Comparative analysis of common practices for promoting household energy conservation

Tiffany Norman, MPA candidate
School of Public Administration
University of Victoria
March 2015

Client: Russ Francis, Policy and Performance Management Analyst
Ministry of Energy and Mines, Corporate Initiatives Branch

Supervisor: Dr. Lynda Gagné, Assistant Professor, CPA (CGA)
School of Public Administration, University of Victoria

Second Reader: Dr. Rebecca Warburton, Associate Professor
School of Public Administration, University of Victoria

Chair: Dr. Kimberly Speers, Assistant Teaching Professor
School of Public Administration, University of Victoria
1 ACKNOWLEDGEMENTS

I would like to thank Russ Francis and Voytek Gretka for their support and feedback throughout the project. Also, thank you to Dr. Lynda Gagné for her advice and guidance on this project, as well as all my professors at the School of Public Administration for preparing me for this project, and for my future career.

Finally, I would like to express my heartfelt gratitude to my friends and family, who have seen very little of me since I began the MPA program.
2 EXECUTIVE SUMMARY

2.1 INTRODUCTION
The Government of British Columbia has placed a high priority on energy conservation and efficiency. The Government’s 2007 BC Energy Plan and the 2008 Climate Action plan set aggressive goals for energy conservation and emissions reductions using demand management measures. Household energy use is an important factor in overall energy consumption with estimated 15-20 percent of total energy use attributed to household consumption.

This report was prepared for the Ministry of Energy and Mines and Minister Responsible for Core Review, to provide a comparative analysis of policies and programs for promoting household energy conservation in Canada, the United States, and abroad. The main objectives for this report are to:

- Document household energy conservation strategies adopted in Canada, the United States, and abroad;
- Compare methods used in other jurisdictions and identify the strengths and weaknesses of different approaches; and
- Provide recommendations for energy conservation strategies suitable for application in BC.

2.2 METHODS
The research objectives were explored through three methods. A literature review of existing academic research related to household energy consumption and best practices for promoting energy conservation and efficiency provides the primary basis for comparing the relative strengths and weaknesses of strategies employed by other jurisdictions. A jurisdictional scan documents the existing policies in the Canadian provinces, the American states of Washington, Oregon and California, and in Germany. Finally, five interviews with experts in the area of energy conservation and/or efficiency ensure that the analysis of the literature review and the jurisdictional scan adequately considers any BC-specific issues, and corroborates best practices identified in the literature review.

2.3 FINDINGS

2.3.1 Literature Review
The academic literature identified the following types of household energy consumption programs.

- Behavioural interventions that target voluntary consumption behavior such as:
  - tailored information;
  - goal-setting; and
  - feedback (especially if it is comparative).
• Structural strategies consist of financial incentives that make conservation practices more desirable by changing the contextual background in which consumers make decisions.

• Other drivers of energy efficient behaviours include:
  o the use of technology, such as programmable thermostats and occupation prediction technology; and
  o the extent to which energy efficient practices are seen as convenient and low-cost.

The research also identified factors influencing household consumption patterns including:

• level of education;
• household income; and
• household size.

2.3.2 Jurisdictional Scan
A review of the Canadian provinces, the west coast American states and of Germany provided a comprehensive view of existing strategies for addressing household energy consumption. The following approaches were identified:

• the use of a provincial/state energy plan;
• a central agency for providing information to consumers;
• incentive and rebate programs;
• programs targeting low-income households;
• public education campaigns; and
• tailored information through online tools such as energy calculators and home energy assessments.

Many approaches were common across the jurisdictions, such as the existence of an overarching government energy plan, and incentive and rebate programs. However, there was considerable variation in the way these strategies were approached. For example, while several jurisdictions had a central energy agency, some were provincial offices while others were run by Crown Corporations or non-profit organizations. Common strategies not currently employed in BC include a central energy agency and a public education campaign.

2.3.3 Interviews
The expert interviews confirmed many of the findings from the literature review both in terms of challenges for creating an effective household energy conservation strategy and the methods for promoting best practices. The importance of tailored information was emphasized with participants indicating that there is not a single “best” approach that can be promoted, but that the most appropriate action depends on the individual situation. Several participants highlighted that this requires a diverse energy strategy that caters to individual needs.
2.3.4 Ways of Reducing Household Energy Consumption

Overall, the research found that households vary widely, and it is therefore difficult to recommend a single approach for reducing household energy consumption. However, in general, the research identified a number of actions households can take to reduce energy consumption. These include:

- Turning down thermostats in the evening and in unoccupied homes and rooms;
- Investing in high-efficiency appliances such as heat pumps and high-efficiency furnaces and/or water heaters;
- Improving the home’s efficiency through upgrades to insulation, windows and doors; and
- Replacing incandescent light bulbs with LED bulbs.

2.4 RECOMMENDATIONS

Based on the findings from the literature review, the jurisdictional scan, and the expert interviews, the following four actions are recommended:

1. Create a public education campaign to advertise efficiency and conservation programs.
2. Create a single agency to serve as a point-of-access for consumers to obtain information about energy conservation and efficiency.
3. Create web and mobile-based tools that provide consumers with more information about their energy consumption.
4. Expand existing pilot programs to a Province-wide on-bill financing program, allowing homeowners to finance the cost of efficiency-increasing home improvements.
3 TABLE OF CONTENTS

1 Acknowledgements .............................................................................................................. 1-i
2 Executive Summary .............................................................................................................. 2-ii
  2.1 Introduction ...................................................................................................................... 2-ii
  2.2 Methods .......................................................................................................................... 2-ii
  2.3 Findings ........................................................................................................................... 2-ii
    2.3.1 Literature Review ........................................................................................................ 2-ii
    2.3.2 Jurisdictional Scan ...................................................................................................... 2-iii
    2.3.3 Interviews .................................................................................................................. 2-iii
    2.3.4 Ways of Reducing Household Energy Consumption ................................................ 2-iv
  2.4 Recommendations ............................................................................................................ 2-iv
3 Table of Contents ............................................................................................................... 3-v
4 List of tables and Figures .................................................................................................... 4-viii
5 Introduction and Background .............................................................................................. 1
  5.1 Introduction ...................................................................................................................... 1
  5.2 Background ...................................................................................................................... 1
  5.3 Organization of Report ..................................................................................................... 3
6 Methodology ........................................................................................................................ 4
  6.1 Conceptual Framework .................................................................................................... 4
  6.2 Literature Review ............................................................................................................. 5
  6.3 Jurisdictional Scan .......................................................................................................... 6
  6.4 Interviews ........................................................................................................................ 6
  6.5 Limitations and Delimitations ......................................................................................... 7
7 Literature review .................................................................................................................... 8
  7.1 Household energy use ....................................................................................................... 8
  7.2 Using technology to promote energy Efficiency ................................................................. 9
  7.3 Other methods for reducing household energy consumption .......................................... 10
  7.4 Factors influencing household energy consumption ...................................................... 11
  7.5 Demand side management .............................................................................................. 11
  7.6 Summary ........................................................................................................................ 12
8 Jurisdictional Scan .............................................................................................................. 14
  8.1 Alberta ............................................................................................................................ 14
    8.1.1 Provincial Energy Strategy ......................................................................................... 14
    8.1.2 One Simple Act .......................................................................................................... 15

[3-v]
8.1.3 Energy Efficiency Rebates ................................................................. 15
8.2 Saskatchewan .................................................................................. 16
  8.2.1 Provincial Climate Change Plan ...................................................... 16
  8.2.2 Go Green Fund ........................................................................ 16
  8.2.3 Net Metering Program ................................................................. 16
  8.2.4 ENERGY STAR® PST Exemption and the ENERGY STAR® Loan Program .......... 16
8.3 Manitoba ................................................................................................ 17
  8.3.1 2008 Action on Climate Change ................................................... 17
  8.3.2 Green Manitoba ...................................................................... 17
  8.3.3 Manitoba Hydro – Power Smart .................................................... 17
8.4 Ontario .................................................................................................. 18
  8.4.1 2013 Long-Term Energy Plan ...................................................... 18
  8.4.2 Ontario EcoSchools ................................................................... 18
  8.4.3 saveONenergy ........................................................................ 18
8.5 Quebec .................................................................................................. 19
  8.5.1 Quebec Energy Strategy 2006 – 2015 ............................................ 19
  8.5.2 Household Efficiency Programs ................................................... 19
8.6 Nova Scotia ............................................................................................ 20
  8.6.1 Nova Scotia’s Climate Change Action Plan .................................... 20
  8.6.2 Efficiency Nova Scotia ................................................................. 20
8.7 New Brunswick ..................................................................................... 21
  8.7.1 The New Brunswick Energy Blueprint 2011 .................................. 21
  8.7.2 Efficiency New Brunswick ............................................................ 21
8.8 Newfoundland ........................................................................................ 21
  8.8.2 2011 Energy Efficiency Action Plan ............................................ 22
8.9 Prince Edward Island ............................................................................ 22
  8.9.2 PEI Energy Efficiency Grant Program ....................................... 23
8.10 Washington .......................................................................................... 23
  8.10.1 2012 Washington State Energy Strategy .................................... 23
  8.10.2 Washington Department of Commerce Energy Efficiency Programs .......... 23
8.11 Oregon .................................................................................................. 24
  8.11.1 State of Oregon 10-Year Energy Action Plan .................................. 24
  8.11.2 Energy Trust of Oregon ............................................................... 24
4 LIST OF TABLES AND FIGURES

Figure 1- Conceptual Framework ......................................................... 5

Table 1- Socio-demographic Factors Influencing Household Energy Use ........................................ 12
Table 2 - Methods for Reducing Household Energy Consumption ........................................... 13
Table 3 Summary of Existing Programs ........................................................................... 27
5 **INTRODUCTION AND BACKGROUND**

5.1 **INTRODUCTION**
This report was prepared for the British Columbia (BC) Ministry of Energy and Mines and Minister Responsible for Core Review (MEM). It provides a comparative analysis of common policies and programs for promoting household energy conservation. The research provides a better understanding of household direct energy consumption and identifies promising practices for promoting household energy conservation practices in BC. The specific objectives for this research were to:

- Document household energy conservation strategies adopted in Canada, the United States, and abroad;
- Compare methods used in other jurisdictions and identify the strengths and weaknesses of different approaches; and
- Provide recommendations for energy conservation strategies suitable for application in BC.

This research is beneficial to both the client and society more generally. With households estimated to be responsible for 15 – 20 percent of total energy use, they are a key target for household conservation strategies (OECD 2001 cited in Steg 2008, p. 4449). Improving household energy efficiency and encouraging conservation will help the Province meet conservation and reduction commitments. This research will also identify strategies for promoting energy efficiency and conservation behaviours in the general public. In addition to reducing greenhouse gas emissions and providing environmental benefits, improved energy efficiency also provides financial benefits to the public through decreased energy costs (Peters and Papineau, 2004, p. 1).

