



# RETROFITTING VANCOUVER'S EXISTING BUILDING STOCK

## AN ASSESSMENT OF POLICY AND MARKET MECHANISMS AVAILABLE TO STIMULATE LARGE SCALE ADOPTION

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# 1.0 INTRODUCTION

As threats posed by climate change increasingly affect our lives, governments, businesses, and individuals will need to find a way to reduce the amount of energy consumed by everyday activities. While transportation and industry are two major sources of emissions, it is buildings that may present the greatest opportunity to reduce emissions drastically with the least cost to society. As the world increasingly urbanizes and density increases, buildings' share of greenhouse gas (GHG) emissions will likely continue to grow and cities will need to lead the way in finding ways to mitigate these emissions.

In a recent study entitled *Pathway to a Low Carbon Economy*, McKinsey & Company laid out a plan for the global society to achieve the levels of GHG emission reductions required to stabilize temperatures and prevent Climate Change related disasters. The study listed energy efficiency as the single greatest potential contributor to GHG emission abatement. Making the building stock more energy efficient through retrofitting was identified as a key action to achieving significant GHG emission reductions.<sup>1</sup> Retrofitting existing buildings to be more energy efficient is a complex undertaking. This level of complexity and the perception of inherent risks have thus far prevented energy efficiency retrofit projects from gaining critical mass in the commercial private sector. As governments such as the City of Vancouver begin setting goals around reducing energy use in existing buildings, it is clear that policies enacted will need to be carefully crafted in order to achieve these goals in an economically efficient manner. If done correctly, GHG reductions from building retrofits should have a positive economic impact for owners as opposed to significant costs, making these one of the most economically viable and attractive methods of GHG mitigation.<sup>2</sup>

Despite the seemingly obvious benefits of energy retrofits, without changes in the legislative framework, incentive structures, or a shock to energy prices, adoption will likely continue to be low. Buildings in British Columbia enjoy the lowest average energy cost in Canada and also have one of the lower energy intensity levels,<sup>3</sup> both of which limit the relevance of utility bills as a catalyst for a retrofit project. In order to move the market forward, governments at all levels should put in place a combination of rules and incentives that move building owners toward retrofits in a manner that is profitable for them and benefits society through job creation and cost effective GHG reductions.

<sup>1</sup> McKinsey and Company, (2009). *Pathways to a Low Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve*. Retrieved from: <https://solutions.mckinsey.com/ClimateDesk/default.aspx>.

<sup>2</sup> Nock, I. & Wheelock, C.,(2010). *Energy Efficiency Retrofits for Commercial and Public Buildings*. Retrieved from <http://www.pikeresearch.com/research/energy-efficiency-retrofits-for-commercial-and-public-buildings>.

<sup>3</sup> Natural Resources Canada, (June 2007 ). *Commercial and Institutional Consumption of Energy Survey* .Retrieved from: <http://oee.nrcan.gc.ca/Publications/statistics/cices06/index.cfm>.

This report will explore various options, including both policy options that are being openly considered by the City of Vancouver as well as those enacted in other jurisdictions at various levels of government. This will assist in determining which policy, or combination of policies, will be most effective in mandating energy efficiency retrofits in existing buildings while creating jobs and increasing value for building owners both in the public and private sectors.

We will begin with a discussion of the barriers that are commonly understood to be actively preventing retrofits from gaining critical mass. This is followed by a discussion of some available policy and market tools that could be employed in the Metro Vancouver context to aid in removing barriers. The final section of the report will layout some conclusions and recommendations for further study. This is not intended to be a direct policy recommendation but rather a high-level assessment of the barriers that exist and a realistic approach to navigating them.

## 1.1 CITY OF VANCOUVER

Vancouver's stated goal is to establish itself as the world's Greenest City by 2020. One component of the plan to achieve this goal is a reduction of GHG emissions by 33% from 2007 levels.<sup>4</sup> Given that buildings in Vancouver account for 54% of GHG emissions,<sup>5</sup> the success of the Greenest City initiative relies heavily on the energy efficiency of the city's building stock. The city has already taken action by updating the building code to require that all new buildings built in the city be equivalent to the Leadership in Energy and Environmental Design (LEED) Gold certification level. While this policy is a step in the right direction, it only addresses new building stock, which represents about 3% of buildings in Vancouver. In order for Vancouver to reduce its GHG emissions to the levels stated in the 2020 goals, it needs to address the existing commercial building stock. The city has listed a 20% reduction in energy use and GHG emissions from existing buildings as a component of the 2020 goals and, while no policy is in place at this time to enable this transformation, it is being openly discussed.<sup>6</sup> The plan outlines both incentives and regulations, some of which are addressed in this paper. However the focus appears to be mainly on residential real estate, which represents roughly half of energy use and GHG emissions from buildings.<sup>7</sup>

<sup>4</sup> City of Vancouver.(2009). Vancouver 2020: A Bright Green Future. Retrieved from: <http://vancouver.ca/greenestcity/PDF/Vancouver2020-ABrightGreenFuture.pdf>.

<sup>5</sup> City of Vancouver. (July 22, 2010). *News Release: City partners with industry to approve greenest building policy in North America* [Press Release]. Retrieved from <http://vancouver.ca/mediaroom/news/detail.htm?row=109&date=2010-07-22>

<sup>6</sup> City of Vancouver.(2009). Vancouver 2020: A Bright Green Future. Retrieved from: <http://vancouver.ca/greenestcity/PDF/Vancouver2020-ABrightGreenFuture.pdf>.

<sup>7</sup> City of Vancouver (2009).*2020 Goals: Green Buildings*. Retrieved from <http://talkgreenvancouver.ca/goals/green-buildings>.

## 1.2 GOVERNMENT OF BRITISH COLUMBIA

While the report mainly focuses on Vancouver, it should be noted that, as of the 2006 census, the City of Vancouver represents a population of roughly 578,000 of the roughly 2.1 million people in the Metro Vancouver region.<sup>8</sup> Therefore, any actions taken by Vancouver will be limited in impact without similar action from other municipalities in the region. Vancouver enjoys unique legal status in the Province of British Columbia (see section 4.3) and thus is able to take greater action than other cities. Unless changes are made in this legal framework, cooperation from the Government of British Columbia will be required in order to move things forward in the region. There are also certain areas where even Vancouver does not have the decision making power on its own and will subsequently require cooperation from the Province in order to implement change.

## 1.3 BC HYDRO

BC Hydro is a Crown Corporation owned by the BC Government that provides electricity to the Province. Many of the recommendations listed in this paper will require action and/or cooperation from BC Hydro in order to be effective. BC Hydro has recently taken a big step toward helping with the measurement required to promote conservation through its' Smart Meter program which starts rolling out in Summer 2011.<sup>9</sup> The program is an initial step to modernizing the grid, promoting conservation and measuring the success of efficiency initiatives. This report will suggest other ways in which BC Hydro's unique position as a government-owned entity may be leveraged in order to enable large-scale adoption of energy retrofits.



### SMART Meter Program Benefits:

- Improved safety and reliability;
- Enhanced customer service;
- Reduced electricity theft;
- Improved operational efficiency and reduced wasted electricity;
- Support for greater customer choice and control;
- Help modernize British Columbia's electricity system.

<sup>8</sup> City of Vancouver (2010). *About Vancouver*. Retrieved from <http://vancouver.ca/aboutvan.htm>.

<sup>9</sup> BC Hydro. (2010). *Smart Metering Infrastructure Program*. Retrieved from [http://www.bchydro.com/planning\\_regulatory/projects/smart\\_metering\\_infrastructure\\_program.html](http://www.bchydro.com/planning_regulatory/projects/smart_metering_infrastructure_program.html).

## 2.0 BARRIERS

Despite the cost saving opportunities that arise from a reduction in energy consumption, there are some significant barriers that exist which need to be addressed if cities such as Vancouver hope to make any serious headway in reducing GHG emissions from its building stock. Governments have the power to influence the rate of adoption and break these barriers through a combination of legislation, incentives, and other programs. The programs may be designed to encourage or enable energy retrofits; to force a building owner's hand and make a retrofit mandatory; or, ideally, some combination of the two. Some of these are within the power of a municipal government to enact while others will require action from provincial and/or federal governments.

### 2.1 INCENTIVE STRUCTURES

One major barrier to energy retrofits is that in many lease arrangements it is the tenants who pay the utility costs in addition to their rent and not the actual owner/operator. This means that the owners are not actually the ones paying the utility costs other than those deemed to be in common areas. With this incentive structure in place, the owner would finance an energy retrofit and reap none of the benefits unless (1) the tenant agreed to pay a higher rent in order to offset the reduction of their utility bill, or (2) the owners and tenants were to renegotiate a 'Green Lease' where the structure of the lease is altered to better align incentives for energy efficiency initiatives. The Real Property Association of Canada (RealPAC) has put together a guide to Green Leases<sup>10</sup> and most real estate service companies now offer Green Leases as an option, however uptake has been slow.

### 2.2 FINANCING

Access to financing for retrofits often tends to be plagued with difficulties driven by ownership of buildings, valuation of retrofit assets and technologies, and ownership of the retrofit process. For instance, many buildings are owned by shell corporations that serve no function other than as a holding asset company. Because of this, they are generally unable to get financing other than the mortgage on the building itself because there are no further cashflows that can be used to guarantee the loan for further retrofits or projects related to the building.<sup>11</sup> With this in mind, policy makers will need to look at ways to either issue loans themselves, co-sign or guarantee loans to the ownership entities, or find ways to avoid the building owners having to finance the retrofit project themselves through third party incentive structures.

<sup>10</sup> S. Michael Brooks. (May 2008). *Green Leases and Green Buildings*. Retrieved from RealPAC website: <http://www.realpac.ca/green-office-leases>

<sup>11</sup> White, P. (2010). *An Awakening in Energy Efficiency: Financing Private Sector Energy Retrofits*. Retrieved from Johnson Controls Inc. website: [www.johnsoncontrols.com](http://www.johnsoncontrols.com).

## 2.3 PRIORITY LEVELS

Another issue that could be the a large barrier to energy retrofits reaching any kind of critical mass is the lack of general attention to this issue from the owners and tenants. While properly planned and executed retrofits do have a long-term cost cutting effect that can improve cashflows for building owners, they may not be the most profitable option for investment among all available options. Retrofit projects will often have a lower Internal Rate of Return (IRR) than alternative investments that are more expansionary<sup>12</sup> such as purchasing a new building. IRRs in real estate investments vary depending on market conditions and the overall economy but it is not rare to see them in the 10% range.<sup>13</sup> This type of return would be tough to beat from a pure energy savings point of view.

If building owners making investment decisions are indifferent to environmental factors they will invariably choose the project that they deem to have the largest positive effect on their cashflows. In the absence of some sort of regulation or change to the cost structure, the owner will not perform an energy retrofit until other options are exhausted. For this reason, it is recommended that the city and other government organizations find ways to both require building owners to retrofit their buildings while enhancing or helping them to maximize the profitability of a retrofit project.

## 2.4 LOW VACANCY RATES

Two of the commonly cited indirect benefits of sustainable office buildings are decreased vacancy rates and higher rents than less efficient buildings.<sup>14</sup> While somewhat more difficult to prove than an improvement in operating costs, these revenue-side benefits are often used in justifying retrofit projects. The problem with this in the context of Metro Vancouver is that vacancy rates are already very low and, subsequently, rental rates are high. According to a 2010 study by real estate services firm CB Richard Ellis (CBRE) the vacancy rate peaked at roughly 9.7% in Metro Vancouver during the recent recession. Much of this vacancy concentrated in suburban areas such as Richmond and Burnaby while downtown Vancouver's vacancy rate is 5.2%, one of the lowest downtown vacancy rates in North America.<sup>15</sup> With vacancy rates already so low and relatively limited new development, supply is constrained and rates

<sup>12</sup> White, P. (2010) *An Awakening in Energy Efficiency: Financing Private Sector Energy Retrofits*. Retrieved from Johnson Controls Inc. Website: [www.johnsoncontrols.com](http://www.johnsoncontrols.com)

<sup>13</sup> Lolito, F., Park, T., & Peyton, M.S.(2006). *Investing in Office Property: Strategies for Picking Winners and Losers*. Retrieved from TIAA-CREF Asset Management website: [www.tcasset.com/news/research\\_docs/TCAM\\_Office\\_Property.pdf](http://www.tcasset.com/news/research_docs/TCAM_Office_Property.pdf)

<sup>14</sup> Benefield, J.D., Johnson, K.H., & Wiley, J.A. (2010). Green Design and the Market for Commercial Office Space. *Journal of Real Estate Finance and Economics*.

<sup>15</sup> CB Richard Ellis. (2010). *Canada's Commercial Real Estate Market Bounces Back in 2010 with Lower Vacancy Rates, Higher Absorption*. Retrieved from [www.cbre.ca/.../CBREQ42010NationalandIndustrialTrendsReleaseFINAL.pdf](http://www.cbre.ca/.../CBREQ42010NationalandIndustrialTrendsReleaseFINAL.pdf)

remain high. These are all positives for a building owner and make it difficult to imagine any revenue-side benefits arising from a retrofit, leaving operational costs as the primary source of return.

## 2.5 LOW UTILITY COSTS

British Columbians enjoy the lowest energy costs in Canada. Additionally, buildings in BC have a relatively low level of energy intensity (measured in gigajoules of energy used per square metre).<sup>16</sup> The combination of these two factors means that BC has one of the lowest energy costs per square metre in the country, which significantly reduces the incentive to conserve and, instead relies upon non-financial motivations (branding, environmental awareness, etc.) to encourage energy retrofits. While energy costs are not under the jurisdiction of the city and are regulated by the Provincial Government, an upward movement in utility rates, particularly during peak hours, could go a long way in encouraging conservation initiatives. BC Hydro has taken an important first step on this subject with the commencement of their Smart Meter program. The Smart Meters are an essential step in BC Hydro's 'Grid Modernization' program which aims to "provide a more reliable, safe and cost-effective supply of power" and at the same time "connects customers to the utility, creating a partnership that enables us to meet electricity needs and support a conservation culture."<sup>17</sup>

## 2.6 READINESS AND CAPACITY

An additional issue that has been cited as a possible impediment to widespread adoption of energy retrofits is the capacity of the construction industry to carry out these projects at a large scale. In particular, labour is mentioned as an area where lack of capacity could be a major obstacle for cities to meet targets related to retrofits.<sup>18</sup> This speaks to the need for further collaboration between industry, different levels of government, as well as education and training institutions that will need to identify existing skilled workers locally, attract skilled workers from other parts of the world, and train young people to fill these roles into the future.

<sup>16</sup> Natural Resources Canada. (June 2007). *Commercial and Institutional Consumption of Energy Survey*. Retrieved from [www.nrcan.gc.ca/Publications/statistics/cices06/index.cfm](http://www.nrcan.gc.ca/Publications/statistics/cices06/index.cfm).

<sup>17</sup> BC Hydro. (2010). *Smart Metering Infrastructure Program*. Retrieved from [http://www.bchydro.com/planning\\_regulatory/projects/smart\\_metering\\_infrastructure\\_program.html](http://www.bchydro.com/planning_regulatory/projects/smart_metering_infrastructure_program.html).

<sup>18</sup> McLachlan, Manley. (October 2010). *Construction and Development: Advancing the State of Sustainable Practice*. Retrieved from Gaining Ground Summit website: [http://www.gaininggroundsummit.com/day1\\_panel.html](http://www.gaininggroundsummit.com/day1_panel.html).

## 3.0 METHODS OF ENCOURAGING RETROFITS

With significant barriers to large-scale adoption of energy retrofits it appears that, barring some kind of major market shock, the market cannot be relied upon as the lone catalyst. Municipal governments, with the help and cooperation of state/provincial or federal governments as well as utility providers and regulators will need to be the ones to make this happen. Of course, this does not mean that cities should institute Draconian standards and enforcement programs that force massive expenditures and harm the income statements of building owners. In the absence of any kind of incentive or positive reinforcement, programs such as these may do little else but cause building owners to invest elsewhere costing jobs, lowering property values and simply shifting GHG emissions outside the city's borders. Given that GHG emissions are not localized and are a global problem, this sort of policy would be pointless.

Vancouver is a relatively small city by global standards and any programs must be carried out very carefully in order to keep current investors in the city while continuing to find ways to encourage new money to come to the region. Doing this while maintaining the push toward becoming the World's Greenest City will require a combination of push and pull, encouragement and enforcement, and the proverbial 'carrot' and 'stick'.

WITH SIGNIFICANT BARRIERS TO LARGE-SCALE ADOPTION OF ENERGY RETROFITS IT APPEARS THAT, BARRING SOME KIND OF MAJOR MARKET SHOCK, THE MARKET CANNOT BE RELIED UPON AS THE LONE CATALYST.

### 3.1 ENFORCEMENT

If governments hope to encourage large scale adoption of retrofit programs then they will need to find ways to bring them to the top of a building owner's agenda. As mentioned above, energy retrofits are not currently a top priority when looked at for their financial attributes alone. With this in mind, it is very possible the governments are going to need to force the hand of building owners through regulation. The easiest way to do this is through changes to building codes.

#### 3.1.1 ENERGY CODES

**Jurisdiction: Municipal, Provincial**

**Barrier(s) Addressed: Priority Levels**

On the enforcement side of the equation, energy codes are the most prominent method in place to ensure action on emission mitigation in buildings. These codes have been adopted in various forms by a number of jurisdictions across

the globe and tend to vary in their levels of stringency as well as the scope of their application. In the attempt to develop a standard on which jurisdictions can base their own codes, the International Energy Conservation Code (IECC) was created in 1989. The IECC contains detailed standards for different types of buildings in different climate zones. The provisions of the code include standards for building envelopes, mechanical systems, water heating, electrical power and lighting, among others. This level of detail allows for application in any jurisdiction with freedom to alter the agreement as needed. The code is regularly updated to include more stringent requirements and remain technologically current.<sup>19</sup> The adoption of these codes by various levels of government is growing. In the United States for example, all but eight states have adopted some variant of the IECC. The versions used range from 1989 to 2009 with the newest being the most stringent.<sup>20</sup> The major limitation of the IECC is that it applies specifically to new construction or to additions or alterations made to existing buildings. The document specifically states “this code shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code”.<sup>21</sup> This limitation makes sense given that the IECC group has no legal authority in any particular jurisdiction and publishing a code that mandated compliance from all existing buildings would likely mean that it would never be adopted. That being said, if a jurisdiction adopting the IECC code (or some variant thereof) wishes to have a meaningful impact on GHG emissions, provisions will need to be made in order to mandate the retrofitting of existing buildings.

An example of this type of policy can be found in New York City where buildings account for 75% of GHG emissions. Most buildings are long lasting and replaced rarely as indicated by estimates that the city's current building stock will make up 85% of the building stock in 2030.<sup>22</sup> As part of its PlaNYC initiative to create a “Greener, Greater New York”, the city has put in place Local Law 87 entitled Energy Audits and Retro-commissioning. The purpose of this law is to “require large buildings<sup>23</sup> to undergo an energy audit every ten years<sup>23</sup>, along with retro-commissioning, to “tune up” the building's existing systems and ensure efficient operation.”<sup>24</sup> What this means is that in any given year less than 1% of

<sup>19</sup> International Code Council. (2009). *2009 International Energy Conservation Code*. Retrieved from <http://www.iccsafe.org/store/pages/doeregistration.aspx>.

<sup>20</sup> Colker, R. (January, 2010). Clarifying Requirements for State Energy Codes. *ASHRAE Journal*.

<sup>21</sup> International Code Council. (2009). *2009 International Energy Conservation Code*. Retrieved from <http://www.iccsafe.org/store/pages/doeregistration.aspx>.

<sup>22</sup> The City of New York. (2010). *PlaNYC Progress Report 2010*. Retrieved from [http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc\\_progress\\_report\\_2010.pdf](http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_progress_report_2010.pdf).

<sup>23</sup> Large buildings are defined as those with over 50,000 gross square feet. These large buildings account for 36% of New York's GHG footprint and roughly \$6.75 Billion in energy costs for building owners and tenants. It is estimated that GHG emissions in a building this size can be reduced by an average of 25% if a qualified Energy Service Company (ESCO) were to perform an energy efficiency retrofit.

<sup>24</sup> The City of New York. (2009). *Audits and Retro-commissioning Summary*. Retrieved from <http://www.brightpower.biz/energyauditnyc>.

the projected building stock from 2030 will be turned over or built in a new location. Stats such as these show the importance of action on existing buildings and the limited impact of new building policies when adopted in isolation.<sup>25</sup> Previous iterations of this code had included a “loophole whereby the code would not be applied to existing buildings unless they were to renovate more than 50% of the current space.” New York Mayor Michael Bloomberg has taken a major step forward in the plan to drastically reduce the city’s carbon emissions by closing this loophole, mandating audits and the requiring owners to conform to the code upon completion of the audit. Despite being strict and comprehensive the laws are not meant to be punitive - the mandated upgrades are designed to be cost-effective and part of the audit process. The city estimates that the impact of the Greener, Greater Buildings initiative will reduce GHG emissions by 4.5 million metric tonnes by 2030, contributing a 7.5% reduction in total GHG emissions from the city’s 2005 baseline.



Vancouver lists “Regulation” as one of the strategies to be used in meeting goals dealing with building energy use. Specific measures that are discussed include Outcomes-based Codes, Green Renovation Policy, and HVAC by-laws. The Outcomes-based codes<sup>26</sup> action mentions that actual rather than modeled energy use will be used in assessing code compliance but does not mention any specifics around what type of code this will be and to whom it will apply.

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<sup>25</sup> Christmas, J., & Henderson, S. (2010). *Financing Retrofits in Large Commercial Buildings through PACE Loans: Implications for Building Owners*. Retrieved from <http://www.less-en.org/?page=FinancingRetrofitsinLargeCommercialBuildingsthroughPACELoans>.

<sup>26</sup> Regulatory approach to limiting actual building energy use, which focuses directly on current energy use, post occupancy time period, while not replacing the current code structure but rather add layer on top.

The Green Renovation Policy applies specifically to homeowners and is similar in effect to the code in New York City prior to Bloomberg's recent change, meaning that owners are not required to undertake an audit or make any efficiency upgrades until they renovate a significant portion of their home. A similar program is mentioned for commercial and multi-unit residential buildings as a measure that will be implemented in the future. The policy makes no mention of required audits or energy code compliance and thus creates risk of delayed action. The HVAC by-law, targeted to be in place by 2012, is the closest that the Action Plan comes to a true enforcement program and could be seen as a precursor to a more comprehensive audit and retrofit program.<sup>27</sup>

### 3.1.2 VOLUNTARY CERTIFICATION AND BUILDING CODES

#### Jurisdiction: Private Sector

#### Barrier(s) Addressed: None (only effective if made mandatory)

An alternative to the IECC is the use of energy or environmental rating systems such as LEED or ENERGY STAR, among others. If a building has achieved or is pursuing certification under one of these programs they will often be exempt from having to do detailed reporting on code compliance or current efficiency levels. These voluntary standards are often developed cooperatively with code creators in order to ensure that they are complimentary.<sup>28</sup> Pursuit of voluntary certifications that mandate efficiency levels at, or greater than, those in energy codes should be encouraged by government bodies looking to find ways to lower the GHG footprint of their building stock.

## 3.2 MARKET MECHANISMS

Energy efficiency retrofit projects are characterized by a high upfront cost coupled with a relatively long payback period. This pay back is achieved primarily through savings on utilities. While the numbers do add up, there is a certain lack of 'sexiness' to this type of investment and building owners may look toward more immediate impact from their investment dollars.

In an effort to address these concerns, different financial mechanisms have been developed to find ways to either reduce upfront cash payments, improve the speed of payback or, if possible, tie the repayment to the building rather than the owner so that the time horizon of payback becomes less of a factor for an owner that may sell before the payback period is complete. If government entities are going to put in place legislation that requires building owners to comply with energy codes (as is suggested here), there will need to be financial programs put into place that will limit cost to building owners and, ideally, help owners to improve their bottom line.

<sup>27</sup> City of Vancouver (2009). *2020 Goals: Green Buildings*. Retrieved from <http://talkgreenvancouver.ca/goals/green-buildings>.

<sup>28</sup> Owens, B., & Sigmon, J. (June 2010). LEED and Green Building Codes. *ASHRAE Journal*.

### 3.2.1 ENERGY PERFORMANCE CONTRACTING

#### Jurisdiction: Private Sector

#### Barrier(s) Addressed: Financing

One of the most commonly cited barriers to energy retrofit projects is the perceived risk to building owners regarding the payback on their investment. In response to this, Energy Performance Contracting (EPC)<sup>29</sup> has developed as a possible solution. The process of an EPC<sup>30</sup> is fairly simple; an energy audit is undertaken by an Energy Service Company (ESCO), which then makes suggestions on where efficiencies can be gained cost effectively. At this point, if the owner decides to move forward with the project, the owner and the ESCO enter into a contract where the energy savings are guaranteed by the ESCO and the payback schedule is put in place based on these savings. In some cases the financing of the upfront cost is provided by the ESCO although more recently building owners have been seeking their own financing for these projects.<sup>31</sup>

By financing the project the owner avoids the upfront cash expenditure of the project and, because the savings are guaranteed to cover the costs, the risk of a building's cashflow being negatively affected is removed. Once the cost of the project has been repaid, the savings are then fully attributed to the building owner and they are left with a more efficient and more profitable building than they began with.

Of course, since the projects generate only a small incremental change in short-term cashflow, energy efficiency projects may not be top of mind for building owners. This is why government-mandated audits and efficiency levels are crucial. If the EPC model is used in conjunction with a mandatory energy code policy, building owners will be compelled to prioritize energy efficiency and have the means to do so in the most profitable fashion. One caveat that exists in combining EPC with mandatory energy code compliance for existing buildings is that the guaranteed savings from the ESCO audit may not be enough to bring the building up to code and, as such, there is a possibility that for some buildings, code compliance cannot be undertaken profitably. With this in mind, any policy created along these lines will need to consider whether additional incentives will be required in order to avoid having a negative impact on the cashflow statements of building owners.

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<sup>30</sup> EPC- A performance-based procurement method and financial mechanism for building renewal whereby utility bill savings that result from the installation of new building systems (reducing energy use) pay for the cost of the building renewal project. A "Guaranteed Energy Savings" Performance Contract includes language that obligates the contractor, a qualified Energy Services Company (ESCO), to pay the difference if at any time the savings fall short of the guarantee.

<sup>31</sup> Donahue, P.A.. (August, 2000). *Energy Performance Contracting: A New Tool for Financing Energy-Efficiency Projects*. Retrieved from <http://www1.eere.energy.gov/femp/financing/espcs.html>.

### 3.2.2 TAX BILL AND PACE

**Jurisdiction: Municipal (requires Provincial authorization)**

**Barrier(s) Addressed: Financing**

Similar to the EPC agreements, property assessed clean energy (PACE) bonds are another mechanism in place to aid in financing building retrofits. PACE bonds, also known as tax-lien financing are agreements where building owners borrow from a “municipal financing district” who then add the repayment amounts to the property tax bill assessed to the building.<sup>32</sup> As with the EPC arrangements, once the project is repaid, all savings go to the building owner. PACE Bonds are listed in the city’s action plan for green buildings as a means of financing retrofits in single-family homes. There is no mention of PACE Bonds or any other financing tool listed for commercial buildings.<sup>33</sup> PACE bonds have been implemented in a number of American cities including Berkeley, California, where the concept was originally developed and in New York City where they have been integral in enabling the retrofits mandated by the PlaNYC program.<sup>34</sup> In order for municipalities to create a PACE program, they need to be granted the authority to do so by State or Provincial governments. At this stage, the City of Vancouver has moved to adopting a pilot PACE program, focused solely on residential buildings.<sup>35</sup> