BC hydro
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Evaluation of the Large and Medium General Service Conservation Rates: F2014

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Power Smart Evaluation

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Executive Summary

Introduction

The purpose of this report is to provide a comprehensive evaluation of the impacts and customer response to BC Hydro's Large General Service (LGS) and Medium General Service (MGS) conservation rates for BC Hydro's fiscal year 2014 (F2014), which covers the period April 1, 2013 through March 31, 2014. The scope of this evaluation includes electric energy conservation effects as well as customer understanding and experience with the LGS and MGS rates. BC Hydro previously completed an evaluation of the LGS and MGS conservation rates for calendar years 2011 and 2012. The current evaluation extends that analysis.

BC Hydro's LGS and MGS rate classes are made up of all BC Hydro general service accounts that purchase electricity at distribution voltage and have a monthly peak demand above 35 kilowatts (kW). MGS refers to general service accounts with a monthly peak demand that is equal to or greater than 35 kW but less than 150 kW, or whose energy consumption in any 12 consecutive periods is less than or equal to 550,000 kilowatt-hours (kWh). LGS refers to general service accounts with a monthly peak demand equal to or greater than 150 kW, or whose energy consumption in any 12 month period is greater than 550,000 kWh.

This diverse group of customers includes a wide range of facility types, such as hospitals, manufacturing facilities, office buildings, retail, and the common areas of multi-unit residential buildings. The total electricity purchases of these rate classes was approximately 13,600 gigawatt hours (GWh) in F2014, covering approximately 23,000 accounts.

Prior to the implementation of the conservation rates, LGS and MGS customers were served under a declining block energy charge. Starting in January 2011, conservation rates were introduced that were designed to encourage customers to conserve electric energy. Under the LGS and MGS conservation rate, this encouragement is provided through a credit when consumption is lower than historical average consumption, and an additional charge when consumption is higher. The credit and charge (referred to as Part 2 of the conservation rate) are priced at a higher level than the base rate (referred to as Part 1). In effect, the conservation rates deliver a marginal price signal to customers that approximates BC Hydro's long run marginal cost (LRMC) of new energy supply.

To evaluate the impact of the conservation rates, and with the approval of the British Columbia Utilities Commission (BCUC), in 2010 BC Hydro assigned 400 accounts to control groups before the implementation of the conservation rates. Experimental design methods were used to select control accounts. Two hundred accounts were drawn from the MGS population and 200 from the LGS population. The control group accounts were maintained on the pre-existing rate, with prices increasing each year in concert with general rate increases. The remaining population of accounts (called the treatment groups in this report) started a transition to the conservation rate on January 1, 2011.

LGS customers transitioned as one group to the conservation rate structure on January 1, 2011. MGS customers were divided into two groups (MGS1, and MGS2/3) for the purpose of transitioning to the conservation rate structure. MGS1 was made up of 4,000 accounts, and MGS2/3 was made up of 12,500 accounts. All MGS customers completed transition to the conservation rate by April 1, 2013.

Approach

Table ES1.1 summarizes the evaluation objectives and research questions for this evaluation.

Table ES 1.1. Evaluation Objectives and Research Questions

Evaluation Objective	Research Questions
1. Assess customer awareness, understanding and acceptance of the LGS and MGS rates.	• What is the current level of unaided awareness of the energy charges? • How easy or difficult is it to understand how the rate works? • What is the customers' level of understanding on using the rate as a tool in managing their energy bill? • How much support do customers have for the conservation rate? Do customers believe the rate is fair? How does this compare between customers experiencing growth vs. those who are conserving? • What changes were observed in awareness, understanding and acceptance since the previous evaluation?
2. Understand customer response to the conservation rates.	• How much of an incentive to conserve does the energy charge (Part 1 and Part 2) provide? • How easy or difficult is it for customers to manage their energy consumption? • How much effort are customers putting into minimizing their energy charge? • What are the major factors behind customer efforts to manage electricity use? • What is the price signal to which customers are responding? • What changes were observed in customer response since the past evaluation?
3. Assess the effectiveness of the LGS and MGS control groups for the evaluation of energy savings.	• Are the control groups still equivalent to the treatment groups? • What is the relative precision of the control groups?
4. Estimate the energy and peak demand savings attributable to the LGS and MGS conservation rates.	• What are the energy and peak demand savings due to the LGS and MGS conservation rates in F2014, relative to calendar year 2010? • What changes are observed in energy savings since the past evaluation? • What are possible explanations for any variance between reported and evaluated electricity savings?
5. Large customer impact analysis	• Can a response to the introduction of the LGS conservation rate be detected at the site level for a selection of key account customers[1] with energy management initiatives?

[1] Key account customers are BC Hydro's largest Industrial, Commercial, Institutional and Government accounts.

Table ES1.2 summarizes, for each of the evaluation objectives, the evaluation data and methods used.

Table ES 1.2. Evaluation Objectives, Data and Methods

Evaluation Objective	Data	Methods
1. Assess customer awareness, understanding and acceptance of the LGS and MGS conservation rates.	• Customer surveys • Customer focus groups • Key Account Manager[2] interviews	• Qualitative analysis • Cross tabulations
2. Understand customer response to the conservation rates.	• Customer surveys • Customer focus groups • Key Account Manager interviews	• Qualitative analysis • Cross tabulations
3. Assess the effectiveness of the LGS and MGS control groups for the evaluation of energy savings.	• BC Hydro billing data on electricity purchases from January 2010 to March 2014 • BC Hydro account data on customers characteristics (e.g., region, account sector) • Power Smart program tracking data	• Statistical tests • Stratified sampling design analysis
4. Estimate the energy and peak demand savings attributable to the LGS and MGS conservation rates.	• BC Hydro billing data from January 2010 to March 2014	• Experimental design with randomized controlled trial • Statistical outlier identification (Grubbs' test) • Difference-in-differences • Statistical bootstrapping • Rate class average peak to energy ratio
5. Large customer impact analysis	• BC Hydro billing data • Customer-level data (e.g. production)	• Customer-level regression models

Results

Results for Objective 1: Customer Awareness, Understanding and Acceptance of the Conservation Rates

Unaided awareness of the conservation rate in 2014 was 35% for LGS customers, 26% for MGS1 customers and 22% for MGS2/3 customers. Of these three groups, LGS customers have been on the conservation rate the longest (since January 2011). For these customers, unaided awareness has remained fairly steady since 2012, when it was at 33%. These levels of unaided awareness are lower than found for other BC Hydro conservation rates. Unaided awareness of their conservation rate was measured at 50% for residential customers[3] and 83% for large industrial customers[4].

Fewer than one quarter of LGS and MGS customers reported that, following a written description and illustration of the rate, it is very easy to understand how the rate works. Reported levels of ease of understanding how the rate works, again following a written description and illustration of their conservation rate, stayed fairly constant between 2012 and 2014, with the exception of LGS customers reporting that the

[2] Key Account Managers manage BC Hydro's relationship with its largest Industrial, Commercial, Institutional and Government accounts.
[3] BC Hydro, 2014, Evaluation of the Residential Inclining Block Conservation Rate F2009-F2012, page 33.
[4] BC Hydro, 2013, F2012 Demand Side Management Milestone Evaluation Summary Report, page 43

rate is very easy to understand, where an increase from 16% to 23% was observed. These levels of understanding are lower than found for the residential conservation rate structure, where the same approach to testing understanding resulted in 44% of residential customers reporting that their rate was very easy to understand.[5,6]

Focus group participants, who were decision makers regarding energy at LGS and MGS sites, demonstrated key gaps in understanding how to use the rate as a tool to manage their energy bill through changes in consumption, even after video and moderator explanations.

After being informed that the intent of the rate was to promote conservation, between 9% and 21% of customers strongly supported the rate, depending on their rate class, while 5% to 7% strongly opposed it. The share of LGS customers who strongly supported the rate increased from 14% in 2012 to 21% in 2014. Most focus group participants and key account customers complained about the mechanics of the rate. The energy charge was viewed as a penalty by customers with growing electricity consumption. The complexity of the rate structure created an administrative burden for customers with a single BC Hydro account and multiple tenants.

Results for Objective 2: Customer Response to the Conservation Rates

Of the 35% of LGS, 26% MGS1, and 22% of MGS2/3 customers who could correctly identify the energy charge component of their rate unaided, 41% indicated that it served as a major incentive to conserve electricity while 35% indicated that it served as no incentives at all. These results indicate that the overall incentive effect of the energy charge was modest.

Focus group participants reported that the conservation rate was too complicated to act on because there are various inputs to the rate that were perceived as too difficult for customers to measure and manage themselves.

Most customers did not find it easy to minimize their energy charges. In 2014, 64% of LGS customers, 55% of MGS1 customers and 59% of MGS2/3 customers said that it was very difficult or somewhat difficult to manage their account to minimize energy charges. Nonetheless, 63% of LGS customers, 57% of MGS1 customers, and 47% of MGS2/3 customers reported putting a great or fair deal of effort into minimizing energy charges. The share of customers reporting a great deal of effort to minimize energy charges increased from 2012 to 2014 across all customer groups. Particularly large increases are seen for the MGS1 group (from 6% to 17%) and for the LGS group (from 17% to 25%)

Customers were asked about the various factors that were major drivers of managing their electricity consumption. The most commonly cited major driver was wanting operating costs to be as low as possible (76% of respondents), followed by the overall level of electricity prices (59% of respondents). The incentive to save electricity built into the rate was assessed as a major driver of managing electricity consumption by 21% of respondents.

The economic price signal to which customers responded is varied. Focus group participants reported that they mainly look at the total bill amount only. Few customers took the time to dissect their energy bill because they had limited understanding of the rate structure. However, some key account customers did understand the rate structure and managed their electricity to minimize Part 2 charges.

[5] BC Hydro, 2012, Residential Rate Survey

[6] Comparable results are not available for the Transmission Service Rate

Results for Objective 3: Assess the Effectiveness of the Control Group

Of the 400 control accounts assigned in 2010, 295 were found to still be valid at the time of this evaluation (i.e. they remained in the control group). The other 105 accounts were lost from the control groups either because of account closure, or migration to a different rate class as a result of significant changes in account consumption. A similar proportion of LGS and MGS treatment accounts also experienced account closure or migration to a different rate class, and these accounts were not included in the analysis[7].

Effective control groups are equivalent to their treatment groups on all observable factors that are expected to impact electricity consumption, with the exception of their electricity rate. Analysis of the factors listed below was completed to test the effectiveness of the control groups:

- Equivalent average electricity consumption in the base year prior to conservation rate implementation (calendar year 2010).
- Distribution of consumption by percentile.
- Equivalent average base year consumption by major account sector (industrial, commercial, and multi-unit residential).
- Equivalent average base year consumption by region.
- Equivalent average participation rates in Power Smart programs.
- Relative precision, indicating how closely a sample can predict a variable of interest for a population.
- Control group contamination resulting from control accounts with parent corporations in the treatment group.

The control groups were found to be effective for the purpose of evaluating energy savings due to the LGS and MGS conservation rates. The control groups were equivalent to their treatment groups on the basis of electricity consumption in the year prior to conservation rate implementation, account sector and region. Further, the percentile distribution of annual electricity consumption and the level of Power Smart program participation were found to be similar between the control and treatment groups. The relative precision was found to be good for the MGS control group (overall 2% relative to a target of 20% or lower) and fair for the LGS control group (overall 12% relative to a target of 20% or lower). Finally, the control groups were found to be uncontaminated by having a parent corporation in the treatment group.

Results for Objective 4: Energy and Peak Demand Savings

The past evaluation estimated the annual rate of savings at 144 GWh/yr by the end of 2011 and 200 GWh/yr by the end of 2012, both relative to calendar year 2010. These results were statistically significant at the 90% confidence level. The current evaluation estimated the annual rate of savings at 77 GWh/yr by the end of F2014, relative to calendar year 2010. The F2014 results are statistically significant at the 85% confidence level, but not at the 90% confidence level that was achieved in the past evaluation. This means that the F2014 savings have a lower level of certainty than did the 2011 and 2012 savings, and that the F2014 savings are statistically equivalent to zero at the 90% confidence level.

The minimum acceptable level of certainty varies by industry and needs to be determined by each user of the information. BC Hydro aims for a confidence level of 80% or better for net evaluated energy savings derived from sampling based methods such as the one employed in this evaluation. Results that meet or exceed this level are reported as statistically significant, along with their associated confidence level.

[7] 16,500 valid treatment accounts were identified for the purpose of this analysis, relative to a population of 23,000 in 2010.

Shown below are the reported and evaluated energy and peak demand savings for the LGS and MGS conservation rates during the evaluation time period. Energy savings are shown as an annual rate of savings in F2014, relative to calendar year 2010. This annual rate of savings includes any savings that commenced in 2011 or 2012 and continued to persist in F2014. This means that the F2014 energy savings are cumulative since the implementation of the conservation rates, and cannot be added to savings from 2012 and 2011.

Evaluated net energy savings for F2014 are 77 GWh per year, which is substantially less than the forecasted (reported) savings of 919 GWh per year. All evaluated net savings resulted from the LGS conservation rate with no savings from the MGS conservation rate.

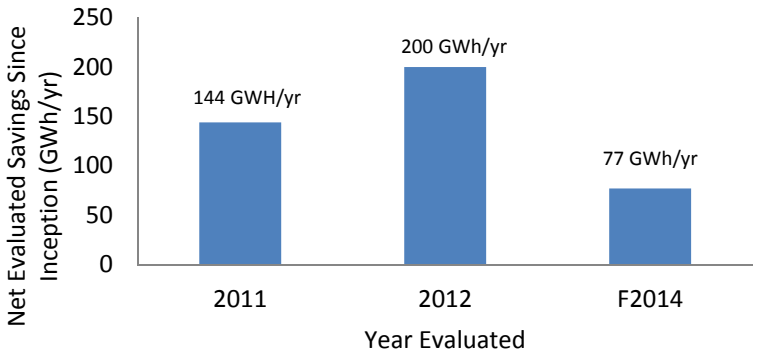
Table ES 1.3. Summary of Energy and Peak Demand Savings, F2014

Year	Cumulative Energy Savings (GWh/yr)		Peak Demand Savings (MW)	
	Reported	Evaluated Net	Reported	Evaluated Net
F2014	919	77*	128	11

* Statistically significant at the 85% confidence level. p-value = 0.14.

Net evaluated savings for each year, at a confidence level of at least 85%, are shown below.

Figure ES 1.1. Net Evaluated Savings for Each Year Evaluated



Research[8] indicates that more informed customers are more responsive to price changes than are less informed customers. Evidence from this evaluation indicates that unaided awareness and demonstrated understanding of the conservation rate was low, and that customers found the rate structure to be too complex to inform their decision making on investment in energy efficiency. This suggests that one reason for the variance between evaluated and reported savings was low levels of customer awareness and understanding of the conservation rates, due at least in part to their complexity.

[8] Carter, D. W. and J. W. Milon 2005. Price Knowledge in Household Demand for Utility Services. Land Economics 81(2): 265-283.

Results for Objective 5: Large Customer Impact Analysis

Regression modelling of 12 industrial key account LGS customers with dedicated energy managers on staff did not detect a statistically significant response to the introduction of the LGS conservation rate. These customers would be expected to be responsive to the conservation rate, because they consume considerable amounts of electricity and have staff dedicated to energy management.

Findings and Recommendations

Findings are summarized below:

1. Only a small portion of LGS and MGS customers were able to correctly identify their rate structure without assistance. Unaided awareness of the rate structure was 35%, 26%, and 22% among LGS, MGS1, and MGS2/3 customers respectively.

2. Survey results indicated that most customers (between 68% and 77% across the rate groups) believed that how the rate works was very or somewhat easy to understand after reading a description and illustration of their conservation rate. However, only a minority of these believed that it was *very* easy to understand and further exploration of this issue in the focus groups revealed that the rate may be much harder to understand than these survey results would suggest. Even though focus participants were decision makers around the management of energy accounts and had previously completed the survey which aided their understanding of the rate structure, few demonstrated a good understanding of the rate structure. Key gaps in their understanding persisted even after video and moderator explanations of the rate.

3. After being informed that the intent of the rate was to conserve electricity, between 9% and 21% of customers strongly supported the conservation rate structures, depending on their rate class, while 5% to 7% strongly opposed it. Qualitative research indicated that customers experiencing consistent moderate growth did not support the rate, and saw the Part 2 energy charge as a penalty for growth. Some customers complained that the complexity of the rate structure created an administrative burden.

4. The incentive effect of the Part 2 energy charge and credit appeared to be modest. A total of 41% of customers with unaided awareness of the energy charge reported that it served as a major incentive to conserve electricity. However, another 35% of these customers reported that it served as no incentive at all. Qualitative research indicated that customers found the Part 2 energy charge and credit mechanism to be too complex to serve as a motivator for conservation.

5. The control groups closely matched the treatment groups in a number of important ways, and they were therefore valid and effective control groups for the purpose of evaluating the LGS and MGS rates.

6. The MGS conservation rate structure did not produce statistically significant energy savings. This result is consistent with the past evaluation.

7. Evaluated net energy savings for the LGS conservation rate structure were 77 GWh per year in F2014, relative to calendar year 2010 while evaluated net energy savings for the MGS conservation rate were zero. This is 8% of reported savings (919 GWh/yr for both MGS and LGS combined as of March 2014).

8. The variance between evaluated and reported savings is substantial. Evidence from this evaluation suggests that one reason for the variance is low levels of customer awareness and understanding of their conservation rates due at least in part to their complexity.

9. Regression modeling of 12 large LGS sites failed to detect an effect on energy consumption due to the introduction of the LGS conservation rate in 2011.

Recommendations are summarized below:

1. Maintain the LGS and MGS control groups, so long as the MGS and LGS conservation rates are continued in their current form. Maintenance of the control group is required for future evaluation of the LGS and MGS conservation rates.

2. Consider revising the LGS and MGS conservation rates. Unaided awareness of the rate structure has remained low at approximately one third of LGS customers, demonstrated understanding of the conservation rate structures is low, customers indicated that the rate is too complex to inform their decision making on energy efficiency and energy savings remain well below forecast.

3. Consider revising the LGS and MGS savings forecast model, given the variance between evaluated and reported energy savings.

Conclusions

Multiple lines of evidence indicate that the customer response to the LGS and MGS conservation rates was considerably less than forecast. Awareness and demonstrated understanding of the conservation rates was low. Evaluated net energy savings in F2014 were 77 GWh per year, or 8% of reported savings. Analysis of 12 key account customers, who would be expected to be responsive to the LGS rate, did not detect a statistically significant response to the introduction of the LGS rate.

1.0 Introduction

1.1 Evaluation Scope

The purpose of this report is to provide a comprehensive evaluation of BC Hydro's LGS and MGS conservation rates for BC Hydro's F2014, which covers the period April 1, 2013 through March 31, 2014. The scope of this evaluation includes electricity conservation impacts as well as customer understanding and experience with the LGS and MGS rates. This evaluation was completed by BC Hydro's Power Smart Evaluation Department, with technical review by three external evaluation experts, who confirmed that the evaluation methods and analysis were sound.

BC Hydro previously completed an evaluation of the LGS and MGS conservation rates for calendar years 2011 and 2012. The current evaluation extends that analysis to the end of F2014, using the same control group and analytical methods. The current evaluation adds the following additional lines of evidence: focus groups, Key Account Manager interviews, and regression analysis of 12 key account customers.

1.2 Organization of the Report

Section 2 summarizes the evaluation approach, Section 3 sets out the evaluation results, Section 4 summarizes the findings and recommendations and Section 5 presents the conclusions. The Appendices include detailed descriptions of the evaluation methodologies used for this evaluation as well as additional results.

1.3 Initiative Description

BC Hydro's LGS and MGS rate classes are made up of all BC Hydro general service accounts that purchase electricity at distribution voltage and have a monthly peak demand above 35 kW. MGS accounts generally have monthly peak demand that is equal to or greater than 35 kW but less than 150 kW, and energy consumption in any 12 consecutive periods that is less than or equal to 550,000 kWh. LGS accounts generally have a monthly peak demand equal to or greater than 150 kW, and energy consumption in any 12 month period that is greater than 550,000 kWh.

This diverse group of customers includes a wide range of facility types, such as hospitals, schools, manufacturing facilities, office buildings, retail, and the common areas of multi-unit residential buildings. The total electricity purchases of these rate classes was approximately 13,600 GWh in F2014, covering approximately 23,000 accounts.

Both MGS and LGS rate structures have three primary components: a variable energy charge for total electricity usage measured in kWh; a variable demand charge for peak demand measured in kW; and a fixed basic charge to cover the fixed costs of service. This evaluation focuses on the energy charge.

Prior to the implementation of the conservation rates, LGS and MGS customers were served under a declining block energy charge. Starting in January 2011, conservation rates were introduced that were designed to encourage customers to conserve electricity. Under the LGS and MGS rate conservation rates, this encouragement is provided through a bill credit when consumption is lower than historical average consumption, and an additional charge when consumption is higher, both of which are priced at a higher level than the base rate. Historical average consumption levels are determined through the creation of monthly baselines for each account based on a three year rolling average of consumption. In effect, the conservation rates deliver a marginal price signal to customers that approximates BC Hydro's LRMC of new energy supply.

The LGS and MGS conservation rate structure design consists of two parts. For part 1, a higher (Tier 1) price applies to electricity consumption up to 14,800 kWh per billing period, and a lower (Tier 2) price applies to

consumption beyond 14,800 kWh per billing period. Part 2 of the rate structure is the credit / charge mechanism. The customer receives a credit for energy savings up to 20 per cent of their monthly baseline, and pays an additional charge for additional energy consumption up to 20 per cent of their monthly baseline. Each month, BC Hydro calculates the customer baseline, which is the customer's average energy usage in the same month over the past three years. Baselines are unique to each account and are updated every year.

Figures 1.1 and 1.2 illustrate how the conservation rates work.

Figure 1.1. Illustrative Schematic of the LGS and MGS Conservation Rates

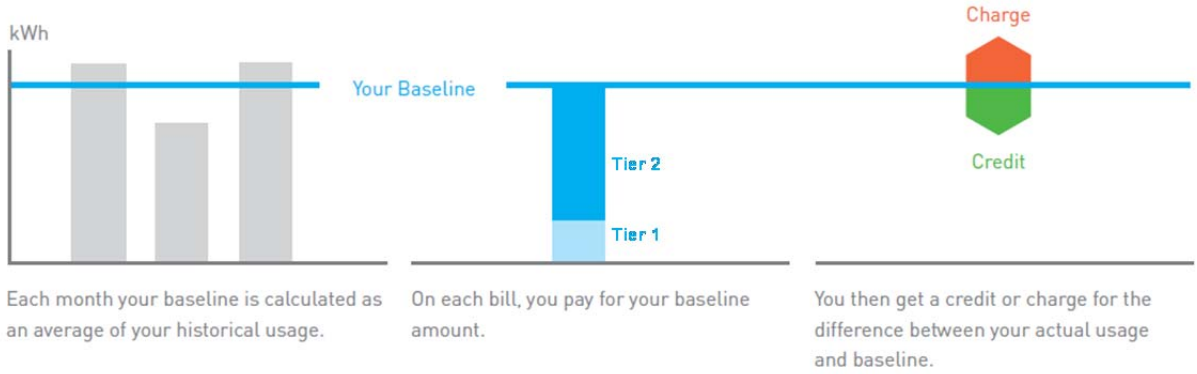
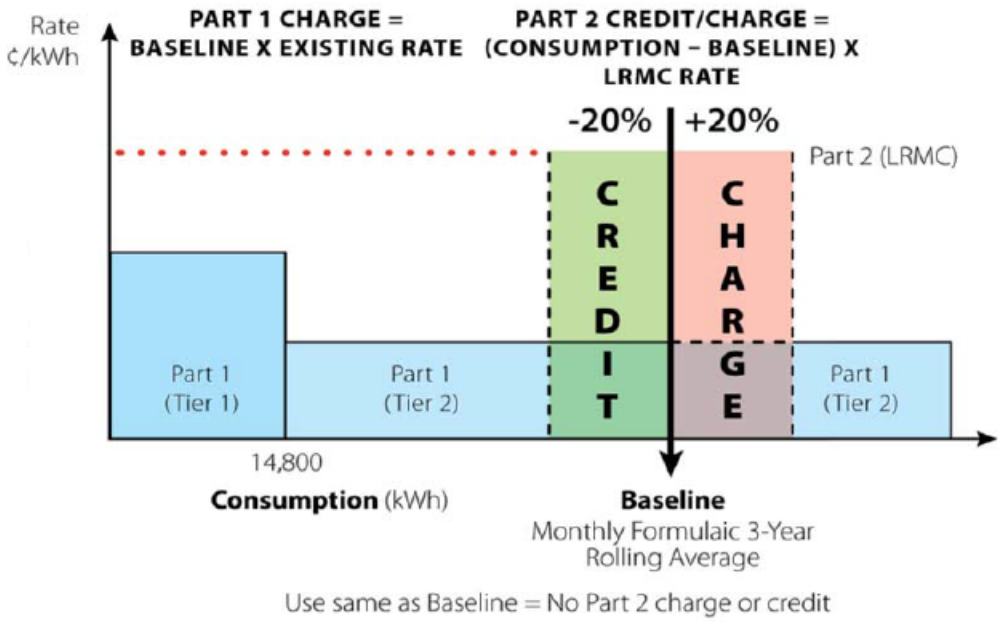


Figure 1.2. LGS Conservation Rate



Both the LGS and MGS rate structures went through transitional stages before stabilizing in their current form. For LGS, the transition included assigning a lower, interim value (6.68 cents/kWh) for the Part 2 credit and charge for the first fifteen months, before valuing it at the higher (9.42 cents/kWh) BC Hydro LRMC[9] of new energy supply starting April 1, 2012. The transition also included setting the initial monthly baselines at the higher of average consumption from January 1, 2005 to December 31, 2007 or July 1, 2007 to June 30, 2010. This had the effect of setting customer baselines higher than they otherwise would be until 2014, resulting in smaller Part 2 charges due to increases in consumption and/or larger Part 2 credits due to decreases in consumption. For MGS accounts, the transition included a rate shaping stage. Under rate shaping, the lower Tier 2 rate was gradually increased each year. The Part 2 credit / charge did not start to be applied to MGS accounts until April 2012. Additional detail is included in Appendix B.

Table 1.1 provides a brief history of the implementation of the LGS and MGS conservation rates.

Table 1.1. LGS and MGS Conservation Rate Implementation Time Line

Date	Event
Oct 16, 2009	BC Hydro applied to its regulator, the BCUC for approval of the LGS Rate Application including the creation of two new rate classes (LGS and MGS) and new energy conservation rates.
June 29, 2010	BCUC Order G-110-10 approved a modified two part conservation rate, a schedule for LGS transfer to the conservation rate structure, and separate schedule for MGS transfer. MGS accounts were divided into three groups (MGS1, MGS2 and MGS3). Approval was granted for the creation of a control group for the purpose of future rate evaluation.
Jan 1, 2011	Conservation rate structure implemented for the approximately 6,500 LGS accounts. LGS Part 2 price was set at a transitional value of 6.68 cents/kWh. MGS customer accounts start rate shaping. 400 control accounts (200 in each MGS and LGS) maintained on the pre-existing rate structure.
April 1, 2012	Conservation rate structure in place for the first group of about 4,000 MGS1 customer accounts with peak demand > or equal to 85 kW. LGS Part 2 price increased to 9.42 cents/kWh to reflect BC Hydro LRMC.
August 30, 2012	BCUC Order G-115-12 approved BC Hydro's application to accelerate the MGS implementation schedule from April 1, 2014 to April 1, 2013 for MGS accounts with peak demand less than 55 kW and greater than or equal to 35 kW.
April 1, 2013	Conservation rate structure in place for the remaining MGS customer accounts, called MGS2/3, made up of about 12,500 accounts with peak demand > or equal to 35 kW and less than 85 kW
January 1, 2014	End of transition period of setting LGS customers baselines at the higher of average consumption from January 1, 2005 to December 31, 2007 or July 1, 2007 to June 30, 2010. From here on, baselines were a rolling three-year average of historic usage.

With approval of the BCUC, BC Hydro was able to randomly select and assign 400 accounts to a control group in 2010 before the implementation of new conservation rates. Two hundred accounts were drawn from the MGS population and 200 from the LGS population. These are called the control groups in this evaluation, while the remaining accounts are called the treatment groups. The control group accounts were maintained on the pre-existing rate (Rate Schedules 1200, 1201, 1210 & 1211 Exempt General Service), with prices increasing each year in concert with general rate increases.

To support the implementation of the LGS and MGS rates, BC Hydro undertook detailed consultations with relevant customers and conducted a variety of information and advertising activities. These activities included the development of a dedicated website, letters to customers, bill inserts, and online tools. Customized

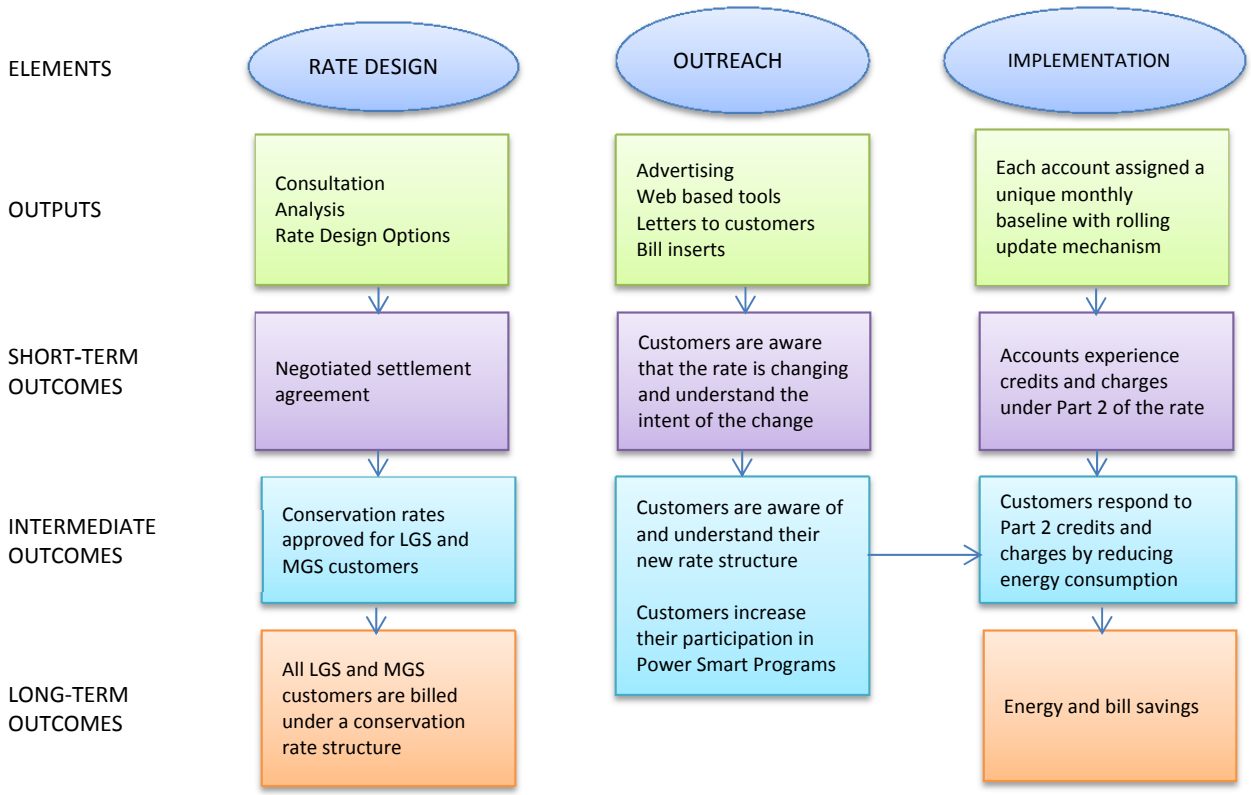
[9] LRMC used in the context of the Part 2 rate refers to BC Hydro's Long Run Marginal Cost of new energy supply, which at the time of the LGS/MGS BCUC review process in 2009 was based on the levelized weighted average plant-gate price for firm energy from BC Hydro's F2006 Call for Tenders (grossed up to account for line losses and inflation) as a proxy. BC Hydro's 2013 Integrated Resource Plan provides that BC Hydro's current energy LRMC is between 8.5 cents/kWh and 10.0 cents/kWh.

communication material was provided to control accounts, to ensure control accounts did not mistakenly believe that they were billed under the conservation rates.