5.2 **BACKGROUND**
The client for this report is the BC Ministry of Energy and Mines and Minister Responsible for Core Review (MEM). Promoting energy efficiency and conservation, alternative energy resources, and new energy technologies is identified as a key purpose for the Ministry in the 2014 Annual Service Plan (Ministry of Energy and Mines, 2014, p. 7). The BC Government has placed a high priority on energy efficiency and conservation. In 2007, the BC Energy Plan set ambitious energy conservation targets to reduce demand for electricity and “to acquire 50 percent of BC Hydro’s incremental resource needs through conservation by 2020” (BC Government, 2007, p. 5).

Policies that address household energy consumption are essential for a comprehensive energy strategy, as direct emissions from fossil fuels used in the home and for transportation account for approximately one third of BC’s total greenhouse gas (GHG) emissions (Lee, 2010, p.1). Increased levels of GHGs in the atmosphere will result in increased occurrences of extreme weather as well as “increases in mean surface air temperature, increases in global mean rates of precipitation and evaporation, rising sea level, and changes in the biosphere” (Ledley et al.,

[1]
1999, p. 457). Since the implementation of BCs 2008 Climate Action Plan, emission levels have stabilized. This stability of GHG emissions can be attributed at least in part to policy, behaviour change, and efficiency, as a growth in emissions did not resume after the economic recovery (Ministry of Environment, 2014, p. 4). However, without changes to current policy, experts predict that BC’s greenhouse gas emissions may begin to increase again (Ministry of Environment, 2014, p. 6).

Provincial energy objectives described in the Clean Energy Act (2010) require that demand side measures be used to manage energy consumption. This, in addition to the requirement for the submission of an Integrated Resource Plan to the Ministry every five years, ensures that BC Hydro develops strategies aimed at reducing energy demand. However, though demand side management is emphasized in BC Hydro’s 2013 Integrated Resource Plan, the Joint Review Panel Report for the Site C Clean Energy Project suggests that BC Hydro is not living up to this commitment and should create a more balanced approach that does not emphasize the development of new supply sources over demand side management (Joint Review Panel, 2014, p. 324).

BC Hydro also has programs targeting household energy efficiency, such as the Home Energy Monitor Program, which provides homeowners with a real-time summary of energy use in kilowatts and monetary cost (BC Hydro, 2015a, para. 1). This program is enabled by the introduction of smart meters in British Columbia, which were installed by BC Hydro beginning in 2011 (BC Hydro, 2015b, para. 1).

In addition to environmental imperatives for managing household energy consumption, the Ministry has also faced recent political pressure regarding energy policy following the announcement of the government’s 10 Year Plan for BC Hydro in November 2013, which includes rate increases of 26 percent over the next five years (Ministry of Energy and Mines, 2013, p. 1). The increases are one portion of BC Hydro’s Integrated Resource Plan, which must respond to an expected 40 percent growth in demand for electricity in the next 20 years (BC Hydro, 2013a, p. 6).

Coinciding with its announcement of the rate increases, the Government concluded its LiveSmart program in March 2014. The LiveSmart program began in 2008 and provided financial incentives to homeowners for improving the energy efficiency of their homes (BC Government, 2013a, para. 2). Aspects of the LiveSmart program, such as the Business Energy Advisor service, transitioned to BC Hydro following the conclusion of the program (BC Government, 2014a, para. 3).

In addition to the LiveSmart program, the Province has paired with BC Hydro and Fortis BC in the creation of two new household energy conservation programs. The Home Energy Rebate Offer provides customers with rebates on energy upgrades such as insulation, ventilation, and space heating improvements (BC Hydro, 2014a, para. 1). The Energy Conservation Assistance Program targets low-income households and is available to homeowners and renters. The program provides an energy evaluation for low-income households followed by the installation of energy saving products such as energy efficient light bulbs and weather-stripping (BC Hydro,
In some cases, homeowners may qualify to receive an ENERGY STAR® refrigerator, upgraded insulation, or a high-efficiency gas furnace (BC Hydro, 2014b, para. 5). The Province has also paired with BC Hydro and Fortis BC in the development of two on-bill financing pilot programs in the communities of Colwood and Okanagan-Similkameen. These programs gave homeowners the ability to retrofit their homes for increased energy efficiency without incurring upfront costs (BC Government, 2013b).

5.3 Organization of Report

The remainder of this report consists of the following sections. The Methodology section describes the methods used in the research that supports the report and provides a brief overview of the reasons for choosing these methods. The Literature Review section summarizes the existing academic research on the subject of household energy conservation and energy use trends. The Jurisdictional Scan section reviews energy policies targeting household energy consumption in the Canadian provinces, the west coast American states, and in Germany. The Interviews section includes the analysis of five interviews conducted with experts in the field of household energy use and/or efficiency. In the Discussion section, the information from the previous sections is synthesized to establish a set of options, which are explored in the Recommendations section. Finally the Conclusion briefly summarizes the entire report and discusses next steps for further research.
6 METHODOLOGY

The research objectives for this report are to:

- Document household energy conservation strategies adopted in Canada, the United States, and abroad;
- Compare methods used in other jurisdictions and identify the strengths and weaknesses of different approaches; and
- Provide recommendations for energy conservation strategies suitable for application in BC.

The Methodology section is divided into five subsections. The Conceptual Framework section (see Figure 1) provides a visual representation of the internal and external factors affecting household energy consumption behaviors. The Literature Review section describes the types of literature that were reviewed, and the reasons they were chosen. An overview of the jurisdictions included in the report and the reason for selecting them is included in the Jurisdictional Scan section. The Interviews Section describes the methods used in conducting expert interviews and a discussion of the reason for choosing them. Finally, in the Limitations and Delimitations section, weaknesses in the research are identified and discussed.

6.1 CONCEPTUAL FRAMEWORK

Figure 1 describes the conceptual framework for this research. Based on the information found in the literature review, several internal and external factors have an effect on household energy consumption behaviours. Internally, household size, income level, and level of education have been shown to affect household energy use. External levers targeting energy use generally fall into two categories: structural strategies such as financial incentives, and behavioural interventions, such as goal-setting, tailored information, and feedback. It is an assumption of this report that a comprehensive household energy use strategy should include both structural strategies and behavioural interventions, and that it should consider internal factors affecting household energy use.
6.2 Literature Review

The literature review was conducted using the UVic Library website. The search parameters were kept wide, including “any” content type (including book, e-book, journal article, newspaper article, etc.), and “any” discipline (including economics, social sciences, engineering, etc.). Wide parameters were used to achieve a wider cross-section of results that included policy papers, economic analysis, and scientific journals. Search terms and keywords used include “household energy conservation”, “household energy use trends”, “demand side management”, “household
energy policy”, “energy conservation strategies”, “energy efficiency policy”, “household energy emissions”, and “promoting energy efficiency”. Articles that included specific strategies targeting household energy consumption or that discussed factors affecting household energy use were retained, while articles that did not explicitly address household energy use were not included. The findings of the literature review are the primary basis for comparing the relative strengths and weaknesses of strategies employed by other jurisdictions.

6.3 JURISDICTIONAL SCAN
In the United States, the west coast states were chosen because their geographic location makes them more similar to BC in terms of climate and energy sources. Washington, Oregon, and California are expected to have a more moderate climate, similar to many areas of BC, therefore increasing the chance that policy initiatives in these areas may be applicable to BC. In addition, these states are members of the Pacific Coast Collaborative which is a cooperative agreement for addressing energy issues (Pacific Coast Collaborative, n.d., Home). A scan of energy policy in Germany is also included in the jurisdictional scan. Though European countries may not be similar to the legislative or regulatory context in BC, or be similar in terms of natural resources, Germany is included because it has been ranked highly for energy efficiency (Power and Zulauf, 2011, p. 3).

The strength of the jurisdictions’ policies and programs was evaluated using the information from the literature review and the expert interviews. Although some programs or policies may be less effective and efficient than others, it is assumed that they all have impacts and therefore that the jurisdictions using multiple strategies identified in the literature would be more effective in changing household behavior.

6.4 INTERVIEWS
The purpose of the interviews was to identify any gaps in the literature review and to ensure that the literature review did not omit BC-specific issues. Furthermore, the interviews corroborate best practices and challenges identified in the literature. The interviews relate to the research questions by providing another source of information for evaluating the strengths and weaknesses of policies and programs employed by other jurisdictions and inform the development of recommendations.

Five interviews were conducted with experts in the area of energy consumption and/or energy markets. Of the five experts, two worked with the BC Sustainable Energy Association, and three worked for BC Hydro. The interviews were conducted in a semi-structured fashion consisting of guiding questions. While structured interviews employ a formal tone and a standardized approach, semi-structured interviews allow for more spontaneous responses (Taylor & Francis, 2013, Types of Interviews). A semi-structured format was used to ensure that all interviews addressed the same overall topics, while allowing for flexibility in terms of the participant’s approach to the questions, as well as allowing for follow-up questions from the researcher, where necessary. A sample of the interview questions can be found in Appendix A.
6.5 LIMITATIONS AND DELIMITATIONS

It is a delimitation of this report that an in-depth analysis of building code policies is not included, as this would significantly expand the scope of the report. Though building codes can be expected to have an impact on household energy consumption, this report focuses on programs that result in behavioural change at the household level.

Another delimitation of this report is that the evaluating cost-effectiveness or economic efficiency is out of scope for this research. The report includes a review of existing policies and programs of other jurisdictions, but does not include an in-depth analysis of the costs of implementing these programs.

A limitation of the report is that the experts who were interviewed for the report represent a less diverse group than was originally intended. Three of the experts worked with BC Hydro, and two worked with the BC Sustainable Energy Association. Though experts in the academic field and those working as home energy auditors were also invited to participate, they did not respond to attempts made to contact them. It is not expected that the lack of diversity impacted the recommendations of the report, as the analysis of the jurisdictional scan was primarily obtained by measuring the existing programs against best practices in the academic literature. The expert interviews were included to corroborate the academic literature and to ensure that the report did not fail to recognize BC-specific issues.
7 LITERATURE REVIEW

The literature review is divided into six subsections. The first subsection includes a breakdown of household energy use and recent trends regarding household energy consumption. In the next section, research on the use of technology to promote energy efficiency is reviewed, including the limitations of such technology. The next two sections include the discussion of methods found to be the most successful for reducing household energy use and situational factors influencing energy use behaviours. Next, a review of demand side management highlights the reasons demand side management is identified as a best practice in addition to potential implementation challenges. The section concludes with a summary of the review, including summary tables.

These areas relate directly to the research questions by forming the fundamental basis for analyzing the energy conservation and/or efficiency programs and policies identified in the jurisdictional scan. The strengths and weaknesses of policies and programs of the jurisdictions will be compared by referring to the academic literature regarding household energy consumption, demand side management, and factors effecting energy consumption.

