Improving Energy Efficiency Participation in the District of West Vancouver

Reagan Rockzsfforde

UBC Sustainability Scholar, 2018

8/21/2018

Prepared for Courtney Miller,
Planning & Development Services,
District of West Vancouver

Table of Contents

Section 1—Introduction

Using insights from behavioural and social science research, and best practices in existing programs, this analysis examines different pathways to energy efficiency in the District of West Vancouver. Current trends suggest that energy efficiency programs have been shifting towards the integration of behavioural-based approaches to achieve more significant impact. The recommended behavioural program for the District combines three key dimensions—community-based, outreach and competitions. The strength of this proposal relies on its proven potential in improving participation, energy savings and cost-effectiveness. In addition, it contributes to a community's overall vitality through its more inclusive, participatory and interactive approach. Furthermore, such a behavioural program offers a long-term benefit of positive behavioural change through nudging and motivating individuals to set energy-saving goals and take actions to achieve them.

Low participation rates remain as one of the most prominent challenges in almost all efficiency programs. The availability of incentives does not necessarily translate to optimal participation, and other non-financial barriers contribute to low uptake. Studies suggest that social and informational barriers also pose challenges to people's willingness to participate. While traditional rebate programs target specific products or technologies, behavioural programs directly target customers' attitude and perception toward energy consumption.

As a result, there are now behavioural-based approaches that use strategies like feedbacks, nudging, competitions, outreach and education. Evaluations of these behavioural programs reveal better participation rates when implemented with existing incentive-based programs.

As the District of West Vancouver considers the appropriate approach, it can improve outcomes by ensuring that a complementary behavioural program is utilized to improve household participation. Achieving the District's goals will depend in part on increased household participation in existing utility programs. This is because most efficiency savings come from many types of home improvements that are incentivized and supported by utility-run programs. Therefore, the challenge for the District is how to increase uptake in these programs to maximize energy savings.

Like most jurisdictions, broader energy efficiency policy and regulation in British Columbia are determined at the provincial level and then implemented at the local level. The standard energy efficiency programs that municipalities across the province are implementing are mostly in partnership with utility companies, who administer these incentive-based programs.

For example, BC Hydro and FortisBC jointly administer the Home Renovation Rebate Program (HRRP), which offers rebates up to $6,750 per household. The Province also supports homeowners through its BC Home Energy Coach Program that enables residents to save energy, choose contractors and learn more about available incentives and efficient products,

and it offers rebates through its Oil to Heat Pump Program.[1] Despite these incentives to address high capital costs, participation rates among households is typically limited. The impact of the $35 million, province-wide LiveSmart Program launched in 2008 was limited. Over three years, 33,431 homes—4% of the Province's detached housing stock—participated. The average incentive was $1,000, although incentives of up to $7,000 were available.

Participation in utility programs in West Vancouver has also been low. Only 70 local households applied to the HRRP through BC Hydro since 2014, and FortisBC reports only 15 participants in 2017. Although 181 residents participated in other individual upgrade programs like fireplace, water heater and furnace, this figure represents only one percent of the District's total households.

To provide an answer to this problem, this analysis aims to accomplish the following objectives:

- Examine the District's housing, energy and socio-economic characteristics
- Identify barriers to participation in energy efficiency
- Review the dimensions of an effective program
- Review the types of behavioural programs
- Examine program alternatives
- Examine behavioural program as an approach
- Recommend a program and propose implementation strategies

It would be a new undertaking for the District to design and implement its own community energy efficiency residential retrofit program. The District's adopted energy and emissions framework and other local governments' efforts in the Metro Vancouver region serve as templates to improve participation. Ultimately, the findings of this analysis will be valuable tool that can guide and inform the District's pathway of action as its policymakers assess strategies that will forward its progress towards meeting its climate and sustainability targets.

[1] Both of these programs are administered by City Green Solutions, a BC non-profit that offers home and building energy efficiency services.

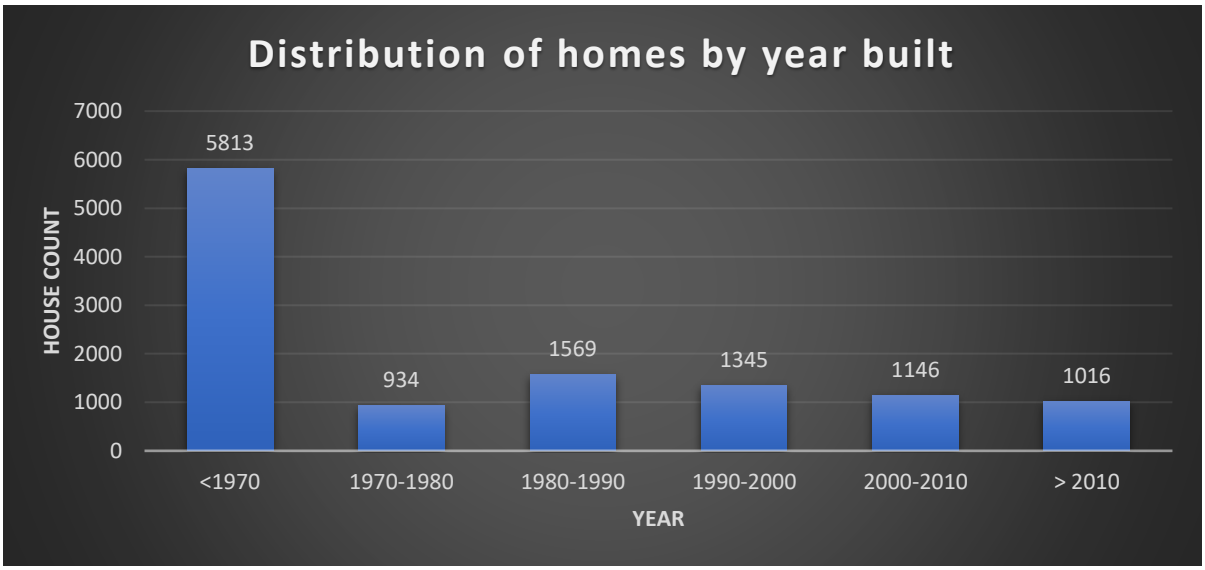
Section 2—Housing, energy and socio-economic characteristics

This section provides context of West Vancouver's housing, energy profile and socio-economic characteristics. It identifies relevant factors, identifies opportunities, and considers barriers to advancing energy efficiency within the District.

Home size and year built

There are about 16,935 private dwellings in West Vancouver, and 55 percent or 9,355 of those are single-detached homes.[2] In terms of the year houses were built, almost half were built before 1970 or prior to the enactment of British Columbia's first building code (see Graph 1). This suggests that with the latest building codes and standards, there is a large opportunity to lower energy consumption through improving efficiency because older homes require deeper upgrades and improvements.

Graph 1. Ages of homes in West Vancouver

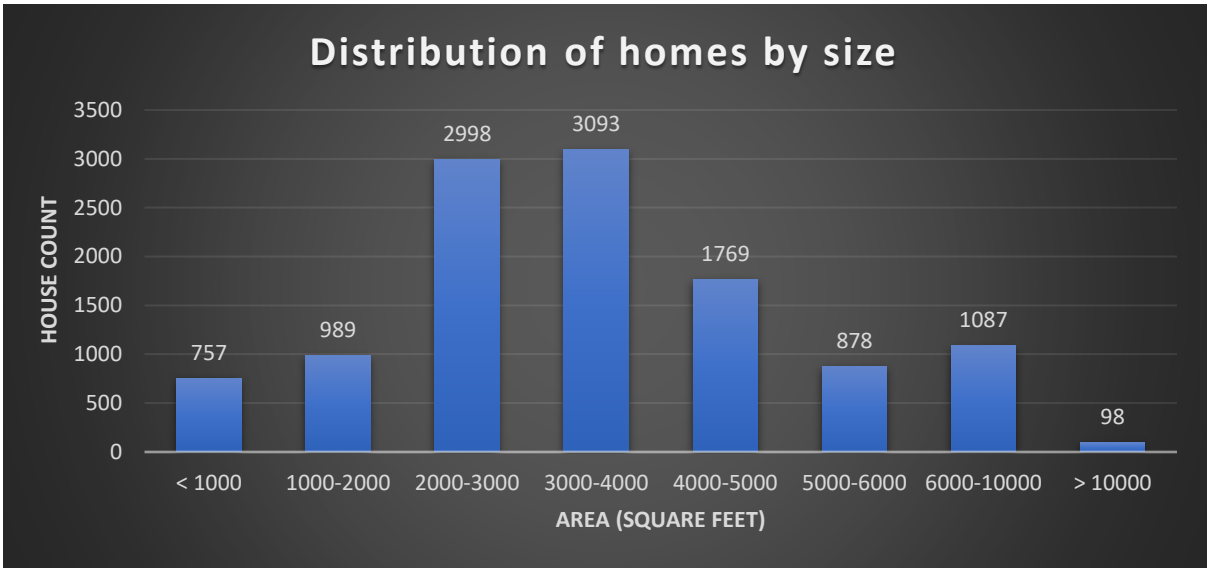


In addition, based on the housing data collected by the District, single-family homes are larger on average than most homes across British Columbia. The average size of homes over 1,000 square feet is 3,869 square feet, while the average home size in the province is 2,077 square feet.[3] 52 percent of the total houses have areas between 2,000 to 4,000 square feet and, of these, 32 percent are over 4,000 square feet in size (see Graph 2).[4] Larger homes often have a higher energy demand due to the fact that they have larger area to heat, cool and light. A Pew Research Center study found that the average home size in the U.S. in 2012 was 28 percent

[2] Statistics Canada, 2016 Census Profile.
[3] Point2Homes.com (2017). www.point2homes.com/news/canada-real-estate/how-large-are-canadian-homes.html
[4] District of West Vancouver data.

bigger than homes in 1970.[5] At the same time, the overall energy intensity in the U.S. has changed very insignificantly over the past three decades, suggesting that bigger homes correlate to higher energy consumption. Moreover, household size has decreased as home size continued to increase (Stephan and Crawford, 2015). This opposite movement resulted to higher energy per capita.

