2015
Greenest City Scholars
City of Vancouver

Non-Market Multi-Family Housing Energy Retrofit Analysis

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Executive Summary

In 2009, in an effort to become the greenest city in the world, the City of Vancouver partnered with 120 organizations and 35,000 professionals to develop the 2020 Greenest City Action Plan (GCAP). Since 2010, the University of British Columbia Sustainability Initiative (USI) has partnered with the City of Vancouver through the Greenest City Scholars Program to help advance the City towards the goals of the 2020 GCAP. In April 2015, the City of Vancouver Sustainability Group identified non-market housing as a sector with potential for reduction in GHG emissions through energy retrofits.

The City of Vancouver currently has 24,950 non-market housing units spread over 484 housing projects operated by 208 different organizations, and is actively pursuing the addition of 5,000 new housing units to their stock. The majority of these units were built between 1950 and 2000 and considering the advancements of mechanical equipment to cool and heat buildings built since then, these buildings have potential for energy savings and reduction of GHG emissions.

The BC Housing, BCNPHA, BC Hydro, and FortisBC administer energy retrofit programs that have reduced GHG Emissions from their directly managed non-market housing projects significantly. In 2013 BC Housing reduced GHG Emissions from directly managed housing projects by 32% relative to their 2005 baseline. Furthermore, in June 2014, the City of Vancouver Sustainability Group presented an administrative report (RTS No. 9983) to the Standing Committee on Planning, Transportation and Environment on Energy Retrofit Strategy for Existing Buildings. The report identified energy benchmarking - the mechanism by which energy consumption data is gathered, assessed, and compared to the energy performance of similar buildings - as an influencer to owners reducing their energy consumption. The involvement in energy benchmarking has led to a 7% reduction in energy use in participating buildings over a 3 year period. By expanding the plans of this report to include all non-market housing projects on City-owned properties, further headway to reduce GHG can be made.

By increasing the scope of current programs within the City of Vancouver to enable easy access to data that allows non-market project owners to evaluate the current state of their energy consumption, as well as incentivizing them to participate in established energy retrofit programs from BC Housing, BC Hydro, and FortisBC, significant improvements can be made in the non-market housing sector that will reduce GHG and move the city one step closer to becoming the greenest city in the world.

Part 1: Introduction

2020 Greenest City Action Plan

In 2009, Mayor Gregor Robertson formed the Greenest City Action Team comprised of local experts with the mission of identifying best practices towards greening a city from leaders around the world. The team developed the goals and targets that would later become the basis for the 2020 Greenest City Action Plan (GCAP). The 2020 GCAP is a comprehensive document developed through rigorous efforts from over 60 City staff and more than 120 organizations along with contributions from more than 35,000 people around the world.

The 2020 GCAP serves as the road map for the City of Vancouver becoming the greenest city in the world by 2020. The Action Plan outlines 10 goals as targets for 2020:

1. Green Economy
2. Climate Leadership
3. Green Buildings
4. Green Transportation
5. Zero Waste
6. Access to Nature
7. Lighter Footprint
8. Clean Water
9. Clear Air
10. Local Food

The focus of this report will be on Target 2 of Goal 3: Green Buildings, set to "[r]educe energy use and GHG emissions in existing buildings by 20% over 2007 levels." The baseline from 2007 levels for this target is 1,145,000 tCO_2e and the 2020 target is set at 920,000 tCO_2e. As of the 2014-2015 Implementation Update, GHG emissions have been reduced by 5% and stand at 1,085,000 tCO_2e.

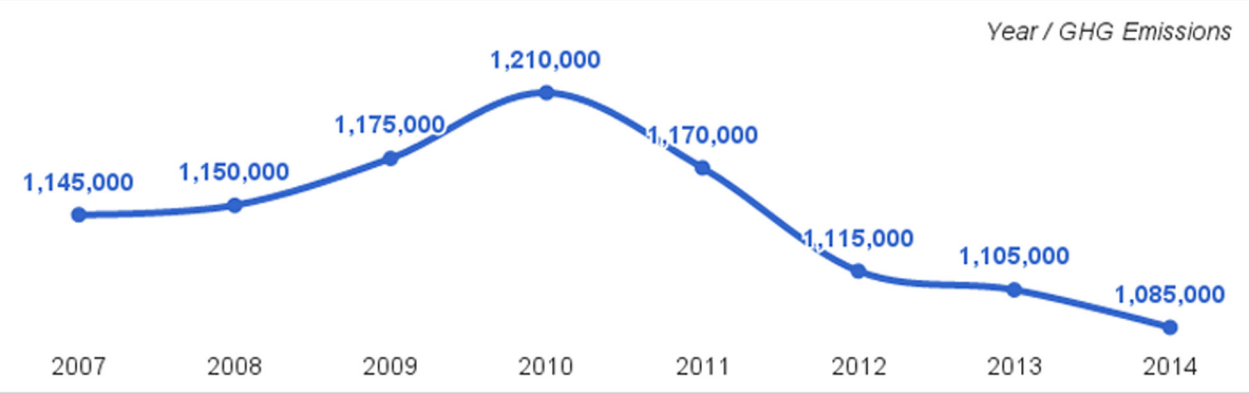

Figure 1. Total tCO_2e emissions from all buildings in Vancouver.

Although GHG emissions have only been reduced by 5% over the 2007 levels, it is

important to note the increase from 2007 to 2010 and the 11% reduction in four years since 2010.

Greenest City Scholars Program

The University of British Columbia Sustainability Initiative (USI) and the City of Vancouver have been collaborating since 2010 in sponsoring graduate students working with the City in advancing the 2020 Greenest City Action Plan. Every year a number of graduate students join forces with different departments and teams within the City of Vancouver to research and formulate plans that support specific goals of the 2020 GCAP. Until 2015, 59 projects have been completed under this collaboration.

This report is based on one of twenty research projects that were performed during 2015. This project was carried out by Hooman Shahrokhi, MASc Student in the Civil Engineering - Construction & Project Management Program at UBC and mentored by Micah Lang, C40 Green Building Planner from the Sustainability Group at the City of Vancouver.

Non-Market Housing Energy Retrofit Analysis

The Sustainability Group has identified non-market housing - affordable housing where rent is not determined by market conditions - as a sector with potential for reduction in GHG emissions specifically through energy retrofits. Therefore, the goal of this research project was set to analyze the current conditions of this housing stock, exploring measures already in place towards Goal 3 of the 2020 GCAP, and identifying potential avenues of supporting the sector in advancing the goal.

Vancouver Non-Market Housing Stock

Housing affordability is a challenge in Vancouver and for those with low income it is particularly difficult to find affordable housing options. The City of Vancouver has measures in place to protect the current affordable housing stock and the Council is actively pursuing the addition of 5,000 new housing units to the stock. Currently, the City of Vancouver has 24,950 non-market housing units spread over 484 housing projects operated by 208 different organizations.

Ownership & Operation

The housing projects are owned and operated by a number of different organizations.

They can generally be divided into four groups: 1) public housing - owned and operated by government agencies; 2) nonprofit housing - owned or operated by nonprofit organizations; 3) co-operative housing - owned and operated by co-operative associations; 4) urban native housing - owned or operated by nonprofit organizations targeted to the aboriginal people.