7.1 HOUSEHOLD ENERGY USE

Households are an important target group for the promotion of energy conservation behaviours. Households consume energy both directly and indirectly. Direct energy use refers to the use of fuels such as electricity and natural gas, whereas indirect use refers to the energy that is consumed as a result of the transportation, production, and disposal of goods and services (Benders et al., 2005, p. 3612). Although direct energy use is estimated to account only for 40 to 50 percent of total energy consumption, most research has been conducted on direct use, and studies of indirect energy use are much less common (Steg, 2008, p. 4449). The reason for this disparity is attributed to the fact that indirect energy requirements are more difficult to determine (Benders et al., 2005, p. 3613).

Average household direct energy use has increased over recent years. De Almeida et al. (2010, p. 1884) found that residential electricity consumption has risen 1.6 percent per year between 1999 and 2007 in EU countries. In the UK, energy demand for household lighting rose more than 10 percent in the 1990’s, despite government programs aimed at encouraging reduced energy consumption, including government subsidization of compact fluorescent lighting and compulsory energy labelling (Crosbie, Stokes & Guy, 2008, p. 980). Similarly, data from the U.S shows that household energy use increased 12.4 percent, or 0.5 percent per year between 1980 and 2005 (Hoijati and Wade, 2012, p. 305).

Several reasons for these increases have been proposed. While household energy use in the US increased 12.4 percent between 1980 and 2005, total living space increased by 58 percent, resulting in an actual decrease in energy use per square foot (Hoijati and Wade, 2012, p. 305). Another reason for the increase in household energy consumption is the proliferation of new energy loads, with consumption from small devices increasing by 50 percent between 1990 and 2004 (IEA, 2007, p. 67). Aesthetic standards are another contributing factor to increased
household energy consumption, with the shift away from single ceiling bulb lighting in favour of multi-sourced lighting (Crosbie, Stokes and Guy, 2008, p. 980).

7.2 **USING TECHNOLOGY TO PROMOTE ENERGY EFFICIENCY**

Advances in technology, such as the installation of programmable thermostats, have created new ways of promoting increased household energy efficiency. Programmable thermostats create the opportunity for significant reduction in energy use, with estimated energy savings of 1 percent for each degree (Fahrenheit) of overnight temperature setback sustained for 8 hours per day (Plourde, 2003, p.2). Recommendations for optimal setbacks range from 2 to 6 degrees Celsius, though risk of moisture problems and decreased comfort increases at the high end of this range (Canadian Mortgage and Housing Corporation, 2015, para 8).

However, evidence has shown that actual use of programmable thermostats makes little difference to household consumption patterns and may actually increase energy use (Meier et al., 2011, p. 1891). Many users of programmable thermostats find them to be complicated and therefore rely on manual operations rather than using programmable settings (Meier et al., 2011, p. 1893). In addition, research has suggested that the claims of potential energy savings gained from programmable thermostats may be overestimated as they assume that users know how to use them, use them effectively, and that they did not manually set back their thermostats before switching to a programmable model (Checkett-Hanks, 2000, para 5).

Failure to appropriately utilize programmable thermostats may have considerable impact on household energy use in BC, as the BC Hydro 2012 Residential End-Use Survey estimates the penetration of programmable thermostats to be 37 percent in BC (BC Hydro, 2013b, p. 85). This number differs considerably from survey results from 2008, which estimated that 56 percent of residential users had a programmable thermostat. The difference is attributed to an overestimation of programmable thermostat use in earlier studies as a result of customer confusion and a lack of awareness of the difference between manual and programmable thermostats (BC Hydro 2013b, p. 85).

When used properly, it has been suggested that programmable thermostats could result in savings to homeowners of approximately $180 USD per year (Peffer et al., 2011, p. 2530). These savings may increase as the capabilities of programmable thermostats continue to expand. Currently, programmable thermostats may include such controls as settings for multiple zones, humidity levels, information regarding the current local weather, and the ability to schedule different temperature settings for different times, such as night setback, weekday, weekend, and vacation settings, etc. (Peffer, et al., 2011, p. 2529-2530). Furthermore, technological advances have also created the opportunity for occupancy prediction using location information from mobile phones (Lee et al., 2013, p. 1332).

These technologies, if successful, could have significant impact on energy use, as consumption of energy can decrease by more than 20 percent when temperature settings are lowered in unoccupied rooms or buildings (Lee et al., 2013, p. 1332). However, currently, occupancy prediction technologies suffer from significant limitations. For example, programs relying on
mobile GPS locations cause significant drain to mobile devices’ battery life (Lee et al., 2013, p. 1332).

7.3 Other Methods for Reducing Household Energy Consumption

Programs for reducing household energy consumption patterns typically fall into two categories. Behavioural interventions encourage voluntary behaviour by changing households’ knowledge, preferences and perceptions, while structural strategies focus on changing the contextual background in which energy conservation decisions are made. An example of the latter is the provision of financial incentives that make energy conservation practices more desirable (Abrahamse et al., 2005, p. 274, Steg, 2008, p. 4450). Programs encouraging behavioural change may target efficiency (one-time behaviours, such as the purchase of high efficiency appliances or improvement of insulation) or curtailment behaviours (repeated efforts to decrease energy consumption) (Abrahamse et al., 2005, p. 274).

A common example of a structural strategy is on-bill financing programs. In on-bill financing programs, a utility company provides the upfront costs for efficiency retrofits. Homeowners are then able to pay the cost of the retrofit over time via an on-bill surcharge. In these programs it is assumed that the energy savings will be greater or equal to the cost of the retrofit (Nandivada, 2014, p. 372). Similar programs, known as on-bill repayment programs provide capital costs through a third party organization instead of a utility company, but these programs are less common (Nandivada, 2014, p. 373). On-bill financing programs may employ tariff-based systems or on-bill loans. In a tariff-based system, efficiency improvements are tied to the energy meter instead of the customer allowing the repayment period to extend to a new customer in some cases. A benefit of a tariff-based system is that repayments may be considered a portion of a customer’s utility bill, as opposed to being considered a loan (Jewell, 2009 p.18). These programs may also be beneficial for credit-constrained customers, as financing may take into account payment history (Bell, Nadel & Hayes, 2011, p.1).

Several common strategies are used to encourage voluntary behavioural change, such as “tailored information, goal-setting, and feedback” (Abrahamse et al., 2007, p. 266). Tailored information addresses the specific needs of the individual. This approach has been shown to be more effective than interventions that are intended to increase knowledge generally (Abrahamse et al., 2007, p. 266). Information programs aimed at energy reduction that do not include tailored information rarely result in long-term behavioural changes (Benders et al., 2006, p.3613). In addition to providing tailored feedback, informational strategies have the most success when the desirable behaviours are relatively convenient, and do not require significant amounts of time, money or effort (Steg, 2008, p. 4445). While tailored information is an effective strategy, obtaining personalized information may be difficult and time-consuming, which can be a barrier to this approach (Benders et al., 2006, p. 3613).

Goal-setting may also be an effective tool for promoting energy conservation behaviours. Under this model, households are given a specific target, such as a 5 or 10 percent overall reduction in energy use. Goal-setting strategies are especially effective when they include a formal commitment or promise to reduce energy consumption, or when feedback is provided
Feedback may be individual (related to your own household’s efficacy in reducing consumption), or comparative (related to the energy savings of others). Comparative feedback, also known as group feedback can be effective in that it promotes energy saving behaviours as a social norm. This form of feedback may be especially effective in a workplace setting, or for small groups of households that share information regarding energy use (Abrahamse et al., 2005, p. 274).

### 7.4 Factors Influencing Household Energy Consumption

There are several situational factors that may influence consumption behaviour. Socio-demographic differences, such as age, size, composition, and type of household, and education and income level have been shown to influence pro-environmental behaviours (He, H.Z and Kua, H.W, 2013, p. 107). Though level of education is not correlated with awareness of energy consumption, it is the determining factor in energy literacy, defined as the ability to make the best choice when considering the trade-off between long-term energy savings and the upfront cost of investing in energy efficient products and strategies (Brounen et al., 2013, p. 43). Additional situational factors include environmental and behavioural knowledge and service availability (He, H.Z and Kua, H.W, 2013, p. 107). Psychological variables such as attitudes towards pro-environmental behaviours have also been linked to overall energy use (Abrahamse and Steg, 2009, p. 711).

Household income and household size are the primary factors determining differences in household energy requirements. Energy requirements increase with income due to an increased number of electrical appliances (OECD, 2011, p. 22). Indirect energy requirements are greater for higher income households, while low-income earners require more direct energy (Benders et al., 2006, p. 3613). While socio-demographics are related to energy use, changes in household energy use are related to psychological factors, such as attitudes, and are not explained by socio-demographics. Awareness of consequences and the assignment of responsibility have been shown to affect energy savings (Abrahamse and Steg, 2009, p. 719).

### 7.5 Demand Side Management

The BC Government has identified demand side management strategies as a cost-effective way of reducing emissions (BC Government, 2007, p. 5). Demand side management refers to policies that are designed to influence the demand for electricity and gas utilities by encouraging reduced consumption and modified usage patterns. Demand side management is aimed at reducing demand, rather than the traditional model of scaling up supply to keep up with demand, and is intended as a low-cost alternative to utility companies investing in the development of new generation opportunities (Warren, 2014, p.942). These strategies have increasingly been used to moderate electrical and gas emissions in Canada (Peters and Papineau, 2004, p. 2). Programs can vary widely, from programs that provide financial incentives for energy efficient actions, to information-based or training programs that do not provide any direct financial assistance (Peters and Papineau, 2004, p. 2).
Demand side management approaches by governments may be particularly desirable because the market does not promote energy efficiency, due to the inherent motivation for energy utilities to increase the revenues generated from their products (Peters and Papineau, 2004, p. 4). The B.C. Government has multiple mechanisms at its disposal to influence the energy market including legislation, regulations, the building code, fuel standards, the carbon tax, directives to the BC Utilities Commission, and directions to Crown corporations such as BC Hydro. The focus on demand side strategies may result in a more equal playing field between demand side management resources and supply options (Peters and Papineau, 2004, p. 3).

Despite the desirability of demand side management strategies, utility companies may have few reasons to adopt these programs on their own. For example, efforts to increase energy sustainability in Australia have been hindered by the existence of low-cost coal-based energy options, providing Australian energy businesses with little incentive to support demand side management strategies (Mitelman, 2012, p. 44). In order to promote demand side management programs, some jurisdictions have mandated the use of demand side management strategies by utility companies through legislation, such as BC’s Clean Energy Act (2010).

7.6 SUMMARY
The literature identified several factors to be considered when evaluating strategies for reducing household energy consumption. Firstly, several factors play a role in household energy consumption, so it is important to know how these factors affect energy use before targeting programs to specific populations. Factors influencing household energy use are summarized in Table 1. Table 2 provides a summary of methods for reducing household energy consumption.

Table 1- Socio-demographic Factors Influencing Household Energy Use

<table>
<thead>
<tr>
<th>Influencing Factor</th>
<th>Effect on Household Energy Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of education</td>
<td>Not correlated with awareness of consumption, but is correlated with the ability to make the best choice considering long-term benefits.</td>
</tr>
<tr>
<td>Household income:</td>
<td></td>
</tr>
<tr>
<td>Low-income households</td>
<td>Higher consumption of direct energy</td>
</tr>
<tr>
<td>High-income households</td>
<td>Higher indirect energy consumption, and increased requirements for energy to supply electrical appliances</td>
</tr>
<tr>
<td>Psychological factors:</td>
<td></td>
</tr>
<tr>
<td>Assignment of responsibility</td>
<td>Increased energy savings when users feel responsibility</td>
</tr>
<tr>
<td>Awareness of consequences</td>
<td>Increased energy savings when users understand consequences of energy use</td>
</tr>
<tr>
<td>Method</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Behavioural Interventions</strong></td>
<td></td>
</tr>
<tr>
<td>Tailored information</td>
<td>Users are given information that relates to their specific situation</td>
</tr>
<tr>
<td>Feedback</td>
<td>Users are given feedback on their consumption patterns</td>
</tr>
<tr>
<td>Goal-setting</td>
<td>Users are given specific targets to meet</td>
</tr>
<tr>
<td><strong>Structural Strategies</strong></td>
<td></td>
</tr>
<tr>
<td>Financial incentives</td>
<td>Financial incentives are provided for certain efficiency investments</td>
</tr>
<tr>
<td><strong>Use of Technology</strong></td>
<td></td>
</tr>
<tr>
<td>Programmable thermostats</td>
<td>Allows users to program thermostats so temperature is automatically decreased at night/during the work day</td>
</tr>
<tr>
<td>Occupancy prediction</td>
<td>Uses technology such as GPS to predict when rooms or buildings are unoccupied</td>
</tr>
</tbody>
</table>
The Jurisdictional Scan examines demand-side energy management policies in Canada, the U.S., and Germany. The section is organized according to jurisdiction, starting with the Canadian provinces, following with the U.S. states of Washington, Oregon and California, and concluding with Germany. These jurisdictions are included to provide a comprehensive analysis of household energy conservation programs and policies in Canada and abroad.

All of the Canadian provinces are included in the scan, as policies in other Canadian jurisdictions are most likely to be applicable to British Columbia given their similar legislative and regulatory contexts. The west coast U.S. states are included as they are expected to be the most similar to British Columbia in terms of natural resources and types of energy consumption. In addition, these states are members of the Pacific Coast Collaborative, and have agreements in place for cooperative action with BC. Though Germany may not be similar to British Columbia in terms of legislative and regulatory context or energy resources, a brief overview of energy policy in that country is included in order to provide a broad scope for reviewing existing policies. In addition, Germany has been ranked highly for energy efficient practices, therefore it may provide examples of particularly well-constructed energy policies (Power and Zulauf, 2011, p. 3).

The jurisdictional scan includes an analysis of existing policy, programs, and action plans in the chosen jurisdictions. As none of the jurisdictions have been contacted directly for information regarding their policies and programs, the information has been compiled using information found on government websites, publicly-available policy documents, existing legislation, and websites for utility companies, non-profit organizations, and Crown Corporations.

The jurisdictional scan is the primary tool that is used to address the first research objective: to document household energy conservation strategies adopted in Canada, the United States, and abroad. The documentation of existing strategies in the chosen jurisdictions provides a better understanding of how BC currently ranks in terms of household energy policy and a large pool of data to analyze in order to address the third research objective: to provide recommendations for energy conservation strategies suitable for application in BC.

8.1 ALBERTA

8.1.1 Provincial Energy Strategy

In 2008, Alberta Energy launched a Provincial Energy Strategy in alignment with the Alberta Government’s priority of ensuring environmentally sustainable resource development. Alberta has a strong energy sector, with considerable natural gas, conventional oil, bitumen, and coal resources. In addition to energy derived from the burning of fossil fuels, Alberta has begun to develop alternative energy such as biomass, wind, and geothermal power. Alberta’s Energy Strategy also indicates that the Province is considering the benefits and risks of nuclear power (Alberta Energy, 2008).

Overall, the strategic outcomes of Alberta’s Energy Strategy focus strongly on clean energy production, and maintaining economic prosperity, and the plan acknowledges that energy
development has often been given more consideration than conservation and efficiency strategies (Alberta Energy, 2008, p. 17). However, the plan also seeks to increase knowledge and awareness of energy issues and to promote more efficient use of energy through behavioural changes (Alberta Energy, 2008, p. 21).

Strategies for encouraging energy efficiency and conservation include improved measurement through smart metres and smart grids to help Albertans to understand their energy consumption patterns, increased funding for energy efficient transportation, and changes to building code standards to produce more energy efficient buildings (Alberta Energy, 2008, p. 38).

Of these strategies, only smart metres and smart grids target energy consumption behavioural change at the household level. While greener public transportation and energy efficient building practices may be expected to reduce household energy consumption overall, these strategies do not require any behavioural change or a greater understanding of energy issues by Alberta households.

Though increased knowledge and awareness of energy issues is identified as a strategic outcome, the report provides only a few bullets describing actions for meeting this goal. These actions include working with the education system to ensure that information about the energy industry is included in school curriculum, auditing the effectiveness of public communications and reporting strategies, developing a better understanding of the public’s energy literacy, and speaking out on and defending government action (Alberta Energy, 2008, p. 46).

8.1.2 One Simple Act

While Alberta’s Provincial Energy Strategy includes little focus on household direct energy consumption, the One Simple Act program is a Government of Alberta public information and education program that promotes environmentally friendly lifestyles and actions “at home, at work, in communities and at school” (Alberta Government, 2014a, para. 1). Tools targeted at household energy use include tips for simple actions that can reduce consumption, such as tips for having a “green” Christmas, an “Eco-Action Calculator” that helps households learn ways to reduce impact on the environment while saving money on energy costs, and a home assessment tool that helps homeowners to assess their energy efficiency and identify actions to reduce environmental impact. The assessment tool gives points by dividing eco actions into “fast and free”, “simple and low cost”, and “spend to save” categories, allowing consumers to identify strategies that are scalable in terms of cost and effort (Alberta Government, 2014b, Eco Check-up for the Home).

The One Simple Act program also engages the Alberta public interaction, with the ability to contribute comments to the One Simple Act website in addition to a One Simple Act Facebook page. The public can also sign up to receive a bi-monthly newsletter by joining the One Simple Act email list (Alberta Government, 2014c, para 10).

8.1.3 Energy Efficiency Rebates

Between 2009 and 2012, the Alberta Government provided $52 million in energy efficiency rebates to Albertans (Alberta Government, 2014d, para. 11). The program provided rebates on purchases such as ENERGY STAR® qualified appliances (such as washing machines, furnaces
and hot water tanks), new homes meeting specific energy standards, and pre- and post-retrofit home energy evaluations (Alberta Government, 2010, p. 1).

8.2 Saskatchewan

8.2.1 Provincial Climate Change Plan
Saskatchewan’s Climate Change Plan was created to reduce annual greenhouse gas emissions, which, according to Environment Canada were 74.8 million tonnes in 2012. This number represents 10 percent of Canada’s GHG emissions nationally, though Saskatchewan houses just 3 percent of Canada’s population. The program primarily targets the oil and gas industry and electricity generation specifically, as these represent 55 percent of Saskatchewan’s total emissions (Government of Saskatchewan, 2013a). Saskatchewan’s Climate Change Action plan is not published online, therefore it is unknown if the plan includes any provisions that specifically target household energy use.

8.2.2 Go Green Fund
The Government of Saskatchewan created the Go Green Fund to encourage individuals, communities and businesses to find solutions to the Province’s environmental challenges. The fund provides financial assistance to results-based programs that aim to lower greenhouse gas emissions, conserve water, sustain biodiversity, reduce rate, or improve the public’s ability to understand and accept the need for action in response to environmental issues (Government of Saskatchewan, 2013b, para 3).

The fund has supported projects such as a research study that evaluated the cost effectiveness of using seasonally cold air to operate refrigerators and freezers to reduce reliance on electricity for cold storage, investment in the development of wind turbines and wind storage technology, and a rebate program for those who purchased or built a new home that met a high standard for energy efficiency (Government of Saskatchewan, 2013c,).

8.2.3 Net Metering Program
The Go Green Fund also committed $2.9 million to reduce greenhouse gas emissions by investing in environmentally friendly sources of power generation (Government of Saskatchewan, 2013d, para 4). The program allows Saskatchewan residents who generate their own electricity using environmentally friendly technologies to deliver the electricity that they do not consume back to the grid. Excess electricity that is sent to the grid is tracked using a bi-directional meter and is applied as a credit on the program participant’s energy bill (SaskPower, 2014, para 3).

8.2.4 ENERGY STAR® PST Exemption and the ENERGY STAR® Loan Program.
In order to promote energy conservation, PST exemptions are applied to qualifying energy efficient appliances such as furnaces, heat pumps, and ENERGY STAR® appliances (Government of Saskatchewan, 2013d, para 2). In addition, until March 31, 2015 homeowners are able to finance the purchase of high efficiency equipment including furnaces, natural gas boilers and water heaters (Government of Saskatchewan, 2013d, para 5).
8.3 MANITOBA

8.3.1 2008 Action on Climate Change
In conjunction with the adoption of Manitoba’s Climate Change and Emissions Reduction Act, the Province established an updated Climate action plan which includes more than 60 individual actions aimed at helping Manitoba meet its Kyoto targets (Manitoba Government, n.d., para. 12).

A key component of Manitoba’s climate action plan is the creation of sustainable cities and communities, with specific emphasis on municipalities. According to the report, up to 50 percent of Canada’s GHG emissions are directly or indirectly influenced or controlled by municipal governments (Manitoba Government, 2008, p. 35). Several programs have been initiated to promote environmentally friendly practices and improved efficiency at the municipal level. These include:

- **The Island Lake Energy Efficiency Pilot Initiative**
  - In collaboration with Manitoba Hydro, this program aims to support local employment opportunities and training to retrofit homes in the area;

- **Neighbourhoods Alive!**
  - A program dedicated to revitalizing designated communities within the Province and providing energy-efficient, affordable housing; and

- **The Climate Change Connection (C3)**
  - A public education and outreach program established in 2001. C3 has a variety of campaigns and programs, including an anti-idling campaign, brochures and guides for businesses, communities, and agriculture, and community and youth forums.

(Manitoba Government, 2008, p. 36-37)

8.3.2 Green Manitoba
In addition, the Province has committed to working with Municipalities to provide support to ensure that municipal governments have individual emissions reduction plans, local action plans and energy and water conservation strategies (Manitoba Government, 2008, p. 38). This partnership with Municipalities is supported through Green Manitoba, a special operating agency of the Manitoba government as a central resource for information related to sustainability initiatives within the Province (Green Manitoba, 2014a, para.1). Green Manitoba focuses on a variety of program areas, such as waste reduction, water conservation, environmental sustainability education, and climate change (Green Manitoba, 2014b, para 2).

8.3.3 Manitoba Hydro – Power Smart
Manitoba Hydro offers a Power Smart program providing incentives for consumers to adopt energy saving technologies. These include rebates on LED lighting, home insulation rebates, a program that allows qualifying homeowners to finance new insulation and a high-efficiency natural gas furnace for as little as $9.50/month over 5 years, and the ability borrow up to $5,500 over a maximum term of 15 years in order to upgrade to a high-efficiency furnace. In addition,
Manitoba Hydro produces booklets and videos offering tips for do-it-yourself home energy improvements requiring little to no cost (Manitoba Hydro, n.d., Be Power Smart).

8.4 ONTARIO

8.4.1 2013 Long-Term Energy Plan
Ontario has seen significant changes in their energy policies over the last decade. The 2013 Long-term Energy Plan highlights this transition from a system suffering from a shortage of supply, out-dated energy infrastructure and a strong reliance on imports and coal-based energy, to system that includes multiple sources of energy including and wind power, natural gas, nuclear power, bioenergy and hydroelectric sources (Ontario Government, 2013, p.2-3). The energy plan indicates that, while the Province will continue to focus on nuclear energy, plans for the construction of two new nuclear generating facilities has been deferred due to Ontario’s strong supply situation (Ontario Government, 2013, p.3).

Overall, Ontario’s energy plan places a strong emphasis on placing conservation above creating new supply, and the Province expects that better building codes and standards in addition to conservation and efficiency programs will offset nearly all of the electricity demand growth to 2032 (Ontario Government, 2013, p. 4). The plan also forecasts lower cost and price of energy than was forecast in 2010. Ratepayer savings are predicted due to wind generation, an amended Green Energy Investment Agreement, and the deferment of the construction of new nuclear facilities (Ontario Government, 2013, p. 6).

In addition to the plan’s strong focus on clean energy, it also recognizes the importance of behavioural change at the end-user level. Programs and initiatives targeting behavioural change include the Green Button Initiative, which allows energy users to review their smart grid energy data through web-based applications, the Energy Apps for Ontario Challenge, which offers $50,000 to the developer of the best app that uses electricity information from smart grids, and a social benchmarking pilot program to test different strategies enabling consumers to compare their energy usage to similar households (Ontario Government, 2013, p. 22).

8.4.2 Ontario EcoSchools
Another program referenced by Ontario’s Long-term Energy Plan is Ontario EcoSchools (Ontario Government, 2013, p. 25). Ontario EcoSchools provides environmental education for children in grades K-12 that helps children develop “ecological literacy and environmental practices to become environmentally responsible citizens” (Ontario EcoSchools, n.d. para. 1).

The Ontario EcoSchools program has been running since 2002 and has six focus areas: “Teamwork and Leadership, Energy Conservation, Waste Minimization, School Ground Greening, Ecological Literacy (curriculum), and Environmental Stewardship” (Ontario EcoSchools, n.d., para. 5).

8.4.3 saveONenergy
SaveONenergy provides information to residents and businesses in Ontario on available conservation programs (saveONenergy, 2015a, para 2). Residential programs include a heating
and cooling incentive that provides homeowners with up to $650 in incentives when upgrading to eligible heating and cooling appliances (saveONenergy, 2015b, para 1) and the peaksaver PLUS program, which allows the utility company to make adjustments to reduce the energy consumption of appliances during periods of peak demands. The program also provides homeowners with a free home energy display to monitor energy consumption (saveONenergy, 2015c, para 2). Ontario residents can download and print coupons to receive discounts on eligible products such as power bars equipped with timers, programmable thermostats, and energy efficient light bulbs (saveONenergy, 2015d, para 2). In addition to energy efficiency programs, the saveONenergy website also provides tips and information for conserving energy in the home (saveONenergy, 2015e, para 1).

8.5 QUEBEC

8.5.1 Quebec Energy Strategy 2006 – 2015

The Quebec Energy Strategy is a comprehensive action plan that focuses on securing energy supplies, promoting economic development through better use of energy, providing opportunities for involvement from local communities and First Nations groups, promoting more efficient energy use, making the Province a leader for sustainable development, and ensuring that electricity rates are set at an optimal level (Government of Quebec, 2006, p. 4). Though the strategy does aim to support more efficient use of energy and references programs that are specifically targeted for low-income households, the methods for achieving greater household energy efficiency are not clearly identified in the plan.

8.5.2 Household Efficiency Programs

Énergie et Ressources Naturelles offers several programs to improve household energy efficiency including:

- **Heating with Green Power.** This program provides financial assistance to homeowners replacing their oil burning heating systems and water heaters with more efficient alternatives (Government of Quebec, 2013a, para 1).
- **Rénoclimat.** This program provides financial assistance to homeowners renovating their homes to improve their energy efficiency and measures the energy performance of participant’s homes before and after renovation occurs (Government of Quebec, 2013b, para. 12).
- **Éconologis.** This program aids low income households by providing a free home visit from an energy advisor who provides advice for increasing energy savings from home heating, hot water, household appliances and lighting. In addition, the advisors may take steps to improve participant’s household efficiency by taking specific action such as applying window caulking and weather stripping, insulating electrical outlets, and installing low-flow showerheads. The program also includes the installation of electronic thermostats for free (Government of Quebec, 2013c, Program Content).
8.6 Nova Scotia

8.6.1 Nova Scotia’s Climate Change Action Plan
In 2009, Nova Scotia released its Climate Action Plan to address two priority objectives: reducing greenhouse gas emissions and preparing for climate changes that are already occurring (Nova Scotia Environment, 2009, p. 1). Much of the plan focuses on increasing the use of renewable energy sources rather than burning fossil fuels like coal, which accounts for approximately 75 percent of Nova Scotia’s electricity generation (Nova Scotia Environment 2009, p. 13). The plan does not include any detailed actions for reducing household energy consumption, though it does state the Province’s intention to expand existing energy efficiency programs in addition to creating new ones, and also proposes changes to Nova Scotia’s Building Code Act in order to increase efficiency (Nova Scotia Environment, 2009, p. 16).

8.6.2 Efficiency Nova Scotia
Efficiency Nova Scotia is a non-profit organization that provides information regarding energy efficiency programs and services in the Province (Efficiency Nova Scotia, 2015a, para 1). Efficiency Nova Scotia provides information on energy efficient appliances such as heat pumps, connects residents with contractors for retrofitting their homes, and can provide residents with a “Home Energy Report” (Efficiency Nova Scotia, 2015b, para 1). Using a Home Energy Chart, or Home Energy Assessment, Efficiency Nova Scotia can provide specific recommendations for improving home energy efficiency and will specifically tailor the recommendations based on the financial needs of the customer (Efficiency Nova Scotia, 2015b, para 2). Nova Scotians can also obtain rebates on energy efficient products ranging from three to thirty dollars (Efficiency Nova Scotia, 2015b, para 3).

The Efficiency Nova Scotia website also has an Energy Use Calculator that estimates home energy use in kilowatt hours per month, cost per two month billing cycle, and annual cost. The calculator estimates energy use based on the age of the home, the number of people occupying the home, square footage, number of appliances (for example, clothes washer and dryer, and number of loads per week). The tool allows customers to estimate the cost of their current practices and can also estimate the amount of savings that may result from behavioural changes (Efficiency Nova Scotia, 2015c, page 1).

Efficiency Nova Scotia is funded by the “Electricity Demand-Side Management Fund”, which is applies a minor charge on electricity ratepayers’ power bills, and “The Provincial Fund” which is funded through a “fee for service agreement (contract)” with the Province of Nova Scotia. Funds from the Demand-Side Management Fund must be dedicated to the support of electricity efficiency actions whereas the Provincial Fund must be used for non-electricity efficiency streams (Efficiency Nova Scotia, 2013d, p.2).
8.7 New Brunswick

8.7.1 The New Brunswick Energy Blueprint 2011
In 2001, the New Brunswick Department of Energy released a long-term action plan as a response to a report from the Energy Commission. The key objectives of the report are ensure stable and affordable energy prices, to protect energy security in the Province, to increase the reliability of the existing electrical system, to promote environmentally responsible actions, and to ensure that regulations are effective (Department of Energy, 2011, p.1). The plan does not include any comprehensive strategies specifically targeting household energy consumption, however it does reference existing programs that are provided by Efficiency New Brunswick (NB) (Department of Energy, 2011, p. 11).

8.7.2 Efficiency New Brunswick
Efficiency NB is a Crown Corporation that has been operating since 2005. The mission of the organization is to provide advice to New Brunswick residents to promote more efficient energy use and educate the public regarding impacts to the environment (Efficiency New Brunswick [NB], 2013a, para. 2).

The Efficiency NB website provides one-stop access to a variety of efficiency programs and information including tips for developing more efficient energy use behaviours, success stories from members of the community, and links to other programs outside of Efficiency NB. (Efficiency NB, 2013b, Residential Home Page). The agency has programs targeting low-income households, such as the Low Income Efficiency Program, which provides energy upgrades to low income households such as insulation, air sealing, and lighting upgrades, and programs for those who are planning build new construction (Efficiency NB, 2013c, para. 1).

According to Efficiency NB’s 2012-2013 Annual report, Efficiency NB’s programs have resulted in $60.45 million in annual energy savings, and a reduction of 377,220 tonnes of greenhouse gas emissions annually (Efficiency NB, 2013d). Efficiency NB also rolled out a social media strategy in the 2012-2013 fiscal year including a Facebook page that reached its goal of “3,000 likes” within 19 days (Efficiency NB, 2013d). The outreach program also participates in events such as residential home shows, trade shows, and municipality association meetings, and also directly responds to inquiries from New Brunswick residents by phone, email, and social media sites (Efficiency NB, 2013d, p. 24).

8.8 Newfoundland

In 2007, the Ministry of Natural Resources in Newfoundland released its first long-term energy plan that focuses on obtaining an economic benefit from Newfoundland’s energy resources while ensuring that energy development initiatives are in alignment with climate change goals (Department of Natural Resources, 2007, Letter from the Premier).

Though the 2007 plan does not go into detail regarding household energy efficiency programs, it does indicate that the Province will focus on strategies for reducing household energy
consumption through a variety of programs, such as rebates for home retrofits, supporting more efficient heating technology, and public education initiatives (Department of Natural Resources, 2007, p. 60). In addition, the plan commits to dedicated funding to provide low-income households with energy audits and retrofit opportunities (Department of Natural Resources, 2007, p. 60).