The use of conservation rates is one of three tools used in BC Hydro's Demand Side Management (DSM) Plan, the other two being Power Smart programs and Codes & Standards. LGS and MGS customers participate in a range of Power Smart programs, and are subject to a variety of energy efficiency standards and building codes.

A logic model divides a DSM initiative into its main elements, and then describes the outputs and outcomes associated with each element. The primary purpose of a logic model is to describe the underlying assumptions of the initiative to identify key elements for achieving the desired outcomes. For the LGS and MGS conservation rates the main elements were rate design, outreach to customers, and conservation rate implementation. The long-term outcomes are that all LGS and MGS customers are transitioned to the conservation rate structure, and that they are able to respond to its price signal thereby creating energy and bill savings.

Figure 1.3. Logic Model



2.0 Approach

2.1 Evaluation Objectives

A summary of the evaluation objectives and research questions for this evaluation is shown below.

Table 2.1. Evaluation Objectives and Research Questions

Evaluation Objective	Research Questions
2. Assess customer awareness, understanding and acceptance of the LGS and MGS rates.	• What is the current level of unaided awareness of the energy charges? • How easy or difficult is it to understand how the rate works? • What is the customers' level of understanding on using the rate as a tool in managing their energy bill? • How easy or difficult is it to understand how the rate works? • How much support do customers have for the conservation rate? Do customers believe the rate is fair? How does this compare between customers experiencing growth vs. those who are conserving? • What changes were observed in awareness, understanding and acceptance since the previous evaluation?
2. Understand customer response to the conservation rates.	• How much of an incentive to conserve does the energy charge (Part 1 and Part 2) provide? • How easy or difficult is it for customers to manage their energy consumption? • How much effort are customers putting into minimizing their energy charge? • What are the major factors behind customer efforts to manage electricity use? • What is the price signal to which customers are responding? • What changes were observed in customer response since the past evaluation?
3. Assess the effectiveness of the LGS and MGS control groups for the evaluation of energy savings.	• Are the control groups still equivalent to the treatment groups? • What is the relative precision of the control groups?
4. Estimate the energy and peak demand savings attributable to the LGS and MGS conservation rates.	• What are the energy and peak demand savings due to the LGS and MGS conservation rates in F2014, relative to calendar year 2010? • What changes are observed in energy savings since the past evaluation? • What are possible explanations for any variance between reported and evaluated electricity savings?
5. Large customer impact analysis	• Can a response to the introduction of the LGS conservation rate be detected at the site level for a selection of key account customers with energy management initiatives?

2.2 Methodology Review

Evaluations of conservation rates and energy programs were reviewed to inform the selection of a methodology for this evaluation. Details of the review are included in Appendix C and a summary is provided here.

Thirteen evaluations of conservation rates were identified through a search of relevant websites.[10] To be included, studies had to meet the following criteria: (1) the customer group had to be business customers; and (2) the pricing scheme facing customers had to be multi-part so that customers faced at least two pricing

[10] Consortium for Energy Efficiency: cee1.org; International Energy Program Evaluation Conference: IEPEC.org; American Council for an Energy Efficient Economy: aceee.org.

periods or at least two pricing tiers. All studies used some variation of the econometric demand modelling approach which produces an estimate of own price elasticity from which a conservation impact can be calculated. Two BC Hydro evaluations of the conservation impacts of the Transmission Service Rate (TSR) and Residential Inclining Block (RIB) were also reviewed. These evaluations also relied on econometric demand modelling as the primary impact evaluation method.

Studies that include research on the customer experience and response to electricity prices typically rely on surveys of a sample of participants. Three studies were reviewed that used this method, including a U.S. national survey of customer response to time of use rates, an assessment of customer response to a time of use rate in Ontario, and a study on a time of use rate in California. Past BC Hydro rate evaluations have also used surveys, including RIB and TSR. The TSR evaluation also used structured interviews to conduct qualitative research.

In 2013, BC Hydro completed an evaluation of the LGS and MGS conservation rates for calendar years 2011 and 2012. That evaluation used surveys to assess customer experience with the rate, and experimental design with randomized control trial to estimate savings impacts.

2.3 Methodology

Because of the availability of a valid control group, and the complexity of the LGS and MGS pricing scheme, experimental design was used to estimate energy savings. Experimental design with a randomized controlled trial (RCT) is considered the strongest research method across many fields of evaluation because it can control for all factors aside from the treatment of interest.

In 2013, BC Hydro completed an evaluation of the LGS and MGS conservation rates for calendar years 2011 and 2012. The current evaluation extends that analysis to the end of F2014, using the same control groups[11] and analytical methods. It also adds the following additional lines of evidence: focus groups, Key Account Manager interviews, and regression analysis of 12 large customers.

The current evaluation also includes identification and removal of outlier accounts from the estimation of energy savings. This step was not required in the past evaluation because fewer outliers were present. However, with the passage of time since the introduction of the conservation rates, more LGS and MGS accounts have undergone major business changes, resulting in a larger number of outlier accounts. With the exception of the identification and removal of outliers, this evaluation uses the same analytical methods for the estimation of energy and peak demand savings as did the past evaluation.

This evaluation relies on surveys, focus groups and Key Account Manager interviews to understand customer awareness, understanding and response to the LGS and MGS conservation rates. Surveys were used to get a representative view of the entire LGS and MGS rate classes. Focus groups were used to gain a greater understanding of specific issues. Key Account Manager interviews were conducted to understand the experience of the largest LGS customers. The objectives, data sources and methods used for this evaluation are summarized below.

[11] Due to control group attrition and outlier identification (see results section) some control accounts that were included in the past evaluation are not included in this one.

Table 2.2. Evaluation Objectives, Data Sources and Methods

Evaluation Objective	Data	Methods
1. Assess customer awareness, understanding and acceptance of the LGS and MGS conservation rates.	• Customer surveys • Customer focus groups • Key Account Manager interviews	• Qualitative analysis • Cross tabulation
2. Understand customer response to the conservation rates.	• Customer surveys • Customer focus groups • Key Account Manager interviews	• Qualitative analysis • Cross tabulations
3. Assess the effectiveness of the LGS and MGS control groups for the evaluation of energy savings.	• BC Hydro billing data on electricity purchases from January 2010 to March 2014 • BC Hydro account data on customers characteristics (e.g., region, account sector) • Power Smart program tracking data	• Statistical tests • Stratified sampling design analysis
4. Estimate the energy and peak demand savings attributable to the LGS and MGS conservation rates.	• BC Hydro billing data from January 2010 to March 2014	• Experimental design with randomized controlled trial • Statistical outlier identification (Grubbs' test) • Difference-in-differences • Statistical bootstrapping • Rate class average peak to energy ratio
5. Large customer impact analysis	• BC Hydro billing data • Customer-level data (e.g. production)	• Customer-level regression models

2.3.1 Methodology to Assess Customer Awareness, Understanding, Acceptance and Response

For the analysis of Objectives 1 and Objective 2, three methods were used: cross tabulations of data from an online customer survey, content analysis of interviews with Key Account Managers, and analysis of customer focus groups.

The customer survey was fielded in May and June of 2014. The full survey questionnaire can be found in Appendix E. The main steps in undertaking the customer surveys are listed below. The same survey methodology was used in this evaluation as in the past evaluation.

- Survey Design. A draft survey instrument was prepared based on the previous research, reviewed with program stakeholders, and revised.
- Survey Sample Selection. The population of all LGS and MGS accounts was identified and a random sample of accounts was selected from each rate group.
- Survey Fielding. An internet-based survey was administered to the sample.

- Data Cleaning and Analysis. Survey data was cleaned to eliminate obvious errors, results were expanded to a larger group of related accounts as explained below, and cross tabulations were produced for a variety of survey questions.

All surveys are subject to potential bias. Common causes of bias include social desirability bias (i.e., when respondents provide the answers that they believe the inquirer wants to hear), as well as uninformed responses (e.g., a respondent reports a higher level of understanding of an issue than they actually possess). For this evaluation, careful and neutral wording of questions was used to reduce social desirability bias. The potential for uninformed responses was partially mitigated through the use of schematics and descriptions to promote understanding. However, given the complexity of the rates, full mitigation of uninformed responses in this case may not have been achieved.

The survey generated results from 288 respondents. However, in a number of cases, the survey respondent was responsible for additional LGS/MGS accounts. Therefore, the sample was expanded to make it more comparable to the population. The expanded sample included an additional 22 accounts located at the same sites as the respondent and an additional 548 accounts located at other sites than the respondent, for a total of 858 accounts.

The table below shows the distribution of the customer population (as of May 2014) and the expanded sample. The distribution by rate class is essentially the same, suggesting that the sample is broadly representative of the population.

Table 2.3. Distribution of Customer Survey Responses

	Population of Accounts		Expanded Sample of Accounts	
	Number	**Share (%)**	**Number**	**Share (%)**
LGS	6,550	29	248	29
MGS1	3,925	17	149	17
MGS2/3	12,160	54	461	54
Total	**22,635**	**100**	**858**	**100**

Seven Key Account Managers for LGS customers in government, commercial real estate, wood products, manufacturing, and health care were interviewed in mid-2014.

Four 90 minute customer focus groups were conducted in September 2014 to explore four main research areas. Eighteen customers representing both LGS and MGS rate classes participated in the focus groups. These participants were recruited through the 2014 survey. Focus group participants were first guided through a discussion about their attitudes and opinions of the conservation rate's energy charge as well as the demand charge. Next, drivers and enablers of conservation were explored, followed by barriers to conservation. Finally, after reviewing and gaining a better understanding of the current rate structure, each focus group concluded with a discussion of alternate rate structures. The full focus group report can be found in Appendix F.

The research findings from the focus groups and Key Account Manager interviews are qualitative and designed to be illustrative rather than statistically representative in nature. Focus groups and interviews are used for gaining deeper insights on understanding and opinions, and hearing from the subject first hand and in their own words. Focus groups and interviews use a cross-section of a population to explore the range of attitudes or opinions but should not be considered a representative reflection of attitudes or opinions among the population.

2.3.2 Methodology to Assess the Effectiveness of the Control Groups

The key to conducting a valid cause and effect analysis through experimental design is to construct a control group that is equivalent to the treatment group among all observable factors that impact the variable of interest. For this evaluation, the variable of interest is electric energy consumption, and the base year is calendar year 2010, which is the year prior to the introduction of the conservation rates. The Complete Random Experimental Design method was used to design the experiment and create MGS and LGS control groups. Additional detail on the design of the control groups can be found in Appendix C.

The following steps were used to assess the effectiveness of the control groups:

1. Identify remaining valid control group accounts. Control group account attrition occurred because of account closures, as well as migration of accounts to different rate classes due to significant changes in account consumption in accordance with BC Hydro's Electric Tariff. Valid control accounts were defined as those accounts that remained on the pre-existing rate schedule and for which consecutive data (i.e. continuous electricity consumption history) was available for the time period of January 2010 through March 2014.

2. Identify valid treatment accounts to include in the analysis. Valid treatment accounts are defined as accounts with continuous electricity consumption history, under the same tariff, for the time period January 2010 through March 2014.

3. Test the control groups for equivalency to the treatment groups on the following basis:

    a. Average base year (calendar 2010) consumption by rate class.

    b. Average base year consumption by account sector.

    c. Average base year consumption by BC Hydro service territory region.

    d. Base year consumption distribution by percentile (from 10% to 90%).

    e. Power Smart program participation rates from January 2013 through March 2014.

4. Estimate achievable relative precision of the remaining valid control group accounts using base year 2010 electricity consumption. The control group was post-stratified based on sampling theory. The motivation for post-stratification was to test and validate the representativeness of the control groups by estimating their relative precision[12]. Post-stratification is a statistical method for assessing the variance of a sample[13], after the completion of an experiment. Relative precision provides an estimate of how closely the sample can predict the population. The lower the relative precision, the better the sample is at predicting a population. BC Hydro aims for a relative precision of 20% or lower for sampling based evaluation methods.

[12] Energy program evaluation practitioners will be familiar with the use of post-stratification for re-weighting a sample. For clarity, that was not the motivation for, or application of post-stratification in this instance.

[13] Variance is assessed by partitioning the population into distinct groups such that the variance of each group is minimized. For this study groups were selected on the basis of 2010 electricity consumption, across the entire rate class. Groups with larger variance will need a larger number of control accounts in order to reach a given precision level. Once the variance of each group was known, relative precision can be calculated based on the actual number of control accounts.

5. Identify control accounts that have corporate parent and/or sister accounts in the treatment groups (e.g., chain stores, government buildings). Test for control group contamination[14] at these sites by comparing their change in consumption to that of to control accounts that are not associated with treatment accounts.

2.3.3 Methodology to Estimate Energy and Peak Demand Savings

Energy and peak demand impacts were estimated through the following steps:

a. Define the base year as calendar year 2010, which was the year before implementation of the LGS rate structure and the start of rate shaping for MGS customers. A length of one year is required to capture seasonal effects on electricity consumption.

b. Identify valid treatment and control accounts to include in the analysis. Valid treatment and control accounts are defined as accounts with continuous electricity consumption history, under the same tariff for the time period January 2010 through March 2014.

c. Identify outlier accounts and remove them from further analysis. Outliers are control and treatment accounts that have undergone major business changes that significantly impact their electricity consumption. Because these business changes are not related to the conservation rates, including them in the analysis can distort the results. Consultation with BC Hydro Key Account Managers confirmed that all outliers among customers with which they were familiar had undergone major business changes.

   Outlier accounts were identified using the repeated Grubbs' test[15]. Grubbs' test is a distribution distance-based outlier detection approach, which detects outliers in a univariate data set by assuming it came from a normally distributed population. It checks the value which shows the largest absolute deviation from the mean. Then a g statistic is calculated as the largest absolute deviation from the mean divided by the standard deviation of the sample. If the resulting g statistic is greater than the critical value, the corresponding value will be regarded as an outlier.

d. Transform monthly consumption of valid, non-outlier control and treatment accounts to natural logarithmic form. Logarithmic transformation is required to meet one of the theoretical requirements of the difference-in-differences method (described below), which is normal distribution of the variable of interest. See Appendix C for details on the difference-in-differences method, and Appendix D for details on the distributions of control and treatment accounts.

e. Calculate the average (mean) of the log transformed consumption for each year for each of the treatment and control groups.

f. Apply the difference-in-differences method to the mean of the log transformed consumption between F2014 and 2010 to estimate F2014 impacts. Difference-in-differences is an impact evaluation approach which relies on comparing the consumption between treatment and control accounts before and after the intervention, according to Equation 1.

[14] Control group contamination occurs if the control group is influenced by the treatment, which could occur if head office directs energy management activities for a number of different sites, in a manner that is consistent with the assumption that all are under the same conservation rates.

[15] Grubbs, F. E. 1950. Sample criteria for testing outlying observations, The Annals of Mathematical Statistics 21(1), p.27-58.

Equation 1

$$DDE = (Treatment_{Post} - Treatment_{Pre}) - (Control_{Post} - Control_{Pre})$$

Where,

The difference-in-differences estimator (DDE) is the estimation of the difference between the two groups in natural log form.

$Treatment_{Post}$ is the average of the natural log of annual electric energy consumption of valid, non-outlier treatment accounts in F2014.

$Treatment_{Pre}$ is the average of the natural log of annual electric energy consumption of valid, non-outiler, treatment accounts in the base year of calendar year 2010.

$Control_{Post}$ is the average of the natural log of annual electric energy consumption of valid, non-outlier, control accounts in F2014.

$Control_{Pre}$ is the average of the natural log of annual electric energy consumption of valid, non-outlier control accounts in the base year of calendar year 2010.

Additional details on the application of the difference-in-differences method for this evaluation are provided in Appendices C and D.

g. Using the rules of working with logarithms, transform the results from natural log to relative savings.

h. Apply the relative savings to the entire population of active LGS and MGS accounts to calculate cumulative annual savings.

i. Test the results of the difference-in-differences calculations for statistical significance using the bootstrapping method. The bootstrapping method allows for statistical tests of data that do not meet one of the standard statistical distributions, such as a normal distribution. BC Hydro aims for a confidence level of 80% or better for net evaluated energy savings derived from sampling based methods such as the one employed in this evaluation. Results that meet or exceed this level are reported as statistically significant, along with their associated confidence level. For further information on bootstrapping see Appendix C.

The primary data source for the analysis was energy consumption data and data on account characteristics (eg. region) obtained from the BC Hydro billing system and Power Smart program tracking systems.

Peak demand savings were calculated by applying a peak-to-energy ratio of 0.139 MW/GWh. This ratio is calculated from a rate class load shape for all distribution service accounts with peak demand over 35 KW, and is applicable to both LGS and MGS accounts.

Contamination of the control group is the main threat to the validity of this method and potential source of bias. Control group contamination can occur if control group accounts believe, incorrectly, that they are on the conservation rate structure, or if they respond to messaging designed to encourage conservation actions in response to the rate. The impact evaluation methodology does not control for unobservable factors such as beliefs. Survey analysis was used to determine the potential extent of control group contamination that could result from high levels of general awareness of the conservation rates. Analysis and comparison of consumption changes for control accounts with and without the same corporate parent as a treatment account was completed to test for control group contamination.

The influence of parallel DSM initiatives is controlled for in the same way as other exogenous factors, such as economic growth, through the design of a randomized control group that is exposed to the same factors as are the treatment group. The influence of Power Smart programs was tested by comparing rates of Power Smart program participation between treatment and control accounts.

2.3.4 Methodology for Large Customer Impact Analysis

To understand the impact of the LGS conservation rate on industrial customers with consumption greater than 6 GWh/yr, the following model for individual sites was used:

Equation 2:

$$\ln(kWh_t) = \alpha + \beta \ln(Production_t) + \gamma \ln(Average\ price_t) + \theta\ LGS\ Rate_t + \varepsilon_t$$

Where:

- ln() is the natural logarithm of the relevant variable
- t indexes the months in a 48 month time series
- The greek letters α, β, γ, θ, ε represent the parameters to be estimated
- kWh is the monthly electricity consumption
- Production is monthly site production, measured in physical units, such as board feet of lumber or litres of waste water
- Average Price is the overall average unit price of electricity ($/kWh) for the rate class
- LGS Rate is a binary (dummy) variable set to a value of zero prior to the introduction of the conservation rate, and a value of 1 after its introduction.

If the value of the coefficient (θ) on the LGS Rate variable is negative and statistically significant then the model has measured a conservation response to the introduction of the conservation rate structure. Please note that the large customer regression equations are in double log form, so the key assumptions are that price and activity elasticities are constant. The models were run on twelve sites that agreed to share production data with BC Hydro for the purpose of this analysis.

Because only twelve sites were modeled, the results will not be generalizable to the population of all LGS accounts, but rather can be considered as case studies. The validity of the results is constrained by the quality and completeness of the data inputs. BC Hydro aims for a level of statistical significance of 80% or better on the coefficients of interest from regression models used for DSM evaluation.

2.4 Alternative Methodologies

Three alternative methods were considered for the evaluation of energy and demand savings: Autoregressive Integrated Moving Average (ARIMA) modelling, Analysis of Covariance (ANCOVA) and estimation of own price elasticity. These methods were not selected because experimental design with randomized controlled trial was feasible and is recognized as the strongest methodology. A brief description of the alternative methods is provided below.

ARIMA models are a type of time series econometric analysis that recognizes the correlation in error terms when fitting a regression model to predict electricity consumption. If successful, the ARIMA approach can provide estimates of impacts on a monthly basis. However, it is a complex method that relies on high quality input data and professional judgement. This method was not pursued further because an experimental design with randomized control trial allows for a more straight forward approach that minimizes uncertainty and the potential for error.

ANCOVA is a widely used longitudinal modelling approach across scientific research fields. In an ANCOVA model, the base year measurement (i.e. calendar year 2010 electricity consumption) is included in the model as a predictor of future consumption after the intervention (i.e. the conservation rate structure). Other variables that are expected to influence electricity consumption, such as business sector and economic index levels, are also included in the model. Various ANCOVA models were attempted with post intervention annual consumption or logarithm of post intervention annual consumption as the dependent variable. None of the models were powerful enough to adequately explain the observed variations. This outcome is likely due to the wide diversity of business type and energy usage covered by the LGS and MGS rates.

Another potential alternative explored was to use econometric models of demand in relation to price to estimate own price elasticity, from which an estimate of the conservation impact can be calculated. As described in the Methodology Review section above and in Appendix C, elasticity-based methods are the most common rate impact evaluation method used in the DSM evaluation industry. The elasticity-based method was not used as the primary impact analysis method because the existence of a control group allowed for the use of the difference-in-differences method, which has the advantages of requiring fewer adjustments, assumptions and data inputs.

As described in Section 2.3.4, a variation of the elasticity-based method was used as a secondary line of evidence to analyze the rate response for twelve industrial sector LGS customers.

3.0 Results

3.1 Results for Customer Awareness, Understanding and Support of the Conservation Rates

Awareness

Surveys in 2012 and 2014 were used to assess the level of unaided awareness of LGS and MGS customers about their energy charge structure. Survey respondents were asked *"please indicate which one of the following types of energy charges (for kWh usage) you believe applies to this account"*. To ensure the respondent understood the question, a schematic and short description of each rate structure option was provided. See Appendix E for the survey instruments.

Only a small portion of LGS and MGS customers were able to correctly identify their rate structure without assistance. LGS customers transitioned to the conservation rate in January 2011. Among these customers, unaided awareness of the correct conservation rate structure was 33% in 2012 and 35% in 2014. Among MGS1 customers, who transitioned to the conservation rate starting in April 2012, unaided awareness increased from 20% in 2012 to 26% in 2014. Among MGS2/3 customers, who transitioned to the conservation rate starting in April 2013, unaided awareness was 22% in 2014.

Table 3.1. Survey Results for Unaided Awareness of Energy Charge

	2012 survey		2014 survey	
	Time on the conservation rate	% of respondents who correctly identified their rate structure	Time on the conservation rate	% of respondents who correctly identified their rate structure
LGS	1.5 years	33%	3.5 years	35%
MGS1	0.5 years	20%	2 years	26%
MGS2/3	N/A	N/A	1 year	22%

These levels of unaided awareness are lower than found for other BC Hydro conservation rates. Unaided awareness of their conservation rate was measured at 50% for residential customers[16] and 83% for large industrial customers[17].

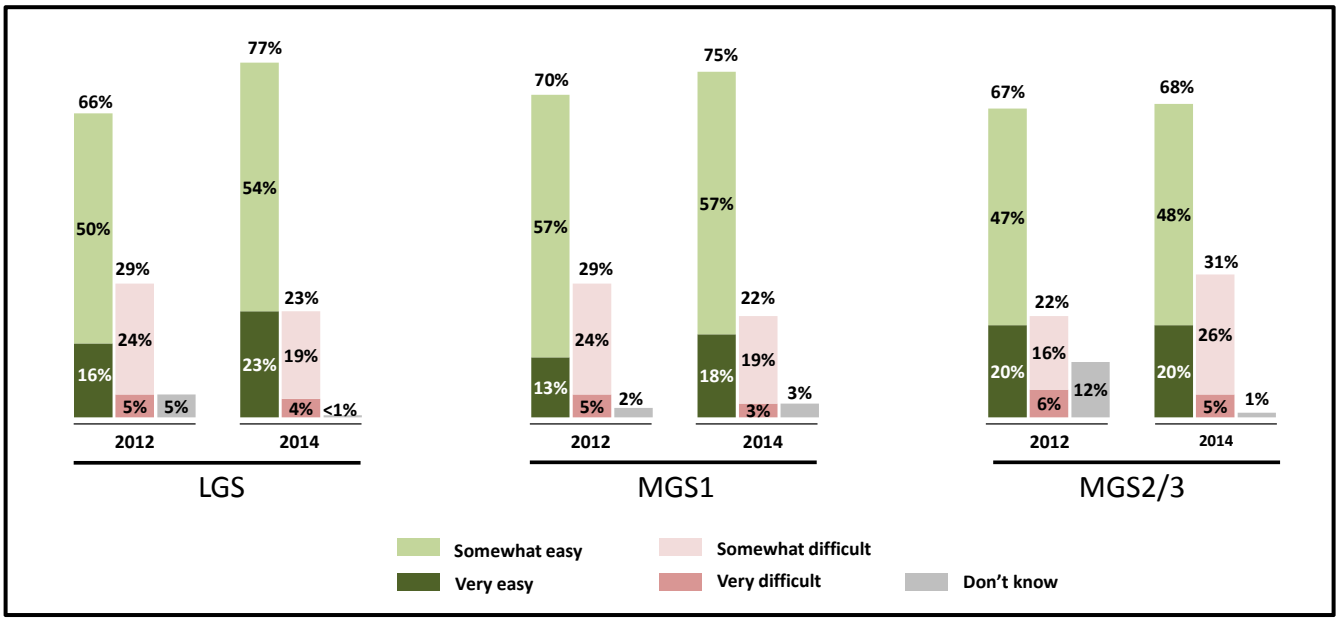
Understanding

Surveys, focus groups and Key Account Manager interviews were used to assess customer understanding of the conservation rate structure. Overall, few customers find the rate very easy to understand.

Less than one quarter of LGS and MGS customers reported that the rate is very easy to understand following a written description (see survey instrument in Appendix E) and illustration of their conservation rate. Reported levels of ease of understanding of the rate, again following a written description and illustration of their conservation rate, stayed fairly constant between 2012 and 2014, with the exception of LGS customers reporting that the rate is very easy to understand, where an increase from 16% to 23% was observed.

[16] *Supra*, note 3.
[17] *Supra*, note 4.

Figure 3.1. Survey Results for Ease of Understanding of the Rate after Reading a Description and Viewing a Schematic of their Conservation Rate



Because these reported levels of ease of understanding were based on a description of the rate, they may not accurately reflect how easy it is for customers to understand their actual electricity bill.

Results from the focus group research indicated that few customers were able to demonstrate a complete understanding of the application of the conservation rate. Out of all 18 focus group participants, only a few participants were able to correctly explain, unprompted, how the conservation rate worked. Even though participants were decision makers around the management of their BC Hydro electricity accounts and had previously completed the online survey which aided their understanding of the conservation rate, few participants began the discussion able to accurately articulate all the components of the conservation rate.

As the focus group progressed, a video explaining the conservation rate was shown and the rate structure was explained by the moderator. Even after both were delivered, participants continued to demonstrate key gaps in their understanding of the rate.

The two main areas of confusion were the concept and calculation of a rolling, historical average monthly baseline, and the value of the Part 2 Energy Charge or Credit. Understanding of these concepts is required for customers to know how changes in their electricity consumption would translate into bill impacts.

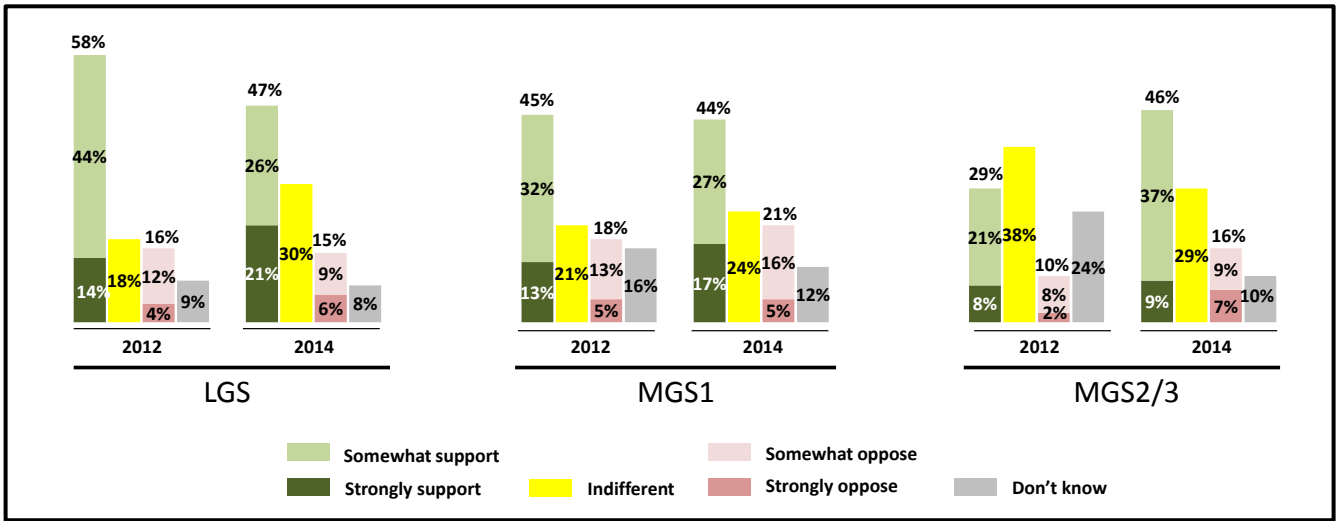
Results of the Key Account Manager interviews indicate that Energy Managers, Key Account Manager Contacts, and Financial staff at Key Accounts were most likely to understand the conservation rate structure. Each of the Key Account Managers were asked to estimate the proportion of their customers that have a good understanding of the LGS rate, including knowing what changes in electricity consumption would result in a Part 2 credit or charge. Key Account Managers estimated that between one-third and one-half of their customers had a good understanding, and that while many understood the intent of the rate, only a few people within an organization understand the mechanics of how it worked.

Support

Surveys, focus groups and Key Account Manager interviews were used to assess customer support for the conservation rate structure. Overall, customers appeared to support the intent of the rate to promote conservation, but had little support for the mechanics of how the rate works in practice.

