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Making it Happen – The Transition to a Sustainable Society

Backgrounder 4

Financing Sustainability: Models for the Energy efficient single-family house in Canada

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This backgrounder, prepared by Telfer MBA students, reviews mechanisms currently available to help consumers pay for expensive additional features to bring a house up to net zero energy standards.

Typically, a net zero energy house can cost between $130,000 to $150,000 more than an ordinary house. This paper begins by reviewing the different beneficiaries, apart from the consumer, that would gain from net zero energy houses. These include municipalities, utilities, home builders, and communities.

Six approaches to financing sustainable housing are examined

1. *rental of equipment and energy generating to the homeowner;*
2. *energy service companies (ESCOs) that provide renewable energy for a fee;*
3. *mortgages and loans, including green mortgages and loans, for home improvements;*
4. *government incentives including tax credits, rebates, feed-in tariffs and grants;*
5. *community level services or systems such as district heating from solar energy sources; and*
6. *financing through local improvement charges.*

These approaches are evaluated in terms of their strengths and weaknesses, and recommendations are made for improving the availability of instruments and making them more flexible and user-friendly.

Table of Contents

1. Executive Summary

Since 1980, Canadian organizations, builders, all levels of government and a number of homeowners have been deploying efforts towards building a sustainable Canada capable of achieving energy efficiency on a large-scale. At times, efforts are considerable; at others they are meek and even unpopular. The Telfer School of Business of the University of Ottawa is trying to uncover "What is stopping us?". In an attempt to explore barriers, the School organized a series of workshop with various experts to gain valuable insight on the problem.

As an initial task, the School focused on identifying the key barriers to innovation and change in the Canadian residential sector. The barriers identified through the workshops are numerous: costs, consumer awareness, legislation, availability of skilled trades, public perception, etc.

But one barrier was highlighted as being key: the considerable up-front costs associated with implementing sustainable technologies in a home, which is the focus of this study. A team of MBA candidates from the Telfer School of Business undertook to study data on the subject, analyze the information found and propose financial instruments that would address it.

In fact, considerable up-front expenditures are necessary to include green technologies such as photovoltaic equipment, in new home construction. Typically, these additional costs are carried on the mortgage with cost recovery taking several years. The current value proposition has not encouraged decision makers to include energy-efficient or energy-renewable technologies in their construction plans. It is essential therefore to address this value proposition from the perspective of the first owner of a property.

This paper attempts to identify all of the beneficiaries of higher performance homes and to present ways of better aligning costs with those beneficiaries. It analyzes financial models that shift the burden from the homeowner alone to other areas that also derive benefit from green residences. Such additional beneficiaries include municipalities, utility providers and society in general as.

Existing financial instruments are examined to find ways of improving them so they can achieve the desired outcome. New instruments that are likely to improve the faulty value proposition are also proposed. Moreover, the overarching issue of leadership is addressed. The experts interviewed highlighted the apparent lack of leadership in promoting the solutions that are available and the general disregard for making them known. In fact, most of the solutions already exist but are offered as pockets of solutions with numerous conditions and regional applications. Leadership therefore needs to be assumed by national organizations to implement these instruments on a larger scale, thereby increasing reach, visibility and overall accessibility.

2. Background

Since 1980, Canada has been making efforts to green its residential sector through the implementation of initiatives such as the R-2000 program by Natural Resources Canada (NRCan). This program was designed to "encourage the construction of energy-efficient single-family houses in Canada by improving the technical standards of new home construction." [1] Various regional green studies were also undertaken by both public and private sector stakeholders: Cities[Plus] in Vancouver[2], Choosing our Future in Ottawa[3] and QUEST in Canada[4]. However as of 2009, progress remains limited and widespread adoption of energy-efficient technologies is lagging.

The Telfer School of Business of the University of Ottawa has hosted two workshops in 2009 to identify the biggest barriers to innovation and change in the Canadian residential sector and in sustainable communities. Experts from various areas attended and contributed valuable insight. According to the attendees, the technologies required to build high performance homes are readily available but other factors impede their adoption including consumer awareness, the availability of skilled trades, legislation, building codes, culture, public perception, etc.

The workshops brought together scientists, city officials, utility representatives, builders etc. from across Canada. They concluded that substantial up-front costs, the leadership required and the existing financial mechanisms are all areas requiring attention in order to accelerate that pace of change. Although the forces at play are complex, the key barriers to impeding change are reducible to costs, awareness and capacity.

This paper targets one of those barriers – cost. It responds to the results of the R-2000 Program Evaluation conducted in September of 1995 which explicitly stated:

> *There is really only one significant barrier – the high cost of the R-2000 upgrade. The average homeowner paid about $8,400 per house for the upgrade; …Low public awareness, low energy prices and low housing starts may also keep demand low.* [5]

The additional upfront costs associated with energy-efficiency are typically carried on the homeowner's mortgage with payback through energy savings taking several years. While most of the financial burden associated with purchase and maintenance of these systems falls on the homeowner, many additional parties share in the benefits. As long as the perceived value proposition is restricted only to the homeowner, it is insufficient to encourage a widespread adoption by homeowners of these energy-efficient upgrades.

2.1. Objectives

A team of MBA candidates from the Telfer School of Business undertook to study data pertaining to sustainability upgrades and propose financial instruments that would encourage their adoption. The

[1] Evaluation of the R-2000 Program of Natural Resources Canada, September 1995, p.i
[2] http://www.citiesplus.ca/
[3] http://transitiontosustainability.blogspot.com/search/label/choosing%20our%20future
[4] http://questcanada.org/
[5] Evaluation of the R-2000 Program of Natural Resources Canada, September 1995, p.iii

objective was to identify a range of existing and desirable financial instruments that would make high performance upgrades more attractive in new home construction.

The study identified financial models that reduce the financial burden borne exclusively by the homeowner by spreading them to other parties who realize benefits from the higher performing homes or who are better positioned to absorb them. Creative models are required for financing new home improvements to better align the cost/benefits of low environmental footprint housing, encouraging new homeowners to build their homes to higher performance standards. Specifically, the study's objectives were to provide:

- A relative estimate of the incremental costs involved in upgrading a new home construction from minimum code to high performance (ERS 80 e.g. R2000) to ultra-high performance (ERS 100 e.g. NetZero);
- A stakeholder analysis that identifies the various parties involved in the construction, financing, and provision of utilities. Focus will be on parties who are affected (directly and indirectly) from the upgrades;
- An identification of the net savings resulting from upgrades and identification of the party that realizes them;
- An identification of the financial mechanisms that can be employed to allocate resulting costs and benefits; and
- A gap analysis of the actual and desired states.

Based on answers to these questions, it developed a set of recommendations for future action.