### 8.8.2 2011 Energy Efficiency Action Plan

In 2011, Department of Natural Resources in collaboration with the Department of Environment and Conservation expanded on the conservation and efficiency objectives outlined in the 2007 plan by releasing an action plan that exclusively focuses on energy efficiency (Government of Newfoundland and Labrador, 2011). Household energy consumption is addressed specifically in the report, as household direct energy use is estimated to account for 14 percent of the Province’s overall energy consumption (Government of Newfoundland and Labrador, 2011, p. 25). Much of the action plan relates improving building practices to provide a better energy rating for new buildings, however the plan also recognizes the need to improve efficiency in existing buildings by improving the building envelope through cost-effective retrofits (Government of Newfoundland and Labrador, 2011, p. 25).

Household energy efficiency programs identified in the 2011 action plan include:

- The EnerGuide for Houses program, which provides grants of up to $1500 to homeowners to improve their household energy efficiency through retrofits;
- The Residential Energy Efficiency Program, which provides an incentive of up to $4000 for low-income households to increase the energy efficiency of their homes;
- The Coastal Labrador Energy Efficiency Pilot Project in Hopedale and Port Hope Simpson, which was a public engagement initiative that aimed to raise community awareness surrounding energy, in addition to providing toolkits for residents to implement low-cost energy-saving technologies; and
- The takeCharge program, which is led by the Newfoundland and Labrador Hydro and Newfoundland Power, which provides rebates on the purchase of energy efficient products such as insulation, programmable thermostats, ENERGY STAR® Windows. (Government of Newfoundland and Labrador, 2011, p. 29)

In addition to these programs, the 2011 Action plan commits to expanding the Coastal Labrador Energy Efficiency pilot program to two more communities, as well as supporting collaboration with other provinces, territories, and the federal government regarding the need for new energy codes, product standards and energy labelling (Government of Newfoundland and Labrador, 2011, p. 30).

### 8.9 Prince Edward Island


Prince Edward Island (PEI) is unique among the Canadian provinces as the only province that lacks significant energy resources such as hydroelectric or nuclear energy and with the majority
of its energy needs being met by imported, petroleum-based resources (Department of Environment, Energy and Forestry 2008, p. 22). For this reason, Prince Edward Island’s energy strategy emphasizes the need to promote energy efficiency and conservation, recognizing that energy efficiency is most often cheaper than energy production (Department of Environment, Energy and Forestry, 2008, p. 12).

In addition to strategies targeting improved efficiency through better building practices, industrial practices, and transportation policies, the PEI energy strategy targets household energy consumption with policies directed at appliances with greater energy efficiency, and lighting and space heating strategies (Department of Environment, Energy and Forestry 2008, p. 12).

Also included in the Province’s energy strategy is the creation of the Office of Energy Efficiency (OEE), which is mandated with assisting PEI residents in finding ways to reduce their energy consumption. The OEE provides a single point-of-access for island residents for information regarding both provincial and federal energy efficiency programs (Department of Environment, Energy and Forestry, 2008, p. 14).

8.9.2 PEI Energy Efficiency Grant Program
The PEI Energy Efficiency provides grants for homeowners who are implementing energy efficient upgrades to their homes. The amount of the grant depends on the household income level, with the maximum grant set at $5,000 for homeowners with a total household income less than $20,000 (Office of Energy Efficiency, 2015 para. 5).

8.10 Washington

8.10.1 2012 Washington State Energy Strategy
In 2012, Washington State released its first comprehensive energy strategy in almost two decades. While the plan’s primary focus is on the transportation sector and diversifying energy supply, the strategy somewhat addresses household energy consumption in terms of the efficiency of buildings (Department of Commerce, 2012, p. 2). In addition to recognizing the importance of existing low-income programs, the policy recommendations for building standards emphasize the need to ensure that homeowners understand which strategies would be most effective for improving household energy efficiency, and providing access to financing for energy improvements (Department of Commerce, 2012, p. 7).

8.10.2 Washington Department of Commerce Energy Efficiency Programs
The Department of Commerce provides several programs for improving energy efficiency in Washington State. In addition to programs targeting improvements to the public facilities, the State Energy Code, and Clean Energy research, the Department of Commerce offers several programs that specifically target household energy use such as the Weatherization Program, which targets low-income households by improving the energy efficiency of homes through weatherization, and the Clean Energy Fund, which, in addition to supporting clean energy research, supports the implementation of on-bill financing for energy efficient upgrades (Department of Commerce, n.d., Energy Efficiency Programs Overview).
8.11 Oregon

8.11.1 State of Oregon 10-Year Energy Action Plan
In 2012, the Department of Energy released its 10-Year Energy Action Plan to ensure that Oregon is able to maintain a stable supply of clean energy into the future (State of Oregon, 2012, p. 2). Much of the plan focuses on the development of clean energy resources, and promoting cleaner transportation but provides little in terms of direct objectives or goals related to household energy consumption. However, the plan does reference the success of existing programs such as Clean Energy Works Oregon, which provides support for the remodeling of residential homes (State of Oregon, 2012, p. 22).

8.11.2 Energy Trust of Oregon
The Energy Trust of Oregon is a non-profit organization that provides a one-window source of information for energy consumers in Oregon (Energy Trust of Oregon, n.d.). The Trust has targeted programs for homeowners and renters, in addition to different programs for new homes, and manufactured homes. On the Energy Trust of Oregon website, residents can get information on available cash incentives, finding a contractor who is qualified in energy efficient upgrades, advice on small changes that can save energy, and a survey to assess how efficient their home is (Energy Trust of Oregon, n.d.).

8.11.3 Residential Energy Tax Incentive
Oregon residents are able to claim a credit on their income taxes when they invest in improving the energy efficiency of their homes, such upgrading heating and ventilation systems, water heaters, or investing in renewable fuel sources such as solar energy systems, wind power, or alternative fuel stations (Oregon Department of Energy, n.d.).

8.11.4 State Energy Loan Program
The Energy Loan Program promotes energy conservation by providing low interest loans for projects in Oregon that promote efficient energy practices, such as using alternative or renewable fuel, or conserving energy through other means. In addition to being accessible to businesses, schools, counties and non-profit organizations, individuals can also apply to enroll in the program (Oregon Department of Energy, n.d., a para 3). Interest rates on the loan vary from 5.50 to 7.50 percent (Oregon Department of Energy, n.d., b para 1).

8.12 California

8.12.1 California Integrated Energy Report
The state of California has been dedicating resources to energy policy since 2003 when the state adopted the State of California Energy Action Plan. The plan was updated in 2005, but has since been replaced by the Integrated Energy Policy Report (California Energy Commission, 2015, para.4). Because the Integrated Energy report is a biennial report, the focus of the document varies by year. The 2013 Integrated Energy report focuses on energy issues such as nuclear energy, electricity, and changes in transportation trends, as well as energy efficiency and climate change (California Energy Commission, 2013, p.1). The 2013 report does not specifically
address household energy consumption or strategies for behavioural change (though it does address building construction efficiency standards); this may be due to the fact that only 7 percent of California’s gross GHG emissions are attributed to the residential sector, while the transportation and industrial sectors are responsible for 39 and 23 percent, respectively (California Energy Commission, 2013, p. 313).

### 8.12.2 Energy Upgrade California
Energy Upgrade California is a joint initiative that includes the California Public Utilities Commission, the California Energy Commission, local governments, businesses and non-profit organizations (Energy Upgrade California, 2015a, para. 1). The Energy Upgrade California website includes educational information about energy use and renewable and clean energy, practical recommendations for reducing energy use through behavioral changes regarding heating and cooling practices, the use of electronics, lighting, and other energy consuming behaviours, and information about energy rebates, incentives and efficiency programs (Energy Upgrade California, 2015b).

### 8.12.3 San Francisco’s Residential Energy and Water Conservation Requirements
In 1982, San Francisco enacted an ordinance requiring homeowners to upgrade their homes to meet defined energy requirements prior to selling their homes (Department of Building Inspection, 2009, p.2). Energy conservation measures that must be met include the insulation of hot water pipes and tanks, the cleaning and repair of boilers, and the weather-stripping of doors (Department of Building Inspection, 2009, p.3); however, the energy conservation ordinance only applies to residential buildings constructed prior to 1978 (Department of Building Inspection, 2009, p.2).

### 8.13 Germany

#### 8.13.1 Efficiency Legislation
Germany offers an example of an aggressive approach to energy efficiency that has resulted in Germany being ranked first for energy efficiency measures among G20 countries (Power and Zulauf, 2011, p.3). Germany’s energy policies have been shaped by high energy prices, high consumption, unstable energy sources, and a reliance on imported fuel. As a result, Germany’s approach to energy conservation includes a strong legislative element from the federal government (Power and Zulauf, 2011, p.6).

Legislative tools for regulating energy conservation include:

- The *Energy Conservation Act*, which regulates building standards nationwide and prescribes obligatory measureable for increases in efficiency through upgrades to building envelopes, mandatory energy performance certification, and the requirement to use renewable energy sources over oil and gas;
- The *Heating Costs Act*, which specifically targets the 60 percent of German households who live in rental properties by increasing the heating charges based on consumption in order to encourage behavioural changes; and
  (Power and Zulauf, 2011, p.7)

### 8.13.2 The German Energy Agency
The German Energy Agency was created to increase the up-take of energy efficiency programs and technologies and provides public information campaigns, training of industry experts in the highest standards of energy efficient building practices, and providing energy advice to residents, public entities, and industry (Power and Zulauf, 2011, p. 9). While the German Energy Agency does not directly deliver programs or services itself, it acts as a coordinator and provides a guiding standards to regional agencies (Power and Zulauf, 2011, p. 9).

### 8.13.3 Energy Funding and Subsidies
In addition to strong legislation, and public information and advice provided by the German Energy Agency, Germany’s approach also includes four streams of incentives. The Kreditanstalt für Wiederaufbau (KfW), a German investment bank, provides the primary source of energy efficiency loan programs and subsidies (Power and Zulauf, 2011, p.9). In addition to KfW programs, the federal government offers several subsidy programs, including programs targeting low-income households, as do regional and municipal authorities, where programs vary by region (Power and Zulauf, 2011, p. 9).

### 8.14 Summary
The results of the jurisdictional scan are displayed in *Table 3*. The table includes common themes found in various jurisdictions, such as an overarching government strategy, and also includes methods identified in the jurisdictional scan, including tailored information and financial incentives. Overall, Ontario’s policies showed the most comprehensive program in the North American jurisdictions lacking only a program targeting low-income households. Saskatchewan had the least robust program, with only a provincial plan (that was not available on line and may or may not directly address household consumption), and an incentive program.