In both 2012 and 2014, survey respondents were informed that the intent of the rate was to promote conservation and were then asked questions about their support for the rate. Results are summarized below. As of 2014, between 9% and 21% of customers strongly supported the rate, while 5% to 7% strongly opposed it.

Figure 3.2. Survey Results for Support for the Conservation Rate after being informed of intent of the Rate to Promote Conservation



The share of LGS customers who strongly supported the rate increased from 14% to 21%. However, in both years and across all customer groups, most customers (between 75% and 90%) did not strongly support or strongly oppose the rate.

Participants in the focus groups did not express support for the specific LGS and MGS rates that they are on and how they are being charged. The Tier 1 threshold of 14,800 kWh that is charged at a higher unit price seemed completely arbitrary to focus group participants. They did not know where the 14,800 Tier 1 value originated from or whether it was fixed or calculated. Also, the Part 2 energy charge was strongly perceived as an unfair "penalty" in all focus groups and even went so far as to make participants in some groups feel angry in wanting to know why it existed and where it came from. Focus group participants tended to overlook the potential for savings from the Part 2 energy credit and instead focused on the negative impact of the Part 2 energy charge. In many focus group discussions, the Part 2 energy charge became the focus of the rate structure as a penalty for growing their business, instead of supporting the intended message to promote energy conservation. For focus group participants, adding infrastructure, for example by expanding operations, was always perceived to have a negative impact on the total bill.

Key Account Manager interviews revealed that Key Account customers with multiple similar sites and separate BC Hydro bills were supportive of the reporting and tracking features of the rate. In particular, these customers benefited from being able to compare Part 2 charges and credits across similar sites. However, Key Account Managers reported that customers with consistent moderate growth did not support the rate. Growth at these customer sites was enough to trigger energy bill charges under Part 2, but not large enough to trigger an exemption from the Part 2 energy charge. Key Account Managers also reported a lack of support for the rate among customers with a single BC Hydro bill covering multiple tenants. For these Key Account customers, the

complexity of the rate resulted in an administrative burden because of difficulties determining how to fairly allocate electricity costs amount tenants. All such Key Account customers are believed to use third party service firms to administer electricity bills.

3.2 Results for Customer Response to the Conservation Rates

Incentive Effect

The incentive effect of the rate structure to conserve electricity was explored through surveys, focus groups and Key Account Manager interviews.

Survey respondents answered questions about the energy charge portion of their bill, which includes both Part 1 and Part 2 components. In the 2014 survey, of the 35% of LGS, 26% MGS1, and 22% of MGS2/3 customers who could correctly identify the energy charge component of their rate unaided, 41% of customers reported that it served as a major incentive to conserve electricity. However, another 35% of these customers reported that it served as no incentive at all. These results, combined with the low level of unaided awareness (35% for LGS customers, see Section 3.1), indicate that the overall incentive effect of the rate structure was modest.

Focus group participants reported that the Part 2 energy credit mechanism was perceived as a short term motivator given that the rolling baseline calculation will only result in savings at the Part 2 price for three years. This lessened the perceived benefit of making an initial capital investment for energy efficiency improvements.

Focus group participants commented that the conservation rate structure is unnecessarily complex. As a result of this complexity, customers felt disempowered in actively managing their account and controlling their total bill amount. As a result, management was disconnected from analyzing and acting on bills to manage the account's electricity consumption.

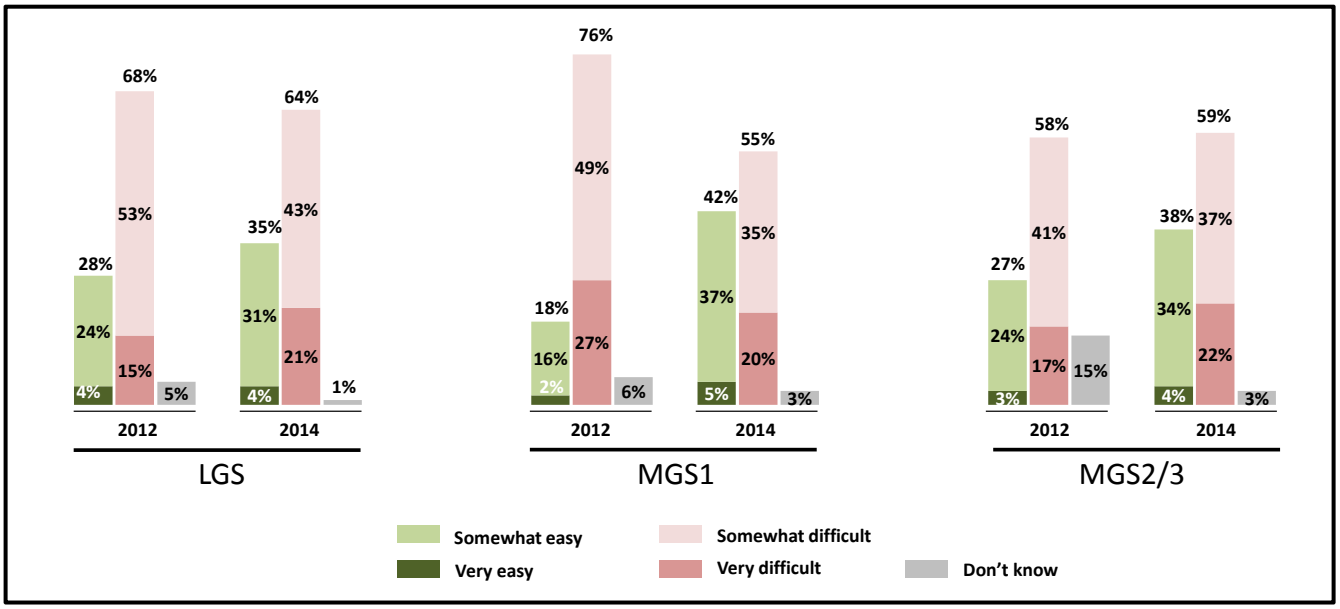
Key Account Manager interviews revealed that while Key Account customers recognized that the LGS rate structure sends a message to conserve electricity, on its own they believed it did little to motivate energy conservation. Key Account Managers reported that customers find embedding the conservation rate into energy management initiatives too complicated, and that customers preferred Power Smart program incentives as a more direct motivator of conservation.

Ease of Minimizing Total Energy Charges

The ease of minimizing total energy charges was explored through surveys, focus groups and Key Account Manager interviews. Total energy charges include all energy charges under both Part 1 and Part 2 of the rate, but do not include demand charges or basic charges. Overall, most LGS and MGS customers find it difficult to minimize their total energy charges under the LGS and MGS conservation rates.

In both 2012 and 2014, survey respondents were asked how easy it was to manage their account to minimize the energy charge. Reponses are summarized below. In 2014, 35% to 42% of respondents indicated that it was very easy or somewhat easy to manage their account to minimize energy charges, while 55% to 64% said that it was very difficult or somewhat difficult.

Figure 3.3. Survey Results for Easy to Minimize Energy Charge



The proportion of customers in all customer groups reporting that it was easy or somewhat easy to minimize total energy charges increased from 2012 to 2014, with the greatest increase occurring for MGS1 customers who went from 18% to 42%.

Focus group participants reported that the calculation of a rolling, historical baseline was difficult for customers to understand and put into practice for budgeting in their businesses. Being a moving average, it was difficult to isolate how a single change will impact the total bill amount in both the short and long term.

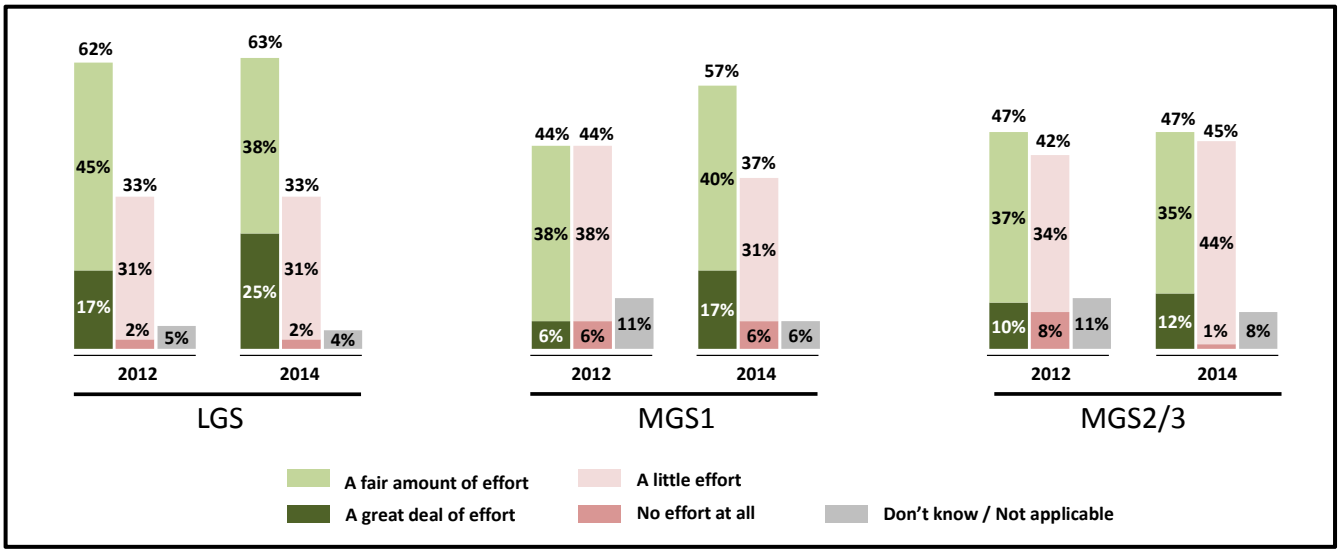
Key Account Manager interviews revealed that Key Account customers who were expanding, undergoing renovation, or who face significant year-over-year variability in activity levels found it difficult to manage their bill to minimize the total energy charge.

Effort Put into Minimizing Energy Charges

The effort put into minimizing energy charges was explored through surveys and focus groups. LGS customers reported putting in more effort to minimize energy charges than did the relatively smaller MGS customers.

Survey respondents were asked how much effort was made to minimize the energy charge. Their responses are shown below. In 2014, about 63% of LGS customers, 57% of MGS1 customers and 47% of MGS2/3 customers said that a great or fair amount of effort was made to minimize energy charges. A total of 33% to 45% reported that no or little effort was made to minimize energy charges.

Figure 3.4. Survey Results for Effort Made to Minimize Energy Charge



The share of customers who reported a great deal of effort to minimize energy charges increased from 2012 to 2014 across all customer groups. Particularly large increases are seen for the MGS1 group (from 6% to 17%) and for the LGS group (from 17% to 25%).

Customers were asked about the various factors that were major drivers of managing their electricity consumption. The most commonly cited major driver was wanting operating costs to be as low as possible (76% of respondents), followed by overall level of electricity prices (59% of respondents). The incentive to save electricity built into the rate was assessed as a major driver of managing electricity consumption by 21% of respondents. See Appendix D for full results.

Focus group participants reported that energy conservation was a relatively low operational priority for them. Most customers estimated that electricity made up about 2%-5% of operating costs in their business, while some customers who were less sure about their usage guessed in the range of 2%-15%. While customers supported taking steps to improve efficiency and reduce energy consumption, return on investment was a major consideration as well as the capital cost and the lead-time needed to make improvements.

Price Signal to Which Customers Respond

The price signal to which customers respond was explored through focus groups and Key Account Manager interviews. The price signal to which customers respond was varied, with some customers responding specifically to the Part 2 charges and credits (marginal price), and others responding only to the total bill.

Focus group participants reported that they mainly looked only at the total bill amount. Customers understood, at least in principle, the rationale behind both energy and demand charges; however, the charges received minimal, if any, attention from customers when reading the energy bill. Rarely were steps taken to track these charges in the long term or through real time monitoring. Few focus group participants took the time to dissect their energy bill because they had limited understanding of the rate structure. Most customers failed to fully understand the Part 1 and 2 energy charge in the rate structure due to weak knowledge on two key aspects of the energy bill calculation. The decreasing block structure seemed counterintuitive for many customers while the concept of a rolling, historical baseline linking to an energy credit or charge was confusing to most customers.

However, Key Account Manager interviews revealed that at least some Key Account customers were responding to the Part 2 credit/charge and not just to the total bill. Some customers' energy management staff

saw Part 2 credits as a personal accomplishment reflecting conservation. One energy management metric tracked by some Key Account customers was the level of credits under the conservation rate. Large commercial customers with multiple facilities could run reports on all facilities and see Part 2 credits or charges by site. Some customers' energy management staff were able to use this reporting tool to understand and manage energy at different sites. Some Key Account customers also reported receiving significant Part 2 energy credits that they re-invested in further conservation.

3.3 Results for Assessing the Effectiveness of the Control Groups

The control groups were reviewed to determine whether they were still effective for the purpose of evaluating energy savings from the LGS and MGS rates. Of the 400 control accounts assigned in 2010, 295 were found to still be valid at the time of this evaluation. The other 105 accounts were lost from the control groups either because of account closure or migration to a different rate class as a result of significant changes in account consumption. A similar proportion of LGS and MGS treatment accounts also experienced account closure or migration to a different rate class, and these accounts were not included in the analysis. Approximately 16,500 valid treatment accounts were identified for the purpose of this analysis, relative to a population of approximately 23,000 in 2010.

Shown below is the number of treatment and control group accounts included in the analysis, as well as their base year (calendar year 2010) average annual consumption. The observed differences in energy consumption between the treatment and control groups are not statistically significant at the 90 per cent confidence level. These results indicate that the control and treatment accounts are statistically equivalent on the basis of mean annual consumption in the base year.[18]

Table 3.2. Mean Base Year Consumption by Rate Class: Treatment and Control

Group	Number of Valid Accounts	Mean Annual Consumption (GWh)	Standard deviation (GWh)
LGS Treatment	5,119	1.697	3.050
LGS Control	166	1.776	3.060
Difference		-0.079*	
MGS Treatment	11,304	0.216	0.113
MGS Control	129	0.218	0.113
Difference		-0.002*	

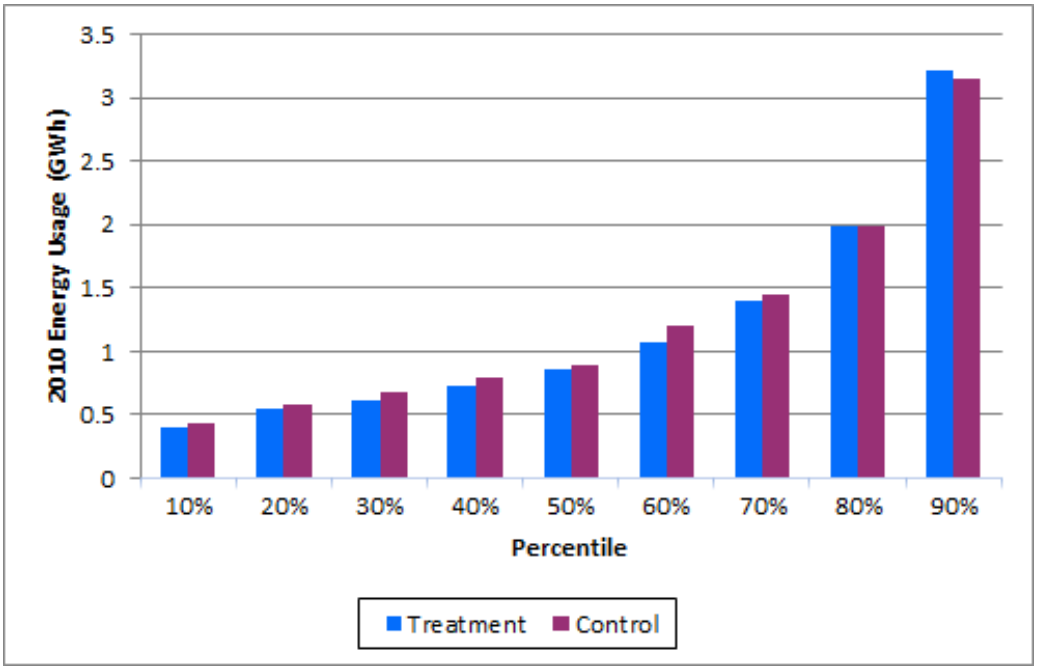
*: Not statistically significant at the 90% confidence level.

The figure below shows 2010 energy consumption by percentile[19] for the LGS treatment and control groups. Control group accounts are found at each percentile level, and their consumption by percentile is similar to that of the treatment group. This suggests that the control group consumption was distributed similarly to that of the treatment group, and thus provided a reasonable representation of the energy consumption of the treatment group. Similar results were found for the MGS control and treatment groups, and are presented in Appendix D. Additional findings related to the distribution of the control and treatment accounts are also presented in Appendix D.

[18] In some cases the differences in means may appear to be significant in absolute terms, in spite of being statistically equivalent. This outcome is due at least in part to the relatively large standard deviation.

[19] In this case, percentiles show how much of the population falls below a certain value. In the figure below, 10% of treatment and control accounts have annual consumption below approximately 0.45 GWh (see the 10% column), while 90% of control and treatment accounts have consumption below approximately 3.2 GWh (see the 90% column). An effective control group will have a similar percentile distribution as its treatment group.

Figure 3.5. Annual Consumption for LGS Control and Treatment Groups in 2010, by Consumption Percentile



Energy usage of the LGS control group in the base year of 2010 was compared with the treatment group by account sector. These results are shown below. Differences in mean consumption were not statistically significant at the 90 per cent confidence level. These results indicate that the LGS control and treatment groups were statistically equivalent on the basis of mean annual consumption in the base year by account sector. The same results were found when this analysis was completed on MGS accounts (see Appendix D).

Table 3.3. Mean Base Year Consumption and Number of Accounts by Sector: LGS Treatment and Control

Account Sector	Number of Valid Accounts		Mean Annual Consumption (GWh)		
	Treatment	Control	Treatment	Control	Difference
Commercial	3,268	108	1.595	1.548	0.047*
Industrial	1,612	50	2.013	2.344	-0.331*
Multi-unit Residential	239	8	0.976	1.300	-0.324*

*Not statistically significant at the 90% confidence level.

Mean base year consumption for the LGS treatment and control accounts was also analyzed by region, and these results are presented below. As shown, the differences in mean annual energy consumption are not statistically significant at 90 per cent confidence level for any of the regions. These results indicate that mean base year consumption of LGS control and treatment accounts were statistically equivalent on a regional basis.

Table 3.4. Mean Base Year Consumption by Region: LGS Treatment and Control

Region	Number of Valid Accounts		Mean Annual Consumption (GWh)		
	Treatment	Control	Treatment	Control	Difference
Lower Mainland	3,352	105	1.770	1.926	-0.156*
North	424	10	1.872	1.536	0.336*
Southern Interior	530	17	1.464	2.029	-0.565*
Vancouver Island	813	34	1.461	1.255	0.206*

*Not statistically significant at 90% confidence level.

LGS and MGS customers participate in a range of Power Smart programs that can impact their energy consumption. Under or over-representation of program participation among control group customers would distort the results of this evaluation. Comparison of program participation rates of the control and treatment groups during the evaluation analysis timeframe (January 2013 to March 2014) was completed. Similar levels of program participation were found for both the treatment and control accounts. For example, the same percentage of accounts (14%) in the LGS treatment and control groups had participated in at least one Power Smart Program offer during the analysis timeframe. Full results are included in Appendix D.

Precision of a sample design indicates how closely a sample estimate approximates the true value for the corresponding population. It is usually measured by relative precision, which is the error bound at a certain confidence level divided by the expected value. The lower the relative precision is, the more precise a sampling design is. BC Hydro aims for relative precision of 20 per cent or less in DSM evaluation. Relative precision for the remaining valid LGS control accounts was calculated and found to be 12 per cent overall. Similar analysis for the MGS control group found an overall relative precision of 2 per cent. These results indicate that the control group is a good predictor of consumption for MGS accounts, and a fair predictor of consumption for LGS accounts. LGS control group relative precision could have been improved by increasing the number of large LGS accounts in the control group. Detailed results are included in Appendix D.

If account holders in the control groups incorrectly believe that they are served under the conservation rate structure, then control group contamination has occurred that could result in an under-estimation of energy savings. Corporations that have multiple sites (e.g., supermarket chains or hotels), including at least one in the control groups and the remaining in the treatment groups, pose a risk of control group contamination resulting from centralized energy management efforts. Analysis was completed to test for this type of control group contamination. Annual changes in electricity consumption were analyzed for control accounts with and without parent or sister accounts in the treatment groups. No evidence of control group contamination was found. For detailed results, see Appendix D.

As a result of the analysis described above, the controls groups were found to be effective for the purpose of evaluating energy savings due to the LGS and MGS conservation rates.

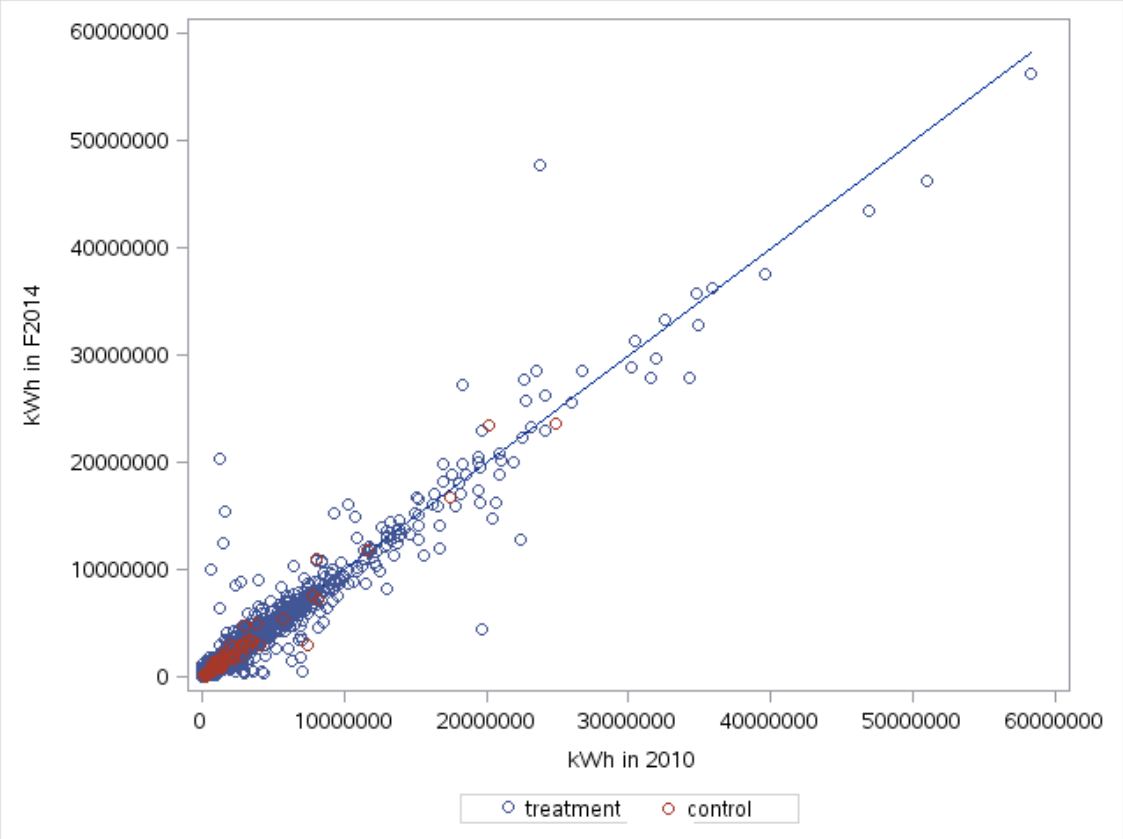
3.4 Results for Energy and Peak Demand Savings

Outlier Identification

Outliers are observations in the data set that exhibit changes not related to the intervention being studied. Outliers are removed from further analysis to avoid distorting the results. Major renovations, expansions or extended shutdowns at LGS and MGS customer sites have large impacts on energy consumption, and ideally such sites are removed from analysis.

Shown below is the scatter plot of F2014 versus 2010 electricity consumption for the LGS treatment and control groups. The 45 degree reference line indicates when electricity consumption is the same in both years. Points above the line represent increased consumption in F2014 relative to 2010, and points below the line indicate decreased consumption.

Figure 3.6. Electricity Consumption Changes for LGS Accounts between 2010 and F2014



It is apparent from the scatter plot that some LGS accounts have experienced significant changes in consumption since 2010. For example, the most extreme example of growth among LGS treatment accounts saw F2014 consumption that was 30,000% of 2010 consumption, while the most extreme example of decline saw F2014 consumption that was 7% of 2010 consumption. Similar but less extreme changes were found among the control group, with the largest differences seeing F2014 consumption being 185% and 14% of 2010 consumption.

The reasons behind several extreme consumption changes were confirmed through the Key Account Manager interviews as being related to business changes such as a major renovation. However due to limitations in the information available, it was not feasible to verify that each account with an extreme change in consumption was due to a significant business change. Therefore, the Grubbs' test[20], which is a statistical outlier detection method, was applied to remove outlier accounts in both the treatment and control groups from further analysis to avoid distortion.

At a 90% confidence level, application of the Grubbs' test identified 97 and 3 LGS treatment and control accounts, respectively, as outliers. LGS outliers were defined as accounts with F2014 consumption greater than 177% or less than 14% of 2010 levels. Among MGS accounts, the Grubbs' test identified 168 outliers in the treatment group and 8 in the control group. MGS outliers were defined as accounts with F2014 consumption greater than 175% or less than 22% of 2010 levels. Outlier accounts were removed from further analysis.

Energy and Peak Demand Savings

This section presents calculations and results for energy savings from the LGS conservation rate. Numbers are rounded for the purpose of presentation, which results in some discrepancies between the numbers used in the calculations, and those presented here.

$Treatment_{post}$ and $Treatment_{pre}$ denote the consumption for the LGS treatment accounts in F2014 and in 2010, respectively. $Control_{post}$ and $Control_{pre}$ denote the consumption for the LGS control accounts in F2014 and in 2010. Using Equation 1 and the average of the natural logarithms of consumption, the difference-in-differences estimator (DDE) is calculated as follows:

$$DDE = (ln(Treatment_{Post}) - ln(Treatment_{Pre})) - (ln(Control_{Post}) - ln(Control_{Pre}))$$

$$For\ F2014:\ DDE = (13.813 - 13.839) - (13.889 - 13.908)$$

$$(-0.026) - (-0.019) = -0.007$$

Since the treatment groups were found to have no systematic differences on the basis of region, account sector, Power Smart program participation and other observable extraneous variables (see section 3.3), it is reasonable to assume that the pre-existing difference $ln(Treatment_{Pre}) - ln(Control_{Pre})$ between the two groups would remain constant over time without the conservation rate. A counterfactual outcome for the LGS treatment group, which indicates what the LGS treatment group's consumption would have been had it not been exposed to the conservation rate, can be estimated as $ln(Treatment_{Pre}) - ln(Control_{Pre}) + ln(Control_{Post})$.

DDE provides a measure of the impact of the LGS conservation rate by comparing the actual outcome for the LGS treatment group to its counterfactual. Re-arranging terms in Equation 1, DDE can also be simplified and written in the following way:

$$DDE = ln(Treatment_{Post}) - \{ln(Treatment_{Pre}) - ln(Control_{Pre}) + ln(Control_{Post})\}$$

$$= ln(Treatment_{Post}) - ln(Counterfactual)$$

The calculations so far have all been in natural log form. The next step is to transform the results from natural logs to relative savings. Using the rules of logarithms, DDE can be expressed as follows:

$$DDE = ln\left(\frac{Treatment}{Counterfactual}\right)$$

[20] Grubbs, F. E., Sample criteria for testing outlying observations, The Annals of Mathematical Statistics 21(1), p.27-58, March 1950.

Taking the exponential function of both sides,

$$exp(DDE) = \frac{Treatment}{Counterfactual}$$

To show the change in the treatment group relative to the counterfactual, this can also be written as,

$$\frac{(Counterfactual - Treatment)}{Counterfactural} = 1 - exp(DDE)$$

For 2014: Relative Savings in the LGS treatment group = 1 - exp(-0.007) = 0.70%

Finally, energy savings in absolute terms are calculated by applying the relative savings as follows. There were 6,762 active LGS treatment accounts as of March 31, 2014. Their total consumption in F2014 was 10,536 GWh, which includes partial year consumption for some new accounts. Their annualized consumption in F2014 was estimated as 10,866 GWh/yr by extrapolating incomplete consumption for new accounts using the average load shape of existing accounts. The consumption that would have occurred in the absence of the conservation rate was calculated as: 10,866 GWh/yr * [1/(1-0.007)] = 10,943 GWh/yr.

LGS rate energy savings at the end of F2014 = 10,943 GWh/yr – 10,866 GWh/yr = 77 GWh/yr

Results are summarized below.

Table 3.5. Evaluated Savings from the LGS Conservation Rate in F2014

Calendar Year	Average of Log of Account Consumption		DD Estimator	Relative Savings	Energy Savings (GWh/yr)
	Treatment	Control			
Base Year 2010	13.839	13.908			
F2014	13.813	13.889	-0.007	0.70%*	77

*Statistically significant at 85% confidence level. p-value = 0.14

The same method was used to determine whether savings occurred for the MGS rate structure. No statistically significant savings were detected. See Appendix D for results.

Summary results are shown below for both the LGS and MGS conservation rates. Energy savings are shown as an annual rate of savings in F2014, relative to calendar year 2010. This annual rate of savings includes any savings that commenced in 2011 or 2012 and continued to persist into F2014. This means that the F2014 energy savings are cumulative since the implementation of the conservation rates, and cannot be added to savings from 2012 and 2011. Net evaluated savings are statistically significant at the 85% confidence level.

Table 3.6. Summary of Energy and Peak Demand Savings from the LGS and MGS Conservation Rates in F2014

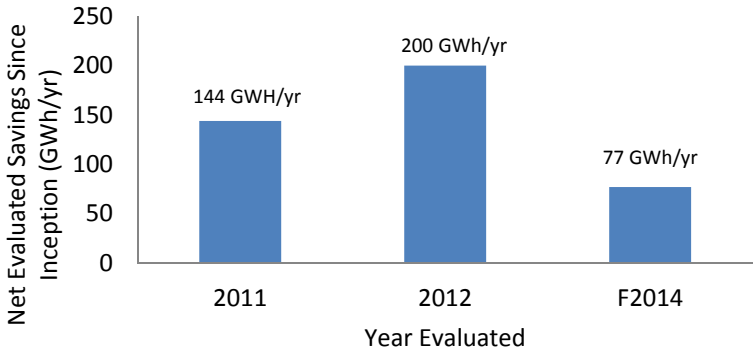
Fiscal Year	Cumulative Energy Saving (GWh/yr)		Peak Demand Savings (MW)	
	Reported	Evaluated	Reported	Evaluated
F2014	919	77*	128	11

*Statistically significant at 85% confidence level. p-value = 0.14

The prior evaluation estimated net evaluated energy savings at 144 GWh/yr by the end of 2011 and 200 GWh/yr by the end of 2012, both relative to calendar year 2010.[21] All evaluated savings were from the LGS conservation rate, with no savings from the MGS conservation rate.

Net evaluated savings for each year, at a confidence level of at least 85%, are shown below.

Figure 3.7. Net Evaluated Savings for Each Year Evaluated



Energy savings estimates for 2011 and 2012 were statistically significant at the 90% confidence level while energy savings estimates for F2014 were statistically significant at the 85% confidence level. This means that the F2014 savings have a lower level of certainty than did the 2011 and 2012 savings. It also means that the F2014 energy savings are statistically equivalent to zero at the 90% confidence level.

BC Hydro aims for a confidence level of 80% or better for net evaluated energy savings derived from sampling based methods such as the one employed in this evaluation. Results that meet or exceed this level are reported as statistically significant, along with their associated confidence level. The minimum acceptable confidence level varies by industry and needs to be determined by the user of the information. Shown below are the energy savings for each year evaluated at various levels of confidence that are commonly selected as the minimum acceptable level in different fields of research[22].

Table 3.7. Net Evaluated Savings at Different Confidence Levels

Year	80%	85%	90%	95%
F2014	77	77	0	0
2012	200	200	200	0
2011	144	144	144	0

[21] BC Hydro. 2013. *Evaluation of the Large General Service and Medium General Service Conservation Rates for Calendar Years 2011 and 2012*

[22] Note that the relative precision of the control groups is constant at all confidence levels shown, (12% for LGS and 2% for MGS in F2014, 15% for LGS and 2% for MGS in 2011 and 2012).

Variance Analysis

Research indicates that to respond to a price signal, customers must be aware of the pricing scheme and understand how it functions[23]. This evaluation found that the level of unaided awareness of the conservation rate structure was modest and that few customers reported that the rate structure was very easy to understand. Most focus group participants did not understand how the rate works, and found it too complex to inform their decision making on energy efficiency investments. This suggests that one reason for the variance between evaluated and reported savings was low levels of customer awareness and understanding of the conservation rates, due at least in part to their complexity.

The focus groups also indicated that some customers focus on their total bill amount rather than the Part 2 energy charge or credit, which may mean they did not differentiate and respond to the marginal energy price independently of other components. This is a deviation from the forecast assumptions, resulting in a weaker than intended price signal and customer response.

3.5 Results for Large Customer Impact Analysis

Regression modeling using Equation 2 (see page 24) was completed for 12 industrial sector LGS accounts in the following business areas: lumber, waste water treatment, and food processing. These 12 sites were selected for modeling for the following reason:

- They are large business customers with Power Smart funded Energy Managers, which makes them more likely to have a response to the rate large enough to detect through regression modeling. As described in Sections 3.1 and 3.2, large customers are more likely to put in effort to minimize their energy charge than are small customers, and customers with Energy Managers are more likely to understand the conservation rate than those without.
- They were willing to share monthly production data with BC Hydro for the purpose of this analysis;
- Based on their business type, their electricity consumption is expected to be dependent on production levels. The presence of a single important driver of electricity consumption improves the probability of successful regression modeling, relative to sites (such as hospitals or universities) with multiple complex and interdependent drivers of electricity consumption.

Model results were generally inconclusive, with low Adjusted R-Square values and few coefficients with the expected signs or statistical significance levels. Further, the coefficient on the on the LGS rate dummy variables were not statistically significant, meaning the models were unable to measure a statistically significant response to the introduction of the LGS conservation rate. Full model results can be found in Appendix D.

[23] Carter, D. W. and J. W. Milon. (2005); Ito, K. (2014).

3.6 Confidence and Precision

The table below summarizes key findings related to confidence and precision[24] by evaluation objective.

Table 3.8. Summary of Confidence and Precision by Evaluation Objective

Objectives	Confidence	Precision
1. Assess customer awareness, understanding and acceptance of the LGS and MGS conservation rates.	Both the 2012 and 2014 survey had confidence levels of 95%.	Margin of error for the 2012 survey was +/- 4.7%. Based on the expanded sample, the margin of error for the 2014 survey was +/- 3.3%.
2. Understand customer response to the conservation rates.	Both the 2012 and 2014 survey had confidence levels of 95%.	Margin of error for the 2012 survey was +/- 4.7%. Based on the expanded sample, the margin of error for the 2014 survey was +/- 3.3%.
3. Assess the effectiveness of the LGS and MGS control groups for the evaluation of energy savings.	The control and treatment groups are equivalent at the 90% confidence level.	The relative precision of the LGS control group was 12%. The relative precision of the MGS control group was 2%.
4. Estimate the energy and peak demand savings attributable to the LGS and MGS conservation rates.	F2014 Energy savings for the LGS conservation rate structure were statistically significant the 85% confidence level.	Not applicable
5. Large customer impact analysis	Coefficients on the variable of interest (response to the introduction of the LGS conservation rate structure) were not statistically significant.	Not applicable

[24] Relative precision and margin of error provide indications of how well a sample represents a population.

3.7 Limitations

The research findings from the focus groups and Key Account Manager interviews are purely qualitative and are thus designed to be illustrative rather than statistically representative in nature. Conclusions from these lines of evidence do not reflect the extent to which something is happening or the percentages of LGS and MGS customers who possess certain attitudes or opinions.

The impact analysis provides statistically significant results for the overall impact of the LGS and MGS conservation rates, but that significance does not apply if results are disaggregated by region, account size, business type, or other potential variables of interest.

The use of an average peak-to-energy ratio based on the LGS and MGS rate class load shape adds uncertainty to the estimates of peak demand savings. It is difficult to determine exactly how the customer response to the LGS rate directly translates into actions taken during the short time frame that defines the overall system peak.

4.0 Findings and Recommendations

4.1 Findings

1. Only a small portion of LGS and MGS customers were able to correctly identify their rate structure without assistance. Unaided awareness of the rate structure was 35%, 26%, and 22% among LGS, MGS1, and MGS2/3 customers respectively.

2. Survey results indicated that most customers (between 68% and 77% across the rate groups) believed that how the rate works was very or somewhat easy to understand after reading a description and illustration of their conservation rate. However, only a minority of these believed that it was very easy to understand and further exploration of this issue in the focus groups revealed that the rate may be much harder to understand than these survey results would suggest. Even though focus participants were decision makers around the management of energy accounts and had previously completed the survey which aided their understanding of the rate structure, few demonstrated a good understanding of the rate structure. Key gaps in their understanding persisted even after video and moderator explanations of the rate.

3. After being informed that the intent of the rate was to conserve electricity, between 9% and 21% of customers strongly supported the conservation rate structure, depending on their rate class, while 5% to 7% strongly opposed it. Qualitative research indicated that customers experiencing consistent moderate growth did not support the rate, and saw the Part 2 energy charge as a penalty for growth. Some customers complained that the complexity of the rate structure created an administrative burden.

4. The incentive effect of the Part 2 energy charge and credit appeared to be modest. A total of 41% of customers with unaided awareness of the energy charge reported that it served as a major incentive to conserve electricity. However, another 35% of these customers reported that it served as no incentive at all. Qualitative research indicated that customers found the Part 2 energy charge and credit mechanism to be too complex to serve as a motivator for conservation.

5. The control groups closely matched the treatment groups in a number of important ways, and they were therefore valid and effective control groups for the purpose of evaluating the LGS and MGS rates.

6. The MGS conservation rate structure did not produce statistically significant energy savings. This result is consistent with the past evaluation.

7. Evaluated net energy savings for the LGS conservation rate structure were 77 GWh per year in F2014, relative to calendar year 2010, while evaluated net energy savings for the MGS conservation rate were zero. This is 8% of reported savings (919 GWh/yr for both MGS and LGS combined as of March 2014).

8. The variance between evaluated and reported savings is substantial. Evidence from this evaluation suggests that one reason for the variance is low levels of customer awareness and understanding of the conservation rates due at least in part to their complexity.

9. Regression modeling of 12 large LGS sites failed to detect an effect on energy consumption due to the introduction of the LGS conservation rate in 2011.

4.2 Recommendations

1. Maintain the LGS and MGS control groups, so long as the MGS and LGS conservation rates are continued in their current form. Maintenance of the control group is required for future evaluation of the LGS and MGS conservation rates.

2. Consider revising the LGS and MGS conservation rates. Unaided awareness of the rate structure has remained low at approximately one third of LGS customers, demonstrated understanding of the conservation rate structures is low, customers indicated that the rate is too complex to inform their decision making on energy efficiency and energy savings remain well below forecast.

3. Consider revising the LGS and MGS savings forecast model, given the variance between evaluated and reported energy savings.

5.0 Conclusions

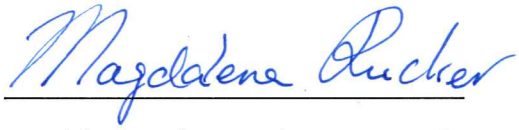
Multiple lines of evidence indicate that the customer response to the LGS and MGS conservation rates has been considerably less than forecast. Awareness and demonstrated understanding of the conservation rates is low. Evaluated net energy savings in F2014 were 77 GWh per year, or 8% of reported savings. Analysis of 12 key account customers, who would be expected to be most responsive to the LGS rate, did not detect a statistically significant response to the introduction of the LGS rate.

Evaluation Oversight Committee Sign-Off

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 Evaluation of the LGS and MGS Conservation Rates for F2014 meets the following criteria for approval by the Evaluation Oversight Committee:

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



Magdalena Rucker, Sr. Planner, BC Hydro Resource Planning

Evaluation Oversight Committee Chair

References

Aigner, D. and L. Lillard. 1984. Measuring Peak Load Pricing Responses from Experimental Data Journal of Business and Economic Statistics 2.

Aigner, D. and J. Hirschberg. 1985. Commercial/Industrial Customer Response to Time-of-use Prices: Some Experimental Results. Rand Journal of Economics 16(3).

Angevine, G. and D. Hryltzak-Lieffers. 2007. Ontario Industrial Electricity Demand Responsiveness to Price (technical paper). The Fraser Institute Energy Series, No. 1.

Babrose, G. and C. Goldman. 2004. A Survey of Utility Experience with Real Time Pricing. Report Prepared by Neenan Associates for Office of Electric Transmission and Distribution, U.S. Department of Energy.

BC Hydro. 2003. Energy Policy Implementation Process: BC Hydro Information Session and Workshop on Stepped Rates and Access Principles, March 5.

BC Hydro, 2013, F2012 Demand Side Management Milestone Evaluation Summary Report.

BC Hydro 2013. Evaluation of the Large General Service and Medium General Service Conservation Rates for Calendar Years 2011 and 2012.

BC Hydro, 2014, Evaluation of the Residential Inclining Block Conservation Rate F2009-F2012.

Carter, D. W. and J. W. Milon 2005. Price Knowledge in Household Demand for Utility Services. Land Economics 81(2): 265-283.

Caves, D. W., and E. E. Leamer. 1984. Estimation of Time-of-Use Pricing Responses in the Absence of Experimental Data. J. of Econometrics 26.

Charles River Associates. 2005. Impact Evaluation of the California Statewide Pricing Pilot, Final Report. CEC Website, Working Group 3.

Chung, C. 1978. Econometric Modelling of the Industrial Demand for Electricity by Time-of-Day – An Application to the California Cement Industry.EPRI Workshop on Electricity Demand by Time of Day.

Chung, C. and D. Aigner. 1981. Industrial and Commercial Demand for Electricity by Time-of-Day in California. Energy Journal 2(3).

Grubbs, F. E. 1950. Sample Criteria for Testing Outlying Observations, The Annals of Mathematical Statistics 21(1), p.27-58.

Pfeffermann, D. and Rao, C. R. 2009. Handbook of Statistics: Sample Surveys: Theory, Methods and Infernece, Elsevier: Oxford, UK.Faruqui, A. and K. Eakin, eds. 2000.Pricing in Competitive Electric Markets, Kluwer Academic Publishers: Dordecht, Netherlands.

Faruqui, A. and S. George. 2005. Using Demand Models to Estimate the Impact of Dynamic Pricing in California. Proceedings of the 2005 International Energy Program Evaluation Conference.

Herriges, J., S. Baladi, D. Caves and B. Neenan. 1993. The Response of Industrial Customers to Electricity Rates Based upon Dynamic Marginal Costs. Review of Economics and Statistics 75.

Ito, K. 2014. Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing. American Economic Review 104(2): 537-563.

Natural Resources Canada. 2011. Summary Report of Energy Use in the Canadian Manufacturing Sector, 2005-2009, July 2011.

New York. Federal Energy Regulatory Commission (2006). Federal Energy Regulatory Commission, Assessment of Demand Response and Advanced Metering: Staff Report, Docket AD06-2-000, August.

Park, R. and J. Acton. 1984. Large Business Customer Response to Time-of-Day Electricity Rates. Journal of Econometrics 26.

Peak Load Management Alliance (PLMA). 2002. Demand Response: Principles for Regulatory Guidance. March.

Peak Load Management Alliance (PLMA). 2002. Demand Response: Design Principles for Creating Customer and Market Value. November.

Schwarz, P., T. Taylor, M. Birmingham and S. Darden. 2002. Industrial Response to Electricity Real-Time Prices: Short Run and Long Run. Economic Inquiry 40.

Sheen, J., C. Chen and T. Wang. 1994. Response of Large Industrial Customers to Electricity Pricing by Voluntary Time-of-Use in Taiwan. IEEE Transactions on Power Systems 9(1).

Taylor, T., P. Schwartz and J. Cochell. 2005. 24/7 Hourly Response to Electricity Real-Time Pricing with up to Eight Summers of Experience. Journal of Regulatory Economics 27.

Tishler, A. 1983. The Industrial and Commercial Demand for Electricity under Time –of-Use Pricing. Journal of Econometrics 23.

Tishler, A. 1984. A Model of Industrial Demand for Electricity under Time-of-Use Pricing and Three Labor Shifts. Resources and Energy 6.

U.S. Department of Energy. 2006. Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them. A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005.February.

Van der Loo, M.P.J. Distribution based outlier detection for univariate data. Discussion paper 10003, Statistics Netherlands, The Hague. Accessed from www.markvanderloo.eu in Oct 10, 2014.

Vickrey, W. 1971.Responsive Pricing of Public Utility Services.Bell Journal of Economics, 2.

Woo, C-K. (1985). Demand for Electricity of Small Nonresidential Customers under Time-of-Use (TOU) Pricing. The Energy Journal 6(4).

Zanikau, J. and I. Hallett. 2008. Aggregate Industrial Energy Consumer Response to Wholesale Prices in the Restructured Texas Electricity Market. Energy Economics 30(4).

Appendix A Results Summary

Table A.1. Cumulative Run Rate Savings from January 1, 2011 through March 31, 2014

	Reported	Evaluated Net
Energy savings (GWh/yr)	919	77*
Peak demand savings (MW)	128	11

* Statistically significant at the 85% confidence level. p-value = 0.14.

Table A.2. Net Savings Adjustments

Factor	Approach
Electricity cross effects (% of evaluated gross)	The evaluation method produces an estimate of net savings that includes electricity cross effects. A stand-alone estimate of electricity cross effects cannot be estimated with this evaluation method.
Persistence	Savings are estimated on a cumulative run rate basis, which means that if savings from calendar year 2011 persist to F2014 then they are included in the evaluated net savings results for F2014. The evaluation method cannot distinguish between savings that started in 2011 and persisted through to the end of F2014, and those savings that started and ended in 2011, and were then replaced by savings from new actions that started in F2014.

Appendix B Additional Details on the Initiative Description

For both the LGS and MGS rate structures, each month's baseline is an average of the total kWh usage for the same month over the past three years. For example, the January baseline is an average of the usage in the past three Januarys. Baselines are established to reflect the monthly historic use and are the starting point for the bill energy charges.

Both LGS and MGS rate structures went through transitional stages before stabilizing at the new conservation rate structure.

For LGS, the transition included assigning a lower, interim value (6.68 cents/kWh) for the Part 2 credit and charge for the first 15 months, before valuing it at the higher LRMC-based rate (9.42 cents/kWh) starting April 1, 2012. The transition also included setting the initial monthly baselines at the higher of average consumption from January 1, 2005 to December 31, 2007, or from July 1, 2007 to June 30, 2010. By using the higher of two consumption periods, accounts that were affected by the downturn in the economy, as well as those accounts that were unaffected, received a higher baseline. This had the effect of setting customer baselines higher than they otherwise would be until 2014, when baselines are set by the rolling 3 year average of monthly consumption, and by then will exclude the first year initial baseline. This could result in smaller Part 2 charges due to increases in consumption and/or larger Part 2 credits due to decreases in consumption.

For MGS accounts, the transition included a period where only Part 1 charges were applied to actual consumption. Under the provisions and schedule outlined in paragraph 8 of the LGS Negotiated Settlement Agreement (LGS NSA), rate shaping is applied to the MGS Part 1 charges in each year. Under rate shaping, the differential between the Tier 1 and Tier 2 rates were reduced each year by proportionally raising the lower Tier 2 rate and proportionally lowering the higher Tier 1 rate relative to what they would have otherwise been without rate shaping where class average rate changes are only applied. For accounts that have energy consumption less than 14,800 kWh per month, their average rate and marginal rate will be the same (Tier 1) and it will be proportionally lower under rate shaping than otherwise. For accounts that have energy consumption greater than 14,800 kWh per month, the marginal rate (Tier 2) will be proportionally higher under rate shaping than otherwise.

The Part 2 credit / charge did not start to be applied to MGS accounts until April 2012. Under the two part conservation rate structure, Part 1 charges apply to each account's baseline in each month and are effectively a fixed charge given that the baseline volumes are not based on current actual consumption. Rate shaping does not affect the LRMC price signal and therefore is not expected to affect conservation for accounts with consumption within the price limit band where the LRMC price is their marginal price. For MGS accounts that have consumption outside the price limit band in a billing period credited or charged at the Tier 2 rate, rate shaping may provide a proportionally higher marginal price (Tier 2) than otherwise without rate shaping.

Table B.1. provides a summary of the LGS and MGS conservation rate prices, along with the control group (Exempt Large General Service RS1200).

Table B.1. Summary of LGS and MGS Tariff as of April 1, 2013

BC Hydro Rates *Rate schedules provided are examples of rates from each of the rate classes and do not provide information on minimums or special conditions.*						
Rate Class & Schedule	**Rate**	**April 2013 (Final)**	**April 2012 (Final)**	**May 2011 (Final)**	**Jan 2011 (Final)**	**April 2010 (Final)**
All	BCUC Order	G-48-14	G-77-12A	G-77-12A	G-110-10	G-180-10
	Rate Increase (%)	1.44	3.91	8.00		6.11
	Rate Rider (%)	5.0	5.0	2.5	2.5	4.0
Medium General Service 1500	Basic Charge (cents/day)	19.53	19.25	18.53	17.16	
	Demand First 35 kW (per kW)	$0.00	$0.00	$0.00	$0.00	
	Demand Next 115 kW (per kW)	$4.76	$4.69	$4.51	$4.18	
	Demand Additional kW (per kW)	$9.13	$9.00	$8.66	$8.02	
	Part 1 Energy Up to 14,800 kWh/Month (cents/kWh)	8.85	8.97	8.72	8.10	
	Part 1 Energy Above 14,800 kWh/Month (cents/kWh)	5.49	4.90	4.44	4.05	
	Part 2 Energy Rate (cents/kWh)	9.56	9.42	N/A	N/A	
	Minimum Energy Charge (cents/kWh)	2.85	2.81	N/A	N/A	
Large General Service 1600	Basic Charge (cents/day)	19.53	19.25	18.53	17.16	
	Demand First 35 kW (per kW)	$0.00	$0.00	$0.00	$0.00	
	Demand Next 115 kW (per kW)	$4.76	$4.69	$4.51	$4.18	
	Demand Additional kW (per kW)	$9.13	$9.00	$8.66	$8.02	
	Part 1 Energy Up to 14,800 kWh/Month (cents/kWh)	9.61	9.37	8.85	8.15	
	Part 1 Energy Above 14,800 kWh/Month (cents/kWh)	4.62	4.51	4.26	3.93	
	Part 2 Energy Rate (cents/kWh)	9.56	9.42	6.68	6.68	
	Minimum Energy Charge (cents/kWh)	2.85	2.81	2.7	2.5	
Exempt Large General Service 1200	Basic Charge (cents/day)	19.53	19.25	18.53		17.16
	Demand First 35 kW (per kW)	$0.00	$0.00	$0.00		$0.00
	Demand Next 115 kW (per kW)	$4.76	$4.69	$4.51		$4.18
	Demand Additional kW (per kW)	$9.13	$9.00	$8.66		$8.02
	Energy Up to 14,800 kWh/Month (cents/kWh)	9.28	9.15	8.81		8.16
	Energy Above 14,800 kWh/Month (cents/kWh)	4.46	4.40	4.24		3.93

Source: RRA Update F14 Interim Rates.

Appendix C Approach Details

Additional Details from the Methodology Review

The purpose of the methodology review was to understand the analytical methods used in recent evaluations of commercial and industrial rates. All of these studies use some variation of the econometric demand modelling approach, and there are no randomized controlled trials. Thirteen relevant studies were identified through a search of relevant websites (Consortium for Energy Efficiency: cee1.org; International Energy Program Evaluation Conference: IEPEC.org; American Council for an Energy Efficient Economy: aceee.org.) as well as an internet search. To be included, the study had to meet the following criteria:(1) the customer group had to be commercial or industrial (2) the pricing scheme facing customers had to be multi-part so that customers faced at least two pricing periods or at least two pricing tiers; and (3) the evaluation had to estimate own price elasticity, if only substitution elasticities were estimated, the study was not included.

Recall the definition of price elasticity of demand (η) as the relative change in quantity divided by the relative change in price, when the change in price is small

Equation C.1

$$\eta = (\Delta quantity/quantity)/(\Delta price/price)$$

Rearranging to isolate the change in quantity term, we then have

Equation C.2

$$\Delta quantity = \eta \cdot quantity \cdot (\Delta price/price),$$

So the key parameter of interest is the own price elasticity η, because the initial quantity is given and the relative change in price is a rate design decision.

If we consider only the impact of price as driver of electricity consumption, then the simplest constant elasticity demand curve is

Equation C.3

$$quantity = A \cdot price^{\eta}$$

So taking logs we have the double log form

Equation C.4

$$logquantity = logA + \eta logprice$$

And then taking differentials and noting that the differential of a constant is zero

Equation C.5

$$\Delta(logquantity) = \eta \cdot \Delta(logprice)$$

Recalling Δ(logu) = (Δu)/u

Equation C.6

$$\Delta(quantity)/quantity = \eta \cdot \Delta(logprice)/price$$

So rearranging, we then have

Equation C.7

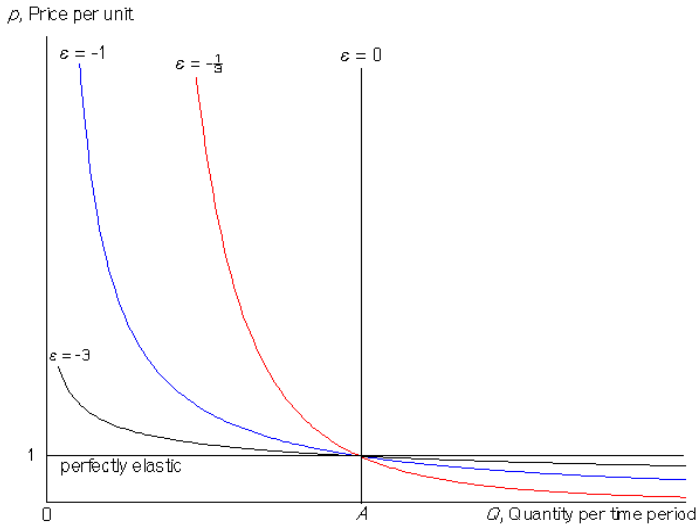
$$\eta = [\Delta(quantity)/quantity] / [\Delta(logprice)/price]$$

So the key parameter of interest is the own price elasticity η, because the initial quantity is given and the relative change in price is a rate design decision.

Elasticity of demand is the same at every point along a constant elasticity demand curve as shown in the next figure, and there are several specific cases shown:

- Perfectly inelastic demand curve, where = 0 everywhere, is a vertical straight line.
- The next most vertical demand curve in the figure is also inelastic, with a demand elasticity of -1/3 everywhere.
- The unitary elasticity, = -1, demand curve is flatter than the inelastic demand curves.
- As the elasticity becomes more negative (such as the = -3 demand curve), the demand curves become flatter.
- The demand curve that is completely flat is perfectly elastic.

Figure C.1. Examples of Demand Curves



Some key findings from the methodology review are are as follows:

- First, the studies identified used econometric methods to estimate own price and/or cross price elasticities of demand, and there were no randomized controlled trials – the method used in the present study.
- Second, all the studies found some degree of price response, that is, each study found that own price elasticities had the correct sign, and they were statistically significant
- Third, the price elasticities vary substantially across studies.

- Fourth, large customers were generally more price responsive than smaller customers. This may reflect greater opportunities to save energy for large energy users.
- Fifth, customers with larger energy costs as share of total costs were generally more price responsive. This may reflect the importance of energy savings if energy costs are a large share of total costs.

Table C.1. Summary of Business Multi-part Rate Studies

Study	Modeling Method	Data	Rate
Chung (1978)	Translog	Time series	Mandatory TOU
Chung (1981)	Translog	Time series	Mandatory TOU
Tishler (1983)	Quadratic	Time series	Mandatory TOU
Aigner (1985)	Translog	Time series	Mandatory TOU
Tishler (1984)	Quadratic	Time series	Mandatory TOU
Acton (1984)	Double log	Panel data	Voluntary TOU
Woo (1985)	Leontief	Panel data	Mandatory TOU
Woo (1985)	Translog	Panel data	Mandatory TOU
Sheen (1995)	Translog	Panel data	Voluntary TOU
Schwartz (2002)	Gen McFadden	Panel data	Voluntary RTP
Taylor (2005)	Gen McFadden	Panel data	Voluntary RTP
Angevine (2007)	Double log	Times series	Mandatory RTP
Zarnikau (2007)	Gen McFadden	Time series	Mandatory RTP

To understand why econometric demand modelling was an appropriate method for the rate studies reviewed, and to consider whether it could be applied to the LGS/MGS conservation rate structure evaluation, recall the definition of price elasticity of demand (η) as the relative change in quantity divided by the relative change in price, when the change in price is small. Recall Equations C.1 and C.2 from earlier.

The key parameter of interest for the evaluation studies reviewed was own price elasticity η. The initial quantity is given and the relative change in price is a rate design decision. This approach applies to the typical rate situation where prices are parametric (e.g., the marginal price signal is constant at any given point in time) such as with BC Hydro's Transmission Service Rate and Residential Inclining Block rates.

Given the relatively more complicated design of the LGS/MGS rate, it is not obvious that this simple model applies. First, the price change under the LGS/MGS conservation rate structures is not small because, for example, for different segments of the load, the marginal rate per kWh facing LGS customers can vary by over 100 per cent (e.g., between Part 2 credits and charges, which are valued at the long run marginal price, and Tier 2 of Part 1 of the rate structure. Refer to Table B.1 of Appendix B). Second, pricing is highly non-linear because of: (1) the two part rate, (2) the charge/credit for consuming more than or less than the baseline up to a 20 per cent change; (3) reversion to the part 1 rate for changes greater than 20 per cent from the baseline. Third, the supply curve facing a given customer is not continuous but has steps as consumption moves more than 20 per cent from the baseline.

While there is a large body of literature on the difficulties in estimating price effects with non-linear pricing, whether or not it is appropriate to do so using simple demand elasticity models is, to some extent, a matter of judgment. For the evaluation of BC Hydro's Transmission Service Rate and Residential Inclining Block Rate, it

was believed that econometric methods could be applied because each customer faced a transparent supply curve. The situation for LGS/MGS is much more complex with moving baselines, multiple tiers, and credits and charges.

Randomized controlled trials and econometric models are valid alternative evaluation methods. Randomized controlled trails are preferable if the evaluation issue is only to understand the effect of the treatment on the treated. Econometric models are preferred if there are multiple evaluation questions which require estimating the underlying structure. Listed below are some examples of energy program evaluations that used randomized control trial methods.

Table C.2. Evaluation Studies Using Randomized Control Trial

Program	Evaluation Method
Cape Light Compact Residential Smart Energy Monitoring Pilot	Randomized Controlled Trial with Opt-In Enrolment, Difference-in-Differences
Energy Trust of Oregon Home Energy Reports	Randomized Controlled Trial with Opt-Out Enrolment, Difference-in-Differences
Illinois Citizens Utility Board (CUB) Energy Saver with Efficiency 2.0	Randomized Controlled Trial with Opt-In Enrolment, Difference-in-Differences
Payson City Energy Efficiency Reports	Randomized Controlled Trial, Difference-in-Differences
Puget Sound Energy Home Energy Reports	Randomized Controlled Trial with Opt-Out Enrolment, Difference-in-Differences
Sacramento Municipal Utility District Home Energy Reports	Randomized Controlled Trial with Opt-Out Enrolment, Difference-in-Differences
Seattle City Light Home Energy Reports	Randomized Controlled Trial with Opt-Out Enrolment, Difference-in-Differences
Snohomish Public Utility District Energy Challenge	Randomized Controlled Trial with Opt-In Enrolment, Difference-in-Differences
Western Massachusetts Electric Company Western Mass Saves!	Randomized Controlled Trial with Opt-In Enrolment, Difference-in-Differences
BC Hydro Evaluation of the Large General Service and Medium General Service Conservation Rates for Calendar Years 2011 and 2012	Randomized Controlled Trial Difference-in-Differences

Additional Details on Sampling Design of Pre-selected Control Groups

Finding a proper counterfactual or baseline condition against which to estimate impacts is one of the primary challenges of evaluation. The counterfactual indicates what would have happened in the absence of an intervention. However, the same subject cannot be observed in two distinct situations—being treated and untreated at the same time.

A valid control group is the desired replacement of counterfactual of any impact assessment. The best way to achieve impact evaluation of intervention is through a Completely Randomized Design/Randomized Controlled Trial Design (RCT), which ensures that the treatment group, on average, is identical to the control group except for the impact of the intervention. In an RCT, the treatments are assigned completely at random so that each experimental unit has the same chance of receiving any one treatment (including no treatment, i.e. assignment to the control group).

Usually, RCT is conducted for experiments with homogeneous experimental units, such as laboratory experiments or clinical trials. Random assignment is the key issue for designing an experiment that can establish strong evidence of cause and effect by ruling out as many extraneous variables as possible. In an ideal RCT experiment, treatment and control groups do not systematically differ on any variable (other than the treatment variable), and those extraneous variables will affect the outcome equally and the difference between the experimental and control groups can be attributed to the treatment.

Shown below is the RCT sample design strategy used to pre-select the control accounts in 2010 for the LGS and MGS conservation rate evaluations.

