system of two regressions. Described by Equation B.1, the first regression is the basic model of Equation 1 from Section 2.3.1 applied to Step 1 consumption only. Described by Equation B.2, the second regression is the model applied to Step 2 consumption only. Described by Equation B.3, a restriction is imposed to set the coefficient for the natural log of the Step 1 price equal to the coefficient for the natural log of the Step 2 price. The system of Seemingly Unrelated Regressions (SUR) is shown below.

Equation B.1

$$ln\,(Consumption\ of\ Step\ 1) = \alpha\ +\ \beta \cdot Heat\ +\ \gamma \cdot Premise + \delta \cdot BillingPeriod\ +\ \omega 1 \cdot\ CDD\ +\ \omega 2 \cdot$$

$$HDD +\ \theta\ \cdot ln\left(DSM_{Expenditure}\right) +\ \ \cdot ln\,(Price1) +\ \sigma \cdot\ ln\,(Disposable_{Income}) + \varphi \cdot C\ +\ \mu$$

Equation B.2

$$ln\,(Consumption\ of\ Step\ 2) = \alpha\ +\ \beta \cdot Heat\ +\ \gamma \cdot Premise + \delta \cdot BillingPeriod\ +\ \omega 1 \cdot\ CDD\ +\ \omega 2 \cdot$$

$$HDD +\ \theta\ \cdot ln\left(DSM_{Expenditure}\right) +\ \ \cdot ln\,(Price2) +\ \sigma \cdot\ ln\,(Disposable_{Income}) + \varphi \cdot C\ +\ \mu$$

Equation B.3

$$Price1 = \ Price2$$

This method for estimating class average price elasticity assumes that the large customers and small customers are equally responsive. If the equal price elasticity restriction is not rejected by the data, the class average price elasticity is equal to , implying that each price (Price 1 and Price 2) exerts the same degree of impacts on consumption change in each portion of consumption (Step 1 and Step 2).

B.2. Methodology Review

Evaluations of electricity rate design usually take two approaches: one is qualitative assessment of customer responses and another is quantitative studies of price elasticity—a measure of customers' consumption changes in response to changes in price.

This methodology and literature review first describes briefly some examples of qualitative evaluation of customers' response and then focuses more on the methodology used for quantitative research. This will include approaches to data collection and techniques adopted to estimate price elasticity. Finally results from some major studies of price elasticity in different electricity markets are presented at the end of this review.

Qualitative research on customer's response to electricity price is conducted through customer survey, the most common approach to this type of study. Examples of such research approach can be seen in 2013 DEFG's national survey of the US customers' challenges in adapting to the rate changes and the effectiveness of the Time of Use rate. Navigant Consulting also uses survey as a tool to in its evaluation of Time of Use rate for Newmarket Tay Power Distribution in Ontario to achieve one of evaluation objectives—assessing customers' response to rate design as well as opportunities to improve rate design. Similarly, Peters (2009) et al. also adopt survey as the major research vehicle when investigating customer participation in and response to Sacramento Municipal Utility District's Time of Use rate design.

For qualitative studies of the relationship between electricity demand and electricity rates, most literatures are found in economic studies. The common approach to these studies is to conduct quantitative analysis of electricity price elasticity. In this approach, economists select appropriate dataset, usually based on study objective and modeling requirements, and adopt different econometric modeling techniques to suit for the

nature of market and research issues in their study[7]. Data construction and modeling techniques are the integral parts of the evaluation work. This review looks into past evaluation literatures on price elasticity in electricity markets and discusses three issues related to the quantitative research methodology:

1. Approaches to data construction in econometric modeling
2. Econometric modeling techniques
3. Elasticity modeling results

Approaches to data construction in econometric modeling. From the perspective of how data are collected and used for the empirical analysis of price elasticity, the econometric studies can be generally classified into two categories. One is to use aggregated data of a customer class or a rate experiment group(s), and another is to select a sample from a customer class for analysis. A common consideration in both these approaches is the availability and robustness of the data, which often dictates the econometric modeling approach and has a direct impact on the validity and robustness of empirical results. In both these approaches, data have to cover the most important factors that affect electricity consumption, such as weather condition, customers' economic conditions, dwelling characteristics and electricity price.

Using aggregated billing data. This approach is usually adopted when customer level data is not available or cannot be served as a representation of a customer class. This approach covers the entire customer class and data are usually constructed in time series or interrupted time series. This approach provides strong external validity of evaluation analysis since it targets the entire customer class in the study. For the same reason, it allows for the possibility of dissecting analysis into different customer segments, geographic areas or customer profiles—usually with a higher level of accuracy or validity than customer level data analysis can provide.

Paul et al. (2009) use the aggregated electricity sales data, real disposable income data, heating and cooling degree days and lighting hours to analyze demand and price elasticity at the regional level of US electricity market demand. Ito (2009) collects data from two utilities in southern California (PSG&E and SDG&E) as well as consumer data from the U.S. Bureau of Labor's Consumer Expenditure Survey to estimate the regional price elasticity (in Southern California) of the two-tiered and five-tiered rate structure in California. Hartman, R. (1983) uses aggregated consumption data at the state level to estimate short-run electricity price elasticity in 46 states in the US.

Using customer level data. This is an alternative method of data construction when aggregated data is unavailable for analysis. This method requires the selection of a customer sample representative of customer class. Other data pertaining to the sample customers have to be collected as well in order to perform econometric analysis. The advantage of customer level data over aggregated data is the possibility of having more in-depth data coverage for analysis.

Many evaluations use customer level data when the rate designs are experimental or for a limited customer segment or geographical area. Charles River Associates (2005) evaluates several time-varying price pilot programs in California using program participants data collected from billing records and program participants survey. Reiss and White (2012) construct data at customer level with a sample of 1300 customers to analyze California's five tiered rates. Herriges, J. A. and K. K. King (1994) estimate the price elasticity for an inclining block rate design experiment with a sample of customers who are randomly drawn from Wisconsin Electric's billing system and randomly assigned to one of five rate structures (four are inclining block rates and one is flat

[7] Very few evaluations rely only on the sample analysis of select customer bills, in which customers' electricity bills are compared and statistical tests are conducted between different periods under different rate structures to show any consumption difference. The robustness of this approach is limited due to the lack of detailed analysis and assessment of the class wide rate impacts and other factor analysis that may impact consumption. One example of using this methodology can be found in (Lai, 2006).

rate). Fell et al. (2010) use customer level data with inclusion of household expenditure on appliances purchases to estimate elasticity of average price paid by consumers as well as elasticity of marginal price.

Econometric modeling techniques. From the perspective of econometric techniques adopted for elasticity modeling, the mainly used technique is regression methods including ordinary least square, maximum likelihood and generalized least square. Linear regression analysis is the mostly used technique for modeling of electricity demand because electricity demand is best fitted by linear consumption model based on economic theories. Hsiao and Mountain (1985) use linear regression in two stage modeling of electricity price elasticity of Ontario Hydro customer. Barnes et al. (1981) use both the OLS and Maximum Likelihood method to estimate the average price elasticity in the US –same as Hartman, R. (1983) in their estimates of elasticity of 46 states in the US.

Some less frequently techniques include the Seemingly Unrelated Regression (SUR) model to address the issues of price endogeneity as seen in Liu (1991). Fèvre et al. (2003) discusses the lack of price variation due to slow changes as an issue in the estimation of price elasticity. A proposal to overcome the difficulty is to use the observed preferences for the attributes or factors to statistically identify customer responsiveness to different prices or product attributes. Market simulation is also used to analyze the price elasticity. Market simulation can generate samples of different size of customers. Regression and/or statistical analysis can then be performed on the sample generated by simulation. Berstein (1987) uses a Monte Carlo simulation to compare the results from using maximum likelihood (ML) method and ordinary least squares (OLS) method to estimate the non-linear electricity price impacts on demand for electricity.

Elasticity modeling. It is commonly acknowledged that price elasticity of electricity demand is heterogeneous—varying significantly among different regions in different climate zones, on different custom segments with different demographic and economic characteristics. This section of the review lists some major study results of price elasticity in different markets. At the end of this review, a table is provided to summarize results of elasticity modeling from various studies together with the data and target market of the studies.

Taylor (1975) surveys price elasticity studies of various electricity price structures and finds that elasticity varies by region. This finding is then confirmed by other studies, such as Paul et al. (2009) which finds that price elasticity ranges from -0.32 in East South Central U.S. to -0.05 in Middle Atlantic. Pacific Northwest, close to British Columbia, has a price elasticity of -0.13.

Reiss and White (2005) use customer level data for California from the 1993 and 1997 Residential Energy Consumption Survey (RECS). Reiss and White find that electricity demand can be broken down into an inelastic baseline component, and incremental use (for appliances such as pumps, air conditioners, swimming pools, refrigerators) that is elastic. A mean value for short-run price elasticity is estimated to be -0.4, but as the authors point out, other studies in the residential sector have shown widely varying estimates. Meanwhile, the study concludes that a large part of California residents exhibit no short-run response to electricity price change.

Both Rand (2005) and EPRI (2010) evaluate electricity price elasticity at the national and the regional level and come to the similar results of estimation. Both studies provide a range estimate of elasticity which varies from region to region. For the Pacific region (California, Washington and Oregon), the estimates of the short-run elasticity from these two studies range from -0.18 to -0.33.

Reiss (2012) finds that highly skewed distribution of price elasticity within the residential customer class, with a small fraction of households accounting for most aggregate demand response. It suggests that there are two types of households with respect to electricity demand behaviors and price elasticity in California, one is households with electric space heating and/or air conditioning that are more price elastic than another type of household using no electric space heating and/or air conditioning.

Table B.1. Summary of Electricity Price Elasticity Studies and Results

Study	Data	Target Market	Short-run Elasticity	Long-run Elasticity
Barnes et al. (1981)	The US Federal Energy Regulatory Commission and Bureau of Labor Statistics Data	Entire US market	-0.55	N/A
Henson (1984)	Monthly data for 1077 households observed during 1977-78	Bonneville Power Administration	-0.11 to -0.28	N/A
Herriges and King (1994)	Sampled Customer level monthly data (n=1500)	Wisconsin	-0.02 to -0.04	N/A
Hsiao and Mountain (1994)	Monthly sales by municipal utility in 1989	Ontario	-0.0 to -0.07	N/A
Paul et al. (2009)		Various states in the US		N/A
Reiss and White (2005)	Customer level data from 1994 to	California	-0.4	N/A
Rand (2005)	State level data from 1977 to 2004	US market at national and state level	-0.13 to -0.32 at regional level; -0.24 at national level	-0.17 to -0.62 at regional level; -0.32 at national level
EPRI (2010)	EIA data from 1993 to 2007	US market at national and state level	-0.05 to -0.37 at regional level; -0.10 - 0.29 at national level	N/A

Previous BC Hydro Evaluations of the RIB. BC Hydro's previous evaluations of the RIB rate (F2009 and F2010) employed survey analysis and econometric analysis models of aggregated billing data to conduct qualitative and quantitative analysis of the RIB's impacts. The previous evaluations only covered approximately one and a half years after the implementation of the RIB rate, so the data were much shorter in duration than in the current evaluation. In BC Hydro's F2010 RIB Rate Evaluation, the analysis was conducted on a period of 16 years (from 1994 to 2010) to estimate the Step 1 and Step 2 price elasticity. This period was mainly under the most flat rate schedule with only one and half year's RIB period.

B.3. Customer Survey

Population and Survey Sample Profile of Residential Customers

Table B.2 details the population distribution of BC Hydro's 1.6 million RIB qualified customers on three known population parameters in the corporation's customer account billing system – region, dwelling type and Step 2 consumption status – and the survey sample distribution of customers after statistical weighting.

The single largest segment of residential customers in F2012 – 58 per cent – resided in the Lower Mainland while the balance of customers were two times more likely to have resided on Vancouver Island than in the Southern Interior or the North. The distribution of dwelling types followed much of the same pattern in that 59 per cent of customers lived in single detached houses while most others lived in apartments/condominiums rather than in duplexes, row houses, townhouses, mobile homes and 'other' types of dwellings.

Table B.2 Population and Survey Sample Profile of Residential Customers

	Population*	Survey Sample
	100% ⇓	100% ⇓
Region		
Lower Mainland	58%	58%
Vancouver Island	21%	21%
Southern Interior	12%	12%
North	9%	9%
Dwelling Type		
Single detached house/duplex	59%	59%
Row house/townhouse	9%	9%
Apartment/Condominium	27%	27%
Mobile home/other	5%	5%
Step 2 Consumption Status in F2012		
Never into Step 2 (0 months)	33%	35%
Sometimes into Step 2 (1-11 months)	40%	40%
Always into Step 2 (12 months)	27%	25%

Column totals may not total 100% due to rounding of values and/or missing values.
* As per BC Hydro's customer account billing system for region, dwelling type and Step 2 Consumption Status.

The distribution of residential customers in the survey sample also very closely followed the overall population in terms of the number of times in F2012 households incurred Step 2 consumption. Although most customers are billed on a bi-monthly basis and the Step 2 threshold is set at 1,350 kWh, this statistic is based on calendarized monthly consumption with the Step 2 threshold at 675 kWh. Very similar to the overall population of RIB qualified accounts, a total of 35 per cent of customers in the sample 'never' (0 months) incurred Step 2 consumption in the twelve months of F2012, 40 per cent of customers 'sometimes' (1-11 months) incurred Step 2 consumption and 25 per cent 'always' (12 months) incurred Step 2 consumption.

This observation – underscoring the representativeness of the survey data – is important due to the fact that customer awareness levels and opinions toward the inclining block rate have proven to be highly correlated to exposure to Step 2 and overall consumption.

Housing Profile of Residential Customers

The 2012 Residential End-Use Study estimated that a total of 41 per cent of residential customers relied primarily on electricity to facilitate their home's space heating needs. The incidence in the unweighted survey sample measured very closely at 39 per cent, but due to the importance and impact of fuel type on overall electricity consumption, the statistical weighting procedure was designed to adjust the incidence to 41 per cent in the final weighted dataset.

Table B.3 Housing Profile of the Population and Survey Sample of Residential Customers

	Population*	Survey Sample
	100% ⇓	100% ⇓
Main Space Heating Fuel		
Electricity	41%	41%
Non-Electric	59%	59%
Main Water Heating Fuel		
Electricity	36%	36%
Non-Electric	43%	43%
No hot water tank (central)	21%	21%
Floor Area (square feet)		
<500	1%	1%
500-1,000	21%	22%
1,001-1,500	20%	25%
1,501-2,000	16%	19%
2,001-2,500	14%	16%
2,501-3,000	9%	8%
Over 3,000	9%	9%
Year Home Built		
Before 1950	7%	7%
1950-1975	25%	26%
1976-1985	22%	21%
1986-1995	20%	21%
1996-2005	16%	18%
2006-2012	10%	7%

Column totals may not total 100% due to rounding of values and/or missing values confidence. Missing values have been discounted.
* As per the distribution of RIB qualified tariff 1101 records in BC Hydro's 2012 Residential End-Use Study.

Very closely reflecting the incidence in the overall population as estimated from the end-use study, a total of 36 per cent of residential customers in the survey sample were categorized as relying on electricity to facilitate their homes' water heating needs. A total of 43 per cent of customers relied on natural gas, oil or propane for their hot water heating while 21 per cent of customers – most of them in apartments/condominiums – relied on a central system for their hot water.

The profile of survey respondents in terms of their dwelling's floor space and vintage also very closely followed that of the overall population.

Demographic Profile of Residential Customers

As BC Hydro's customer account billing system does not include standard demographic information beyond region and dwelling type, the corporation's 2012 Residential End-Use Study was leveraged to serve as a proxy for further sample comparisons to the population.

The demographic composition of the survey sample was very representative of the population in terms of primary account holders being generally split by gender and the majority being at least 55 years old. Close to four in ten account holders have attended university, including some three in ten who have earned university degrees, while the balance of others are most likely to have attended college, vocational or technical school.

As per the end-use study, a total of 84 per cent of residential customers owned their homes. This incidence increased to 86 per cent in the survey sample, but the small difference was inconsequential to the representativeness of the data and accompanying findings in this evaluation.

Table B.4 Demographic Profile of the Population and Survey Sample of Residential Customers

	Population*	Survey Sample
	100% ⇓	100% ⇓
Gender of Primary Account Holder		
Male	53%	49%
Female	47%	51%
Age of Primary Account Holder		
18-24	1%	1%
25-34	8%	7%
35-44	14%	13%
45-54	20%	19%
55-64	25%	25%
65+	33%	35%
Education of Primary Account Holder		
Less than grade 12	9%	9%
High school diploma	15%	14%
Some college/vocational/technical school	19%	18%
College/vocational/technical school graduate	20%	21%
Some university	7%	6%
University/Graduate Degree	31%	33%
Home Ownership		
Own/Co-op	84%	86%
Rent	16%	14%

Column totals may not total 100% due to rounding of values and/or missing values confidence. Missing values have been discounted.
* As per the distribution of RIB qualified tariff 1101 records in BC Hydro's 2012 Residential End-Use Study.

The profile of survey respondents in terms of their household composition and household income closely followed that of all BC Hydro residential customers. Households in the survey sample were comprised of an average of 2.4 people and were split evenly by total household income – one-half with annual earnings less than $60,000 and one-half with annual earnings of $60,000 or more.

The overall incidence of BC Hydro's RIB qualified customers in F2012 that could be classified as 'low income' as defined by Statistics Canada was estimated to have been 10 per cent [8]. Given the complexity of the account flagging and estimation procedure in the absence of finer income figures on a household-by-household basis, the 'low income' incidence of 9 per cent in the survey sample was considered to be very consistent with that of the population.