Based on the table, California also appears to lag behind the other jurisdictions, though this may be misleading. While California’s most recent Energy Report did not specifically address household energy use, these reports are biennial, and household energy use may have been addressed more thoroughly in other years. In addition, San Francisco’s Residential Energy and Water Conservation Requirements is a unique program among the jurisdictions, but it does not fall into any of the categories in the table.
### Table 3 Summary of Existing Programs

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Demand Management Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy Action plan</td>
</tr>
<tr>
<td>BC</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Alberta</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Manitoba</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Ontario</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Quebec</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>PEI</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Washington</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Oregon</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>California</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Germany</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>
9  INTERVIEWS

Five energy efficiency experts were interviewed as part of this research. The analysis of these interviews is divided into four sections. The first section relates to questions regarding the most challenging aspects of building an effective energy strategy, and whether any of these challenges are specific to BC. The next section describes the results from the interview questions related to the influence of technology on household energy consumption patterns, followed by the results from questions regarding setback temperatures of thermostats. The final section reviews the responses to questions surrounding opportunities for change. A list of the specific interview questions can be seen in Appendix A.

Interviews were conducted with experts in the field of household energy policy and/or energy efficiency. The main purpose of the interviews is to ensure that the recommendations provided in the report are appropriate for application in BC, as indicated in the research objectives. In addition to ensuring that the analysis of the jurisdictional scan considers BC-specific challenges and opportunities, they also provide an opportunity to confirm that the insights of experts who work in the energy conservation industry also support best practices identified in the academic literature.

9.1 BIGGEST AREAS OF CHALLENGE

The experts were asked what they saw as the biggest challenges for building an effective household energy conservation strategy for BC, and whether or not they saw these challenges as BC-specific.

The identified challenges were relatively consistent across the interview subjects. Four out of five participants indicated that BC’s low utility costs compared to other jurisdictions is a challenge, though one of the four said that, though it could be argued that low energy prices are a challenge, there are many other jurisdictions in Canada and the United States with similarly low rates.

Two participants stated that many BC households feel that they are already doing what they can to increase their household efficiency and do not believe additional actions are needed. Similarly, one participant indicated that consumers generally lack knowledge regarding their household energy consumption patterns, and that they may not connect the action (such as turning on a light or raising the temperature on the thermostat) with a cost of fuel. For those that do understand their opportunities to increase their energy efficiency, one participant noted that investing in increasing household energy efficiency may not be how people want to spend their money.

In addition to these challenges, two participants stated that they believed there is a lack of political will in the Province to address energy efficiency, with one stating the Provincial government should be connecting with social enterprises to champion conservation and efficiency programs at the community level, either in the physical community or via an online community. The participant suggested that online engagement may be more successful in motivating consumers because many people today are more closely connected with an online
community of people sharing similar interests than they are with the people who live physically near them.

Aside from the cost of energy, the participants indicated that these challenges are not specific to BC. Competing priorities, a lack of knowledge, and the belief that appropriate actions are already being taken were identified as general challenges across various jurisdictions. However, one participant noted that “fuel splitting” was a BC-specific challenge and highlighted that BC Hydro has a tendency to create programs that target reduced electricity usage regardless of changes that may result in oil and gas usage, and that this is a short-sighted response given that BC’s hydroelectric electricity produces much lower emissions than oil and gas consumption.

When asked about how BC differences affect the creation of an effective energy policy, one participant indicated that because fuel is relatively cheap, there is a need to focus on other benefits to energy efficiency. The money that a consumer saves by changing to a more efficient light bulb may not be enough to motivate a change in behavior. Another participant indicated that it is important that government support energy efficiency policies and treat it as a priority in order to promote change.

9.2 THE ROLE OF TECHNOLOGY

All five participants, when asked about the role that technology plays in household consumption patterns noted that consumers now have access to much more information and greater control regarding their energy use due to increased automation through applications on smart phones, detailed displays on appliances, and consumption information available from smart meters. However, one participant noted that though consumers have much more information available to them than they used to have, that does not necessarily mean that they are actually interested in that information.

Three of the five participants mentioned that technology also plays a role in consumption patterns because people now have more appliances than in the past. Households today commonly have multiple televisions and increased plug loads from computers, cell phones, chargers, and personal video recorders, and this plays a significant role in household consumption. However, one participant pointed out that space and water heating are the biggest draws on household energy use, and that the most important issue is ensuring the highest efficiency of those appliances. In addition, another participant noted that, though households today have more appliances than they used to, those appliances are much more efficient than they used to be. Where a refrigerator used to consume 1500 to 1600 kilowatt hours per year, a typical refrigerator today consumes approximately 500 kilowatt hours per year.

Regarding the use of technology to better promote energy efficiency, one participant noted that there should be better marketing of energy efficient appliances. Using heat pumps as an example, the participant noted that people often do not fully understand what these appliances are, or how they operate to increase the efficiency of a home. Four participants reiterated that the increased information consumers receive from smart meters and apps can provide consumers with a greater understanding of the ways their actions affect their overall consumption, and may also provide a mechanism for them to compare their usage to others.
Anecdotally, one of the participants echoed the findings in the literature indicating that programmable thermostats may not always result in lower energy consumption. He stated that after installing a programmable thermostat in his bathroom during a renovation, he had such a hard time trying to program it that once it was done, he never touched it again. In his experience, the user interface on the thermostat was so complicated that it made the device nearly unusable.

9.3 Temperature Setbacks
The participants were asked a question about optimal setback temperatures. Information from the literature indicated that significant energy savings can be realized when thermostats are set back in the evening. However, a standard recommendation for an optimal setback temperature was not clearly expressed in the literature. Results from the interviews also showed a lack of consistent messaging regarding setback temperatures.

One participant was not aware of any standard recommendation for setback temperatures. Another was unsure of whether or not there was a standard recommendation, but indicated anecdotally that he sets his thermostat to 15 in the evening based on his own personal preference. Another participant stated that a setback temperature of 15 degrees in the evening was the standard recommendation, and that this was based on a generalization of personal preference. One participant stated that they believed there is a recommended setback temperature but couldn’t recall what it was, and the final participant believed that the recommendation is to set temperature back to 16 degrees Celsius and that this recommendation is based on how long it takes the heating system to recover heat in the morning.

9.4 Opportunities for Change
Participants were asked what they believed were the largest barriers stopping BC household from adopting more efficient practices. The responses to this question largely mirrored the responses to the question about the biggest challenges for building a household energy policy in British Columbia. Participants noted that people have a tendency to put off big tasks, that there may be a lack of awareness regarding what changes are required, that the required changes may be expensive and that the upfront costs may not result in immediately noticeable savings on utility bills. Other barriers listed included the fact that utility costs are low in BC and that increasing energy efficiency is not important enough in comparison to other priorities.

When asked about the biggest change that homeowners can make to reduce household energy consumption, the answers were varied. Two participants indicated that it was a difficult question to answer, as it the answer is influenced by factors such as oil versus electric heating, age of the home and time of year. One participant stated that installing a heat pump was the best change that a household can make, while another participant stated that in some cases, a heat pump may not be the best option if there are more pressing issues, such as poor insulation and inefficient windows. One person indicated that there were two streams that can target household consumption: behavioural change and the efficiency of the home itself, but also stated that heating and cooling generally create the highest draw on energy; therefore behavioural changes and household efficiency upgrades should ideally target the heating and cooling of the home.
The final participant indicated that the biggest change depends on the level of commitment of the homeowner. At the most committed level, a full retrofit of the home is the biggest change that can be made, but there are a number of changes that can be made that require a smaller financial investment.

As several of the participants indicated that the biggest change a homeowner can make was highly dependent on the situation, follow-up questions asking why the response given is considered the best approach, and how this approach could best be promoted were not entirely relevant. However, two participants did highlight the importance of knowledgeable tradespeople who have the expertise to recommend the appropriate option homeowners. While homeowners may not know whether or heat pump or new insulation is the best choice for their home, industry standards should ensure that tradespeople do have the requisite knowledge. In addition, one participant used the Residential Energy and Water Conservation requirements in San Francisco as an example of a best practice, as the program ensures that efficiency measures like improving the heat envelope of the home are addressed whenever a home is sold. This approach was also considered to be desirable because it does not cost the government money to operate. Instead, he stated that the costs of the mandatory retrofit would be rolled into a mortgage payment causes little hardship for homeowners or government agencies. As long as these upgrades are cost-effective, this approach is reasonable, although establishing cost-effectiveness is beyond the scope of this research.

Overall, the experts agreed that heating and cooling are the biggest energy users at the household level. For that reason, all of the experts highlighted need for policies that address heating and cooling, whether that is done through changes to building code standards, or by subsidizing home energy audits. Other best practices that were emphasized by the participants were the need for social engagement.
10 DISCUSSION

This section of the report compares strengths and weaknesses of the individual jurisdiction’s household energy policies by comparing the existing policies and programs against the best practices found in the literature, and those indicated during the expert interviews.

10.1 BC-SPECIFIC CONSIDERATIONS

The expert interviews identified two BC-specific challenges: the low cost of energy and fuel splitting. Four out of five participants indicated that low fuel costs may represent a challenge for creating an effective household energy conservation strategy. A simple solution to this challenge may be to increase the cost of fuel in order to promote behavioural change. However, a 26 percent rate increase over five years is already included in BC Hydro’s 10-year plan and additional increases beyond those identified in the plan could create significant public backlash. Furthermore, changing the price of fuel may not be effective if energy users lack the ability to weigh long-term benefits against upfront costs. Therefore, though low-energy prices were repeatedly identified by the experts as a challenge to energy conservation, the findings do not support a recommendation for price increases above those that are already included as part of BC Hydro’s plan.

Fuel-splitting was identified as a BC-specific challenge by one of the participants, who cited the fact that programs supplied by BC Hydro are focused exclusively on electricity consumption, and do not address other sources of energy like oil or natural gas. This may be compounded by the fact that provincial incentive programs such as LiveSmart have recently transitioned from the BC Government to BC Hydro. Public education programs, incentives, and rebates may need to be developed independently from BC Hydro to ensure that conservation programs do not exclusively target electricity consumption.

10.2 SUITABILITY OF COMPARISONS TO BC

Germany was included in the jurisdictional scan because the country has been identified as a leader in energy conservation. However, though Germany provides an example of an aggressive approach to energy conservation, its approach may not be suitable for application in BC at this time.

Germany’s energy policies were driven by high energy prices, unreliable energy supply, and a reliance on fossil fuels. In addition, Germany’s energy policy is primarily the responsibility of the federal government, with regional authorities taking a more minor role. This is much different from the situation in BC, which is characterized by low energy prices and hydroelectric energy that does not produce high carbon emissions. The adoption of aggressive energy conservation legislation as in Germany would result in political pushback, especially given the fact that none of the North American jurisdictions reviewed have implemented similar legislation in relation to household energy use.