Table C.3. Pre-Selected Control Group Design

Account Sector	MGS1	MGS2	MGS3	LGS	Total
⇓	< 55kW	55 kW < 85 kW	85 kW < 150 kW	>= 150 kW or	
Commercial Accounts	21 control accounts with 1st tertile consumption	18 control accounts with 1st tertile consumption	11 control accounts with 1st tertile consumption	42 control accounts with 1st tertile consumption	275
	21 control accounts with 2nd tertile consumption	18 control accounts with 2nd tertile consumption	11 control accounts with 2nd tertile consumption	42 control accounts with 2nd tertile consumption	
	21 control accounts with 3rd tertile consumption	18 control accounts with 3rd tertile consumption	10 control accounts with 3rd tertile consumption	42 control accounts with 3rd tertile consumption	
Industrial Accounts	6 control accounts with 1st tertile consumption	4 control accounts with 1st tertile consumption	4 control accounts with 1st tertile consumption	22 control accounts with 1st tertile consumption	107
	6 control accounts with 2nd tertile consumption	4 control accounts with 2nd tertile consumption	4 control accounts with 2nd tertile consumption	22 control accounts with 2nd tertile consumption	
	6 control accounts with 3rd tertile consumption	4 control accounts with 3rd tertile consumption	4 control accounts with 3rd tertile consumption	21 control accounts with 3rd tertile consumption	
Multi-Unit Residential Accounts	1 control accounts with 1st tertile consumption	1 control accounts with 1st tertile consumption	1 control accounts with 1st tertile consumption	3 control accounts with 1st tertile consumption	18
	1 control accounts with 2nd tertile consumption	1 control accounts with 2nd tertile consumption	1 control accounts with 2nd tertile consumption	3 control accounts with 2nd tertile consumption	
	1 control accounts with 3rd tertile consumption	1 control accounts with 3rd tertile consumption	1 control accounts with 3rd tertile consumption	3 control accounts with 3rd tertile consumption	
Total	84	69	47	200	**400**

Additional Details on the Difference-in-Differences Method

Difference-in-differences (DD) estimation is an impact evaluation approach which relies on a comparison of participants and nonparticipants before and after the intervention. The key of DD's implementation in program impact analysis is to credibly identify a control group similar enough to program participants during the pre-program period. By applying the DD approach, the difference is calculated between the observed mean outcomes for the treatment and control groups before and after program intervention to estimate program effect.

The DD estimator is originally derived from a linear model described as below.

Given a two-period setting for both treatment and control groups, an outcome Y can be modelled as the following linear function:

$$Y = \alpha + \beta T + \gamma t + \delta(T \cdot t) + \varepsilon$$

Where:

T is the treatment;

t = 0 is the pre-program period, and

t = 1 is the post program period;

$T \cdot t$ stands for the interaction between treatment and time; and

ε is a random unobserved "error" term.

And all parameters can be interpreted as below,

α = constant term

β = treatment group specific effect (to account for average permanent differences between treatment and control)

γ = time trend common to control and treatment groups

δ = true effect of treatment

Based on the linear model above, the expected values of the average outcomes of the treatment (T=1) and control (T=0) groups during pre (t=0) and post (t=1) intervention are given as below correspondingly,

$$E(Y_0^T) = \alpha + \beta$$

$$E(Y_1^T) = \alpha + \beta + \gamma + \delta$$

$$E(Y_0^c) = \alpha$$

$$E(Y_1^c) = \alpha + \gamma$$

Therefore, the true effect of treatment $\delta = (E(Y_1^T) - E(Y_0^T)) - (E(Y_1^C) - E(Y_0^C))$.

Based on statistical inference, the statistical mean is an unbiased best estimator of the expected value of an outcome variable Y. Therefore, the DD estimator, DDE, is derived as (mean (Y_1^T) − mean (Y_0^T)) – (mean (Y_1^C) − mean (Y_0^C)) to estimate the program effect.

As a result of the linear model, to apply the DD approach in an impact analysis, output data should meet the assumptions of linear models, including normality, homogeneity and independence of each subject. In addition, the conventional DD estimator requires that, in the absence of the treatment, the average outcomes for the treated and control groups would have followed parallel paths over time. This assumption is plausible if pre-treatment characteristics that are thought to be associated with the dynamics of the outcome variable are balanced between the treated and the untreated groups.

Both the LGS/MGS and their control groups have been exposed to the identical economic environment, because the control group is only a fraction of the LGS rates eligible population and they are similar from "firmographic" and business type perspectives. It is considered reasonable to assume that pre-treatment characteristics associated with the dynamics of the outcome variable are balanced between the treated and the untreated groups. Because energy usage of both the LGS/MGS and their control groups are normally distributed and comparable on a logarithmic scale in the 2010 baseline year, the DD approach is applied to estimate energy savings of LGS conservation rates on a logarithmic scale in years 2011 and 2012.

Let ln(Treatment) and ln(Control) denote logarithmic transformation of energy usage of the LGS group and the control group, and DDE denotes the DD estimator – the estimation of their difference. Then, re-arranging terms in the DDE can also be simplified and written in the following way, where the counterfactual is estimated by the outcome of the control group modified by the pre-existing difference between the two groups:

Equation C.8

$$DDE = ln(Treatment_{Post}) - \{\ln(Treatment_{Pre}) - ln(Control_{Pre}) + ln(Control_{Post})\}$$

$$= ln(Treatment_{Post}) - ln(Counterfactual)$$

The calculations so far have all been in natural log form. The next step is to transform the results from natural logs to relative savings. Using the rules of logarithms:

Equation C.9

$$DDE = ln(\frac{Treatment}{Counterfactual})$$

Taking the exponential function of both sides,

Equation C.10

$$exp(DDE) = \frac{Treatment}{Counterfactual}$$

To show the change in the treatment group relative to the counterfactual, this can also be written as,

Equation C.11

$$\frac{(Counterfactual - Treatment)}{Counterfactural} = 1 - exp(DDE)$$

Eventually, relative change of energy usage due to new rates structure estimated through Equation C.11 is applied to estimated overall energy savings attributable to LGS/MGS conservation rates.

Additional Details on the Bootstrapping Method

A Pairwise Bootstrap approach was applied to create an empirical distribution of energy savings and test the statistically significant impact of the conservation rates on energy conservation. Bootstrapping is a non-parametric technique which draws a defined number of random samples from the original dataset (which, in and of itself, is a sample from the population) to create pseudo data and then to estimate the distribution of the object of interest over these pseudo data. As one of the Monte Carlo methods applied based on observed data, Bootstrapping was firstly introduced by Efron B. in 1979. Ever since, it has been used widely in the applied science fields to estimate properties of an estimator or construct hypothesis tests. Bootstrapping generates empirical distributions that have no convenient statistical formulae, and it can be a useful alternative to classic statistical inference when the traditional underlying parametric assumptions (i.e. assuming a normal distribution or asymptotic theory with infinite sample size) are not met, or are suspect.

The Pairwise Bootstrap method was applied by repeatedly drawing accounts (not including outliers or accounts lost due to attrition) randomly with replacement from each of the LGS and MGS control groups. The Pairwise Bootstrap resampled pre and post annual consumption jointly and created pseudo data of counterfactual of LGS/MGS treatment group during both 2010 and F2014. Based on the empirical distribution of pseudo data, the difference between treatment and control groups was tested during both pre and post intervention periods. Because the experimental design was treated as Complete Random Design in this study, a Simple Random Sampling (SRS) approach was applied accordingly in resampling.

Appendix D Result Details

Additional Survey Results

Table D.1. Previously Heard of a Demand Charge (% of Respondents)

	LGS	MGS1	MGS2/3	Total
Yes	82	64	59	67
No	15	29	30	25
Don't Know	3	8	11	8
Total	100	100	100	100

Table D.2. Believe that the Demand Charge is…(% of Respondents)

Only among respondents who believe their account has a demand charge	LGS	MGS1	MGS2/3	Total
Flat demand charge	13	14	16	15
Inclining block demand charge	80	80	84	82
Other type of demand charge	1	-	-	0
DK	6	6	1	4
Total	100	100	100	100

Table D.3. Easy to Minimize the Demand Charge (% of Respondents)

Only among respondents who believe their account has a demand charge	LGS	MGS1	MGS2/3	Total
Very easy	1	5	3	3
Somewhat easy	29	18	28	27
Somewhat difficult	48	59	42	47
Very difficult	22	18	23	22
Don't Know	-	-	3	2
Total	100	100	100	100

Table D.4. Effort Made to Minimize the Demand Charge (% of Respondents)

Only among respondents who believe their account has a demand charge	LGS	MGS1	MGS2/3	Total
A great deal of effort	9	8	4	7
A fair amount of effort	43	36	34	38
A little effort	34	43	39	38
Not effort at all	11	6	8	9
Not applicable	3	6	15	9
Don't Know	-	-	-	-
Total	100	100	100	100

Table D.5. Support for the Demand Charge (% of Respondents)

	LGS	MGS1	MGS2/3	Total
Strongly support	13	12	6	9
Somewhat support	25	23	33	29
Indifferent	31	26	23	26
Somewhat oppose	15	23	15	17
Strongly oppose	5	8	12	9
Don't Know	11	8	12	11
Total	100	100	100	100

Table D.6. Percent of Survey Respondents Assessing Various Factors as Major Drivers of Managing Electricity Consumption (% of Respondents)

	LGS	MGS1	MGS2/3	Total
Want operating costs to be as low as possible	78	70	77	76
Overall level of electricity prices	50	56	59	59
For the environment - right thing to do	43	44	33	38
Need for more cost cutting measures	24	23	26	25
Decrease pay-back time of capital investments	31	21	22	25
Incentive to save electricity built into rate	27	19	17	21
Suppliers and customers want us to conserve electricity	20	15	10	14
Our employees want us to conserve electricity	17	14	10	13
Overall level of natural gas prices	13	8	12	12

Table D.7. Percent of Survey Respondents Assessing Various Factors as Major Barriers of Managing Electricity Consumption (% of Respondents)

	LGS	MGS1	MGS2/3	Total
Other operational priorities	34	29	39	36
Lack of access to funding for investment	30	24	35	32
Lack of financial incentives for conservation	17	26	35	28
Insufficient payback	23	18	24	23
Current energy use near lowest possible level	21	14	18	18
Can't control employees' behaviour in regards to energy efficiency practices	12	12	17	15
Lack of staffing/staffing requirements	16	13	14	15
Lack of knowledge of where the opportunities for savings might be	6	10	15	11
Takes too much time	10	14	6	8
Lack of executive support	2	4	7	5

Table D.8. Reported Level of Understanding of their Rate (% of Respondents)

Only among respondents reported to be aware of the rate prior to completing the survey	**Total**
Excellent understanding	11
Good understanding	28
Fair understanding	47
Poor understanding	11
Very poor understanding	2
Don't Know	1

Additional Consumption Data Exploration Results

Shown below are the control group distributions on an absolute, and log transformed basis.

Figure D.1. Histogram of LGS Treatment and Control Group Base Year Absolute Consumption

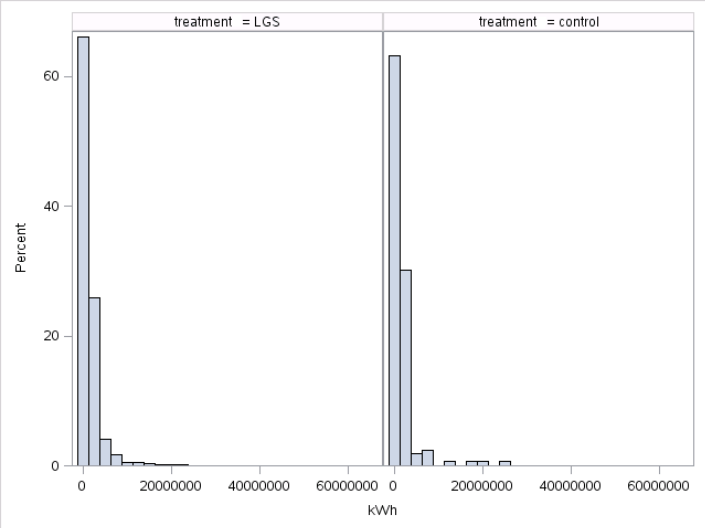


Figure D.2. Histogram of LGS Treatment and Control Group Base Year Log Transformed Consumption

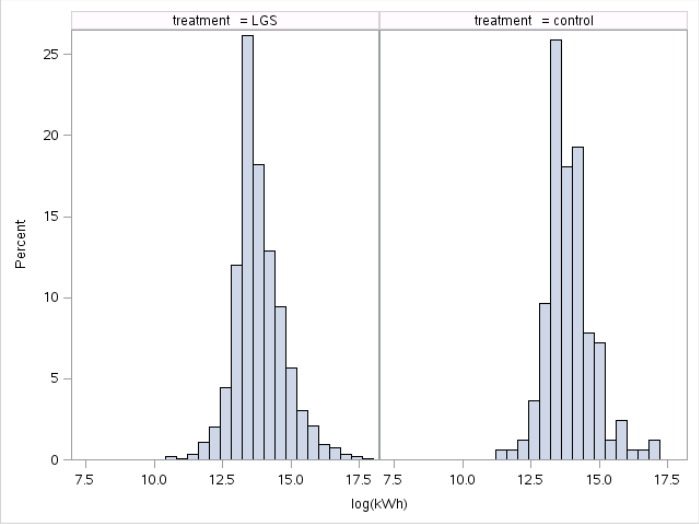


Figure D.3. Histogram of MGS Treatment and Control Group Base Year Absolute Consumption

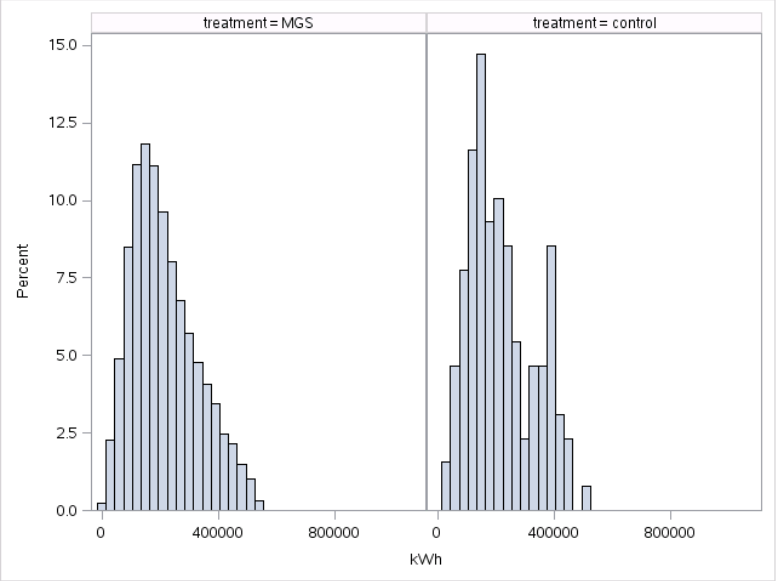
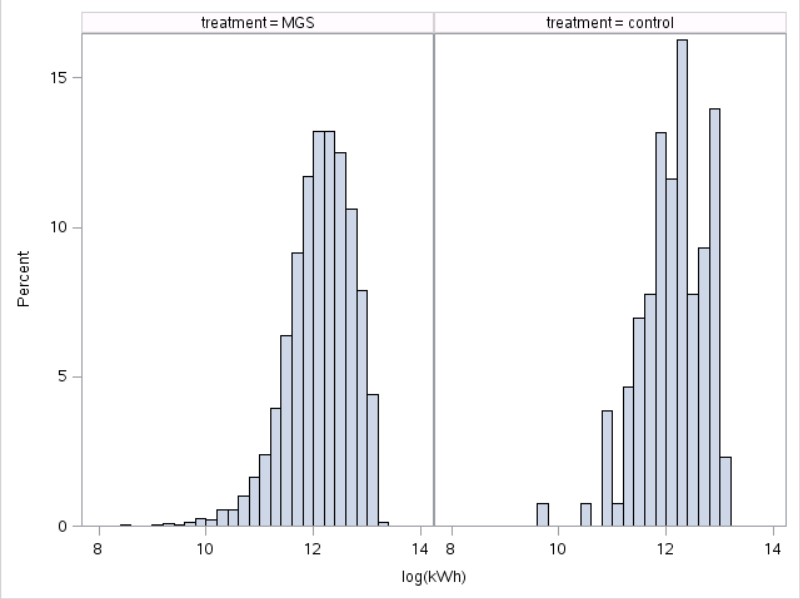


Figure D.4. Histogram of MGS Treatment and Control Group Base Year Log Transformed Consumption



The scatter plot below of electricity consumption in 2011 versus 2010 on a logarithmic scale for the LGS treatment and control groups provides a visualization of changes to energy consumption. In the figure, the reference line y=x with slope 1 shows the point at which 2010 consumption is equivalent to 2011 consumption. Points below the reference line indicate a consumption decrease, and points above the line represent a consumption increase.

Figure D.5. Scatter Plot of Electricity Usage in F2014 versus 2010 for LGS Treatment and Control Groups (Logarithmic Scale)

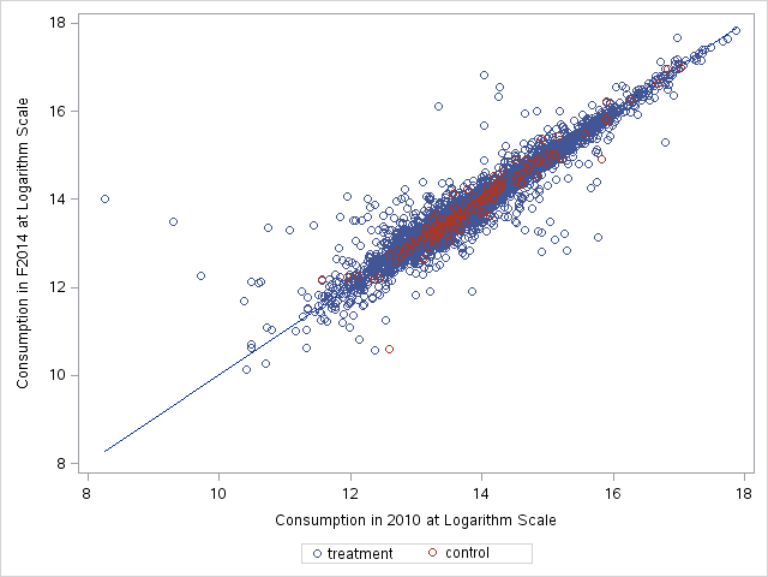
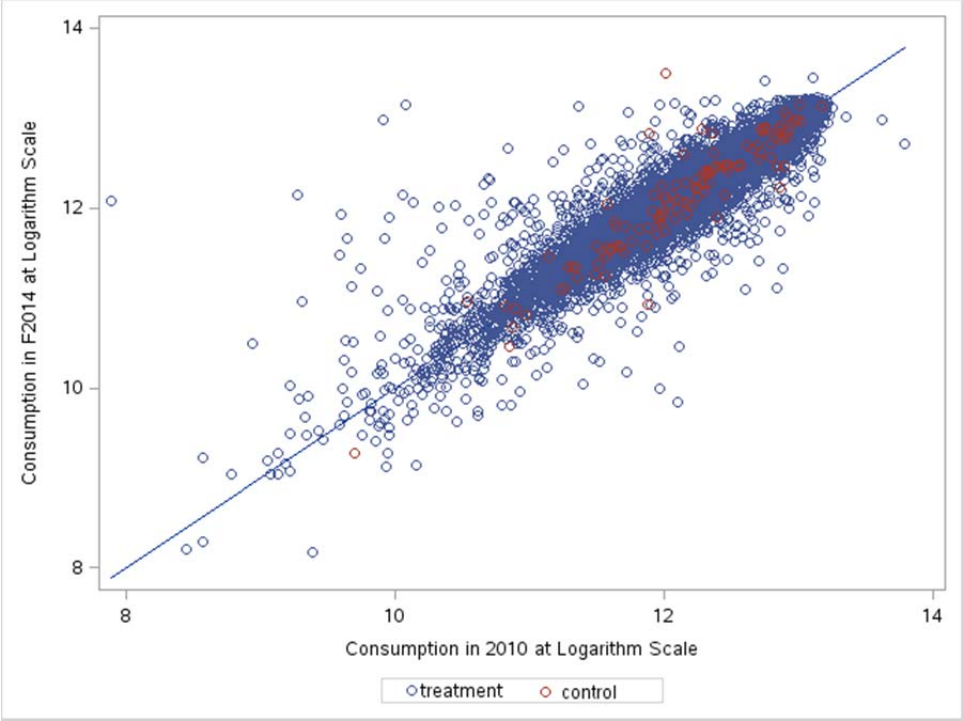


Figure D.6. Scatter Plot of Electricity Usage in 2014 versus 2010 MGS Treatment and Control Groups (Logarithmic Scale)



Additional Details on Assessment of Control Group Effectiveness

Figure D.7. Annual Consumption for MGS Control and Treatment Groups, by Consumption Percentile

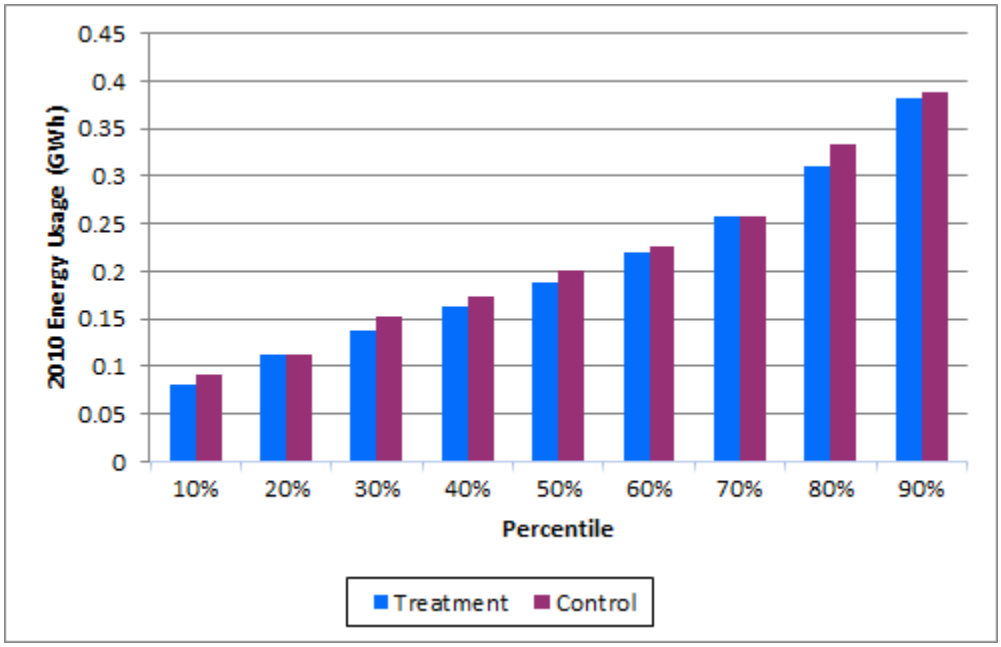


Table D.9. Mean Base Year Consumption and Number of Valid Accounts for MGS Treatment and Control Groups, by Sector

Account Sector	Number of Valid Accounts		Mean Annual Consumption (GWh)		
	Treatment	Control	Treatment Accounts	Control Accounts	Difference
Commercial	8,477	101	0.218	0.216	0.002*
Industrial	2,175	21	0.190	0.197	-0.007*
Residential	648	7	0.271	0.317	-0.046*
Unclassified	4	N/A	0.141	N/A	N/A

*Not statistically significant at the 90% confidence level.

Table D.10. Mean Base Year Consumption and Number of Valid Accounts for MGS Treatment and Control Groups, by Region.

Region	Number of Valid Accounts		Mean Annual Consumption (GWh)		
	Treatment	Control	Treatment	Control	Difference
Lower Mainland	6,079	70	0.231	0.239	-0.008*
North	1,269	10	0.203	0.165	0.038*
Southern Interior	1,519	17	0.192	0.254	-0.062*
Vancouver Island	2,437	32	0.200	0.170	0.030*

*Not statistically significant at 90% confidence level according to bootstrapping.

Table D.11. Power Smart Program Participation for LGS Treatment and Control Groups

Power Smart Program Offer	Group	Number of valid accounts	Number of accounts participated	Participation (%)
Prescriptive Incentive Projects	LGS Treatment	5,119	518	10
	LGS Control	166	18	11
			Difference	-1*
Custom Incentive Projects	LGS Treatment	5,119	119	2
	LGS Control	166	4	2
			Difference	0
Funded Enabling Activities	LGS Treatment	5,119	95	2
	LGS Control	166	2	1
			Difference	1*
Overall at least one program offer	LGS Treatment	5,119	732	14
	LGS Control	166	24	14
			Difference	0

*Not statistically significant difference at 90% confidence level.

Table D.12. Power Smart Program Participation for MGS Treatment and Control Groups

Power Smart Program Offer	Group	Number of valid accounts	Number of accounts participated	Participation (%)
Prescriptive Incentive Projects	MGS Treatment	11,304	441	4
	MGS Control	129	5	4
			Difference	0
Custom Incentive Projects	MGS Treatment	11,304	153	1
	MGS Control	129	4	3
			Difference	-2**
Funded Enabling Activities	MGS Treatment	11,304	110	1
	MGS Control	129	0	0
			Difference	1*
Overall at least one program offer	LGS Treatment	11,304	704	6
	MGS Control	129	9	7
			Difference	-1*

*Not statistically significant difference at 90% confidence level.

**: Not statistically significant difference at 95% confidence level.

Precision of a sampling design measures how close a sample estimator is expected to be to the true value of a parameter. It is usually measured by relative precision -- the expected error bound of an estimator at a certain confidence level over the expected value of this estimator. The lower the relative precision, the more precise a sampling design is. BC Hydro aims for a relative precision of 20 per cent or less for DSM evaluation. In order to calculate relative precision, the control group samples were post-stratified by baseline consumption and the relative precision of the sampling design was calculated with Dalenius-Hodges stratifying sampling approach, at a 90 per cent confidence level.

As shown in the table below, the overall relative precision for the LGS control group, on an absolute basis, is 12 per cent, while the precision for individual stratum varies from a low of 6 per cent for small and medium accounts, to a high of 337 per cent for the largest accounts. Relative precision was also calculated on a logarithm basis, which aligns with the analytical method used in the impact analysis. On a log basis, overall relative precision is 0.71 per cent, ranging from a low of 0.4 per cent for medium sized accounts to a high of 14 per cent for the largest accounts.

The results of the analysis of relative precision indicate that overall, the LGS control group is representative of its treatment group. However, when each stratum is examined separately, it is apparent that the largest stratum is not well represented by its control group. This result is intuitive, given that the largest LGS accounts are also the most diverse. This stratum contains accounts as varied as sawmills, hospitals, universities, and large retail. The results from the analysis of relative precision indicate that, while overall findings resulting from the comparison of the control group to the treatment group are valid, it is not valid to analyze the largest stratum in isolation.

Table D.13. LGS Control Group Relative Precision of Sampling Design

Stratum	Consumption Range (GWh/yr)	Percentage of Total LGS Consumption (%)	Number of LGS Accounts	Number of Valid LGS Control Accounts	Relative Precision Absolute Basis (%)	Relative Precision Log Basis (%)
1	0 - 0.94	19	2,856	86	6	0.64
2	0.95 -2.3	26	1,592	55	6	0.41
3	2.4 - 6.4	25	633	17	12	0.74
4	6.5 -58.2	30	204	8	337	14
Overall		**100**	**5,285**	**166**	**12**	**0.71**

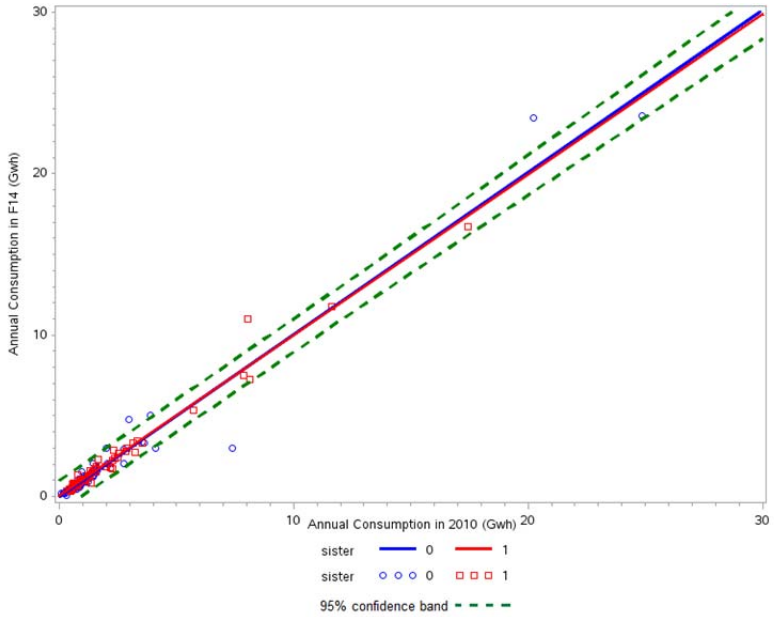
Similar analysis of the relative precision was completed for the MGS control and treatment groups and is shown below. Results show that a very low relative precision overall, at 2 per cent on an absolute basis, with no single stratum above 10 per cent. The lower relative precision of the MGS accounts relative to LGS accounts is to be expected, as MGS accounts have relatively lower diversity of facility types and energy end use equipment compared to LGS accounts. The results indicate that the MGS control group provides a precise estimate of the MGS treatment group, across all account size stratums.

Table D.14. MGS Control Group Relative Precision of Sampling Design

Stratum	Consumption Range (GWh/yr)	Percentage of Total MGS Consumption (%)	Number of MGS Accounts	Number of Valid MGS Control Accounts	Relative Precision, Absolute Basis (%)	Relative Precision, Log Basis (%)
1	0 - 0.129	10%	2,792	33	10	1.17
2	0.130 – 0.220	27%	3,832	43	4	0.32
3	0.221 – 0.340	33%	2,999	27	4	0.32
4	0.341 – 0.971	30%	1,810	26	4	0.31
Overall		**100%**	**11,433**	**129**	**2**	**0.30**

Analysis was completed to test for the possibility of control group contamination for control accounts that have sister accounts in the treatment group (eg. chain stores with one site in the control group, and all other sites under the conservation rates). As shown below, the change in consumption from 2010 to 2011 for sites with sisters in the treatment group was similar to that of sites without sisters in the treatment group. This result provides evidence that control group contamination did not occur.

Figure D.8. Annual Consumption for LGS Control Accounts with and Without Sister Accounts in the LGS Treatment Group, 2010 versus F2014



Additional Details on Energy and Peak Demand Savings for MGS Customers

Table D.15. Cumulative Run Rate Savings from the MGS Conservation Rate in F2014.

Calendar Year	Average of Log of Account Consumption		Difference	DD Estimator	Relative Savings	Energy Savings (GWh/yr)
	Treatment	Control				
Base Year 2010	12.139	12.145	-0.006			
F2014	12.120	12.106	0.014	0.02	0	0

*No statistically significant difference existed in both pre and post period at either 80% or 90% confidence level.