Graph 2. Sizes of homes in West Vancouver

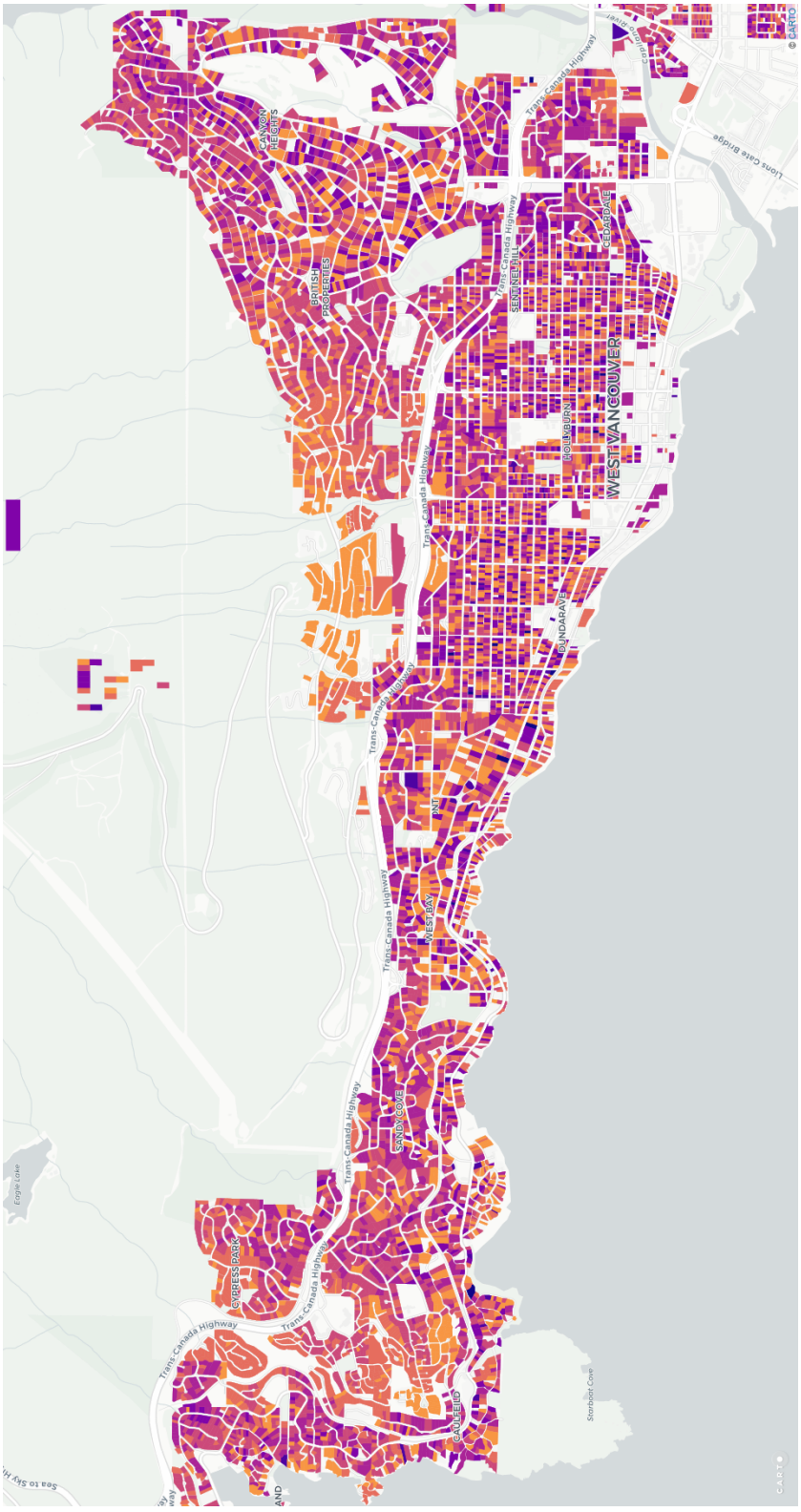


Energy profile

The Collaborative for Advanced Landscape Planning (CALP)[6] estimated in 2017 the relative EUI at the parcel level across all communities within the Metro Vancouver region (see Map 1). One metric that measures home energy consumption is energy use intensity (EUI), which expresses a home's energy use in relation to its floor area. Map 1 below shows West Vancouver's household energy use, where light to dark purple shades signify higher EUI. The data suggest that energy use in many parts of West Vancouver is significantly high, as shown by areas shaded purple. This suggests that the existing high level of energy consumption presents opportunities for a District energy efficiency program to make an impact on GHG emissions and overall sustainability targets.

[5] Pew Research Center (2015). As American homes get bigger, energy efficiency gains are wiped out.
[6] CALP is an interdisciplinary research team at UBC focused on sustainability and climate change

Map 1. Energy usage intensity in West Vancouver



Income distribution

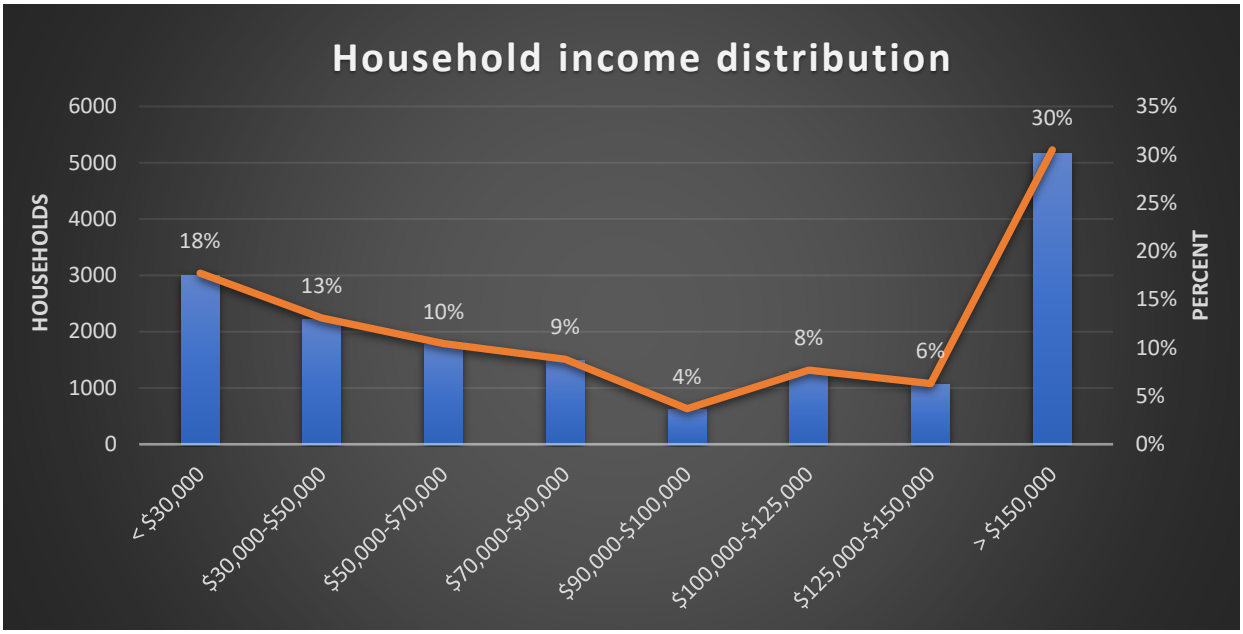
Studies find that household income is one of the key determinants of energy efficiency adoption. One study found that higher income home owners are more likely to invest than renting lower income households (Ameli and Brandt, 2015). Another study found that income can influence energy intensity by influencing relative energy efficiency; those who can afford more efficient technologies can see a reduction in their overall energy use (Metcalf, 2008).

Map 2 below shows that, with the exemption of few neighbourhoods, households in West Vancouver are on average earn high incomes relative to the rest of the Greater Vancouver region. Graph 3 below illustrates the distribution of income in the District with 36 percent of household incomes above $125,000 and about 31 percent of household incomes falling the middle-income range.[7] This implies that if energy efficiency and income do in fact have a direct relationship, then the high household incomes in West Vancouver could improve outcomes of a program.

Map 2. Income heat map for West Vancouver

[7] Statistics Canada, 2016 Census Profile.

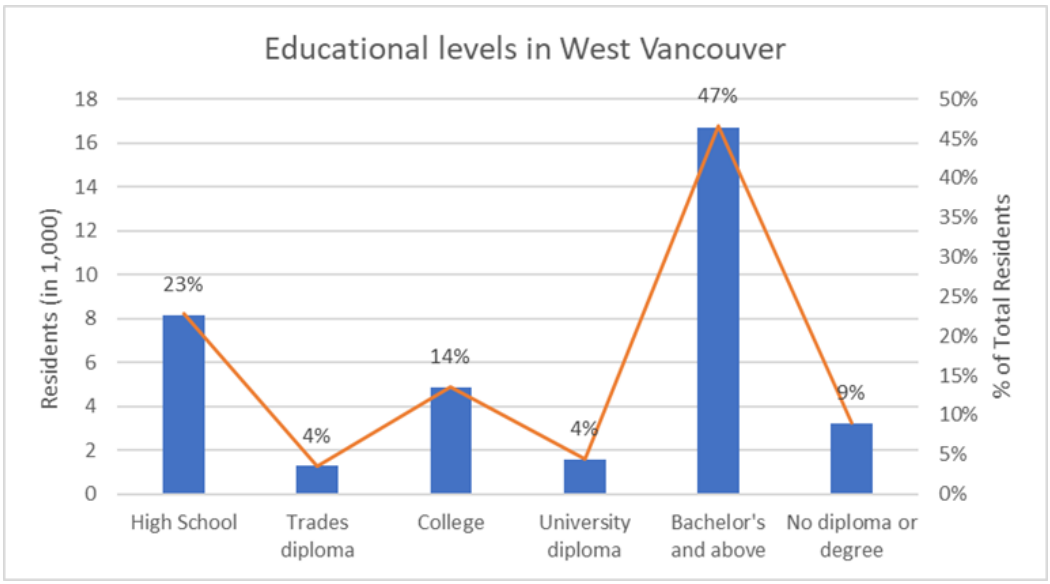
Graph 3. Distribution of income in West Vancouver



Education level, age and family status

Generally, several studies found that individuals who are educated and those with children are more likely to participate in energy efficiency (Mahaptra and Gustavsson, 2008; Mills and Schleich, 2009, Mills and Schleich 2012, Michelsen and Madlener 2012, Sardianou and Genoudi 2013). West Vancouver's residents tend to have higher levels of education compared to the rest of the Metro Vancouver region with about 47 percent holding bachelor's degree or higher (see Graph 4).

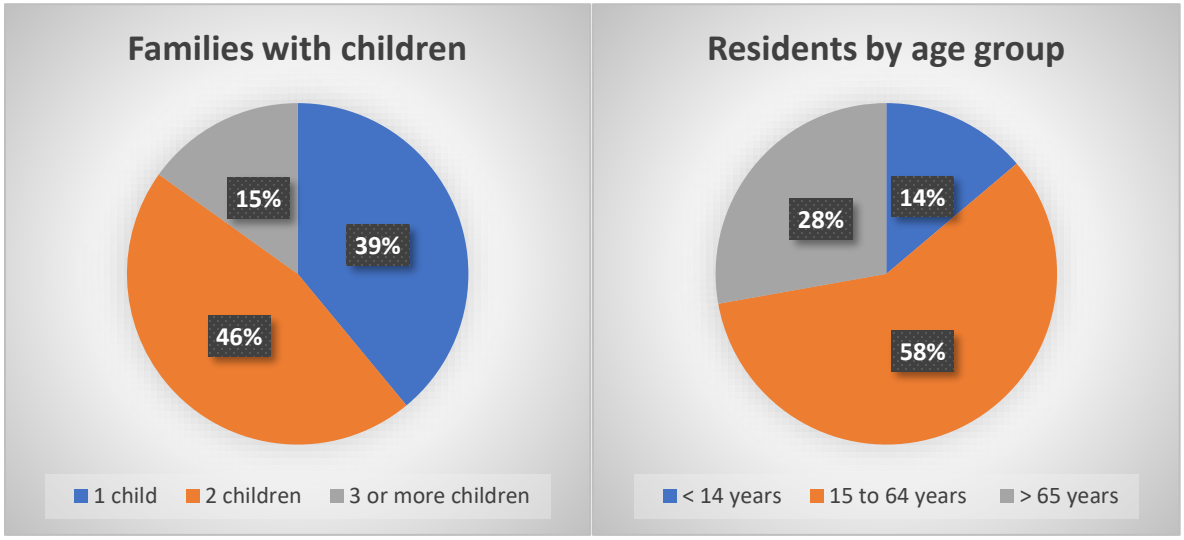
Graph 4. Educational characteristics of residents



There are 10,650 families in private households in West Vancouver, and about 52 percent of them have at least one child or more.[8] Graph 5 shows that among married couples with children, 46 percent have two children and 39 percent have one child.

Although there is a strong evidence of the impact of the key characteristics mentioned above, the impact of age on household participation is less clear. Some studies find that the likelihood of participation to energy efficient or renewable measures declines with age (Mills and Schleich, 2012; Michelsen and Madlener, 2012). Other studies suggest that middle-aged people are more likely to adopt such measures than younger ones (Mills and Schleich,2010; Sardianou and Genoudi, 2013).

