

**ADDRESSING BARRIERS: LOWER MAINLAND
LOW-INCOME HOUSEHOLDS AND
ENERGY EFFICIENCY**

by

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Abstract

This study uses focus groups and in-depth interviews to explore why some and not other low-income British Columbia residents use compact fluorescent lamps (CFLs), generating policy options aimed at improving the energy efficiency of low-income households. Study results indicate affordability, lack of awareness or poor product knowledge, not having a BC Hydro account, and CFL mercury content are significant barriers to increasing CFL uptake. After evaluating five possible policy options according to cost, effectiveness, administrative feasibility, equity and public acceptability, this study recommends distributing five free CFLs and an educational pamphlet on CFLs to all low-income BC households in advance of banning energy inefficient lighting. The study also outlines lessons learned for increasing low-income uptake of energy efficiency measures.

Keywords: Energy efficiency; compact fluorescent lamp; low-income; British Columbia; energy burden; energy poverty

Subject Terms: Energy policy -- British Columbia; Dwellings -- Energy Conservation -- Government policy -- Canada; Low-income housing -- British Columbia; Incentives in conservation of natural resources -- Canada

Executive Summary

This study investigates how to increase uptake of energy efficiency measures by low-income British Columbia households by focusing on compact fluorescent lamps (CFLs). CFLs have high electricity savings potential for users and are applicable in all rented and owned dwelling types. The study uses focus groups and in-depth individual interviews to understand why some and not other low-income BC residents use CFLs. Focus group and individual interviews indicate affordability, lack of awareness or poor product knowledge, not having a BC Hydro account, and CFL mercury content are significant barriers to increasing CFL uptake among low-income households. The study evaluates five policy options to increase CFL uptake by low-income BC households according to cost, effectiveness, administrative feasibility, equity, and public acceptability, including:

- Maintaining CFL Component of Power Smart Low Income Program (Status Quo)
- Distributing Five CFLs and Pamphlet to Low-Income BC Hydro Customers
- Distributing Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers
- Banning Energy Inefficient Lighting
- Distributing Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers in Advance of Banning Inefficient Lighting

Based on the multi-criteria evaluation, the study recommends the provincial government ban inefficient lighting even if the federal government does not implement its proposed ban. In advance of a ban, the study recommends the provincial government and BC Hydro distribute five free CFLs and an educational pamphlet to all low-income BC residents. The paper concludes by addressing implementation difficulties and outlining next steps.

Dedication

To Mum and Dad.

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Glossary

BC	British Columbia
BCUC	British Columbia Utilities Commission
CFL	Compact fluorescent lamp; an energy saving light.
Kilowatt hour (kWh)	Unit of electrical energy equal to one thousand watt hours.
Megawatt hour (MWh)	Unit of electrical energy equal to one million watt hours.
RIB	Residential Inclining Block rate

1: Policy Problem and Background

This study starts with the idea that too few low-income BC households employ energy efficiency measures. More specifically, it explores ways of improving low-income energy efficiency in British Columbia by forwarding proposals to increase low-income household compact fluorescent lamp (CFL) uptake. The investigation aims to address “energy poverty”, a condition caused by the combination of low household incomes and “poor energy efficiency in homes” (UK Government, 2001). As improving energy efficiency in low-income homes is a proven method of alleviating or even eliminating energy poverty (Oppenheim & MacGregor, 2000, UK Government, 2001, Boardman, 1991), it is the core focus of this study. The remainder of this section outlines energy provision in BC, energy poverty in BC, how energy efficiency addresses energy provision and energy poverty difficulties in BC, and provides background information on CFLs.

1.1 Energy Provision in British Columbia

While BC has the second lowest electricity rates in North America, a variety of factors are driving prices upward. BC has reached a point where its heritage hydropower sources have significantly aged and require replacement infrastructure and/or improvements. At the same time, demand for electricity in BC is growing, creating a gap between electricity demand and supply. Provincial demand for electricity is projected to increase by 25 to 45 percent over the next 20 years, seriously exacerbating the gap between demand and supply (BC Hydro, 2006). To put it in perspective, this gap is the “equivalent electricity required to power 1.4 to 2.5 million new homes” (BC Hydro, 2006). In sharp contrast to the province’s historic surplus of electricity, BC has been a net importer of electricity since 2001 (BC Hydro, 2008 A). The 2007 BC Energy Plan

stresses the role of energy efficiency and conservation to help meet the electricity needs of the province and sets an ambitious target “to acquire 50 percent of BC Hydro’s incremental resource needs through conservation by 2020” (BC Ministry of Energy, Mines and Petroleum Resources, 2007, p. 5). In order to achieve such an ambitious conservation target, the province is focusing on demand side management as a source of energy supply in an unprecedented manner, including prompting BC residents to adopt energy efficiency measures.

“Energy efficiency” is defined as the ratio of useful output to energy input. In other words, energy efficiency measures use less energy to provide the same end use or service at the same level of quality as standard measures. For example, an energy efficient refrigerator uses less energy than a regular refrigerator while offering the same services such as chilling contents, ice cube production and water disposal. Sometimes confused with energy conservation, energy efficiency is generally associated with new technology and products while energy conservation refers to behavioural changes such as turning off the lights in an unoccupied room. Energy efficiency measures provide users with savings on their energy bill by reducing energy consumption and can pay for themselves through these savings provided they are cost effective. Cost effective energy efficiency measures recover the cost of initial investment through longer-term energy savings often called a ‘payback period’. A measure is cost effective as long as the payback period is no longer than the life of the energy efficiency measure.

Energy efficiency provides savings to both consumers and suppliers. Consumers save on their energy bills by consuming less energy, thereby reducing demand, making energy efficiency a viable, and relatively cheap, supply option. However, a “rebound effect” can diminish or even negate the reduction in energy consumption delivered by energy efficiency. This occurs when improving energy efficiency reduces the marginal cost of the energy service and therefore increases demand for the service, increasing energy consumption. The rebound effect can also occur when customers use disposable income increases obtained through energy efficiency to

purchase more energy consuming items. A recent study on residential energy efficiency improvements and subsequent energy consumption found:

The conservers (30% of households) had higher initial energy consumption levels and achieved two-thirds of the potential savings identified by the energy evaluation. Consumers (12% of households) had higher ownership rates of high-efficiency furnaces and water heaters and demonstrated the rebound effect of increased demand for energy services following the evaluation. Low-income groups were the most likely to behave as conservers (42%) while high-income groups were the least likely to be conservers (13%) and the most likely to be consumers. (Parker, 2004, p. 2).

That low-income households are less likely to demonstrate the rebound effect has significant implications for energy efficiency policy. Low-income households are more likely to deliver energy savings from energy efficiency improvements, making them exemplary candidates for energy efficiency programs. A second factor making low-income households ideal targets for energy efficiency programs deals with free-ridership. Free-riders are demand side management program participants who made the decision to invest in the energy efficiency measure independent of the program. Free-riders receive an incentive to purchase the measure even though they would have purchased the measure without the incentive. Due to a lack of disposable income and other barriers, low-income households are less likely than higher income households to invest in energy efficiency measures and are therefore less likely to be free-riders (Kelly, 2007).

The BC Energy Plan also encourages utilities to employ economic incentives in support of its conservation goal. The Plan outlines policy actions regarding: “Exploring new rate structures to identify opportunities to use rates as a mechanism to motivate customers either to use less electricity or use less at specific times; and, employing new rate structures to help customers implement new energy efficient products and technologies” (BC Ministry of Energy, Mines and Petroleum Resources, 2007, p.8). In response to these policy directives, in February

2008, BC Hydro submitted a proposal to its regulator, the British Columbia Utilities Commission (BCUC), to replace the historic flat rate structure with the Residential Inclining Block rate (RIB).

Six months later, the BCUC approved the RIB application, which came into effect in October 2008. The RIB pricing structure recognizes a certain level of demand for electricity is inelastic, as it is a basic need for sanitation, cooking, home and water heating, and so on, in homes that use electricity for such energy services. Therefore, a “lifeline” of 1,350 kilowatt hours (kWh) per two-month billing period is provided at a rate of 5.98 cents/kWh, which is lower than the former flat residential rate of 6.55 cents/kWh (BC Hydro, n.d.). Should customers use more than 1,350 kWh in a two-month billing period, they will be charged the second step rate of 7.21 cents/kWh (BC Hydro, n.d.). According to BC Hydro, 84 percent of their low-income customers, measured by the Low-Income Cut-Off, will see a reduction in their electricity bills annually under the RIB (BC Utilities Commission, 2008). However, both the Step 1 and Step 2 RIB rates are set to increase in April 2009 (BC Hydro, n.d.). As rates increase, low-income households must expend an even greater proportion of income on energy, making energy efficiency improvements that much more necessary.

1.2 Energy Poverty in British Columbia

As income decreases, the proportion of income spent on energy expenditures increases. “Energy burden”, occurs when low-income consumers expend a disproportionate amount of income on energy purchases. Virtually every study on residential energy use since the 1970s has confirmed the existence of the energy burden (Hirst et al., 1982, Garbacz, 1983, Baxter et al., 1986, Boardman, 1991, Baxter, 1998, Healy, 2004). According to the UK Government, unreasonable energy burden becomes “energy poverty” when households expend ten percent or more of after-tax household income on home energy (Kelly, 2007).

Table 1.1 Energy Expenditures as a Percentage of Income

INCOME QUINTILE	BRITISH COLUMBIAN AVERAGE				BC avg	CDN avg
	After Tax Income	Electricity	Gas + Other Fuel	Energy Bill	% of Income	% of Income
All	\$53,342	\$894	\$1,793	\$2,687	5.04%	6.64%
Lowest	\$14,064	\$652	\$1,825	\$2,477	17.61%	20.38%
2 nd	\$30,839	\$763	\$1,781	\$2,544	8.25%	11.03%
3 rd	\$48,126	\$875	\$1,710	\$2,585	5.37%	7.54%
4 th	\$67,833	\$1,015	\$1,671	\$2,686	3.96%	5.37%
Highest	\$110,540	\$1,101	\$1,923	\$3,024	2.74%	3.48%

Source: Adapted from Kelly, 2007.

Statistics Canada's 2002 Survey of Household Spending data in Table 1.1 shows British Columbians fare slightly better than the Canadian average in terms of energy burden and energy poverty. Broken into income quintiles, the first column displays BC average after-tax income. The next three columns display average electricity expenditure, average gas/other fuel expenditure and average total energy bill expenditure. The last two columns show the average percentage of after-tax income spent on home energy in BC and across Canada. In BC, those in the lowest income quintile spend an average of 17.6 percent of income on energy - almost twice the 10 percent level delineating energy poverty. The second income quintile in BC also experiences a significant energy burden, spending 8.25 percent of after-tax income on home energy. The BC Public Interest Advocacy Centre estimates more than 270,000 BC homes (500,000 people) suffer from energy poverty (2008).

While energy burden and energy poverty can apply to all energy sources, this study focuses on electricity for two reasons. First, the electricity sector in BC is regulated and the government therefore has a role to play. Second, a disproportionate number of low-income households rely on electricity as their primary heating fuel, which is the largest component of residential energy consumption (IndEco Strategic Consulting Inc., 2003). In Canada, 44 percent of the lowest income quintile use electricity as their principal heating fuel, compared to only 20.5 percent of the highest income quintile (Natural Resources Canada, 2008 B).

Some energy poverty results from inefficient energy technology. Low-income households are more likely to have aging, energy inefficient appliances and other energy consuming equipment (Natural Resources Canada, 2008 B). The Canadian Environmental Law Association reports “compared to both the Canadian average and the highest Canadian income quintile, the lowest Canadian income quintile has a far greater proportion of households that have principle heating equipment more than ten years old,” meaning their heating system is more likely to be inefficient (IndEco Strategic Consulting Inc., 2003, p. 5). Evidence from European jurisdictions also shows low-income households are the least energy efficient (Clinch and Healy, 2000). According to data on Canadian dwelling and equipment characteristics, the lowest income quintile “has a far greater proportion of households that are rented, have electric water heating, have electric space heating and have principal heating equipment of which 76 percent is more than 10 years old” (Natural Resources Canada, 2008 B, p. 4). In sum, many low-income households must consume more energy to obtain the same level of energy service as higher-income households due to inefficient energy consuming equipment.

The United States and the United Kingdom have a long tradition of programs to assist low-income households with energy expenditures that focus on assisting those households to increase the level of energy efficiency within their home. While Canada has been slower to adopt such programs, six provinces have implemented energy efficiency programs targeting low-income households in the past three years (Kelly, 2007, Janigan, 2006). BC has likely been one of the last to do so because of its relatively low electricity rates. As BC Hydro Executive Vice President Beverly Van Ruyven explains: “We are moving into an era where there will be more substantial rate increases and we think that we need to pay attention to [the low-income] segment of our customer base, and help them out because they are the least able to overcome ... capital barriers to investing in energy efficiency measures” (Simpson, 2008, p. 2).

Energy efficiency is widely acknowledged as an effective method of alleviating and even eliminating energy burden and energy poverty (Oppenheim & MacGregor, 2000, Boardman, 1991). However, low-income customers face barriers to investing in energy-efficiency measures, including in BC where BC Hydro acknowledges low-income customers “may have been underserved by past [Power Smart] program offers due to barriers that are more pronounced for low-income customers” (BC Hydro, 2008 B, p.151). Major barriers low-income households face to investing in energy efficiency measures include lack of awareness and accessibility, due in part to lack of mobility, language barriers, lack of time and resources, and an increased incidence of rental accommodation; affordability; and to a lesser extent, barriers regarding the participation process, welfare stigma, fear, and distrust. Section 2.2 discusses each barrier in more detail.

BC Hydro introduced its first energy efficiency program targeted at low-income customers in April 2008, and the provincial government announced funding for improving the energy efficiency of low-income homes in December 2008. The provincial government is also introducing “a new regulation under the Utilities Commission Act to support adequate and cost effective energy conservation and efficiency. This new regulation requires and supports new utility conservation programs that are aimed at low-income households and those who rent” (BC Ministry of Energy, Mines, and Petroleum Resources, 2008). Clearly, improving the energy efficiency of low-income BC households is a growing priority for utilities and government.

1.3 Compact Fluorescent Lamps (CFLs)

This study uses compact fluorescent lamp (CFL) uptake by low-income BC residents as a proxy for general energy efficiency measure uptake. This narrowing to CFLs is justified as exploring all such measures - such as energy efficient appliances, windows, and insulation - is too broad for a study of this size. In addition, testing multiple measures reduces the ability to drill down and explore in detail previously outlined uptake barriers. Work by other authors supports this narrowing. For example, Gaffney (2006) identifies CFLs as the most needed energy

efficiency measure for low-income households, meaning the existing lighting measures in low-income dwellings were inadequate with regard to energy efficiency. Of the low-income dwellings studied, Gaffney (2006) found 80 percent of those dwellings require energy efficient lighting measures, such as CFLs. Gaffney (2006) also found CFLs to be one of the three highest applicable energy efficiency measures for low-income households, meaning they are a technically feasible energy efficiency measure to install. CFLs are applicable in both rented and owned accommodation, an important point when considering a low-income audience. Beyond their applicability and need in low-income housing, CFLs have the highest electricity savings potential. Gaffney (2006) determined lighting measures overwhelmingly have the highest electric energy savings potential, generating 44% of electric energy savings, compared to infiltration measures¹ (20%), appliances (20%), cooling measures (9%), water heating measures (5%), and minor home repair (2%).

According to BC Hydro's Conservation Potential Review (2007), lighting is the second largest residential end-use of electricity, accounting for 16% of electricity use, after space heating which accounts for 24%. The Conservation Potential Review performed extensive analysis of the applicability and energy savings potential of forty-three residential energy efficiency measures. CFLs were determined to be applicable in all dwelling types, and to have a very high electric energy savings potential of 75%. CFL users therefore consume less electricity and save money on their energy bill. According to BC Hydro, customers can reduce electricity costs by \$20 per year by replacing five high-use incandescent light bulbs with CFLs (BC Hydro, 2009 A). In addition, CFLs last ten times longer than incandescent light bulbs, burning 10,000 hours as opposed to an incandescent light bulb's 1,000 hours. While CFLs cost more initially, users actually save money on bulb purchases over the long term because they would require ten

¹ Infiltration measures include: "caulking, weatherstripping, ceiling insulation, duct sealing, and room air conditioner/evaporative cooler covers" (Gaffney, 2006, p. 55).

incandescent light bulbs at a cost of \$7.50 to equal one CFL at a cost of \$5, thus saving \$2.50 (BC Hydro, 2009 A).

Having received increasing requests from utilities for data on CFL uptake, Michael Reid included four CFL-related questions on a nationwide survey aimed at US consumers, which received 34,750 responses. Reid (2008) found CFL users are likely to have more than one CFL. The survey found 50% of respondents have no CFLs installed in the household, 6% have one CFL, 23% have two to five CFLs, and 21% have more than five (Reid, 2008). Reid's results suggest CFLs are a "gate-way" energy efficiency measure, at least in terms of lighting.

BC already has high CFL penetration, with 47% of households using at least one CFL. This is much higher than the 32% of Canadian households using at least one CFL, as well as compared to other regions: Atlantic (22%), Quebec (24%), Ontario (33%), and the Prairies (35%) (Natural Resources Canada, 2008 B). These results are likely in part due to BC Hydro's aggressive CFL campaign, which included mailing all BC Hydro customers vouchers for two free CFLs. The program started on Vancouver Island in 2002 and ended in the northern and southern interior of BC in 2004. Over the two year CFL giveaway campaign, "BC Hydro distributed approximately 1.8 million CFLs to nearly 650,000 customers at retailers across the province" (BC Hydro, 2005, p. 48). This program excluded people without a BC Hydro account. Unfortunately, data on BC CFL penetration by income is not publicly available.

I hypothesize low-income participation in this program was lower than median and high-income participation levels. The main barrier for low-income participation in this program is a process barrier. The program delivered vouchers for CFLs, instead of the actual CFL. Thus, in order to participate, one must travel to the store redeeming vouchers for CFLs. As noted by BC Hydro, lack of mobility is a process barrier for low-income customers (2008 B). The low-income stakeholder interviewed about policy options, Nathan Allen, the Manager of Pigeon Park Savings and a long-time resident of a co-operative in Vancouver's Downtown Eastside, echoed this

sentiment. Allen explained low-income Lower Mainland residents face mobility barriers, such as lacking access to personal transportation, or even public transportation (personal communication, February 11, 2009). They are therefore unlikely to make a special trip to a store, likely outside of their neighbourhood, to redeem a voucher. Allen mentioned he, like many other low-income residents of the Downtown Eastside, shops exclusively at Army & Navy, due to its discount prices and close proximity.

Recognizing the need to tailor a program for low-income customers, BC Hydro implemented the Power Smart Low Income program, which includes distributing three free CFLs to low-income customers, in April 2008. The stated program goals are to “provide opportunities for low income customers to generate energy savings and reduce their electricity bill through changes within their home; and provide access to energy-efficient products for customers that may have been underserved by past program offers due to barriers that are more pronounced for low income customers” (BC Hydro, 2008, p. 152). More information on the Power Smart Low Income program is available in the description of Policy Option 1 in Section 5.1.

In 2006, BC Hydro donated 30,000 CFLs to public housing (BC Housing, 2007). As a Crown Agency, BC Housing is “required to make its operations carbon neutral by 2010,” which it plans to achieve largely through reducing energy consumption through energy and water retrofits (BC Housing, 2009). BC Housing collaborated with BC Hydro and the Ministry of Energy, Mines and Petroleum Resources in order to improve the energy efficiency of its buildings, and plans to ban inefficient incandescent lighting. BC Housing has committed to installing CFLs in all new social housing projects it funds (BC Housing, n.d.).

The Energy Savings Plan, a Provincial Government pilot program implemented between April 2006 and March 2007, provided funding for reducing energy consumption in the province. One component of the program was targeted at low-income families living in rented accommodation and landlords providing social housing (Kelly, 2007). The Energy Savings Plan

was originally developed to build on the federal government's short-lived EnerGuide for Low-Income Housing (EGLIH) program. When EGLIH was cancelled the Energy Savings Plan low-income program directed its budget of \$800,000 at rental rooming housing and multi-unit residential buildings. The pilot achieved "extremely cost effective energy savings" (Kelly, 2007, p. 12).

In December 2008, the provincial government announced a Low-Income Energy Efficiency program, which devotes seventeen million dollars to energy efficiency retrofits for low-income housing. The program aims to improve the energy efficiency of nine thousand low-income residential units, at an approximate cost of two thousand dollars per unit, by March 31, 2011 (Ministry of Energy, Mines and Petroleum Resources, 2008). CFLs are one of the energy efficiency measures identified for possible installation by the program (LiveSmart BC, 2009). Finally, the federal government has announced plans to ban energy inefficient lighting, for which CFLs are a popular and relatively cheap replacement, by 2012 (Natural Resources Canada, 2009).

1.4 Summary

While BC has been fortunate to have very low electricity rates and a surplus of supply, these days are ending. The province faces a serious electricity supply and demand gap, and is committed to self-sufficient and clean supply options to meet growing demand. Self-sufficiency and clean energy are more expensive supply options compared to our heritage power sources. Thus reduced energy consumption through conservation and energy efficiency are key tenets of the Government's plan to meet growing demand. In addition to being a source of energy supply, energy efficiency provides a long-lasting solution to energy burden and energy poverty. However, according to BC Hydro "even if energy efficient technologies and resources are available, low-income customers may not have the means to access technologies and resources due to a lack of mobility, language barriers, [literacy barriers] and other issues" (2008 B, p. 152). Promoting the purchase and installation of CFLs is "central to the demand-side management

efforts of utilities and other organizations promoting energy efficiency”, but a lack of data on CFL uptake hinders effective CFL program evaluation and planning (Reid, 2008, p.258).

This study uses focus groups and interviews to improve understanding of low-income BC households’ CFL use or non-use. Section 2 outlines the methodology employed in this study. Section 3 presents focus group and individual interview results. Section 4 outlines the criteria and measures against which the policy options are evaluated. Section 5 describes the policy options available to increase CFL uptake by low-income BC households, evaluated in Section 6. Section 7 concludes by discussing recommended next steps and possible implementation difficulties.

2: Methodology

This section describes study methodology aimed at understanding why some and not other low-income BC residents use compact fluorescent lamps (CFLs). After discussing the research design, the section outlines the grounded theory approach employed to analyze the collected data. The section also explains study variables, the participant recruitment process, and focus group and interview details.

2.1 Research Design

This study uses focus group and in-depth individual interviews with low-income residents to investigate why some and not other low-income Lower Mainland households use CFLs.² Focus groups enable researchers to “better understand how people feel or think about an issue, product, or service” (Krueger, 2000, p. 4) and are therefore the ideal methodology in order to understand detailed patterns of low-income CFL use or non-use. Used as a research tool since the Second World War, most notably due to the work done by Robert K. Merton, focus groups were primarily used for marketing research. In the past, academics largely overlooked focus groups as a rigorous and effective methodology. However, in the 1980s, academics began paying more attention, especially those interested in the behaviour of marginalized groups difficult or impossible to reach through more standard research methods (Krueger, 2000). While the data

² The initial research design for this study was to analyze data from low-income customers included in BC Hydro’s Residential End Use survey. Unfortunately, BC Hydro was not able to release these highly confidential data. In addition, the Residential End Use Survey sampling technique excluded approximately one-sixth of low-income BC households. The survey only reaches households with a BC Hydro account, and 50,000 of the 300,000 low-income BC households do not have an account with BC Hydro. The survey excludes those people who do not pay directly for the electricity consumption, which in itself is a major barrier to investment in energy efficiency measures. In addition, the survey does not include questions specifically designed to understand why some and not other low-income BC households use CFLs. Lack of access to this dataset reduced the study focus from BC to Lower Mainland-based residents and eliminated the possibility of analyzing energy efficiency measures other than CFLs.

obtained is not generalizable to a larger population, “qualitative methods are beneficial because they facilitate finding the explanation of cause-and-effect relationships inherent in societal problems by analyzing subjective data at a more profound level” (Cone, 2008, p. 28). Focus groups gather data based on group interaction as participants “influence each other by responding to ideas and comments of others”, and thus differ from group interviews (Krueger, 2000, p. 5).

A major benefit of focus groups is their nondirective, open-ended approach, which is well suited to the grounded theory approach used in this study (Krueger, 2000). Grounded theory approach allows researchers to analyze data as they are collected and use insights to inform further data collection. The process is circular, encouraging the researcher to delve beyond initial hypotheses. Focus groups are well suited for grounded theory as participants interact and move beyond moderator posed questions. Grounded theory studies aim to develop a theory about a phenomenon in which not all of the relevant concepts have been identified, or where “the concepts are poorly understood or conceptually underdeveloped” (Strauss, 1990, p. 37). The research question must be broad enough to allow for flexibility and freedom (Strauss, 1990). Finally, grounded theory research questions are generally oriented toward process and action (Strauss, 1990).

The inability to generalize data obtained from focus groups is the single most significant data limitation. While the interaction between focus groups participants is a major strength of focus group data due to the richness in data it provides, participants’ responses “are not independent of one another, which restricts the generalizability of results” (Stewart, Shamdasani & Rook, 2006, p. 43). In addition, the interaction between participants can lead to biased results if one or several participants dominate the discussion. To minimize the possibility of this limitation, the moderator probed participants who spoke less often than other participants spoke, and routinely requested that anyone with a differing view share their thoughts. In addition, the sample size is very small and not random.

To analyze data, focus group discussions are transcribed verbatim, ensuring participants' comments followed the question posed by the moderator, allowing for consistency. Transcripts are then open coded to discover all possible meanings contained in the data (Corbin & Strauss, 2007). After thoroughly examining the data and considering all of the potential meanings, I was able to place "interpretive conceptual labels on the data," which eventually formed categories (Corbin & Strauss, 2007, p. 160). Frequently appearing concepts became core categories, which emerge into themes. Finally, axial coding uncovers how categories relate and, in some cases, reveals causal relationships.

2.2 Initial Variables

While variables and related hypotheses change through the grounded theory process, all studies begin with an initial set. In this study, the dependent variable assesses whether or not a participant uses CFLs in their home, through which the study seeks to understand why some and not other low-income residents use CFLs. Participants with one or more CFLs installed in their home are "users," and participants with no CFLs installed in their home are "non-users." Initial independent variables are described below.

2.2.1 Awareness and Accessibility

Traditional demand side management (DSM) programs are often ineffective for recruiting low-income participants who are "hard-to-reach" consumers. For example, when California restructured the state's electricity industry in 1996, special communication plans and programs were developed to educate and assist hard-to-reach customers, defined as "those who are not reached through the communication channels that serve the majority of the state's consumers" (Hippis & Hungerford, 2004, p. 112). Low-income customers were included in this category.

In its *Implementation Plan for Energy-Focused Demand Side Management*, BC Hydro recognizes low-income customers face increased awareness and accessibility barriers as compared to median and higher income customers, such as a lack of mobility and language barriers (BC Hydro, 2008 B). In her seminal study on the energy needs of California's low-income population, Kathleen Gaffney (2006) finds awareness to be the most significant barrier to participating in low-income energy assistance programs. Speaking a primary language other than English, being non-White, living in a densely populated region or a multi-family dwelling, and renting, are the primary characteristics associated with low levels of awareness (Gaffney, 2006).

Clinch and Healy (2004) report a serious "information gap" in the residential energy efficiency market to be the primary reason for low uptake in Ireland, finding "32.3% of energy inefficient households (or 78,000 households) were not aware of the benefits of energy-saving measures, while a further 19% (46,000 households) did not know of their existence" (Clinch & Healy, 2004, p. 217). Regarding awareness, Reid hypothesized environmental benefits were an important reason people use CFLs (2008). However, only eight percent of respondents using CFLs cited environmental benefits as the most important reason for using CFLs (Reid, 2008).

2.2.2 Affordability

In addition to being hard-to-reach, low-income customers are the least able to afford to participate in traditional DSM programs, which often offer a portion of the cost of an energy efficient measure upfront or as a rebate, but generally require that participants pay the balance in order to obtain the measure (Natural Resources Canada, 2008 A). BC Hydro identifies affordability as the third major barrier low-income customers face to participating in DSM programs and/or investing in energy efficiency (2008 B). A study conducted by WestEd and the California Energy Commission on conservation understanding and behaviour among low-income customers found:

Many participants felt they were prevented from conserving more because of the cost of some conservation measures. Energy efficient appliances were often mentioned as too expensive. Even low-energy light bulbs were out of reach of many low-income participants. Although rebates were available at the time, many respondents were not familiar with them or felt that the rebates didn't make new appliances or \$10 light bulbs any more affordable than they were before (Hungerford, Hipps & Ormsby, 2002, p.113).

BC Hydro recognizes “low-income customers have little or no disposable income to spend on energy efficiency improvements” (2008 B, p. 152). Low-income households also have limited access to credit to use to invest in energy efficiency measures (Clinch & Healy, 2000). Besides having limited access to credit, studies have shown that low-income households display “an aversion to borrowing funds” (Clinch & Healy, 2000). In addition, they may use a higher discount rate than a higher income household would when calculating the payback of energy efficiency measures due to the uncertainty of their finances, and a preference for present savings over future savings (Clinch & Healy, 2000).

Finally, according to Clinch and Healy (2000), low-income households are likely to have more pressing needs for their funds than investment in the energy efficiency of their home. Clinch and Healy (2004) surveyed 240,000 respondents from energy-inefficient households in Ireland on the issue of non-investment in energy efficiency measures. The study found financial constraints to be a significant barrier to investment in energy efficiency measures, with 32 percent (76,000 households) reporting “an inability to pay for these measures, while a further 6 percent (13,000 households) reported more pressing priorities for expenditure” (Clinch & Healy, 2004, p.217). In addition, 3 percent (7,000 households) identified borrowing constraints as a reason for non-investment in energy efficiency measures (Clinch & Healy, 2004).

2.2.3 Ownership

A disproportionate number of low-income Canadian households rent rather than own their home. Of the lowest income quintile in Canada, 69 percent rent, as opposed to 47 percent in

the second quintile, 33 percent in the third quintile, 19 percent in the fourth quintile, and 9 percent in the highest quintile (Natural Resources Canada for the DSM Working Group, 2005). Renting reduces or eliminates the motivation to invest in energy efficiency measures because these measures are often permanent to the dwelling, which belongs to someone else, once installed.

Renters are less motivated than homeowners to install even the cheapest energy efficiency improvements - such as switching out incandescent light bulbs for compact fluorescent lamps (CFLs). In his 2008 study, Reid found renters are less likely than homeowners to use CFLs. CFLs last up to ten years, a period for which a renter is less likely to remain in the dwelling and benefit from the investment. Reid (2008) also found that people living in their homes for one year or less were less likely to use CFLs than people living in their homes for two or more years. Another problem related to tenure is that landlords have little to no incentive to improve the energy efficiency of the dwellings they rent out, when the tenant is responsible for paying the energy bill. The reduced motivation for tenants and landlords to increase the energy efficiency of rental accommodation is known as the “split incentive” barrier (BC Sustainable Energy Association, 2008).

A final barrier related to tenure occurs when tenants do not directly pay for electricity and/or space and water heating. In some low-income housing, energy fees are subsidised or included in the rental fee. In addition, there are between 100,000 and 120,000 secondary suites in BC, residents of which are less likely to have a BC Hydro account (Tenants’ Rights Action Coalition, n.d.). If a person does not pay a BC Hydro bill, they have very little incentive to reduce his or her electricity consumption, especially through energy efficiency improvements.³ BC Hydro’s Power Smart Low Income Program Manager estimates 50,000 of the 300,000 low-

³ In such a case, the property owner may be motivated to install energy efficiency measures if he or she is covering energy consumption costs. However, this study focuses on energy efficiency measure uptake by low-income BC residents, not property owners.

income BC households do not have BC Hydro accounts (personal communication, February 12, 2009).

2.2.4 Process, Stigma, Fear and Distrust

Gaffney (2006) finds barriers to investing in energy efficiency measures faced by low-income customers related to the participation process, stigma, fear and distrust to be less significant than lack of awareness, but still important. Of the survey respondents, 23 percent “strongly agreed with the statement ‘It takes too long to get services from most programs’” (Gaffney, 2006, p. 58). Gaffney found that different ethnic and racial groups had differing perceptions about the participation process of low-income energy assistance programs. Non-white households were more likely to find difficulty in completing the program forms, compiling the necessary information to prove their income, and applying for the programs (Gaffney, 2006). Gaffney (2006) hypothesizes this could be due to “underlying cultural issues or distinctions between racial and ethnic groups” (p. 58). However, Gaffney (2006) concludes the difference in the perception of the participation process is more likely due to a language barrier, such as not speaking English at all, or as a primary language. Respondents that do not speak English, live in a rural area, or are disabled, were more likely than other respondents to perceive process barriers to participation (Gaffney, 2006).

Gaffney (2006) found fear or distrust to be a barrier for only a small portion of survey respondents. Barriers to participation in low-income energy assistance programs related to fear or distrust are: worried the supplied information will be provided to government agencies (15 percent strongly agreed); being told what to do/how to live (8 percent); and, having people from a utility or the government in the home (3 percent) (Gaffney, 2006). Immigrants and the elderly were more likely to perceive barriers to participation related to fear or distrust. Gaffney’s study found no evidence of differences between ethnic or racial groups in relation to the fear/distrust barrier.

The final barrier to participation in low-income energy assistance programs Gaffney's study analyzes is "welfare stigma." The barrier statements analyzed, and the percentage of participants strong agreeing, were: "I don't like to use programs because there are other people who need them more me (18%); I would be embarrassed if my neighbour or friends knew I was participating in these types of programs (4%); Someone else in the household is against participating in these programs (3%)" (Gaffney, 2006, p. 59). Gaffney (2006) found differences between racial and ethnic groups concerning welfare stigma. White households were more likely to believe others had a greater need of programs than they did, and to be embarrassed by someone finding out about their participation in a social program, than households of another race or ethnicity (Gaffney, 2006). Respondents living in rural areas were also more likely to believe other households had a greater need than his or her household for social programs, and therefore reluctant to participate (Gaffney, 2006).

2.3 Focus Group Details

Focus group participants were recruited over a four-week period using a variety of methods.⁴ The Vancouver based organization Think City (www.thinkcity.ca) sent an email message to its membership outlining the research opportunity, instructing those interested to contact me via telephone or email. Posters outlining the research opportunity were posted at Downtown Eastside single resident occupant (SRO) hotels, Pigeon Park Savings, the Vancouver Community College and the Vancouver Public Library Downtown branch. An advertisement was also posted on Vancouver's Craigslist. Twenty-five respondents were screened using a series of eligibility questions confirming they were 19 years of age or older, had an annual household after-tax income of \$30,000⁵ or less, were the primary decision-maker with regard to household

⁴ See Appendix A for additional focus group recruitment details.

⁵ Based on the 2003 Core Needs Income Threshold of \$31,500 for a one-bedroom dwelling in Vancouver (Natural Resources Canada for DSM Working Group, 2005).

purchases in their home, and lived in the Lower Mainland. All focus group attendees received a \$20 honorarium for their participation.

Where initially the study planned to compare the views of users to non-users, of the twenty-five recruits only two used CFLs in their home. Difficulties recruiting low-income CFL users forced analysis to switch from using focus groups comprised of users and non-users to non-user only focus groups and in-depth interviews with the two recruited users. While eight participants were scheduled for the first focus group, five attended. Of the seven registered for the second focus group, five attended. Following proper focus group methodology, a volunteer moderator conducted focus group discussion, while the author observed interaction (Morgan, 1997).

Both focus groups took place in December 2008. To ensure a wide-variety of participants were able to attend, one focus group took place in the morning, and the other took place in the evening. Participants signed informed consent forms and completed an anonymous questionnaire before the session began. The moderator explained sessions were being audio-recorded and transcribed verbatim for the purpose of analysis. The moderator assured participants no names would appear anywhere in the report, and that their anonymity is guaranteed. The moderator asked participants to share their point of view, even if it differs from what others have said.

The moderator began each focus group session by asking participants to discuss what they know of CFLs and the reasons they do not use CFLs. The first phase of focus group questions were purposefully open-ended so as not to lead participants and keep the discussion open to barriers the research has not yet identified. In the second focus group session phase, researchers used a reveal/ask methodology in which the moderator reveals CFL facts, then asks participants if they will purchase CFLs based on the information provided. Revealed facts include: (1) CFLs use 75 percent less energy than regular incandescent light bulbs while

providing the same amount of light and come in many shapes, sizes, light outputs and colour temperatures; (2) a CFL costs anywhere from three to ten dollars more than a regular incandescent light bulb; (3) CFL related environmental benefits; (4) long life of the CFL bulb and related saved time, effort and money; (5) electricity bill savings from replacing incandescent bulbs with CFLs; (6) ability to take purchased CFLs when moving residences, thereby reducing the rental barrier; and (7) CFL mercury content.

After the reveal/ask portion of the focus group, the moderator asked participants at what price they would purchase CFLs to explicitly test the affordability barrier. Next, the moderator told participants about the Energy Saving Kits available through the Power Smart Low Income program, asking participants if they were aware of the program, and if they would participate. Finally, the moderator asked each participant to explain why he or she would or would not purchase CFLs based on the entire focus group discussion.⁶

2.4 In-Depth Interviews Details

The interview questions investigated why some low-income Lower Mainland residents use CFLs. Using the grounded theory approach, I addressed two independent variables discovered at the focus groups in the interviews. At the focus groups, several participants explained the quality of CFL lighting temperature and colour was an important reason why they do not use CFLs. I determined this to be either an aesthetics barrier, in the case where people have encountered CFLs and really do not like the colour temperature and lighting, or this could be a misinformation or misperception barrier, wherein people have never encountered CFLs, yet are convinced the lighting colour and temperature is inferior to incandescent bulbs. In addition, some participants mentioned they did not believe CFLs would fit their fixtures, or would be aesthetically displeasing in fixtures that leave the bulb exposed. This can be a misperception barrier, as CFLs that more closely resemble regular light bulbs are now available. In this case,

⁶ See Appendix B for a complete record of focus group questions.

people may believe only swirly CFLs are available. In other cases, CFLs truly may not fit existing fixtures.

2.5 Focus Group and Interview Participants

All participants reside in the Lower Mainland, with the majority living in Vancouver's Downtown Eastside (33%), followed by other areas of East Vancouver (25%), Burnaby (17%), Kitsilano (17%), and Surrey (8%). Only one participant was a homeowner, with the other eleven participants renting accommodation. Fifty percent of participants were male, and fifty percent were female. The average age of participants was 42 years, and the median age was 47 years. The oldest participant was 60 years of age, and the youngest was 23 years of age. The majority of participants (58 percent) were the sole resident in their home, while the remaining 42 percent reported living with others. Most participants reported the main language spoken at home as English; however, one participant spoke Spanish in the home, and one spoke Korean. The majority of participants, at 58%, reside in apartments, while 25% reside in single-resident occupancy hotels, 8% reside in a single-family dwelling, and 8% reside in mobile homes. The average after-tax annual household income of participants was \$19,458. The median income was \$20,000, with the lowest reported income being zero dollars, and the highest \$30,000.

2.6 Summary

This study employs focus group and individual interviews in order to investigate why some and not other low-income BC households use CFLs. A number of initial barriers, including awareness and accessibility, affordability, ownership, process, stigma, fear and distrust, were tested in focus group discussions. Using the grounded theory approach, barriers identified during focus group discussions were tested during individual interviews with low-income CFL users. The next section discusses focus group and individual interview results.

3: Interview Results

This section discusses focus group and individual interview results. The focus group section discusses themes identified in the analysis of focus group transcripts and details of important group interactions and dynamics. The focus group section also summarizes participants' decisions regarding CFL uptake based on disclosures about CFLs made during the reveal/ask phase of the discussion. The final subsection summarizes in-depth interview findings.

3.1 Focus Groups Phase 1: Emerging Themes

This section provides a detailed overview of the first phase of focus group testing. Nine emerging themes arose in the focus group discussions, discussed below as much as possible in the participants' own words. These include: Lack of Awareness and Knowledge, Affordability, Quality Concerns, Lack of BC Hydro Account, Environmental Concerns, Electricity Savings, Long Life of Bulb, Mercury Content, and Process and Distrust.

3.1.1 Lack of Awareness and Knowledge

Over half of the focus group participants reported having limited CFL awareness and knowledge. One participant explained a CFL is “a miniature fluorescent tube that’s been wound up in a little spiral, that’s all I know.” The participant was not able to take this explanation further to identify the main purpose of CFLs, using less energy than an incandescent light bulb to provide the same amount of light. Two other participants were also aware that CFLs are the “wound up” or “spiral” light bulb, but did not know anything else about them beyond appearance. In contrast, one participant explained, “I’ve heard of (CFLs), I just don’t know exactly what it is. I probably wouldn’t be able to tell if I’ve ever seen one before, like I wouldn’t be able to pick it

out.” Two participants admitted to the group that they knew nothing about CFLs, not even about their appearance. These findings are in line with BC Hydro’s understanding of the barriers to CFL uptake. According to BC Hydro, “most customers aren’t aware that special application CFLs and fixtures exist and have a number of benefits” (2008 B, p. 142).

The participants repeatedly brought up the need for more awareness and knowledge about CFLs. One participant explained, “I buy as cheap as possible. I buy my light bulbs at the dollar store. But if I knew more about (CFLs), like the larger impact, then I might be more tempted to buy them.” Another participant echoed this sentiment, telling the group “I’ve never heard a lot about (CFLs), like what they do, and what the benefits are. I don’t think it’s common knowledge to identify a light bulb with its benefits, price, and all that, it’s just not out there yet.” One participant identified the need for more education about CFLs especially considering they are more expensive than regular incandescent light bulbs:

I think unless the public is educated, you got Joe Blow coming in (the store) and his kid is screaming and he has to get light bulbs, and he sees one for \$1.29 and another for \$3, he’s just going to get the one for \$1.29. So it has to be... a really good educational program so the public realizes that you know, ‘hey this going to actually save me money in the long run,’ but if they don’t know that, they’re just going to go for the one that’s cheapest at the get go – they don’t care.

One participant felt there was a link between being low-income and having limited resources and knowledge about environmentally sustainable products, explaining:

With low-income, in places where people aren’t earning as much money and don’t have access to a lot of resources, there maybe is a gap as to how, where, how much they can contribute to saving the environment for so and so reason you need to spend so much money here and there... I never really considered this problem until this research right now, a lot of people can’t afford to – I was thinking only about my health, like a lot of people can’t afford organic [food and products] but there’s way more going on.

Participants identified lack of awareness and knowledge as a major reason they have not used CFLs. Due to the nature of the focus group discussion, in which participants learned a lot about CFLs, participants overcame the awareness and knowledge barrier. By the end of the focus

group, no participants said they would not buy CFLs due to a lack of awareness or knowledge. After becoming aware and knowledgeable about CFLs, five of the ten participants claimed they would use CFLs and the remaining five reported they would not use CFLs.

3.1.2 Affordability

Another common theme raised by participants was affordability, a barrier BC Hydro identifies in regard to CFL uptake (2008 B). The questionnaire asked respondents what one standard CFL costs, providing them with six choices ranging from \$2.50 up to \$17.50; the correct answer is \$5.00.⁷ Of the ten non-users, 40% thought CFLs were half the correct price, at \$2.50, which is still more expensive than a regular incandescent light bulb. Three non-users, or 30%, answered this question correctly. Two non-users (20%) believed CFLs cost \$7.50 each. The final non-user believed CFLs cost \$15.00 each. Despite the surprising number of respondents who believe a CFL costs less than it does, I believe affordability is a barrier to usage as 60% of non-users believe a CFL costs five dollars or more.

The questionnaire included an additional question testing knowledge and affordability, asking respondents how much more one CFL costs than an incandescent light bulb. The choice of answers included: no difference in price; \$1.00; \$3.00; \$5.00; \$10.00; and \$15.00. Due to the wide variety of factors involved in pricing CFLs, the correct answer is a range of three to ten dollars more expensive (BC Hydro, 2009 A). I was surprised to find one participant believes there is no difference in price, because of the affordability barrier. Three respondents believe CFLs only cost one-dollar more than incandescent light bulbs. The majority of focus group participants (40%) answered correctly, reporting CFLs cost three dollars more than incandescent

⁷ The price of CFLs can vary depending on a number of factors, including but not limited to, whether they are purchased individually or in a multi-pack, ability to dim, ability to be used outdoors, shape and size, colour temperature and light output, etc. (BC Hydro, 2009 A). A reasonable average was determined to be \$5.00.

light bulbs. One respondent answered CFLs cost ten dollars more, also within the correct range. One respondent believed a CFL costs fifteen dollars more than an incandescent light bulb.

In response to the moderator asking the main reason participants do not use CFLs, one participant answered, “With me it is just expense. I don’t have a lot of money so I try to save money wherever I can.” Other participants echoed this sentiment, explaining, “I’m working about 15-20 hours a week so every penny matters to me,” and “You’re thinking about going as cheap as possible, you can’t spend that much.” One participant shared a recent experience with the group: “I almost did [purchase a CFL] on Monday. It was just strictly you know, I’m on a budget, and I went for the cheaper option.” The majority of participants explained they did not purchase CFLs because they were more expensive than regular incandescent light bulbs.

After learning about the various benefits of CFLs, affordability remained a barrier for participants. One participants’ “bottom line,” based on the entire discussion, was that he would not buy CFLs until they were the same price as incandescent light bulbs. With regard to replacing her incandescent light bulbs with CFLs, another explained:

When I get a job, I am going to seriously think about these things...but like right now, seriously I’ve got (sic) a hundred bucks to spend a week and that’s it. I think when you’re in a low-income situation ... I mean I would like to say I would buy (CFLs) right away, but thinking about people with a low income, you’re going to have other priorities - if you’re middle-class, that’s a different story. It seems almost like a luxury when you are on a limited income. Theoretically, I can say ‘yes I would buy it,’ but honestly, I would need to find a full-time job in order to afford (CFLs).

One participant pondered, “I wonder if (CFLs are) the kind of thing where only people who shop at Capers⁸ will be able to afford them – I hope not.”

Participants at both focus groups said they did not think they could afford to switch all of their incandescent light bulbs for CFLs at once. In response to a participant who felt the electricity bill savings would make up for the initial outlay, and therefore cost should not be such

⁸ Capers is a high-end natural and organic foods retailer.

a major barrier, another participant retorted: “Cost would mean something to me. I might be able to go out and buy one, but I ain’t gonna (sic) go out and purchase five or ten.” Both focus groups decided the only way to switch out the bulbs would be to replace them one at a time, as the regular bulbs burnt out. A participant explained, “For people that are low-income, re-doing your entire house all at once is probably not feasible, but as a bulb goes you can replace it and do that until you’ve completely made the transition, at that point it will show on your bills.”

3.1.3 Quality Concerns

Several participants were concerned about an array of real or perceived quality issues with CFLs. When CFLs first came out, there were valid quality issues, such as the time it took for the light to turn on, not having the option to dim the light, not being able to use them outdoors, problems with flickering, the colour temperature of the light, and so on. However, since then, CFLs have greatly improved in all of these areas. Therefore, the majority of the quality concerns raised by participants are based on misinformation. As BC Hydro explains, “customers perceive that there are drawbacks of CFL technology, in part due to perceptions developed from the first generation of CFLs” (2008 B, p. 142). Older participants were more likely to express quality concerns as a reason for not using CFLs. These participants were more likely to have heard about the difficulties CFLs faced upon their earlier release. Younger participants and people with no awareness or knowledge of CFLs before attending the focus group did not express quality concerns.

When asked to describe the main reasons for not using CFLs, an older participant explained: “Well, the first (CFLs) that came out were just too big for the light fixtures that I have, just too long, and the lights were fluorescent tubes and have a blue-ish tinge to it, that’s not very attractive.” While this participant acknowledged he had heard CFLs have since improved with regard to colour temperature and shapes, he still had a concern related to CFL quality:

My main concern would be light output. I, uh, work from home and my eyes are changing weekly and I really need a bright light to read because I'm reading very small text. I just had to replace all my 60 watt light bulbs with 100 watt for my work area because I couldn't read with that light anymore.

CFLs use less wattage to deliver the same amount of light as an incandescent light bulb. This participant expressed a lack of knowledge in that he seems to think a CFL will provide less light output than an incandescent light bulb, rather than simply use less energy. This is really therefore a knowledge issue. This participant cited quality concerns regarding colour temperature and light output as the main reasons he would not use CFLs.

Another participant, also older than the median age of the group, illustrated the link between quality concerns and a lack of awareness and knowledge when he asked the group:

Do [CFLs] work for reading though? I don't like with normal fluorescent bulbs it's like when, especially when you're in a classroom setting for awhile, they seem to have pulsation or so, it sort of flickers a bit, and it doesn't - after awhile I just get a mad headache from them, so I dislike fluorescents, it's sort of built into my thinking, you know so, I've never tried one these these... uh, CFLs.

This participant explained he had never tried CFLs, based on his negative experience with fluorescent lighting, but acknowledged he was not aware if CFL lighting flickered. Another participant was also concerned about quality, and expressed a lack of awareness: "A lot of times you want a nice soft light for the kitchen and I don't know if you can get the CFLs in daylight light, a nice white bright." Another common concern raised by participants was around the compatibility of CFLs with lighting fixtures. For example, one participant asked the group, "Can you get [CFLs] in all the different formats? You know, sometimes in the bathroom you've got those round ones, can you get CFL spotlights, floodlights and all that?"

3.1.4 Lack of BC Hydro Account

Almost all participants without a BC Hydro account reported they would be more likely to use CFLs if they were directly paying for their electricity. For example, one participant

explained, “Another factor [why I don’t use CFLs] might be I don’t pay for my own Hydro bills, it comes with my rent.” Another participant echoed this sentiment, stating, “I think if I owned my own place and I was paying for my Hydro, I might buy [CFLs].” After hearing more about the benefits of using CFLs, the same participant later exclaimed, “I don’t pay for utilities now so I’m not as motivated, but if I was paying for utilities I would 100% buy [CFLs].”

3.1.5 Environmental Concerns

Most participants felt the environmental benefits of using CFLs were a good reason to use CFLs. One participant in particular described this sentiment:

It’s funny that they don’t market the environmental aspects of [CFLs]. Theoretically, there wouldn’t be the demand for new dams, all that sort of stuff, huge power lines going everywhere. I’ve never seen – I’ve never seen CFLs promoted quite in that way - they just say it saves you energy, but they’ve never, I’ve never had it pointed out that by, just because I save money, that energy, that means if everybody did that we wouldn’t have to have as many flow of the river dams being built and that stuff.

In response to this statement, one participant looked visibly affronted, crossing his arms and loudly exhaling. Unfortunately, the participant would not elaborate verbally on this physical response. Another participant scoffed and responded directly to the participant who had made the statement, exclaiming, “There’s a bit of a leap in your logic!” A third participant also did not believe environmental benefits constituted a reason to use CFLs, explaining that while they may benefit the environment, there is no benefit for him.

While not everyone felt the environmental benefits associated with CFLs were valid and important, almost half of the participants did. One participant explained, “I wouldn’t see the savings [on my bill from using CFLs] because I don’t pay my own Hydro, but generally, if you can reduce your power consumption that’s gotta (sic) be a good thing overall.” Another participant pondered, “I can’t really imagine, just the saving of energy - if everybody in the world changed to that light bulb, it would be incredible.”

3.1.6 Electricity Savings

The participants felt divided on the monetary savings CFLs deliver users by consuming less electricity. After the moderator told the group that by replacing five incandescent light bulbs with CFLs, they could save twenty dollars per year on their electricity bill, one participant pointed out:

I mean it saves \$20, but the initial outlay for five, is what, \$15, \$16, \$18 or more, so on the get go you're only, right at the start, you're only ahead by maybe two bucks that year, but the following year you're ahead more and more, and you don't have to change it. So eventually you do get that money back, but initially it's a two-dollar difference in the first year, wow, whoopee (laughs).

A participant at the same focus group agreed with this sentiment, taking it further, explaining, "There's always a factor like, you can buy something but you can take it home and drop it, you know, or there can be a fault in it. As soon as you have factors like that coming in, the savings diminish because your time spent - like I'm time-starved - so thinking to save twenty dollars isn't motivation."

One participant acknowledged the electricity savings over-time would cover the initial outlay; however, he did not think he could afford to buy five CFLs at once to realize the savings of twenty dollars per year. Another participant was surprised to hear the savings would only be twenty dollars, thinking it would be more. Both focus groups brought up the high initial cost to purchase five CFLs, and the reaction to the electricity savings was less enthusiastic than hypothesized. The participants seemed stalled on the initial cost of five CFLs, and did not give much thought to the savings of twenty dollars per year over up to the ten years that CFLs last. Only four participants reported that based on the electricity savings they would purchase CFLs. Two participants would maybe buy CFLs, and the remaining four participants said they would not buy CFLs based on this information.

3.1.7 Long Life of Bulb

None of the focus group participants knew CFLs last up to ten years, or ten times longer than regular incandescent light bulbs. Ten incandescent bulbs, at a price of \$7.50, therefore equal one CFL, at a price of \$5.00. Upon learning this, participants were astonished. One participant claimed, “That would be the strongest selling point I can think of. The length of light, just a little bit of extra money, and I don’t have to buy one for five years or something like that. So you know, it’s a good deal.” Another participant exclaimed,

Wow! I don’t think I’m ever going to buy normal light bulbs again knowing that information. That’s insane – ten times longer! There is absolutely no benefit to buying cheaper light bulbs. It’s just a fraction of the cost more. There’s less effort, in terms of you don’t have to run around buying more light bulbs. You don’t have to waste as much, you use less power, it lasts longer! There is just no downside to this light bulb, I would buy it - I will buy it!

The long life of the bulb illustrates the high efficiency of CFLs, which resonated with one participant, who explained, “It’s just the actual efficiency of it that would be the clincher for me.” Two participants were enthusiastic about the convenience of having a bulb that lasts so long. As one explained, “The incandescent bulb seems to go out anytime, just like that (snaps fingers) and if a CFL lasts ten times longer you don’t have to change it...it’d be great – ten times longer!” Seven participants reported they would use CFLs based on the long-life of the bulb. This finding is in line with the results of Reid’s survey, which found the long life of the bulb to be a primary reason people use CFLs (2008).

3.1.8 Mercury Content

One participant brought mercury up at the beginning of the discussion, noting, “They use mercury in the manufacturing process. I don’t know the details, but that does concern me. Also disposing [of CFLs], you have to be very careful because I believe there is mercury in the bulb somewhere.” Three of the ten participants knew CFLs contained mercury, while one knew CFLs contained some sort of hazardous material. Several participants brought up mercury repeatedly as

a reason they would not use CFLs. Others who reported they would maybe use CFLs expressed concern about mercury. For the most part, participants were concerned about the time and effort it would take to locate a recycler who accepts CFLs, and then to make a special trip to bring old CFLs to that recycler. As one participant explained,

If I have to hop on my bike and trundle off to the recycling centre, for my one burnt out CFL, I probably wouldn't [use CFLs]. But if it was a system like with soda bottles where I can take it back to the store where I bought it just like I do with my can of Coke, and it's convenient... But if I have to trundle way the heck out of my way to give them my one light bulb, then I wouldn't do it.

Three participants felt it would not be a problem to store CFLs and recycle them when convenient.

In addition to being concerned about having to dispose of CFLs carefully, another participant felt mercury offset the environmental benefits provided by CFLs:

[Mercury] makes the idea of the light bulb being an energy saver in any way, very dim off that, because really at the end of the day your light bulb is going to burn out, and I am going to be responsible for a load of mercury, so you know. The disposal of it, that's costly, that's my time, I have to find a place, go, and what if they don't accept it? That would turn me actually off because more and more I expect the producer to take some responsibility for putting mercury in the product.

One participant was concerned about the impact CFLs would have on her health, and told the group she would need to research this issue before she would consider using CFLs. In his closing remarks, one participant told the group, "One thing that worries me is the mercury; I thought it was some sort of gas, but mercury is even worse."

3.1.9 Process and Distrust

The final theme that emerged was around participation in current BC Hydro Power Smart programs. The first program offer involves a fifty percent discount on CFLs when purchased online. Upon hearing about this offer, one theme that emerged was around process. Six participants reported they would not participate in this program offer, one would consider

participating, and three would participate. The main reason participants would not participate in this offer was due to process concerns. One participant explained: “I don’t have credit cards, so it’s unlikely [I would participate] because then I’d have to go and get a prepaid Visa. And also usually when packages arrive at my building there is nobody in and so they stick a little notice on the front door and you have to go the post office, so it’s just a lot of trouble.” One participant does not use her credit card online. One participant referred to himself as “computer illiterate.” Participants identified several process barriers, such as lack of a credit card, limited to no access to a computer and knowledge about computers, distrust, and inconvenience associated with receiving packages in multi-unit residential buildings and single-resident occupant hotels.

The second program discussed was Power Smart’s Low Income program. Several process and distrust barriers were raised by participants while discussing whether they would participate in this program. First, the moderator told the group about the Energy Savings Kits available to BC Hydro’s low-income customers through the program. One participant explained, “I don’t think I would [participate], I don’t have a BC Hydro account for one thing, but even if I did, I just don’t like giving information out period. I do as little of that as possible, and for the savings, it’s just not worth it. I’m a little paranoid that way.” The main process barrier identified with regard to the Energy Savings Kit offer is it is only available to BC Hydro account holders, and thus half of the participants are ineligible for participation.

Next, the moderator explained the program also involves a free home energy audit and the possibility of having BC Hydro install and pay for energy efficiency measures. Again, participants identified process and distrust barriers. One participant explained “I would not [participate] because I rent, so I would have to discuss with my landlord. I think it takes time and would be difficult.” Another participant felt the program was invasive, explaining:

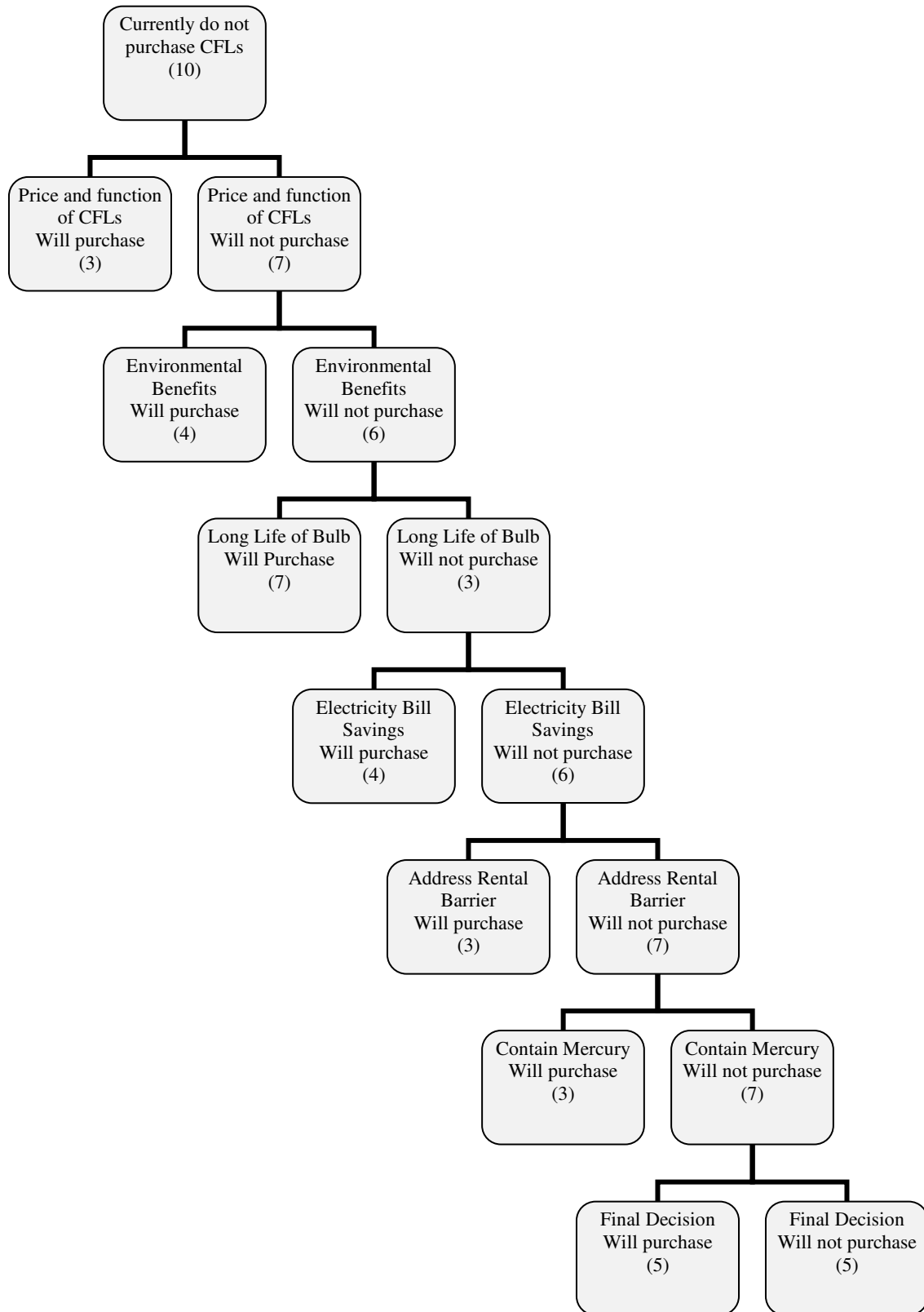
I don’t think I would want somebody coming into my home even if they were going to pay to do everything. I have my own little system and my own reasons for my own choices. So no, I wouldn’t trust somebody to come in with all new

replacements for the system I've set up. I wouldn't trust that they have the flexibility that I have. You know anybody who comes in has an objective and a goal and that's to fulfill that, and that's just psychology. I find it intrusive, even if I got it free!

3.2 Focus Groups Phase Two: Reveal/Ask Test Results

As previously outlined, the moderator provided focus group participants with accurate CFL information in stages to investigate why some low-income Lower Mainland non-users might decide to start using CFLs. After each disclosure, the moderator asked participants if they would use CFLs based on the information provided. Figure 3.1 illustrates reveal/ask test results, showing disclosures then the associated number of participants reporting they would or would not use CFLs. Participants reporting they “will maybe purchase” CFLs are included in “will not purchase” CFLs totals.

Figure 3.1 Focus Group Reveal/Ask Test Results



In sum, most participants changed their minds about CFL usage many times throughout the discussion. This exercise illustrates the complexity involved in decision-making regarding CFL uptake. All ten participants entered the discussion as non-users, with only five remaining in this category by the end of the discussion. The long life of the bulb was the most effective disclosure at increasing CFL uptake, causing seven participants to report they would use CFLs. That CFLs contain mercury caused seven participants to report they would not use CFLs. Appendix D outlines a complete record of uptake decisions made by focus group participants in response to disclosures.

3.3 In-Depth Interviews

Two in-depth interviews reveal the importance of awareness and knowledge in causing people to use CFLs. Both users heard and learned about CFLs, and decided to try them out. Both purchased their CFLs at full-price, and did not receive a rebate or incentive. The first interviewee read a BC Hydro newspaper advertisement about ways to save energy in the home, one of which was to replace incandescent light bulbs with CFLs. After reading the advertisement, the participant began replacing burnt out incandescent light bulbs with CFLs. The participant reported using CFLs for financial savings as well as environmental benefits.

The second interviewee first heard about CFLs in an interior design course, where it was learned CFLs emit less radiance and will not dull surfaces and paints as do regular incandescent light bulbs. Several years later, the interviewee noticed two reading lamp light bulbs became uncomfortably hot when reading for a long time. Remembering CFLs emit less radiance, the participant replaced the two incandescent light bulbs with CFLs. The interviewee reported less radiance to be the initial purchase reason, but plans to switch out incandescent light bulbs as they burn out with CFLs since learning of the energy saving and environmental benefits.

Both participants were in a low-income situation when they first purchased CFLs and were still in a low-income situation when interviewed, yet they did not feel an affordability barrier exists in purchasing CFLs. Both users felt the additional cost of CFLs is justified by the benefits they provide. Both users have BC Hydro accounts. Of note, both CFL users were not aware CFLs contain mercury and were surprised to learn this. Both felt mercury content somewhat diminishes environmental benefits. As one participant explained, “[By using CFLs] you’re not helping the environment in the long run!” In addition to environmental concerns, one participant was concerned about the possible health effects, explaining, “mercury is dangerous for people too ... I don’t know if I would want to continue to [use CFLs] because of health issues.” When asked if they would continue to use CFLs knowing CFLs contain mercury, one interviewee would not due to health concerns. The other participant would continue to use CFLs and would “probably just throw [CFLs] away. They last so long, so I would only be throwing one away every once in awhile. So unless it was very convenient I would just throw it away.”

3.4 Summary

As expected, focus group results indicate affordability is a significant barrier to low-income resident CFL use, with reluctance increasing when combined with low awareness and product knowledge. When participants learned CFLs provide electricity savings, bulb longevity and environmental benefits they were more likely to overcome the affordability barrier. However, affordability remained a barrier for some non-users despite increased knowledge. The importance of awareness and accurate product knowledge is supported by findings from individual interviews with low-income CFL users. Mercury content and quality concerns are also significant barriers. These barriers are also stronger when combined with a lack of accurate knowledge. Finally, focus group participants without a BC Hydro account were less motivated to use CFLs, while both CFL users interviewed had BC Hydro accounts. These results indicate having a BC Hydro account is an important factor in the decision to use CFLs. The reveal/ask

phase of the focus groups indicate decision-making with regard to CFL uptake is highly complex. The next section outlines the criteria used to evaluate policy options to increase CFL uptake by low-income BC households.

4: Criteria and Measures

This section discusses the criteria and measures the study employs to evaluate the policy options to increase CFL uptake by low-income BC households, explained in Section 5. Criteria include cost, effectiveness, administrative feasibility, equity and public acceptability. This section describes the relevance and measures of the criteria. In order to compare the options, I rank each criterion numerically from one (worst) to three (best). The highest available score is 18, where an option scores three points for each measure.

4.1 Cost

The study measures cost in two ways. First by program costs, the monetary cost of implementing the policy option measured in Canadian dollars, based on estimations made by the Program Manager of BC Hydro's Power Smart Low Income program. Second, cost is measured by the avoided cost of electricity. Reductions in electricity consumption achieved through energy efficiency improvements result in an avoided cost of electricity, which is "the unit cost of acquiring the next resource to meet demand" (BC Hydro, 2007, p. 232). The avoided cost of electricity is \$88 per megawatt hour (MWh), "BC Hydro's 2006 reference energy price, which is based on the weighted average cost of energy delivered to the Lower Mainland that BC Hydro contracted in the F2006 Call for Tenders" (BC Hydro, 2008 B, p. 96). Avoided cost estimations are based on the electricity savings an option achieves, the information for which is obtained from BC Hydro's 2007 Conservation Potential Review.

Both program cost and avoided cost have equal weight to the other criteria (up to three points each), thus the cost criterion is worth twice as much as the other criteria (up to six points). High program cost options are awarded one point, medium cost options two points, and low cost

options three points. A high avoided cost is awarded three points, a medium avoided cost two points and a low avoided cost one point. The table below outlines the gradations between high, medium and low program cost and avoided cost.

Table 4.1 Cost Ranking Details

Ranking	Dollar Amount (\$)	Program Cost Score	Avoided Cost Score
High	≥ 2 million	1	3
Medium	< 2 million	2	2
Low	< 1 million	3	1

4.2 Effectiveness

This criterion refers to CFL uptake, measured by the likelihood the option will result in low-income BC households switching from incandescent bulbs to CFLs. Evaluation is based on the literature, feedback from experts, and focus group results. As numerical estimates are not available, assessment is based on the qualitative rankings “high” (most effective) “medium” and “low” (least effective). Highly effective measures of this criterion score three points, medium two points, and low one point.

4.3 Administrative Feasibility

This criterion refers to the complexity involved in developing and implementing the policy options. It includes considerations of the number of agencies involved, and whether new systems or programs will need to be developed to implement the option. Based on the results of expert interviews, options requiring a large number of agencies and/or new systems or programs have “low” administrative feasibility and score one point. Options involving a moderate number of agencies and new systems or programs have “medium” administrative feasibility and score two points. Finally, options requiring few agencies and new systems or programs have “high” administrative feasibility and score three points.

4.4 Equity

This criterion refers to horizontal equity measured by the impact on low-income BC households, with special consideration given to the impact on low-income households without a BC Hydro account because these households do not realize the electricity bill savings from using CFLs. The options have high (most equitable), moderate, or low (least equitable) equity depending on the percentage of the low-income population reached, and the impact on low-income households without a BC Hydro account. The evaluation of equity is based on feedback from experts interviewed about the policy options. Options that reach all low-income BC residents and positively impact low-income non-BC Hydro customers are highly equitable and score three points. Options that reach a significant amount of low-income residents and have a neutral effect on low-income residents without a BC Hydro account, or reach a small number of households but have a positive impact on low-income residents without a BC Hydro account, are moderately equitable and score two points. Options that do not reach a significant portion of low-income residents and do not include or negatively impact non-BC Hydro customers have low equity and score one point.

4.5 Public Acceptability

This criterion measures the level of public support in response to the options. The evaluation of public acceptability is based on expert feedback, news media sources, and the literature. Options expected to have high public support score three points, moderate public support score two points, and low public support score one point.

5: Policy Options

This section outlines five possible policy options available to increase low-income BC household CFL uptake, generated from literature, and focus group and individual interview results. Options to increase low-income CFL uptake include: Maintaining CFL Component of Power Smart Low Income Program (Status Quo); Distributing Five CFLs and Pamphlet to Low-Income BC Hydro Customers; Distributing Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers; Banning Energy Inefficient Lighting; and, Distributing Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers in Advance of Banning Energy Inefficient Lighting.

5.1 Option 1: Maintain CFL Component of Power Smart Low Income Program (Status Quo)

BC Hydro's Power Smart Low Income program helps low-income BC households reduce electricity consumption by installing energy efficiency measures. The program provides low-income households with a free Energy Saving Kit, which includes two indoor CFLs and one outdoor CFL, weather-stripping, fridge and freezer thermometers, window insulating film, electrical outlet and switch sealers, kitchen and bathroom tap aerators, an energy saving nightlight and a low flow showerhead. Information on behavioural changes customers can make to conserve electricity is also included in the Energy Saving Kit. In addition to the Energy Saving Kits, the Power Smart Low Income program offers basic and advanced energy efficiency retrofits, such as replacing inefficient refrigerators. The energy efficiency home retrofit component of the program is beyond the scope of this study. For the purpose of this study, only the CFL component of the Energy Saving Kit is considered.

BC Hydro customers are eligible to receive a free Energy Saving Kit regardless of their primary home heating energy source, whether they rent or own, or live in a single-family dwelling or apartment. By not excluding customers based on primary fuel source, household type or ownership, the Power Smart Low Income program incorporates three characteristics of exemplary low-income energy efficiency programs identified in the American Council for an Energy Efficient Economy's seminal report (Kushler, York & Witte, 2005).

Power Smart does not publicize what constitutes low-income. Customers thinking they may be eligible to participate in the program call BC Hydro and provide annual household income, region of residence and number of occupants in their household, with eligibility determined by Low-Income Cut-Off (LICO) methodology developed by Statistics Canada. The program excludes people who do not have an account with BC Hydro.

This program is in BC Hydro's 20 Year Demand Side Management Plan, targeted to reach all 250,000 low-income BC Hydro customers between 2008 and 2028. The program aims to deliver 45,000 Energy Saving Kits to low-income customers by 2012, when the federal ban on energy inefficient lighting is planned to take place. According to the Program Manger, CFLs will be removed from the Energy Saving Kits when energy inefficient lighting is banned (personal communication, February 12, 2009). Based on this information, the CFL component of the program is evaluated up to 2012, making the target for CFL delivery 45,000 low-income BC Hydro customers.

5.2 Option 2: Distribute Five CFLs and Pamphlet to Low-Income BC Hydro Customers

This option proposes to increase CFL uptake in low-income households by distributing free CFLs⁹ and an educational pamphlet to low-income BC Hydro customers. This option addresses an important participation barrier identified with BC Hydro's previous CFL giveaway

⁹ Energy Star certified CFLs.

campaign, namely that customers received vouchers for CFLs rather than a physical CFL. This option distributes CFLs by delivering CFLs to participants, rather than providing a voucher or other measures. Under this option, all low-income BC Hydro customers will receive five¹⁰ standard CFLs and the pamphlet described below. A standard CFL is a relatively low-cost standard CFL, as opposed to CFLs that are a specialized shape or are dimmable, which are more expensive (BC Hydro, 2007). The target is to reach all 250,000 low-income BC Hydro customers.

CFL Pamphlet

According to the literature and focus group and individual interview results, a lack of awareness and product knowledge of CFLs is a significant barrier to CFL uptake by low-income BC households. The American Council for an Energy Efficient Economy's report on best practices of low-income energy efficiency programs identified incorporating education as a characteristic of exemplary programs (Kushler, York & Witte, 2005). A report on removing barriers to low-income households using energy efficiency measures by the Public Interest Advocacy Centre also identified customer education as a key element of the successful uptake of energy efficiency measures on the part of low-income people (Janigan, 2006). Data obtained from focus groups and interviews conducted for this study reinforce the need for increased awareness and knowledge of CFLs. Increasing awareness and knowledge of CFLs in the low-income community is especially important because CFLs cost more than regular light bulbs at the point of purchase, but since they last ten times longer than regular bulbs, and use less electricity to provide the same service, they provide users with monetary savings. Without knowing of the long-term savings, those already financially strapped are less likely to select the more expensive light bulbs.

¹⁰ Options to distribute one CFL, three CFLs, and five CFLs were considered. Five CFLs was determined to be the optimal number of CFLs to distribute. Please refer to Appendix E for evaluation results of distributing one CFL and three CFLs.

One focus group participant mentioned he wished he had known about the benefits of using CFLs earlier, and suggested there should be advertisements on television about them. However, he quickly interrupted his suggestion, when he remembered he does not have a television, or regularly watch television. While BC Hydro regularly includes information on reducing energy consumption with its bills, and has extensive information available on its website, there are some unique challenges with delivering information to low-income households due to media barriers, such as lack of a television or computer. According to the literature, delivery of energy efficiency programs and information should be distributed through local organizations already in contact with low-income residents (Kushler, York & Witte, 2005, Janigan, 2006).

The Public Interest Advocacy Centre found low-income energy efficiency education programs are “best achieved when there is a fit between the program materials and communication and the level of understanding and comprehension of the target customer group” (Janigan, 2006, p. 85). In addition, the report found multilingual and simple text material is necessary for educating low-income households about energy efficiency.

Suggested pamphlet content includes:

- **CFL Benefits** - Highlight the long-term savings on bulb purchases and electricity bill savings to show low-income residents they can save money in two ways. Also, outline environmental benefits including reduced electricity consumption and lower material usage and transportation costs as compared to incandescent light bulbs.
- **Quality Concerns** - Explain CFL design advances, such as a broader range of colour temperatures, light outputs and shapes, and no flickering with quality brands. Include guidelines for CFL selection and usage, such as selecting Energy Star certified CFLs that contain less mercury and come with warranties. Explain CFLs radiate differently than incandescent light bulbs, which causes some users to complain of a “dingy” lighting effect. In order to address this, users may want to use a slightly higher wattage than is equivalent between a CFL and a regular light bulb, or try different colour temperatures (Baskind, 2008). Finally, explain CFLs are best utilized in high-use fixtures.

- **Mercury** - Explain CFL mercury content is not a danger to humans or the environment as long as CFLs are disposed of properly. BC Hydro recently increased the amount of information on mercury in CFLs on its website. However, being “time-starved” as one participant put it, and “computer illiterate” as two others put it, having information about the mercury contained in CFLs available online is not the best delivery method when considering a low-income target audience, which is struggling to meet basic needs and does not have widespread access to and/or knowledge of computers. Pamphlet compares the amount of mercury in a standard CFL to the amount of mercury in other common items, such as amalgam dental fillings and watch batteries, to illustrate how miniscule the amount of mercury in CFLs is, compared to the mercury in other familiar products. Pamphlet includes instructions for correctly disposing of a broken CFL, and a list of places that accept CFLs for recycling.

5.3 Option 3: Distribute Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers

The Status Quo and Option 2 only reach low-income BC Hydro customers. Of the 300,000 low-income BC households, 250,000 have accounts with BC Hydro. The third policy option proposes distributing five CFLs¹¹ and the pamphlet described above to the 50,000 low-income BC households without a BC Hydro account. To do so, the provincial government organizes distribution through the Ministry of Environment or the Ministry of Energy, Mines, and Petroleum Resources, or outsources the program to an external agency such as Eaga Canada Services Inc. or City Green Solutions, both of which have delivered provincial low-income energy efficiency pilots. The target is to reach all 50,000 low-income BC households who are not BC Hydro customers.

5.4 Option 4: Ban Energy Inefficient Lighting

In order to increase CFL uptake by low-income BC households, the provincial and/or federal government could ban energy inefficient lighting. In April 2007, the Minister of Natural

¹¹ Energy Star certified CFLs.

Resources announced plans to ban inefficient lighting by 2012. The BC government is working with federal officials to implement the ban. The ban “covers the majority of sales of existing medium screw base incandescent lamps. Incandescent lamps of 25 and 150 watts are not covered as they currently only represent approximately 2% of total sales” (Natural Resources Canada, 2009). The ban excludes lighting products lacking effective replacements. Although the federal government has announced plans to implement the ban, it is included in this study as an option because it has not yet been implemented and it remains to be seen whether it will be implemented. If the federal government does not implement the ban, the BC government could ban inefficient lighting at the provincial level in order to increase CFL uptake by low-income households.

5.5 Option 5: Distribute Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers in Advance of Ban on Energy Inefficient Lighting

The final option proposed to increase CFL uptake by low-income BC households is distributing five CFLs and the pamphlet to low-income non-BC Hydro customers in advance of banning inefficient lighting. This option could be implemented in the case of a federal or provincial ban on inefficient lighting. Low-income households without a BC Hydro account will not directly benefit from the lower electricity consumption from CFL usage yet will be forced to purchase more expensive light bulbs; in order to address this adverse equity impact, they receive free Energy Star certified CFLs and an informational pamphlet.

6: Option Evaluation

This section evaluates the options outlined in Section 5 based on cost, effectiveness, administrative feasibility, equity and public acceptability. Evaluation focuses on the period before 2012 when a planned federal ban on inefficient lighting comes into effect. The Comparative Rankings Matrix offered in Table 6.1 summarizes the evaluation of options. A complete discussion of the evaluation for each option follows. Finally, this section recommends policy actions to increase CFL uptake by low-income BC households.

Table 6.1 Comparative Rankings Matrix

CRITERIA	POLICY OPTION				
	Status Quo (CFL Component)	Give CFLs + Pamphlet BCH	Give CFLs + Pamphlet non-BCH	Ban Inefficient Lighting	Give non-BCH CFLs + Pamphlet then Ban
Cost					
<i>Program Cost (\$)</i>	528,750	4.2M	852,500	Low	Low
<i>Avoided Cost (\$)</i>	665,280	6.2M	1.2M	High	High
Score / 6	4	4	5	6	6
Effectiveness	Low	Med	Med	High	High
Score / 3	1	2	2	3	3
Admin. Feasibility	Med	Med	Low	Med	Low
Score / 3	2	2	1	2	1
Equity	Low	Med	Med	Med	High
Score / 3	1	2	2	2	3
Public Acceptability	High	High	High	Low	Med
Score / 3	3	3	3	1	2
TOTAL / 18	11	13	13	14	15

6.1 Maintain CFL Component of Power Smart Low Income Program (Status Quo)

Cost: This study only takes into account the CFL component of the Power Smart Low Income program, thus program cost evaluated here is the cost of delivering three CFLs to 45,000 low-income BC Hydro customers. According to the Power Smart Low Income Program Manager, the estimated cost per participant for the CFL portion of the Low Income program is \$2.50 per CFL; \$1.00 for assembling and packaging; \$0.75 to register participants; and \$2.50 for mailing and shipping (personal communication, February 12, 2009). Based on these estimations, the cost per participant for distributing three CFLs is \$11.75. The cost to deliver three CFLs to the targeted 45,000 low-income BC Hydro customers is \$528,750, which is “low,” scoring three points.

Based on the assumption the CFL will be placed in a high-use fixture, the annual electricity savings of a standard CFL fixture is 56-kilowatt hours per year (BC Hydro, 2007). Thus if all 45,000 low-income BC Hydro customers replace three high-use incandescent light bulbs with CFLs, the electricity savings would be approximately 7,560 MWh per year.¹² At the avoided cost of electricity of \$88/MWh, the Status Quo results in an avoided cost of electricity of \$665,280, which is “low,” scoring one point. Avoided cost of electricity exceeds program costs by \$136,530.¹³ In total, the cost criterion scores four points out of a possible six.

Effectiveness: According to the literature and experience in other jurisdictions, energy efficiency programs distributing free CFLs effectively increase CFL uptake. Reid found Delaware to be the US state with the second highest CFL penetration, with an average of 4.9 CFLs per household, which he attributes to a 2006 program in which the state gave every household two CFLs (2008). That the average household has more than the two CFLs from the state is in line with Reid’s finding that that “if people can be persuaded to put just one CFL in service, the odds of stimulating future purchases are greatly improved” (2008, p. 11). Results from Canada’s Survey of Household Energy Use support this, finding “among households that used a CFL in 2003, only 27 percent used only one CFL, while 40 percent used four or more CFLs” (Natural Resources Canada, 2008 B, p. 28).

Distributing CFLs addresses quality concerns people have about CFLs that arise from misperceptions or misinformation. By showing people CFLs are comparable to incandescent light bulbs, it disproves false beliefs about the quality of light output or colour temperature. Reid’s 2008 study found over 75% of CFL users reported the lighting quality of CFLs to be better or the same as incandescent light bulbs. However, quality concerns also arise due to poor quality

¹² 7,560,000 kWh per year.

¹³ Avoided cost exceeds program cost up to an avoided cost of electricity of \$70/MWh.

CFLs and incorrect CFL usage. In order to ensure quality concerns are proven wrong, the CFLs distributed in the Energy Saving Kits are Energy Star certified. Energy Star certified CFLs come with a warranty to ensure the quality of the bulb. This option does not address the issue of optimal CFL usage through providing information on CFLs.

While distributing free CFLs is an effective method of increasing uptake, the Status Quo ranks “low” (one point) in terms of causing low-income BC households to switch from incandescent light bulbs to CFLs for two reasons. First, despite the Power Smart Low Income program having been available for ten months when the focus groups and interviews were conducted, all study participants were unaware of the program. In addition, no BC Hydro customer focus group participants had CFLs installed in their households. No matter how well designed a program, if it does not reach people, it cannot be effective.

Second, educational materials, such as a pamphlet on CFLs are not included with the CFLs distributed. Focus group results indicate the importance of disclosing the benefits of using CFLs, tips for overcoming quality issues, and addressing concerns regarding mercury content are important for future CFL uptake. The literature also highlights the importance and effectiveness of an educational component of energy efficiency programs (Kushler, York & Witte, 2005, Janigan, 2006, Oppenheim & MacGregor, 2000). An educational pamphlet is important for increasing the likelihood CFL recipients will choose to purchase CFLs in future instead of incandescent light bulbs.

Administrative Feasibility: The status quo ranks “medium” in terms of administrative feasibility, based on feedback from the Power Smart Low Income Program Manager and is awarded two points (personal communication, February 12, 2009).

Equity: The program has set a target of delivering three CFLs via the Energy Savings Kit to 45,000 low-income customers, 18 percent of its low-income customer base, by 2012 (personal communication, February 12, 2009). The Status Quo ranks “low” (one point) in terms of equity because the Energy Saving Kits are only available to BC Hydro customers, and thus exclude low-income households without a BC Hydro account, and the program only aims to reach a small proportion of the low-income customer base over four years (2008 to 2012).

Public Acceptability: Customer surveys and studies “have shown that a substantial majority of electricity customers favour programs that assist low-income customers” (Oppenheim & MacGregor, 2000, p. 3). These findings are reinforced by feedback from the Power Smart Low Income Program Manager, who reports public support for the program has been high (personal communication, February 12, 2009). Thus, this option ranks “high” for public acceptability and is awarded three points.

6.2 Distribute Five CFLs and Pamphlet to Low-Income BC Hydro Customers

Cost: Based on the previously discussed cost estimations for distributing free CFLs, it would cost \$16.75 per participant to deliver five CFLs. Thus, to distribute five CFLs to all 250,000 of BC Hydro’s low-income customers it would cost \$4,187,500. According to the Power Smart Low Income Program Manager, it could cost anywhere from \$5,000 to \$10,000 to design the pamphlet and fifteen cents to print each pamphlet (personal communication, February 12, 2009). Based on this information, this study estimates it will cost \$7,500 to design the pamphlet and \$37,500 to print enough pamphlets for all low-income BC Hydro customers. Distribution costs for the pamphlet are zero as it is included with the CFLs. The total cost for distributing five CFLs and a pamphlet to all low-income BC Hydro customers is \$4,232,500, making it a high program cost option, scoring one point.

As discussed, the annual electricity savings of a standard CFL fixture is 56-kilowatt hours per year (BC Hydro, 2007). Thus, if all 250,000 low-income BC Hydro customers replace five incandescent light bulbs with standard CFLs, the electricity savings will amount to 70,000 MWh per year. This option would result in an avoided cost of electricity of \$6.2 million, which is ranked “high” and awarded three points. The avoided cost of electricity exceeds the cost of distributing five CFLs and a pamphlet to all low-income BC Hydro customers by \$2 million.¹⁴ In total, the cost criterion scores four points.

Effectiveness: Like the Status Quo, this option also addresses quality concerns people have about CFLs that arise from misperceptions or misinformation by distributing Energy Star certified CFLs for people to try and likely find the quality to be comparable to incandescent lighting (Reed, 2008). Unlike the Status Quo, this option also addresses the issue of optimal CFL usage through the pamphlet, increasing the effectiveness of this option relative to the Status Quo. Pairing a pamphlet with a giveaway increases the effectiveness of both the giveaway and the pamphlet. For example, the Alliance to Save Energy studied a Niagara Mohawk Power Company’s energy efficiency program and found:

Customers who received education along with energy efficiency services showed energy savings greater than 25 percent of their usage in the first year after the installation of efficiency measures, and over 20 percent three years later. These results were compared to those found for a group that had received only the energy efficiency services: 16 and less than 13 percent of usage after one and three years, respectively. Thus, providing education in the optimal use of appliances and other energy end uses (including lighting and water heating) added between 7 and 9 percent to the total energy savings achieved. (Oppenheim & MacGregor, 2000, p. 8).

Despite the expected high effectiveness of a giveaway and a pamphlet based on the literature, focus group results indicate decision-making regarding CFL uptake is complex. This option ranks “medium” (two points) in terms of increasing CFL uptake by low-income BC households.

¹⁴ Avoided cost exceeds program cost up to an avoided cost of electricity of \$61/MWh.

Administrative Feasibility: This option is similar to the option to Maintain CFL Component of Power Smart Low Income Program (Status Quo) in terms of target audience and program fundamentals, and thus ranks “medium” (two points) based on feedback from the Power Smart Low Income Program Manager (personal communication, February 12, 2009).

Equity: This option targets all 250,000 of BC Hydro’s low-income customers, or 83 percent of low-income BC households. While this option reaches a significant portion of low-income BC households, it ranks “medium” in terms of equity because it does not reach low-income non-BC Hydro customers and is awarded two points.

Public Acceptability: As noted in the evaluation of public acceptability for the Status Quo, work by Oppenheim and MacGregor (2000) shows public support for low-income energy efficiency programs is high. These findings are reinforced by feedback from the Power Smart Low Income Program Manager, who reports public support for the program has been high (personal communication, February 12, 2009). Thus, this option ranks “high” for public acceptability and is awarded three points.

6.3 Distribute Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers

Cost: This option proposes to increase CFL uptake by low-income BC households by distributing five CFLs to low-income non-BC Hydro customers. Based on BC Hydro’s estimated costs for distributing five CFLs, that is, \$11.75 per participant, it would cost \$837,500 to reach the 50,000 non-BC Hydro customers who are low-income according to Statistics Canada’s Low-Income Cut-off (personal communication, February 12, 2009). As described in Section 6.2, this

study estimates it will cost \$7,500 to design the pamphlet and \$7,500 to print enough pamphlets for all low-income non-BC Hydro customers. Distribution costs for the pamphlet are zero as it is included with the CFLs. The total cost for distributing five CFLs and a pamphlet to all low-income non-BC Hydro customers is \$852,500, which is “low” for program cost evaluation and is awarded three points.

If all 50,000 recipients replace five high use incandescent light bulbs with CFLs from the giveaway, an estimated 14,000 MWh of electricity would be saved, resulting in an avoided cost of electricity of \$1.2 million, which is deemed “medium” (two points), and exceeds program costs by \$347,500.¹⁵ In total, this option scores five of a possible six points for cost.

Effectiveness: This option ranks “medium” (two points) in terms of increasing CFL uptake by low-income BC households for same reasons discussed in the evaluation of the effectiveness of Option 2: Distribute Five CFLs and Pamphlet to Low-Income BC Hydro Customers in Section 6.2. Both options are identical expect for the target population, thus effectiveness in terms of increasing CFL uptake is the same.

Administrative Feasibility: Distributing five CFLs and a pamphlet to low-income non-BC Hydro customers ranks “low” in terms of administrative feasibility based on expert feedback and is awarded one point (personal communication, February 11, 2009, personal communication, February 12, 2009). While BC Hydro has the capacity and knowledge necessary to implement this program, BC Hydro is limited to reaching customers only. The provincial government could fund an external agency with experience delivering energy efficiency programs to low-income households, such as Eaga Canada Services Inc. or City Green Solutions, to deliver the program.

¹⁵ Avoided cost exceeds program cost up to an avoided cost of electricity of \$61/MWh.

While there are many uncertainties with the implementation of this option, it is clear that many agencies would need to be involved, and new processes would have to be developed. In addition, the literature indicates low-income utility customers are hard-to-reach (Hippis & Hungerford, 2004). It reasonably follows that low-income non-customers would be even harder to reach, if for no other reason than identification.

Equity: This option targets 50,000 households, or 17 percent of low-income BC households. Although this option does not reach a significant portion of low-income BC households, it is ranked as moderately equitable on the basis that it reaches and has a positive impact on non-BC Hydro customers, that is, those people who will not realize the electricity bill savings of using CFLs. This option is awarded two points for equity.

Public Acceptability: As noted in the evaluation of public acceptability for the Status Quo, work by Oppenheim and MacGregor (2000) shows public support for low-income energy efficiency programs is high. Feedback from the Power Smart Low Income Program Manager, who reports public support for the program has been high, reinforces this finding (personal communication, February 12, 2009). Thus, this option ranks “high” for public acceptability and is awarded three points.

6.4 Ban Energy Inefficient Lighting

Cost: In order to implement the proposed federal ban on inefficient lighting, federal government staff time would be required. This study only focuses on costs to BC Hydro or the provincial government. While the provincial government is cooperating with the federal government to work towards a ban on energy inefficient lighting, no information is available on the amount of time staff will spend on this issue and what that would cost. While the provincial

government will incur some cost to implement this option in the form of employee hours, the federal government, for which costs are outside the scope of this study, will endure a larger proportion of the cost, thus the cost for this option is estimated to be “low” and is awarded three points. While the exact avoided cost of electricity is unknown, it will most certainly be high, exceeding program cost, and thus scores three points. This option is awarded six points for cost.

Effectiveness: This option is highly effective in increasing CFL uptake by low-income BC households because they will only have efficient lighting choices, and is awarded three points. While there are other efficient lighting options, such as Light Emitting Diodes (LEDs), CFLs are the cheapest option currently available.

Administrative Feasibility: This option has “medium” administrative feasibility due to the relatively high number of organizations involved, and is awarded two points. In addition, new efficiency requirements for lighting will have to be developed and this new system will require regulation.

Equity: Although this option targets all 300,000 low-income BC households, it ranks “moderate” (two points) in terms of equity because it forces low-income non-BC Hydro customers to purchase relatively expensive energy efficient light bulbs from which they will not realize savings on their electricity bill.

Public Acceptability: Some segments of the public strongly support a ban on energy inefficient lighting, while others strongly oppose a ban. Reasons for support largely hinge on electricity savings, economic benefits and environmental benefits (Prescott, 2009). Reasons for opposition

vary, including, a preference for choice, health concerns regarding the ultra-violet light and electric magnetic field radiations given off by CFLs, mercury content, higher cost relative to incandescent bulbs, home heating losses from switching to efficient lighting, and quality concerns. Health Canada, BC Hydro, and many ban supporters, maintain health concerns regarding ultra-violet light and electric magnetic field radiation are unsubstantiated (BC Hydro, 2009 B, Health Canada, 2004). In response to concerns regarding increased heating costs because of replacing incandescent light bulbs with CFLs, BC Hydro maintains:

When you replace [incandescent light bulbs] with CFLs, you may lose a tiny amount of heat, but you can more than offset the miniscule increase in your heating load by simply draftproofing and caulking your doors and windows. It's not efficient to rely on the heat created by incandescent bulbs to heat your home. BC Hydro recommends using the most efficient lighting products for your home lighting and the most efficient heating practices to heat your home. (BC Hydro, 2009 B).

Despite the seemingly good answers CFL supporters provide in response to the above concerns, members of the Affordable Energy Working Group note public concern about CFLs is increasing (personal communication, February 19, 2009). Representatives from the Working Group hypothesize this increase in public concern is a direct result of recent major media stories on potential health risks of CFL usage. For example, 16:9, a weekly investigative television show airing on the Global Canada Network recently ran two in-depth reports on the alleged health risks of ultra-violet light and electric magnetic field radiation given off by CFLs (Global, n.d.). Members of the Affordable Energy Working Group reported a subsequent sharp increase in public concern about the safety of CFLs. As a cautionary, this study ranks a ban on energy inefficient lighting as having "low" public acceptability, scoring one point. However, it is believed public acceptability could be greatly improved through effective CFL knowledge campaigns in advance of a ban.

6.5 Distribute Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers in Advance of Ban on Energy Inefficient Lighting

Cost: The program cost for this option is low, for the reasons outlined in the evaluation of program cost for Option 4. As outlined under the evaluation of Option 3 program cost, distributing five CFLs and a pamphlet to all low-income non-BC Hydro customers costs \$852,500, which is also low cost. Therefore, this option is ranked “low” for program cost, and is awarded three points. While the exact avoided cost of electricity is unknown, it will most certainly be high (three points) and exceed program costs. In total, this option scores six points in terms of cost.

Effectiveness: This option is highly effective in increasing CFL uptake by low-income BC households because they will only have efficient lighting choices. In addition, low-income non-BC Hydro customers will have five CFLs to help with the transition to more expensive efficient lighting. Thus, this option is awarded three points for effectiveness.

Administrative Feasibility: This option has “low” administrative feasibility and is awarded one point for the same reasons outlined in the evaluation of administrative feasibility for Option 3, distributing CFLs and pamphlet to low-income non-BC Hydro customers and Option 4, banning energy inefficient lighting.

Equity: This option targets all 300,000 low-income BC households in terms of the ban, and 50,000 low-income non-BC Hydro customers in terms of CFL distribution. This option is highly equitable because it reaches all low-income BC residents, and addresses the negative impact a ban on inefficient lighting would have on low-income non-BC Hydro customers, who will not

benefit from electricity savings achieved by using CFLs. By giving these households five CFLs in advance of the ban, they will have a stock of efficient light bulbs to ease the transition to efficient lighting. This option is awarded three points for equity.

Public Acceptability: This option fares slightly better than the option to ban energy inefficient lighting in terms of public acceptability because it aims to offset the negative equity impact a ban has on low-income BC households without a BC Hydro account. As previously noted, public support is high for low-income energy efficiency programs. Thus, this option ranks “medium” for public acceptability, and is awarded two points.

6.6 Recommendations

Once all options are evaluated according to the criteria, Option 5, Distribute Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers in Advance of Ban on Energy Inefficient Lighting, emerges as the optimal policy option to increase CFL uptake by low-income BC households. This option ranks low for program cost, high for avoided cost of electricity, high for effectiveness, and high for equity. While this option ranks “medium” and “low” for public acceptability and administrative feasibility respectively, suggestions for improving the administrative feasibility and public acceptability of this option are discussed under Next Steps in Section 7.

Evaluation results indicate if the federal government does not implement the ban, the BC government should consider doing so at the provincial level. The cost of implementing the ban at the provincial level would be more costly than if the federal government headed the ban as outlined under Option 4, as the province would incur all of the stakeholder consultation, planning, implementation, and regulation costs. However, the study estimates the cost to the province to

ban inefficient lighting would be “moderate”, while the avoided cost is “high”, thus avoided cost will still exceed program cost.

While Option 4, Ban Energy Inefficient Lighting, ranks almost as high as Option 5, it is not recommended because Option 5 provides the same benefits, without the adverse equity impact. In addition, Option 5 has higher public acceptability. Similarly, Option 3, Distributing Five CFLs and Pamphlet to Low-Income Non-BC Hydro Customers is not recommended because combining this option with a ban on energy inefficient lighting is a superior option based on the previously outlined evaluation.

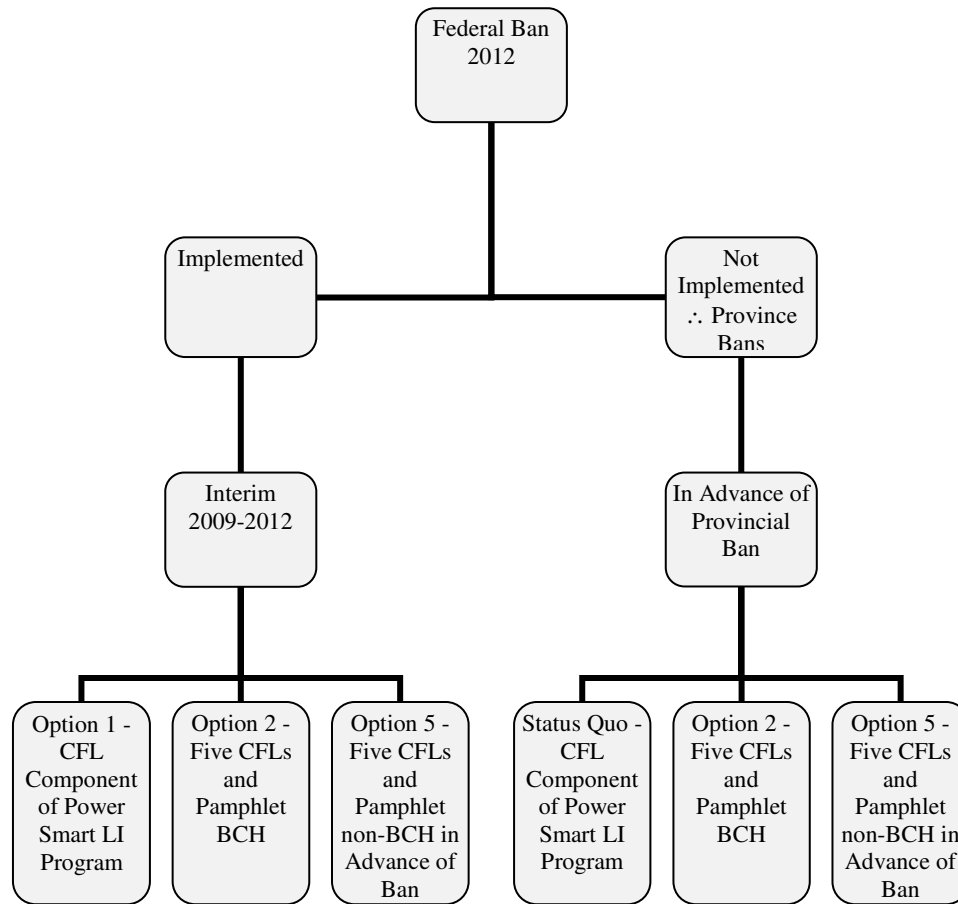
The avoided cost of electricity for Option 2, Distribute Five CFLs and Pamphlet to Low-Income BC Hydro Customers, far exceeds program costs. BC Hydro should therefore implement Option 2, especially if government bans energy inefficient lighting. Distributing free CFLs and improving education and awareness of CFLs would improve the public acceptability of a ban, as well as alleviate equity concerns regarding impact on low-income households.

The Status Quo has the lowest score of all policy options evaluated, largely because only the CFL component of the Power Smart Low Income program is considered. While this study considers how to increase CFL uptake by low-income BC households, Power Smart is attempting to increase the energy efficiency of low-income BC Hydro customers more broadly than simply increasing CFL uptake. A report on best practices of energy efficiency programs found offering a wide range of services “for a full menu of customer end-use applications – lighting, appliances, HVAC, building envelope, and other systems and technologies” to be characteristic of exemplary programs (York & Kushler, 2008). Thus, the study recommends BC Hydro continue to offer the Power Smart Low Income program.

Figure 6.1 outlines the recommended policy actions in the context of the federal ban being implemented or not being implemented. If the federal ban goes ahead for 2012, BC Hydro and the provincial government should distribute five CFLs and the pamphlet to all low-income

BC residents, as well as continue with the Status Quo. If the federal ban does not go ahead, the provincial government should consider implementing the ban in BC. The study recommends the same policy actions in the case of a ban at the federal level as at the provincial level.

Figure 6.1 Policy Recommendations Diagram



7: Next Steps

If the federal government bans energy inefficient lighting, BC government and BC Hydro should distribute five CFLs and an educational pamphlet to all low-income BC households in advance of the ban. If the federal government does not implement the ban, BC should do so at the provincial level, and, in coordination with BC Hydro, distribute five CFLs and an educational pamphlet to all low-income BC households in advance. The province has already set aside \$17 million for the Low-Income Energy Efficiency program. Funds from this program could be devoted to the CFL campaign targeting low-income non-BC Hydro customers. The province could deliver the program through the same organizations it used for low-income energy efficiency pilots, such as Eaga Canada Services Inc. or City Green Solutions. The organization responsible for implementing CFL distribution should work closely with organizations already in contact with low-income BC households, such as the BC Old Age Pensioners Organization, BC Housing, the Ministry of Housing and Social Development, BC Non-Profit Housing Association, Co-op Housing Federation of BC, and Pigeon Park Savings. Collaborating with these agencies would help overcome the administrative feasibility difficulty of identifying and reaching recipients raised in the evaluation section.

Focus group results illustrate the complexity involved in decision-making with regard to CFL uptake. Improving awareness and product knowledge on CFLs resulted in five non-CFL users reporting they would use CFLs. The literature supports the finding that improving knowledge is important in increasing uptake of energy efficiency measures. An added benefit of improving CFL knowledge is improving the public acceptability of banning energy inefficient lighting. In addition to including the pamphlet with free CFLs distributed, in-person information sessions would be useful were appropriate. For example, the provincial government, BC Hydro

and BC Housing are currently conducting energy efficiency upgrades in low-income housing. As part of this process, they should schedule brief information sessions whereby a representative explains the changes taking place in the building, the energy efficiency measures being installed, and the resulting benefits to tenants. Finally, in social housing buildings where BC Housing replaces incandescent bulbs with CFLs as part of its commitment to meeting its energy efficiency targets, it should post notices containing information similar to that outlined in the pamphlet in those buildings.

While the study recommends the continuation of the Status Quo, lessons drawn from this study have potential to improve the Power Smart Low Income program. As indicated by focus group results and the literature, providing information on the energy efficiency measures included in the Energy Saving Kits would increase the electricity savings and thus effectiveness. In addition, collaborating with organizations already in contact with low-income BC residents would assist BC Hydro in reaching this hard-to-reach segment of their customer base (Janigan 2006, Kushler, York & Witte, 2005).

As indicated by focus group results and the literature, some low-income households cannot afford to replace incandescent light bulbs with CFLs. Based on this finding, one can reasonably assume low-income BC households cannot afford to replace their single-pane windows with energy-efficient windows, and so on. Affordability is thus a key barrier to improving the energy efficiency of low-income households. Another important lesson gained from the discussion about CFLs, which we can apply to energy efficiency measures more broadly, is the lack of awareness and knowledge of low-income households with regard to energy efficiency. Finally, as we have seen, renters and people without BC Hydro accounts have largely been excluded from energy efficiency programs, and lack the motivation or ability to purchase and install energy efficiency measures.

Appendices

Appendix A: Focus Group Recruitment

Record of attempts made to recruit focus group participants through organizations

Organization Contacted	Date Contacted	Method of Communication	Will Assist with Recruitment / How?
Think City	November 16/08	Email and Phone	Yes (Sent members email)
BC Sustainable Energy Association	November 25/08	Email	Peter Ronald replied to say J. Abbott would follow up with me.
	December 8/08	Emailed Jamie Abbott	No
	December 8/08	Website – Vancouver chapter	No
Pivot Legal Organization	December 3/08	Email	Yes (Post poster on premises)
BC Public Interest Advocacy Centre	November 6/08	Email	No response
	December 3/08	Email	No response
BC Citizens for Public Power	December 7/08	Website	No response
Humanities 101 (UBC)	December 2/08	Email	No response
West End Renters Association	December 8/08	Email	No response
Simon Fraser University	December 8/08	Website	No response
Pigeon Park Bank	December 9/08	In Person	Yes (Post posters)
Vancouver Community College	December 9/08	In Person	Yes (Posted poster on premises)
Solar BC	December 10/08	Website	Maybe – timing might not work
City Green Solutions	December 10/08	Email	No response
Vancouver Public Library	December 10/08	In Person	Yes (Posted poster)
Craigslist Vancouver	December 11/08	Posted Gig	Yes

Appendix B: Focus Group Questions

1. Who has never heard of CFLs before this study, or would consider themselves to have limited knowledge on them? Can you please tell us a little about that?
2. Can anyone give a brief description of CFLs, and tell us how much they cost?
3. I would now like us to discuss what you feel are the main reasons you have not purchased and installed CFLs in your household, so what prevents or discourages you from using CFLs.

I would now like to run through a series of information about CFLs. I will be asking each of you if based on the information provided, you would consider purchasing CFLs, and if not, why. Please discuss the reason for your stance, and please remember we are equally interested in why you would or would not consider purchasing CFLs.

4. CFLs use about one quarter (or 75% less) of the energy that incandescent bulbs use to deliver the same amount of light. They come in many shapes and sizes as well as different light output levels and colour temperatures, to suit almost any fixture and function. They cost anywhere from \$3-10 more than a regular incandescent light bulb. Would you purchase CFLs based on the information provided, and please explain why.
5. The energy savings from replacing incandescent bulbs with CFLs helps decrease the need for new energy generation facilities and the associated environmental impacts. In addition, because CFLs last so much longer than standard incandescents, there is less material and manufacturing required. CFLs are therefore considered to be environmentally-friendly products. Would you purchase CFLs based on the information provided, and please explain why.
6. Because CFLs last 10 times longer, you'll only buy one CFL bulb for every 10 incandescents you'd need. One incandescent bulb on average lasts 1,000 hours, while a CFL lasts 10,000 hours. This means that you would have to buy 10 incandescent bulbs at a cost of \$7.50, to equal one CFL, which costs \$5, saving you \$2.50 as well as time and effort. Would you purchase CFLs based on the information provided, and please explain why.
7. CFLs use up to 75% less energy than incandescents so you also save money by using less energy - The typical annual cost of operation of four incandescent bulbs is \$28.00, while it only costs \$6.44 to operate four CFLs. Replace five incandescent bulbs with CFLs and you'll save more than \$20 per year. Would you purchase CFLs based on the information provided, and please explain why.
8. At what price would you purchase CFLs - how much cheaper would they have to be for you to buy them?
9. Power Smart is providing a 50% off instant online rebate for CFLs purchased online. You must purchase the CFLs online in order to receive this deal. Would you purchase CFLs through this offer, and please explain why.

10. Power Smart has recently developed a Low-Income program; if you qualify, you can receive four free CFLs among other energy efficiency measures. In order to receive this free Energy Saving Kit, you must call BC Hydro and provide your BC Hydro account number, the city you live in, how many people live in your household and your annual household income. Would you participate in this program offer, and please explain why.
11. Most CFLs contain a small amount of mercury - about one-fifth of what's in an average watch battery and less than one-hundredth that found in a typical amalgam dental filling. However, CFLs should not be put in the garbage for disposal as the broken bulbs will release mercury into the environment. CFLs require special disposal, such as being dropped off at recycling centre that accepts CFLs. Would you purchase CFLs based on the information provided, and please explain why.
12. In the Power Smart program mentioned, they are also offering free home energy audits, where a representative will come to your home and assess the energy efficiency of it, and what upgrades could be made to save energy. The cost of these upgrades could be covered and completed by Power Smart. Would you participate in this program and please explain why.
13. We are nearing the end of our time. Before we wrap up, I would like to know if based on our entire discussion about CFLs, would you start to use CFLs, and please explain why.

Appendix C: Participant Questionnaire

1. In what neighbourhood is your home located? _____
(For example, Kitsilano, Downtown Eastside, West End, etc.)
2. Do you own or rent your home?
 - Own
 - Rent
3. Please indicate your gender:
 - Female
 - Male
4. How long have you lived in your current home? Please only answer in years **or** months, not both.

_____ years, **or**
_____ months
5. What year were you born? _____
6. How many people reside in your household? _____ people
7. What is the primary language spoken in your household? _____
8. Which type of dwelling do you live in?
 - Single Room Occupancy Hotel
 - Apartment/condominium
 - Row/townhouse
 - Duplex
 - Single detached house
 - Other (please specify): _____
9. Does your household have an account with BC Hydro?
 - Yes
 - No
10. How much do you think one standard Compact Fluorescent Light bulb (CFL) costs?
 - \$2.50
 - \$5.00
 - \$7.50
 - \$10.00
 - \$15.00
 - \$17.50

11. How much more do you think a standard CFL costs than a regular, incandescent light bulb?
- No difference in price
 - \$1.00
 - \$3.00
 - \$5.00
 - \$10.00
 - \$15.00
12. Do you have any Compact Fluorescent Light bulbs (CFLs) installed in your home?
- Yes
 - No
13. Do you have any other energy efficiency measures installed in your home?
- Yes
 - No
 - Don't know
14. Have you ever participated in a BC Hydro Power Smart program?
- Yes
 - No
15. Annual Household Income after tax: \$_____ / year

Thank you!

Appendix D: Reveal/Ask Test Results

Focus Group #1 Reveal/Ask Test Results

Based on the information provided, would you use CFLs?		PARTICIPANTS				
		A	B	C	D	E
<u>General Info</u>	<i>Yes / No</i>	Maybe	Yes	Maybe	Yes	No
	<i>Comment</i>	Afford-ability		Concerned re mercury and light output		Afford-ability
<u>Environment</u>	<i>Yes / No</i>	Maybe	No	No	No	Maybe
	<i>Comment</i>		Does not benefit me	Afford – ability and light output	Mercury	
<u>Long Life of Bulb</u>	<i>Yes / No</i>	No	Yes	Maybe	Maybe	Yes
	<i>Comment</i>			Depends on light output and colour temp		
<u>Savings on Electricity Bill</u>	<i>Yes / No</i>	No	No	Yes	No	Maybe
	<i>Comment</i>	Initial outlay is too high	Prefer to buy cheapest bulb	Not for the \$ savings but to use less electricity	Prefer to buy cheapest bulb	
<u>Price at which would buy</u>	<i>\$ or Compared to incan - descents</i>	Same price	Cheaper	Un - decided	Same	Same
	<i>Comment</i>	Or need more education		Light output, colour temp and mercury		

Focus Group #1 – Reveal/Ask Test Results cont.

Based on the information provided, would you use CFLs?		PARTICIPANTS				
		A	B	C	D	E
<u>Rental barrier addressed</u>	<i>Yes / No</i>	No	Yes	Yes	-	No
	<i>Comment</i>	Silly!			Did not answer	Concerned they would break.
<u>PS Online Rebate (50% off)</u>	<i>Yes / No</i>	Yes	No	No	No	Yes
	<i>Comment</i>	“In a heartbeat” Very convenient	Prefers to purchase bulbs in store	No credit card. Also difficult to receive shipments at residence	Inconvenient	Good past experience buying online
<u>Mercury in CFLs</u>	<i>Yes / No</i>	No	No	Yes	No	No
	<i>Comment</i>	If could conveniently recycle				
<u>PS Low Income pgm – Energy Saving Kit</u>	<i>Yes / No</i>	Yes	Yes	No	Yes	No
	<i>Comment</i>			“I don’t like giving out information period.” Also ineligible	Would inquire about disposal	Does not have a BCH account (ineligible)
<u>PS Low Income pgm – Home Energy Audit</u>	<i>Yes / No</i>	Yes	No	Maybe	No	No
	<i>Comment</i>		Rents. Too much trouble to get landlord involved.	Would mention it to landlord	Invasive; doesn’t want someone coming into home	Ineligible
<u>Final decision on using CFLs</u>	<i>Yes / No</i>	Maybe	Yes	Yes	Yes	No
	<i>Comment</i>	If improve quality	Save money by using less energy			Not until same price as incandescents. Mercury.

Focus Group #2 – Reveal/Ask Test Results

Based on the information provided, would you use CFLs?		PARTICIPANTS				
		A	B	C	D	E
<u>General Info</u>	<i>Yes / No</i>	Maybe	No	No	Yes	No
	<i>Comment</i>	Affordability	Affordability	Affordability	Environmental and \$ savings	Would buy CFLs if paying for electricity
<u>Environment</u>	<i>Yes / No</i>	Maybe	Maybe	No	Yes	Yes
	<i>Comment</i>	Affordability		Would buy if paying for electricity	“More power to you!”	
<u>Long Life of Bulb</u>	<i>Yes / No</i>	Yes	Yes	Yes	Yes	Yes
	<i>Comment</i>				Save \$ on your bill and your bulbs	
<u>Savings on bill</u>	<i>Yes / No</i>	Yes	No	Maybe	Yes	Yes
	<i>Comment</i>	But would not replace out bulbs all at once (affordability)	Other priorities for money used upfront for CFLs	Affordability		Thought the savings would be greater
<u>Price at which would buy</u>	<i>Yes / No</i>	\$4.50	\$8-9	\$10	-	\$4.50
	<i>Comment</i>	No more than 3 x price of regular bulb	Environmentally friendly products are expensive to produce	“If I can afford a pack of cigarettes for ten bucks...”	Did not state a price	Double or three times the price of a regular bulb

Focus Group #2 – Reveal/Ask Test Results cont.

Based on the information provided, would you use CFLs?	PARTICIPANTS					
	A	B	C	D	E	
<u>Rental barrier addressed</u>	<i>Yes / No</i>	No	No	No	No	Yes
	<i>Comment</i>	“Tacky”	Obsessive			Wouldn’t want to start from scratch
<u>PS Online Rebate (50% off)</u>	<i>Yes / No</i>	Maybe	No	No	No	Yes
	<i>Comment</i>	Would have to be premeditated	Doesn’t use credit card on internet	Computer illiterate	Doesn’t shop online	Good way to start making the switch
<u>Mercury</u>	<i>Yes / No</i>	Maybe	Maybe	Maybe	Yes	Yes
	<i>Comment</i>	If could conveniently recycle	Would check if there was a better alternative	“Knowing me I would just put the CFL in the garbage”	“I am totally environmentally friendly”	No problem to recycle
<u>PS Low Income pgm – Energy Saving Kit</u>	<i>Yes / No</i>	Yes	Yes	No	Yes	No
	<i>Comment</i>	Would help to make the switch		Ineligible – no BC Hydro account		Ineligible – no BC Hydro account
<u>PS Low Income pgm – Home Energy Audit</u>	<i>Yes / No</i>	Yes	Yes	No	Yes	No
	<i>Comment</i>			Ineligible – no BC Hydro account		Ineligible – no BC Hydro account
<u>Final decision on using CFLs</u>	<i>Yes / No</i>	No	Maybe	No	Yes	Yes
	<i>Comment</i>	“Can’t afford to buy any CFLs this month”	Would check how mercury would affect health. Would wait until employed full-time.	Reported would use but “Mercury is still a concern”		

Appendix E: Optimal Number of CFLs to Distribute

This Appendix provides an overview of the evaluation conducted to determine the optimal number of CFLs to distribute for Option 2: Distribute Five CFLs and Pamphlet to Low-Income BC Hydro Customers. Options to distribute one CFL and three CFLs were considered, the evaluation of which is outlined below. Options to distribute more than five CFLs are not considered on the basis that a standard one-bedroom apartment has a main lighting fixture in the bedroom, bathroom, living room, kitchen and entrance/hall, totalling five high-use fixtures. Effectiveness, administrative feasibility, equity and public acceptability for Option 2 are the same regardless of the number of CFLs delivered. The evaluation of these criteria is outlined in Option 2.

The avoided cost of electricity achieved through distributing one CFL is less than the program cost of doing so. While the avoided cost of electricity exceeds the cost of distributing both three and five CFLs, the avoided cost of electricity achieved through giving away five CFLs far exceeds the cost of doing so. Thus, five CFLs was determined to be the optimal number of CFLs to distribute in both Options 2 and 3. Evaluation of the ideal number of CFLs for distribution was conducted for Option 2 and applied to Option 3: Distribute CFLs to and Pamphlet Low-Income Non-BC Hydro Customers. Distributing five CFLs to low-income BC Hydro customers saves more electricity than distributing one and three CFLs.

Evaluation: Distribute One CFL to Low-income BC Hydro Customers

Cost: The estimated cost per participant for the CFL portion of BC Hydro's Low Income program is \$2.50 per CFL; \$1.00 for assembling and packaging; \$0.75 to register participants; and \$2.50 for mailing and shipping (personal communication, February 12, 2009). Based on these estimated costs, the cost per participant for distributing one CFL is \$6.75. BC Hydro has

identified 250,000 low-income customers. The cost to deliver one CFL to all 250,000 low-income customers is therefore \$1,687,500.

According to the Conservation Potential Review, the annual electricity savings of a standard CFL fixture is 56-kilowatt hours per year (BC Hydro, 2007). This estimation is based on the assumption the CFL will be placed in a high-use fixture. Based on this information, if all 250,000 low-income BC Hydro customers replaced one high-use incandescent light bulb with a CFL, the electricity savings would be 14,000 MWh per year. Based on the avoided cost assumptions previously discussed, this option would result in an avoided cost of electricity of \$1.2 million. The avoided cost of electricity for this option is less than the cost of delivering the program.

Evaluation: Distribute Three CFLs to Low-Income BC Hydro Customers

Cost: Based on the costs estimations for a CFL distribution program previously outlined, the cost per participant for distributing three CFLs is \$11.75. It would therefore cost \$2,937,500 to reach all 250,000 of BC Hydro's low-income customers. Based on the electricity saving estimations previously discussed, if all 250,000 low-income BC Hydro customers replaced three incandescent light bulbs with standard CFLs, the electricity savings would amount to 42,000 MWh per year. Based on the estimations and assumptions previously discussed, this option would result in an avoided cost of electricity of \$3.7 million. The avoided cost of electricity achieved from distributing three CFLs to low-income BC Hydro customers exceeds the cost of the program by \$762,500.

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Expert Interviews

Name	Title, Organization	Date
Nathan Allen	Manager, Pigeon Park Savings	February 11, 2009
Margo Longland	Program Manager, BC Hydro Power Smart Low Income Program	February 12, 2009
Working Group on Affordable Energy	Representatives from Ministry of Energy, Mines, and Petroleum Resources, BC Hydro, Terasen Gas, Eaga Canada Services Inc., City Green Solutions, Fortis BC, and more.	February 19, 2009

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