Additional Details on Energy Savings for the three months of January to March 2014

The past evaluation of the LGS MGS conservation rates covered the period January 1, 2011 through December 21, 2012, and the current evaluation covers the period April 1, 2013 through March 31, 2014. A three month gap (January to March 2013) exists between the two evaluation analysis time periods. To fill this gap, savings calculations for the three months of January through March 2013 were completed. Energy savings for these three months were estimated as 11 GWh relative to the same three months in 2010. Results were statistically significant at the 90% level. These savings are superseded by the F2014 result. In other words, the savings for the three months January to March 2013 should not be added to the savings for F2014.

Additional Details on the Large Customer Analysis

Conventional demand theory models consumption as a function of activity and price variables. Relevant activity variables might include production for industrial facilities, occupancy for commercial facilities and income for residential dwellings. Price variables might include the price of the product as well as the prices of substitute and complementary products.

Recall the definition of price elasticity of demand (eta) as the relative change in quantity divided by the relative change in price, when the change in price is small

Equation D.1

$$\eta = (\Delta quantity/quantity)/(\Delta price/price)$$

Rearranging to isolate the change in quantity term, we then have

Equation D.2

$$\Delta quantity = \eta \cdot quantity \cdot (\Delta price/price),$$

So the key parameter of interest in understanding the impact of rate changes on demand is the own price elasticity, η, because the initial quantity is given and the relative change in price is a rate design decision.

If both dependent and independent variables are measured in logs, then the elasticities are just the relevant regression coefficients. However, this result does not hold if the independent variable is a dummy variable. In this case, the elasticity is given by $[\exp(b_d) - 1]$, where b_d is the estimated regression coefficient on the dummy variable.

To understand the impact of the LGS rate on the very large LGS customers, we estimated the following model for individual sites, where ln is the natural log of the relevant variable, t indexes the months and the Greek letters represent parameters to be estimated:

Equation D.3

$$ln(kWh)_t = \alpha + \beta ln(Production)_t + \gamma ln(Average\ price)_t + \theta\ LGS\ Rate_t + \varepsilon_t$$

If the covariance's of the errors are zero or there is no auto-correlation, ordinary least squares estimation is appropriate. However for the data used in this modelling, errors are correlated over time rather than independent, perhaps due to persistent shocks reflecting the inertia of economic processes or due to omitted variables that are hopefully uncorrelated to variables in the model. Auto-correlated errors have three main consequences. First, although the estimated OLS errors are unbiased, tests for the statistical significance of the parameters and the associated error bands are not correct. Second, OLS is no longer an efficient method of estimating parameters. Third, OLS is no longer an efficient method of forecasting future values of the dependent variable.

Suppose the errors are given by the first-order scheme as follows

Equation D.4

$$\varepsilon_t = \rho\varepsilon_{t-1} + u_t,\ t = 1, 2, \ldots, T$$

We assume that the absolute value of the parameter ρ is less than one, the u_t are independently and identically distributed with variance σ_u^2, and ε_t are generated by a stationary stochastic process beginning in the infinite past. Roughly speaking, a stochastic process is stationary if the mean, variance and covariances for given lags are constant over time.

For the evaluation of BC Hydro's TSR and RIB Rate, it was believed that econometric methods could be readily applied because each customer faced a transparent supply curve, so that the marginal price could be viewed as exogenous. The situation for LGS/MGS is much more complex with moving customer-specific baselines, multiple pricing tiers, and credits and charges, so the marginal price is both hard to define and potentially endogenous. So instead of the marginal price, we use expected price in the analysis, and proxy this with the average price for the customer group (see, for example, recent work by Ito, 2014). This is conventional demand equation where consumption depends on price and on production, with the additional feature of a dummy variable to capture the impact, if any, of change in rate structure, as opposed to a change in the average rate or price level.

Since this is a set of time-series regression, there is a separate model for each of the one dozen facilities we modelled, and we ran each regression assuming first-order autocorrelation (using maximum likelihood regression). The rate dummy takes the value 0 for the period before January 2011 and the value 1 for the period from January 2011 onward, so the coefficient θ is the estimated impact of the rate structure for that particular firm, before the normalization explained above. The key point is that if the rate structure has an independent effect on electricity consumption, then θ will be negative and statistically significant.

The table below presents the results of the regressions. Please note: (1) that the standard error of the regression coefficient is shown below the regression coefficient in parentheses, (2) that the statistical significance of the regression coefficient is indicated by the number of asterisks (10% by one asterisk, 5% by two asterisks, and 1% by three asterisks), (3) that the statistical significance of the F statistic is shown below the F statistic in parentheses, and (4) that the estimated autocorrelation coefficient is shown below the Durbin-Watson statistic in parentheses.

Note the following. First, for ten of the twelve regressions β, (the coefficient on production) is positive and significantly significant as expected. Second, for none of the twelve regressions, is γ (the average price elasticity) negative and significantly significant as expected. Third, for none of the twelve regressions is θ (the coefficient on the introduction of the conservation rate structure) negative and significantly significant at the 80% level or better. The regressions therefore provide no support for an independent impact of the rate structure on electricity consumption.

Table D.16. Determinants of Log of Electricity Consumption (MWh/month, n = 48 months)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Constant	0.29	7.76***	1.19	8.22***	0.27	6.16***
	(0.99)	(1.26)	(2.38)	(2.75)	(1.44)	(1.20)
Log production	0.81***	-0.094**	0.46**	0.33***	0.44***	-0.0021
	(0.094)	(0.050)	(0.21)	(0.11)	(0.093)	(0.12)
Log average price	-0.33	0.20	1.22	-1.63	1.59**	0.60
	(0.26)	(0.69)	(0.88)	(1.40)	(0.80)	(0.41)
Rate dummy	-0.0088	0.19*	-0.09	0.32	0.090	-0.068
	(0.042)	(0.10)	(0.14)	(0.22)	(0.12)	(0.063)
Adjusted R-sq.	0.69	0.19	0.18	0.13	0.89	0.01
F	35.9	4.75	4.39	3.28	130.9	0.89
	(0.00)	(0.00)	(0.01)	(0.03)	(0.00)	(0.40)
Durbin-Watson	2.06	2.15	2.02	2.66	2.03	1.95
	(-0.03)	(-0.08)	(-0.01)	(-0.33)	(-0.01)	(0.02)

Table D.16. Continued. Determinants of Log of Electricity Consumption (MWh/month, n = 48 months)

	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12
Constant	4.73***	5.1***	1.31***	3.19***	3.05*	1.10
	(1.10)	(0.91)	(0.35)	(1.02)	(1.74)	(2.68)
Log production	0.19*	0.16***	0.67***	0.058**	0.54***	0.80**
	(0.13)	(0.042)	(0.023)	(0.028)	(0.20)	(0.39)
Log average price	0.64	-0.069	-0.044	1.12**	-0.15	-0.051
	(0.43)	(0.42)	(0.15)	(0.52)	(0.26)	(0.92)
Rate dummy	-0.073	0.036	0.022	0.013	0.0085	-0.063
	(0.067)	(0.067)	(0.024)	(0.81)	(0.041)	(0.14)
Adjusted R-sq.	0.21	0.21	0.95	0.62	0.15	0.04
F	5.05	5.21	332.2	26.2	3.86	1.62
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.20)
Durbin-Watson	2.01	2.04	1.92	1.88	1.95	1.74
	(-0.01)	(-0.02)	(0.04)	(0.06)	(0.03)	(0.13)

Appendix E Survey Questionnaire

Rates, Conservation and Energy Efficiency Survey

Thank you for taking the time to complete this Rates, Conservation and Energy Efficiency Survey.

{For Survey IDs 100,000 - 159,999} **Please complete the survey specifically in regards to your organization's use of electricity located at: (insert service address, service town)**

If you feel another colleague has a greater understanding of this account, then you may forward the original email invitation to that person.

{For Survey IDs - 200,000 - 259,999} **Your organization uses electricity via two or more meters located at: (insert service address, service town)**

Please complete the survey specifically in regards to the largest account at this address – that is, the meter with the highest consumption of electricity.

If you feel another colleague has a greater understanding of this account, then you may forward the original email invitation to that person.

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

For privacy reasons, do not self-identify (unless for the purposes of entering the contest) or identify other specific individuals in your written comments.

Any comments including self-identification or identification of third parties will be discarded.

Thank you for your participation, your opinions are extremely important to us.

Should you have any questions about how to complete your survey, please call Matt Shepherd, Project Manager, Mustel Group at (604) 742-2242 in Vancouver, or outside the Lower Mainland, call toll free, 1-866-742-2242. If you have questions about why BC Hydro is conducting this research or prefer not to receive any further correspondence in this regard, please call Marc Pedersen, Senior Evaluation Advisor, BC Hydro, at (604) 453-6308 (call collect if outside of the Lower Mainland) for assistance.

About this Account

1. Which of the following best describes the ownership of this account?

☐[1] Government or public sector

☐[2] Non-governmental organization (non-profit)

☐[3] For profit ⇒ Which of the following best describes the for profit business?

- ☐[4] Independently owned
- ☐[5] Franchise (e.g. Tim Hortons)
- ☐[6] Part of a chain (e.g. The Bay)
- ☐[7] Don't know

☐[99] Don't know/Not sure

About this Account

2. Please check the one box that indicates the primary activity related to this account. (select only one)

☐[1] Agriculture/Fishing	☐[14] Healthcare/Hospitals
☐[2] Arts/Entertainment/Film	☐[15] Hospitality/Lodging/Tourism
☐[3] Automotive	☐[16] Manufacturing
☐[4] Banking/Finance/Insurance	☐[17] Membership Organizations
☐[5] Building or Property Management	☐[18] Mining
☐[6] Business/Professional Services	☐[19] Personal Services
☐[7] Camps/Recreation/Sports/Amusement	☐[20] Restaurants and food service
☐[8] Charity/Not for profit	☐[21] Retail Trade (non-food)
☐[9] Communications/Media	☐[22] Retail Food Stores
☐[10] Construction/Home & Building Contractors	☐[23] Wholesale and Distribution
☐[11] Education	☐[24] Transportation
☐[12] Forestry	☐[25] Utilities & Energy
☐[13] Government - Local/Provincial/Federal	
☐[98] Other (specify _____)	

About this Account

3. To what extent would you say the [INSERT **'business sales or revenue associated with this account has'** IF Q1=3 THROUGH 99; INSERT **'organization's size and level of service(s) associated with this account have'** IF Q1=1 OR 2] **increased or decreased over the past two years?**

☐[1] Increased a great deal

☐[2] Increased a little

☐[3] Stayed about the same

☐[4] Decreased a little

☐[5] Decreased a great deal

☐[99] Don't know/Not sure

☐[97] Prefer not to say

About You

4. Which of the following best describes your position/title within the organization: (select only one)

☐[1] Business owner or co-owner
☐[2] Executive
☐[3] Facility or property manager/supervisor
☐[4] General manager
☐[5] Energy manager – hired as part of BC Hydro's Power Smart Partner Program
☐[6] Energy manager – NOT hired as part of BC Hydro's Power Smart Partner Program
☐[7] Operations or maintenance manager
☐[8] Operations or maintenance technician/engineer
☐[9] Finance manager
☐[10] Purchasing manager
☐[11] Accountant/Bookkeeper

☐[98] Other (please specify) _____

About You

5. For each of the following, please indicate whether you are primarily or jointly responsible for decision making in relation to the organization that this account is located at, whether someone else is, or whether it is not applicable to the organization.

Decisions related to…	Yes, I am the primary or joint decision maker	No, someone else is the decision maker	Not applicable at this organization
a. Capital investments	☐1	☐2	☐97
b. Investments in energy-efficient equipment	☐1	☐2	☐97
c. Production/operating schedule of equipment	☐1	☐2	☐97
d. Energy management	☐1	☐2	☐97
e. Maintenance of equipment	☐1	☐2	☐97
f. Hours of operation	☐1	☐2	☐97
g. Finance/accounting	☐1	☐2	☐97

About Your Account's Price of Electricity

6. Please think about the amount of money your organization pays for electricity every month, every two months, or even over the course of a year, and consider the benefits it receives in return.

Would you say that the amount of money your organization 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/not sure

About Your Account's Price of Electricity

7. Thinking of things in a slightly different way, would you say that BC Hydro's electricity <u>prices</u> for businesses and organizations 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/not sure

About Your Account's Price of Electricity

8. Over the past 2 years, do you think that BC Hydro's electricity <u>prices</u> for businesses and organizations 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/not sure

About Your Account's Price of Electricity

9. Regardless of your organization's current effort to manage its consumption of electricity, to what extent do BC Hydro's electricity prices for businesses and organizations serve as an incentive in any of your organization's efforts to minimize electricity bills related to this account?

☐[1] They serve as a major incentive

☐[2] They serve as a minor incentive

☐[3] They serve no incentive at all

☐[99] Don't know/not sure

About Your Account's Rate

As you may know, there are a variety of rate structures that utility companies can implement for their various customer groups. Generally speaking, rates structures can include, but are not limited to, combinations of an energy charge, a demand charge, and a basic charge.

In this section of the survey, we would like to explore your awareness, understanding and opinion of the rate structure that applies to this account billed under BC Hydro's [INSERT '**Large**' FOR SURVEY IDs 100,000 - 119,999; 200,000 - 219,999: INSERT '**Medium**' FOR SURVEY IDs 120,000 - 159,999; 220,000 - 259,999] **General Service tariff.**

REMINDER

In this section, we are interested in your current understanding of the rate structure that you believe this account is on and your top-of-mind thoughts about it.

We ask you not to view any of your bills or other BC Hydro correspondence while completing this section of the survey.

THANK YOU!

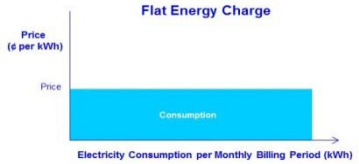
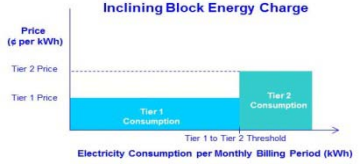
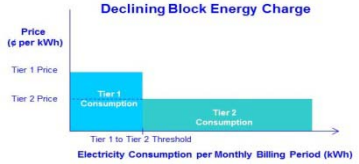
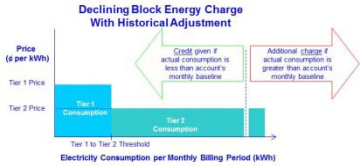
TREATMENT: SURVEY IDs 100,000 - 259,999: CONTINUE WITH Q10
CONTROL: SURVEY IDs 300,000 - 409,999: SKIP TO Q23 (demand charge)

About Your Account's Rate – the energy charge

'Energy' is the total amount of electricity consumed over a period of time and is typically measured in kilowatt hours (kWh).

The energy charge is the price per kilowatt hour of electricity consumed (¢ per kWh).

10a. Please indicate which one of the following types of energy charges you believe applies to this account. Please scroll down…

☐[1]	Flat Energy Charge The price per kilowatt hour of electricity is constant regardless of the amount of electricity used in a monthly billing period.	
☐[2]	Inclining Block Energy Charge The price per kilowatt hour 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 monthly billing period.	
☐[3]	Declining Block Energy Charge The price per kilowatt hour 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 monthly billing period.	
☐[4]	Declining Block Energy Charge with Historical Adjustment Similar to the declining block energy charge (as above), but with an additional credit or charge adjustment based on a comparison of the account's current usage versus its historical monthly baseline.	
☐[98]	Other type of energy charge: please specify _____	
☐[99]	Don't know/not sure	

About Your Account's Rate – the energy charge

ASK 10b ONLY IF Q10a = 1, 2, 3, 4, 98; ELSE SKIP TO PREAMBLE TO Q11a (DESCRIPTION PAGE)

10b. Thinking about the [INSERT ANSWER TO Q10a: flat energy charge / inclining block energy charge / declining block energy charge / declining block energy charge with historical adjustment] that you believe applies to this account, to what extent does this energy charge serve as an incentive in any of your organization's efforts to minimize electricity bills related to this account?

☐[1] It serves as a major incentive

☐[2] It serves as a minor incentive

☐[3] It serves no incentive at all

☐[99] Don't know/not sure

DO NOT ALLOW RESPONDENT TO NAVIGATE BACK TO Q10a

About Your Account's Rate – the energy charge

NOTE: DO NOT ALLOW THE RESPONDENT TO NAVIGATE BACK TO Q10

PREAMBLE FOR Q11

In January 2011, BC Hydro began to change the method it charges Large General Service (LGS) and Medium General Service (MGS) accounts for their consumption of electricity from a declining block energy charge to a conservation rate structure with historical adjustments.

All LGS accounts transitioned to the conservation rate structure on January 1, 2011 while MGS accounts were staggered in their transition to the conservation rate over the past several years.

SHOW ILLUSTRATION TO THE RIGHT AS PER THE CONSERVATION RATE

This rate structure is designed to encourage customers to use less electricity than they have historically done so (called the baseline). Using less electricity than your baseline results in a CREDIT on your bill. Using more than your baseline results in an additional CHARGE.

Here's a closer look at how it works:

1. **The conservation rate starts with an account's monthly baseline – its 3-year historical average consumption for that month.**
2. **The energy charge for the account's current month's energy usage has two parts.**
3. **In Part 1 of the energy charge, the customer pays one price (Tier 1) for up to 14,800 kWh in the month, and a second, lower price (Tier 2) for any additional kWh beyond 14,800 kWh up to the account's baseline for that month.**
4. **In Part 2 of the energy charge, an adjustment is made if there is a difference between the account's actual consumption in the month versus its 3-year baseline for that month.**
    - **If the account's actual usage in the month is less than its baseline average, then the customer account receives a credit, and a portion of the credit is at a higher price;**
    - **If the account's actual usage in the month is greater than its baseline average, then the customer account receives an additional charge, and the charge is also at a higher price reflecting the cost of new supply;**
    - **If the account's actual usage in the month is equal to its baseline, then there is no Part 2 adjustment.**

NOTE: DO NOT ALLOW THE RESPONDENT TO NAVIGATE BACK TO Q10

About Your Account's Rate – the energy charge

11a. Having read a little more about the conservation rate that BC Hydro uses for charging Large and Medium General Service accounts for their consumption of electricity, 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/not sure

About Your Account's Rate – the energy charge

ASK Q11b IF Q11a = 3 OR 4; ELSE, SKIP TO Q12

11b. What part(s) of the conservation rate's energy charge do you find difficult to understand? (select all that apply)

The Part 1 energy charges

- ☐[1] What they are
- ☐[2] How they are applied
- ☐[3] How they impact my bill

The Part 2 energy charges and credits

- ☐[4] What they are
- ☐[5] How or under what circumstances the Part 2 credits are realized
- ☐[6] How or under what circumstances the Part 2 charges are realized
- ☐[7] How they impact my bill

The monthly customer baseline

- ☐[8] What it is used for
- ☐[9] How it is determined
- ☐[10] How it impacts my bill

☐[98] Other (please specify) _____

☐[99] Don't know/not sure

About Your Account's Rate – the energy charge

12. Which of the following statements best describes your awareness of how BC Hydro charges this [INSERT '**Large**' FOR SURVEY IDs 100,000 - 119,999; 200,000 - 219,999: INSERT '**Medium**' FOR SURVEY IDs 120,000 - 159,999; 220,000 - 259,999] **General Service account for its consumption of electricity?**

☐[1] Prior to this survey, I was fully aware that BC Hydro's charges this account for its consumption of electricity on this conservation rate structure

☐[2] Now that it has been mentioned, I had heard that BC Hydro charges this account for its consumption of electricity on this conservation rate structure

☐[3] This is the first time I have heard that this account is charged on this conservation rate structure ⇒ SKIP TO Q17

☐[99] Don't know ⇒ SKIP TO Q17

About Your Account's Rate – the energy charge

13. How did you <u>first</u> become aware of this conservation rate? (select one only)

☐[1] Email notification

☐[2] Letter notification via Canada Post

☐[3] Personal notification from BC Hydro representative (in-person or via telephone)

☐[4] BC Hydro website (general)

☐[5] BC Hydro eNewsletters

☐[6] An energy consultant

☐[7] Word of mouth such as from a colleague or friend

☐[98] Other: please specify _____

☐[9] Can't remember

☐[99] Don't know/not sure

About Your Account's Rate – the energy charge

14. How would you rate your actual understanding – prior to receiving this survey – of the conservation rate that BC Hydro uses for charging Large and Medium General Service accounts?

☐[1] Excellent understanding

☐[2] Good understanding

☐[3] Fair understanding

☐[4] Poor understanding ⇒ SKIP TO Q16

☐[5] Very poor understanding ⇒ SKIP TO Q16

☐[99] Don't know ⇒ SKIP TO Q16

About Your Account's Rate – the energy charge

15. Regardless of how you first became aware of the conservation rate, which communications method did you find most helpful in understanding how the rate works? (select one only)

☐[1] Email Notification

☐[2] Letter via Canada Post

☐[3] Personal discussions from BC Hydro representative (in-person or via telephone)

☐[4] Forecaster tool on BC Hydro's website

☐[5] Video tutorial on BC Hydro's website

☐[6] BC Hydro website (general)

☐[7] Discussions with a colleague or friend

☐[8] Discussions with an energy consultant

☐[98] Other: please specify _____

☐[99] Don't know/not sure

About Your Account's Rate – the energy charge

16. Thinking about the higher price that is applied to Part 2 credits or charges, which one of the following best reflects your understanding of the basis for this price? (select all that apply)

☐[1] To reward customers who use less energy than their baseline, and to penalize those that use more.

☐[2] To reflect BC Hydro's higher cost of new electricity supply.

☐[99] Don't know

About Your Account's Rate – the energy charge

ASK ALL TREATMENT

17. Thinking about the conservation rate that actually applies to this account, to what extent does this type of energy charge serve as an incentive in any of your organization's efforts to minimize electricity bills related to this account?

☐[1] It serves as a major incentive

☐[2] It serves as a minor incentive

☐[3] It serves no incentive at all

☐[99] Don't know/not sure

About Your Account's Rate – the energy charge

18. Assuming your organization wanted to do so, how easy or difficult is it to manage this account to minimize the total energy charges on the bill?

This might be done by installing energy-efficient measures, turning off lights and equipment when not in use, etc.

☐[1] Very easy

☐[2] Somewhat easy

☐[3] Somewhat difficult

☐[4] Very difficult

☐[99] Don't know/not sure

About Your Account's Rate – the energy charge

19. How much of an effort does your organization currently make managing this account to minimize the total energy charges on the bill?

☐[1] A great deal of effort

☐[2] A fair amount of effort

☐[3] A little effort

☐[4] No effort at all

☐[97] Not Applicable – there is little opportunity to manage the energy charges related to this account.

☐[99] Don't know/not sure

About Your Account's Rate – the energy charge

20a. Overall, does your organization support or oppose the conservation rate that applies to this account, or is your organization indifferent about it?

In considering your response, please consider only this rate structure – not the specific tier 1 and tier 2 prices of electricity.

☐[1] Strongly support

☐[2] Somewhat support

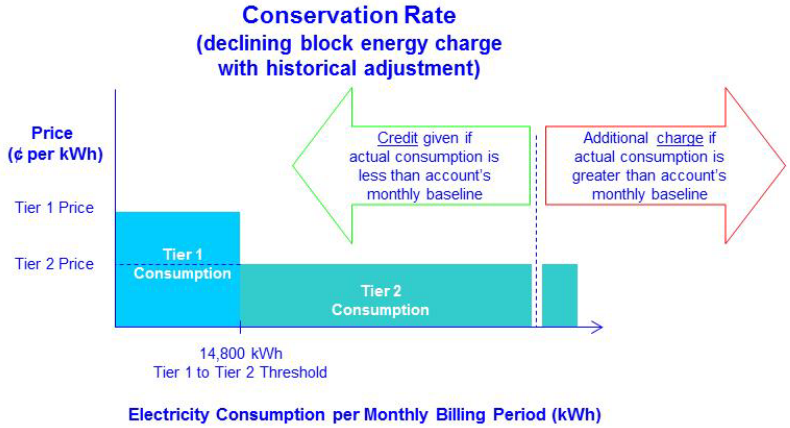
☐[3] Indifferent ⇒ SKIP TO PREAMBLE TO Q21

☐[4] Somewhat oppose

☐[5] Strongly oppose

☐[99] Don't know/not sure ⇒ SKIP TO PREAMBLE TO Q21

SHOW ILLUSTRATION TO THE RIGHT AS PER THE CONSERVATION RATE



About Your Account's Rate – the energy charge

ASK Q20b IF Q20a = 1, 2, 4 OR 5; ELSE SKIP TO PREAMBLE TO Q21

20b. For what reasons does your organization [INSERT FROM Q20a: VALUE LABEL FOR CODE 1, 2, 4 OR 5] **the conservation rate that applies to this account?** (In consideration of privacy issues, please do not reference any individuals' names.) (OPEN-END)

Other Rate Structures – the energy charge

As suggested earlier, there are other types of energy charges utilities can implement to charge businesses and organizations for their consumption of electricity.

From a customer perspective, each type of energy charge may be viewed differently, depending on how easy it is to understand, how easy it is to 'see' the signal to conserve electricity, how easy it is to act on, and among other considerations, how fair the energy charge is perceived to be.

With these considerations in mind, please indicate if your organization would support or oppose each type of energy charge presented.

Other Rate Structures – the energy charge

21. Would your organization support or oppose a flat energy charge whereby the price per kilowatt hour of electricity is constant regardless of the amount of electricity used in a monthly billing period, or would your organization be indifferent about it.

In considering your response, please consider only this rate structure – not what the price may be.

☐1 Strongly support

☐2 Somewhat support

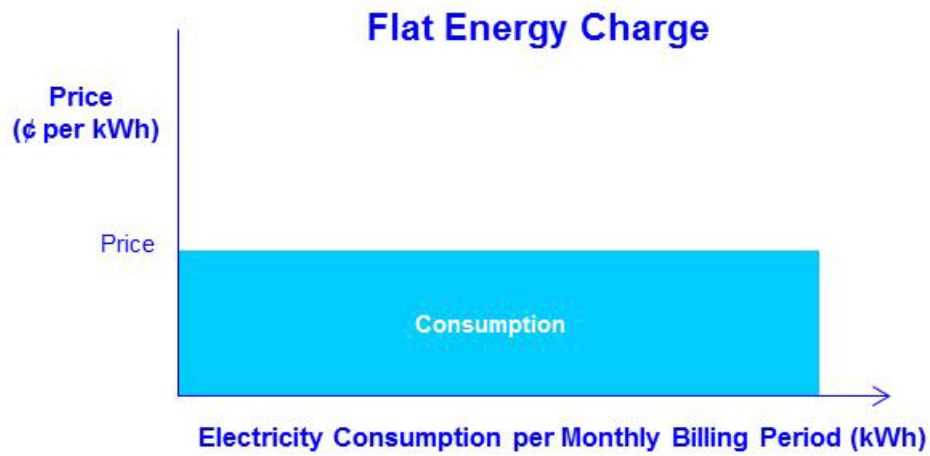
☐3 Indifferent

☐4 Somewhat oppose

☐5 Strongly oppose

☐99 Don't know/not sure

SHOW ILLUSTRATION TO THE RIGHT AS PER THE FLAT ENERGY CHARGE



Other Rate Structures – the energy charge

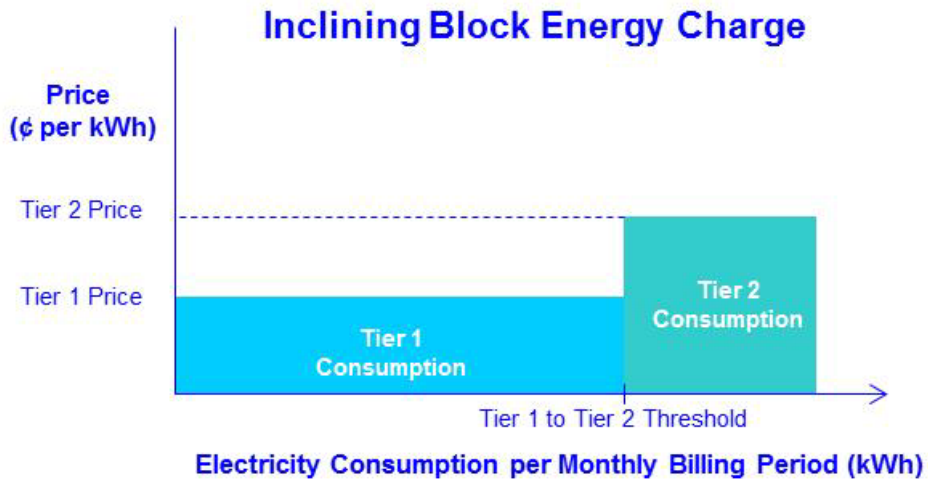
22. Would your organization support or oppose an inclining block energy charge whereby the price per kilowatt hour of electricity is lower for the first portion of electricity used, and steps up to a higher price for any additional consumption beyond a specified threshold in a monthly billing period, or would your organization be indifferent about it.

In considering your response, please consider only this rate structure – not what the prices may be.

- ☐[1] Strongly support
- ☐[2] Somewhat support
- ☐[3] Indifferent
- ☐[4] Somewhat oppose
- ☐[5] Strongly oppose

☐[99] Don't know/not sure

SHOW ILLUSTRATION TO THE RIGHT AS PER THE INCLINING BLOCK ENERGY CHARGE



About Your Account's Rate – the demand charge

'Demand' is the rate that electricity is being consumed at any given moment in time and is typically measured in kilowatts (kW). It is not to be confused with 'Energy' which is the total amount of electricity consumed over a period of time.

The demand charge is the price per kilowatt of electricity ($ per kW) and is charged to only those accounts that sometimes consume electricity at a moderate to high rate – above a specified threshold.