A breakdown of project ownerships is presented in fig. 2. It is important to note that most projects are not operated by their owners. For example, of the 206 projects on City owned property, less than 5% are operated by the City. Another important factor to note is that these projects have about 30 different types of operating agreements with BC Housing, which regulates operations in exchange for different types of assistance. These organizational arrangements become challenges in performing energy upgrades as demonstrated later in this report.

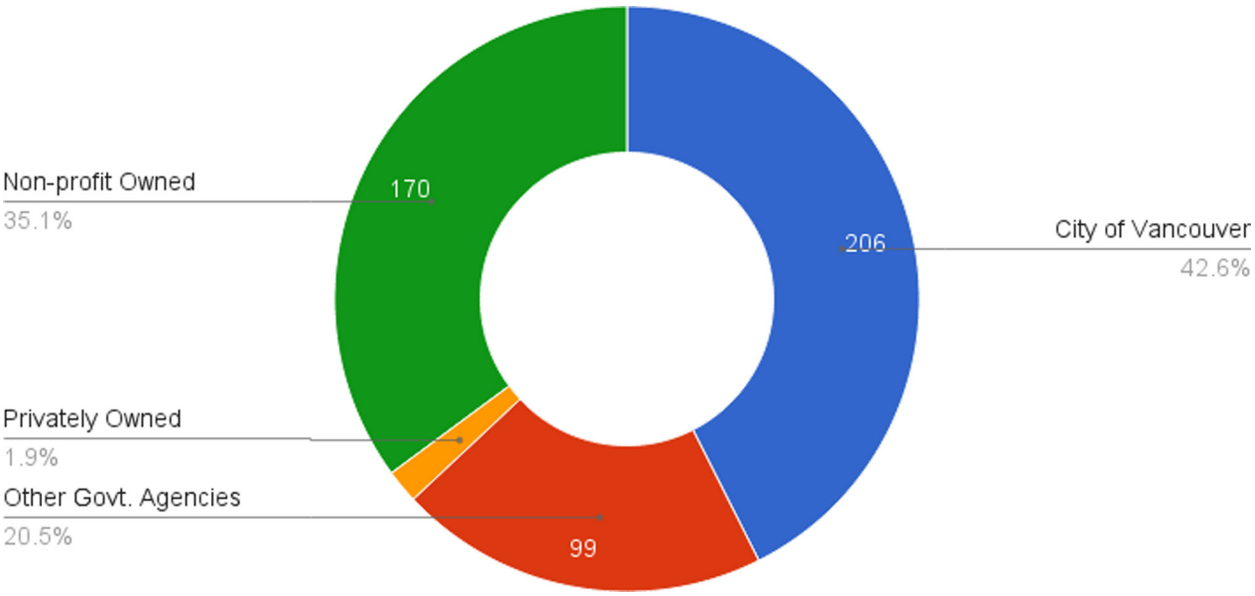

Figure 2. Breakdown of non-market housing project ownership.

Sector Breakdown

The focus of this research has been set on three subgroups of the largest operators and projects, selected because they collectively represent a significant percentage of the non-market building stock and some of their data was available for analysis. The projects selected are mainly the larger projects with the assumption that they have a potential for larger impact. The three groups are assembled as such:

1. 209 projects operated by operators with at least 10 projects.

2. 36 projects operated by operators with at least 200 units.
3. 18 projects with at least 100 units.

In total, the above 3 subgroups consist of 263 projects with 15,657 units and are operated by 39 different organizations. It is important to note that all facts and figures presented in this section are based on these 263 projects.

A breakdown of project building sizes is shown in fig. 3. As expected, the density of larger buildings is easily noticeable in this graph. It is important to note that while high-rise buildings make up only 10% of all projects, they account for 21% of all units in the housing stock. It is also important to note this fact as it may be argued that upgrades to higher density housing will affect more units and more people, or that upgrades aimed at low-rise buildings should be prioritized as they account for over two-thirds of the housing stock.

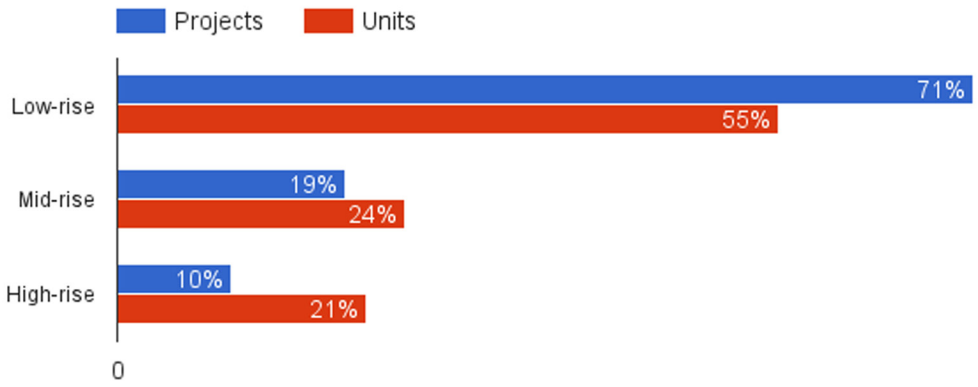

Figure 3. Number of projects compared to number of units per project size.

As demonstrated in fig. 4, most of the housing projects were built between 1950 and 2000. Considering the growing use of mechanical equipment to cool and heat the buildings built during that period, it is safe to identify those buildings as ones with the largest potential for energy savings and reduction of GHG emissions.

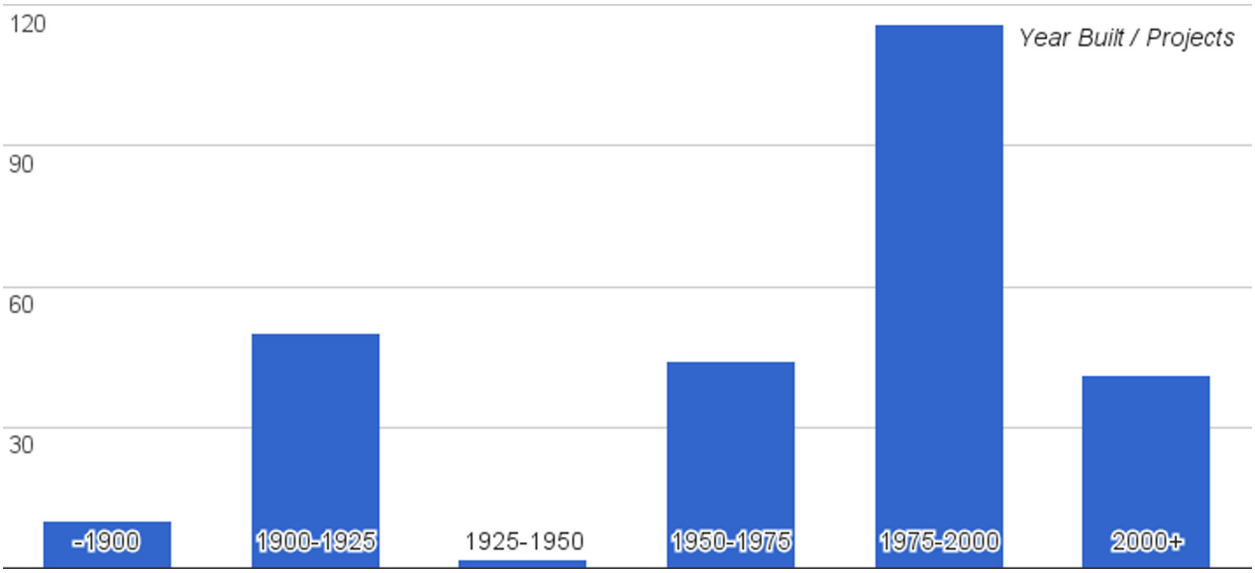

Figure 4. Project distribution by year built.