Graph 5. Family and age distribution in West Vancouver.



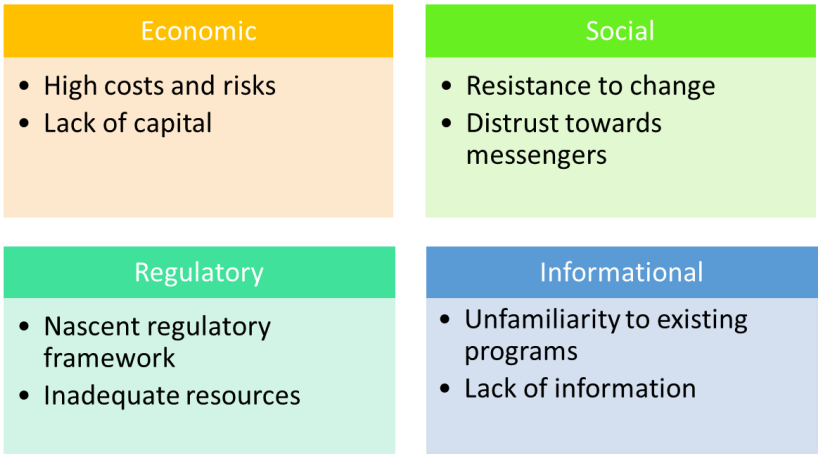
A study that segmented California's market found that people 35 to 64 years old and those over 55 years old have high inclination for efficiency practices (Opinion Dynamics, 2009). In addition, those over 55 years old have higher concern for convenience and comfort. These findings suggest that it could be beneficial to target these groups within West Vancouver since they comprise a considerable proportion of the population and, by extension, the existing community energy use (see Graph 5).

[8] Statistics Canada, 2016 Census Profile.

Section 3—Key barriers to participation in energy efficiency

Identifying and understanding the barriers to increasing the adoption of energy efficiency measures is important to a program's success. When a program addresses these barriers as well as solutions to overcome them, it becomes easier for residential customers to commit to and implement energy-saving improvements. In this section, key barriers are identified and examined. Based on the literature reviewed, this analysis grouped barriers into four categories: economic; social; regulatory; and informational. The discussion in this section focuses only on high costs, resistance to change and unfamiliarity to existing programs because these are the most cited and studied barriers by the studies that this analysis focused on.

Figure 1. Potential barriers to energy efficiency implementation in West Vancouver



High cost

The high cost of energy efficiency upgrades remains a significant barrier to participation. The evaluation of the LiveSmart BC Efficiency Incentive Program revealed that 48 percent of non-participants cited the high cost of conducting an initial energy assessment as a barrier to participation.[9] This is despite the same report finding that saving on home energy costs is the main reason for uptake for 48 percent of participants. Although incentive-based policies seek to lower costs, advanced home improvements are still not cost-effective for many homeowners. Costs increase in a sliding scale depending on the depth of upgrades.

Table 1 summarizes estimated costs of retrofitting a home in British Columbia.[10] Shallow upgrades, which include basic measures like lighting, caulking and smart controls, cost up to $5,000. On the other hand, deep upgrades cost between $100,000 to $150,000. Consumers value immediate savings more than those that come much later and tend to have low confidence in expected paybacks. As a result, they often tend to choose cheaper option that

[9] BC Hydro (2013). Evaluation of the LiveSmart BC Efficiency Incentive Program.
[10] Pembina Institute (2016). Building energy retrofit potential in B.C.

only produces energy savings between 10 to 20 percent over an expensive option that produces much higher savings, but at greater cost per unit of energy savings.

Table 1. Estimates of costs and energy savings for upgrades in British Columbia[11]

Upgrade depth	Measure examples	Energy savings	Payback period	Cost
Shallow	Lighting, smart controls, caulking	10-20%	1-3 years	< $5,000
Moderate	Furnace, heat pumps, roof insulation	30-50%	3-6 years	$5,000-50,000
Deep	Windows, wall insulation, renewables	40-80%	6+ years	$100,000-150,000

Resistance to change

One of the key social barriers mentioned in studies is resistance to change. People stick to the status quo or default settings because of reasons including the cost of the alternatives, convenience of doing nothing, lifestyle, culture and the complexity of new information. They will resist change even if alternatives may yield better outcomes. Consumers are expected to objectively weigh up the costs and benefits of all alternatives before making a decision, but they behave unpredictably by routinely deviating from the 'rational choice' model of human behaviour (Frederiks, Stenner and Hobman, 2014).

There are many biases that contribute to people's resistance to change their energy behaviour. A Lawrence Berkeley National Laboratory (LBNL) report (2010) listed some of the most important consumer biases toward energy efficiency:

1. Consumers are more sensitive to losses than to gains, and therefore, they are more worried about what they may lose than what they may gain from a decision to upgrade their appliances or retrofit their homes.
2. Consumers dislike too much information about energy saving measures as it overwhelms if not confuses them. As a result, they may only selectively implement or completely disregard recommendations.
3. Consumers assume they are doing a better job at energy conservation than others.

Another study (Frederiks, Stenner and Hobman, 2014) examined other behavioural biases such as satisficing[12], temporal and spatial discounting, conforming to social norms, being motivated by rewards and incentives and using trust in decision-making. It identified that:

1. People tend to achieve satisfactory rather than the optimal savings. A satisfactory result is good enough for consumers because it requires less information processing.

[11] Pembina Institute (2016). Building energy retrofit potential in B.C.

[12] Satisficing is a decision-making strategy that aims for a satisfactory or adequate result rather than the optimal solution.

2. People perceive things as less valuable the further away they are in time and space despite their long-term benefits. In terms of discounting the future, they prefer smaller immediate rewards over larger future rewards.
3. People conform to social norms by following others' behaviour when making decisions. A person living in a neighbourhood with no interest in energy efficiency is expected to act similarly.
4. People use trust when assessing risk and comparing costs and benefits. They look at the credibility of information source in terms of expertise, experience, openness and honesty. Once people realize that information source lack these qualities, they react negatively and disengage from any efforts to get them involved in energy measures.

In addition, people sometimes resist change because they do not have an idea of the consequences of their choices or actions. People might not change their behaviour unless they get a clear picture of their consumption patterns and trends. The European Union's environmental agency found that consumers need frames of reference such as feedback measures to help them determine if their consumption is excessive (European Environment Agency, 2013). According to this report, meaningful, clearly communicated and continual feedback from energy suppliers is so far the most effective strategy to change consumers' behaviour when it comes to saving energy.

Finally, people resist change if they are rushed to adopt major improvements or not given opportunity to choose easier and simpler measures. The Sustainable Energy Authority of Ireland (SEAI) found that small steps matter when households are making their decision regarding energy efficiency (SEAI, 2016). Sometimes consumers prefer to make small improvements first before deciding on a bigger upgrade. In addition, targeting households at their trigger points such as retirement, purchase of a new house or an already planned home improvement will increase the possibility of convincing them to consider energy efficiency.

Low public awareness

Increasing participation is a function of rising public awareness about energy efficiency and available programs. When participation is low, it is either because people are not interested, or that they do not know anything about the program. The low public awareness barrier can be classified into lack of education, inexperienced and fallacious information. In fact, one of the major market barriers identified by the evaluation of the BC LiveSmart Program is the lack of awareness of energy efficiency opportunities. About 50 percent of households in British Columbia knew about the program and its mandate, which means the other half of households did not hear or know little about the program.

Increasing the awareness of homeowners is important to stimulating interest in any energy-saving measures. A six-year SEAI study conductedfound that understanding consumer awareness about energy efficiency will enable more targeted policies and programs (SEAI, 2016). Specifically, stimulating household interest requires an increased level of awareness

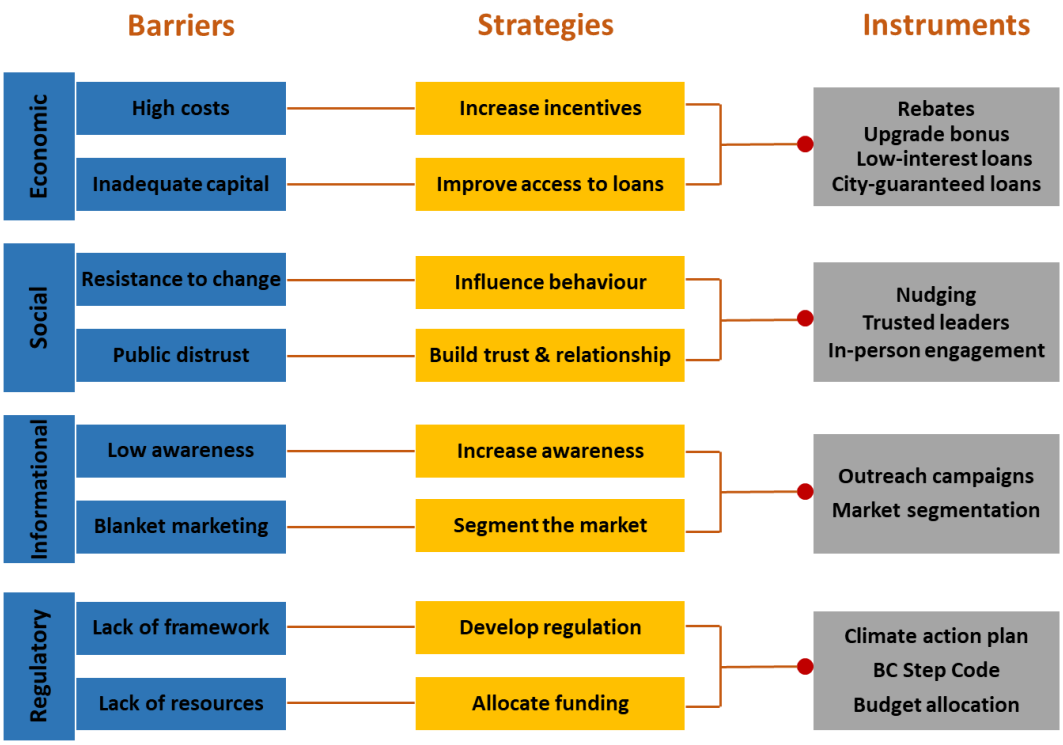
among homeowners about initiatives and the benefits of home retrofits. Households are also more willing to engage when information comes from a trusted source understood to be acting in their best interest and providing impartial advice. Trust serves as a decision-making tool, which might have greater behavioural influence if information comes from high-credibility sources (Frederiks, Stenner and Hobman, 2014).

Addressing the barriers

Each of the potential barriers has a corresponding solution and a recommended instrument to achieve the solution. One of the goals of well-designed energy efficiency programs is to lower, if not eliminate, the barriers that prevent residential customers from participating in energy-saving programs. Because barriers and solutions vary from program to program, it is important to identify the barriers within a specific market or jurisdiction that the program aims to target.

Diagram 1 summarizes the identified barriers to participation and strategies to address them based from the various literature examined in this analysis. The analysis then recommended specific instruments to adopt to eliminate these barriers. Under economic barriers, increasing incentives through more rebates and improving access to loans through low-interest loans can lower costs and increase capital. For social barriers, influencing behaviour by nudging and building public trust using community leaders can lead to acceptance of change. Finally, increasing public awareness and using market segmentation can address informational barriers to raise awareness and target specific segments of the population.