23. Prior to this survey, had you ever heard of a demand charge?

☐[1] Yes ⇒ CONTINUE

☐[2] No ⇒ SKIP TO PREAMBLE TO Q26

☐[99] Don't know/not sure ⇒ SKIP TO PREAMBLE TO Q26

About Your Account's Rate – the demand charge

24. Based on your understanding, does the rate structure for this account include a demand charge?

☐[1] Yes ⇒ CONTINUE

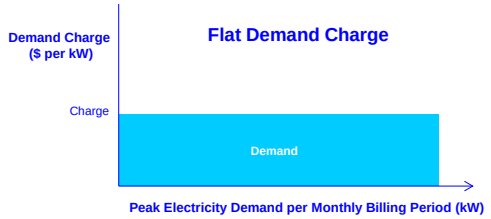
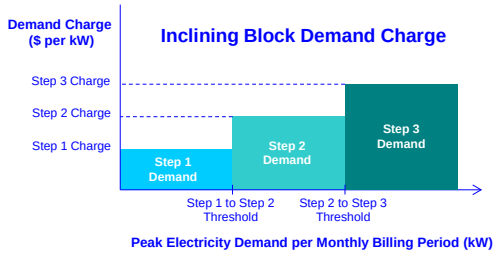
☐[2] No ⇒ SKIP TO PREAMBLE TO Q26

☐[99] Don't know/not sure ⇒ SKIP TO PREAMBLE TO Q26

About Your Account's Rate – the demand charge

25. Please indicate which one of the following types of demand charges you believe applies to this account.

The demand charge for this account is…

☐[1]	Flat Demand Charge The demand charge is constant regardless of the rate at which electricity is being used.	
☐[2]	Inclining Block Demand Charge The demand charge steps-up to a higher amount when electricity is being used at a high rate. This is known as an inclining block demand charge.	
☐[98]	Other type of demand charge: please specify _____	
☐[99]	Don't know/not sure	

About Your Account's Rate – the demand charge

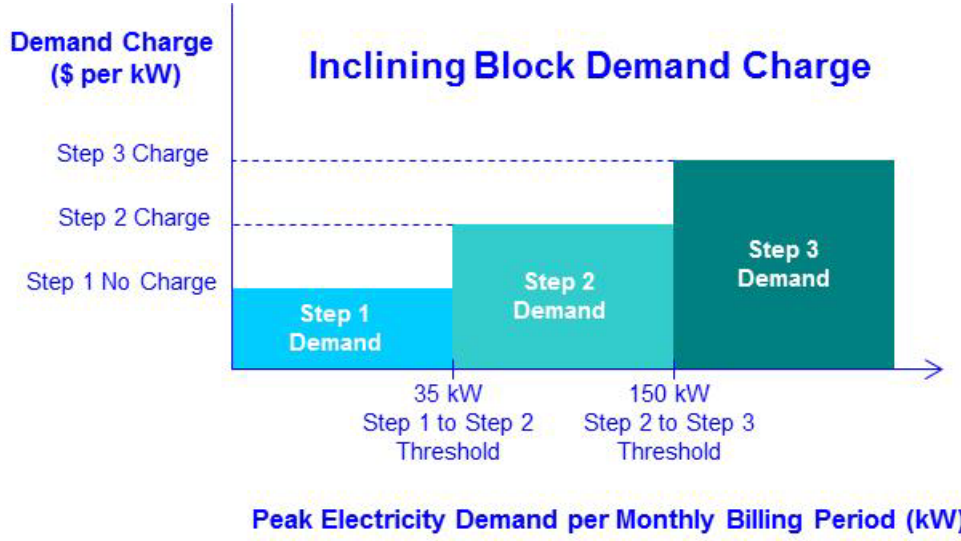
In fact, all Large and Medium General Service accounts have a demand charge, because their peak (maximum) rate of consuming electricity reach 35 kW or over – at least once, and at any time – in a year. As an example, an account with an average demand of 20 kW, but at one time reaches 35 kW or over will have a demand charge.

The demand charge is an inclining block whereby the charge steps-up to a higher amount when electricity is being used at a high rate.

This structure is designed to reflect the greater costs of the infrastructure and maintenance associated with the capacity to supply more power when required.

Here's a closer look at how it works:

1. **The price of an account's demand charge in a monthly billing period is dependent on the peak rate it consumes electricity in that month.**
2. **If the account's peak rate of consuming electricity in a given month never exceeds 35 kW, then there is no demand charge for that month.**
3. **If the account's peak rate of consuming electricity in a given month exceeds 35 kW, then there is no charge for the first 35 kW, but there is a Step 2 charge per kW for the next 115 kW in that month up to 150 kW, and a higher Step 3 charge per kW for the remaining kW.**



About Your Account's Rate – the demand charge

26. Having read a little more about the demand charge that BC Hydro uses for charging Large and Medium General Service accounts for their rate of using electricity, how easy or difficult would you say it is to understand how the charge works?

☐[1] Very easy

☐[2] Somewhat easy

☐[3] Somewhat difficult

☐[4] Very difficult

☐[99] Don't know/not sure

CONTINUE TO Q27 IF Q24=YES; ELSE SKIP TO Q32a

About Your Account's Rate – the demand charge

27. Which of the following statements best describes your awareness of the demand charge that BC Hydro uses to charge this [INSERT '**Large**' FOR SURVEY IDs 100,000 - 119,999; 200,000 - 219,999: INSERT '**Medium**' FOR SURVEY IDs 120,000 - 159,999; 220,000 - 259,999] **General Service account for the rate at which it consumes electricity?**

☐[1] Prior to this survey, I was fully aware that this account has a demand charge for the rate at which it consumes electricity

☐[2] Now that it has been mentioned, I had heard that this account has a demand charge for the rate at which it consumes electricity

☐[3] This is the first time I have heard that this account has a demand charge ⇒ SKIP TO Q29

☐[99] Don't know ⇒ SKIP TO Q29

About Your Account's Rate – the demand charge

28. How would you rate your actual understanding – prior to receiving this survey – of the demand charge that BC Hydro uses to charge Large and Medium General Service accounts for the rate at which they consume electricity?

☐[1] Excellent understanding

☐[2] Good understanding

☐[3] Fair understanding

☐[4] Poor understanding

☐[5] Very poor understanding

☐[99] Don't know

About Your Account's Rate – the demand charge

29. To what extent does this inclining block demand charge serve as an incentive in any of your organization's efforts to minimize electricity bills related to this account?

☐[1] It serves as a major incentive

☐[2] It serves as a minor incentive

☐[3] It serves no incentive at all

☐[99] Don't know/not sure

About Your Account's Rate – the demand charge

30. Assuming your organization wanted to do so, how easy or difficult is it to currently manage this account to minimize the total demand charges on the bill?

This might be done by turning off unnecessary or not-in-use equipment, staggering equipment start-up, performing energy-intensive processes during different shifts, changing thermostat set points, etc.

☐[1] Very easy

☐[2] Somewhat easy

☐[3] Somewhat difficult

☐[4] Very difficult

☐[99] Don't know/not sure

About Your Account's Rate – the demand charge

31. How much of an effort does your organization make managing this account to minimize the total demand charges on the bill?

☐[1] A great deal of effort

☐[2] A fair amount of effort

☐[3] A little effort

☐[4] No effort at all

☐[97] Not Applicable – there is little opportunity to manage the demand charges related to this account.

☐[99] Don't know/not sure

About Your Account's Rate – the demand charge

32a. Overall, does your organization support or oppose the inclining block type of demand charge that applies to this account, or is your organization indifferent about it?

In considering your response, please consider only this demand charge structure – not the associated prices.

☐[1] Strongly support

☐[2] Somewhat support

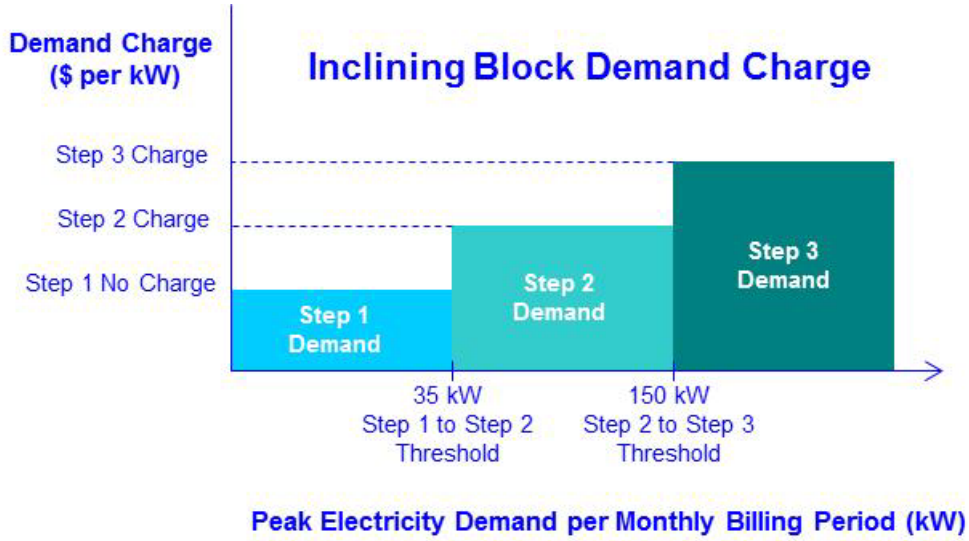
☐[3] Indifferent ⇒ SKIP TO Q33

☐[4] Somewhat oppose

☐[5] Strongly oppose

☐[99] Don't know/not sure ⇒ SKIP TO Q33

SHOW CHART ILLUSTRATING INCLINING DEMAND CHARGE



About Your Account's Rate – the demand charge

ASK Q32b IF Q32A = 1, 2, 4 OR 5; ELSE SKIP TO PREAMBLE TO Q33

32b. For what reasons does your organization [INSERT FROM Q32a: VALUE LABEL FOR CODE 1, 2, 4 OR 5] **the inclining block type of demand charge that applies to this account?** (In consideration of privacy issues, please do not reference any individuals' names.) (OPEN-END)

Other Rate Structures – the demand charge

There are other types of demand charges utilities can implement to charge businesses and organizations for their rate of consuming electricity.

From a customer perspective, each type of demand charge may be viewed differently, depending on how easy it is to understand, how easy it is to 'see' the signal to conserve electricity, how easy it is to act on, and among other considerations, how fair the demand charge is perceived to be.

With these considerations in mind, please indicate if your organization would support or oppose the following type of demand charge presented.

Other Rate Structures – the demand charge

33. Would your organization support or oppose a flat demand charge whereby the charge per kilowatt of electricity is constant regardless of the rate at which it is used in a monthly billing period, or would your organization be indifferent about it?

In considering your response, please consider only this demand charge structure – not the associated price.

- ☐1 Strongly support
- ☐2 Somewhat support
- ☐3 Indifferent
- ☐4 Somewhat oppose
- ☐5 Strongly oppose

- ☐99 Don't know/not sure

SHOW ILLUSTRATION TO THE RIGHT AS PER THE FLAT DEMAND CHARGE

About Your Account's Bill

34. Thinking about the total annual operating cost (including labour, other energy, rent/leasing, materials, etc.) at this organization's address, what percentage of it is attributable to the annual electricity bill for this account?

_____ % of total annual operating costs at this address are for this account's electricity use

☐[999] Don't know/not sure

About Your Account's Bill

35. How often do you or another decision maker at your organization look over this account's electricity bill?

☐[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 and/or our accounting department just pays it ⇒ SKIP TO Q37

☐[99] Don't know/not sure

About Your Account's Bill

36. And when you or another decision maker at your organization does look at the account's bill, which parts of it are typically looked at? (select all that apply)

☐[1] Total dollar amount owed, including taxes
☐[2] Total electricity consumption on the bill (kWh)

SHOW CODES 3 AND 4 ONLY IF: SURVEY IDS 100,000-259,999 (TREATMENT ACCOUNTS)

☐[3] Part 1 Energy charge
☐[4] Part 2 Energy charge or credit

SHOW CODES 5 AND 6 ONLY IF: SURVEY IDS 300,000-409,999 (CONTROL ACCOUNTS)

☐[5] Sub-total dollar amount specifically for each of the various energy blocks
☐[6] Sub-total electricity consumption specifically for each of the various energy blocks

☐[7] Sub-total dollar amount specifically for each of the various demand blocks
☐[8] Sub-total electricity consumption specifically for each of the various demand bocks

☐[9] Power factor surcharge

☐[10] Comparison to previous bills
☐[11] Daily average usage
☐[12] Bill due date

☐[98] Other: please specify _____

☐[99] Don't know/not sure

☐[97] No part of the bill in particular

About Your Account's Bill

37. To what extent does the total dollar amount of your electricity bills serve as an incentive in any of your organization's efforts to minimize electricity bills related to this account?

☐[1] Major incentive

☐[2] Minor incentive

☐[3] No incentive at all

☐[99] Don't know

About Your Account's Bill

38. Over the past 2 years, would you say the <u>total dollar amount</u> of this account'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/not sure

About Your Account's Bill

39. How much of an understanding does your organization have about the factors that cause any changes in this account's total electricity bill?

☐[1] A great deal of understanding ⇒ CONTINUE

☐[2] A fair amount of understanding ⇒ CONTINUE

☐[3] A little understanding ⇒ CONTINUE

☐[4] No understanding at all ⇒ SKIP TO Q41

☐[99] Don't know/not sure ⇒ CONTINUE

About Your Account's Bill

ASK Q40 ONLY IF Q38 =1, 2, 4 OR 5 AND Q39 = 1, 2, 3 OR 99 IN; ELSE SKIP TO Q41 [SKIP Q40 IF Q38=3/99 AND/OR Q39=4]

40. Which one of the following do you believe has been the most dominant factor in explaining the [INSERT **"increase"** IF Q38 = 1 OR 2; INSERT **"decrease"** IF Q38 = 4 OR 5] **in this specific account's total electricity bills over the past 2 years? Which do you believe has been the second most dominant factor? Any other factors? RANDOMIZE**

	Most dominant factor (select only one in this column)	Second most dominant factor (select only one in this column)	All other factors (select all that apply in this column)
Change in the method BC Hydro charges this account for its consumption of electricity (from a declining block energy charge to the conservation rate) (ONLY FOR MGS1/2/3 (SURVEY IDs 120,000-159,999; 220,000-259,999)	☐1	☐1	☐1
Change in the overall price this account is charged for its consumption of electricity	☐2	☐2	☐2
Change in the overall consumption level (total energy consumed) of this account likely due to longer/shorter operating hours	☐3	☐3	☐3
Changes by BC Hydro in the demand charge (price per kilowatt) (ONLY IF Q27=1 OR 2)	☐4	☐4	☐4
The peak rate of consumption as reflected in the demand charge (ONLY IF Q27=1 OR 2)	☐5	☐5	☐5
The addition, removal or change of equipment and machinery	☐6	☐6	☐6
Occupancy levels	☐7	☐7	☐7
Temperature/weather	☐8	☐8	☐8
Other factor: please specify _____	☐9	☐9	☐9
Other factor: please specify _____	☐10	☐10	☐10
Don't know/not sure	☐99	☐99	☐99
Not applicable – the account's bill never really changes	☐97		

Managing Electricity Use

41. Overall, how much of an effort would you say your organization is <u>currently</u> making to manage its use 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/Not sure

Managing Electricity Use

42. And compared to 2 years ago, would you say your organization is making more of an effort to manage its use 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/not sure

Managing Electricity Use – motivators

SKIP TO Q44 FOR ORGANIZATIONS WHICH MADE "NO EFFORT AT ALL" TO MANAGE IN Q41=4

In this section, we would like to learn about what motivated your organization to make an effort to manage its use of electricity over the past 2 years.

43. For each item in the table below, please indicate how much of a factor it has had on your organization's effort to manage its use of electricity over the past 2 years. RANDOMIZE

		Major factor	Minor factor	Not a factor	Don't know
a.	Due to economic downturn – we had to take more cost-cutting measures	☐1	☐2	☐3	☐99
b.	Just want operating costs to be as low as possible	☐1	☐2	☐3	☐99
c.	The incentive to conserve electricity that is built into BC Hydro's rate structure	☐1	☐2	☐3	☐99
d.	Overall level of electricity prices	☐1	☐2	☐3	☐99
e.	Overall level of natural gas prices	☐1	☐2	☐3	☐99
f.	To decrease pay-back time of capital investments	☐1	☐2	☐3	☐99
g.	Our suppliers and customers want us to conserve electricity	☐1	☐2	☐3	☐99
h.	Our employees want us to conserve electricity	☐1	☐2	☐3	☐99
i.	For the environment - it's just the right thing to do	☐1	☐2	☐3	☐99
j.	BC Hydro Key Account Manager (ONLY IF FLAGQ43=1)	☐1	☐2	☐3	☐99
k.	If applicable: Other factor (1): specify_____	☐1	☐2	☐3	☐99
l.	If applicable: Other factor (2): specify_____	☐1	☐2	☐3	☐99

Managing Electricity Use – barriers

In this section, we would like to learn about the barriers [INSERT '**your organization may have faced in its effort'** IF Q41= 1, 2 3, 99; INSERT '**that may have prevented your organization from making any effort at all'** IF Q41= 4] **to manage its use of electricity over the past 2 years.**

44. For each item in the table below, please indicate how much of a barrier it has been on your organization to manage its use of electricity over the past 2 years. RANDOMIZE

		Major barrier	Minor barrier	No barrier	Don't know
a.	Lack of access to funding for capital investment into energy efficiency	☐1	☐2	☐3	☐99
b.	Lack of executive support	☐1	☐2	☐3	☐99
c.	Lack of staffing/staffing requirements	☐1	☐2	☐3	☐99
d.	Lack of knowledge of where the opportunities for savings might be	☐1	☐2	☐3	☐99
e.	Lack of financial incentives for conservation program and energy efficiency	☐1	☐2	☐3	☐99
f.	Can't control employees' behaviour in regards to energy efficiency practices	☐1	☐2	☐3	☐99
g.	Insufficient pay-back of capital or operational investments in energy efficiency	☐1	☐2	☐3	☐99
h.	There are other operational priorities	☐1	☐2	☐3	☐99
i.	Takes too much time	☐1	☐2	☐3	☐99
j.	Current usage is already near its lowest possible level	☐1	☐2	☐3	☐99
k.	Currently leasing the property and no property changes are permitted	☐1	☐2	☐3	☐99
l.	If applicable: Other barrier (1): specify_____	☐1	☐2	☐3	☐99
m.	If applicable: Other barrier (2): specify_____	☐1	☐2	☐3	☐99

Other LGS/MGS Accounts at this Location

ASK Q45 ONLY IF FLAGQ45=1 (MULTI LGS/MGS ACCOUNTS AT SAME SITE); ELSE SKIP TO RULE FOR Q46

45. Due to the fact that your organization uses electricity via several LGS/MGS meters located at this service address, you were asked to complete the survey specifically in regards to the largest account at the location.

Among other questions, you were asked about your understanding of the account's rate structure, the ease and effort in managing its consumption, as well as your organization's overall opinion of the structure.

Would you agree that many of your responses in regards to that account generally extend to the other LGS/MGS account(s) at the same location?

☐[98] Yes, agree You may add a comment here if you wish: INSERT TEXT BOX

☐[998] No, disagree You may add a comment here if you wish: INSERT TEXT BOX

☐[99] Don't know/not sure

LGS/MGS Accounts at Other Locations

ASK Q46a ONLY IF FLAGQ46=1 (MULTI LGS/MGS SITES) = YES; ELSE SKIP TO Q47

46a. Our records indicate that your organization also has [INSERT COUNT OF ALL OTHER LGS/MGS] LGS/MGS account(s) at other locations. (Note that this figure might be even higher depending on how you consider your organization's hierarchy or structure.)

Approximately how many of these other LGS/MGS accounts would you say you are a primary or joint decision maker?

By this we mean you are involved in any or all decisions around capital investments, investments in energy-efficient equipment, production, energy management, maintenance of equipment, hours of operation and/or finance and accounting.

RECORD ABSOLUTE	⇒ CONTINUE
☐[98] None of these other accounts	⇒ SKIP TO Q47
☐[998] Don't know/not sure	⇒ SKIP TO Q47

LGS/MGS Accounts at Other Locations

46b. Would you agree that many of your responses in regards to the account referenced in this survey generally extend to the [INSERT ANSWER FROM Q46a] other LGS/MGS account(s) that you are knowledgeable of at the other location(s)?

By this we mean your responses in regards to your understanding of this account's rate structure, the ease and effort in managing its consumption, as well as your organization's opinion of the structure would likely be the same responses you would give in regards to the LGS/MGS accounts at the other locations.

☐[98] Yes, agree You may add a comment here if you wish: INSERT TEXT BOX

☐[998] No, disagree You may add a comment here if you wish: INSERT TEXT BOX

☐[99] Don't know/not sure

Permission for Linkage to Account History

47. The key objective of this survey is to collect the necessary information to inform our evaluation of the corporation's rate structures and pricing methods.

To facilitate this, it is important to analyze an account's consumption of electricity for a period dating back to 2009 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 this account has consumed over the past couple of 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.

May we please have your permission for BC Hydro to do this?

☐[1] Yes
☐[2] No

Interested in Participating in a Discussion Group about Electricity Rates?

48. SHOW ONLY IF FLAGQ48=1 (LOWER MAINLAND): **BC Hydro is tentatively planning to conduct some discussion groups in September with customers about their electricity rates, conservation and energy efficiency. For any one discussion group, we would like to invite customers who are similar to each other in their attitudes and opinions in these areas. This can be most effectively done by selecting customers from the original survey data. This can only be achieved by having a respondent's permission to link their survey responses to their contact information.**

SHOW FOR ALL: **If we conduct discussion groups in regards to electricity rates, conservation and energy efficiency and wish to invite you, may we please have your permission to link your survey responses to your contact information? Of course, your survey responses would remain confidential in a secure environment and would not be used on an individual basis for other purposes.**

☐[1] Yes

First Name: Last Name:

Business Telephone:

Business Email:

☐[2] No thank you

Incentive Prize Draw

49. Please provide 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. Official rules and regulations are detailed here.

First Name: Last Name:

Business Telephone:

Business Email:

☐ No thank you

Appendix F Focus Group Report

BC Hydro's
Large General Service
and
Medium General Service
Conservation Rate Structure

Qualitative Research Report

November 5, 2014

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Bengtson
MARKET RESEARCH

Table of Contents

Executive Summary

Introduction

In this qualitative study, four focus groups were conducted with LGS/MGS customers to explore four main research areas. Firstly, customers were guided through a discussion about their attitudes and opinions of the conservation rate's energy charge as well as the demand charge. Secondly, drivers and enablers of conservation were explored followed by barriers to conservation. Finally, after reviewing and gaining a better understanding of the current rate structure, each ninety minute focus group concluded with customers suggesting alternate rate structures.

Key Findings

1. Opinions & Attitudes of the Conservation Rate Structure

Few customers have a full understanding of the rate structure

Out of all 18 focus group participants, only a few participants were able to correctly explain, unprompted, how the rate structure worked and verbally rationalize the rate structure from graphs. Even though participants were decision makers around the management of accounts and had previously completed an online survey which aided their understanding of the rate structure, few participants began the discussion with a solid understanding of the rate structure.

As the focus group progressed, a video explaining the rate structure was shown and the rate structure was explained by the moderator. Even after both were delivered, participants continued to demonstrate key gaps in understanding that in many cases remained even at the end of the focus group.

Larger government and public sector customers had the best overall understanding of the elements of the BC Hydro rate structure.

"As Energy Manager, I'm the only one who understands it."

Municipality

Energy and demand charges are both perceived by customers as confusing and are rarely used to conserve energy

Customers understand, at least in principle, the rationale behind both energy and demand charges; however, the charges receive minimal, if any, attention from customers when reading the energy bill. Rarely are steps taken to track these charges in the long term or through real time monitoring.

"I look at the kWh, just out of curiosity, and then the total. Our company has made some effort to conserve so we also take a look that there's no power factor for electricity but that's about it".

Printing

"We monitor in real time and have techs to go out when we're approaching the peak demand. They can switch some things between gas and electric".

Resort

Energy conservation is a relatively low operational priority

Most customers estimated that electricity makes up about 2%-5% of operating costs in their business, while some customers who are less sure about their usage guessed in the range of 2-15%. While customers support taking steps to improve efficiency and reduce energy consumption, return on investment (ROI) is a major consideration as well as the capital cost and the lead-time needed to make improvements.

"We use a heat process so the more goods we manufacture, the more electricity we use".

Building Equipment

"We've done some of the simpler things but then the capital costs of the bigger upgrades- they have to be planned out so it takes a longer lead time to do those… There is a will to do it but what's the ROI going to be?"

Logistics

2. Conservation Drivers & Enablers

Customers mainly look at the total bill amount

Few customers take the time to dissect their energy bill because they have limited understanding of the rate structure let alone being able to manipulate the structure for budget projections or finding ways to save money.

"If there's a big change we look why [for the reasons] but otherwise if it's just $50 or $100 we don't do much".

Power Tools

"Our bill is very stable so I just look at the dollar amount and pay it".

Distribution

3. Conservation Barriers

Rate structure is complicated & difficult to understand

Most customers fail to fully understand the Part 1 and 2 energy charge in the rate structure due to weak knowledge on two key aspects of the energy bill calculation- the declining block structure seems counterintuitive for many customers while the concept of a rolling, historical baseline linking to an energy credit or charge is confusing to most customers.

"If we had a better idea what the other factors were [in the calculation besides the total bill amount], we would probably look at it."

Social Services

"[The most difficult things to understand are] the penalty and credit- the moving parts. It's not complicated in math but hard to get people's attention to explain. If you can't explain it in two slides and 30 seconds in a meeting, you're done".

Parks & Recreation

"It's job security for me because it's so hard to understand. Do you know how long it has taken me to understand it? I have explained it to our senior team for three years and everyone just goes blank and says, 'What do you think? Tell us what to do'".

Tourism

"Are Part 1 and Part 2 the same as Tier 1 and Tier 2? That I find confusing. So, what is Part 2 then?"

Social Services

In Part 1, the 14,800 kWh threshold for the Tier 1 charge comes across as an ambiguous value. Even customers in Group 1, who had the strongest understanding of the overall rate structure, did not know how or where this value was generated.

"Where did the 14,800 kWh come from? It seems completely arbitrary".

Building Equipment

Customers do not feel empowered to conserve energy

Calculations are too complicated to engage or empower customers because there are various inputs that are perceived as too difficult for customers to measure and manage themselves. As a result, management is disconnected from analyzing and acting on bills to manage the account's electricity consumption and usually just makes payment unless there is a major spike in the **total bill amount**.

"I have a degree and I look at it and have no idea how they generate it or where the numbers come from. It's almost incomprehensible".

Building Equipment

"I don't do the math for people. I just lay out what they will save and give the price per kWh. If I get into details, their eyes will just glaze over".

Parks & Recreation

"The fact that you can't communicate it to anyone is a really big problem. Right now, I'm the only one who wants to look at [the bill] and everyone else is like, 'Oh my God, get serious' and if you don't look at it you can't understand it".

Tourism

"Accounts Receivable flags [bill] increases but it would actually be interesting to flag decreases too."

Non- Profit

Customers are unable to know when their energy consumption is approaching their baseline which makes it difficult for them to actively engage with their energy consumption in real time.

"Who is going to tell me [in advance] if I'm going over or under the baseline?"

Power Tools

"I've tried to look stuff up from smart meters and you can get some information but not everything so you're just waiting until the end of the month [when the bill comes]".

Logistics

Concept of the Baseline is particularly problematic

The calculation of a rolling, historical baseline is difficult for customers to understand and put into practice for budgeting in their businesses. Being a moving average, it's difficult to isolate how a single change will impact the total bill amount in both the short and long term.

An energy credit from energy conservation is perceived as short term given the rolling baseline calculation will only result in savings at the Part 2 price for three years. Each year, the total energy reduction will be absorbed into one third of the historical baseline calculation resulting in decreasing credits over time. By the third year, the credit will be fully absorbed into the baseline and savings will cease from the high Part 2 rate. Other than overall bill savings, this lessens the perceived benefit of making an initial capital investment for improvements.

"The average part isn't [complicated] but the percent above and below part [in Part 2] for the credit or penalty is quite complicated. I'm not a numbers person so I would say it's complicated".

Agriculture

"My understanding is that the baseline was established through the Power Smart program and at some point it will reset".

Distribution

Energy Charge is perceived as a penalty

Customers tend to overlook the potential for savings from the Part 2 energy credit and instead focus on the negative impact of the energy charge. The energy charge becomes the focus of the rate structure instead of supporting the intended message to promote energy conservation.

Adding infrastructure is always perceived to have a negative impact on the total bill. Increased energy needs will result in an energy charge that will be gradually absorbed into the creation of a new baseline.

"If I add to my business, I don't want to be penalized for the next three years".

Industry

"I didn't realize it was a rolling average so we won't be penalized forever".

Forestry

"My problem is when you add infrastructure you will automatically pay double because you will be above your baseline".

Tourism

"We're looking to increase our usage [and grow our business] over the years, not keep it the same. It's a distinct disadvantage to grow".

Building Equipment

Fairness of the rate structure

The Tier 1 value and energy charge had a strong emotional response. Customers did not know where the 14,800 Tier 1 value originated from or whether it was fixed or calculated. Also, the Part 2 energy charge was strongly perceived as an unfair "penalty" in all groups and even went so far as to make participants in some groups feel in wanting to know why it existed and where it came from.

"Where did the 14,800 kWh come from? It seems completely arbitrary".

Building Equipment Customer

"There's a direct correlation between growing my business and paying more".

Distribution

"We're saving energy but that benefit is gone after three years and [BC] Hydro is still benefitting by having more supply and not having to build another dam".

Printing

4. Alternative Rate Structures

Eliminate the baseline

Customers suggested eliminating the baseline because it is so difficult to understand and use to manage their electricity bill. It was thought that eliminating the baseline would simplify the rate structure by minimizing the number of moving parts and eliminating the need for tracking and analyzing previous consumption patterns. A simpler rate structure would also make the bill easier to explain and explain to others which would allow for an energy conservation agenda to be adopted more in business.

"An inclining block structure alone would be easier and just get rid of the baseline".

Tourism

Increasing block structure or flat rate

Most customers also agreed that an inclining block or flat rate structure would be an incentive to conserve energy because the more you use, the more likely you are going to have to pay a higher price for electricity.

"With the first block X amount, the next block X amount, et cetera- that's very logical and easy to explain to people".

Printing

Background

The LGS and MGS Customer Classes: BC Hydro's Large General Service (LGS) and Medium General Service (MGS) rate classes are comprised of some 24,000 BC Hydro accounts that purchase electricity at distribution voltage and have a monthly peak demand – the rate of electricity usage – above 35 kilowatts (kW). LGS refers to general service accounts with a monthly peak demand equal to or greater than 150 kW and/or whose total energy consumption in any 12 month period is greater than 550,000 kilowatt hours (kWh). MGS refers to general service accounts with a monthly peak demand that is equal to or greater than 35 kW but less than 150 kW, and whose energy consumption in any 12 consecutive periods is less than or equal to 550,000 kWh.

This diverse group of customers includes a wide range of facility types, such as hospitals, manufacturing facilities, office buildings, retail stores, and the common areas of multi-unit residential buildings.

Change in Rate Structure: In January 2011, LGS and MGS customers began their transition from being billed under a declining block energy charge for their consumption of electricity to a rate structure designed to encourage conservation. Under the LGS/MGS conservation rate structure, the incentive to conserve is provided via a bill credit when monthly consumption is lower than historical average consumption and an additional charge when consumption is higher.

LGS customers transitioned to the conservation rate structure collectively as one group on January 1, 2011. Based on their monthly peak demand for electricity in the reference year, MGS customers were further disaggregated into three sub-groups so as to facilitate their staggered transition to the conservation rate structure. The MGS1 group started on an interim rate shaping stage on January 1, 2011 and transitioned to the conservation rate structure April 1, 2012. The MGS2 and MGS3 groups started on an interim rate shaping stage in January 1, 2011, and transitioned to the conservation rate structure April 2013.

Evaluation of the Conservation Rate Structure: Having already completed an evaluation of the LGS and MGS Conservation Rate for up to fiscal year ended March 31, 2012, Power Smart Evaluation is currently embarking on an evaluation of the rate in regards to fiscal years 2013 and 2014. Findings are also intended to inform the comprehensive Rate Design Application (RDA) in 2015, and provide support should there be any proposed changes to the LGS and/or MGS rate structures.