Project Spread & Map

An interesting fact about the concentration of this sector becomes evident when projects are broken down by location. About 69% of all non-market housing projects are located within 5 of 22 official neighborhoods in the City of Vancouver. Fig. 5 shows the top 10 neighborhoods with the largest number of housing projects and fig. 6 shows a map of the City with all projects divided into groups as outlined earlier in this report as well as broken down into neighborhoods with the top 6 neighborhoods highlighted in shades of green - with the intensity of the green shade indicating the intensity of the concentration.

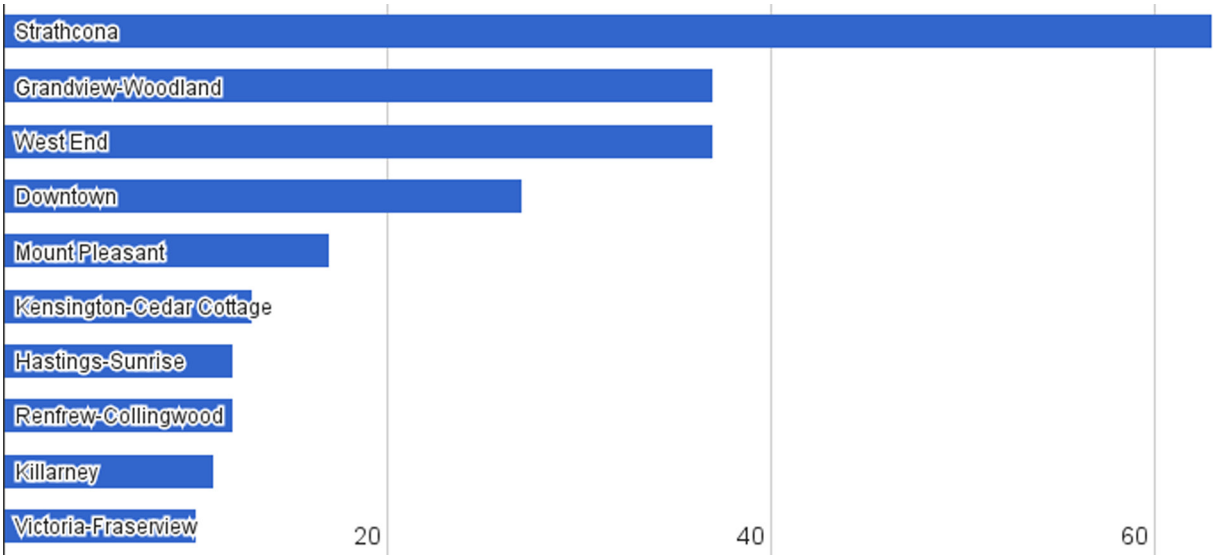

Figure 5. Top 10 neighborhoods with largest number of non-market housing.

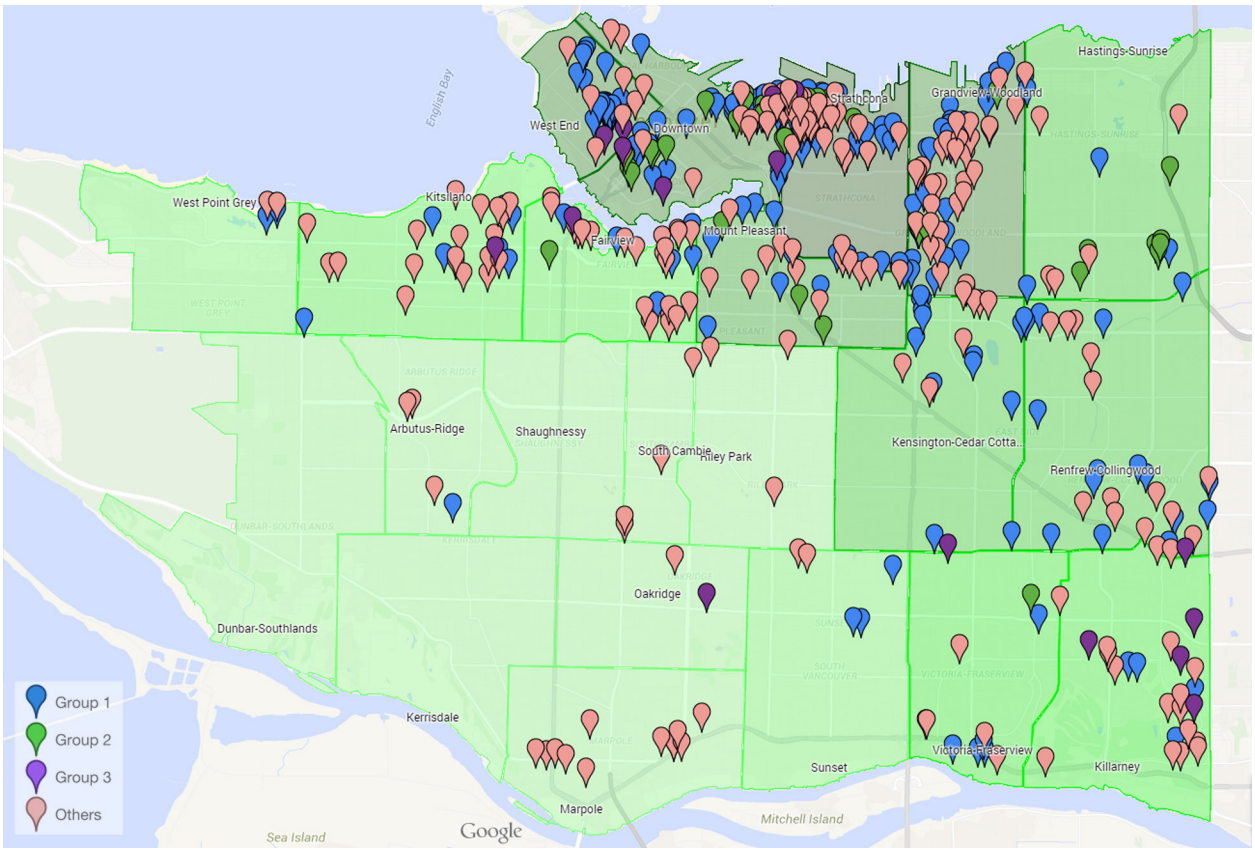

Figure 6. Map of the City showing all non-market housing projects and all 22 neighborhoods. The intensity of the green shading correlates with the intensity of the concentration of housing projects in that neighborhood.

Stakeholders

As previously discussed, there are many parties involved in the operation of non-market housing projects in the City of Vancouver. These organizations share the same goal of providing affordable housing to residents who need it but the efforts for each may be different. An effective and productive working relationship between the different stakeholders is key to successful cooperation and advancement of the common goal.

City of Vancouver

The City of Vancouver has interest in the non-market housing sector in a few different ways. The first and probably most important interest is to increase the affordability of the housing market for all residents and especially those who are in need of assistance. The City also owns the land - and in many cases, the improvements if a lease is not extended - of about 43% of all non-market housing projects. However, most of these properties (about 95%) are

operated by other organizations, mainly nonprofit organizations. The City also operates 12 housing projects, 10 of which are owned by the city and 2 that are owned by the Province.