Diagram 1. Barriers to energy efficiency participation and potential solutions



Section 4—Dimensions of an effective program

The effectiveness a municipal led program reflects whether it has successfully addressed the barriers to participation. Ultimately, a program should result in lowered costs, improved acceptance to change and better public awareness. The following suite of elements are critical to a proposed program for it to have significant impact to reduce barriers: positive behavioural change; robust marketing; and right incentives.

1. Positive behavioural change

An effective program should be able to influence positively consumer behaviour toward more energy efficiency. One of the ways to get people thinking about energy efficiency and actually influence them take to action is by nudging them. Nudge Theory[13] recognizes that people do not always make rational decisions. Some policies take the form of nudges, which are "liberty-preserving approaches that steer people in particular directions," but also allow them freedom of choice (Sunstein, 2014).

Nudges prod people to make decisions that are in their broad self-interest with small interventions. Instead of penalizing people if they do not behave in certain ways, nudging is about making it easier for them to make decisions. One field experiment has demonstrated that an average program based on nudges can reduce household consumption of electricity by 2 percent (Allcott, 2011).

The whole concept of nudging is not new to the field of energy efficiency. Many energy savings programs are increasing participation rate among residential customers by incorporating some small steps or incentives to make it easier for them to implement measures that can lead to lower energy use. One example of influencing customer behaviour through nudging is automatic enrolment of residential customers in energy efficiency measures. Customers can always opt out of these measures. By moving towards an opt-out policy, utilities can counter customer bias to stick with the status quo, which is do nothing. One recent Canadian example is EfficiencyOne, which delivers energy savings programs within Nova Scotia.[14]

Another widely used nudge is providing performance feedback. Households make unconscious decisions about energy use and often ignore the fact that they may be wasting or consuming too much energy. To give households a point of reference, most electric utilities now give feedbacks regarding their consumption levels by showing them their daily, weekly or monthly usage through their online account interfaces. Sometimes, customers get notifications when they are near or over certain usage thresholds.

[13] Richard Thaler and Cass Sunstein's book *Nudge: Improving Decisions About Health, Wealth, and Happiness*, brought nudge theory to prominence. Thaler won the Nobel Prize in Economics in 2017 for his contribution to behavioural economics.

[14] In 2017, almost $19 million was spent for incentives to achieve residential energy savings of 54 GWh.

Finally, streamlining information and the process is also a way of nudging. Households are turned off by the complexity of information about energy efficiency. Aware of this issue, programs are now simplifying choices and procedures to reduce the hassle for the homeowners and encourage them to participate. For example, to minimize the amount of information and choices for customers, Xcel Energy's One Stop Program in Minneapolis and St. Paul trimmed its suggestions for energy efficiency improvement to just three recommendations. To help households, Long Island Green Homes provides a list of reliable contractors to do the energy assessment. Similarly, the "Together We Save" pilot in Milwaukee provides an energy advocate to guide the participant through the program.

2. Robust marketing

Each market is different in terms of demographics, geography and tastes. Moreover, some barriers are stronger in some markets, but weaker in others. A comprehensive understanding of the market and the potential challenges to increasing the demand for energy efficiency are key to successful program design and implementation (de la Rue du Can et al., 2014). One way to achieve this is by segmenting the market.

Segmentation in energy efficiency, however, has been limited to sector-specific groupings—residential, small business, large commercial and industrial—and no significant work has been done to segment within these major groups (Du Bois, 2014). There is an increasing need for market segmentation to go beyond the typical rate class approach that utilities implement to using consumer-specific attributes such as age, income, education or even ethnicity.

The SEAI provides a creative alternative to group households as illustrated by Diagram 2. By segmenting households into aspirational, comfort and value seekers and cost-driven, the agency was able to identify targeted actions that could lead to more uptake in retrofit programs (SEAI, 2016).

Diagram 2. Alternative consumer segments in the residential sector[15]

Identifying the target audience means dividing the market into sub-groups to better understand each group's needs, challenges and experiences. Carefully identifying the audience allows the

[15] SEAI (2016). Behavioural insights on energy efficiency in the residential sector.

efficient delivery of tailored messages relevant to each audience. It is easier to identify the strategies that will entice people to engage and influence positive decisions after the identification of the audience that a program is seeking to reach (LBNL, 2010).

For example, after senior citizens have been identified as the target audience, then it is easier to find ways to engage them. Solutions could focus on providing more financial incentives or more information because they are more often to have fixed incomes and limited technological familiarity to navigate available energy efficiency resources.

Targeting groups can address resource allocation challenges, and therefore, it is a more cost-effective way to begin market penetration than targeting the entire population (LBNL, 2010). Moreover, market segmentation can improve results and enhance the performance of programs (Conzemius Van de Grift et al., 2014).

A study that looked at how program design affects participation and outcomes, concluded that it is important to avoid "one size fits all' programs and consider designing for particular subsets of the population (Hoicka, Parker and Andrey, 2014). In fact, a targeted approach can reduce energy consumption per customer more than blanket approaches, which on average is at least 4 to 7 percent among a smaller group (Sussman and Chikumbo, 2016).

An example is the custom segmentation conducted by Colorado Electric, a utility southeastern Colorado, to market its direct installation program of lighting and refrigeration measures (ACEEE, 2014). The first phase of its strategy involved geographic segmentation, focusing on two areas in Colorado Electric's service territory that are mainly made up of older buildings. The second phase involved demographic segmentation in response to the local Latino population that comprises 50 percent of the city of Pueblo. The marketing campaign was developed in a way that ensured that the program sponsored events hosted by the Latino Chamber and that email, social media and advertising were aimed at the Latino community. These segmentations led to project completion for 7 percent of Latino Chamber members. Moreover, energy savings goals were exceeded (151 percent of kWh goal), and the program remained 15 percent under budget.

District of Columbia's WeatherizeDC program targeted homes using two main demographic data: house's year of construction and household income. This targeting resulted in an 8 percent conversion rate between those who signed up for an energy assessment and those who followed through with their commitment (LBNL, 2010).

One study in Oregon found that the most attractive targets were identified as those who are high energy users, have attitudinal readiness and have financial capacity (Peters et al., 2009). Another study found that older individuals, those with higher incomes and those with no children are likely to be the most receptive audiences for home energy measures (Action Research, 2010).

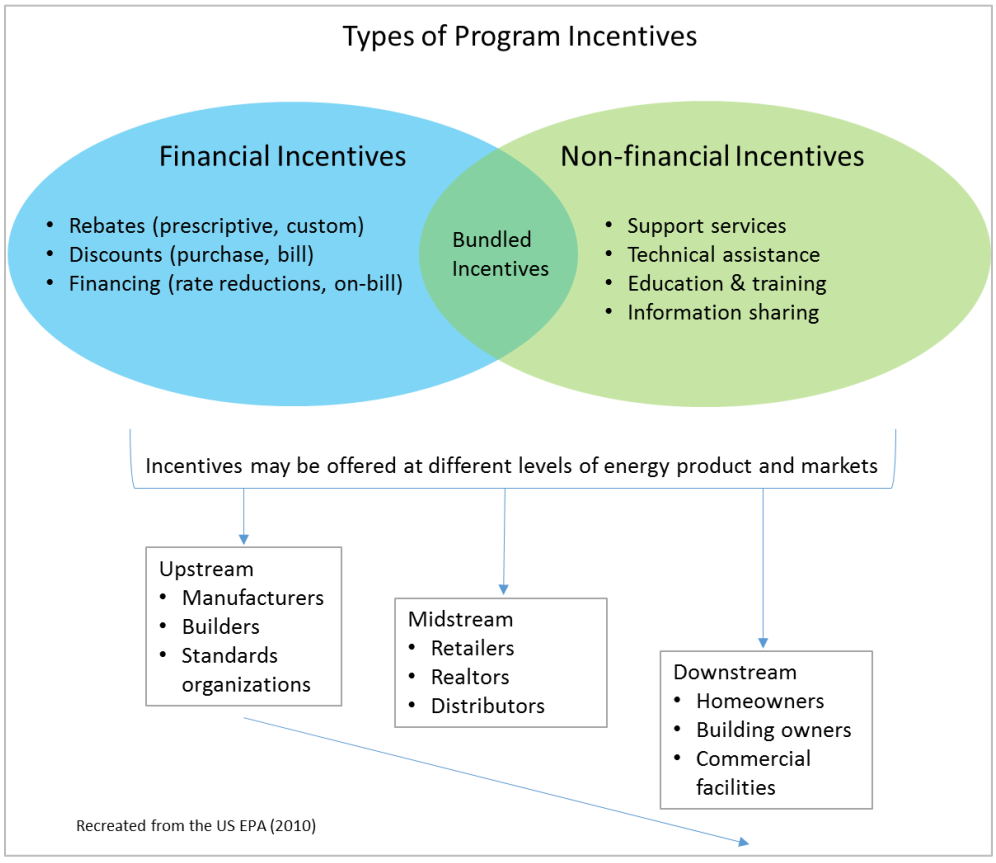
3. Right incentives

High up-front cost of efficient products is one of the key barriers that prevent people from investing in them (de la Rue du Can et al., 2014). Providing incentives is a major component of many programs to accelerate the penetration of energy-efficient products and motivate customers to take actions to improve their energy efficiency. To achieve this, the design of an incentive-based program should clearly identify the following elements: incentive's efficiency level target, amount, recipient, form and eligibility requirements (de la Rue du Can et al., 2014).

Environmental Protection Agency (2010) classified incentives into three types—financial, non-financial and bundled—over three levels of market intervention: downstream (consumers), midstream (retailers) and upstream (manufacturers). Diagram 3 illustrates such classification.

Direct financial incentives are payments or subsidies to individual customers in the form of rebates (after a purchase of an energy efficient product), discounts (upfront rebates at the point of purchase) and financing through loans (EPA, 2010). Non-financial incentives are other benefits such as free technical and information services. Bundled incentives are combination of both financial and non-financial benefits.

Diagram 3. Types of incentives by market



An example of direct financial incentive is city of Vancouver's Home Renovation Rebate Program, which offers up to $4,750 for eight upgrades and a bonus of $750 for installation of three upgrades.[16] BC Hydro's appliance rebate is up to $100 plus an additional $50 provided by participating cities and municipalities.[17] Southern California Edison offers a sign-up bonus of $75 to customers who enroll in its Smart Energy Program and up to $40 in bill credits in exchange for reduction in energy use during the summer months.

Some incentives are non-monetary in the form of free technical and information services like replacement, installation, energy audit and advice. Perhaps one of the most comprehensive set of non-financial incentives is Alberta's Residential No-Charge Energy Savings Program[18], which as its name implies, provides some energy-efficient products and services free of charge. This program offers free LED lightbulbs, high-efficiency shower heads, faucet aerators, smart power bars and thermostats. Some programs like the Energy Conservation Assistance Program provided by BC Hydro and Fortis offers free home energy assessment, energy-saving products and energy advice and tips to low-income customers.

Section 5—Behavioural programs

Behavioural programs are innovations that deliberately apply models and approaches drawn from the social and behavioural sciences to affect energy use (California Public Utilities Commission, 2014). They exclude those programs that are based on incentives, rebates or regulations, and emphasize systematic evaluation (Sussman and Chikumbo, 2016).

Behavioural programs can be classified into three main groups: cognition, calculus and social interactions (Minnesota Department of Commerce, 2015). Figure 3 illustrates the distinct types of programs under each category.

Types of behavioural programs

Cognition programs appeal to emotions and change behaviour by delivering information to customers (Minnesota Department of Commerce, 2015). Education and training programs that focus on raising awareness are the best example of this category.