2.2. Methodology

The study team began by reviewing the Workshop proceedings and presentations given by experts. It then moved on to undertake three primary activities:

- Interviews with a variety of subject matter experts;
- A review of financing models and/or studies on the subject;
- Performance of various types of analysis to identify solutions.

A standardized questionnaire was developed and sent to subject matter experts in advance of the interviews in order to assist them in preparing. Seven interviews were conducted total ranging from 45 minutes to two hours. Interviewees were then given a chance to verify the team's notes to eliminate any errors or misinterpretations. The interviews were performed over four weeks and provided the team with a wealth of additional information.

3. Incremental Costs for High Performance Upgrades

According to interview respondents, the cost of building a higher performing home depends on factors such as the size of the home and labour market costs. The key cost drivers, however, are the size of the home and the amount and type of equipment necessary to achieve the level of performance required. In the case of R-2000[6] extra costs arise from the need for additional inspections during construction and the need for a better-quality building envelope. For a Net-Zero[7] home, the costs are primarily attributable to renewable energy equipment like photovoltaic technologies.

It was not possible to define a precise incremental cost for performance upgrades but it was possible to provide some ranges that were in approximate agreement. The experts interviewed stated that a

[6] http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/About-r-2000.cfm
[7] http://www.netzeroenergyhome.ca/

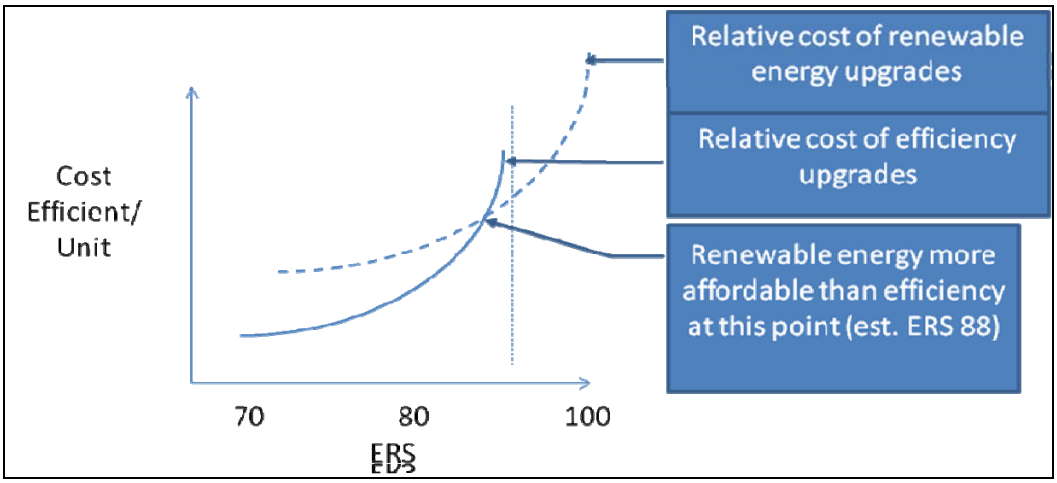
conventional house in Canada usually rates at an ERS[8] of 74 and an R-2000 house, which rates as an ERS of 80 would require approximately $8,000 to $12,000 depending on size. Considering a typical house of 2,000 square feet, this cost differential averages about $5 a square foot. To move from a conventional home to an ERS 100 or Net-Zero house would require an additional $100,000 to $150,000 or about as much as $75 more a square foot.

One interviewee stated that "it doesn't make sense to upgrade to ERS 100 because significant investment in photovoltaic or geothermal energy are required, leading to an incremental costs of over $130,000, based on the CMHC Equilibrium houses project". However, another interviewee suggested that for a fraction of the cost, homes could be designed and built "solar-ready" permitting easier integration of solar technologies when these become more affordable.

A number of respondents stressed the importance of planning and design considerations when trying to achieve higher home performance. Proper home orientation on the lot allows a design that can take maximum advantage of the sunlight in the winter while reducing the need for air conditioning in the summer. A number of respondents stressed that the when trying to achieve higher performance, the first goal should be energy efficiency and only then should the addition of renewable energy sources be considered.

To upgrade a home design to the performance range of ERS 80, the key cost drivers are better windows, improved insulation (and related structural changes), heat recovery and ventilation systems. As one respondent put it, "At ERS 75, it is far cheaper to replace a kilowatt of purchased energy through efficiency improvements than by replacing it with renewable energy. Above 88 it's likely more economical to produce renewable energy rather than pursue further increases in efficiency." As the cost of renewable energy technology decreases, this equilibrium point will happen at a lower energy rating. The interviewee illustrated this concept with the following diagram:

Figure 1: Cost relative to NRCan's EnerGuide Rating Service



Note: Although not addressed specifically by the EnerGuide Rating system, water usage and air quality are also key component of a higher energy-efficiency home. (R-2000 and Net-Zero alike)

[8] EnerGuide for Houses rating / EnerGuide Rating Service by NRCan: http://oee.nrcan.gc.ca/residential/personal/new-homes/upgrade-packages/energuide-service.cfm?attr=4

4. Savings

According to one interviewee, the Canadian Home Builders Association estimates the current price of the energy savings to be approximately $2,000/year[9] in the case of an R-2000 house but they are unknown for a house with a higher ERS score. Data for the higher energy-efficiency house (ERS 80 to 100) is currently unavailable given the limited number of houses built to those standards at present. One respondent commented that it is too early to determine the effects that economies of scale will have as more ERS 90 to ERS 100 homes are built.

Considering the additional costs incurred from the onset, the return on investment (ROI) is approximated as ranging between 6 and 15% according to the experts consulted for an R-2000 house. When asked about return on investment (ROI) or payback periods for the upgrades, the interview participants indicated that a typical payback period ranges from 10 to 15 years for the upgrade from ERS 74 to ERS 80. Of course savings will continue well beyond the pay back period.

One interviewee noted that $2,000 of savings established for an R-2000 house represents about 2/3 of its energy consumption costs. Considering the premise that a Net-Zero house (ERS 100) effectively generates as much energy as it consumes, we can hypothesize that the resulting savings may be as high as $3,000/year.

As proposed under Ontario's Green Energy Act (GEA), the new feed-in-tariff[10] rate of 0.80$/kWh[11] for houses that are producing energy and selling it back to the power grid is anticipated to work in favour of ERS 100 homeowners and yield a similar pay back [12]. The Ontario Power Authority estimates the payback to be in the neighborhood of 20 years.[13]

5. Beneficiaries

5.1. Homeowners

Beyond energy savings, other benefits accrue to the homeowners including higher quality home construction, improved air quality and less noise permeation. Although a few of the respondents identified higher resale value as a benefit, it was impossible to quantify additional resale value or the relative market attractiveness of a higher performance home.