The North American jurisdictions are more easily compared to BC as programs and policies are created at the provincial or state level, and low energy prices are not uncommon. However, in
reviewing the energy plans of the original jurisdictions, several jurisdictions had action plans that strongly emphasized energy supply as opposed to demand-side management. For example, Nova Scotia’s Climate Change Action plan strongly emphasizes the adoption of renewable energy resources, and does not include detailed plans related to household energy consumption. However, 75 percent of Nova Scotia’s energy needs are met by burning fossil fuels like coal.

Similarly, in Saskatchewan, the Go Green Fund and the Net Metering Program focus on creating renewable energy supply as opposed to reducing overall energy demand, which is reasonable given Saskatchewan’s high oil and gas emissions. However, though some of the jurisdictions show a strong focus on developing renewable energy sources, all of them have also implemented demand side management programs targeting household energy consumption that may be appropriate for application in BC.

### 10.3 Evaluation Criteria

Based on the literature review and expert interviews the evaluation of the jurisdictional policy scan is based on the following assumptions:

1. Space heating and cooling are the biggest contributors to household energy consumption.
2. Household energy consumption has increased in recent years and this can be partially attributed to increases in the number of appliances that households use.
3. Energy consumption can be affected by a variety of situational factors, such as environmental knowledge and household income level.
4. Consumers are not always able to accurately consider the long-term benefits of investing in energy conservation, and they may be under the impression that they have already adopted sufficient conservation measures.
5. Credit constraints may provide challenges for investing in efficiency improvements.
6. Technology such as programmable thermostats can create significant energy savings, but only if they are used correctly.
7. Recommended temperature setbacks should be between 3 and 5 degrees Celsius in order to be effective while reducing risk for moisture and discomfort problems.
8. Energy consumption programs may be behaviourally-based or structurally-based.
9. Behavioural strategies are most effective when feedback is tailored to the specific consumer, and when the proposed changes are convenient.
10. In addition to tailored information, goal-setting can promote energy conservation behaviours, especially where feedback is comparative.
11. People are more likely to make changes related to energy conservation and/or efficiency when it is convenient and inexpensive.

Using these assumptions, it is suggested that the most successful jurisdictions will have implemented policies and programs that:

1. Have an action plan that specifically targets household energy conservation;
2. Target household space heating and cooling and appliance use;
3. Include effectively marketed and easily accessible public education programs on best practices and the benefits of investing in efficiency;
4. Include programs that are specifically targeted to low-income households;
5. Include both behavioural and structural (incentives) strategies;
6. Include tailored information and goal-setting; and
7. Include low and no-cost strategies in addition to those requiring more investment of time, money, or effort.
8. Take advantage of technology.

10.4 LEADERS IN HOUSEHOLD ENERGY CONSERVATION

BC’s current policies and programs for reducing household energy conservation contain many several elements of a comprehensive energy strategy. Household energy use is addressed in the BC Energy Plan, incentives programs exist that target home heating and cooling and low-income households, and the BC Home Energy Monitor program provides real-time feedback to users on their energy consumption. However, the Province does not have a public information campaign to educate consumers on the importance of energy efficiency and conservation, nor does it have a single agency that can provide one-window access to information. In addition, though the Province has developed two on-bill financing pilot programs, it has yet to develop a Province-wide program.

In addition, findings from the BC Hydro Residential End-Use Study suggest that many British Columbians lack a firm understanding of energy saving technology, given previous results in which many users allegedly failed to distinguish between manual and programmable thermostats. This aligns with findings from the academic literature that suggest that many people do not know how to effectively operate programmable thermostats, which may result in increased energy use compared to manual thermostats.

Web-based tools are another common strategy employed by other jurisdictions. Like BC Hydro’s Home Energy Monitor Program, online tools like energy use calculators and home energy surveys provide an opportunity for homeowners to evaluate their energy consumption for free. These tools are readily available on the internet, which makes them convenient – another factor contributing to success. In addition, tools like Alberta’s One Simple Act Home Assessment Survey can provide specific recommendations based on a homeowner’s needs and finances.

Several jurisdictions, such as Oregon, Manitoba, PEI and Germany have financing programs or government grants available to consumers investing in energy efficient technology. The literature shows that people are more likely to invest in energy conservation and/or efficiency when it is convenient, and does not involve high costs in terms of time or money. Offering financing is a structural strategy that makes investing in energy efficiency more desirable by reducing the upfront costs and spreading them out over time. Without programs of this kind, it may be more difficult to motivate people to invest in high cost efficiency measures, in addition to making it difficult for credit-constrained households to invest in efficiency.

While goal-setting is identified as a driver of behavioural change in the literature, very few jurisdictions had policies or programs that involve goal-setting. While provincial, state, or federal action plans commonly included emission reduction and conservation standards, goal-setting programs that are directly targeted to household energy consumption were not common.
One reason for this may be the cost associated with goal-setting programs. To have a program that provides a homeowner with a goal of reducing energy consumption by five percent is not meaningful if the homeowner does not track their consumption patterns. Furthermore, the literature shows that goal-setting is more effective when participants are able to compare their results against their peers. Though comparative feedback may increase engagement, this is more difficult to coordinate than installing a home energy monitor, or providing access to an online energy use calculator.
11 RECOMMENDATIONS

British Columbia’s current policies and programs contain many indicators of a successful household energy conservation strategy. However, a review of the academic literature and of neighbouring jurisdictions highlights areas where the Province could improve upon existing strategies. To improve the Province’s household energy policies, BC should:

1. Create a public education campaign to advertise efficiency and conservation programs.
   Programs such as the Home Energy Monitor Program, which provides tailored information to energy users in the form of real-time feedback may be successful in promoting behavioural change according to the academic research. By widely advertising new and existing programs, the Province can promote greater uptake. Through advertising, the Province could also provide consistent messaging in relation to best practices such as temperature setbacks by advertising a recommended nighttime setback of three to five degrees Celsius.

   A public education campaign should be developed collaboratively with BC Hydro and Fortis BC to ensure that the campaign address homeowners heating with oil and gas in addition to electric customers.

2. Create a single agency to serve as a point-of-access for consumers to obtain information about energy conservation and efficiency.
   A common trend among the surveyed jurisdictions is the existence of a single agency that acts as a conduit for information related to energy efficiency and conservation, and government programs. The structure of these agencies differs considerably with some being operated as an office of the government and others by Crown Corporations or non-profit agencies.

   This approach may be effective because it makes it easier for consumers to access the information they need, making it more convenient, and because it raises awareness of consequences of energy use, which has also been shown to reduce energy consumption.

3. Create web and mobile-based tools that provide consumers with more information about their energy consumption.
   Tools like Alberta’s One Simple Act Home Energy Assessment Tool and Efficiency Nova Scotia’s Energy Use Calculator provide tailored feedback to consumers through self-assessment. These tools are low cost, compared to home energy audits by professional auditors, but they can still provide recommendations to homeowners that include both low- and no-cost options as well as options that require higher investment. In addition, these tools can ensure that the recommendations include options that address homeowners who have oil or gas heating.
4. Expand existing pilot programs to a Province-wide on-bill financing program allowing homeowners to finance the cost of efficiency-increasing home improvements.

As indicated by the literature review and the expert interviews, it is common for energy users to put off big tasks, or to prioritize other things above investing in energy efficiency. Eliminating the upfront costs of efficiency upgrades can make these investments seem more desirable and convenient. Furthermore, on-bill financing programs may be beneficial to credit-constrained customers who may otherwise be unable to finance efficiency improvements. The Province should expand existing pilot programs with the goal of implementing Province-wide availability.
12 Conclusion

British Columbia has expressed a strong commitment to energy conservation and efficiency. As a result, the Province has created an energy plan that includes many pieces of a successful energy strategy, such as tailored information and the creation of incentives that target heating and cooling and low-income households.

However, there are some gaps in BC’s approach to energy efficiency. The Province has not developed a public education campaign, nor does BC have a single agency providing information to consumer related to energy conservation. A one-window approach is seen in eight out of 14 jurisdictions. In addition, though the Province does have programs that provide tailored information, such as the Home Energy Monitor Program offered by BC Hydro, the Province could improve by developing easy-to-access web and mobile tools that allow homeowners to self-assess their energy use and that provides tips for reducing energy consumption. Finally, the Province does not have a program that serves the needs of credit-constrained households that may have difficulty financing efficiency upgrades to their homes.

This report provides recommendations for addressing household energy use through a literature review, a comparison of policies and programs in neighbouring jurisdictions, and interviews with energy experts. However, this report only addresses direct energy consumption. To ensure that the Province’s strategy address all aspects of household energy consumption (including direct and indirect energy), further research into household indirect energy use should be conducted.

Another opportunity for further research is San Francisco’s Residential Energy and Water Conservation Requirements program. This program was not explored in depth, as it does not target voluntary behavioural change, because participation is mandatory. In addition, the program is closely tied to building standards, which are not addressed here. However, mandatory household upgrades could result in significant energy savings, and further research should be conducted to determine if a similar program is feasible in BC.
13 REFERENCES


Clean Energy Act, Revised Statutes of British Columbia (2010). Retrieved from the Legislative Assembly of British Columbia website: https://www.leg.bc.ca/39th2nd/1st_read/gov17-1.htm


http://www.efficaciteenergetique.gouv.qc.ca/en/my-home/econologis/contenu-du-programme-econologis/#.VLrNEhDN5Qs


[44]


[45]
Thank you for agreeing to participate in an interview. I am conducting this research project for my client at the Ministry of Energy and Mines. The ministry is interested in identifying best practices for household energy conservation. As an expert in the field, your contribution will help to identify key issues and challenges for promoting household energy conservation.

Today’s interview is expected to take no more than 40 minutes. Should you decide at any point before the project is completed that you would like to withdraw, you may contact me by phone or email, and your data will not be included in the final report.

As indicated on the consent form, you will not be mentioned by name in the report, though your organization will be named.

You are welcome to decline to respond to any and all questions, as you feel necessary. Do you have any questions before we begin?

Questions:

1. What do you see as the biggest challenges for building an effective household energy conservation strategy for BC?
   a. Do you see any of these challenges as BC-specific? If so, how does BC differ from other jurisdictions?
   b. How do these differences affect the creation of an effective energy policy?

2. What role does technology play in household consumptions patterns?
   a. How can technology best be used to promote better energy efficiency?

3. What are the largest barriers that stop BC households from adopting more efficient practices?

4. The literature indicates that turning thermostat temperature down in the evening can reduce household energy use significantly. What temperature do you recommend as an optimal setback temperature?
   a. Why is this temperature considered optimal?

5. What do you think is the biggest change people can make to reduce household energy consumption?
a. How could this practice be best promoted?

b. Why do you consider this to be the best strategy?

Thank you for taking the time to participate in this interview today, your input is greatly appreciated.