Table B.5 Demographic Profile of the Population and Survey Sample of Residential Customers

	Population*	Survey Sample
	100% ⇓	100% ⇓
Number of Household Occupants		
1	26%	28%
2	43%	42%
3	12%	13%
4 +	19%	17%
Average number of occupants	2.4	2.4
Household Composition		
Has children 0-5	8%	8%
Has children 6-12	10%	9%
Has young adults 13-24	19%	17%
Has adults 25-64	72%	70%
Has adults 65 +	38%	40%
Household Income		
Less than $20,000	8%	10%
$20,000 < $40,000	22%	24%
$40,000 < $60,000	20%	19%
$60,000 < $80,000	15%	16%
$80,000 < $120,000	21%	20%
$120,000 +	14%	11%
Low Income Status		
Yes, 'low income' household	10%	9%
No	90%	91%

Column totals may not total 100% due to rounding of values and/or missing values confidence. Missing values have been discounted.
* As per the distribution of RIB qualified tariff 1101 records in BC Hydro's 2012 Residential End-Use Study.

[8] The low income cut-off (LICO) rate as defined by Statistics Canada is the percentage of families or households which fall below a low income threshold – that being, an income level whereby a family spends a larger share of its total income on the necessities of food, shelter and clothing than does an average family in an appropriate comparison group (the lower a household's income, a greater percentage of the total is tied to the necessities of living). Three variables together identify low income households of interest: annual household income, number of household occupants, and population of the household's census metropolitan area (CMA). Households with annual earnings less than the Low Income Cut-Off (LICO) for their household size and CMA population are considered low income.

Unaided Awareness of BC Hydro's Residential Rate Structure

Customer awareness of the method they are charged for their use of electricity was derived based on responses to a series of questions pertaining, but not limited to, awareness of various rate structures in concept, awareness of BC Hydro's current rate structure, and awareness that it was introduced in October 2008. Through a series of consistency checks, this multi-input approach helped to categorize each customer's belief of the rate structure – prior to them receiving the survey – into one of four bins: 1) inclining block rate, 2) flat rate, 3) declining block rate, and 4) don't know.

For some analysis, this awareness variable was further collapsed into two bins: 1) previously aware of the inclining block rate, and, 2) not previously aware (all other responses). In addition to facilitating cross-tabular analysis with other survey parameters, this particular awareness variable was then linked to survey respondents' F2012 consumption data from the BC Hydro billing system for statistical analysis such as ANOVA and linear regression.

Appendix C - Results Details

C.1. Econometric Modeling

Step 1 Price Elasticity. Estimates of Step 1 price elasticity were explored using the same functional forms and the Step 2 models described below. Step 1 price elasticity was not able to be estimated from the data for two primary reasons: First, Step 1 price experienced very small changes in real dollars (deflated by general inflation) and total consumption over the eight years covered by the study. The initial Step 1 price in F2009 saw a net reduction from the flat rate of 6.21 cents/kWh to 5.46 cents/kWh. Subsequent Step 1 price increases were steady but small. Overall, in real terms, the Step 1 price went from the pre-RIB flat rate of 5.51 cents/kWh to 5.76 cents/kWh in F2013, representing only a 4.5% total increase over a five-year period. Therefore, there was a prolonged period of low variation of the Step 1 price. Second, the maximum Step 1 consumption was by definition, capped at the bimonthly threshold of 1350kWh. This limited the upside variation in Step 1 consumption. Different econometric models were tested but no significant and conclusive results on the value and sign of elasticity could be derived.

Step 2 Price Elasticity. The complete model specifications and the results are provided on the following pages:

Model 1 Specification:

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \delta \cdot BillingPeriod + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \chi \cdot Region + \theta \cdot ln\left(DSM_{Expenditure}\right) + \cdot ln\,(Price) + \sigma \cdot ln\,(Disposable\_Income) + \varphi \cdot C + \mu$$

Model 1 Results:

Root MSE	0.12174	*R-Square*	0.8978
Dependent Mean	7.95088	*Adj R-Sq*	0.8968
Durbin-Watson D	0.312		

Parameter Estimates

Variable	*Label*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
Intercept	Intercept	4.37027	0.50569	8.64	<.0001
Ln (Price)	Natural Log of Tier 2 Real Price	-0.10116	0.02182	-4.64	<.0001
CDD	Cooling degree days	0.00060937	0.00010539	5.78	<.0001
HDD	Heating degree days	0.00011634	0.00002197	5.29	<.0001
D_HEAT_ELECTRIC	Dummy variable of Electric Heating Source	0.24384	0.01646	14.82	<.0001
Ln (Disposable_Income)	Natural log of Disposable Income	0.33914	0.04609	7.36	<.0001
D_Reg_LM	Dummy variable of Lower Mainland	0.05709	0.00859	6.64	<.0001
D_Reg_N	Dummy variable of Northern Interior	-0.14105	0.01162	-12.14	<.0001
D_Reg_SI	Dummy variable of South Interior	-0.13283	0.01041	-12.76	<.0001
D_MOB	Dummy variable of Mobile Home	-0.55453	0.01140	-48.64	<.0001
D_APT	Dummy variable of Apartment	-1.15348	0.02861	-40.31	<.0001
D_ROW	Dummy variable of Row House	-0.74587	0.00881	-84.62	<.0001
D_SFD	Dummy variable of Single Family Detached House	-0.30755	0.01561	-19.70	<.0001
BP_2	Billing Period: JUN-JUL	-0.21515	0.01708	-12.60	<.0001
BP_3	Billing Period: AUG-SEP	-0.16835	0.01404	-11.99	<.0001
BP_4	Billing Period: OCT-NOV	0.17280	0.01282	13.48	<.0001
BP_5	Billing Period: DEC-JAN	0.38014	0.02031	18.72	<.0001
BP_6	Billing Period: FEB-MAR	0.26275	0.01594	16.48	<.0001
Ln (DSM Expenditure)	Natural log of DSM Expenditures	-0.02767	0.00362	-7.64	<.0001
C_large	correction term: large customers	-0.20895	0.02183	-9.57	<.0001

Model 2 Specification:

Model 2 has the same specification as Model 1 with one additional interaction term ($D\_Heat\_Electric\_HDD$) of HDD and the Electric Heating Source dummy variable.

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \delta \cdot BillingPeriod + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \omega 3 \cdot D_{Heat\_Electric\_HDD} + \xi \cdot Region + \theta \cdot \ln(DSM_{Expenditure}) + \cdot \ln(Price) + \sigma \cdot \ln(Disposable_{Income}) + \varphi \cdot C + \mu$$

Model 2 Results:

Root MSE	0.10883	*R-Square*	0.9184
Dependent Mean	7.95088	*Adj R-Sq*	0.9175
Durbin-Watson D	0.198		

Parameter Estimates

Variable	*Label*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
Intercept	Intercept	3.79091	0.45282	8.37	<.0001
Ln (Price)	Natural Log of Tier 2 Real Price	-0.12689	0.01954	-6.49	<.0001
CDD	Cooling degree days	0.00077198	0.00009451	8.17	<.0001
HDD	Heating degree days	-0.00000539	0.00002042	-0.26	0.7917
D_HEAT_ELECTRIC	Dummy variable of Electric Heating Source	0.18274	0.01497	12.20	<.0001
D_Heat_Electric_HDD	Interaction term of dummy variable of Electric Heating Home and HDD	0.00027276	0.00001247	21.88	<.0001
Ln (Disposable_Income)	Natural log of Disposable Income	0.36803	0.04122	8.93	<.0001
D_Reg_LM	Dummy variable of Lower Mainland	0.03533	0.00774	4.56	<.0001
D_Reg_N	Dummy variable of Northern Interior	-0.15261	0.01040	-14.68	<.0001
D_Reg_SI	Dummy variable of South Interior	-0.15878	0.00938	-16.93	<.0001
D_MOB	Dummy variable of Mobile Home	-0.50509	0.01044	-48.38	<.0001
D_APT	Dummy variable of Apartment	-1.34077	0.02697	-49.71	<.0001
D_ROW	Dummy variable of Row House	-0.74099	0.00788	-94.00	<.0001
D_SFD	Dummy variable of Single Family Detached House	-0.24550	0.01424	-17.24	<.0001
BP_2	Billing Period: JUN-JUL	-0.29058	0.01565	-18.57	<.0001
BP_3	Billing Period: AUG-SEP	-0.22158	0.01278	-17.33	<.0001
BP_4	Billing Period: OCT-NOV	0.20993	0.01158	18.13	<.0001
BP_5	Billing Period: DEC-JAN	0.45347	0.01846	24.56	<.0001
BP_6	Billing Period: FEB-MAR	0.30658	0.01439	21.30	<.0001
Ln (DSM Expenditure)	Natural log of DSM Expenditures	-0.01917	0.00326	-5.88	<.0001
C_large	correction term: large customers	-0.35907	0.02068	-17.36	<.0001

While the parameter estimate for HDD is negative in this model (a negative coefficient implies that electricity use decreases in colder weather), the parameter estimate is not statistically different from zero because a

stronger indicator of HDD is provided by the interaction term with electric heat. The HDD variable is important to keep in this model since it is expected to have a significant impact on the price coefficient because all customers, beyond those captured in the interaction variable, are expected to consider both price and weather as part of their consumption decisions.

Model 3 Specification :
Model 3 has the same specification as Model 2 without including variables for the billing period.

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \omega 3 \cdot D_{Heat\_Electric\_HDD} + \text{ʒ} \cdot Region + \theta \cdot \ln(DSM_{Expenditure}) + \cdot \ln(Price) + \sigma \cdot \ln(Disposable_{Income}) + \varphi \cdot C + \mu$$

Model 3 Results :

Root MSE	0.12643	*R-Square*	0.8896
Dependent Mean	7.95088	*Adj R-Sq*	0.8887
Durbin-Watson D	0.428		

Parameter Estimates

Variable	*Label*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
Intercept	Intercept	5.89028	0.50961	11.56	<.0001
Ln (Price)	Natural Log of Tier 2 Real Price	-0.08435	0.02243	-3.76	0.0002
CDD	Cooling degree days	0.00044379	0.00009624	4.61	<.0001
HDD	Heating degree days	0.00033930	0.00001728	19.63	<.0001
D_HEAT_ELECTRIC	Dummy variable of Electric Heating Source	-0.00650	0.01442	-0.45	0.6521
D_Heat_Electric_HDD	Interaction term of dummy variable of Electric Heating Home and HDD	0.00020274	0.00001405	14.43	<.0001
Ln (Disposable_Income)	Natural log of Disposable Income	0.22351	0.04689	4.77	<.0001
D_Reg_LM	Dummy variable of Lower Mainland	0.08871	0.00857	10.35	<.0001
D_Reg_N	Dummy variable of Northern Interior	-0.22787	0.01133	-20.12	<.0001
D_Reg_SI	Dummy variable of South Interior	-0.12945	0.01029	-12.58	<.0001
D_MOB	Dummy variable of Mobile Home	-0.61689	0.01073	-57.51	<.0001
D_APT	Dummy variable of Apartment	-0.90508	0.02253	-40.18	<.0001
D_ROW	Dummy variable of Row House	-0.75240	0.00914	-82.32	<.0001
D_SFD	Dummy variable of Single Family Detached House	-0.42086	0.01403	-30.00	<.0001
Ln (DSM Expenditure)	Natural log of DSM Expenditures	-0.02770	0.00355	-7.79	<.0001
C_large	correction term: large customers	-0.00810	0.01645	-0.49	0.6226

Model 4 Specification :

Model 4 has the same specification as Model 2 and includes interaction terms for HDD with dwelling type (*D_APT_HDD, D_ROW_HDD, D_MOB_HDD, D_SFD_HDD*).

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \omega 3 \cdot D_{Heat\_Electric\_HDD} + \omega 4 \cdot D_{Dwell_{HDD}} + \xi \cdot Region + \theta \cdot \ln(DSM_{Expenditure}) + \cdot \ln(Price) + \sigma \cdot \ln(Disposable_{Income}) + \varphi \cdot C + \mu$$

Model 4 Results :

Root MSE	0.10295	*R-Square*	0.9271
Dependent Mean	7.95088	*Adj R-Sq*	0.9262
Durbin-Watson D	0.231		

Parameter Estimates

Variable	*Label*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
Intercept	Intercept	3.69724	0.43695	8.46	<.0001
Ln (Price)	Natural Log of Tier 2 Real Price	-0.13194	0.01868	-7.06	<.0001
CDD	Cooling degree days	0.00080912	0.00009130	8.86	<.0001
HDD	Heating degree days	-0.00015786	0.00002229	-7.08	<.0001
D_HEAT_ELECTRIC	Dummy variable of Electric Heating Source	0.19842	0.01661	11.95	<.0001
D_Heat_Electric_HDD	Interaction term of dummy variable of Electric Heating Home and HDD	0.00027879	0.00001221	22.82	<.0001
Ln (Disposable_Income)	Natural log of Disposable Income	0.37995	0.03932	9.66	<.0001
D_Reg_LM	Dummy variable of Lower Mainland	0.03158	0.00763	4.14	<.0001
D_Reg_N	Dummy variable of Northern Interior	-0.15682	0.01000	-15.68	<.0001
D_Reg_SI	Dummy variable of South Interior	-0.16545	0.00943	-17.55	<.0001
D_MOB	Dummy variable of Mobile Home	-0.60951	0.01677	-36.35	<.0001
D_APT	Dummy variable of Apartment	-1.49792	0.03804	-39.38	<.0001
D_ROW	Dummy variable of Row House	-0.88841	0.01302	-68.23	<.0001
D_SFD	Dummy variable of Single Family Detached House	-0.30847	0.02151	-14.34	<.0001
D_APT_HDD	Interaction term between Apartment and HDD	0.00019774	0.00001910	10.35	<.0001
D_ROW_HDD	Interaction term between Row House and HDD	0.00024511	0.00001760	13.93	<.0001
D_MOB_HDD	Interaction term between Mobile Home and HDD	0.00018804	0.00001802	10.43	<.0001
D_SFD_HDD	Interaction term between Single Family Dwelling and HDD	0.00013169	0.00001872	7.04	<.0001
BP_2	Billing Period: JUN-JUL	-0.30602	0.01686	-18.15	<.0001

Parameter Estimates

Variable	*Label*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
BP_3	Billing Period: AUG-SEP	-0.23241	0.01336	-17.39	<.0001
BP_4	Billing Period: OCT-NOV	0.21889	0.01180	18.56	<.0001
BP_5	Billing Period: DEC-JAN	0.46945	0.01926	24.37	<.0001
BP_6	Billing Period: FEB-MAR	0.31737	0.01458	21.76	<.0001
Ln (DSM Expenditure)	Natural log of DSM Expenditures	-0.01905	0.00315	-6.05	<.0001
C_large	correction term: large customers	-0.38932	0.02524	-15.43	<.0001

The rational for the inclusion of additional interaction terms over and above the interaction term between heating degree days and electric heat in model 2 were that weather affects consumption of households differently depending on the type of dwelling. Households likely consume relatively more electricity during colder weather and housing type may also be strongly correlated with insulation levels and other structural characteristics that affect the relation between HDD and electricity consumption.

Regression results for this model proved confounding due to the negative sign on the coefficient for the HDD variable and the fact that it was statistically significant. This may be explained by a decrease in electricity consumption in colder weather by seasonal dwellings that are completely unoccupied in the winter. While seasonal dwellings are scattered throughout the province, there is not enough information to know whether or not this is a reasonable explanation for the negative and significant coefficient on HDD. Therefore, while the model specification has strong explanatory power, and provides support for the upper end of the range of price elasticity, the inability to suitably explain the results resulted in the omission of the model from the discussion.

Model 5 Specification:

Model 5 has the same specification as Model 1 and includes an additional term of DSM expenditures lagged by 12 months.

$$\ln(Consumption) = \alpha + \beta \cdot Heat + \gamma \cdot Premise + \delta \cdot BillingPeriod + \omega 1 \cdot CDD + \omega 2 \cdot HDD + \text{ʒ} \cdot Region + \theta 1 \cdot ln\left(DSM_{Expenditure}\right) + \theta 2 \cdot ln\left(DSM_{Expenditure\_Lag}\right) + \cdot ln\left(Price\right) + \sigma \cdot ln\left(Disposable\_Income\right) + \varphi \cdot C + \mu$$

Model 5 Results:

Root MSE	0.12125	*R-Square*	0.8987
Dependent Mean	7.95580	*Adj R-Sq*	0.8975
Durbin-Watson D	0.329		

Parameter Estimates

Variable	*Label*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
Intercept	Intercept	4.60295	0.76903	5.99	<.0001
Log_P2	Natural Log of Tier 2 Real Price	-0.09444	0.02430	-3.89	0.0001
CDD	Cooling degree days	0.00058524	0.00012340	4.74	<.0001
HDD	Heating degree days	0.00011600	0.00002345	4.95	<.0001
D_HEAT_ELECTRIC	Dummy variable of Electric Heating Source	0.24246	0.01776	13.65	<.0001
Log_Disposable_Income	Natural log of Disposable Income	0.31849	0.07163	4.45	<.0001
D_Reg_LM	Dummy variable of Lower Mainland	0.05589	0.00919	6.08	<.0001
D_Reg_N	Dummy variable of Northern Interior	-0.14233	0.01240	-11.48	<.0001
D_Reg_SI	Dummy variable of South Interior	-0.13107	0.01111	-11.80	<.0001
D_MOB	Dummy variable of Mobile Home	-0.55266	0.01219	-45.32	<.0001
D_APT	Dummy variable of Apartment	-1.15503	0.03062	-37.72	<.0001
D_ROW	Dummy variable of Row House	-0.74437	0.00940	-79.21	<.0001
D_SFD	Dummy variable of Single Family Detached House	-0.30189	0.01663	-18.15	<.0001
BP_2	Billing Period: JUN-JUL	-0.21753	0.01826	-11.91	<.0001
BP_3	Billing Period: AUG-SEP	-0.17141	0.01511	-11.34	<.0001
BP_4	Billing Period: OCT-NOV	0.17202	0.01357	12.67	<.0001
BP_5	Billing Period: DEC-JAN	0.38293	0.02135	17.93	<.0001
BP_6	Billing Period: FEB-MAR	0.26904	0.01715	15.69	<.0001
Log_DSMExpenditure	Natural log of DSM Expenditures	-0.02316	0.00944	-2.45	0.0142
Log_DSMExpenditure_lag	Natural log of DSM Expenditures lagging by 12 month	-0.00565	0.00897	-0.63	0.5286
C_large	correction term: large customers	-0.21028	0.02339	-8.99	<.0001

This model was used to investigate the lag effect of DSM expenditures and whether including a lagging term in the model affects the estimate of price elasticity. The results indicate that the price elasticity estimate is slightly lower by adding the DSM expenditure lag term (-0.094 vs. -0.101 between Model 5 and Model 1). However, the coefficient estimate for the lagged DSM expenditure term is not statistically significant. Other model specifications tested also indicated either insignificant and/or a positive coefficient associated with the lagging term. These results are consistent with the fact that BC Hydro's DSM expenditures in the residential sector are largely comprised of financial incentives for energy efficient products or conservation measures. These products or measures are relatively easy to install and do not require long lead time to begin to realize energy savings. In many cases, DSM expenditures on financial incentives actually occur after energy savings begin to be realized. While not including the lagging term effectively ignores any lag effect in DSM expenditures that may exist as noted in the Limitations section of the report, the results from the investigation concluded that in this instance any lag effect for DSM expenditures specific to the residential sector does not significantly affect the price elasticity estimate. Therefore, the price elasticity models adopted in the evaluation did not include a lagging term for expenditures.