At least one respondent suggested that knowledge of long-term benefits to homeowners is lagging in the real estate industry and the added value is not being marketed adequately. Another indicated that the real estate market is primarily influenced by comparative home prices and it is not clear that higher performance is necessarily translating to a higher sales price.

For homes with renewable energy generating capacity, the prospect of net metering could further reduce energy bills while offering the added reliability of being able to sell excess power back to the

[9] Home builder, interview
[10] "The Green Energy Act, 2009 (GEA) was introduced to the Ontario Legislature on February 23, 2009. It includes a proposal for a new renewable energy program known as a Feed-in Tariff (FIT) Program designed to further encourage the development of renewable energy supply". http://www.powerauthority.on.ca/FIT/
[11] http://www.powerauthority.on.ca/fit/Storage/30/10149_FIT_Price_Schedule_-_Draft_March_13__2009.pdf
[12] Industry Association, interview
[13] http://www.powerauthority.on.ca/fit/Page.asp?PageID=122&ContentID=10098

utility, thereby reducing the net monthly consumption from the utility. In any case, the ROI or payback is more attractive to the homeowner as energy prices increase.

At present, however, there are considerable disincentives for homeowners to pursue these upgrades. If the upgrades do increase home value, homeowners in cities where municipal taxes are based on home prices will see their property taxes increase, offsetting some of the savings from lower utility bills. In the case of the more complicated home energy systems, some respondents indicated that homeowners are not well positioned to maintain the systems or to deal with the risks associated with new technologies. Rising municipal development charges were also cited as a factor. These charges increase the cost of a new home and result in lower demand for newer, better performing homes. There were also concerns raised about potential nuisance issues arising from freestanding solar panel structures or wind turbines.

5.2. Utilities

The electric utilities were cited by a number of respondents as beneficiaries of increased efficiency homes. Energy conservation translates into reduced system peak loads and a flattening of the system load profile. The utility benefits from reduced capital expenditure on generation, transmission, and distribution infrastructure. Distributed generation helps utilities realize their conservation mandates and targets for renewable energy generation.

With competition from other energy sources, natural gas distribution companies have incentives to promote energy conservation. Reduced gas consumption can help offset increases in per unit natural gas prices allowing gas to remain a cost effective energy solution. However, as demand decreases, natural gas distributors will receive less revenue. Since the utility requires the ability to recover its costs to install infrastructure to connect the customer, changes may have to be made in the way that this cost recovery is performed. One interviewee felt that this could be accomplished through a higher fixed charge, but that this ran the risk of driving customers away. As one respondent put it, "there is ambivalence here – even if the utilities' business models are based on revenue targets, they still have conservation targets.[14]" Faced with this prospect, gas companies are looking to diversify their business.

5.3. Municipalities

Although not explicitly discussed with the interviewees, water efficiency [low flush toilets, low-flow showerheads and faucets] is another characteristic of higher performance homes. The resulting reduction in required capacity, especially during peak demand periods, is a benefit for municipalities. Conservation efforts allow municipalities to defer system expansions because of reduced water or sewage treatment requirements, leading to significant savings. The taxpayers would benefit indirectly from these reduced requirements. In addition, there are tremendous energy savings arising from reductions in the volume of water that is pumped and treated by municipal systems. As a result, one interviewee suggested that municipal development charges should be reduced for higher performance homes since they put less demand on municipal systems.

5.4. Home Builders

Builders who are building higher performance homes benefit from being able to distinguish themselves in the market. At the same time, builders may be penalized by the market due to the higher prices associated with higher performance homes. This could be offset by increased consumer awareness and increased promotion of the net benefits by real estate professionals.

[14] Municipal officals, interview

Some homebuilders are only willing to change their practices in response to changes in government regulation. One interviewee identified the large tract builders as being less motivated since they prefer proven building techniques and rely on the skill level of the available workforce. Changes in building practices carry considerable risk and require crew retraining. On the other end of the spectrum, some of the custom homebuilders were seen to be the most motivated, capitalizing on their flexibility to distinguish themselves in the market.

The higher prices combined with the significant risks and learning curves associated with new technologies and building practices are disincentives for builders to promote higher performance homes. As one respondent put it, the building industry is very risk averse and nobody wants to be first. However, "(the) vast majority of builders watch each other like hawks. When they see someone do something that is different and it works, they will be in the next day…. It is really a question of how to develop the right business models and then successfully demonstrate them. The minute that you have done that, you are going to have a bunch of entrepreneurs who want to get on that trend."[15]

At least one interviewee felt that changes to the provincial building codes could require ERS80 construction by 2011. However, he expressed concern that "energy efficient homes must be affordable, or they won't get ordered and built."[16]

5.5. Others

Numerous other stakeholders were mentioned by the respondents although analysis fell outside of the scope of the study. These are summarized in Table 1.

Table 1: Beneficiaries of energy upgrades

Who benefits?	What is the nature of the benefits?
Landlord / Owner	Increase in property value; favorable public perception; marketable features; potentially lower turnover of tenants; lower operating costs for main systems; protection against energy price shocks.
Tenant	Savings on energy bills; improved heat balancing; improved air quality; less noise; protection against energy price shocks
Government (all levels)	Reducing infrastructure costs (less water treatment capacity required) ; easier to achieve conservation targets; promotion of the environment.
Society	Reduced GHG emissions; less dependence on imported fuel; increased employment rate because the construction industry is labour intensive.
"Green" industry	High performance home builders benefit from market differentiation; contractors increase their profits; suppliers of products/services like insulation or solar panels increase their sales.
Financing community	Homeowners who have lower energy costs have more financing capability and less risks

A special case of single-family dwellings is rental properties. For such homes, the owners may not have incentives to invest in conservation measures since tenants typically pay the utilities. However, it is conceivable that higher utility bills could lead to higher tenant turnover and eco-conscious tenants may prefer homes with a smaller environmental footprint. There may be tax incentives or other incentives specifically targeted at the property owner, however these were not investigated under this study.

[15] Industry Association, interview
[16] ibid

6. Financial Instruments

There are financial instruments that can shift the burden of investment in sustainability from the homeowner alone to include other beneficiaries such as utilities and municipalities. Existing instruments are examined here to find ways of improving them so they can achieve the desired outcome.

6.1. The rental model

Rental of energy efficient equipment is a viable option for the homeowner who is seeking higher performance home systems without incurring the upfront capital cost. In the rental model, the homeowner enters into a contract with a company that typically supplies, installs, maintains and disposes of the equipment. The company recovers its cost and profit through monthly rental charge. The technical know-how necessary to maintain and dispose of these assets, especially photovoltaics, suggests that the ownership should be retained closest to the entity best able to manage it.