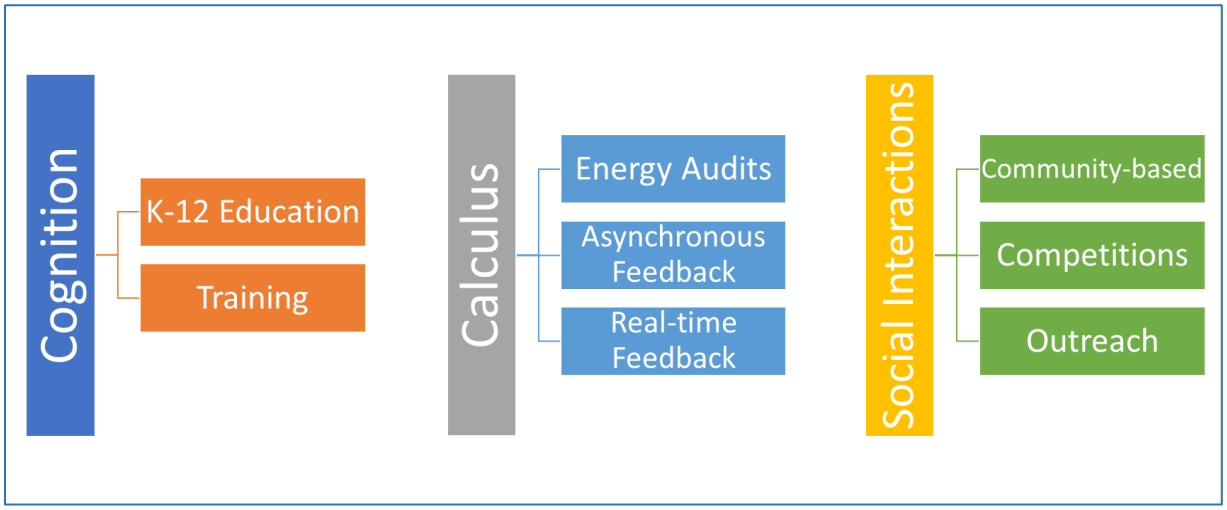
Calculus programs, on the other hand, provides highly customized and targeted information focused on direct behavioral feedback that leads to savings. Examples of programs under this

[16] In partnership with BC Hydro and Fortis.
[17] Bonus rebate is offered by these jurisdictions: Abbotsford, Coquitlam, Nanaimo, New Westminster, City of North Vancouver, District of North Vancouver, Richmond, Vancouver, West Vancouver and Langley.
[18] This is part of a five-year program worth $645 million funded by the Alberta's carbon tax. The total incentives handed out is currently about $45 million (Global News, 2018).

category include diagnostic measures like energy assessment and feedback measures like home energy reports.

Finally, social interaction programs share information through interactions online or in-person. These programs are designed based on the concepts of "sociability and belonged experience" (Mazur-Stommen & Farley, 2010). These are key qualities present in community-based programs like grassroots campaigns and competition programs like energy challenges and games.

Figure 3. Types of behavioural programs



A behavioural program employs the following intervention strategies to influence behaviour:

- Commitment – asking individuals to make pledges to implement certain measures.
- Feedback – giving individuals information about their energy performance.
- Follow-through – following up with individuals who made commitments.
- Nudge – prodding individuals to make energy-efficient decisions.
- Education – improving awareness and understanding of energy efficiency.
- In-person interaction – engaging individuals in a face-to-face setting.
- Rewards – offering incentives in exchange of adopting measures.
- Social norms – informing individuals about what others are doing.

Some programs use only one of these strategies while some combine two or more depending on the type of behaviour to be changed and the target audience.

Social interaction programs

Among the three types of behavioural programs, social interaction is an area where local governments can make the most impact in changing energy consumption behaviour. The strategies under social interaction programs do not require energy consumption data and other private information to implement, which often restrict local governments when designing a behavioural program. Calculus programs, on the other hand, are more appropriate for utilities because they require consumption data to provide feedback to households, and the utilities are collecting and have access to those data. Cognition programs such as trainings are more appropriate for organizations like businesses and companies that aim to target their members or employees.

Studies have found that live interactions between two or more people create social influence that can effectively encourage energy reduction behaviors (Gonzales et al., 2013; Mazur-Stommen and Farley, 2013). In-person interactions create liking, rapport, and the sense of connection, which makes direct verbal communication a more persuasive form of interaction than others (Wilson and Sherrell, 1993). Behavioural program designers are now incorporating these findings to increase interest and participation in energy efficiency.

Providing social marketing, increasing awareness and creating interest, social interaction programs target not only neighbourhoods, but also communities like churches, schools and immigrants and groups like employees, business owners and homeowner associations. Each program is structured differently based on the type of community and group.

Community-based

Two of the most widely employed interactions are community-based and competition programs. Community-based programs assume that people are more likely to trust information that they receive through in-person interactions from trusted community members and others who are similar to themselves (Minnesota Department of Commerce, 2015). Moreover, these programs are most effective if their structure includes the following dimensions: face-to-face interactions, door-to-door campaigns, outreach from trusted community leaders and competitions.

Cool North Shore: a community-based program

Cool North Shore (CNS) is an organization focused on climate change and sustainability in the North Shore region that implements a community-based energy efficiency program. CNS has three key features: it is grassroots, it employs behavioural approach and it collaborates with local governments.

Started by neighbours in West Vancouver concerned about climate change, its Cool Neighbourhoods program continues a true grassroots effort today aiming to help residents reduce energy consumption through marketing existing energy-saving measures. Believing that change can start from the bottom up, the community members behind Cool Neighbourhoods

organized a community-focused program that is not only neighbor-to-neighbour, but also easy, fun, collaborative and inclusive.

In order to encourage uptake of BC Hydro and Fortis programs, Cool Neighbourhoods engages residents about energy efficiency over social gatherings such as picnics and dinners hosted by neighbours. In addition, it uses behavioral strategies such as door-to-door outreach, local event attendance, goal setting and feedback.

The program offers a weatherization campaign for a group of four to six neighbours, which includes a one-hour thermal imaging session for each home. Households are also provided with advice on improving energy conservation and information on available incentives and rebates. As part of the easy and fun aspect of the program, homeowners host get-togethers to learn about home energy efficiency from experts, neighbourhood leaders and each other through sharing experiences, challenges and success stories.

In addition to Cool Neighbourhoods, CNS also hosts a monthly speaker and networking event called Cool Drinks. This initiative serves as an outreach to promote Cool Neighbourhoods and as a networking opportunity for residents to connect with their community.

Focusing on the theme of acting together within the community, Cool Neighbourhoods also partners with local governments within North Shore and utilities to expand its services and reach through more funding and resources. As a non-profit grassroots group, CNS pursues partnerships for financial support to sustain its mission.

Competitions

Energy efficiency competitions, on the other hand, are relatively new within the portfolio of programs, but they can effectively change behaviour because the entire process of earning rewards is fun (Grossberg et al., 2015). They include games and challenges and use incentives and rewards as motivators to compete against each other. In addition to being fun, competitions track results of energy savings and provide public acknowledgement to participants for their progress and commitment. Moreover, most participants will likely change their behaviour because they all receive recognition and rewards (Sussman and Chikumbo, 2016).

Examples of notable competition programs

Building Energy Challenge (Richmond, British Columbia)

Objective of competition: To assist its communities identify energy-saving opportunities.

Target community or group: Businesses and multi-family building residents.

Contest mechanism: Participants benchmarked their usage and earned points based on saved energy.

Rewards or incentives: Free energy training and advice and recognition of their participation and leadership.

Cool California Challenge (Cities across California)

Objective of competition: To reduce GHG emissions from household energy and transportation

Target community or group: Residential neighbourhoods

Contest mechanism: Participants earned points based on their self-reported energy usage as well as shared photos and stories on program website

Rewards or incentives: City with the highest reduction is awarded “Coolest California City”

Biggest Energy Saver (San Diego, California)

Objective of competition: To reduce household energy consumption

Target community or group: Households within communities and middle schools

Contest mechanism: Participants opted in to an online software and joined a middle school team and earned points based on their self-reported energy usage

Rewards or incentives: Win prizes for participating households and their partner schools

Chicago Neighborhood Energy Challenge (Chicago, Illinois)

Objective of competition: To reduce energy consumption in buildings and households

Target community or group: Households within multi-family and senior living buildings

Contest mechanism: Participants attended 36 workshops cutting down on energy usage through simple behaviour modifications and tracked their reduction levels

Rewards or incentives: $100 monthly for buildings and gift certificates for individual households; at the end of the competition, a total cash prize of $36,000 were given to top 3 buildings and total cash prize of $750 for top households

Are behavioural programs effective?

The impact of behavioural programs on energy savings are typically evaluated using rigorous experimental or quasi-experimental designs on an ex-post basis. The difficulty of the methodology discourages the evaluation of behavioural programs, resulting to limited findings on their impacts. Current evaluations of existing programs, however, provide evidence that interventions that target behavioural change lead to positive effects. Specifically, community-based energy programs have shown success for overcoming various barriers and increasing participation in the adoption of energy technologies (Reames, 2016).

Impact of behavioural programs in the United States

The Minnesota Department of Commerce (2015) conducted one of the most comprehensive reviews to date, which surveyed 170 studies on energy savings and examined 58 program evaluations on conservation impacts.

It found that the energy savings from residential programs ranged from 0-6.5 percent, with community-based, real-time feedback and competition programs providing the highest average reductions in energy use. Table 2 summarizes the effects by program categories.

Table 2. Evaluated impacts of behavioural programs on energy savings

Calculus			Social Interactions		Cognition		
Diagnostics	Asynchronous Feedback	Real-time Feedback	Community-based	Competitions	K-12 Schools	Training	Bench-marking
0% - 6.5%	0% - 3.3%	0% - 6%	12% - 30%	0.1% - 14%	NA	NA	NA

The same study also examined impacts on energy savings of specific types of behavioural programs. The impact of selected community-based programs ranged from 12 to 30 percent, while impact of selected competition programs varied from 5 to 14 percent. Tables 3 and 4 list the respective programs and their evaluated energy savings.

Table 3. Energy savings associated with selected community-based programs in the US

Program	Energy Savings	Participants
Energize Phoenix	12%	2,014
Michigan Saves	14%	7,689
Seattle Community Power Works	30%	3,070
RePower Bainbridge Island Energy Upgrades	30%	977

Table 4. Energy savings associated with selected competition programs in the US

Program	Energy Savings	Participants
Cool California Challenge	14%	2,700
Energy Smackdown	14%	100
Kansas Take Charge Challenge	5%	100,000
SDG&E Energy Challenge	6%	5,634
Chicago Neighborhood Energy Challenge	5%	600

Impact of behavioural programs in Europe

The positive effects of behavioural-based programs are not limited in the United States. A report found that between 5 to 20 percent of energy savings can be achieved through

measures within European Union countries targeting consumer behaviour.[19] Table 5 summarizes the findings.

Table 5. Energy savings associated with behavioural programs in the EU

Intervention	Range of energy savings
Feedback	5–15 %
Direct feedback (including smart meters)	5–15 %
Indirect feedback (e.g. enhanced billing)	2–10 %
Feedback and target setting	5–15 %
Energy audits	5–20 %
Community-based initiatives	5–20 %
Combination interventions (of more than one)	5–20 %

Specifically, an evaluation of EcoTeams, a community-based program in the Netherlands, showed a reduction in electricity consumption of almost 5 percent due to behavioural changes (see Table 6). A follow-up study after two years revealed that reduction of usage further increased to almost 8 percent.