C.2. Additional Customer Insights in Relation to the RIB Rate

C.2.1. Incidence of Step 2 Electricity Consumption by Household Demographics

Customers living in single detached houses have already been shown to be among the most likely to have incurred Step 2 consumption in at least one month of F2012. Given the comparably higher cost of these homes and their comparably larger size, it comes expectedly that customers who own their homes, have higher household incomes and have the most household occupants are all among the most likely to have incurred Step 2 consumption during the year.

Table C.1 Incidence of Step 2 Electricity Consumption in F2012 by Household Demographics

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	Total Sometimes + Always into Step 2
Total | 100% ⇒	35%	40%	25%	65%
Home Ownership				
Own/Co-op ⇒	29%	43%	28%	71%
Rent ⇒	67%	23%	10%	33%
Gender of primary account holder				
Male	31%	43%	26%	69%
Female	39%	36%	25%	61%
Age of primary account holder				
18-34 ⇒	43%	40%	18%	58%
35-54 ⇒	31%	37%	32%	69%
55+ ⇒	35%	41%	24%	65%
Education of primary account holder				
High school or less ⇒	34%	40%	27%	67%
College/vocational/technical/some university ⇒	33%	39%	28%	67%
University/Graduate Degree ⇒	39%	41%	21%	62%
Number of Household Occupants				
1 ⇒	59%	36%	5%	41%
2 ⇒	31%	43%	26%	69%
3 ⇒	20%	44%	36%	80%
4 + ⇒	13%	34%	52%	86%
Household Income				
Under $40,000 ⇒	45%	41%	14%	55%
$40,000 < $80,000 ⇒	38%	39%	24%	63%
$80,000 + ⇒	22%	42%	36%	78%
Low Income Status				
Yes, 'low income' household ⇒	45%	38%	17%	55%
No ⇒	34%	40%	26%	66%

Row totals may not total 100% due to rounding of values and/or missing values.

C.2.2. Consumption Profiles by the Incidence of Step 2 Electricity Consumption

This section presents electricity consumption patterns and insights essentially in reverse of the way presented in Section 3.4.1. Instead of exploring customer sub-groups as to how their consumption distributes into the three unique consumption bins, each of the three consumption bins are explored as to how customer sub-groups distribute within them. Specifically, the tables detail the profile of customer households that 'never' (0 months) incurred Step 2 consumption in the twelve months of F2012, the profile of households that 'sometimes' (1-11 months) incurred Step 2 consumption and the profile of households that 'always' (12 months) incurred Step 2 consumption.

Profile of Region and Dwelling Type by the Incidence of Step 2 Electricity Consumption

The profile of residential customers that 'never' incurred Step 2 consumption in the twelve months of F2012 was comprised of some 71 per cent of Lower Mainland households, due in large part to the greater proportion of apartments/condominiums in the region and the fact they tend to use less electricity than all other dwelling types. In fact, apartments/condominiums had a 50 per cent share of all dwellings that 'never' incurred Step 2 consumption in F2012 – 23 points higher than their overall share of dwellings in BC Hydro's service territory. Related, nearly one-half of these customers were single occupant households.

Given the breadth of the consumption bin, it comes expectedly that the profile of residential customers that 'sometimes' incurred Step 2 consumption in F2012 generally followed that of the overall customer base.

Table C.2 Profile of Region and Dwelling Type by the Incidence of Step 2 Electricity Consumption in F2012

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	All Customers
	100% ⇓	100% ⇓	100% ⇓	100% ⇓
Region				
Lower Mainland	71%	54%	46%	58%
Vancouver Island	13%	24%	29%	21%
Southern Interior	10%	12%	14%	12%
North	6%	10%	11%	9%
Dwelling Type				
Single detached house	34%	57%	83%	56%
Duplex/Row house/townhouse	12%	14%	8%	12%
Apartment/Condominium	50%	23%	3%	27%
Mobile home/other	3%	6%	6%	5%

Distributions based on the survey sample. Column totals may not total 100% due to rounding of values and/or missing values.

The pool of residential customers that 'always' incurred Step 2 consumption in F2012 was comprised of a somewhat greater share of households outside the Lower Mainland – especially on Vancouver island – as compared to their share in the population overall. This consumption bin, however, was more prominently characterized by its dwelling composition by virtue of the fact that 83 per cent were single detached houses – 27 points higher than their 56 per cent share across the entire service territory.

Profile of Space Heating and Water Heating Fuels by the Incidence of Step 2 Electricity Consumption

The profile of households that 'never' incurred Step 2 consumption in the twelve months of F2012 was largely comprised of households that do not rely on electricity for either of their space heating or water heating needs. As for households that 'always' incurred Step 2 consumption, the share of main space heating fuels closely followed that of the overall population – 43 per cent electric and 57 per cent non-electric. This group's profile by water heating fuel, however, does not follow that of the overall population as it is 19 points over-represented by households with electric hot water tanks and 19 points under-represented by households without any hot water tanks at all. As detailed in Section 3.4.1, these findings reflect a complex interplay of customer response involving space heating, water heating, dwelling and other demographic parameters.

Table C.3 Profile of Space and Water Heating Fuels by the Incidence of Step 2 Electricity Consumption in F2012

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	All Customers
	100% ⇓	100% ⇓	100% ⇓	100% ⇓
Main Space Heating Fuel				
Electricity	33%	47%	43%	41%
Non-Electric	67%	53%	57%	59%
Main Water Heating Fuel				
Electricity	15%	42%	55%	36%
Non-Electric	42%	45%	43%	43%
No hot water tank (central)	43%	13%	2%	21%
Main Space Heating and Water Heating Fuels				
Electric Heating & Electric Water	8%	28%	33%	23%
Electric Heating & Non-Electric Water	3%	7%	9%	6%
Electric Heating & Central Water	23%	12%	1%	13%
Non-Electric Heating & Electric Water	7%	13%	22%	13%
Non-Electric Heating & Non-Electric Water	39%	38%	34%	37 %
Non-Electric Heating & Central Water	20%	1%	1%	8%

Distributions based on the survey sample. Column totals may not total 100% due to rounding of values and/or missing values.

Profile of Household Demographics by the Incidence of Step 2 Electricity Consumption

Compared to the population of all residential customers, households that 'always' incurred Step 2 consumption in F2012 were even more likely to own their homes (95% versus 86% overall) and to have reported annual earnings of at least $80,000 (46% versus 31% overall). These findings simply reflect the fact that this consumption bin is largely comprised of single detached houses.

Table C.4 Profile of Household Demographics by the Incidence of Step 2 Electricity Consumption in F2012

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)	All Customers
	100% ⇓	100% ⇓	100% ⇓	100% ⇓
Home Ownership				
Own/Co-op	72%	92%	95%	86%
Rent	28%	8%	5%	14%
Gender of Primary Account Holder				
Male	43%	54%	50%	49%
Female	57%	46%	50%	51%
Age of Primary Account Holder				
18-34	10%	8%	5%	8%
35-54	29%	30%	39%	32%
55+	61%	62%	56%	60%
Education of Primary Account Holder				
High school or less	22%	22%	24%	23%
College/vocational/technical/some university	42%	44%	49%	44%
University/Graduate Degree	37%	34%	27%	33%
Number of Household Occupants				
1	49%	26%	6%	28%
2	37%	45%	42%	42%
3	7%	14%	17%	13%
4 +	7%	15%	35%	17%
Household Income				
Under $40,000	43%	34%	20%	34%
$40,000 < $80,000	37%	34%	34%	35%
$80,000 +	19%	32%	46%	31%
Low Income Status				
Yes, 'low income' household	12%	9%	6%	9%
No	88%	91%	94%	91%

Column totals may not total 100% due to rounding of values and/or missing values.

C.2.3. Extent that Electricity Prices Provide an Incentive to Manage Electricity

This section provides more detail on customer opinion on the extent that electricity prices serves as an incentive to manage their use of electricity.

Given the detailed nature of the line of questioning in the survey, especially in regards to BC Hydro's rate structure, customer respondents were first presented the topic of electricity prices in general as a natural introduction to the comparably more complex content that would follow. However, the placement of the topic early in the survey was not done solely for 'content opening' and transitional purposes, but to allow for strategic insights. It was believed that any attempt to disentangle and understand customer opinions of price versus customer opinions of structure would be best served by soliciting views on price first, rate structure second.

Opinion of Electricity Prices by Region and Household Demographics

Views of electricity prices in terms of how much of an incentive they serve to manage electricity were fairly uniform among most customer sub-groups, but there were some notable differences in terms of the specific proportion of individuals who believed that the prices serve as a 'major incentive'.

Table C.5 Extent that Electricity Prices Incent the Management of Electricity

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	6%	10%	43%	41%	84%
Region					
Lower Mainland ⇒	6%	10%	46%	38%	84%
Vancouver Island ⇒	4%	11%	38%	47%	85%
Southern Interior ⇒	4%	9%	43%	44%	87%
North ⇒	6%	10%	39%	45%	84%
Home Ownership					
Own/Co-op ⇒	5%	10%	43%	42%	85%
Rent ⇒	7%	10%	47%	37%	84%
Gender of Primary Account Holder					
Male ⇒	6%	10%	46%	38%	84%
Female ⇒	5%	11%	40%	44%	84%
Age of Primary Account Holder					
18-34 ⇒	3%	14%	48%	34%	82%
35-54 ⇒	5%	11%	46%	38%	84%
55+ ⇒	6%	10%	41%	44%	85%
Education of Primary Account Holder					
High school or less ⇒	10%	7%	39%	44%	83%
College/vocational/tech./some university ⇒	5%	9%	42%	45%	87%
University/Graduate Degree ⇒	3%	15%	47%	35%	82%
Household Income					
Under $40,000 ⇒	8%	10%	36%	46%	82%
$40,000 < $80,000 ⇒	4%	8%	45%	42%	87%
$80,000 + ⇒	1%	14%	49%	36%	85%
Low Income Status					
Yes, 'low income' household ⇒	12%	7%	30%	51%	81%
No ⇒	5%	11%	44%	40%	84%

Row totals may not total 100% due to rounding of values and/or missing values.

At 38 per cent, customers in the Lower Mainland were 6 to 9 points less likely than all others to feel that electricity prices are such a strong motivator in this regard. This finding is likely due in large part to the higher incidence of apartments/condominiums in the Lower Mainland and the finding that only 32 per cent of these particular customers – who tend to have the lowest of electricity bills – felt that price serves as a 'major incentive' to manage their use of electricity.

Opinions on electricity prices also correlated with customer age as the proportion of those who believed they serve as a 'major incentive' to manage consumption steps up 10 points through the brackets, from a low of 34 per cent among those 18 to 35 years old to a high of 44 per cent among those 55 years old or older.

Similar to their views about the rate structure, customer account holders with lower levels of education and lower household incomes were more likely than others to view price as being a 'major incentive'. Reflecting these findings, customer households flagged as being 'low income' as defined by Statistics Canada were among the most likely to say that their electricity bills provide a strong impetus to conserve.

Opinion of Electricity Prices by Dwelling Type and Fuels

At 55 per cent, customers living in mobile and 'other' types of homes emerged to be more likely than others to believe that electricity prices serve as a 'major incentive' to manage their use of electricity. This finding ties to the fact that customers with lower education levels and lower incomes – shown to have been among the most likely to say that electricity prices serve as a 'major incentive' to manage consumption – have a comparably greater likelihood than others to live in mobile homes and 'other' types of dwellings.

Table C.6 Extent that Electricity Prices Incent the Management of Electricity (con't)

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	6%	10%	43%	41%	84%
Dwelling Type					
Single detached house ⇒	4%	10%	43%	43%	86%
Duplex/Row house/townhouse ⇒	9%	10%	36%	45%	81%
Apartment/Condominium ⇒	8%	12%	48%	32%	80%
Mobile home/other ⇒	4%	10%	31%	55%	86%
Main Space Heating Fuel					
Electricity ⇒	6%	10%	42%	41%	83%
Non-Electric ⇒	6%	10%	44%	41%	85%
Main Water Heating Fuel					
Electricity ⇒	4%	9%	39%	48%	87%
Non-Electric ⇒	6%	10%	44%	40%	84%
No hot water tank (central) ⇒	8%	13%	48%	31%	79%
Main Space Heating and Water Heating					
Electric Heating & Electric Water ⇒	4%	9%	39%	48%	87%
Electric Heating & Non-Electric Water ⇒	8%	9%	46%	37%	83%
Electric Heating & Central Water ⇒	7%	15%	47%	31%	78%
Non-Electric Heating & Electric Water ⇒	4%	9%	40%	47%	87%
Non-Electric Heating & Non-Electric Water ⇒	6%	10%	44%	40%	84%
Non-Electric Heating & Central Water ⇒	9%	10%	48%	33%	81%

Row totals may not total 100% due to rounding of values and/or missing values.

There was no meaningful difference in views on electricity prices between customer households that rely on electricity for their space heating versus customer households that rely on natural gas, oil or propane – 41 per cent in each group believed that prices serve as a 'major incentive' to manage their use of electricity. There were, however, substantial differences by water heating fuel with this proportion measuring 31 per cent among households without hot water tanks, 40 per cent among those that have non-electric hot water tanks and 48 per cent among those that have electric hot water tanks.

C.2.4. Extent that the Total Bill Amounts Provide an Incentive to Manage Electricity

This section provides more detail on customer opinion on the extent that the total dollar amount of their electricity bills serves as an incentive to manage their use of electricity.

Opinion of the Total Bill Amounts by Region and Household Demographics

About nine in ten customers reported that the total dollar amount of their electricity bills serves as either a 'major incentive' (48%) or a 'minor incentive' (42%) to manage their household's consumption of electricity. This view was widely held among all customer sub-groups, but there were some notable differences in terms of the specific proportion who reflected upon the bill as serving a 'major incentive' in this regard.

Table C.7 Extent that the Total Bill Amounts Provide an Incentive to Manage Electricity

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	3%	6%	42%	48%	90%
Region					
Lower Mainland ⇒	4%	7%	44%	46%	90%
Vancouver Island ⇒	2%	5%	42%	51%	93%
Southern Interior ⇒	4%	6%	39%	52%	91%
North ⇒	4%	6%	43%	47%	90%
Home Ownership					
Own/Co-op ⇒	3%	6%	43%	48%	91%
Rent ⇒	4%	8%	42%	46%	88%
Gender of Primary Account Holder					
Male ⇒	3%	7%	43%	47%	90%
Female ⇒	3%	5%	42%	50%	92%
Age of Primary Account Holder					
18-34 ⇒	5%	8%	38%	49%	87%
35-54 ⇒	2%	5%	45%	48%	93%
55+ ⇒	4%	7%	42%	47%	89%
Education of Primary Account Holder					
High school or less ⇒	7%	6%	34%	53%	87%
College/vocational/tech./some university ⇒	2%	6%	42%	50%	92%
University/Graduate Degree ⇒	2%	7%	49%	42%	91%
Household Income					
Under $40,000 ⇒	5%	5%	36%	54%	90%
$40,000 < $80,000 ⇒	2%	6%	41%	51%	92%
$80,000 + ⇒	<1%	7%	50%	43%	93%
Low Income Status					
Yes, 'low income' household ⇒	6%	5%	32%	57%	89%
No ⇒	3%	6%	44%	47%	91%

Row totals may not total 100% due to rounding of values and/or missing values confidence.

Similar to their views about the rate structure and price, customer account holders with lower levels of education and lower incomes were more likely – by about 10 percentage points – than those in the upper brackets to view the total dollar amount of their bills as being a 'major incentive' to manage their consumption of electricity. Reflecting these findings, customer households flagged as being 'low income' as defined by Statistics Canada were among the most likely to say that their electricity bills provide a strong impetus to conserve.

Opinion of the Total Bill Amounts by Dwelling Type and Fuels

At 64 per cent, customers living in mobile and 'other' types of homes emerged to be much more likely than others to consider the total dollar amount of their bills as a 'major incentive' to manage their use of electricity. This finding ties to the fact that customers with lower education levels and lower incomes – shown to be among the most likely to say that the dollar amount of their bills serve as a 'major incentive' to manage consumption – have a comparably greater likelihood than others to live in mobile homes and 'other' types of dwellings.

To compare, the proportion of customers who reported that their electricity bills serve as a 'major incentive' to conserve decreases to 50 per cent among those living in single detached houses, 47 per cent among those living in duplexes, row houses and townhouses, and further to a low of 41 per cent among those living in apartments/condominiums – likely due in large part to the fact that they typically have the lowest of bills.