For example, a utility in Kingston rents solar hot water heater systems including solar collector panels, tanks and pumps. Under its program, homeowners pay for the installation of the system, and a monthly rental charge based on the size of the system as follows:

Table 2: Solar domestic Hot Water System rental rates in Kingston, Ontario

Description	Cost/Month (1)
2 Panel, 300 Litre Tank (2-4 People)	$49.00
3 Panel, 300 Litre Tank (5-7 People)	$58.00
4 Panel, 300 Litre Tank (8-10 People)	$67.00

Source: http://www.utilitieskingston.com/heaters/solar.html

The minimum term of rental is 36 months after which the rental is renewed monthly. Homeowners also have the option to buy the equipment at any time at a cost set by the utility company[17].

Reliance Home Comfort (http://www.reliancehomecomfort.com) is another company that rents systems for home energy conservation. Reliance claims that its solar hot water systems can provide reductions of up to 50% to the home's hot water heating bill[18] In addition to solar hot water systems, Reliance offers rentals of tankless hot water systems. Rental of these heaters starts at $31.90 per month with an estimated savings of 15% over the existing gas water heater[19]. Reliance also rents high efficiency (up to 97% efficient) furnaces, with furnace rentals starting at $59.99 per month.

Rental models are also used for solar photovoltaic (PV). One such service is the ReNU program offered in most American States by Citizenrē (http://renu.citizenre.com). The solar system is owned, installed,

[17] Utilities Kingston. (n.d.). *Heater Solar Rental Terms and Conditions.* Retrieved April 16, 2009, from Utilities Kingston: http://www.utilitieskingston.com/pdf/water/Heater_SolarTermsConditions_0119.pdf
[18] http://www.reliancehomecomfort.com/solar/pdf/SolarWaterHeater_builder.pdf
[19] http://www.reliancehomecomfort.com/content.aspx?product=55&subcategory=3&category=1&media=213

maintained, and monitored by the Citizenrē Corporation. The homeowner pays a monthly flat rate rent for the system based on system size and the rental rate can be locked in for up to 25 years. The homeowner benefits from the power generated from the PV system offsetting power that would otherwise be purchased from the utility. The company offers an online calculator[20] to estimate the savings and deferred GHG emissions that the homeowner would realize as compared to purchasing energy from their existing utility provider. Currently the program has more than 34,000 customers. Interviews indicate that this approach offers advantages in terms of risk management issues and disposal know-how. When these systems need repairs or replacing, the homeowner rarely has the knowledge and capacity needed whereas the system providers do. Therefore ownership of the equipment should be retained by those best able to manage it.

6.2. Energy Services Companies (ESCOs)

Another way of financing energy-efficiency equipment costs is to sign a contract with an energy service company (ESCOs), which can be defined as "a business that develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities over 7 to 20 years[21]". ESCOs generally act as project developers for a wide range of tasks and assume associated technical and performance risks. Typically, they offer the following services:

- Develop, design, and arrange financing for energy efficiency projects;
- Install and maintain the energy efficient equipment involved;
- Measure, monitor, and verify the project's energy savings; and
- Assume the risk that the project will save the planed amount of energy.

These services are bundled into the project's cost and are repaid through the savings generated[22].”

This instrument reduces the burden of high upfront capital costs to the property owner since the energy savings repays the costs over time. This implies that ESCOs have to be able to measure precisely the energy savings realized, which is possible though metering. Another advantage of ESCOs is that their revenues are directly linked to the realized energy-savings, thus encouraging performance.

Unfortunately, the operations of ESCOs are currently focused on industrial, commercial and public buildings rather than individual households. In North America for instance, only two companies (Ameresco and Burns & McDonnell) registered at the National Association of Energy Service Companies are offering their services for the residential sector. This is due to several barriers:

- Energy and cost saving possibilities of a single project/ site are usually small compared to transaction costs especially if ownership of buildings is dispersed among many private owners;
- Transaction costs and project complexity is usually high;
- Building owners are often unaware of energy saving Energy Performance Contracting offers;
- Low subsidized energy prices do not provide an incentive for energy efficiency improvements;
- Perceived disturbance to the home, the hassle, the upfront cost, concern with borrowing with a 2-5 year tie-in, suspicion of energy suppliers and fear of commitment[23].”

[20] http://www.citizenre.net/extras/calculator.htm

[21] National Association of Energy Service Companies’ website, “What is an ESCO?”, http://www.naesco.org/resources/esco.htm.

[22] National Association of Energy Service Companies’ website, “What is an ESCO?”, http://www.naesco.org/resources/esco.htm.

[23] WEC ADEME project on energy efficiency policies, **“**An Assessment of on Energy Service Companies (ESCOs) Worldwide”, March 2007, p.7, http://www.worldenergy.org/documents/esco_synthesis.pdf.

Ways of overcoming these barriers include “government leadership or at least commitment to energy efficiency, energy efficiency obligations on utilities, demonstration projects, project bundling, information campaigns and training programs […][24].”If market conditions are favorable and demand for energy services increase, ESCO activities in the residential sector could generate “saving potentials [that] are estimated to reach up to 40%[25]”.

6.3. Mortgages and Loans

After exploring the two alternatives to ownership, residual items for which costs should effectively be attributed to homeowners need to be financed in a way that increases the accessibility to these technologies increasing the homeowners’ reach. At present, green technologies are deemed expensive and their ROI depends on energy prices. Costs limit their popularity and thus providers find it difficult to realize any economies of scale. The challenge is to break out of this cycle and make these technologies more accessible. Alternative financing mechanisms include “green” mortgages specifically tailored to high-efficiency homes, mortgages that bundle separate loans with varying pay-back periods, and loans targeting green retrofits.

6.3.1. Green Mortgages and Location-based Mortgages

At the time of this study, we found that only a handful of Canadian financial institutions [TD Canada Trust, CIBC and Vancity, possibly also RBC and Citizens] offer green mortgages. Such instruments offer homeowners incentives to "go green" by giving cash rebates, preferential rates, and higher Debt Payment to Income Ratio (DIR) if they are purchasing a house with an ERS of 80 or better. The higher DIR is explained by the fact that the savings arising from lower energy consumption will free up cash for mortgage payments. In the United States, for example, some institutions are building on this principle to include cash freed up by not having to own a car in a high density urban centre[26]. This location-based mortgage allows people to buy more expensive houses in downtown cores given the fact that they will not own a car as a result.

Analyzing data from TD Canada Trust, it was found that the 5-year fixed rate was offered at 4.25% whereas the Green Mortgage was 4.55%. The incentive for a home buyer to get a green mortgage would then rest solely on the fact that 1% of the mortgage value can be received as a cash back when the homeowner purchases qualifying EnergyStar appliances. The cash back comes with conditions as to when the purchases can be made. The TD representative[27] interviewed also confirms that TD does not change its DIR threshold for an energy-efficient house. Only one of the green mortgage characteristics was therefore substantiated in our data collection phase. The green mortgage offered by TD Canada Trust is a valid solution but the homeowner needs to be well educated about the conditions attached.

Vancity, recognized as a leader[28] in green mortgages by our interviewees, is a credit union serving the greater Victoria-Vancouver area and providing a local solution for financing energy-efficient homes. It offers its clients an energy-saving renovation loan for houses called "Bright Ideas"[29], in compliance with NRCan's ecoENERGY Retrofit for Homes program. Bright Ideas targets renovation loans needed to

[24] Ibid, p.11 and following
[25] Ibid, p.7.
[26] http://www.locationefficiency.com/
[27] TD Canada Trust, Personal accounts, interview
[28] https://www.Vancity.com/AboutUs/OurValues/CorporateSocialResponsibility/ClimateChangeSolutions/
[29] https://www.Vancity.com/Loans/BrightIdeas/

upgrade existing homes to ERS 80 or higher standards. This loan is offered at 1% above the prime rate with an amortization period of up to ten years. Vancity also offers solutions for commercial real estate[30].

6.3.2. New concepts

There is a new type of mortgage being designed by the Toronto Atmospheric Fund[31] in collaboration with the Canadian Mortgage and Housing Corporation (CMHC) called the "TowerWise Energy-Efficiency Secured Loan" (TWEEL). The Toronto Atmospheric Fund is developing a "Step-up/Step-Down" mortgage. This mortgage would bundle different loans to finance energy-efficient upgrades in the purchase price of a real estate. As the savings generate positive cash flows, the arrangement "Steps-Down" the mortgage amount and the first layer of debt. As homeowners or landlords retrofit an existing building, they can finance use this type of mortgage to finance costly upgrades and "Step-Up" the mortgage. This mortgage would enable the inclusion of more costly upgrades that are usually cut out of the scope because they are too expensive or yield longer payback periods. Such technologies, often called "orphans," would no longer be left out and would be included in the mortgage.

6.3.3. Loans for home improvements

Different types of loans exist to finance an existing house's retrofit in becoming an energy-efficient house. For example, TD Canada Trust offers loans specifically designed to finance solar, wind and geothermal items with an amortization period of up to 10 years[32]. The longer payback period is justified by the fact that the costs need to extend over the longest pay back period since the energy savings will go on for as long as the technology is functional in the house. The Yukon government also offers loans directly to homeowners for energy-efficiency upgrades for up to $35,000 amortized over 12 years[33].

Homeowners who go through the Canada Mortgage and Housing Corporation (CMHC) to insure their mortgages can benefit from a refund of 10% off their insurance premiums if the mortgage is for an energy upgrade improving the house's energy rating to an ERS 77 or better. It is also valid to finance a new home purchase if it rates ERS 77 or better[34].

6.4. Government Incentives

According to our primary research results, governments are one of the beneficiaries of energy efficiency improvements. They have developed and applied several financing incentives to promote energy efficiency measures for houses. This section describes the different taxes, tariffs and incentives that are used to encourage homeowners to include energy efficiency equipments when building new homes.

6.4.1. Tax credits and rebates

One way of encouraging homeowners to add energy efficiency equipment to new-home constructions is to provide a tax credit. The US and Canada both apply this policy: tax credits can be used to finance large investment such as renewable energy systems, or smaller outlays on appliances. The conditions of these tax credits vary by country so only a few examples will be offered.

In the US, the Department of Energy offers renewable energy tax credits for residential buildings. The premise is that "consumers who install solar energy systems (including solar water heating and solar

[30] Contact at Vancity.com
[31] Industry Rep, interview
[32] TD, Product Manager - Home Improvement TD Canada Trust - Indirect Lending
[33] http://www.housing.yk.ca/green_home_programs.html
[34] http://www.cmhc-schl.gc.ca/en/co/moloin/moloin_008.cfm

electric systems), small wind systems, geothermal heat pumps, and residential fuel cell and micro turbine systems can receive a 30% tax credit for systems placed in service before December 31, 2016[35]."

In Canada, there are several programs that aim at reducing the costs of installing energy efficient appliances. The conditions of these programs vary depending on the province or even municipality. One example is provided by Saskatchewan, which exempts "New ENERGY STAR® qualified freezers, refrigerators, dishwashers and clothes washers[36]" from the 7% provincial sales tax.

6.4.2. Feed-in tariffs

In order to promote the adoption of energy efficient equipment, governments can also implement feed-in tariffs systems, meaning that the government requires electricity utilities to buy back energy produced out of renewable energies at higher-than-market prices. This system can be a way for households to finance renewable energy installations like PV panels for example. Indeed, households that install a PV system will get paid for the amount of power they feed-into the grid. This tariff also encourages households to reduce their energy consumption: the less they consume, the more they can feed-into the grid and pay back their investments. Utilities that pay a higher price for power produced out of renewable sources and fed into the grid, finance it by dividing the extra costs among all their customers. Germany has been a leader in the use of feed-in tariffs and many countries are now using this model as a reference that they adapt to their own needs. In Canada, the Province of Ontario has proposed a Green Energy Act that would include "Feed-in Tariff that guarantees specific rates for energy generated from renewable sources[37]".

6.4.3. Grants

Grants are another instrument that governments can use to share the costs of building energy efficient homes. They can be used to finance construction costs as well as appliance costs for energy efficiency. One example of an instrument that helps homeowners bear the extra costs of building high efficiency homes is the Gaz Métropolitain Novoclimat grant in Québec. It allows "buyers of new high-efficiency Novoclimat-certified houses heated with natural gas and located in Gaz Métropolitain territory [to] obtain a $2,000 grant from Quebec's Energy Efficiency Fund to help cover the extra construction costs for Novoclimat houses compared with conventional new houses[38]".

6.4.4. Others

There are similar government instruments that help homeowners finance their energy efficient construction or appliances, like government preferential loans, vouchers and quotas. Since each incentive or subsidy has different characteristics and conditions depending on the country, they will not be described in detail here. For more details on government incentives, the International Energy Agency provides a database that summarizes all the energy efficiency policies and measures globally[39].

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[35] US Department of Energy's website, "Consumer Energy Tax Incentives", http://www.energy.gov/taxbreaks.htm.
[36] Environment Canada's website, "Incentives and Rebates", http://www.ec.gc.ca/incitatifs-incentives/gc_fi_search_display.asp?id=39&jurisdiction=0&actionArea=4&keyword=.
[37] Ontario Ministry of Energy and Infrastructure's website, "Ontario's Proposed Green Energy Act", March 6, 2009, http://www.mei.gov.on.ca/english/energy/gea/.
[38] Environment Canada's website, "Incentives and rebates", http://www.ec.gc.ca/incitatifs-incentives/gc_fi_search_display.asp?id=39&jurisdiction=0&actionArea=4&keyword=.
[39] International Energy Agency's website, "Energy Efficiency Database", updated December 2008, http://www.iea.org/textbase/pm/index_effi.asp.

6.5. Community Level Systems

Because upgrading to ERS 100 requires significant investment in photovoltaic or geothermal energy reaching up to $130,000, larger scale development or a multi-building approach may offer a solution.

District energy systems and community level projects are another way of providing sustainable energy solutions to homes without the upfront capital costs being carried by the homeowner. By providing heating, cooling, water treatment, and other services at a community or multi-dwelling level, economies of scale can be achieved and technologies can be deployed that would not be economical at a unit level. Such approaches do not exclude other types of home upgrades: when combined with high performance homes, they provide overall net benefits at a community level. A complete analysis of community level systems is outside the scope of this study, but their considerable potential bears a brief mention.

One of the leading proponents of this approach in Canada is QUEST, a collaborative project involving a broad range of government and industry entities. Its stated mission is "to foster a community-based integrated energy approach to land-use, energy, transportation, waste and water and reduce related greenhouse gas, air pollutant emissions, and waste."[40] QUEST has identified the need to create a greater level of political exposure for Integrated Urban Energy Systems (IUES) at all levels of government and to develop a body of knowledge[41].

One community that is a model of success in this area is Drake Landing in Okotoks, Alberta. The Drake Landing Solar Community (DLSC) development consists of 52 detached homes connected to a central heating supply. Each home in the DLSC project is R-2000 certified (Alberta Built Green Gold). Passive solar collectors are installed on each home to collect solar energy for the community heating system and each home has separate solar collectors for passive solar hot water heating system. The 800 passive solar collectors capture up to 1.5MW of energy on a typical summer day. An antifreeze solution is circulated through the system to absorb the heat from the solar collectors. During the summer months, the heat energy is stored underground by pumping the fluid into a series of boreholes. When heating is required, the warm fluid is pumped from the boreholes and circulated. Each home has a heat exchanger that extracts heat from the circulated fluid and a forced air heating system provides warmth for the occupants. The majority of the mechanical equipment for the system is housed in a dedicated building (Energy Center) that includes pumps, auxiliary boilers, and short term thermal storage tanks. [42]

It is estimated that the heating system will provide 90% of the energy required to heat the homes once the system is fully operational. The resulting reduction in GHG emissions will amount to 260 tonnes per year. The combined savings in natural gas is estimated to be 65% to 70% for a standard home[43].

The DLSC pilot program is sponsored by Natural Resources Canada with ATCO Gas providing the energy system. It received approximately $7 million or about $135,000 per unit, half of which was attributed to the experimental nature of the project. Residents pay $60 per month to cover operational costs[44].

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[40]QUEST, Moving Forward: The Integrated Energy Systems Approach in Canadian Communities, March 2009,
http://www.questcanada.org/

[41] ibid

[42] Sibbitt, Onno, McClenahan, Thorton, Brunger, Kokko, et al. (n.d.). *Drake Landing Solar Community Project - Early Results*

[43] Phillips, R. (n.d.). *Here comes the sun.* Retrieved April 2009, 2009, from Building.ca

The Enwave deep water-cooling system in Toronto is another example of district heating system that demonstrates the viability of community-level financing. The resulting savings include a 90% reduction in electricity compared with conventional air-conditioning and a reduction of 79,000 tonnes of carbon dioxide annually[45].

6.6. Local improvement charges

Several experts that were interviewed mentioned the use of local improvement charges (LICs) as an instrument to finance energy efficiency improvements. This section describes the application of LICs and how they could finance energy efficiency.

6.6.1. Definition and current use

Municipalities currently use local improvement charges across Canada to "cover the costs of infrastructure improvements on public property[46] "like sidewalks and roads. Since these improvements generate high up-front costs, the municipality pays for and assigns them to the benefiting property owners. The improvement costs are "paid back in the form of an additional line item on top of the usual municipal tax over a set number of years by the owner of the property[47]." Examples of projects financed by LICs in various cities across Canada "include the installation of curbs, sidewalks, storm sewers, trees, street lighting, road paving, water mains, traffic calming measures[48]." In some provinces like Ontario, LICs can also be used to "pay for green space acquisition and park construction[49]", requiring the voluntary agreement of a certain number of property owners who will then divide the improvement costs and pay them back over a period ranging between 5 and 15 years according to the nature of the project[50]. It seems possible to apply LICs to other kinds of projects, especially projects "that benefit (at least in part) individual property owner[51]."

6.6.2. Application to energy efficiency measures

LICs have been used in certain municipalities to finance improvements for individual property owners. In Yukon for example, LICs have been used for a decade “to fund individual off-grid alternative energy power systems[52]”. At the beginning, LICs were used to enable inhabitants of rural areas to be connected to the electrical grid as well as the landline telephone service. But it appeared that alternative energy systems and energy efficiency measures were also very well suited for financing by LICs. Indeed, such systems have high up-front costs for the homeowner and have a long payback period. Including them in the property taxes reduces the barriers that prevent homeowners from investing in energy efficiency measures, allowing them to spread the costs over the lifetime of the asset. There are two differences between conventional LICs and their application in financing energy efficiency.

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[44] Phillips, R. (n.d.). Here comes the sun. Retrieved April 2009, 2009, from Building.ca: http://www.building.ca/issues/ISarticle.asp?id=196542&story_id=383130143345&issue=02012008&PC=

[45] Enwave. (n.d.). Retrieved April 13, 2009, from Enwave: http://www.enwave.com

[46] Pembina Institute, “Using Local Improvement Charges to Finance Building Energy Efficiency Improvements”, (May 2004), p.4, http://pubs.pembina.org/reports/LICProgramFinal%20ReportMay27042.pdf.

[47] ibid.

[48] ibid.

[49] ibid.

[50] ibid.

[51] ibid., p.5.

[52] ibid., p.6.

These systems are entirely contained on the resident's private property and do not provide direct benefits to other residents. Once paid for, these systems are fully owned by the resident — they are not municipal property[53].Since the system is attached to the property and not to its owner, the payments will be made by the current owner of the house and be transferred to the next owner if the house is sold.

6.6.3. Successful examples of LICs

This section describes two successful implementations of LICs to finance energy efficiency. The first example is the Rural Electrification and Telecommunications Program in Yukon and the second is the Financing Initiative for Renewable and Solar Technology in Berkeley, California.

Rural electrification and telecommunications program in Yukon

This program started in 1984 to "facilitate the extension of electrical services to rural residential, small load commercial and other non-industrial property outside incorporated communities[54]." After the success of this program, its scope has been expanded to include the financing of "alternate energy systems for private use[55]." The Yukon government helps the homeowner make informed decision about the project and then the "financing of approved projects is 100% cost-recoverable from the property-owner(s)[56]."

Financing Initiative for Renewable and Solar Technology in Berkeley, California

The Financing Initiative for Renewable and Solar Technology (FIRST) was launched as a pilot project in November 2008. This program is focused only on solar energy and "provides property owners an opportunity to borrow money from the City's Sustainable Energy Financing District to install solar photovoltaic electric systems and allow the cost to be repaid over 20 years through an annual special tax on their property tax bill[57]." The pilot project has been incredibly successful, as shown by the speed at which applications were submitted on the launching day: "applications to claim the $1.5 million available for the pilot were submitted within 10 minutes[58]!" Currently 38 solar projects are under way and the first two installations of solar photovoltaic systems we been completed in March 2009[59]. The project is very successful in California and it could have a positive impact on other municipalities. Indeed, "as of summer 2008, the city had received more than 1,300 inquiries from municipalities around the world asking how this program will be implemented[60]."

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[53] ibid., p.6.

[54] Yukon Department of Community Services, "Rural electrification Policy and Guidelines", updated February 2009, http://www.community.gov.yk.ca/pdf/RETP-PG-E.pdf.

[55] Yukon Department of Community Services, "Rural Electrification and Telecommunication Program Brochure", updated February 2009, http://www.community.gov.yk.ca/pdf/RETP-B-E.pdf.

[56] ibid.

[57] City of Berkeley's website, "Berkeley FIRST Financing Initiative for Renewable and Solar Technology", http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=26580.

[58] Merrian C. Fuller, Stephen Compagni Portis, and Daniel M. Kammen, "Toward a Low-Carbon Economy: Municipal Financing for Energy Efficiency and Solar Power", January-February 2009, http://www.environmentmagazine.org/Archives/Back%20Issues/January-February%202009/FullerPortisKammen-full.html.

[59] City of Berkeley's website, "First Two Projects Financed Through Berkeley FIRST", http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=19378.

[60] Merrian C. Fuller, Stephen Compagni Portis, and Daniel M. Kammen, "Toward a Low-Carbon Economy: Municipal Financing for Energy Efficiency and Solar Power", January-February 2009,

Ultimately, it is likely that a multi-faceted approach needs to be pursued that would include an array of financial instruments to lessen costs on the homeowners, since one instrument alone will not suffice.

7. Financial instruments Summary

7.1. Gap Analysis

In assessing the array of existing financial instruments, it is observable that the breadth of the solutions available is considerable. However, many are not widely known or applied, which leads to the conclusion that they are being applied locally or in some silo. Comparing the pros and cons of each instrument highlights the need for improvements. The gap between the current state and the desired state in explained in Table 4.

Table 4: Gaps to be addressed

Stakeholder	Current State		Opportunities for improvement
	Pros	Cons	
Rental-Ownership model			
Homeowner	Upfront capital costs are avoided	Payment period is unlimited	Learn from successful examples like Kingston, Canada or in the US National availability
Utility company	Experience to operate and maintain equipment Know-how to dispose and recycle the equipment	Requires a shift in the way utilities do business and get compensated	
Energy Service Companies (ESCOs)			
Homeowner	High upfront capital costs are repaid over a long time Develops awareness for energy consumption patterns	Not attractive when energy prices are low Fear of long-term commitment	Learn from experiences in the industrial sector Increased awareness Authorize ESCOs to trade emissions within the ETS framework
Utility company	Encourages performance since revenues are linked to energy savings Creates long-term relationship with the customers	Not well developed in the residential sector (energy and cost savings are lower in this sector than in the industrial sector)[61]	

http://www.environmentmagazine.org/Archives/Back%20Issues/January-February%202009/FullerPortisKammen-full.html.

[61] Diana Ürge-Vorsatz et al, WEC ADEME project on energy efficiency policies, "An Assessment of on Energy Service Companies (ESCOs) Worldwide", March 2007, http://www.worldenergy.org/documents/esco_synthesis.pdf.

Stakeholder	Current State		Opportunities for improvement
	Pros	Cons	
Green Mortgages			
Homeowner	Renders energy efficient housing more accessible	Poor education on availability Lack of awareness Higher rate Many conditions Risk of "green washing"	National coordination All banks involved Competitive rates Learn from best practices in other countries like the US or Australia
Bank	Opportunity for differentiation (marketing strategy)	Lack of experience in Canada (Private green mortgage financing is recent and limited - around 2 years) Limited offer	
Green Loans			
Homeowner	Specifically designed to finance wind, solar or geothermal equipment Long pay back periods Competitive rates	Poor marketing Limited offer Limited to retrofit	Learn from existing programs for low interest loans offered by utilities or provinces (e.g. PEI and Yukon)
Tax credits, rebates and grants			
Homeowner	Offers financial relief	Limited to retrofit Siloed offer	Performance measurement: monitor existing programs and evaluate their impact Learn from past programs' successes and failures (ex: COSP)
Society		External effects not controlled Not voluntary: the society finances improvements through taxes	
Feed-in tariffs			
Homeowner	Encourage households to install renewable energy and control their energy consumption to maximize the amount they feed in the grid	Not attractive when energy prices are low	Learn from successful examples abroad Less bureaucracy around feeding-in enrolment and requirements
Society	Reduced GHG emissions	Not voluntary : tariffs are financed by all including low-income households	
Government	Help to achieve existing commitment in GHG emissions reduction	Appropriate regulations need to be implemented	
"Green" industry	Generate demand and stimulate the industry		

Stakeholder	Current State		Opportunities for improvement
	Pros	Cons	
Community level systems			
Homeowner	Upfront capital costs shared between members of the community	Common infrastructure with fees	Learn from successful examples like Okotoks or Dockside Green Successfully demonstrate innovative business models communicate to the markets
Builder	Especially relevant for new construction Economies of scale	Harder to realize than for a single house (more parameters) Hard to implement in existing cities where infrastructures are in place	
Utility company	Opportunity for differentiation (marketing strategy)	Expensive pilot programs Requires a shift in the way utilities do business and get compensated	
Homeowner	Additional costs are shared by owners over time and not borne only by the original buyer Voluntary Repayment associated with the property as opposed to original building owner	Higher payments to the municipality	Learn from successful examples in Canada (Yukon) and abroad (California) Need regulatory changes conducive to this model
Society	Make energy efficiency improvements available to multiple segments		
Government	Help to achieve existing commitment to reducing GHG emissions[62] Experience of LIC for public improvements	Risk of default on LICs (very low) The municipality needs to be able to provide the necessary initial financing Competent staff is required to administer the program[63]	

[62] Pembina Institute, *Using Local Improvement Charges to Finance Building Energy Efficiency Improvements*, (May 2004), http://pubs.pembina.org/reports/LICProgramFinal%20ReportMay27042.pdf.
[63] ibid

8. Recommendations

8.1. Ownership

When high-energy efficiency or energy renewable systems need repairs or replacing, the homeowner rarely has the knowledge and capacity needed to do an efficient job. In contrast, the utility company or system provider does. Therefore ownership of the equipment should be retained by those best suited to manage it. The rental model should be made available for all complex or costly pieces of equipment. The value proposition for the equipment provider is that the rental fees paid over long rental periods offset the risks associated with renting its equipment to homeowners.

To reiterate this point, ESCO mechanisms are also a valid way to finance costly equipment and show how future savings can lessen the burden of high up-front costs to the homeowner. However, Canadian ESCO mechanisms are mainly used for commercial real estate because "Energy and cost saving possibilities of a single project/ site are usually small compared to the transaction costs especially in cases when ownership of buildings is dispersed among many private owners". An ESCO doubled with a Community level system, however, could be worthwhile. A concerted effort to offer a rental solution for smaller equipment and an ESCO solution for larger, more costly equipment is a valid approach. In order to do so, collaboration between suppliers, municipalities and homeowners is required.

8.2. Long term loans

Green mortgages need to offer preferential rates and fluctuate as does the prime rate. Conditions such as when the house or the energy-efficient appliances were bought should be eliminated to facilitate access to these financial solutions. All Canadian banks should offer these green products to appeal to their clientele. Green mortgages should also be made available when refinancing comes up and as homeowners of energy-efficient houses become aware of the products' existence. To summarize, there are too many conditions in obtaining a green loan and not enough advertising. Canadian banks should follow suit with the US solution that facilitates downtown living by offering a location-based mortgage which allows people to buy more expensive houses in the high density cores since these homeowners will not own a car and will thus have more money to pay for a mortgage. Banks need to develop complete solutions serving the multitude of needs in addition to advertising and training their loan agents accordingly.

8.3. Awareness building

Several respondents mentioned education as a good non-financial instrument to promote energy-efficiency. Currently governments are offering different types of incentives to encourage energy-efficiency but could have a greater impact by investing in education and awareness building. In fact, when education on energy-efficiency measures comes from private stakeholders, it is often perceived as being biased. The government is perceived as a neutral party that can inform the public about best practices and energy-efficient measures in the residential sector. Banks and the Canada Mortgage and Housing Corporation should work with all levels of government to increase public awareness of the availability of financial instruments oriented to going green.

8.4. Leadership

Currently, solutions are regional and isolated. To overcome this barrier “government leadership or at least commitment to energy efficiency, energy efficiency obligations on utilities, demonstration projects,

project bundling, information campaigns and training programs […]"[64] is necessary. Governments need to realize that if market conditions are favorable and demand for energy services increases, the savings potential and Canada's commitment to achieving energy targets are well worth addressing and championing. A department like NRCan or Environment Canada is well positioned to do so. In fact, the Energy Efficiency Act of 1992 stipulates that the Minister of Natural Resources has the power to "undertake such other projects, programs and activities as in the Minister's opinion advance that purpose."[65]

9. Next Steps

Additional research needs to be done to complete the assessment of financial instruments designed to improve residential energy efficiency. On the basis of interviewee input, the following is recommended:

- Contact NRCan to get a full study on savings (Suzanne Deschênes);
- Consult the CMHC report: *Canadian Loan Fund for Residential Energy Efficiency and Renewable Energy*when it becomes public in September;
- Evaluate the Western Climate Initiative for carbon pricing system;
- Assess increased value for green homes by contacting Chris Chopik at Evolution Green: Chris@EvolutionGreen.com;
- Analyse Sevag Pogharian, architect, ROI calculations for a Net-Zero home in Alstonvale, QC. http://www.greenbuildingfest.com/Presentations/2007/EQuilibrium-Alstonvale-Sevag%20Pogharian-GBF2007.pdf;
- Educate ourselves on upcoming changes to the Municipal Act by contacting Sonja Persram, BSc., MBA, LEED, sonja@sustainable-alternatives.ca;
- Consult Ryan Scott (Avalon, Equilibrium) who is involved in new financial models;
- Look into a builder's website from Texas that is offering prefabricated houses at Net-Zero (Chris Krager, Company website: www.solaustin.com);
- Analyse Net-Metering in Ontario and British Columbia;
- Interview second generation of Net-Zero home builder Peter Ameron in Edmonton ; and
- Communicate results of this study to interviewees and stakeholders

10. Conclusion

Financial instruments enabling homeowners to access homes that are energy efficient are not cohesive in Canada, they are offered without notable promotion and they are not widely popular. This is not the case in other countries like Germany or the United States. Canada is lagging in this area. Nevertheless, some instruments are effective in stimulating demand and allocating costs closer to all beneficiaries but only in local applications such as municipalities like Victoria (with its community Dockside Green), Okotoks and even Kingston. Canada could make a good use of these examples as well as other countries' experiences to make its residential sector green.

Simple design answers including the orientation of a home can provide passive solar energy, which costs nothing and can significantly reduce the amount of energy consumed[66]. Evan that is not a widespread practice in Canada. It would require the appropriate education and training of the design and

[64] Ibid, p.11 and following
[65] Energy Efficiency Act, 1992, Article 21 (e), http://laws.justice.gc.ca/en/showdoc/cs/E-6.4/bo-ga:l_II-gb:s_21//en#anchorbo-ga:l_II-gb:s_21
[66] Industry Associations, interviews

construction industry to make such a change happen. More complex technological solutions to energy efficiencies are costly and require correction to the current value proposition for homeowners who carry the burden of financing the associated high up-front costs. Isolated solutions that are currently observable need to improved, harmonized and applied nationally.

In isolation, the suite of instruments analyzed here is insufficient to provide the proper incentives for homeowners. They need to be offered in alignment with other products to truly be effective in achieving the desired outcome. This highlights the need for collaboration between financial institutions, utility providers and levels of government. Such collaboration can be achieved only if the proper leadership is in place. The federal government through its Department of Natural Resources Canada is well positioned to provide that leadership.