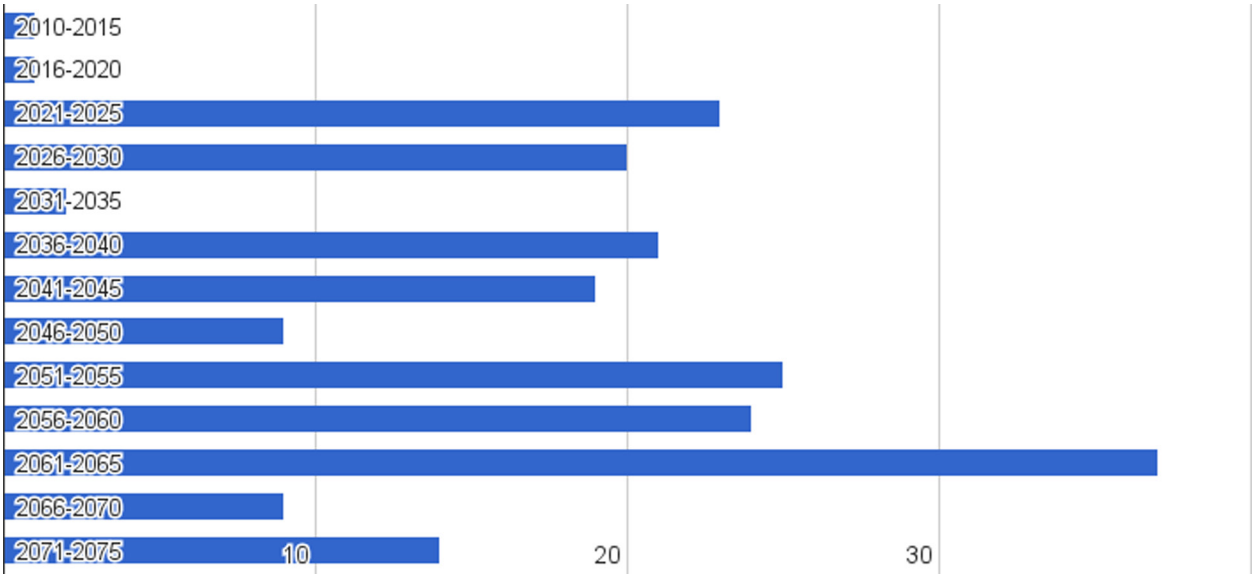

Figure 7. Number of non-market housing project leases expiring per date range on City-owned property.

One of the ways the City of Vancouver is improving housing affordability is by providing non-profit housing organizations with long-term leases with often $1 as total rent on City-owned properties. The graph above (fig. 7) shows the number of leases expiring per date range. As evident in the graph, 99% of all leases expire past the 2020 GCAP deadline of reducing GHG emissions by 20% since 2007 levels. 78% expire after 2030 and over 50% expire past 2050. Considering the City's vested interest in the condition of these properties, there is great opportunity for the City to get involved in retrofits that advance the 2020 GCAP goals.

Moreover, through an interview with City of Vancouver Housing Operations staff, John Hunter, it is determined that projects operated by the City require a thorough investigation of the general property conditions which seem to be poor based on staff knowledge as well as scattered information from building conditions assessments obtained through BC Housing and BCNPHA. This information may be indicative of general conditions at other City-owned properties and requires more thorough investigation. However, the existence of poor conditions in City-owned-and-operated buildings provides a direct and reachable opportunity for the City to get involved with energy retrofits.

Additionally, the interests of the City's Real Estate and Business Planning departments

must be taken into consideration when considering any investment in energy retrofits in such projects. The cooperation of the above named departments is required in aligning overarching City goals and plans.

BC Housing

With ownership of 19%, operation of 6% and providing assistance to over two-thirds* of all non-market housing projects in Vancouver, and a contribution of $610.2M in 2013/14 towards their mission "to assist British Columbians in greatest need of affordable housing," BC Housing is the largest player in this sector (fig. 8).

Although BC Housing's services range anywhere from emergency shelter to home-ownership (fig. 8), its stock of non-market housing projects, operation of projects and assistance to nonprofit organizations in operating housing projects in the City of Vancouver is only of interest to this report.

Since their establishment of the livegreen Housing Sustainability Plan in 2010, BC Housing has increased and formalized their efforts through a triple bottom line approach to provide sustainable housing options. By 2013, through the Housing Excellence strategy area, BC Housing reduced GHG emissions from directly managed housing projects by 32% relative to their 2005 baseline.

Their continued efforts in creating incentive programs and partnerships with utility companies exemplifies their commitment to a sustainable future. These incentive programs and partnerships will be further discussed in later sections of this report. BC Housing's influence and reach over the social housing sector cannot be overlooked and any program or local effort through the City of Vancouver could benefit from a collaboration with BC Housing.

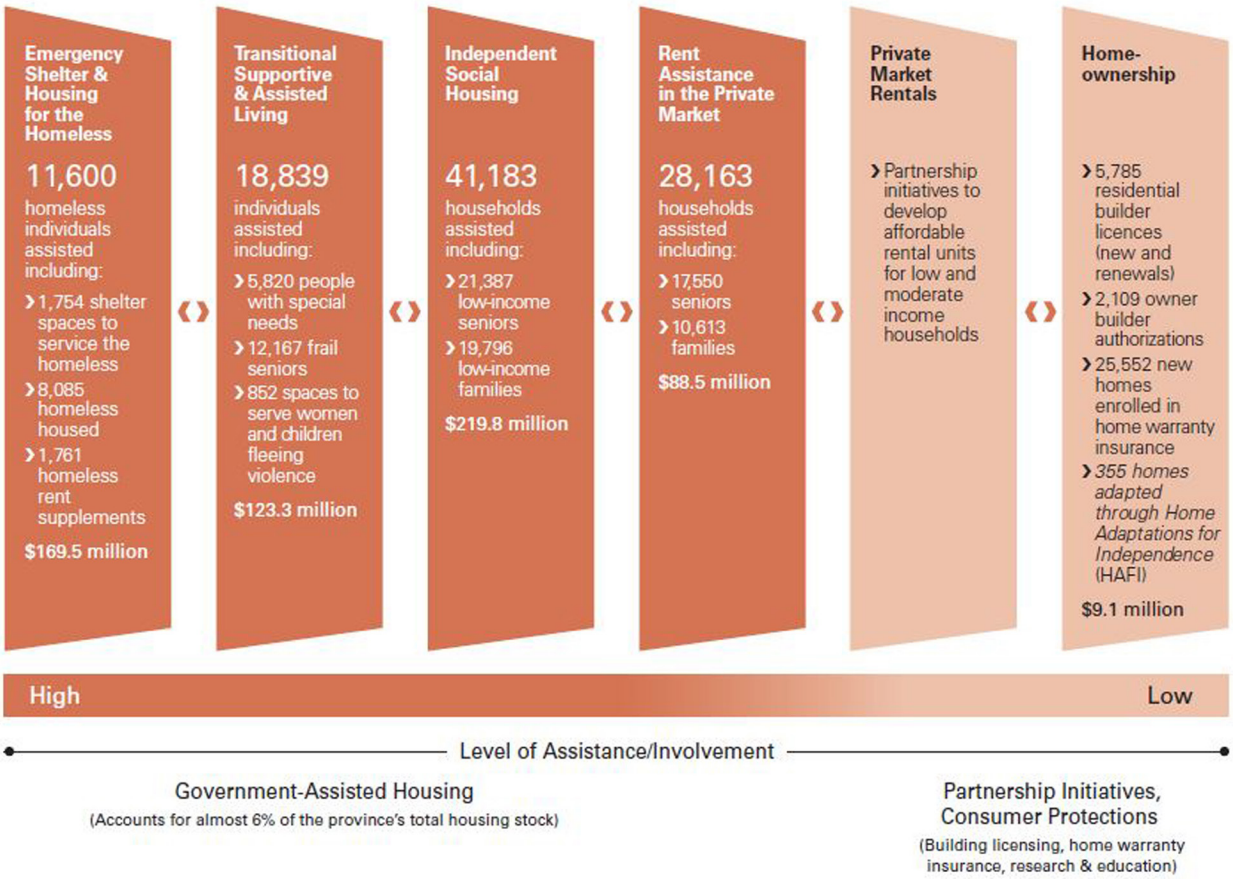

Figure 8. BC Housing's contribution towards the housing continuum in 2013/14. Reprinted from BC Housing - What we do, by BC Housing. Retrieved July 15, 2015 from http://www.bchousing.org/aboutus/activities. Copyright 2015 by BC Housing.

BC Non-Profit Housing Association (BCNPHA)

Although BC Non-Profit Housing Association does not operate housing societies, they provide a wide range of services to other nonprofits which do. BCNPHA "provides leadership and support to members in creating and supporting a high standard of affordable housing throughout British Columbia." One of the areas they work on is Energy Management. Their efforts in this area are twofold:

1. "To advocate on behalf of the sector and develop incentive funding programs…"
2. "To act as the extended staff for housing providers…"

Through an interview with Ian Cullis, Manager of Energy Services, it was determined that BCNPHA's role in assisting housing societies with identifying and performing energy retrofits is crucial. Many of the housing societies that benefit from BCNPHA's services

are not staffed with specialists that can identify sources for improvement and even when they do, navigating the logistics of applying for incentives through the utility companies and BC Housing can become challenging. BCNPHA's involvement with both sides of the equation, allows them to streamline the process for housing societies interested in taking advantage of the available programs.

With that in mind, the Energy Management team at BCNPHA is faced primarily with one challenge. The team consists of two members - the Energy Services Manager and the Energy Specialist - and non-profit housing societies from all over the province which could benefit from their services. Both staff members work at full capacity and when asked about their limiting factors in assisting more housing societies, Ian Cullis identified time as the main factor. However, he went on to use the chicken and egg analogy in pointing out that with more staff, they would need more funding to reach more societies and vice-versa, with more funding, they would need more manpower to expand their reach. Therefore, one without the other may not necessarily lead to a wider reach.

Nonprofit Operators

There are 206 different nonprofit organizations in the City of Vancouver that operate at least one non-market housing society. Of these 206 organizations, 37 of them operate just about 63% of all non-market housing units in the City. In other terms, the top 18% of nonprofit operators - as far as the number of units they operate - are in charge of 64% of all units available in the City. To reach and influence operators identified as groups 1-3 earlier in this report, would affect a significant portion of this sector and is recommended for any outreach program.

Part 2: State of Sector

Data Collection

From very early on in this study, it was determined that a comprehensive dataset did not exist that could paint a clear picture of this housing sector. Through aggregation of multiple data sources, a database with as much relevant data as feasibly possible was created to acquire an idea of the makeup of this sector. This database is built upon the Vancouver Non-Market Housing Inventory database maintained by the Housing Policy & Projects office at the City of Vancouver. Information such as the year built and major improvements year were obtained through property tax data. High-level redevelopment potentials were obtained through the Business Planning office. Sparse energy consumption data were obtained through BCNPHA. Partial energy audit data were obtained through BC Housing. Manual searches were performed on Google Maps to determine approximate building sizes.

Initially, the aim of the study was to collect enough energy consumption data and general building conditions to be able to make a reasonable generalizations about the non-market housing sector in the City of Vancouver. However, the scope of the project did not allow for such rigorous data collection. In turn, case examples are used to demonstrate the conditions and opportunities at some of the buildings on this list.

Data Discrepancies

Cross-checks were performed in order to confirm the validity of data that was obtained from multiple sources. Aside from challenges in matching the data, there were data integrity issues that could not be explained. Generally, the information that was reported to the different sources for information was not passing the validation checks. For example, energy consumption data for the same building that was collected through the City was not matching with what was collected through BCNPHA. Another example is the square footage of multiple buildings that were significantly different from one source to another and neither matched with approximate calculation of square footage through City of Vancouver VanMap Pictometry. Due to the unreliability of such information, they were excluded from the dataset and as a result, reasonable generalizations are unable to be formed.

It is worth noting that there may be valuable information collected and stored by the

different stakeholders that were not identified or used in this research project. One of such data sources which could have been useful to this research project lies with BCNPHA. They collect energy consumption data from projects that they have worked on and ask for regular energy reporting on thereafter. However, due to limited resources, they have been unable to organize this data in a useful manner. In an effort to make use of the data, the Energy Specialist at BCNPHA is currently recruiting volunteers to help with organizing this information. Other stakeholders such as BC Housing may hold more accurate and thorough information collected through Building Condition Assessments commissioned by them.

Need for Better Understanding

As demonstrated above, there is a need for better understanding of the landscape of the non-market housing sector for the purposes of identifying energy retrofit opportunities, estimating investment requirements, and measuring the impact. Discrepancies in the data currently available causes significant uncertainty in the validity of any generalizations drawn as to the energy consumption patterns or building conditions.

Energy benchmarking is a trusted approach in collecting and tracking energy consumption to then be compared with other buildings with similar functions. As part of the Retrofit Strategy for Existing Buildings, the City will collect data on its own buildings and voluntary participants. According to the US Environmental Protection Agency (fig. 9), buildings that used ENERGY STAR Portfolio Manager for 3 consistent years, realized energy savings of 7%. This exemplifies the benefits of having an understanding of current usage and conditions of a building.

Through collaboration with other municipalities and the provincial government, the City of Vancouver is working to put in place processes and tools to facilitate voluntary building energy benchmarking.

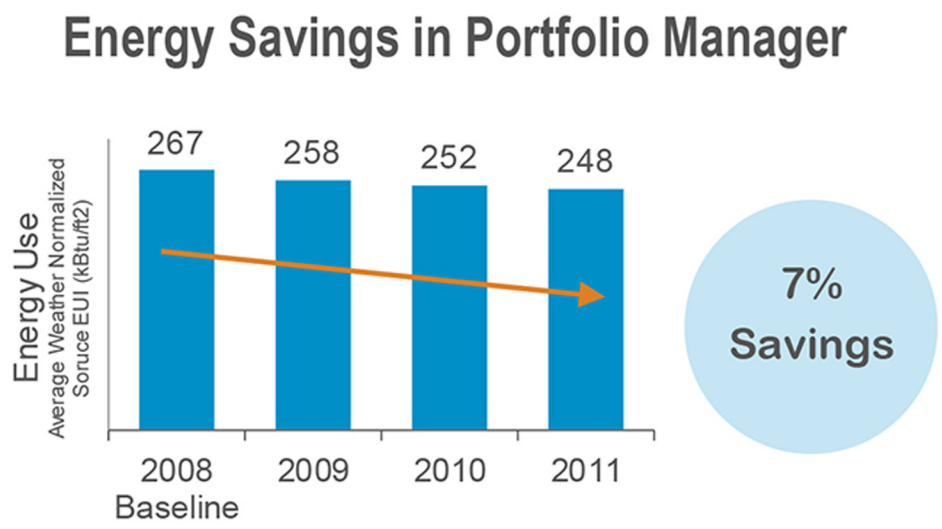

Figure 9. Energy savings in Portfolio Manager. Reprinted from Learn about benchmarking, by United States Environmental Protection Agency. Retrieved July 15, 2015 from http://www.energystar.gov/buildings/about-us/how-can-we-help-you/benchmark-energy-use/benchmarking. Copyright 2015 by United States Environmental Protection Agency.

Part 3: Current Programs

Incentive programs through government agencies or utility companies or both are catalysts for energy saving retrofits. One of such programs that had a wide reach in British Columbia was the LiveSmart BC program. The program ended in 2014 after 6 years and a total of $110 million invested in energy saving retrofits for British Columbians. According to the LiveSmart BC website, the program lead to 15-28 percent energy savings for over 100,000 BC residents who participated in this program. In total, the utility companies, BC Hydro, and FortisBC, contributed over $11 million in the last two years of this program. The utility companies, however, continued to offer their customers rebates and incentives for improving energy efficiency after the ending of the LiveSmart BC program.

While the LiveSmart BC program was geared towards all BC residents, today, the utility companies and BC Housing offer incentive programs specifically geared towards non-market housing societies in British Columbia.

Energy Efficiency Retrofit Program (EERP)

Through a partnership in 2011, BC Housing, BC Non-Profit Housing Association, and BC Hydro formed the Energy Efficiency Retrofit Program (EERP) to create incentives for non-market housing societies to reduce energy consumption and GHG emissions by performing energy retrofits. In 2014, FortisBC joined this partnership in providing incentives for their customers to take advantage of. The paragraph below, from the EERP Funding Guide, explains the goal of the program:

> The EERP builds on existing utility incentive programs (such as BC Hydro Power Smart Express and FortisBC Efficient Boiler programs) by providing further funding to enable providers to complete small-scale energy saving retrofits of items such as light fixtures and boilers. Together, the incentives are intended to encourage providers to undertake small-scale energy retrofit projects and retain a portion of the energy savings.

The EERP is not without its own limitations; the program has the following eligibility requirements as outlined in the EERP Funding Guide:

1. The provider is a non-profit housing society, housing cooperative or municipal housing authority.
2. The retrofits are eligible for an applicable FortisBC or BC Hydro incentive program, and projects are completed in accordance with all requirements of the applicable utility provider.
3. The provider is in Good Standing with the BC Corporate Registry.
4. The development is owned or leased by the provider and is under a current eligible operating agreement with BC Housing.
5. There are no existing breaches or major unresolved issues identified through BC Housing's regular review process and no material debts outstanding under any agreement with BC Housing.
6. For FortisBC retrofit projects:

a. The development is eligible to receive an EERP rebate (grants do not apply for gas-fired items); and

b. Projects are small scale, energy retrofits of ageing gas-fired items (for example, boilers that are at least 10 years old).

Under these eligibility guidelines - specifically the fourth requirement - there will be a number of nonprofits that will not qualify for the EERP and that number is bound to grow in the near future. In 2014, BC Housing announced a new program that helps strengthen the social housing nonprofit sector by transferring ownership of land to the operating nonprofits. According to the BC Housing website, the Asset Transfer Program aims to transfer the ownership of the province-owned land where nonprofit organizations own and operate social housing on. This program came into place after years of nonprofits requesting the ability to purchase these parcels of land. This program will allow nonprofits to secure financing, plan for long-term operations, and become more self-sufficient. There are a total of 350 parcels in the province that have been approved for this program and the projection in October 2014 was that 115 of such transfers will take place by April 2015. Although the project aims to keep previous operating agreements in place, there will be some societies that will not need to renew their agreements after the asset transfer.

A list of all nonprofits with operating agreements was obtained from BC Housing and checked against the list of non-market housing projects in the City of Vancouver. Due to challenges in cross checking the data and different criteria in creation of these lists, it is difficult to determine the exact number of housing societies without an operating

agreement. However, based on partial data matching and sampling of the remainder, it is estimated that about 30 percent or 140 of the non-market housing projects are operating without an operating agreement with BC Housing.

Of the 484 social housing societies in the City of Vancouver, 91 of them are situated on province-owned land. 25 of those projects are operated by BC Housing and will remain as such. The Nicholson Tower and Stamps Place which are currently owned and operated by BC Housing are going to be transferred to nonprofit societies in the near future and under the Asset Transfer Program. The remainder 62 projects are currently operated by nonprofit housing societies and eligible for the Asset Transfer Program. The graph below shows the number of operating agreements between BC Housing and the nonprofit housing providers expiring during each of the labeled periods. These societies will be at risk of losing their operating agreements and disqualifying for the Energy Efficiency Retrofit Program.

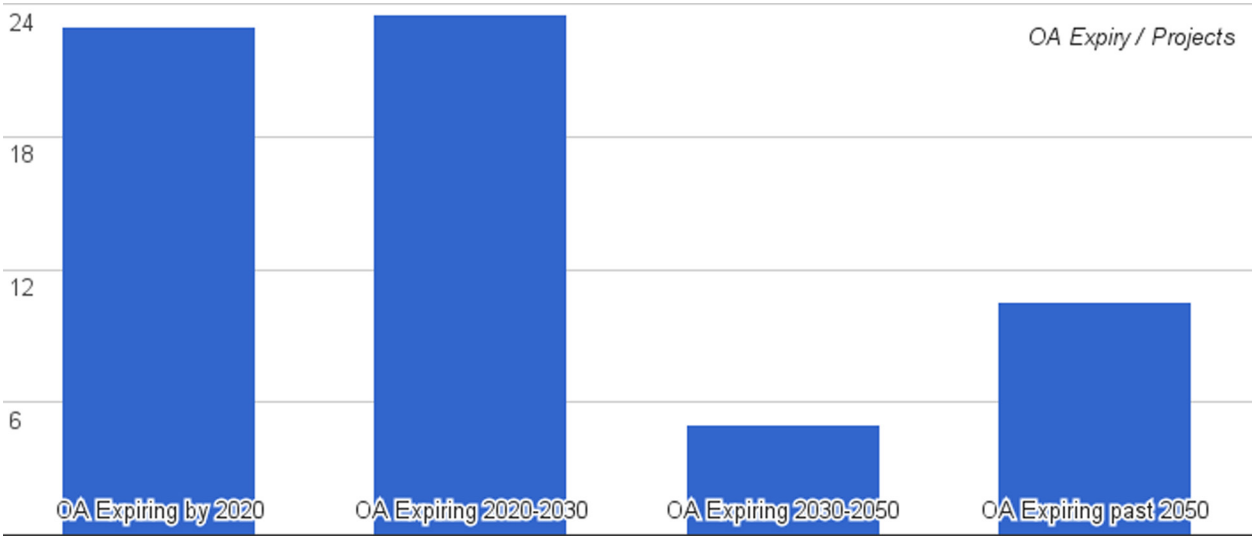

Figure 10. Number of operating agreements between BC Housing and social housing nonprofits expiring during each of the labeled periods.

Eligibility requirement number 2 mandates that retrofits qualify for current incentive programs offered by the utility companies. BC Hydro and FortisBC are currently offering the following incentive programs.

BC Hydro Power Smart Express (PSX) Program

The BC Hydro PSX Program is designed for small to large businesses and it includes nonprofit housing providers. Under this program incentives up to 70 percent of the total project cost are available for the qualifying retrofits of the following equipment:

lighting, commercial kitchens, refrigeration, and HVAC systems.

Applications for this program are initially reviewed by BC Hydro to determine eligibility for the BC Hydro PSX Program. Once BC Hydro approves the application, BC Housing will check the application for eligibility in the overarching Energy Efficiency Retrofit Program. Following BC Housing approval and the availability of funds which are released in April of each year, BC Housing will direct the housing provider to initiate work. Once work is done, BC Hydro will check for completion and advises BC Housing of completion of work and at that point, BC Housing will issue payment to the housing provider.

Under the EERP, housing providers could be eligible for a rebate - up to 100 percent reimbursement - or a grant - 50 percent of project cost. The rebate amount, according to the EERP Funding Guide is "equal to the net present value of the projected energy savings, up to 100% of the project cost" and the grant is "equal to 50% of the project cost, based upon the actual project cost confirmed by BC Hydro."

FortisBC Efficient Boiler Program

Through the FortisBC Efficient Boiler Program, nonprofit housing providers could qualify for incentives of up to $45,000. The rebate provided through FortisBC goes up to $9 per MBH (1,000 BTU/hr) depending on the efficiency of the new boiler. Similar to the BC Hydro PSX Program, housing providers apply to both FortisBC and BC Housing and BC Housing relies on FortisBC for confirmation that the work was done in accordance to the program requirements.

Unlike the BC Hydro PSX program, funding will never cover 100% of the project cost. However, after receiving the incentive through FortisBC and BC Housing, it is very likely that the project costs less than a like-for-like replacement and will lead to energy consumption savings in the future. According to the EERP Funding Guide, FortisBC rebates "are equal to the incremental project costs up to a maximum of the net present value of projected energy savings that the project is expected to deliver over the life of the measure." Incremental project costs are defined as "those over and above the costs for a like-for-like replacement..."

BC Non-Profit Housing Association (BCNPHA)

It is also important to note BCNPHA's role in this program; the Energy Management team at BCNPHA works closely with member societies to vet and prepare applications to

the standards required by BC Housing and the utility companies in order to streamline the process. As part of their role in this program, BCNPHA is equipped to determine eligibility of program participants and is capable of advising on proper retrofit projects.

Often times, BCNPHA will identify and recommend energy retrofit projects to housing societies after they have performed an energy audit. BCNPHA has a goal of performing at least 60 energy audits per year at no cost to its members. Once a potential retrofit project is identified and the provider is interested and capable of taking on the project, BCNPHA will work closely with them throughout the whole process to materialize the project.

Current Retrofit Activity & Results

During this study, all energy-focused retrofit activity in the non-market housing sector in the City of Vancouver pointed towards the EERP and the work that BCNPHA Energy Management team is performing. Any energy retrofit work being performed outside of this program remains unexplored due to its one-off nature and the spread and independence of operating organizations. Although a thorough and comprehensive analysis of the current energy-retrofit activities and results could not be performed due to the scarcity of valid information, a few case examples are presented in the next section to provide an idea of the type of projects that are folding out.

BCNPHA seems to be the most reliable source of information on energy-retrofit projects in the Province. The housing societies that BC Housing leaves out of its programs by requiring the existence of operating agreements are welcomed to join BCNPHA and can still benefit from their services. Moreover, BCNPHA is in possession of a large set of energy consumption data from the housing societies where they have helped carry out energy-retrofit projects. However, the data is stored away and not in a format that could be useful to any of the stakeholders and able to be analyzed due to an exhausted manpower. In the future, when this energy consumption data is imported into ENERGY STAR Portfolio Manager, it can provide a good look at the types of energy-retrofit projects being carried out throughout British Columbia.

Through the information available from BC Housing and BCNPHA from energy audits performed in the past few years and continuously going on, a large amount of deferred work has been identified. Figure 11.1 - 11.4 show a breakdown of such projects and is accompanied by high-level assessments of dollar figures associated with the projects. The reasoning for why this work has been deferred remains unexplored.

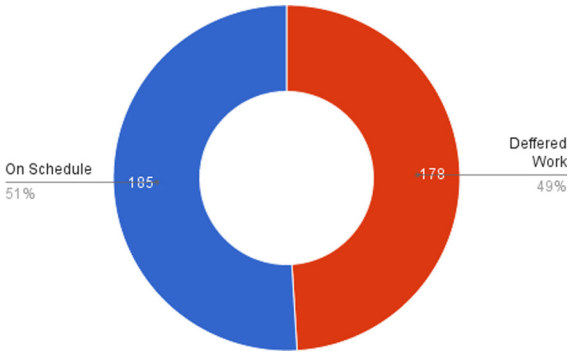

Figure 11.1. On schedule vs. deferred work based on energy audit reports available for 363 buildings.

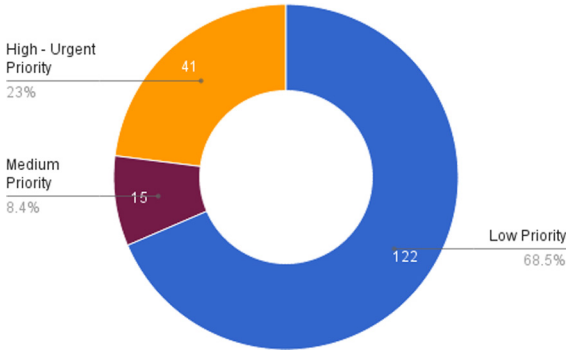

Figure 11.2. Priority distribution of deferred work from energy audit reports available for 363 buildings.

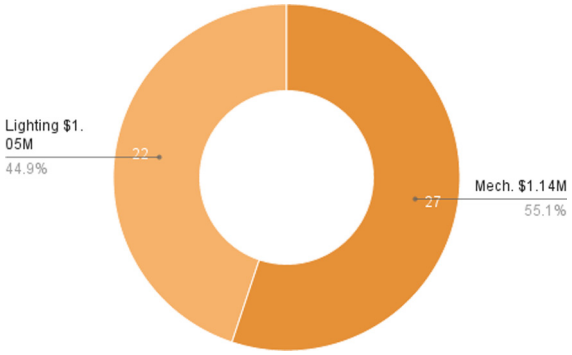

Figure 11.3. Nature and associated cost of high to urgent priority deferred work items.

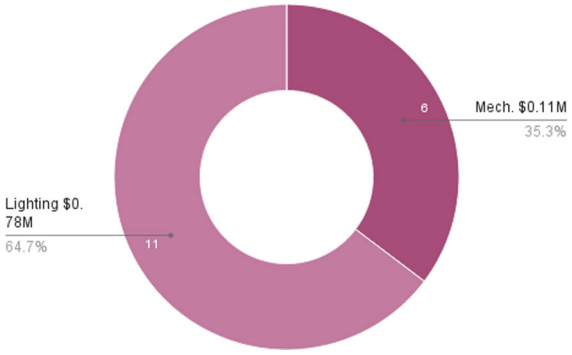

Figure 11.4. Nature and associated cost of medium priority deferred work items.

Part 4: EERP Case Examples

The following examples are presented in order to provide an understanding of the extent of the EERP incentives. Data for these examples has been obtained through a presentation made by BCNPHA in November 2013. The examples do not include all the details on the project; however, they provide a general sense of the incentives available through the Energy Efficiency Retrofit Program. It is important to note the difference between electric and gas retrofits. It can be argued that the incentives favor financial savings as opposed to reducing consumption of fossil fuels and GHG emissions.

Fairhaven United Church Homes

In this project, the high pressure sodium lighting found in the parkade was identified as a wasteful point of energy consumption and provided undesirable lighting conditions. The project aimed to reduce energy consumption and fix the lighting situation by replacing the high pressure sodium lighting with standard fluorescent lighting. With assistance from BCNPHA, Fairhaven United Church Homes applied to BC Hydro and BC Housing for financial incentives through EERP. The project was carried out with the help of BCNPHA and lead to significantly improved lighting conditions and an estimated 40 percent reduction in energy consumption. The high-level financials of the project are presented in table 1.

Table 1. High-level financial breakdown of Fairhaven United Church Homes EERP project - parkade lighting retrofit.

Project Cost	**$5,600**
BC Hydro Incentive	$3,000
BC Housing Incentive	$5,600
Total Incentives	**$8,600**
Total ~~Cost~~/Benefit to Society	**$3,000**
Annual Energy Savings	**$1,900**

Marysville Lions Housing Society

Following a site visit and energy audit at the Marysville Lions Housing Society, BCNPHA identified boilers and hot water tanks in need of replacement. The society's inventory of mechanical equipment included two atmospheric natural gas space heating boilers

and two domestic hot water tanks. All connecting pipes were uninsulated and the systems ran around the clock. With the help of BCNPHA, the society applied for assistance through EERP and the following retrofit work was performed:

- 2 boilers and 2 hot water tanks were replaced with 2 new high-efficiency boilers
- High-efficiency pumps were installed
- New piping connections were insulated
- New controls with outdoor air temperature reset were installed

The energy savings from the equipment replacement are estimated to be up to 23 percent while there is an additional estimated savings of 15% from the installation of outdoor air sensor and new controls. Shortly after the retrofit, the building manager noted significantly less cycling and reduced run times. The financial breakdown of the project can be viewed in table 2.

Table 2. High-level financial breakdown of Marysville Lions Housing Society EERP project.

Project Cost	**$75,000**
BC Hydro Incentive	TBD
FortisBC Incentive	$9,000
BC Housing Incentive	TBD
Total Incentives*	**$30,000**
Total Cost/~~Benefit~~ to Society	**$45,000**
Annual Energy Savings	**$3,300**

**Estimated value*

Although the total project cost may seem high, it is important to note that it is highly likely that a like-for-like replacement of the mechanical equipment would cost the society more. Such retrofit projects are advantageous when the equipment has reached or is near its end of life.

Aldergrove Kinsmen Housing Society

The Aldergrove Kinsmen Housing Society consists of 50 townhouses in Aldergrove, BC, built in 1990. At the time of the retrofit project, their furnaces had reached their end of life and with the help of BCNPHA, they applied to BC Housing and FortisBC under EERP. Initially, the aim was to replace 3 furnaces but, because of financial benefits, they ended up replacing four. The financial breakdown of the energy retrofit project is presented in table 3. It is estimated that the incentives bring the total project cost

below a like-for-like replacement and the estimated 25 percent reduction in energy consumption costs is also very significant.

Table 3. High-level financial breakdown of Aldergrove Kinsmen Housing Society EERP project - furnace replacement.

Project Cost	**$20,000**
FortisBC Incentive	$3,200
BC Housing Incentive	TBD
Total Incentives	**> $3,200**
Total Cost/~~Benefit~~ to Society	**< $16,800**
Annual Energy Savings*	**25%**

**Estimated value*

KinVillage Society

The KinVillage Society project consists of lighting updates to five different sites. The project was larger than just items which qualified for incentives under the EERP and BC Hydro PSX program. A financial summary of the project is presented in table 4. It is important to note the significant upgrade in lighting conditions, as reported by BCNPHA, and installation of Energy Saving Kits in all tenant suites which lead to more advantages than reported in the financial summary.

Table 4.High-level financial breakdown of Aldergrove Kinsmen Housing Society EERP project - furnace replacement.

Project Cost	**$96,600**
BC Hydro Incentive	$21,900
BC Housing Incentive	$52,900
Total Incentives	**$74,800**
Total Cost/~~Benefit~~ to Society	**$21,800**
Annual Energy Savings*	**$20,900**

**Estimated value*

Part 5: Recommendations

Following analysis of the information presented in this report, the following recommendations are made.

Energy Reporting

On June 25, 2014, the Sustainability Group presented an administrative report (RTS No. 9983) to the Standing Committee on Planning, Transportation and Environment on the subject of Energy Retrofit Strategy for Existing Buildings. This report includes, in large part, a section on "Energy Benchmarking for Buildings." Energy benchmarking is described as "a mechanism to gather, assess, and compare the energy performance of similar buildings." The report goes on to identify the benefits of energy benchmarking such as, "7% reduction in energy use in participating buildings over 3 years," increase in market demand for energy efficient buildings when the data is made available to the public, and the owner's aim to reduce energy consumption when the ability to compare data to other buildings is provided. The report goes on to identify a total of 103 large non-market rental properties that will be required to report energy consumption through this program.

It is the recommendation of this report that the City expand its plans to require energy consumption reporting from large buildings (over 50,000 sq ft) to include all non-market housing projects on City-owned properties by a term of the lease contract. This will allow for a much better understanding of the energy consumption of such buildings and helps better identify the poor performing buildings in need of attention. Having such data will shed some light on the general usage patterns for different types of structures or building uses which can be used to later target other buildings that are left out of the energy reporting requirements.

Incentivize Program Participation

The energy retrofit programs identified above through BC Housing, BCNPHA, BC Hydro, and FortisBC cover a large number of the non-market housing providers. Utilizing these programs to advance energy retrofits is a feasible route for housing providers that may be lacking the capital to make such investments. However, the current system leaves the decision to participate in these programs to the housing providers. Often times, BCNPHA will initiate contact with housing providers that they have identified as potential beneficiaries of this program and convince them to take part. It is the

recommendation of this report that the City create further incentives for non-market housing societies to take part in these programs.

Support BCNPHA

As previously noted, one of the main challenges faced by the BCNPHA Energy Management team is their manpower available to carry out their goals. Considering the extent of their effectiveness, enabling their team by providing manpower support could potentially catalyze their impact in the City of Vancouver. It is the recommendation of this report that the City attempt to create a formal partnership with BCNPHA in specifically providing staffing support to help advance BCNPHA's goals within the City of Vancouver.

Loan Program

Based on the data presented in figures 11.1-11.4, it is assumed that nonprofit housing providers could sometimes even lack the funds for required maintenance items. Justifying energy conscious retrofits that usually have a higher capital cost than a like-for-like replacement may not be feasible. According to the Energy Retrofit Strategy for Existing Buildings Administrative Report (RTS No. 9983), precedent shows that the City "Council approved the Home Energy Loan Program in partnership with Vancity and the Vancity Community Foundation to support loans to homeowners undertaking home retrofits." For reasons that seem to remain unexplored, the Program was not successful in meeting its target of 500 applications from homeowners that would qualify for the Program.

With that taken into consideration, it is the recommendation of this report that the City explore the the lessons learned from its failure in order to gather the participation in the program and make available a similar program to non-market housing providers which otherwise lack the capital for energy retrofits.

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