Table C.8 Extent that the Total Bill Amounts Provide an Incentive to Manage Electricity

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	3%	6%	42%	48%	90%
Dwelling Type					
Single detached house ⇒	3%	6%	42%	50%	92%
Duplex/Row house/townhouse ⇒	2%	9%	42%	47%	89%
Apartment/Condominium ⇒	5%	7%	47%	41%	88%
Mobile home/other ⇒	3%	4%	29%	64%	93%
Main Space Heating Fuel					
Electricity ⇒	3%	8%	41%	48%	89%
Non-Electric ⇒	4%	5%	43%	48%	91%
Main Water Heating Fuel					
Electricity ⇒	3%	7%	39%	51%	90%
Non-Electric ⇒	3%	5%	44%	48%	92%
No hot water tank ⇒	6%	9%	45%	41%	86%
Main Space Heating and Water Heating					
Electric Heating & Electric Water ⇒	3%	7%	41%	49%	90%
Electric Heating & Non-Electric Water ⇒	2%	9%	39%	50%	89%
Electric Heating & Central Water ⇒	4%	8%	45%	43%	88%
Non-Electric Heating & Electric Water ⇒	2%	7%	37%	54%	91%
Non-Electric Heating & Non-Electric Water ⇒	3%	4%	45%	48%	93%
Non-Electric Heating & Central Water ⇒	8%	10%	44%	38%	83%

Row totals may not total 100% due to rounding of values and/or missing values confidence.

With few exceptions, customer views toward the total dollar amount of their electricity bills vary little with the types of space heating and water heating fuels they rely upon. Those who take delivery of their hot water via a central system, however, were among the least likely to feel that their bills provide an incentive to manage their use of electricity, but this finding owes itself to the fact that most of them live in apartments/condominiums.

C.2.5. Awareness and Opinions of BC Hydro's Residential Rate Structure

This section provides more detail on customer's prior awareness, understanding and opinions of BC Hydro's residential rate structure.

Unaided Awareness of BC Hydro's Residential Rate Structure by Region and Household Demographics

As explained in Section 3.4.3., unaided awareness that BC Hydro uses an inclining block rate for charging residential households for their consumption of electricity measured highest at 66 per cent among customers on Vancouver Island.

Table C.9 Unaided Awareness of BC Hydro's Residential Rate Structure by Region and Household Demographics

	Inclining block rate	Flat rate	Declining block rate	Don't know
Total | 100% ⇒	50%	31%	2%	17%
Region				
Lower Mainland ⇒	45%	34%	2%	19%
Vancouver Island ⇒	66%	22%	1%	11%
Southern Interior ⇒	43%	34%	2%	20%
North ⇒	49%	30%	2%	20%
Home Ownership				
Own/Co-op ⇒	53%	30%	1%	16%
Rent ⇒	34%	32%	5%	29%
Gender of Primary Account Holder				
Male ⇒	54%	31%	2%	13%
Female ⇒	47%	31%	2%	20%
Age of Primary Account Holder				
18-34 ⇒	55%	32%	2%	11%
35-54 ⇒	56%	29%	2%	13%
55+ ⇒	47%	31%	2%	20%
Education of Primary Account Holder				
High school or less ⇒	38%	32%	1%	28%
College/vocational/technical/some university ⇒	52%	31%	2%	15%
University/Graduate Degree ⇒	59%	29%	2%	10%
Household Income				
Under $40,000 ⇒	43%	26%	2%	29%
$40,000 < $80,000 ⇒	49%	38%	2%	11%
$80,000 + ⇒	58%	32%	3%	7%
Low Income Status				
Yes, 'low income' household ⇒	28%	28%	3%	41%
No ⇒	52%	31%	2%	15%

Row totals may not total 100% due to rounding of values and/or missing values.

Unaided awareness of the inclining block rate measured higher among home owners than among renters. In fact, as many as 29 per cent of all customers who rent their homes – many of them apartments/condominiums – did not know of the method they were charged for their consumption of electricity. By gender and age of the primary account holder, unaided awareness of BC Hydro's inclining block rate measured 7 to 9 percentage points higher among men and those less than 55 years old than among their counterparts.

Unaided awareness of the inclining block rate was even more strongly correlated to level of education, spanning 21 points from a low of 38 per cent among customers who have earned no more than a high school diploma to a high of 59 per cent among those who have attained university degrees. Related, awareness was also tied to annual income, spanning 15 points from a low of 43 per cent among those with household earnings less than $40,000 to a high of 58 per cent among those with household earnings of at least $80,000. Note that educated and affluent consumers are known to be more regular readers of newspapers in which electricity issues and rates are often covered.

Unaided Awareness of BC Hydro's Residential Rate Structure by Dwelling Type and Fuels

Consistent with findings tied to education and income, unaided awareness of the inclining block rate measured highest among customers who own single detached houses – the most expensive of the dwelling types, and typically the highest in consumption.

Table C.10 Unaided Awareness of BC Hydro's Residential Rate Structure by Dwelling Type and Fuels

	Inclining block rate	Flat rate	Declining block rate	Don't know
Total | 100% ⇒	50%	31%	2%	17%
Dwelling Type				
Single detached house ⇒	55%	30%	2%	13%
Duplex/Row house/townhouse ⇒	45%	36%	1%	18%
Apartment/Condominium ⇒	42%	30%	3%	25%
Mobile home/other ⇒	50%	25%	2%	23%
Main Space Heating Fuel				
Electricity ⇒	52%	30%	2%	16%
Non-Electric ⇒	48%	31%	2%	19%
Main Water Heating Fuel				
Electricity ⇒	58%	27%	1%	14%
Non-Electric ⇒	49%	34%	2%	16%
No hot water tank (central) ⇒	40%	29%	4%	27%
Main Space Heating and Water Heating Fuels				
Electric Heating & Electric Water ⇒	60%	27%	1%	12%
Electric Heating & Non-Electric Water ⇒	56%	31%	1%	12%
Electric Heating & Central Water ⇒	36%	34%	5%	24%
Non-Electric Heating & Electric Water ⇒	54%	28%	2%	16%
Non-Electric Heating & Non-Electric Water ⇒	47%	34%	2%	17%
Non-Electric Heating & Central Water ⇒	46%	21%	1%	32%

Row totals may not total 100% due to rounding of values and/or missing values.

Customers who rely on electricity to heat their homes were somewhat more likely than those who rely on natural gas, oil or propane to have been aware of the inclining block rate structure (52% versus 48%). However, at 58 per cent, customers who rely on electricity for their water heating were even more likely to have been aware of the rate. To compare, this proportion decreased to 49 per cent among customers with non-electric hot water tanks and further to 40 per cent among those with central water heating. As previously explained, all of these findings reflect a complex interplay of customer response involving space heating, water heating, dwelling and other demographic parameters. Refer to Section 3.4.1 for the complete details.

Understanding of the RIB Rate by Region and Household Demographics

After first soliciting their awareness of the method BC Hydro uses for charging their household's consumption of electricity, the survey informed respondents that an inclining block rate is indeed the method that the corporation uses. In doing so, the method was also introduced as the corporation's Two-Step Residential Conservation Rate and the Step 1 to Step 2 threshold and prices were detailed.

Having read the details about the corporation's Two-Step Residential Conservation Rate, a total of 44 per cent of customers felt they actually had either an 'excellent', 'good' or 'fair' understanding of the rate prior to receiving the survey – this included some 31 per cent professing either an 'excellent' or a 'good' understanding of it. These findings are generalizable to the entire population of BC Hydro's residential customers charged on this rate because the figures are fully based – the 50 per cent of customers identified as not being previously aware that their consumption of electricity is charged on an inclining block rate have not been discounted.

Table C.11 Understanding of the RIB Rate by Region and Household Demographics

	Not aware of the rate	Don't know	Very poor	Poor	Fair	Good	Excellent	Total at least Fair
Total | 100% ⇒	50%	2%	1%	3%	13%	19%	12%	44%
Region								
Lower Mainland ⇒	55%	2%	1%	3%	12%	17%	11%	40%
Vancouver Island ⇒	34%	1%	1%	2%	18%	29%	15%	62%
Southern Interior ⇒	57%	1%	1%	3%	11%	16%	11%	38%
North ⇒	51%	2%	1%	4%	14%	19%	9%	42%
Home Ownership								
Own/Co-op ⇒	48%	1%	1%	3%	14%	21%	13%	48%
Rent ⇒	66%	5%	2%	2%	10%	11%	4%	25%
Gender of Primary Account Holder								
Male ⇒	46%	2%	1%	3%	13%	22%	14%	49%
Female ⇒	53%	2%	1%	3%	14%	17%	9%	40%
Age of Primary Account Holder								
18-34 ⇒	45%	2%	1%	4%	16%	18%	14%	48%
35-54 ⇒	44%	1%	1%	3%	15%	21%	14%	50%
55+ ⇒	53%	2%	1%	2%	12%	19%	10%	41%
Education of Primary Account Holder								
High school or less ⇒	62%	3%	1%	4%	11%	13%	7%	31%
College/voc./tech./some university ⇒	49%	1%	2%	3%	15%	21%	10%	46%
University/Graduate Degree ⇒	41%	2%	<1%	2%	13%	24%	18%	55%
Household Income								
Under $40,000 ⇒	57%	3%	1%	2%	13%	17%	7%	37%
$40,000 < $80,000 ⇒	51%	1%	1%	2%	13%	21%	11%	46%
$80,000 + ⇒	42%	1%	<1%	3%	14%	24%	16%	54%
Low Income Status								
Yes, 'low income' household ⇒	72%	2%	2%	2%	5%	12%	5%	22%
No ⇒	48%	2%	1%	3%	14%	20%	12%	46%

Row totals due not total 100% as due to rounding of values and/or missing values.

A total of 4 per cent of customers felt they had either a 'poor' understanding' or 'very poor' understanding of the method despite correctly knowing that their consumption of electricity is charged on an inclining block basis. Presumably, these customers felt they had an incorrect understanding of the details around the Step 1 to Step 2 threshold and/or the Step 1 and Step 2 prices.

Partially reflecting their greater awareness of the inclining block rate to begin with, the proportion of customers who believed they had either an 'excellent', 'good' or 'fair' understanding of the Two-Step Residential Conservation Rate climbed markedly to 62 per cent among customers on Vancouver Island. To compare, this top-three box understanding score measured much lower at 38 per cent to 42 per cent among customers elsewhere in the service territory.

The proportion of customers who believed they had at least a 'fair' understanding of the Two-Step Residential Conservation Rate measured 48 per cent among those who own their homes and 25 per cent among those who rent their homes. This finding, in-hand with the better understanding among customers in the higher income groups, helps to explain why this top-three box understanding score climbed to 50 per cent among those who live in comparably more expensive single detached houses.

Men were more likely than women to have at least a 'fair' understanding of the Two-Step Residential Conservation Rate. The top-three box understanding score increased 24 points with education level, from a low of 31 per cent among customer contacts who have earned no more than a high school diploma to a high of 55 per cent among those who have attained university degrees.

Reflecting findings tied to education, understanding of the rate increased 17 points with annual income, from a low of 37 per cent among those with household earnings less than $40,000 to a high of 54 per cent among those with household earnings of at least $80,000. As total household income is one of three components in Statistics Canada's classification of 'low income' households, it follows that correct understanding of the Two-Step Residential Conservation Rate measured lowest at 22 per cent among such 'low income' customers.

Understanding of the RIB Rate by Dwelling Type and Fuels

The proportion of customers who believed they had at least a 'fair' understanding of the Two-Step Residential Conservation Rate spanned 14 points by dwelling type, measuring highest at 50 per cent among those living in single detached houses and lowest at 36 per cent among those living in apartments/condominiums.

The top-three box understanding score measured 47 per cent among the mix of households that rely on electricity for their space heating needs, 53 per cent among households that rely on electricity for their water heating needs, and slightly higher at 56 per cent – the highest of any customer sub-group – among customers households that rely on electricity for both reasons.

Table C.12 Understanding of the RIB Rate by Dwelling Type and Fuels

	Not aware of the rate	Don't know	Very poor	Poor	Fair	Good	Excellent	Total at least Fair
Total | 100% ⇒	50%	2%	1%	3%	13%	19%	12%	44%
Dwelling Type								
Single detached house ⇒	46%	1%	1%	3%	14%	21%	15%	50%
Duplex/Row house/townhouse ⇒	55%	3%	2%	2%	11%	19%	8%	38%
Apartment/Condominium ⇒	58%	4%	<1%	3%	12%	16%	8%	36%
Mobile home/other	50%	1%	2%	2%	18%	21%	7%	46%
Main Space Heating Fuel								
Electricity ⇒	48%	2%	1%	3%	14%	21%	12%	47%
Non-Electric ⇒	52%	2%	1%	3%	12%	18%	12%	42%
Main Water Heating Fuel								
Electricity ⇒	42%	1%	1%	3%	17%	23%	13%	53%
Non-Electric ⇒	51%	1%	1%	3%	12%	20%	12%	44%
No hot water tank (central) ⇒	60%	5%	1%	2%	10%	14%	8%	32%
Main Space Heating and Water Heating Fuels								
Electric Heating & Electric Water ⇒	40%	1%	1%	3%	17%	25%	14%	56%
Electric Heating & Non-Electric Water ⇒	44%	3%	1%	3%	18%	20%	12%	50%
Electric Heating & Central Water ⇒	64%	2%	1%	3%	8%	15%	7%	30%
Non-Electric Heating & Electric Water ⇒	46%	1%	3%	2%	17%	20%	12%	49%
Non-Electric Heating & Non-Electric Water ⇒	53%	1%	1%	3%	11%	19%	12%	42%
Non-Electric Heating & Central Water ⇒	54%	11%	0%	2%	13%	11%	9%	33%

Row totals may not total 100% due to rounding of values and/or missing values.

Customer households that do not have a hot water tank were among the least likely to have at least a 'fair understanding' of the corporation's electricity rate. This finding is consistent with the lower level of understanding among those who live in apartments/condominiums as well as among those in the lower income groups.

Understanding of the RIB Rate by the Incidence of Step 2 Electricity Consumption

Closely following unaided awareness that residential electricity consumption is charged on an inclining block rate, the extent that customers understood the details of the Two-Step Residential Conservation Rate increased with the frequency of exposure to Step 2 consumption. While a total of 36 per cent of customer households that 'never' incurred Step 2 consumption in the twelve months of F2012 emerged to have either an 'excellent', 'good' or 'fair' understanding of the rate, this proportion increased to 46 per cent among customers that 'sometimes' incurred Step 2 consumption and further to 52 per cent among customers that 'always' incurred Step 2 consumption during this period.

Table C.13 Understanding of the RIB Rate by the Incidence of Step 2 Electricity Consumption in F2012

	Not aware of the rate	Don't know	Very poor	Poor	Fair	Good	Excellent	Total at least Fair
Total | 100% ⇒	50%	2%	1%	3%	13%	19%	12%	44%
Step 2 Consumption Status in F2012								
Never into Step 2 ⇒	57%	4%	<1%	2%	11%	15%	10%	36%
Sometimes into Step 2 ⇒	48%	1%	1%	3%	13%	21%	12%	46%
Always into Step 2 ⇒	43%	1%	1%	3%	15%	24%	13%	52%

Row totals may not total 100% due to rounding of values and/or missing values.

Awareness that the RIB Rate was Designed to Encourage Conservation

Among customers who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's consumption of electricity, 75 per cent reported having been previously aware that the rate was designed to encourage conservation.

Awareness that the rate was designed for this purpose spanned 15 points by region, measuring highest at 82 per cent among customers on Vancouver Island and lowest at 67 per cent among customers in the North. Prior awareness measured 9 points higher among men than women, and steps up somewhat with age.

Table C.14 Awareness that the RIB Rate was Designed to Encourage the Conservation of Electricity
- among customers previously aware of the RIB rate -

	No, not previously aware	Yes, previously aware
Total | 100% ⇒	25%	75%
Region		
Lower Mainland ⇒	27%	73%
Vancouver Island ⇒	18%	82%
Southern Interior ⇒	23%	77%
North ⇒	33%	67%
Gender of Primary Account Holder		
Male ⇒	21%	79%
Female ⇒	30%	70%
Age of Primary Account Holder		
18-34 ⇒	30%	70%
35-54 ⇒	26%	74%
55+ ⇒	23%	77%
Education of Primary Account Holder		
High school or less ⇒	34%	66%
College/vocational/technical/some university ⇒	26%	74%
University/Graduate Degree ⇒	20%	80%
Household Income		
Under $40,000 ⇒	27%	73%
$40,000 < $80,000 ⇒	27%	73%
$80,000 + ⇒	23%	77%
Low Income Status		
Yes, 'low income' household ⇒	22%	78%
No ⇒	25%	75%

Row totals may not total 100% due to rounding of values and/or missing values.

Awareness that the inclining block rate was designed to encourage the conservation of electricity was strongly correlated to education level, stepping up from a low of 66 per cent among those who have attained no more than a high school diploma to a high of 80 per cent among those who have earned university degrees. Again, this may reflect the fact that the most educated consumers are known to be more regular readers of newspapers in which electricity issues and rates are often covered.

The Inclining Block Rate as an Incentive to Manage Electricity by Region and Household Demographics

As previously detailed, a total of 82 per cent of customers who correctly understood that their household's consumption of electricity is charged on an inclining block believed the method serves as either a 'major incentive' or a 'minor incentive' to manage its use.

At 84 per cent, customers who own their homes were among the most likely to have viewed the inclining block rate as serving either a 'major incentive' or a 'minor incentive' to manage their household's consumption of electricity. To compare, this proportion measured a total of 14 points lower at 70 per cent among customers who rent their homes.

Table C.15 Extent that the Inclining Block Rate Provides an Incentive to Manage Electricity
– among customers who correctly identify being charged on the inclining block rate –

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	3%	15%	45%	37%	82%
Region					
Lower Mainland ⇒	3%	12%	49%	36%	85%
Vancouver Island ⇒	3%	18%	42%	37%	79%
Southern Interior ⇒	3%	16%	37%	44%	81%
North ⇒	3%	16%	43%	38%	81%
Home Ownership					
Own/Co-op ⇒	3%	13%	46%	38%	84%
Rent ⇒	4%	25%	41%	29%	70%
Gender of Primary Account Holder					
Male ⇒	3%	13%	43%	41%	84%
Female ⇒	3%	16%	48%	34%	82%
Age of Primary Account Holder					
18-34 ⇒	1%	12%	55%	32%	87%
35-54 ⇒	2%	13%	50%	35%	85%
55+ ⇒	4%	16%	42%	38%	80%
Education of Primary Account Holder					
High school or less ⇒	5%	10%	40%	45%	85%
College/vocational/tech./some university ⇒	3%	14%	45%	38%	83%
University/Graduate Degree ⇒	3%	17%	47%	33%	80%
Household Income					
Under $40,000 ⇒	5%	13%	42%	40%	82%
$40,000 < $80,000 ⇒	2%	11%	45%	42%	87%
$80,000 + ⇒	2%	17%	49%	33%	82%
Low Income Status					
Yes, 'low income' household ⇒	2%	11%	40%	48%	88%
No ⇒	3%	15%	45%	37%	82%

Row totals may not total 100% due to rounding of values and/or missing values.

Customers in the bottom two of the three collapsed education and income brackets were substantially more likely – 7 to 12 percentage points – than those in each of the categories' top brackets to have viewed the structure as a 'major incentive' to manage their household's consumption of electricity.

The Inclining Block Rate as an Incentive to Manage Electricity by Dwelling Type and Fuels

In total, customers living in mobile homes and 'other' types of dwellings who correctly understood that their consumption of electricity was charged on an inclining block rate were no more likely than those living in other dwellings to believe that the method serves as an incentive – at least to some extent – to manage their use of it. However, at 52 per cent, there was a large contingent of these customers – in fact, a greater proportion than any other customer sub-group – who do feel that the method serves as a 'major incentive' to manage their household's consumption of electricity. This finding ties to the fact that customers with lower education levels and lower incomes – previously shown to be among the most likely to say that the inclining block rate serves as a 'major incentive' to manage consumption – have a comparably greater likelihood than others to live in mobile homes and 'other' types of dwellings.

Table C.16 Extent that the Inclining Block Provides an Incentive to Manage Electricity
– among customers who correctly identify being charged on the inclining block rate –

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major + minor incentive
Total | 100% ⇒	3%	15%	45%	37%	82%
Dwelling Type					
Single detached house ⇒	2%	14%	46%	38%	84%
Duplex/Row house/townhouse ⇒	4%	17%	43%	36%	79%
Apartment/Condominium ⇒	5%	16%	48%	31%	79%
Mobile home/other ⇒	5%	13%	30%	52%	82%
Main Space Heating Fuel					
Electricity ⇒	3%	17%	44%	37%	81%
Non-Electric ⇒	4%	13%	46%	37%	83%
Main Water Heating Fuel					
Electricity ⇒	3%	16%	44%	37%	81%
Non-Electric ⇒	2%	12%	47%	39%	86%
No hot water tank ⇒	5%	18%	45%	32%	77%
Main Space Heating and Water Heating Fuels					
Electric Heating & Electric Water ⇒	3%	18%	40%	39%	79%
Electric Heating & Non-Electric Water ⇒	2%	14%	55%	29%	84%
Electric Heating & Central Water ⇒	4%	15%	45%	36%	81%
Non-Electric Heating & Electric Water ⇒	3%	14%	49%	34%	83%
Non-Electric Heating & Non-Electric Water ⇒	3%	11%	45%	41%	86%
Non-Electric Heating & Central Water ⇒	8%	21%	46%	26%	72%

Row totals may not total 100% due to rounding of values and/or missing values.

While annual consumption does tend to measure higher among homes that rely on electricity for their space heating and/or water heating needs, customers living in these types of households were no more likely than their counterparts to view the inclining block as an incentive to manage their use of electricity. This finding holds true even after discounting the opinions of those living in apartments/condominiums – dwellings that tend to use less electricity and typically have smaller bills.

The Inclining Block Rate as an Incentive to Manage Electricity by the Incidence of Step 2 Consumption

Among customers who correctly identified the inclining block rate, there were no meaningful differences in their opinions of the method by their Step 2 consumption status. For households that 'always' incurred Step 2 consumption in F2012, a total of 81 per cent believed the method serves as an incentive to manage its use of it, including some 37 per cent who believed it serves as a 'major incentive. To compare, these percentages measured at broadly the same level among the two groups of households that 'sometimes' or 'never' incurred Step 2 consumption during this time.

Table C.17 Extent that the Inclining Block Provides an Incentive to Manage Electricity
– among customers who correctly identify being charged on the inclining block rate –

	Don't know	No incentive at all	Minor incentive	Major incentive	Total major +minor incentive
Total | 100% ⇒	3%	15%	45%	37%	82%
Step 2 Consumption Status in F2012					
Never into Step 2 (0 months) ⇒	5%	12%	46%	37%	83%
Sometimes into Step 2 (1-11 months) ⇒	2%	16%	45%	37%	82%
Always into Step 2 (12 months) ⇒	4%	15%	44%	37%	81%

Row totals may not total 100% due to rounding of values and/or missing values.

Incidence of Step 2 Electricity Consumption by Customer Opinion of RIB Prices

Table C.18 presents the findings from Table 3.15 in Section 3.4.3 essentially in reverse. It details the incidence of Step 2 electricity consumption in F2012 for each of the five different ways customers consider the price of their electricity under the RIB rate.

Among customers who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's consumption of electricity and considered the lower, Step 1 price as being their household's price of electricity in a billing period, 57 per cent are shown to have 'never' incurred Step 2 consumption in the twelve months of F2012.

For customers who considered the Step 2 price on its own as being their household's price of electricity in a billing period, 42 per cent are shown to have 'sometimes' incurred Step 2 consumption in the fiscal period while 46 per cent 'always' incurred Step 2 consumption.

For those who considered each of the Step 1 and Step 2 prices as being their household's price of electricity, depending on the point in time in the billing period and/or their consumption in the billing period, 47 per cent are shown to have 'sometimes' incurred Step 2 consumption in the fiscal period while 35 per cent 'always' incurred Step 2 consumption.

Table C.18 Incidence of Step 2 Electricity Consumption in F2012 by Customer Opinion of RIB Prices
- among customers previously aware of the RIB rate -

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)
Total |100% ⇒	30%	41%	29%
I would say that I consider the lower, Step 1 price as being my household's price of electricity in a billing period ⇒	57%	35%	9%
I would say that I consider the higher, Step 2 price as being my household's price of electricity in a billing period ⇒	12%	42%	46%
I would say that I consider each of the Step 1 and Step 2 prices as being my household's price of electricity, depending on the point in time in the billing period and/or our consumption in the billing period ⇒	18%	47%	35%
I do not think about my household's price of electricity in any of these particular ways ⇒	18%	41%	41%
Don't know ⇒	54%	28%	18%

Row totals may not total 100% due to rounding of values and/or missing values.

As for the one in five customer households that did not think about their household's price of electricity in any of the three given ways, the majority of them were evenly divided between 'sometimes' and 'always' having incurred Step 2 consumption in F2012. Among the very few customers who did not have an opinion either way, approximately one-half of them 'never' incurred Step 2 consumption during the fiscal year. Findings suggest that most of these customers – those who correctly identified the inclining block rate as the method that their household's consumption of electricity is charged – have a logical understanding and view of the price of electricity as it pertains to their own use of it.

Incidence of Step 2 Electricity Consumption by Opinion of the RIB Mechanism

Table C.19 presents the findings from Table 3.16 in Section 3.4.3 essentially in reverse. It details the incidence of Step 2 electricity consumption in F2012 for each of the six response options in regards to the way customers say the RIB rate acts an incentive to manage electricity.

Among customers who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's consumption of electricity and said that they consider the lower, Step 1 price as being their household's price of electricity in a billing period, the single largest segment of them – 50 per cent – are shown to have 'never' incurred Step 2 consumption in the twelve months of F2012.

Table C.19 Incidence of Step 2 Electricity Consumption in F2012 by Customer Opinion of the RIB Mechanism
- among customers previously aware of the RIB Rate and who said it serves as an incentive -

	Never into Step 2 (0 months)	Sometimes into Step 2 (1-11 months)	Always into Step 2 (12 months)
Total | 100% ⇒	28%	42%	30%
The lower, Step 1 price on its own incents our household: I consider the lower, Step 1 price as being the price applicable to all our electricity consumption in a billing period, and we try to manage our consumption of electricity on that basis. ⇒	50%	38%	12%
The higher, Step 2 price on its own incents our household: I consider the higher, Step 2 price as being the price applicable to the part of electricity consumption in a billing period that we have control over, and we try to manage our consumption of electricity on that basis. ⇒	14%	47%	39%
The difference between the Step 1 and Step 2 prices incents our household: If we can manage our consumption of electricity effectively in a billing period, we can have most of it charged at the lower, Step 1 price, perhaps even avoiding Step 2 consumption and the higher, Step 2 price altogether. ⇒	26%	42%	32%
The consumption threshold on its own incents our household: Regardless of the difference in the Step 1 and 2 prices and the amount we pay on our bill, we compare our household's consumption to the Step 1 to Step 2 Threshold (675 kWh for monthly billing; 1,350 kWh for bi-monthly billing) simply because we like to keep our consumption as low as possible compared to it. ⇒	30%	44%	26%
The stepped rate does not incent my household to manage its consumption of electricity in any of these particular ways. ⇒	15%	38%	47%
Don't know ⇒	27%	46%	27%

Row totals may not total 100% due to rounding of values and/or missing values.

Most customers who said that the higher, Step 2 price on its own or the difference between the Step 1 and Step 2 prices provides an incentive to their household to manage its consumption of electricity either 'sometimes' or 'always' incurred Step 2 consumption in F2012.

C.2.6. Electricity Consumption by RIB Rate Awareness

As a first investigation into the relationship between consumption and awareness, an ANOVA (analysis of variance) statistical test showed that the pool of customer households previously aware of the RIB rate incurred significantly higher average consumption in F2012 than the pool of customers not previously aware of the rate (10,495 kWh versus 9,017 kWh). In fact, while the differences were not always statistically significant, RIB-aware customers incurred higher consumption in every scenario shown Table C.20. As customers aware of the rate would likely never choose to deliberately consume more electricity, the findings uncover a causal path; greater consumption leads to a greater likelihood of being aware of the rate.

Table C.20 ANOVA Tests: Mean Electricity Consumption in F2012 by RIB Rate Awareness

	Customers aware of the RIB Rate	Customers not aware of the RIB Rate	Difference between groups	F Statistic	Significance
All Customers					
Total F2012 consumption ⇒	10,495 kWh	9,017 kWh	1,478 kWh	23.766	0.000*
Total Step 1 consumption ⇒	6,469 kWh	6,071 kWh	398 kWh	23.736	0.000*
Total Step 2 consumption ⇒	4,027 kWh	2,946 kWh	1,081 kWh	17.529	0.000*
Customers Never into Step 2 (0 months)					
Total F2012 consumption ⇒	3,993 kWh	3,983 kWh	10 kWh	0.009	0.924
Total Step 1 consumption ⇒	3,993 kWh	3,983 kWh	10 kWh	0.009	0.924
Total Step 2 consumption ⇒	-	-	-	-	-
Customers Sometimes into Step 2 (1-11 months)					
Total F2012 consumption ⇒	9,991 kWh	9,323 kWh	668 kWh	8.455	0.004*
Total Step 1 consumption ⇒	7,085 kWh	7,055 kWh	30 kWh	0.240	0.625
Total Step 2 consumption ⇒	2,906 kWh	2,269 kWh	637 kWh	10.493	0.001*
Customers Always into Step 2 (12months)					
Total F2012 consumption ⇒	17,843 kWh	17,521 kWh	322 kWh	0.175	0.676
Total Step 1 consumption ⇒	8,122 kWh	8,122 kWh	0 kWh	0.000	1.000
Total Step 2 consumption ⇒	9,721 kWh	9,399 kWh	322 kWh	0.175	0.676

* The difference between mean consumption levels is statically significant at the 95% level of confidence.

In a second investigation, a linear regression was conducted with consumption as the dependent variable. The independent variables consisted of rate awareness as well as various combinations of region, dwelling type, heating fuel, floor area, income, household occupants, and saturation levels of some major end-uses.

The coefficient for the awareness variable always emerged positive in the models, but typically not statistically significant at the 95 per cent level of confidence. This meant that in the estimation of a household's electricity consumption using these models, the estimate would sometimes increase – but never decrease – if the household was aware of the inclining block rate. As gleaned from both investigations, awareness of the rate does not directly lead households to having lower consumption as strictly compared to households unaware of the rate.

However, compared over time, households aware of the RIB rate may have had higher energy savings in F2012 than had they not been aware of the rate and/or higher energy savings than in periods prior to becoming aware of the rate. To investigate this, a much larger dataset of customer accounts would be required, including a long time series of consumption history both before and after households became aware of the RIB as disaggregated by a finely specified date variable.

C.2.7. Program Participation by RIB Rate Awareness

BC Hydro offers several energy conservation initiatives and rebate offerings to its residential customers to encourage them to improve energy efficiency and to adopt more energy conscious behaviours in their homes. An investigation into the Refrigerator Buy-Back Program, the Appliance Rebate Program, the Residential Behaviour Program and the two separate offerings in the Low Income Program was conducted to assist in the determination of whether there were differences in program participation among those who correctly understood their use of electricity was charged on an inclining block rate as compared to program participation among all other customers[9].

This procedure relied on 1) customer program participation markers from the corporation's billing system, strictly since the implementation of the inclining block rate in October 2008, 2) the date of program participation, 3) customer awareness of the inclining block rate, and 4) the approximate period as to when the customer first became aware of the rate.

Table C.21 BC Hydro Residential Program Participation since October 2008

	Did not participate in the program	Participated, but never aware of the inclining block rate	Participated, but before becoming aware of the inclining block rate	Participated, and after becoming aware of the inclining block rate
Appliance Rebate Program (ARP)				
Total |100% ⇒	90%	5%	1%	4%
Refrigerator Buy-Back Program (RBB)				
Total |100% ⇒	93%	3%	1%	3%
Team Power Smart Residential Behaviour Program				
Total |100% ⇒	96%	2%	<1%	1%
Energy Savings Kits (ESK)				
Total |100% ⇒	97%	2%	<1%	<1%
Energy Conservation Assistance Program (ECAP)				
Total |100% ⇒	100%	<1%	<1%	0%
Net: Any of the five programs				
Total |100% ⇒	84%	8%	1%	8%

Row totals may not total 100% due to rounding of values and/or missing values.

Customers who correctly identified that their household's consumption of electricity is charged on an inclining block rate emerged to be no more likely to have participated in any of these five residential programs after becoming aware of the rate than all other customers. Specifically, a total of 8 per cent of all customers participated in at least one program since October 2008, and *after* becoming aware of the inclining block rate. To compare, a total of 1 per cent of customers participated in at least one program since October 2008, but *before* becoming aware of the inclining block rate, while an additional 8 per cent of customers participated in at least one program, without ever becoming aware of the rate.

[9] As BC Hydro's Residential Lighting Program is administered direct to customers via retailers, the corporation does not have data on which customers participated. BC Hydro's Renovation Rebate Program is administered in partnership with LiveSmart BC, and for privacy reasons, the corporation does not have data on which customers participated.

C.2.8. In-Home Behaviours by RIB Rate Awareness

The customer survey was comprised of several banks of questions about in-home conservation behaviours. The related tables in this section of the report document the self-reported frequency that individuals and/or their households typically exhibit. Analysis and findings are detailed for each of the two customer groups of interest – those aware of the RIB rate and those unaware – and statistical testing is based on aggregated or pooled data.

Frequency scores in the tables are based on the 4-point scales ('always', 'usually', 'occasionally', 'never') extensively utilized in the surveys. For any behaviour, statistical testing focuses on the difference between the two groups of customers in the top-box score ('always') as well as the top-two box score ('always' + 'usually') as it is the difference in these categories that might help illuminate what might be behind any differences in the groups' actual energy consumption.

Given the large sample sizes, statistically significant differences can emerge between the two groups of customers for the smallest of gaps – even 2 points. With this in mind, it is important to note that statistically significant differences in scores do not necessarily equate to meaningful differences in behaviours.

Space Heating Behaviours

As detailed in Table C.22, the majority of all customers – regardless of their prior knowledge of the RIB rate – reported that they typically *draw the window coverings at night to keep in heat*. However, customers who correctly identified this rate as the method that BC Hydro uses for charging their household's consumption of electricity emerged to be somewhat more consistent in this regard – 59 per cent 'always' did so whereas this top-box frequency score measured 54 per cent among their counterparts.

Table C.22 Space Heating Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Draw window coverings at night to keep in heat					
Previously aware of the inclining block rate ⇒	11%	10%	21%	59%*	80%
Not previously aware ⇒	14%	10%	22%	54%	76%
Use a programmable thermostat or manually turn down the heat at night					
Previously aware of the inclining block rate ⇒	20%	6%	13%	61%*	74%**
Not previously aware ⇒	21%	9%	14%	56%	70%
Use a programmable thermostat or manually turn down the heat when no one is home					
Previously aware of the inclining block rate ⇒	17%	10%	18%	55%	73%
Not previously aware ⇒	22%	9%	18%	51%	69%
Reduce temperature in unused rooms by closing vents or turning down thermostats					
Previously aware of the inclining block rate ⇒	21%	11%	20%	48%*	68%
Not previously aware ⇒	25%	10%	21%	44%	65%
If single paned windows, install storm windows in the fall [3]					
Previously aware of the inclining block rate ⇒	67%	5%	10%	19%	29%
Not previously aware ⇒	70%	3%	6%	20%	26%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
* Statistically significant difference between the two groups' top-box score ('always') at the 95% level of confidence.
** Statistically significant difference between the two groups' top-two box score ('always' + 'usually') at the 95% level of confidence.

Although the contrast was not wholesale, there was a statistically significant difference between customers previously aware of the inclining block rate and all others in the proportion who either 'always' or 'usually' *use a programmable thermostat or manually turn down the heat at night.* Customers previously aware of the rate also emerged somewhat more likely than others to typically use *a programmable thermostat or manually turn down the heat when no one is home, reduce temperature in unused rooms by closing vents or turning down thermostats,* and *if they had single paned windows, to install storm windows in the fall.* However, the differences are not statistically significant at the 95 per cent level of confidence.

Laundry Behaviours

There were no acute differences in the four laundry behaviours explored between customers who identified that their household's electricity consumption is charged on an inclining block rate and customers who were not able to do so. However, for three of the four behaviours – *only doing laundry with full loads, using cold water wash and rinse*, and *using the temperature/moisture sensor* – the top-box or top-two box behaviour scores did measure statistically higher among customers previously aware of the rate than among their counterparts.

Table C.23 Laundry Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Only do laundry with full loads					
Previously aware of the inclining block rate ⇒	1%	3%	47%	49%	96%**
Not previously aware ⇒	1%	6%	41%	51%	92%
Use cold water wash and rinse when doing laundry					
Previously aware of the inclining block rate ⇒	9%	21%	34%	36%	70%
Not previously aware ⇒	11%	21%	27%	42%*	69%
Use the temperature/moisture sensor to turn off the dryer rather than use the timer					
Previously aware of the inclining block rate ⇒	28%	10%	22%	40%	62%**
Not previously aware ⇒	30%	13%	23%	34%	57%
Hang clothes to dry rather than machine dry					
Previously aware of the inclining block rate ⇒	18%	53%	18%	11%	29%
Not previously aware ⇒	23% [3]	50%	14%	13%	27%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
* Statistically significant difference between the two groups' top-box score ('always') at the 95% level of confidence.
** Statistically significant difference between the two groups' top-two box score ('always' + 'usually') at the 95% level of confidence.

Dishwashing Behaviours

At 96 per cent and 95 per cent, respectively, the overwhelming majority of customers previously aware of the RIB rate and all others reported that they typically *only turn on the dishwasher when it is full*. Underscoring the consistency of their behaviour in this regard, these survey statistics include some seven in ten customer households that 'always' do so.

Only about one-half of households in each of these two customer groups either 'always' or 'usually' a*ir dry the dishes rather than use the dishwasher's automated dry cycle*. At 54 per cent, the top-two box behaviour score measured 3 points higher among customers who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's consumption of electricity than it did among all others. However, as this difference was not statistically significant, the finding cannot be generalized to the two groups of customers that exist in BC Hydro's entire residential population.

Table C.24 Dishwashing Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Only turn on the dishwasher when it is full					
Previously aware of the inclining block rate ⇒	1%	3%	26%	70%	96%
Not previously aware ⇒	2%	3%	23%	72%	95%
Air dry the dishes in the dishwasher rather than use the dry cycle					
Previously aware of the inclining block rate ⇒	26%	20%	17%	37%	54%
Not previously aware ⇒	31% [1]	18%	17%	34%	51%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.

Personal Water Use Behaviours

Two in three customer contacts in each of the groups – those previously aware of the RIB rate, and those not previously aware – reported that they typically *keep shower times to less than 5 minutes each*. However, there is a subtle difference between the groups in that those previously aware of how their electricity is charged were significantly less likely than their counterparts to have said that they 'always' do so.

Table C.25 Personal Water Use Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Keep shower times to less than 5 minutes each					
Previously aware of the inclining block rate ⇒	11%	22%	45%	22%	67%
Not previously aware ⇒	13%	21%	37%	29% [*]	66%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.

Behaviours Relating to Water Equipment

Customer households in each of the two groups were by and large similar in their behaviours relating to their water equipment; nine in ten households in each group typically *repair dripping faucets within 1 or 2 days after they are discovered* while about three in ten households *turn off the water heater when no one is in the home for more than 2-3 days.* The top-box and top-two box behaviour scores did measure higher among those previously aware of their household's inclining block electricity rate than among those not previously aware of it, but the differences did not test as being statistically significant.

Table C.26 Behaviours Relating to Water Equipment

	Never	Occasionally	Usually	Always	Total Always + Usually
Repair dripping faucets within 1 or 2 days after they are discovered					
Previously aware of the inclining block rate ⇒	2%	7%	33%	58%	91%
Not previously aware ⇒	3%	7%	35%	55%	90%
Turn off the water heater when no one is in the home for more than 2-3 days [a]					
Previously aware of the inclining block rate ⇒	55%	12%	11%	22%	33%
Not previously aware ⇒	64%	8%	9%	19%	28%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
a. Only among homes with hot water tanks.

Lighting Behaviours

Each of the two customer groups – those previously aware of their household's inclining block electricity rate, and those not previously aware – reported very favourable conservation behaviours in regards to *turning off lights when no one is in the room* and *having the minimum number of lights on in a room for what they are doing*. However, the total proportion of customers who either 'always' or 'usually' do so measured 2 to 3 points higher among those previously aware of the RIB rate than among all others – a difference that tested to be statistically significant.

Table C.27 Lighting Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Turn off lights when no one is in the room					
Previously aware of the inclining block rate ⇒	<1%	4%	41%	55%	96%**
Not previously aware ⇒	<1%	6%	36%	58%	94%
Only have the minimum number of lights on in a room for what I am doing					
Previously aware of the inclining block rate ⇒	<1%	4%	46%	50%	96%**
Not previously aware ⇒	1%	7%	44%	49%	93%
Purchase and install energy-efficient light bulbs – such as CFLs and LEDs – when replacing burnt-out bulbs					
Previously aware of the inclining block rate ⇒	8%	21%	34%	37%	71%
Not previously aware ⇒	7%	18%	31%	44%*	75%**

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
* Statistically significant difference between the two groups' top-box score ('always') at the 95% level of confidence.
** Statistically significant difference between the two groups' top-two box score ('always' + 'usually') at the 95% level of confidence.

Customers were queried on their purchases of CFLs and LEDs in an effort to understand whether some investments in home energy efficiency differ by awareness of the RIB rate. Findings suggest that those who correctly identified the inclining block rate as the method that BC Hydro uses for charging their household's use of electricity were less likely than all others to indicate that they either 'always' or 'usually' *purchase and install energy-efficient light bulbs – such as CFLs and LEDs – when replacing burnt-out bulbs*.

Lighting was chosen as one indicator of investments in home energy efficiency for several reasons. As many consumers differentiate CFLs and LEDs from incandescent lamps primarily on price and energy efficiency rather than on other product attributes such as brand and light quality, the importance of energy efficiency can be more easily isolated. Also, while decision making around other investments in home energy efficiency – such as appliance purchases – may be more involved and have longer-term implications, decision making around lighting purchases are comparably more frequent and, in turn, customer recollection is believed to be more robust.

Other Plug-Load Behaviours

Approximately nine in ten customers in each of the two groups of interest reported that they typically *turn off the television when no-one is in the room or actively watching a program,* or *turn off the computer and printer when not in use OR use the power-save mode.* However, the top-two box behaviour scores among individuals previously aware of their household's inclining block electricity rate were shown to be statistically higher than the scores among all others.

Those previously aware of their household's inclining block electricity rate were essentially no different than others in their use of chargers for electronic devices. Specifically, a total of three in four customers in each of the two groups reported that they typically *unplug chargers for electronic devices when not in use,* including some 51 per cent who 'always' do so.

Table C.28 Other Plug-Load Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Turn off TV when no one is in the room or actively watching the program					
Previously aware of the inclining block rate ⇒	1%	5%	31%	63%	94%**
Not previously aware ⇒	2%	7%	27%	64%	91%
Turn off computer and printer when not in use OR use the power-save mode					
Previously aware of the inclining block rate ⇒	2%	8%	23%	67%*	90%**
Not previously aware ⇒	4%	10%	26%	60%	86%
Unplug chargers for electronic devices – such as cell phones, smart phones, iPads, MP3 players, etc. – when not in use					
Previously aware of the inclining block rate ⇒	11%	14%	24%	51%	75%
Not previously aware ⇒	12%	14%	23%	51%	74%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
* Statistically significant difference between the two groups' top-box score ('always') at the 95% level of confidence.
** Statistically significant difference between the two groups' top-two box score ('always' + 'usually') at the 95% level of confidence.

Other Behaviours

The behavioural dimension *think about ways to save energy* is less end-use centric, and is generally more associated with the holistic measures that tie into an energy conservation ethic. As such, it can be considered as a one of many possible proxies for the individual behaviours already explored.

A total of 64 per cent of individuals in each of the two customer groups of interest reported that they typically *think about ways to save electricity*. However, at 22 per cent versus 26 per cent, customer contacts previously aware of their household's inclining block electricity rate emerged to be less likely than all others to have said that they 'always' do so. This 4-point difference is statistically significant, but it is not necessarily a meaningful difference.

Table C.29 Other Behaviours

	Never	Occasionally	Usually	Always	Total Always + Usually
Think about ways to save electricity					
Previously aware of the inclining block rate ⇒	2%	34%	42%	22%	64%
Not previously aware ⇒	3%	33%	38%	26%*	64%

Row totals may not total 100% due to rounding of values and/or missing values confidence.
Not applicable and Don't Know responses have been discounted from all calculations.
* Statistically significant difference between the two groups' top-box score ('always') at the 95% level of confidence.

Appendix D - Survey Instrument

Section N: Suggestions?

N1. Is there anything BC Hydro can do to make the Two-Step Residential Conservation Rate more effective in encouraging your household to manage its consumption of electricity efficiently and to conserve? (In consideration of privacy issues, please do not reference any individuals' names.)

Section O: Incentive Prize Draw

Please indicate your name and phone number below if you wish to be entered into the draw for one of four $250 gift certificates to a home improvement retailer of your choice.

First Name: _____ Last Name: _____ Telephone: _____

BC hydro

Survey ID: 000000
Pass Key: 000000

ATTN: <NAME>
<MAILING ADDRESS>
<MAILING TOWN, PROVINCE, POSTAL>

SERVICE ADDRESS
<SERVICE ADDRESS>
<SERVICE TOWN>

January 2012

Dear Customer:

Learning more about how our residential customers think about and use electricity today is fundamental for estimating and planning for the needs of tomorrow. As such, your input in this Residential Rate Survey is essential to our understanding of the factors influencing conservation.

Your household has been randomly selected to participate in this survey. Your opinions are very important because you will be representing – in part – other customers who might be similar to you, but have not been randomly chosen to participate.

Synovate, an independent research company, is assisting us in conducting this survey. Your responses will be treated as confidential to BC Hydro and will be compiled with those of other customers. The data will be strictly held by BC Hydro's Power Smart Evaluation group, and the results will be used solely for evaluation and planning purposes related to the needs identified above.

Please ensure your survey responses refer to the residence located at the service address as shown above. The survey should be completed by either the primary or joint account holder.

You may complete this printed survey and return it in the postage paid envelope provided or, alternatively, you may access the electronic version of the survey on the Internet by typing the following website into your browser's address bar: http://www.websurveys.ca/bchydro and using the survey id and passkey shown at the top of this page.

Please complete the survey by January 31, 2012, and for doing so, you can enter your name in a draw for one of four $250 gift certificates to the home improvement retailer of your choice. If you complete the survey on the Internet, your name will be entered in the draw one additional time. Also, if your completed survey is received (in the mail or submitted via the Internet) by January 23, your name will be entered in the draw one additional time.

The information gathered through this survey is being collected in furtherance of BC Hydro's electricity conservation mandate under the *Clean Energy Act*.

Contact information is detailed on the inside cover of this booklet should you have any related questions about how to complete the survey or why BC Hydro has commissioned it.

Thank you for your cooperation and prompt response. Your opinions are extremely important to us.

Yours truly,

Sylvia von Minden
Manager, Rate Design and Tariff Administration

Residential Rate Survey

You and your household have been randomly selected from all BC Hydro residential customers to participate in this Residential Rate Survey. Your participation in this survey and your accompanying opinions are very important because you will be representing – in part – as many as 500 other customers who might be similar to you, but have not been randomly selected to participate.

QUESTIONS?

Synovate, an independent research company, is assisting us in conducting this survey. If you have any further questions about how to complete or return your survey, please call Charlotte Chan, Research Manager, Synovate toll free at 1-800-717-1777.

If you have questions about why BC Hydro is conducting this research, please call Marc Pedersen, Senior Evaluation Advisor, BC Hydro at (604) 453-6308 (call collect if outside of the Lower Mainland) for assistance.

The information gathered through this survey is being collected in furtherance of BC Hydro's electricity conservation mandate under the *Clean Energy Act*.

THANK YOU FOR YOUR COOPERATION AND PROMPT RESPONSE

BC Hydro
333 Dunsmuir Street, Vancouver BC V6B 5R3
www.bchydro.com

L9. What is the main language spoken in your household?

☐[1] English	☐[4] Mandarin	☐[7] German	☐[10] Korean
☐[2] French	☐[5] Punjabi	☐[8] Italian	☐[11] Spanish
☐[3] Cantonese	☐[6] Farsi	☐[9] Japanese	☐[12] Tagalog

☐[13] Other (please specify): _____

L10. Please indicate the combined total income before taxes for your household in the last year. (exclude the income of any boarders or renters)

☐[1] Under $20,000	☐[7] $70,000 to under $80,000
☐[2] $20,000 to under $30,000	☐[8] $80,000 to under $90,000
☐[3] $30,000 to under $40,000	☐[9] $90,000 to under $100,000
☐[4] $40,000 to under $50,000	☐[10] $100,000 to under $110,000
☐[5] $50,000 to under $60,000	☐[11] $110,000 to under $120,000
☐[6] $60,000 to under $70,000	☐[12] $120,000 or over

☐[99] Prefer not to say

L11. Do you or anyone in your household use your property at this service address for farm use where income is generated from agricultural production (crops and/or livestock)?

☐[1] Yes ⇒ If Yes: Is your property at this service address assessed as a farm for tax purposes? ☐[1] Yes ☐[2] No
☐[2] No

L12. Do you or anyone in your household use part of your home as a full-time or part-time office from which they conduct a business?

☐[1] Yes, full-time business ☐[2] Yes, part-time business ☐[3] No

L13. Which of the following describe your current status? (check all that apply)

☐[1] Employed full-time	☐[3] Homemaker	☐[5] Retired
☐[2] Employed part-time	☐[4] Student	☐[6] Unemployed

☐[7] Other (please specify): _____

Section M: Permission for Linkage to Account History

A key objective of this survey is to collect the necessary information to assist in our evaluation of the Two-Step Conservation Rate, including how customers' consumption of electricity may vary with their awareness, understanding and attitudes toward the rate. To facilitate this, it is important to analyze customers' consumption of electricity at their current address for a period dating back to 2006 – two years before the rate came into effect – as a long 'time series' of consumption helps us to better control for year-to-year changes in the weather, the economy, etc.

Rather than asking you to estimate how much electricity your home has consumed over the past few years, BC Hydro would like to access this information from your account history and link it to the responses you have given in this survey. We will NOT review any of your bill payment information.

As the primary or joint account holder, may we please have your permission for BC Hydro to do this?

☐[1] Yes
☐[2] No

Please turn over to the last page…

Section L: You and Your Household

L1. Your age is:

☐[1] 18 to 24 years of age
☐[2] 25 to 34
☐[3] 35 to 44
☐[4] 45 to 54
☐[5] 55 to 64
☐[6] 65 or older

L2. You are:

☐[1] Female
☐[2] Male

L3. Your education is:

☐[1] Less than Grade 12
☐[2] High school diploma
☐[3] Some college, vocational or technical school
☐[4] College, vocational or technical school graduate
☐[5] Some university
☐[6] University/graduate degree

L4. Have you ever lived outside of British Columbia?

☐[1] Yes ⇒ **continue**
☐[2] No ⇒ **skip to question L7**

L5. How many years have you now been living in British Columbia? (Note that if you had once moved outside of British Columbia and have since moved back, please indicate for how many years you have been back for.)

_____ years OR _____ months

L6. Have you ever been either primarily or jointly responsible for paying an electricity bill for a home you lived in outside of British Columbia?

☐[1] Yes
☐[2] No

L7. Please indicate the number of people living in your household on a full-time basis, in the following age categories. Please include any boarders or renters who do not have a separate utility account.

If the service address on the cover page pertains to a seasonal dwelling, then complete the table below in relation to the time(s) of the year when the dwelling is typically occupied.

	Number of people
a. Children 0 - 5 years of age	_____
b. Children 6 - 12	_____
c. Young adults 13 - 24	_____
d. Adults 25 - 64	_____
e. Adults 65 or older	_____
f. Total	= _____

L8. How many people in total were living in your household about one year ago?

_____ people ☐[99] No change / same as current number of people (as per question L7)

PLEASE…

Work your way through the survey from front to back, carefully following the applicable navigation instructions. By doing so, you will likely be instructed to skip past some of the questions not applicable to your household.

THANK YOU!

Section A: Attitudes toward BC Hydro's Residential Electricity Prices

A1. To begin this survey, please think about the amount of money your household pays for electricity every month, every two months, or even over the course of a year, and consider the benefits you receive in return.

Would you say that the amount of money your household pays for its consumption of electricity represents…

☐[1] Excellent value for money
☐[2] Good value for money
☐[3] Fair value for money
☐[4] Poor value for money
☐[5] Very poor value for money
☐[99] Don't know

A2. Thinking of things in a slightly different way, would you say that BC Hydro's residential electricity <u>prices</u> are…

☐[1] Much too high
☐[2] Just a little too high
☐[3] About right
☐[4] Just a little too low
☐[5] Much too low
☐[99] Don't know

A3. Compared to 3 years ago, do you think that BC Hydro's residential electricity <u>prices</u> have…

☐[1] Increased a great deal
☐[2] Increased just a little
☐[3] Stayed about the same
☐[4] Decreased just a little
☐[5] Decreased a great deal
☐[99] Don't know

A4. How do you think BC Hydro's residential electricity <u>prices</u> compare to other electric utilities across North America? Do you think BC Hydro's residential electricity prices are…

☐[1] Much higher than prices elsewhere
☐[2] Just a little higher than prices elsewhere
☐[3] About the same
☐[4] Just a little lower than prices elsewhere
☐[5] Much lower than prices elsewhere
☐[99] Don't know

Section B: Managing Your Household's Electricity Use

B1. Assuming you wanted to do so, how easy or difficult is it for your household to manage its consumption of electricity?

This might be done by changing behaviour, purchasing energy-efficient products, making energy-efficient home upgrades or by participating in conservation programs.

☐[1] Very easy
☐[2] Somewhat easy
☐[3] Somewhat difficult
☐[4] Very difficult
☐[99] Don't know

B2. How much of an effort does your household currently make to manage its consumption of electricity?

☐[1] A great deal of effort
☐[2] A fair amount of effort
☐[3] A little effort
☐[4] No effort at all
☐[99] Don't know

☐[98] Not Applicable – there is little opportunity at this time to manage our household's consumption of electricity

B3. Compared to 3 years ago, would you say your household is making more of an effort to manage its consumption of electricity, less of an effort, or has there been no change?

☐[1] Much more of an effort
☐[2] A little more of an effort
☐[3] No change
☐[4] A little less of an effort
☐[5] Much less of an effort
☐[99] Don't know

B4. Regardless of your household's current effort to manage its consumption of electricity, to what extent do BC Hydro's residential electricity <u>prices</u> serve as an incentive to your household to manage its consumption of electricity?

☐[1] Major incentive
☐[2] Minor incentive
☐[3] No incentive at all
☐[99] Don't know

BC hydro
FOR GENERATIONS

K11. Please indicate (✓) the fuels used to heat this home. If you use more than one fuel, indicate the fuel used to heat most of the home as the Main Fuel, and any additional fuel(s) as Other Fuels. (Note that while hot water can be used for heating, it is not a fuel. We're interested in what fuel is used to heat the hot water.)

Check only one fuel type in the Main Fuel column.

	Main Fuel (check only one) ⇓	**Other Fuels** (check all that apply) ⇓
Electricity	☐[1]	☐[1]
Natural gas	☐[2]	☐[2]
Oil	☐[3]	☐[3]
Wood	☐[4]	☐[4]
Bottled propane	☐[5]	☐[5]
Piped propane	☐[6]	☐[6]
Other (please specify): _____	☐[7]	☐[7]
Don't know	☐[99]	☐[99]

K12. What is the main system used to heat this home? (check only one)

☐[1] Central forced air furnace
☐[2] Electric baseboards
☐[3] Both central forced air furnace AND electric baseboards *
☐[4] Hot water radiant floor(s)
☐[5] Hot water baseboard(s)
☐[6] Hot water radiator(s)
☐[7] Heat pump – air source
☐[8] Heat pump – ground source
☐[9] Natural gas fireplace
☐[10] Wood stove
☐[11] Other (please specify): _____
☐[99] Don't know

* Typically these homes have central heat on the main floor and baseboards upstairs.

K13. What is the main fuel used to heat the (main) hot water heater in this home? (check only one)

☐[1] Electricity
☐[2] Natural gas
☐[3] Bottled Propane
☐[4] Piped Propane
☐[5] Oil
☐[6] Solar
☐[7] Other (please specify): _____

☐[99] Don't know

☐[98] Home does <u>not</u> have a hot water heater (the water is heated centrally in another part of the building)

K14. If natural gas is not selected in questions K11 or K13: Is natural gas service for home heating available where this home is located?

☐[1] Yes
☐[2] No
☐[99] Don't know

Section K: Your Home

For some customers, this survey booklet pertains to a seasonal home rather than a primary residence. Whatever the case may be, please ensure your survey responses in this section are in relation to the service address as shown on the cover page.

K1. What type of home is this? (located at the service address as detailed on the front of the survey booklet)

- ☐[1] Single detached house
- ☐[2] Duplex
- ☐[3] Row house/townhouse (3 or more units attached, each with separate entrance)
- ☐[4] Apartment/condominium
- ☐[5] Mobile home
- ☐[6] Other (please specify) _____

K2. Do you own or rent this home?

- ☐[1] Own ⇒ **continue**
- ☐[2] Co-op ⇒ **continue**
- ☐[3] Rent ⇒ **skip to question K4**

K3. Do you pay maintenance fees?

- ☐[1] Yes ⇒ **continue**
- ☐[2] No ⇒ **skip to question K5**

K4. Which of the following are included in your rent or maintenance fees?

- ☐[1] Heat
- ☐[2] Hot water
- ☐[3] Natural gas for fireplace
- ☐[4] Natural gas for cooking
- ☐[5] None of the above

K5. When was this home built?

- ☐[1] Before 1950
- ☐[2] 1950-1975
- ☐[3] 1976-1985
- ☐[4] 1986-1995
- ☐[5] 1996-2005
- ☐[6] 2006-2011
- ☐[99] Don't know

K6. How many years have you lived in this home? _____ years OR _____ months

K7. How many weeks or months in 2011 was your home left completely unoccupied?

_____ weeks OR _____ months **If 0 weeks, check here ( )**

K8. What is the total floor area of this home? (include basement and unfinished areas; exclude the garage/carport)

_____ square feet OR _____ square meters

K9. Have you ever completed a renovation at this home such that you added floor area?

- ☐[1] Yes ⇒ How many square feet/meters were added? _____ And approximately what month and year? _____
- ☐[2] No

K10. Does your BC Hydro bill cover only your household, or is there an additional suite(s) or household(s) on the same account?

- ☐[1] My household only
- ☐[2] Other suite(s) as well ⇒ How many other suites? _____

B5. When your household does make an effort to manage its consumption of electricity, what is the main reason for doing so? What is the second main reason?

Check only one item in the Main Reason column, and only one item in the Second Main Reason column.

	Main Reason (check only one) ⇓	Second Main Reason (check only one) ⇓
To protect the environment / to reduce my home's GHG emissions	☐[1]	☐[1]
To save money on our home electricity bill	☐[2]	☐[2]
To be part of a large unified effort to use less	☐[3]	☐[3]
To decrease the pay-back time of home renovations or upgrades made	☐[4]	☐[4]
Other (please specify) _____	☐[5]	☐[5]
No second reason		☐[6]
Don't know	☐[99]	☐[99]
Not applicable – our household never makes an effort to manage its electricity use	☐[98]	☐[98]

As a reminder…

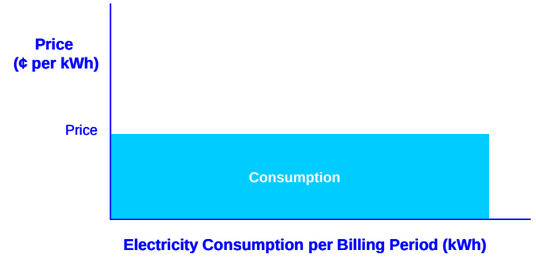
- **Mail the completed survey in the postage paid envelope provided, or complete the electronic version by January 31.**
- **For completing your survey, you can enter your name into a draw for one of four $250 gift certificates to the home improvement retailer of your choice.**
- **If you complete the survey online, your name will be entered in the draw one additional time. Also, if your survey is received (in the mail or submitted via the Internet) by January 23, your name will be entered in the draw one additional time.**
- **Official rules and regulations can be viewed online at**: http://www.websurveys.ca/contestrules

Section C: Rate Structures

In this section of the survey, we would like to explore your awareness and understanding of rate structures – that is, the various methods used to charge customers for their consumption of electricity which is measured in kilowatt hours (kWh). Please review the three most common methods in the illustrations below.

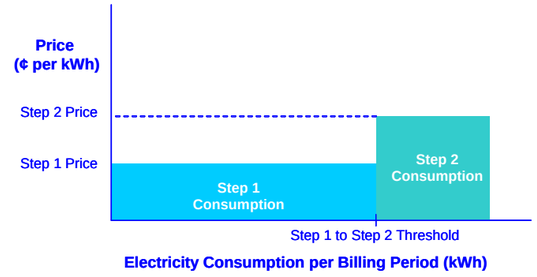
Flat Rate

1. The price per kilowatt hour (kWh) of electricity is constant regardless of the amount of electricity used in a billing period.



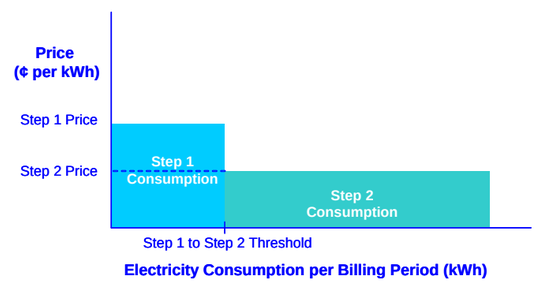
Inclining Block Rate / Stepped Rate

2. The price per kilowatt hour (kWh) of electricity is lower for the first portion of electricity used, and steps up to a higher price for any additional consumption beyond a specified threshold in a billing period. The inclining block rate is also known as a stepped rate.



Declining Block Rate

3. The price per kilowatt hour (kWh) of electricity is higher for the first portion of electricity used, and steps down to a lower price for any additional consumption beyond a specified threshold in a billing period.



Section J: General Energy Attitudes

J1. For the following set of statements, please check (✓) the response option that most accurately reflects your agreement or disagreement with the statement.

Be sure to check the N/A (not applicable) column if the statement does not apply to your household.

		Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	N/A or Don't know
a.	I believe my household's usage of electricity is currently at or near its lowest possible level.	☐1	☐2	☐3	☐4	☐5	☐99
b.	When I do make efforts to conserve electricity at home, it is more about saving money on my bill than helping to save the environment.	☐1	☐2	☐3	☐4	☐5	☐99
c.	Conserving energy is second nature to me – I've always done it, and know how to do it.	☐1	☐2	☐3	☐4	☐5	☐99
d.	I am knowledgeable about ways to save electricity around my home.	☐1	☐2	☐3	☐4	☐5	☐99
e.	We could all use a lot less energy than we do and if many people conserved, we could all make a big difference overall.	☐1	☐2	☐3	☐4	☐5	☐99
f.	Regardless of whether it makes a difference, everyone has a moral obligation to do the best they can to conserve energy.	☐1	☐2	☐3	☐4	☐5	☐99
g.	By making my home more energy-efficient, I am helping to do my part for the environment.	☐1	☐2	☐3	☐4	☐5	☐99
h.	I am an active energy conserver who looks for opportunities to save energy in everything I do.	☐1	☐2	☐3	☐4	☐5	☐99

J2. Please check (✓) the response option that most accurately reflects your agreement or disagreement with the statement.

Note that these three statements have been positioned in a negative context.

		Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	N/A or Don't know
a.	I would not make much of an effort to conserve electricity in my home if it also meant having to feel less comfortable in it.	☐1	☐2	☐3	☐4	☐5	☐99
b.	I really do not care much about energy and see little reason to conserve.	☐1	☐2	☐3	☐4	☐5	☐99
c.	There is not very much any individual can do to conserve energy that will have much effect in the long run.	☐1	☐2	☐3	☐4	☐5	☐99

I3. Electronics

		Always	Usually	Occasionally	Never	N/A or Don't know
a.	Turn off TV when no-one is in the room or actively watching the program	☐1	☐2	☐3	☐4	☐99
b.	Turn off computer and printer when not in use OR use the power-save mode	☐1	☐2	☐3	☐4	☐99
c.	Unplug chargers for electronic devices – such as cell phones, smart phones, iPads, MP3 players, etc. – when not in use	☐1	☐2	☐3	☐4	☐99

I4. Washing and Water Use

		Always	Usually	Occasionally	Never	N/A or Don't know
a.	Repair dripping faucets within 1 or 2 days after they are discovered	☐1	☐2	☐3	☐4	☐99
b.	Only do laundry with full loads	☐1	☐2	☐3	☐4	☐99
c.	Use cold water wash & rinse when doing laundry	☐1	☐2	☐3	☐4	☐99
d.	Use the temperature/moisture sensor to turn off the dryer rather than use the timer	☐1	☐2	☐3	☐4	☐99
e.	Hang clothes to dry rather than machine dry	☐1	☐2	☐3	☐4	☐99
f.	Only turn on dishwasher when it is full	☐1	☐2	☐3	☐4	☐99
g.	Air dry the dishes in the dishwasher rather than use the dry cycle	☐1	☐2	☐3	☐4	☐99
h.	Keep shower times to less than 5 minutes each	☐1	☐2	☐3	☐4	☐99

I5. Lighting

		Always	Usually	Occasionally	Never	N/A or Don't know
a.	Only have the minimum number of lights on in a room for what I am doing	☐1	☐2	☐3	☐4	☐99
b.	Turn off lights when no one is in the room	☐1	☐2	☐3	☐4	☐99
c.	Purchase and install energy-efficient light bulbs – such as CFLs or LEDs – when replacing burnt-out bulbs	☐1	☐2	☐3	☐4	☐99

I6. How often do you do the following?

		Always	Usually	Occasionally	Never	N/A or Don't know
a.	Think about ways to save electricity	☐1	☐2	☐3	☐4	☐99

You may review the explanation of rate structures and the accompanying illustrations on the adjacent page before proceeding with question C1.

C1. Prior to receiving this survey, were you aware of the flat rate method of charging for the consumption of electricity?

☐1 Yes
☐2 No
☐99 Don't know

C2. Prior to receiving this survey, were you aware of the inclining block rate – or stepped rate – method of charging for the consumption of electricity?

☐1 Yes
☐2 No
☐99 Don't know

C3. Prior to receiving this survey, were you aware of the declining block rate method of charging for the consumption of electricity?

☐1 Yes
☐2 No
☐99 Don't know

C4. Prior to receiving this survey, which one of the three basic methods did you believe BC Hydro currently uses for charging its residential customers for their consumption of electricity?

☐1 Flat rate (the price per kilowatt hour (kWh) of electricity is constant regardless of the amount of electricity used in a billing period)

☐2 Inclining block rate (also known as a stepped rate, the price per kilowatt hour (kWh) of electricity is lower for the first portion of electricity used, and steps up to a higher price for any additional consumption beyond a specified threshold in a billing period)

☐3 Declining block rate – (the price per kilowatt hour (kWh) of electricity is higher for the first portion of electricity used, and steps down to a lower price for any additional consumption beyond a specified threshold in a billing period)

☐99 Don't know/not sure

C5. Thinking about your response to question C4 above – the method you believe BC Hydro currently uses for charging its residential customers – to what extent does the method serve as an incentive to your household to manage its consumption of electricity?

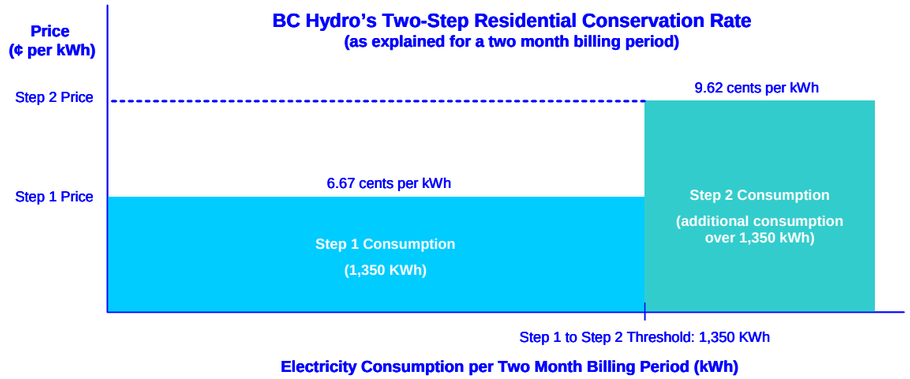
☐1 Major incentive
☐2 Minor incentive
☐3 No incentive at all
☐99 Don't know

Section D: BC Hydro's Two-Step Residential Conservation Rate

In October 2008, BC Hydro changed the method it charges its residential customers for their consumption of electricity from a flat rate to a stepped rate (also known as an inclining block rate).

Under this rate structure, customers who are billed every two months currently pay 6.67 cents per kilowatt hour (kWh) for the first 1,350 kWh used. This first portion is called Step 1. Above that amount, these households pay 9.62 cents per kWh for the balance of the electricity used during the billing period. This second portion is called Step 2. For customers billed on a monthly basis, the Step 1 to Step 2 Threshold is set at 675 kWh, but with the same prices in the billing period as noted above.

This rate structure is designed to encourage conservation and, as such, some customers may also know it as the Two-Step Residential Conservation Rate.



Please read about the Two-Step Residential Conservation Rate – as above – before proceeding with question D1.

D1. Which of the following statements best describes your awareness of BC Hydro's current method of charging its residential customers for their consumption of electricity?

- ☐[1] Prior to this survey, I was fully aware that BC Hydro's method of charging residential electricity consumption had changed from a flat rate to a stepped rate (also known as an inclining block rate). ⇒ **continue**
- ☐[2] Now that it has been mentioned, I had heard of this change from a flat rate to a stepped rate (also known as an inclining block rate). ⇒ **continue**
- ☐[3] Prior to this survey, my understanding was that residential electricity consumption is and has always been billed on a flat rate. ⇒ **skip to question D3**
- ☐[4] Prior to this survey, my understanding was that residential electricity consumption is and has always been billed on a stepped rate (also known as an inclining block rate). ⇒ **skip to question D3**
- ☐[5] Prior to this survey, I did not know about BC Hydro's method of charging residential electricity consumption. ⇒ **skip to question D3**
- ☐[99] Don't know ⇒ **skip to question D3**

D2. Approximately when would you say you first became aware that BC Hydro changed the method it charges its residential customers for their consumption of electricity?

- ☐[1] Less than 6 months ago
- ☐[2] 6 months to less than 12 months ago
- ☐[3] About 1 year ago
- ☐[4] About 2 years ago
- ☐[5] About 3 years ago / right around the time the change was made
- ☐[99] Don't know/not sure

H9. Please indicate whether your home has any additional electrically heated rooms.

Remember that we are referring only to the area of your home covered by your own BC Hydro bill.

	Have one?	
a. Electrically heated car garage	☐[1] Yes	☐[2] No
b. Electrically heated workshop (separate from car garage)	☐[1] Yes	☐[2] No
c. Electrically heated solarium	☐[1] Yes	☐[2] No
d. Electrically heated personal greenhouse	☐[1] Yes	☐[2] No
e. Electrically heated driveway	☐[1] Yes	☐[2] No

Section I: Current In-Home Behaviours

In this section, we would like to understand your current behaviours related to energy use in your home.

I1. For each winter time period listed below, please estimate the average temperature of your home regardless of whether your household uses any heating controls.

	Temperature	Don't know
a. Winter days – when someone is home	____ °C or ____ °F	☐[99]
b. Winter days – when no one is home	____ °C or ____ °F	☐[99]
c. Winter nights – when your household is asleep	____ °C or ____ °F	☐[99]

For each of the following behaviours, please check (✓) the response option that best describes what you normally do. Be sure to check the N/A (not applicable) column if the statement does not apply to your household.

I2. Space Heating and Water Heating

	Always	Usually	Occasionally	Never	N/A or Don't know
a. Use a programmable thermostat or manually turn down the heat at night	☐[1]	☐[2]	☐[3]	☐[4]	☐[99]
b. Use a programmable thermostat or manually turn down the heat when no one is home	☐[1]	☐[2]	☐[3]	☐[4]	☐[99]
c. Reduce temperature in unused rooms by closing vents or turning down thermostats	☐[1]	☐[2]	☐[3]	☐[4]	☐[99]
d. Draw window coverings at night to keep heat in	☐[1]	☐[2]	☐[3]	☐[4]	☐[99]
e. If single paned windows, install storm windows in the fall	☐[1]	☐[2]	☐[3]	☐[4]	☐[99]
f. Turn off the water heater when no one is in the home for more than 2-3 days	☐[1]	☐[2]	☐[3]	☐[4]	☐[99]

H6. Please indicate below the number of each cooking appliance in your home.

Be sure to indicate "0" if your home does not have the item.

	Number in Use		Number in Use
a. Gas ranges (cook top & oven)	_____	d. Electric cook tops	_____
b. Electric ranges (cook top & oven)	_____	e. Separate electric ovens (built-in)	_____
c. Gas cook tops	_____	f. Microwave ovens	_____

H7. Please indicate below the number of each home entertainment and computer item in your home.

Be sure to indicate "0" if your home does not have the item.

	Number in Use
a. Standard (CRT) colour televisions	_____
b. LCD flat screen televisions (some are now known as LED televisions)	_____
c. Plasma televisions	_____
d. Rear projection televisions	_____
e. Digital/cable/satellite set-top boxes	_____
f. Desktop computers (with separate monitors)	_____
g. Laptop/notebook computers	_____
h. All-in-one computers (components are built into the monitor)	_____
i. Printers	_____
j. Routers for connecting multiple computers or for connecting wirelessly to the Internet	_____

H8. Please indicate whether your home has an electrically heated indoor/outdoor pool, hot tub or whirlpool.

Remember that we are referring only to the area of your home covered by your own BC Hydro bill.

	Have one?	
a. Electrically heated indoor swimming pool	☐[1] Yes	☐[2] No
b. Electrically heated outdoor swimming pool	☐[1] Yes	☐[2] No
c. Electrically heated indoor hot tub or whirlpool	☐[1] Yes	☐[2] No
d. Electrically heated outdoor hot tub or whirlpool	☐[1] Yes	☐[2] No

D3. Having read a little more about the stepped rate method that BC Hydro uses for charging its residential customers, how easy or difficult would you say it is to understand how the rate works?

☐[1] Very easy ☐[2] Somewhat easy ☐[3] Somewhat difficult ☐[4] Very difficult ☐[99] Don't know

D4. How well of an understanding would you say you actually had – prior to receiving this survey – about the stepped rate method that BC Hydro uses for charging its residential customers?

☐[1] Excellent understanding ⇒ **continue**
☐[2] Good understanding ⇒ **continue**
☐[3] Fair understanding ⇒ **continue**
☐[4] Poor understanding ⇒ **continue**
☐[5] Very poor understanding ⇒ **continue**
☐[99] Don't know ⇒ **continue**

☐[98] Not applicable – I was not previously aware of the stepped rate method that BC Hydro uses ⇒ **skip to question D11**

D5. Although your household is charged the Step 1 price for its consumption of electricity up to 1,350 kWh in an average two-month billing period and the Step 2 price for any additional consumption, you may not necessarily think about the price of electricity in this way as it applies to your own household.

How do you think about the price of electricity as it applies to your own household? (check only one)

☐[1] I would say that I consider the lower, Step 1 price as being my household's price of electricity in a billing period.

☐[2] I would say that I consider the higher, Step 2 price as being my household's price of electricity in a billing period.

☐[3] I would say that I consider each of the Step 1 and Step 2 prices being my household's price of electricity, depending on the point in time in the billing period and/or our consumption in the billing period.

☐[4] I do not think about my household's price of electricity in any of these particular ways.

☐[99] Don't know

D6. Thinking of your own experience, to what extent does the stepped rate that your household's electricity is charged serve as an incentive to your household to manage its consumption of electricity?

☐[1] Major incentive ⇒ **continue**
☐[2] Minor incentive ⇒ **continue**
☐[3] No incentive at all ⇒ **skip to question D8**
☐[99] Don't know ⇒ **skip to question D8**

D7. Which one of the following statements/scenarios best describes how the stepped rate incents your household to manage its consumption of electricity? (check only one)

☐[1] The lower, Step 1 price on its own incents our household: I consider the lower, Step 1 price as being the price applicable to all our electricity consumption in a billing period, and we try to manage our consumption of electricity on that basis.

☐[2] The higher, Step 2 price on its own incents our household: I consider the higher, Step 2 price as being the price applicable to the part of electricity consumption in a billing period that we have control over, and we try to manage our consumption of electricity on that basis.

☐[3] The difference between the Step 1 and Step 2 prices incents our household: If we can manage our consumption of electricity effectively in a billing period, we can have most of it charged at the lower, Step 1 price, perhaps even avoiding Step 2 consumption and the higher, Step 2 price altogether.

☐[4] The consumption threshold on its own incents our household: Regardless of the difference in the Step 1 and 2 prices and the amount we pay on our bill, we compare our household's consumption to the Step 1 to Step 2 Threshold (675 kWh for monthly billing; 1,350 kWh for bi-monthly billing) simply because we like to keep our consumption as low as possible compared to it.

☐[5] The stepped rate does not incent my household to manage its consumption of electricity in any of these particular ways.

☐[99] Don't know

D8. For the following set of statements, please check (✓) the response option that most accurately reflects your agreement or disagreement with the statement.

Please read each statement in the table below beginning with "As a result of becoming aware that my household is charged on the stepped rate..."

	As a result of becoming aware that my household is charged on the stepped rate…	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Don't know
a.	…our household has thought about our consumption of electricity more often.	☐1	☐2	☐3	☐4	☐5	☐99
b.	…our household has made positive changes to our behaviour in the way we use electricity.	☐1	☐2	☐3	☐4	☐5	☐99
c.	…our household has been more likely to purchase energy-efficient products rather than conventional products.	☐1	☐2	☐3	☐4	☐5	☐99
d.	…our household has completed some energy-efficient home upgrades.	☐1	☐2	☐3	☐4	☐5	☐99
e.	…our household has participated in conservation programs.	☐1	☐2	☐3	☐4	☐5	☐99

D9. How would you say the stepped rate that your household is now billed on compares to the previous flat rate in terms of having actually incented your household to manage its consumption of electricity?

☐1 The stepped rate has served as much more of an incentive than the flat rate to manage our consumption of electricity
☐2 The stepped rate has served as a little more of an incentive than the flat rate
☐3 There has been no difference between the stepped rate and the flat rate
☐4 The stepped rate has served as a little less of an incentive than the flat rate
☐5 The stepped rate has served as much less of an incentive than the flat rate
☐99 Don't know

D10. Prior to receiving this survey, were you aware that the stepped rate is designed to encourage the conservation of electricity?

☐1 Yes
☐2 No
☐99 Don't know

D11. Overall, would you say you generally support the stepped rate, oppose it or are you indifferent about it?

☐1 Strongly support
☐2 Somewhat support
☐3 Indifferent
☐4 Somewhat oppose
☐5 Strongly oppose
☐99 Don't know

D12. Thinking about your response in question D11 above, for what reasons do you feel that way? (In consideration of privacy issues, please do not reference any individuals' names.)

H2. Please indicate below the number of each laundry and dish washing appliance in your home.

Be sure to indicate "0" if your home does not have the item.

	Number in Use		Number in Use
a. Automatic dishwashers	_____	c. Electric clothes dryers	_____
b. Clothes washers	_____	d. Natural gas / propane clothes dryers	_____

H3. Please indicate below the number of each home cooling appliance in your home.

Be sure to indicate "0" if your home does not have the item.

	Number in Use		Number in Use
a. Central air conditioners	_____	c. Window-mounted room air conditioners	_____
b. Portable air conditioners	_____	d. Portable fans	_____

H4. Think about your current ownership of fridges, freezers, laundry, dishwashing and home cooling appliances as specified in questions H1, H2 and H3.

Please list any of those appliances that replaced previous ones over the past 5 years (i.e. your household installed the appliance to replace an older one) and for each, the approximate month and year you installed it.

If none of your current appliances replaced older ones, then check here ( ) and skip to question H5.

Appliance Type Installed to Replace an Older Appliance	Month of Replacement	Year of Replacement
1. Please specify appliance type installed: _____	_____	_____
2. Please specify appliance type installed: _____	_____	_____
3. Please specify appliance type installed: _____	_____	_____
4. Please specify appliance type installed: _____	_____	_____
5. Please specify appliance type installed: _____	_____	_____

H5. Think once again about your current ownership of fridges, freezers, laundry, dishwashing and home cooling appliances as specified in questions H1, H2 and H3.

Please list any of those appliances that were new additions over the past 5 years (i.e. your household did not previously have such an appliance) and for each, the approximate month and year you added it.

If none of your current appliances were new additions, then check here ( ) and skip to question H6.

Appliance Type Added Which Your Household Never Had Before	Month Added	Year Added
1. Please specify appliance type added: _____	_____	_____
2. Please specify appliance type added: _____	_____	_____
3. Please specify appliance type added: _____	_____	_____
4. Please specify appliance type added: _____	_____	_____
5. Please specify appliance type added: _____	_____	_____

Section G: Program Participation

Power Smart is BC Hydro's energy efficiency program which promotes the conservation of electricity via numerous assistance, incentive and rebate programs.

G1. Has your household ever participated in Power Smart's Fridge Buy-Back Program?

☐[1] Yes ☐[2] No ☐[99] Don't know/not sure

G2. Has your household ever participated in Power Smart's Home Electronics Rebate Program?

☐[1] Yes ☐[2] No ☐[99] Don't know/not sure

G3. Has your household ever participated in Power Smart's Home Appliance Rebate Program?

☐[1] Yes ☐[2] No ☐[99] Don't know/not sure

G4. Has your household ever received an Energy Savings Kit and/or received in-home energy conservation assistance from BC Power Smart?

☐[1] Yes ☐[2] No ☐[99] Don't know/not sure

G5. BC Hydro launched Team Power Smart to encourage all British Columbians to work together to use electricity more efficiently and to conserve energy wherever possible. Has your household joined Team Power Smart?

☐[1] Yes ⇒ **continue** ☐[2] No ⇒ **skip to question G7** ☐[99] Don't know/not sure ⇒ **skip to question G7**

G6. Has your household ever started a Team Power Smart challenge to reduce its consumption of electricity by 10 percent over a year?

☐[1] Yes ☐[2] No ☐[99] Don't know/not sure

G7. Has your household ever participated in the LiveSmart BC or ecoEnergy Retrofit Homes Program such that you received rebates on any energy-efficient upgrades made to your home?

☐[1] Yes ☐[2] No ☐[99] Don't know/not sure

Section H: Home Appliances and Equipment

Through the remaining part of the survey, when we ask about your home or residence, we are referring to the area covered by your BC Hydro bill at this address. If you live in an apartment or townhouse complex, please do not include building hallways or outside lighting which are not covered by your own BC Hydro bill.

Please provide an answer only for those appliances and items covered by your home's BC Hydro bill.

H1. Please indicate below the number of each refrigerator and stand-alone freezer appliance in your home.

Be sure to indicate "0" if your home does not have the item.

	Number in Use		Number in Use
a. Refrigerators – automatic defrost	_____	c. Chest freezers (not part of a fridge)	_____
b. Refrigerators – manual defrost	_____	d. Upright freezers (not part of a fridge)	_____

Section E: Total Bill

E1. Compared to 3 years ago, would you say the total dollar amount of your household's electricity bills have…

☐[1] Increased a great deal
☐[2] Increased just a little
☐[3] Stayed about the same
☐[4] Decreased just a little
☐[5] Decreased a great deal
☐[99] Don't know

E2. Thinking of your own experience, to what extent does the total dollar amount of your electricity bills serve as an incentive to your household to manage its consumption of electricity?

☐[1] Major incentive
☐[2] Minor incentive
☐[3] No incentive at all
☐[99] Don't know

E3. Thinking about your response in question E1, which of the following statements do you believe describes the reason(s) for the change in the total dollar amount of your electricity bills over the past 3 years. (check all that apply)

☐[1] I believe the change in our bills has been due to the change in the method BC Hydro charges residential customers for their consumption of electricity (change in rate structure from the flat rate to the stepped rate).

☐[2] I believe the change in our bills has been due to changes in the overall price we pay for electricity.

☐[3] I believe the change in our bills has been due to changes in our consumption level.

☐[99] Don't know/not sure

☐[98] Not applicable – our electricity bills have "stayed about the same" (your previous response to question E1)

E4. Remember that for most customers, BC Hydro's Two-Step Residential Conservation Rate is based on electricity consumption over a two-month billing period, with a lower price for the first 1,350 kilowatt hours of electricity used, and a higher price for any additional electricity used in the same period.

For those customers billed on a monthly basis, this consumption threshold is 675 kilowatt hours.

How often in the past year do you believe your household's consumption of electricity crossed into Step 2 consumption?

☐[1] Never (no billing periods in the past year)
☐[2] Sometimes (some billing periods in the past year)
☐[3] Always (all billing periods in the past year)
☐[99] Don't know

Section F: More About Your Electricity Bill

F1. How does your household receive its electricity bill? (check all that apply)

- ☐[1] We receive a copy in the mail
- ☐[2] We receive a paperless bill through bchydro.com
- ☐[3] Other
- ☐[99] Don't know

F2. How do you typically pay for your electricity bill? (check only one)

- ☐[1] On-line through a personal banking website
- ☐[2] Pre-authorized automatic withdrawal from my bank account
- ☐[3] In-person at a bank
- ☐[4] Mail a cheque
- ☐[5] Other
- ☐[99] Don't know

F3. Some households can choose to have their electricity billed in monthly, equal amounts based on an estimate of consumption for a 12-month period. Each year, the actual consumption is compared to the billed amounts and an adjustment is made.

Have you chosen to have your household's consumption of electricity billed equally on a monthly basis?

- ☐[1] Yes
- ☐[2] No
- ☐[99] Don't know

F4. How often do you look over your household's electricity bill (either the print version or the on-line version)?

- ☐[1] At least once a month
- ☐[2] Once every 2 months
- ☐[3] Once every 3 months
- ☐[4] Once every 4 to 6 months
- ☐[5] Once or twice a year
- ☐[6] Never – we just pay it ⇒ **skip to question F6**
- ☐[99] Don't know/not sure ⇒ **skip to question F6**

F5. When you look at your household's electricity bill, which parts of it do you typically look at? (check all that apply)

- ☐[1] Total dollar amount owed, including taxes
- ☐[2] Total electricity consumption for the billing period (kWh)

- ☐[3] Sub-total dollar amount for Step 1 and Step 2 energy blocks
- ☐[4] Sub-total electricity consumption for Step 1 and Step 2 energy blocks (kWh)

- ☐[5] Illustration of sub-total dollar amount and electricity consumption for Step 1 and Step 2 energy blocks

- ☐[6] Comparison to previous bills
- ☐[7] Daily average usage
- ☐[8] Bill due date

- ☐[9] Other: please specify _____

- ☐[99] Don't know/not sure

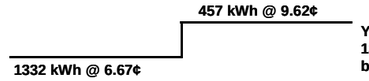
- ☐[0] No part of the bill in particular

F6. The part of the bill that details a household's electricity "consumption and usage charge" is shown in the example below.

Usage Charge[1]

Step 1:	**1332 kW.h @ 0.06670 /kW.h**	**88.84***
Step 2:	**457 kW.h @ 0.09620 /kW.h**	**43.96***

Your total consumption for the billing period is 1789 kW.h and your Conservation Rate breakdown is as follows:



How easy or difficult would you say it is to understand the "consumption and usage charge" on your electricity bill?

- ☐[1] Very easy
- ☐[2] Somewhat easy
- ☐[3] Somewhat difficult
- ☐[4] Very difficult
- ☐[99] Don't know

F7. How useful do you find the "consumption and usage charge" information on your bill – as illustrated in question F6 – in terms of informing any of your household's effort to manage its consumption of electricity?

- ☐[1] Very useful
- ☐[2] Somewhat useful
- ☐[3] Not too useful
- ☐[4] Not at all useful
- ☐[99] Don't know

- ☐[97] Not applicable – our household is currently making no effort at all to manage our consumption of electricity

- ☐[98] Not applicable – our household never looks at the electricity bill

F8. For the following set of statements, please check (✓) the response option that most accurately reflects your agreement or disagreement with the statement.

		Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	N/A or Don't know
a.	I spend more time looking over other bills I receive than my BC Hydro bill.	☐[1]	☐[2]	☐[3]	☐[4]	☐[5]	☐[99]
b.	I have a good understanding of the factors that cause changes in my household's consumption of electricity.	☐[1]	☐[2]	☐[3]	☐[4]	☐[5]	☐[99]