The scope of the current evaluation is to be comprised of three components: 1) estimates of the electric energy conservation effects via statistical techniques, 2) general assessment of customer awareness, understanding and support of the conservation rate via quantitative research, and 3) detailed customer insights and diagnostics of the conservation rate via this qualitative research. This report is strictly in regards to the qualitative research.

Research Objectives

The broad objective of this qualitative research is to gain a deeper, first-hand understanding from LGS and MGS customers about their attitudes and opinions of the conservation rate structure. As the quantitative research was completed in advance of this qualitative phase, findings from the survey were used to identify exact areas in want of further exploration. The demand charge was not fully explored in all groups due to time constraints. The specific objectives of the research were:

- Explore customer attitudes and opinions of the conservation rate's energy charge as well as the demand charge, including:
  - Understanding of the rationale for the conservation rate structure;
  - Understanding of the two charges, areas of confusion, areas of perceived complexity;
  - Extent that each of the two charges serve as an incentive to conserve;
  - Understanding customers' internal mechanism of acting on each of the two charges;
  - Perceived fairness of each of the two charges;
  - Reasons for supporting or opposing the charges.

- Explore other reported drivers and enablers of conservation, including:
  - Extent that price, total bill amount, etc. serve as an incentive to conserve;
  - Perceived hierarchy of the drivers of conservation, including energy charge, demand charge, price, total bill amount, environment, etc.

- Explore reported barriers to conservation, including:
  - Confusion around the conservation rate;
  - Lack of access to funding for energy efficiency upgrades, lack of knowledge, other priorities, etc.

- Explore customer preferences and support of alternative rate structures:
  - Would a different rate structure send a clearer, more easily understood signal to conserve?
  - Would a different rate structure be easier to act upon in terms of conserving?
  - Would a different rate structure be perceived as being fairer?

Methodology

Approach – In view of the study objectives, the types of participants, logistics, and cost implications, focus groups with BC Hydro account decision makers from the Greater Vancouver Area was considered the best approach to achieve the research objectives.

Group Composition – Based on the quantitative research concerning customer awareness, understanding and support of the conservation rate, four group compositions were recruited. As part of the quantitative research, respondents were asked if they would be willing to participate in future research, and these customers were then contacted via telephone/email and asked if they would participate in these focus groups. The focus groups were conducted by Bengtson Market Research, an independent research facility, in downtown Vancouver at 7:30 a.m. and 12:00 pm on September 23 and 24, 2014. Groups were segmented by organization type in order to maintain discussion flow. As much as possible, organizations with Key Account Managers (KAMs) at BC Hydro were grouped together to further promote group homogeneity. The groups were segmented as follows:

GROUP 1 - Government/Public Sector, Tier 1-3, LGS/MGS1 Accounts, all find the energy charge serves as an incentive;

GROUP 2 - Customers who find the Conservation Rate Difficult to Understand/Non-KAM'd/Non-Gov't public sector;

GROUP 3 - Customers Opposed to the Conservation Rate/ Non-Gov't public sector;

GROUP 4 - Non-KAM'd/Non-Gov't public sector customers who have aided awareness of the conservation rate, say it serves as an incentive, and put at least a fair amount of effort into managing their use of electricity.

Across all groups, LGS and MGS customers were similar in their awareness, understanding, and opinions expressed. This might have been partially due to the recruitment and the mixed composition of the groups such that it might have been difficult to sense any differences between these 2 customer groups. But moreover, even if we had conducted LGS-only and MGS-only groups, we still may not have heard anything different between them. Therefore, it was not necessary to segment these groups in the research findings.

The research findings presented in this report are purely qualitative and are thus designed to be illustrative rather than statistically representative in nature. Qualitative research is utilized for getting deeper insights on the how's and the why's, deeper insights on understanding and opinions, deeper understanding of the breadth/continuum of opinions, and hearing from the subject first hand and in their own words. Qualitative research allows for an in-depth understanding of human behavior by utilizing a cross-section of a population to explore the range of peoples' ideas, attitudes, or opinions. Conclusions do not reflect the extent to which something is happening or the percentages of LGS and MGS customers who possess certain attitudes or opinions. Thus, this report documents perceptions, not facts. Participants may hold views based on incorrect information; these perceptions are reported here.

1. Opinions & Attitudes of the Conservation Rate Structure

Customers began the focus groups with gaps in understanding and, 90 minutes later, many still did not have a clear picture

While overall GRP 1 had by far the most knowledgeable participants, many of the participants acknowledged that they did not know all of the finer points of the rate structure. Most were either primary drivers or key participants in discussions about how to reduce consumption and improve efficiency within their organizations; however, not all actively engaged with systematically tracking and analyzing usage and demand charges as would be expected for someone in their position.

"I would have to recall the [rate] structure from a workshop. I don't use it on a daily basis".

Parks & Recreation

"My understanding of it all [the rate structure at the beginning of the focus group] is probably only 75%... [At end of watching video] I still couldn't tell someone off the street exactly what is going on".

Forestry

"Admittedly, I've never actually done any calculations around the Conservation Rate".

Municipality

Perceived rationale of the rate structure

The intended conservation of the rate structure is not clear to customers. The message that comes across most often is that if energy consumption increases, an energy charge will be applied as a penalty for placing increased demand on BC Hydro as the energy supplier.

For customers, they see the benefits of conserving energy only lasting three years but the benefits to BC Hydro are much bigger and long term.

"If you use more than the three year average, you'll pay twice as much for electricity. It's an incentive for them to sit up and pay attention".

Property Management

"I think they [BC Hydro] are trying to crack down on consumption".

Logistics

"We're saving energy but that benefit is gone after three years and [BC] Hydro is still benefitting by having more supply and not having to build another dam".

Printing

Perceived areas of confusion and complexity

Energy charge- The concept and calculation of the baseline as a rolling, historical average was perceived as both confusing and complicated for customers to understand and apply for interpreting their energy bill and conserving energy. Customers were also confused what rate the Part 2 energy charge was calculated at compared to Part 1 rate.

"[The most difficult things to understand are] the penalty and credit- the moving parts".

Parks & Recreation

"Is the energy charge done at the same rate as Tier 1 or 2?"

Printing

Demand charge- Most customers failed to understand the difference between an energy charge and a demand charge. Even after the concept of demand charge was explained using the analogy of a garden hose filling a bucket with water, few were able to fully understand the difference between the charges.

"[You can lower the demand charge by] using less power so there's not as much demand for your operations"

Agriculture

Charges as incentives to conserve energy

Energy charge- Customers know that their energy bill is related to the total amount of energy used without getting into the details specifically for the energy charge. The total bill amount drives conservation more than the energy charge.

"Our industry is coming out of a recession so now instead of getting a credit we get a charge. Instead of running 4 machine centers we're operating 5".

Forestry

Demand charge- Few customers look at the demand charge on their energy bill let alone analyze it to find ways to lessen peak demand and reduce their total bill. For one respondent, the demand charge was used as a type of barometer for measuring how well business is doing but certainly not viewed as an incentive to change.

"I look at the kWh, just out of curiosity, and then the total. Our company has made some effort to conserve so we also take a look that there's no power factor for electricity but that's about it".

Printing

"The key factors for me are power factor and demand. I can tell how well my business is doing by looking at the demand [charge]".

Film Production

Customers' energy monitoring mechanisms

Energy charge- Few customers have any way of tracking energy consumption relative to their baseline to avoid incurring a Part 2 energy charge.

"I need to be able to see on my meter, myself, if I'm going over my baseline".

Agriculture

Demand charge- Few customers have a way of monitoring demand charge at any given time or have a system in place to reduce energy demand during peak periods. Out of all focus group respondents, only one large customer reported having any type of mechanism in place.

"We monitor in real time and have techs to go out when we're approaching the peak demand. They can switch some things between gas and electric".

Resort

Perceived fairness of the rate structure and its components

Without any explanation on the bill or in the video to explain the rate structure, the value of 14,800 kWh in Part 1 seemed completely arbitrary to customers.

Customers also perceive the energy charge as being unfair for a growing business that would have growing energy needs. In this case, the BC Hydro Conservation Rate employed has unintended negative impact on the development of customers' businesses.

The demand charge is better accepted as being fair because the cost structure is clear and the link to paying more for higher energy demand is clear to customers.

"Where did the 14,800 kWh come from? It seems completely arbitrary".

Building Equipment

"There's a direct correlation between growing my business and paying more".

Distribution

"If I add to my business, I don't want to be penalized for the next three years".

Industry

Reasons for supporting or opposing the charges

Energy charge- Customers need to be able to monitor energy consumption relative to the baseline in real time so that they are empowered to control their energy bill.

"Who is going to tell me [in advance] if I'm going over or under the baseline?"

Power Tools

Demand charge- Customers understand why the demand charge matters yet few feel any reason to actively engage with it as part of their bill.

"They've got to build the lines bigger because when warehouse lights go on, the system has to be able to power the lights as well as the rest of the neighborhood."

Logistics

2. Conservation Drivers & Enablers

Customers mainly look at the total bill amount

For most companies the 'bottom-line' is the primary driver for energy conservation. Most companies picked the low-hanging fruit, such as lighting and retrofits, and then chose not to pursue further conservation projects unless they received an incentive from BC Hydro. For some of the larger companies, the incentives for conserving energy were either linked to overall social responsibility or the desire to be perceived as environmentally conscious or "green" for corporate image or business development purposes as well. Generally, most companies support a conservation rate as long as it does not impact their bottom line. For some organizations, having a "green" image was part of their mission; while in other sectors, energy conservation was part of the criteria for bidding on projects.

"[Management] wouldn't even know if [the total amount] looks crazy because they don't have any reference to the previous bills".

Municipality

Replacing old equipment opens the door for energy efficient technology

When it comes time for equipment to be updated or replaced, most customers reported being aware of and considering more energy efficient technologies. The forced need to purchase a new product is an ideal time for more energy efficient products or process options to be seriously considered in most businesses.

"We had to replace equipment anyway so let's put something more efficient in".

Film Production

"Our warehouse lighting was due for an upgrade anyway".

Forestry

Investing in conservation can create business opportunities

One unique comment from a participant showed how customers in some sectors may be able to benefit from demonstrating environmentally-friendly business practices when bidding on projects. While this example only arose in one focus group from one participant, there may be other sectors where this driver could be leveraged to promote energy conservation among BC Hydro customers.

"For some clients, you have to give an environmental statement and if we can say we've done this, this, this, it's advantageous and it has gotten us business that we wouldn't have gotten otherwise".

Industrial

Affinity to energy conservation varies by sector

It was apparent that some sectors have a lower or higher than average interest in energy conservation. Companies that are able to bill energy consumption back to clients (either directly or as a pass-through cost) or companies where profits are directly related to energy consumption, like manufacturing, are less concerned with energy conservation. On the other hand, for companies that are dependent on tourism or the environment, energy conservation is more important as part of their social marketing.

"We bill clients back for power consumption and there's a surcharge on top of that".

Film Production

"If I have work to do, I'm not worried that my power bill is going to go up. I just can't. Get it in, get it done, get it paid".

Manufacturing

"We report on our environmental footprint every year so it's about more than just [energy] cost… plus our industry is directly tied to climate change".

Tourism

"The big driver in the city is decreasing greenhouse gas not reducing energy. That is the target".

Parks & Recreation

"We have an environmental policy, a sustainability policy, and that sort of thing. Our mission statement gives support to this kind of thing. It's pretty green right now so that helps in a general sense".

Municipality

3. Conservation Barriers

Customers need to understand the rate structure before they can conserve energy

There were a number of conservation barriers that arose across all groups. A key concern was return on investment (ROI) or needing some kind of financial support or incentive for expensive energy conservation projects. Some unique sectors were also identified that either had unique reasons for having minimal interest in conserving energy or unique financial restraints on capital expenditure. Then, on the other hand, some companies felt that the cost of energy was low enough to not make conservation a priority.

"Who is going to tell me [in advance] if I'm going over or under the baseline?"

Power Tools

Return on investment (ROI) is a key consideration for clients

Customers reported that the total amount saved and the timeline for savings are key considerations for getting projects approved. There needs to be enough incentive for change instead of maintaining the status quo, especially for major projects requiring high levels of financial planning and investment.

"We've done some of the simpler things but then the capital costs of the bigger upgrades- they have to be planned out so it takes a longer lead time to do those… There is a will to do it but what's the ROI going to be?"

Logistics

"If I tell my Head Office the savings [payback] is in four or five years they go, 'Are you kidding me?'. Most of the time the answer is no".

Advertising

"The cost for what it would be to get below my baseline continually is just not worth it".

Film Production

Customers need financial support or incentives

All four focus groups noted how expensive many of the capital upgrades can be for businesses. This sentiment was especially strong for medium businesses and those dependent on government allocated budgets. Having an available source of funding, a subsidy, or other types of incentives to support energy conservation improvements was positively noted by customers.

"We definitely needed [Power Smart] participation to make it happen [switching the lights]".

Distribution

"When I think about the projects we've done, it's often because we've gotten some kind of capital funding".

Education

"[If it wasn't subsidized,] we might have only done a fraction as opposed to doing everything at the plant. We didn't really care about the storage area because the guys don't work there but we did it anyway".

Forestry

A rate structure perceived as complex does not support active energy management

Customers are not opposed to reviewing and managing their energy bills and electricity consumption, in general, but the perceived complexity of the current BC Hydro rate structure does not promote customer engagement. Many customers commented how they review other types of bills (i.e. natural gas) but continually commented that the BC Hydro rate structure is unnecessarily complex. As a result of this complexity, customers felt disempowered in actively managing their account and controlling their total bill amount.

"Who is going to tell me [in advance] if I'm going over or under the baseline?"

Power Tools

"If I can't understand my bill, how can I possibly know how to save money?"

Printing

"I've tried to look stuff up from smart meters and you can get some information but not everything so you're just waiting until the end of the month [when the bill comes]".

Logistics

Electricity is believed to be cheap

When total bill amounts are stable they are usually acceptable to customers. If rates were to significantly change- and the acceptable amount of change was not defined in this research- it would get the attention of customers. Customers across all groups generally noted that a significant spike in their bill would get some kind of additional attention.

"If energy was more expensive to get people's attention by being 4% of operating cost instead of 2%, it would get their attention… Rates are low enough that the average bill is still low".

Parks & Recreation

Some sectors have difficulty justifying capital upgrades

Some non-profit and public service sectors explained how it was difficult to justify large capital upgrades when money should be allocated toward actual programming. Further research would be needed to quantify the extent and limits of this finding.

"We just had a contractor in to give me a price on upgrading outside lights to LED and he told me it was going to be $20,000… We're non-profit so I can only justify so much in our facilities".

Non-profit

"The bottom line is money. Money saved goes to the classroom".

Education

Most customers think there is a limit to what can be done

All customers were able to describe some type of energy conservation steps that were taken in their business to conserve energy like changing lighting, installing sensors, or retrofits; however, additional steps were more difficult for many customers to identify once the most obvious, major changes were achieved. Continual improvements require extensive planning and longer term commitment.

"I've done everything I can do for a small business [to conserve energy]".

Fuel Tankers

"There comes a point where you've done everything you can and there's nothing more you can do. I can't just turn off my pumps and my lights. My biggest motivation is the bottom line of my business".

Agriculture

"We've done most of the simpler things but then the capital costs of the bigger upgrades- they have to be planned out so it takes longer lead time to do that".

Logistics

4. Alternative Rate Structures

The following alternatives were suggested by customers to make the billing process more fair and easy to understand:

Customers suggest to adopt an inclining block structure or flat rate

For most customers, a declining block structure seemed counterintuitive. Across all groups, customers agreed that having block rates continually increase would be easier to understand and explain to others in their business, as well making forecasting and budgeting easier. More importantly, it would also send a clearer, more easily understood signal to actually conserve and manage electricity. Few customers mentioned that an increasing rate structure would be a disadvantage to large energy users.

"An inclining block structure alone would be easier and just get rid of the baseline".

Tourism

"With the first block X amount, the next block X amount, et cetera- that's very logical and easy to explain to people".

Printing

"[If the declining block structure was eliminated and the rates were increased,] it would be a lot easier to explain to people".

Property Management

"When [other participant] said the second part was cheaper, I was shaking my head but you're right- it is cheaper".

Forestry

Customers suggest to eliminate the baseline

Eliminating the baseline would make calculations simpler for customers by eliminating the need to know the three previous years' consumption which many companies do not track or analyze. By making all bill calculations based on consumption figures from the current billing period, better understanding and analysis of the bill would be possible.

"I understand it's a conservation driven model but you need a pass or something if you're adding infrastructure or you need a way to review the baseline... If I add a piece to my business, I don't want to be penalized for the next three years".

Tourism

"Are Part 1 and Part 2 the same as Tier 1 and Tier 2? That I find confusing. So, what is Part 2 then?"

Social Services

Conclusions

The LGS/MGS Conservation Rate Structure is viewed by very few focus group customers as a structure that compels or motivates energy conservation. Even the few who have a solid grasp of the rate structure say it is still very complicated and almost impossible to explain to others in their organization. This disaffirms 'buy in' from rank and file employees to senior managers and does not help encourage the efficient use of electricity. Although these customers are somewhat aware that their organizations can take advantage of the increased financial incentives through the Conservation Rate, only the largest and especially those with Key Account Managers (KAMs) continuously monitor their energy and demand charges with an eye to keeping their usage below historical baselines and actively work to lower peak demand.

Most LGS/MGS customers do the easiest upgrades, such as lighting or staggered high draw equipment start-up, and only make these changes because a BC Hydro incentive is offered to do so. Return on investment (ROI) is a key consideration in making conservation upgrades and many say the payback takes too long or require too high of a capital input. Most interestingly, most believe they have done as much as they can and are therefore resigned to the complicated rate structure. As a result, customers basically just look at the total amount of their monthly BC Hydro bill and pay it without much thought or reflection.

Part 1 and 2 of the current rate structure are flawed in the eyes of customers in many ways. First of all, the 14,800 kWh value in Tier 1 comes across as arbitrary. Then, the declining block structure of Part 1 seems completely counterintuitive. Possibly the most complicating part though is the baseline. Customers failed to understand that the baseline is based on the previous 3 years of the same month in a rolling average. Only a few companies had the record of previous energy bills needed to be able to predict and analyze long term energy consumption patterns. Lastly, the baseline being used to calculate an energy credit or energy charge, usually termed a "penalty" by customers, draws on too many moving numbers and calculations to be practical in terms of understanding a bill, forecasting, budgeting, or sharing energy conversations with colleagues or management. To customers, the penalty associated with the energy charge is a disincentive for business growth. Ultimately, the perceived complexity of the rate structure makes customers disengage from trying to understand the billing process or finding ways to reduce the total bill amount.

After struggling to understand the energy charge, customers had even more trouble understanding the finer points of the demand charge. Many customers failed to know that it was calculated based on the maximum amount of power needed during a billing period, measured in kilowatts at any given point in time. Few customers were able to apply the concept of the demand charge in a practical sense to find ways to reduce their total bill. Also peak load usage was more obvious to those in businesses or industries that used the kind of equipment where demand spikes are both common and obvious.

In terms of fairness, there were two main areas of dislike for customers. First of all, having learned about it in the focus groups, the Tier 1 value of 14,800 kWh seemed completely arbitrary. Secondly, the energy charge sent a clear message to customers that it was a disadvantage to grow as a business and use more energy. The reference that energy usage above the baseline would cost twice as much was cited in all four groups. Overall though, only the individuals with the strongest understanding of the rate structure became passionately critical of these intricacies, as most customers found the structure complex and were just trying to pick up the basics.

The two main alternative rate structures suggested by customers were to adopt an inclining block rate structure or flat rate and to discontinue the use of a baseline with energy charge and credit calculations. Customers felt that these changes, either individually or together, would make the rate structure more user-friendly and simpler to communicate to others. Through the adoption of a more simplified rate structure, businesses will be empowered to understand and possibly engage more with their hydro bills around energy conservation.

Appendix – Discussion Guide

BCH Rate Structure Discussion Guide

0:00 Introduction

Thanks for coming this evening. I am Steven and I'm with Bengtson Market Research. I'll be the moderator of this group discussion this evening.

How many of you have been to a focus group before? RAISE YOUR HANDS.

For those who have not, a focus group is just a group discussion. My job as the moderator is to make sure everyone has a chance to offer their opinion. And opinion means no right or wrong answer.

There are a few housekeeping items to briefly go over in view of privacy law.

First, you all know you are here because you participated in a BC Hydro survey about commercial electricity rates. This discussion tonight is a further exploration of that topic, and it is been conducted in furtherance of BC Hydro's electricity conservation mandate under the Clean Energy Act.

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 for assistance.

My clients may choose to observe these proceedings through this one-way mirror. If they are back there, it is just to make sure I am doing my job.

I need to remind you that you have been invited to participate as representatives of your organizations, and in that regard, I ask you to speak strictly from that perspective. Also, I ask that you do not offer comments or opinions about individuals by name or in any way that may identify them.

I am videotaping this discussion so that I do not have to take notes. The related video will be securely disposed of once I have completed my written report. You will not find this discussion on YouTube later tonight.

The report will not attribute any portion of today's discussion – including expressed attitudes and opinions – to any identifiable individuals or organizations.

0:05 - 0:10 Introductions

So let's go around the table and everyone tell me your:

- First name
- Company you work for (primary activity)
    - Government or public sector?
    - Non-governmental organization?
    - For profit – Independent, Franchise, Chain?
- What is your responsibility or decision making role regarding your monthly BCH bill?

0:10 – 0:20 Conservation Behaviour

How much do your electricity bills or costs impact the operation of your business? (%) In what ways do they have an impact?

MODERATOR: LISTEN FOR UNAIDED LANGUAGE AROUND CONSERVATION AND/OR IMPORTANCE OF UNDERSTANDING HOW RATES WORK.

How much of a priority is conservation or trying to manage electricity usage within your organization?

What actions – if any – has your organization taken to manage its use of electricity?

0:20 – 0:35 Conservation Drivers & Barriers

Conservation Drivers

What are the drivers/enablers of managing your organization's use of electricity and trying to minimize the bills? (UNAIDED)

PROBES:

- Price
- Total $ amount of bill
- Rate Structure
- Environment
- Social Responsibility

Here is a list of possible drivers or motivators for managing electricity. Please rank them in order of importance: the most important as a 1, the second most important as a 2, etc. There are also a few blanks for you to fill in ones that are not written down. **(REMEMBER THIS IS ABOUT THE MOTIVATORS OR DRIVERS OF THE RATE STRUCTURE NOT THE BENEFITS TO THE ORGANIZATION, e.g. "Keeping operating costs low to increase bottom line")**

- Avoidance of higher priced energy and/or demand tiers
- Overall level of electricity prices
- Total bill amount
- The environment
- Monetary incentives/rebates to make energy efficient upgrades
- Due to economic downturn – we had to take more cost-cutting measures
- To decrease pay-back time of capital investments
- Our employees want us to conserve/manage electricity
- Social responsibility (Good corporate citizen)

GO AROUND TABLE & ASK EACH RESPONDENT FOR 1, 2 & 3 AND WHY FOR EACH

Conservation Barriers

What are the barriers to your organization managing its use of electricity and trying to minimize the bills? (UNAIDED)

MODERATOR: LISTEN FOR UNAIDED LANGUAGE LOW PRICE OF ELECTRICITY, CONFUSION AROUND RATE STRUCTURE, LACK OF ACCESS TO FUNDING FOR ENERGY EFFICIENCY UPGRADES, LACK OF AWARENESS, LACK OF KNOWLEDGE.
PROBES:

- Confusion about the rate structure
- Lack of knowledge
- Lack of access to internal funding for energy efficiency upgrades
- Organization has other priorities
- Can't figure out how organization can get most savings for the amount spent on efficiency upgrades. Don't know where to start
- Lack of executive support
- Currently leasing and no changes allowed
- Insufficient payback of capital or operational investments in energy efficiency
- Lack of staffing/staffing requirements
- Lack of financial incentives for conservation program and energy efficiency

0:35 – 1:15 Awareness, understanding and opinion of rate structure

Imagine that your BC Hydro bill has just arrived. Can each of you, one at a time, walk me through this Hydro bill's movement through your organization?

GO AROUND THE TABLE & GET EACH RESPONDENT TO WALKTHROUGH THE BILLS JOURNEY WITHIN THEIR ORGANIZATION ON ROUTE TO PAYMENT.

PROBES:

- When the bill gets to your organization, what do you do?
- What is the first thing your organization look at? Second thing? Third?
- Other than paying the BC Hydro bill, do the $ totals trigger any other actions?
  - Need to get electricity costs down?
  - Need to conserve?
  - Need to understand where in your organization you use electricity and how much?

UNAIDED AWARENESS AND UNDERSTANDING OF THE RATE STRUCTURE
(THIS IS PARTICIPANTS' BELIEF ON HOW THEY ARE BILLED)

I recognize that you all have completed an online survey regarding the rate structure your organizations are billed on & some of these questions may appear redundant. **(MODERATOR KEEP IN MIND SOME RESPONDENTS WERE AIDED DURING WEB SURVEY)**

Would each of you please write down in bullet points how you believe the rate structure that your organization is billed on works? **(UNAIDED)**

WHEN ALL HAVE COMPLETED, GO AROUND TABLE AND GET THEM TO READ THEIR BULLET POINTS.

AIDED AWARENESS AND UNDERSTANDING OF THE RATE STRUCTURE

(MODERATOR FIRST SHOWS VIDEO THAT EXPLAINS RATE STRUCTURE. MODERATOR THEN SHOWS ILLUSTRATION AND READS FROM SCRIPT)

SCRIPT

Energy Charge

Definition of an Energy Charge:

'Energy' is the total amount of electricity consumed over a period of time and is typically measured in kilowatt hours (kWh).

The energy charge is the price per kilowatt hour of electricity consumed (¢ per kWh).

Description of BC Hydro's Energy Charge

The Large General Service (LGS) and Medium General Service (MGS) rate structures are designed to encourage customers to use less electricity than they have historically done so (called the baseline). Using less electricity than your baseline results in a CREDIT on your bill. Using more than your baseline results in an additional CHARGE.

Here's a closer look at how it works:

1. The rate structure starts with an account's monthly baseline – its 3-year historical average consumption for that month.
2. The energy charge for the account's current month's energy usage has two parts.
3. In Part 1 of the energy charge, the customer pays one price (Tier 1) for up to 14,800 kWh in the month, and a second, lower price (Tier 2) for any additional kWh beyond 14,800 kWh up to the account's baseline for that month.
4. In Part 2 of the energy charge, an adjustment is made if there is a difference between the account's actual consumption in the month versus its 3-year baseline for that month.
    - If the account's actual usage in the month is less than its baseline average, then the customer account receives a credit, and a portion of the credit is at a higher price;
    - If the account's actual usage in the month is greater than its baseline average, then the customer account receives an additional charge, and a portion of the charge is also at a higher price reflecting the cost of new supply;
    - If the account's actual usage in the month is equal to its baseline, then there is no Part 2 adjustment.

Demand Charge

Definition of a Demand Charge:

'Demand' is the rate that electricity is being consumed at any given moment in time and is typically measured in kilowatts (kW). It is not to be confused with 'Energy' which is the total amount of electricity consumed over a period of time.

The demand charge is the price per kilowatt of electricity ($ per kW) above a specified consumption threshold.

Description of BC Hydro's Demand Charge

All Large and Medium General Service accounts have a demand charge. Generally speaking, an account is assigned the MGS rate because its peak (maximum) rate of consuming electricity is expected to reach 35 kW or over, and LGS for expected peak demand over 150 kW.
The demand charge is an inclining block whereby the charge steps-up to a higher amount when electricity is being used at a high rate.

Here's a closer look at how it works:

1. The price of an account's demand charge in a monthly billing period is dependent on the peak rate it consumes electricity in that month.
2. If the account's peak rate of consuming electricity in a given month never exceeds 35 kW, then there is no demand charge for that month.
3. If the account's peak rate of consuming electricity in a given month exceeds 35 kW, then there is no charge for the first 35 kW, but there is a Step 2 charge per kW for the next 115 kW in that month up to 150 kW, and a higher Step 3 charge per kW for the remaining kW.

END SCRIPT

Would each of you please write down in bullet points how this rate structure works?

WHEN ALL HAVE COMPLETED, GO AROUND TABLE AND GET THEM TO READ THEIR BULLET POINTS.

I AM NOW GOING TO PROJECT A FICTITIOUS BCH BILL ON THE SCREEN. (PROJECT LGS BILL BUT EXPLAIN THE MGS BILL IS VERY SIMILAR.

Is it easy to understand? Why/Why not? (Or what ways **was it** difficult to understand?)
What is confusing or hard to understand about it?
What helped you understand it the most in terms of the explanation?
Assuming that it is understood, do you see anything that could be actionable to your organization's managing its use of electricity and trying to minimize the bills?

PROBES:

- Does the calculation of the Energy charge make sense?
- How about the Demand charge?

FOR GROUP #2 (BARRIER-TONES), PROBE ASPECTS OF THE ENERGY CHARGE THEY FIND DIFFICULT TO UNDERSTAND.

What do believe BC Hydro's rationale for this rate structure?
Do you feel that the Energy charge is fair? Why/Why not?
Do you feel that the Demand charge is fair? Why/Why not?
What are your reasons for supporting or opposing the charges?

FOR GROUP #3 (NON-BELIEVERS), PROBE WHY THEY ARE OPPOSED TO THE STRUCTURE OF THE ENERGY CHARGE.

Is the Energy charge an incentive to your organization to manage its electricity bill? Why/Why not?
Is the Demand charge an incentive to manage your electricity bill? Why/Why not?

Which is the greater incentive to manage your electricity bill, Energy or Demand charges?

How easy or difficult would it be to manage your account to minimize the total Energy charges, that is, the charge for the amount of electricity used? Why is that**? (REMIND RESPONDENTS THAT WE ARE TALKING ABOUT THE TOTAL ENERGY CHARGES (Part 1 & Part 2) NOT THE BALANCE PAYABLE)**

How much effort does your organization currently make to minimize the total Energy charges on your bill?

How easy or difficult would it be to manage your account to minimize the total Demand charges, that is, the rate electricity is used, typically measured in kilowatts (kW). It determines the supply of electricity that BC Hydro must deliver at any given time to meet your electricity needs?
Why is that**?**

1:15 – 1:30 Alternative rate structures

Is the current rate structure sending a clear, easily understood signal to manage your organization's use of electricity?

What might improve it?

How or why would that send a clearer, more easily understood signal?

Is the current rate structure easy to act upon in terms of managing your organization's use of electricity?

What might improve it?

How or why would it be easier to act upon?

Do you believe the current rate structure is fair?

What might make it fairer?

Why would it be fairer?

If you could say one thing to BC Hydro regarding the rate structure, what would you say?

MODERATOR TO TALK TO CLIENTS & SEE IF THERE ARE ANY ADDITIONAL QUESTIONS

1:30 Close

Final discussion....Comments from participants.....thanks for participating, etc.