Table 6. Energy savings associated with community-based programs in the EU

EcoTeams	Consumption after ETP programme (compared to control group)	Two-year follow up (compared to control group)
Gas use	– 20.5 %	– 16.9 %
Electricity use	– 4.6 %	– 7.6 %
Water use	– 2.8 %	– 6.7 %
Waste	– 28.5 %	– 32.1 %

Impact of awareness campaign programs in British Columbia

An analysis of home energy efficiency campaigns of 11 jurisdictions across British Columbia looked at the impact of awareness campaigns on participation in existing home retrofit incentive programs in the province. Table 7 shows the conversion rate of homes that participated in an energy assessment (D evaluation) and the homes that actually implemented recommendations from those assessments (E evaluation). The data shows that, except the high conversion rate of 70 percent in one campaign, conversion rate in the rest of the other campaigns ranges from 10 to 31 percent.

[19] European Environment Agency (2013). Achieving energy efficiency through behaviour change: what does it take?

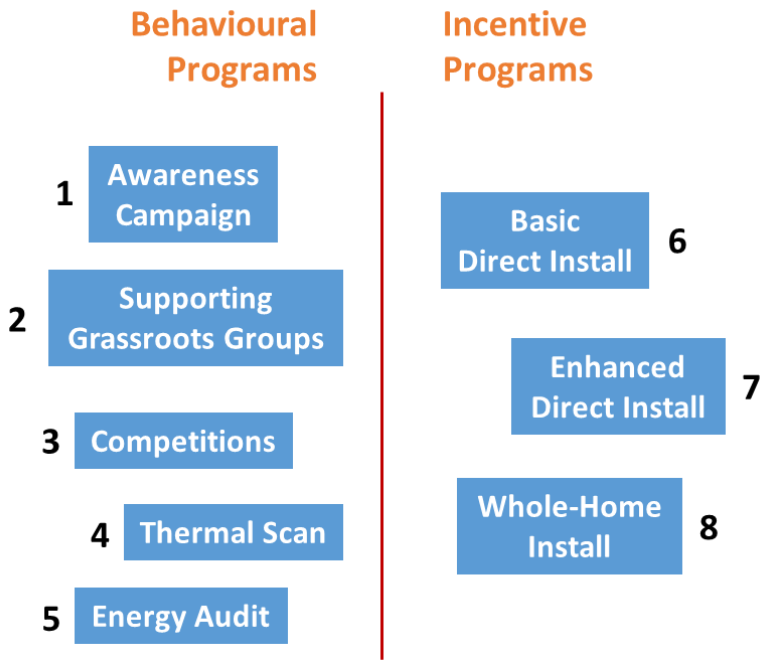
Table 7. Energy savings associated with selected competition programs

Program	D Evaluations	E Evaluations	Energy Savings	Total Campaign Cost
Rossland Energy Diet	257	180	70%	$85,000
Nelson EcoSave	350	107	31%	$168,000
Kootenay Energy Diet	862	166	19%	$245,000
Okanagan Energy Diet	1103	191	17%	$162,000
East Kootenay Energy Diet	188	21	11%	$89,000
Energy Save New Westminster	128	13	10%	$84,000
Power Down Campbell River	81	12	15%	$65,000

Section 6—Program alternatives

Considering all alternatives when choosing the right efficiency program is important in assessing costs and benefits. This section lists the different program alternatives that can be adopted by the District and discusses each option in terms of its advantages and disadvantages. The assessment of the overall strength and weakness of each alternative is based on reviewed literature that included academic studies, program evaluations, reports and best practices within the field of energy efficiency.

Figure 2. Energy efficiency program alternatives



1. Awareness campaign

An awareness campaign program both educates residents about different types of energy-efficient measures they can implement to save energy and engages them to change consumption behaviours. Despite the availability of energy efficiency programs, the lack of information among people leads to low participation level. Because awareness programs focus on communication and engagement with people, implementing this option can be vital in influencing hesitant homeowners to adopt measures or even in stirring up interest among undecided individuals.

The main barriers for this option are distrust towards sources of information and tendency to conduct blanket marketing rather than targeted marketing. The strengths and weaknesses of awareness campaign are the following:

Strengths

- Performs average (4 out of 8 objectives)
- Average chances of influencing behavior
- High engagement
- Inexpensive with low program, household and incentive costs

Weaknesses

- Expensive marketing costs
- Moderately difficult implementation process
- Hard to determine impact on energy savings

2. Supporting grassroots groups

Community-based grassroots groups are gaining success in organizing neighbourhood participation in energy efficiency programs. One way to sustain their development is for local governments to support their efforts by providing financial and other resources. Grassroots groups focus on neighbour-to-neighbour outreach and marketing campaigns. Cool North Shore is a grassroots group in the region that could potentially partner to deliver this program option. One strengths of this alternative is the high engagement and participatory level that it brings to the community. One weakness, however, is that it may require significant amount of funding to sustain operation and staffing.

Strengths

- High chances of influencing behavior
- High engagement
- Effective marketing strategies
- Reliable in establishing trust

Weaknesses

- Moderately difficult implementation process
- Average to high program cost
- Difficult to track savings

3. Competitions

Competitions are fairly new strategy that is becoming a favorite in many jurisdictions because of its fun and interactive approach to saving energy. Competitions can either be energy challenges where participants benchmark their consumption to determine the best performer in saving energy or a game where households earn points for every energy efficient measure they adopt or step they accomplish. It is a program option that encourages everyone in the community to participate for a chance to win prizes and rewards. The strengths and weaknesses of competitions are the following:

Strengths

- High engagement level
- High chances of influencing behaviour
- Inclusive and interactive
- Reliable savings
- "Energy efficiency is fun"

Weaknesses

- Significant amount of incentives

4. Thermal scan

Conducting a thermal scan of homes is currently being employed by some jurisdictions to promote energy efficiency. Using thermal cameras, homes are scanned for temperature, heat loss, insulation problems, air leakages and even moisture. One of example of this program is Vancouver's thermal imaging scan of 15,000 homes for heat loss. The City used the resulting data to target 3,000 homes with the highest potential for energy savings. One notable drawback is high cost of conducting thermal scans, which cost the City of Vancouver about $100,000 or $6 per home.

Strengths

- Average impact on behavioural change
- Low household cost
- High engagement
- Low household and incentive costs

Weaknesses

- High program cost
- Low engagement
- Low

5. Energy audit

Energy audit or assessment records the details of a home's installed equipment, building envelope and operating practices, and develop a list of specific recommendations for reducing consumption. These recommendations may include measure-based actions like upgrades and improvements, or changes in behaviour.

Strengths

- Average impact on behavioural change

Weaknesses

- High program and household costs
- Difficult implementation

- High engagement
- Reliable energy savings
- High level of marketing

6. Basic direct install rebate

Direct install programs, as the name suggests, provides installation of inexpensive energy-efficient products with no cost to households. Energy savings under these programs are typically reliable because there is assurance that measures are installed (LBNL, 2017). Direct install programs also offer high level of engagement because they involve "kitchen table" conversation with the home owners and some type of assessment that provides information on more energy efficiency measures.

The greatest barriers for this option are the lack of data that identify household needs, the cost of the products and the lack of interest among households.

One type of this program is basic direct install, which offers installation of free basic products that can lead to energy savings such as LED lightbulbs, smart power strips and smart thermostats. A basic direct install can serve as an on-ramp to engage customers to take more comprehensive improvements that lead to more energy savings (LBNL, 2017). The strengths and weaknesses of basic direct install are the following:

Strengths
- High chances of influencing behavior
- High engagement
- Low household cost
- Reliable measurement of impact

Weaknesses
- High program costs
- Difficult implementation
- Intense marketing

7. Enhanced direct install rebate

Another type of direct install is an enhanced program, which provides upgrades that offer larger and more persistent energy savings than a basic direct install. Examples of measures include air sealing, insulation, heating and cooling system upgrade, window upgrade and heat pump or water heater upgrade and appliance upgrade. Enhanced installation involves a combination or all of the mentioned measures. The strengths and weaknesses of enhanced direct stall are the following:

Strengths
- High chances of influencing behavior
- High engagement
- Reliable measurement of impact

Weaknesses
- High costs
- Difficult implementation
- Intense marketing

8. Whole-home install rebate

Whole-home install is the most comprehensive direct installation option, which maximizes the replacement of old inefficient products and systems, and addresses building durability and occupant health and safety. Measures under this option include all the measures under both the basic and enhanced direct install. The strengths and weaknesses of whole-home install are the following:

Strengths

- High chances of influencing behavior
- High engagement
- Reliable measurement of impact

Weaknesses

- High costs
- Difficult implementation
- Intense marketing

Table 8. Comparison of program alternatives

	ALTERNATIVES							
	Behavioural-based					Incentive-based		
OBJECTIVES	Awareness Campaign	Competi-tion	Grassroots Group	Thermal Scan	Energy Audit	Basic Direct Install	Enhanced Direct Install	Whole-home install
Behaviour change	H	H	H	M	M	H	H	H
Program cost	L	L	M	H	H	H	H	H
Household cost	L	L	L	L	M	L	M	H
Incentives	L	M	M	L	H	H	H	H
Marketing	M	M	M	M	M	H	H	H
Engagement	H	H	H	L	H	H	H	H
Implementation	L	L	M	L	H	H	H	H
Energy savings	M	M	M	M	M	H	H	H

Top-performing program alternatives

The behavioural-based and incentive-based alternatives are compared using a consequence table, which is a summary matrix showing the performance of each alternative under each objective: impact on behavioural change, program cost, household cost, level of incentives, intensity of marketing, level of engagement, ease of implementation and energy savings.

For this analysis, blue indicates good performance and orange indicates poor performance. The consequence table above shows that the first three behavioural-based alternatives (red highlight) perform better under most objectives compared to the other options. Specifically, awareness campaigns, competitions and supporting grassroots provide very high likelihood of influencing behaviour, minimize household and program costs, allow high level of engagement and result to significant energy savings.

Section 7— Why a behavioural program is the right approach?

Based on the examination of financial and non-financial incentives in the preceding sections, this analysis finds that a behavioural program is a more appropriate option than an incentive-based program. There are three reasons why a behavioral program that focuses on social interactions—awareness campaign, supporting grassroots groups and competitions—is the right approach for the District of West Vancouver.

1. Better participation and energy savings

Achieving higher participation rates and energy savings is the ultimate goal of any energy efficiency program. Evaluations of many programs have attributed meaningful improvement in energy savings to behavioural interventions that targeted how households consume energy. For example, a study of home energy reports delivered by the Sacramento Municipal Utility District (SMUD) found average annual electric savings of 2.4 percent among customers who received monthly reports, as opposed to average annual electric savings of 1.4 percent among customers who received quarterly reports (Integral Analytics, 2012).

Further research works indicate that behavioural interventions can result in meaningful energy savings. An analysis of home energy reports mailed to households, which contains personalized energy use feedback, social comparisons and energy conservation information, found that electricity consumption decreased by the equivalent of about three 60-watt light-bulbs used for one hour after receiving the reports (Allcott and Rogers, 2014). Similarly, a meta-analysis of 156 published fields trials of information-based strategies about environmental impact of activities reduced electricity consumption by 7.4 percent (Delmas, Fischlein and Asensio, 2013).

People's knowledge about energy efficiency or the existence of programs, incentives and energy-efficient products does not always translate into actions that increase savings. Human behaviour can always counteract planned efficiency gains intended from such programs and technological innovations. Correcting this requires a solution that targets directly the core of the problem and changes fundamentally how people view and consume energy.

Therefore, focusing on behavioural change within any energy efficiency effort is the right approach. Behaviour-based programs address the irrational attitudes and biased beliefs that lead to energy inefficiency by providing consumers with information and facts to nudge or motivate them to behave accordingly.

2. Cost-effective

Cost is a top concern when energy-saving program alternatives are evaluated for adoption. The goal is to ensure that cost is minimized for both the program and households. The trio of recommended behavioural programs are the top performers in terms of costs and provide the highest cost-saving benefits.

Recent studies across different regions show that residential behavioural programs are cost-effective. Behavioural-based measures have a low cost to achieve savings in the first year due to low start-up costs compared to rebate-based measures like product, building envelope, and whole-house programs (Dougherty and Conzemius Van de Grift, 2016).

One study found the cost of saved energy ranging from $0.01 to $0.08 per kWh (Mazur-Stommen and Farley, 2013).[20] Another study identifed that the cost to save energy during the first year for behavioural-based programs could be significantly less per kilowatt hour than the cost in rebate-based programs (Dougherty and Conzemius Van de Grift, 2016). Specifically, behaviour change programs cost $0.04 per kWh, while a direct install program cost $0.32 per kWh. Table 9 compares the cost of saved energy between behavioural and rebate programs in midwestern and western United States.

Table 9. Cost comparison between behavioural and rebate-based measures

Utility cost of saved energy	$ per kWh	
	Midwest	West
Behavior change/feedback	$0.04	$0.04
Building/home performance	$0.93	$0.74
Direct install	$0.32	$0.29
Education/awareness	$0.20	$0.27
Prescriptive rebate	$0.10	$0.17

ESource DSM Insights, aggregated US program plans from public filings, sourced in May 2014

3. Complementary and supportive

Incentive-based programs and some behavioural-based efforts are already in place and are administered by BC Hydro and FortisBC. With basic and advanced home improvements as well as appliance upgrades, these programs aim to break the barrier of prohibitive costs of adopting energy-saving measures. However, uptake remains low because these programs do not address the behavioural barriers or those that already included a behavioural piece are challenged by the trust deficit between utilities and households. A behavioural-based approach by a local government complements and supports these existing utility programs. This is a major area of opportunity for a behavioural program to change attitudes, increase awareness, deliver

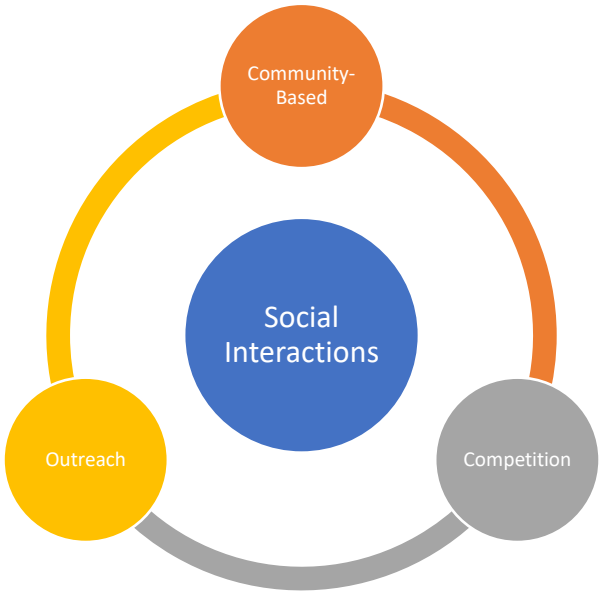
[20] This is a meta-analysis of cost of saved energy for behavior programs that examined numerous programs from 50 entities for cost-effectiveness, and identified ten programs that provided both actual savings and program spending data.

information and engage communities—which are not part of many existing incentive-based programs. It will act as a complementary approach to current energy efficiency programs and as a supportive intervention that targets the attitudinal dimension of low participation.

Section 8 – Recommendation and implementation strategies

Based on the findings from the review of energy efficiency literature and best practices, this analysis recommends an integrated behavioural approach focusing on social interactions that consists of three behavioural-based energy efficiency programs—awareness campaign, community-based and competition. This recommendation was selected using an assessment of all the options based on the following objectives (see Table _____): behavioural change, program cost, household cost, marketing, engagement, implementation and overall impact on energy savings and participation.

Strategies to address the social and informational barriers



Specifically, the following implementation strategies are proposed to address the social and informational barriers:

A. Nudging

Implementing nudges that are low-cost is the first priority for the program to help stimulate interest for energy efficiency. The following basic nudges should be started as soon as possible:

1. Send postcards through mail or e-mail that contain brief information about simple ways people can start saving energy at home. This strategy can be different from existing

utility efforts by highlighting success stories of West Vancouver households that have implemented measures that already resulted to significant savings.

- This should be followed by a one-page infographic that provides more details about the benefits and savings from different home improvements and upgrades.
- Include information about available rebate programs through BC Hydro and FortisBC, and how to access them.

2. Initiate a commitment campaign to gather pledges from households to implement at least one simple energy-saving measure: attend an awareness session, neighbourhood-to-neighbourhood event, schedule an energy assessment or adopt basic or enhanced home upgrade (e.g. appliances, insulation, heating or cooling). This strategy can be different from the same utility efforts by showcasing the benefits that early adopters in the District are already gaining. Inviting them to speak and share their experiences would provide a more relatable example for interested residents.
    - Follow-up on a regular basis based on their commitments to check their progress or provide assistance if they encounter an obstacle along the way.

B. Awareness campaign

Since the delivery of information to households is the focus of an awareness campaign, it is imperative that all available channels are utilized to maximize exposure and impact.

1. Start with social media like in Facebook, Twitter and Snapchat to build presence, following and interest. Ensure that messages are uniform across all media.
2. Start a YouTube channel as well with contents that educate people all about energy efficiency.
3. Expand to broadcast media including television or radio and print media like newspaper and billboards.
4. Develop testimonials from residents and highlight success stories throughout the campaign.
5. Plan in-person interaction with residents through community events. This will be a perfect opportunity to disseminate information, collect commitments and register residents on the program's social media channels.
6. Explore the feasibility of raising awareness among children and youth through classroom education.

C. Supporting grassroots groups

Partnering with a local community-based advocacy group to develop and implement an innovative energy conservation outreach campaign should be a key component of West Vancouver's behavioural-based program. This can increase trust, raise awareness and stimulate interest in the community.

D. Competition

Make energy efficiency interactive and fun, and one way to achieve this is through an energy competition where households compete against each other by achieving the highest reduction in energy use. The top performing households get rewards for their commitment and everyone gets to learn about energy efficiency in an exciting and competitive way.

- Design games in which participants try to reach goals by reducing energy consumption.
- Partner with schools to encourage children's families to participate in the challenge.
- Partner with employers to sponsor energy challenges at work.
- Ensure monetary and non-monetary rewards are part of competition.
- Recognize all households' efforts and leadership in the competition.

Why West Vancouver is best positioned to implement these behavioural strategies?

BC Hydro and Fortis BC, in some capacity, are already nudging their customers, raising public awareness and supporting community-based efforts to increase participation. However, there is evidence that how programs are marketed and who promotes them matters. One study that evaluated a direct load control program offered by an Australian energy company found that self-professed distrust of the local utility was associated with a significantly reduced willingness to participate in an energy program (Stenner et al., 2017).

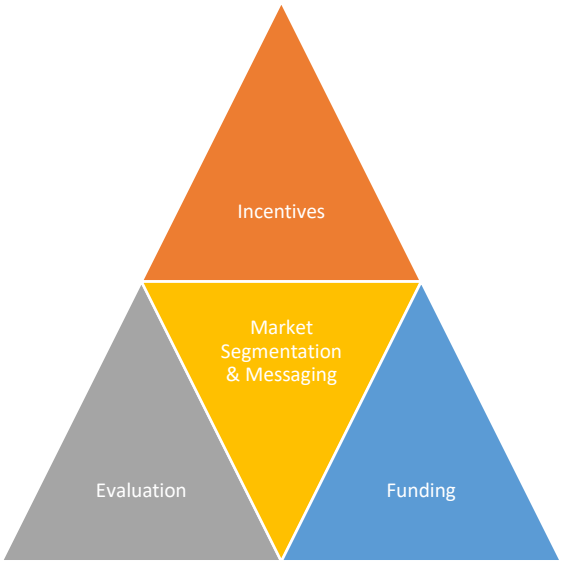
People use trust as a simple decision-making heuristic when assessing risk and making cost-benefit appraisals (Frederiks, Stenner and Hobman, 2014). An untrustworthy messenger makes people wary or skeptical and can disengage or react defensively to the information being shared. It is vital that information, messages and appeals about energy efficiency is delivered by individuals and organizations who possess the key elements of trust—honesty, competence, credibility, reliability, objectivity, openness, fairness, consistency and good will (Poortinga and Pidgeon, 2006).

Competence-based trust and integrity-based trust are both essential to how residents respond to information and outreach campaigns about energy efficiency (Frederiks, Stenner and Hobman, 2014). The local government is likely well positioned to design and implement a behavior program due to existing levels of trust. First, the District as an organization comprised of qualified leaders and trained civil servants strengthens the competence-based trust that people look for when they need clarity and guidance on issues like energy efficiency that require complicated or technical information. Second, the District as a government that has a mission to look after the public's interest strengthens the integrity-based trust among people who rely on credible, consistent and honest sources of information.

Therefore, West Vancouver should take a leading role in this opportunity and leverage its unique position as an entity that many residents trust and count on. Research shows that

messages coming from high-credibility and trustworthy sources were associated with increased interest in energy conservation and savings. People seem to respond best when approached by a peer, somebody they trust and can relate to, especially someone viewed as a leader in the community (LBNL, 2010). The proposed behavioural program can benefit significantly from this, but also on the District's existing relationships and networks, which may be furthered removed from the utilities.

Strategies to improve the effectiveness of a West Vancouver behavioural program



To achieve the intended outcomes and benefits of the integrated behavioural program, the following strategies that improve the effectiveness of the program should be implemented:

A. Funding

Long-term funding from West Vancouver's local government is needed to sustain the proposed program's costs. It is estimated that $20 to $40 is required to achieve annual energy savings of 1 to 2 percent of total retail electricity sales.[21] This means that for West Vancouver with a total population of a just over 40,000, the district will need at least $1 million (after conversion to Canadian dollars) to fund such a program. However, because the proposed program is behavioural-based, the estimated cost should be a fraction of that amount.

The estimated cost of a one-year behavioural program in West Vancouver is $100,000. Please see the appendix for calculation of this estimated cost.

The district should allocate at least $60,000 to fund the first year of the program. The remaining $40,000 could be funded by BC Hydro and Fortis as program partners. These two utility

[21] American Council for an Energy-Efficient Economy (2009). State Energy Efficiency Scorecard.

companies have funded between 46 to 96 percent of total costs of previous energy efficiency campaign programs of various local governments across British Columbia.[22]

B. Incentives

Effective messaging will be likely insufficient to motivate residents, so additional incentives are necessary at least in the short term. Programs that offer small incentives are unlikely to get significant uptake, but full-cost incentives do not always guarantee a successful program either. What does seem important is whether customers consider the project to be a "good deal."[23] There are several ways the district can offer both financial and non-financial incentives that are affordable relative to the program's budget.

Free efficient products
The district can provide free products such as LED lightbulbs, smart thermostats and other technologies to entice more people to participate in the behavioural program. These products can serve as "on-ramps" to deeper energy-saving measures by changing perception and starting conversation with homeowners.

Reward point system
Another way to create interest among residents about the behavioural program is to offer a reward system that assigns points to households that take the first steps to implementing energy efficiency. Residents earn points by simple measures like attending an outreach or neighbourhoods event, saving energy by turning off lights or unplugging appliances, or getting an energy assessment and installing efficient products. The district can partner with local businesses to allow participating residents to redeem accumulated points for cash or products.

Subsidy for assessment cost
The cost of an energy assessment usually discourages households from taking the first step of upgrades. Local governments subsidized between $10-$50 of the assessment cost in previous programs (see appendix for this list). The district should offer a rebate of $50 to 100 households (about 1 percent of total detached homes) as a starting point to gauge interest. Specifically, ensure that at least 50 homes come from the pre-1975 stocks.

Bonus for extra measures
A bonus for going deeper on upgrades can also motivate residents. Currently, BC Hydro and Fortis offer $750 bonus rebate for three or more upgrades. The district can add $50 to increase the available bonus rebate to $800 for additional upgrades.

Access to loans
Access to financing such as loans is also important to overcome the upfront cost barrier for households. This can be addressed by working with banking institutions to join outreach events

[22] BC Hydro (2014). Home Energy Retrofit Incentive Campaigns Analysis Report.
[23] Grevatt, Hoffman, Hoffmeyer (2017). Keys to the house: unlocking residential savings with program models for home energy upgrades.

and provide information about applying to these loans. Vancity offers Eco-Efficiency loan, while CIBC provides Home Power Plan loan.

C. Market segmentation and messaging

Carefully grouping residents to reach is key to the program's success because segmenting the targets provides better understanding of how to influence more positive decisions and how to tailor messages.

Segment by energy efficiency adoption[24]

- Early adopters or those who have already implemented measures
- Laggards or those who have not taken any steps towards efficiency

Segment by priorities[25]

- Aspirational or those who value sustainability and the environment
- Comfort and value seekers or those who are investment-driven, practical and think about the long-term
- Cost-driven or those think about the short-term and looking for quick fix or immediate savings

Segment by demographic and socioeconomic categories[26]

- By age groups
- By ethnicity
- By income level
- By education level

Messaging

In marketing, language is a powerful tool and therefore, it matters a lot to consider carefully what message will deliver the greatest impact to audience. Ensure that the program sells something people want by incorporating the following messages to engage participants:[27]

- Comfort: "Increase your family's comfort and wellbeing."
- Practical Investment and security: "Invest on efficiency to protect your most valuable asset."
- Self-reliance: "Reduce your energy dependence."
- Social norm: "All of your neighbors are making home energy improvements."

[24] LBNL (2010). Driving demand for home energy improvements.
[25] SEAI (2017). Behavioural insights on energy efficiency in the residential sector.
[26] ACEEE (2014). Know before you go: how upfront investment in market research and segmentation can improve outcomes in small business direct install programs.
[27] LBNL (2010). Driving demand for home energy improvements.

- Health: “Protect your family from mold allergies and asthma.”
- Environment: “Eliminate energy waste, and protect the environment for future generations.”

Moreover, only use words that connote positivity. The following words and phrases are likely to inspire and motivate residents:

- Energy upgrades (not retrofit)
- Energy assessment (not audit)
- Save money
- Protect the environment

Finally, one of the social barriers to participation is people’s distrust of others, specifically program messengers. With the combination of the right messages and messengers, the marketing of the program can play a significant role in gaining residents’ trust. One way to achieve this is to use a leader in the community or someone people trust and relate to as a messenger.[28] Enlisting the help of the following as trusted messengers would be helpful:

- Council members
- School representatives
- Church leaders
- Community leaders
- Neighbourhood groups such as Cool North Shore

D. Evaluation

Finally, evaluating the program is important to learn about what works and what does not. Evaluation should focus on quantifying the impact on energy consumption and the cost of savings. The following data should be collected to better assess the effectiveness of the program:

- Number of participants in each component of the program (awareness campaign, community-based and competition)
- Conversion rate between stages (attending an awareness campaign to completed assessment to completed upgrade)
- Number of participating homes as a percent of the target audience
- Estimated energy saved and actual energy saved
- Number of energy efficiency measures implemented and upgrades installed
- Frequency of specific actions per participating household
- Total cost of the program to calculate the cost per participating home

[28] LBNL (2010). Driving demand for home energy improvements.

Program evaluation should employ the best research design by using methods such as a simple pre–post design and experimental or quasi-experimental designs. Using these evaluation methods provides reliable and convincing evidence of program effectiveness.

Section 9 – Conclusion

Energy efficiency is advanced by encouraging investment in efficient products and technologies through incentives and/or by influencing people to change their behaviour through insights drawn from social and behavioural sciences. Review of existing studies, program evaluations and best practices employed by current programs reveal that governmental policy approaches on energy efficiency has been shifting toward the integration of behavioural-based approach to improve participation.

This analysis proposes a behavioural program in the District of West Vancouver that integrates three key dimensions: community-based, outreach and competitions. The strength of such program relies on its powerful potential—and its long-term benefit—of behavioural change through nudging and motivating individuals to set energy-saving goals and take actions to achieve them. In addition to significant energy savings, this approach also offers a cost-effective solution to increase uptake among households. It also contributes to a community's overall vitality through its more inclusive, participatory and interactive approach.

However, it should be noted that a behavioural program is not a replacement for incentive-based programs. Rather, it is a complementary program that supports existing programs in improving the level of participation by directly targeting people's behaviour, which incentive-based programs may fail to adequately address.

The program's design should focus on four key components to become effective. First, the District of West Vancouver should allocate adequate funding to sustain the program from its design and implementation to its evaluation. Second, the District should ensure that such program include additional incentives that are relatively affordable, but motivating like bonus upgrade rebate, assessment cost subsidy and a reward point system.

Third, the behavioural program should also incorporate marketing strategies that maximize reach and impact by focusing on market segmentation and messaging. Finally, an evaluation of the program should be conducted by collecting participation, consumption and cost data throughout its first year of implementation. These components are vital to tapping the full potentials of a behavioural-based program and to optimizing the desired energy efficiency outcomes.

References

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics*, 95(9-10), 1082-1095.

Allcott, H., & Rogers, T. (2014). The short-run and long-run effects of behavioral interventions: experimental evidence from energy conservation. *American Economic Review*, 104(10), 3003-3037.

Ameli, N., & Brandt, N. (2015). Determinants of households' investment in energy efficiency and renewables: evidence from the OECD survey on household environmental behaviour and attitudes. *Environmental Research Letters*, 10(2015), 1-14.

BC Hydro (2013). *Evaluation of the LiveSmart BC efficiency incentive program*. Vancouver, BC: BC Hydro.

Chai, K., & Yeo, C. (2012). Overcoming energy efficiency barriers through systems approach—a conceptual framework. *Energy Policy*, 46(2012), 460-472.

Chu, B. (2017, October 9). What is 'nudge theory' and why should we care? Explaining Richard Thaler's Nobel economics prize-winning concept. *The Independent*. Retrieved from https://www.independent.co.uk/news/business/analysis-and-features/nudge-theory-richard-thaler-meaning-explanation-what-is-it-nobel-economics-prize-winner-2017-a7990461.html

Conzemius Van de Grift, S., Dougherty, A., & Marquis, D. (2014). *Know before you go: how up-front investment in market research and segmentation can improve outcomes in small business direct install programs* (ACEEE Summer Study on Energy Efficiency in Buildings). Washington, DC: American Council for an Energy-Efficient Economy.

Costa, D. L., & Kahn, M. E. (2013). Energy conservation "nudges" and environmentalist ideology: evidence from a randomized residential electricity field experiment. *Journal of the European Economic Association*, 11(3), 680-702.

De la Rue du Can, S., Leventis, G., Phadke, A., & Gopal, A. (2014). Design of incentive programs for accelerating penetration of energy-efficient appliances. *Energy Policy*, 72(2014), 56-66.

Delmas, M. A., Fischlein, M., & Asensio, O. I. (2013). Information strategies and energy conservation behavior: a meta-analysis of experimental studies from 1975 to 2012. *Energy Policy*, 61(2013), 729-739.

Dolan, P., & Metcalfe, R. (2013). *Neighbors, knowledge, and nuggets: two natural field experiments on the role of incentives on energy conservation* (CEP Discussion Papers No. CEPDP1222). London, UK: Centre for Economic Performance, London School of Economics and Political Science.

Dougherty, A., & Conzemius Van de Grift, S. (2016). Behavioral energy feedback program evaluations: a survey of current knowledge and a call to action. *Energy Efficiency*, 9, 899-909.

Environmental Protection Agency (2010). *Customer incentives for energy efficiency through program offerings*. Washington, DC: EPA.

European Environment Agency. (2013). *Achieving energy efficiency through behaviour change: what does it take?* (EEA Technical Report No. 5/2013). Luxembourg: Publications Office of the European Union.

Frederiks, E. R., Stenner, K., & Hobman E. V. (2014). Household energy use: applying behavioural economics to understand consumer decision-making and behaviour. *Renewable and Sustainable Energy Reviews*, 41(2015), 1385-1394.

Gerarden, T. D., Newell, R. G., & Stavins, R. N. (2017). Assessing the energy-efficiency gap. *Journal of Economic Literature*, 55(4), 1486-1525.

Gillingham, K., & Palmer, K. (2014). Bridging the energy efficiency gap: policy insights from economic theory and empirical evidence. *Review of Environmental Economics and Policy*, 8(1), 18-38.

Gillingham, K., & Tsvetanov, T. (2017). *Nudging energy efficiency audits: evidence from a field experiment* (USAEE Working Paper No. 17-320). Cleveland, Ohio: United States Association for Energy Economics.

Grevatt. J., Hoffman, I., & Hoffmeyer, D. (2017). *Keys to the house: unlocking residential savings with program models for home energy upgrades*. Berkeley, CA: LBNL.

Hoicka, C., Parker, P., & Andrey, J. (2014). Residential energy efficiency retrofits: how program design affects participation and outcomes. *Energy Policy*, 65, 594-607.

Julie, A. (2018, January 5). Albertans saw big energy savings and reduced greenhouse gas emissions in 2017: government. *Global News*. Retrieved from https://globalnews.ca/news/3948410/albertans-saw-big-energy-savings-and-reduced-greenhouse-gas-emissions-in-2017-government/

Lawrence Berkeley National Laboratory. (2010). *Driving demand for home energy improvements: motivating residential customers to invest in comprehensive upgrades that eliminate energy waste, avoid high bills, and spur the economy*. Berkeley, CA: LBNL.

Mazur-Stommen, S., & Farley, K. (2013). *ACEEE field guide to utility-run behavior programs* (ACEEE Report No. B132). Washington, DC: American Council for an Energy-Efficient Economy.

Minnesota Department of Commerce (2015). *Energy efficiency behavioural programs: literature review, benchmarking analysis, and evaluation guidelines* (Conservation Applied Research and Development Final Report). St. Paul, MN: Minnesota Department of Commerce.

Poortinga, W., & Pidgeon, N.F. (2006). Prior attitudes, salient value similarity, and dimensionality: toward an integrative model of trust in risk regulation. *Journal of Applied Social Psychology*, 36, 1674-1700.

Reames, T. G. (2016). A community-based approach to low-income residential energy efficiency participation barriers. *Local Environment*, 21(10), 1449-1466.

Stener, K., Frederiks, E. R., Hobman, E. V., & Cook, S. (2017). Willingness to participate in direct load control: the role of consumer distrust. *Applied Energy*, 189(2017), 76-88.

Sunstein, C. (2014). Nudging: a very short guide. *Journal of Consumer Policy*, 37(4), 583-588.

Sussman, R., & Chikumbo, M. (2016). *Behaviour change programs: status and impact* (Report B1601). Washington, DC: American Council for an Energy-Efficient Economy.

Sustainable Energy Authority of Ireland. (2016). *Behavioural insights on energy efficiency in the residential sector*. Dublin, Ireland: Sustainable Energy Authority of Ireland.

Thaler, R., & Sunstein, C. (2008). *Nudge: improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.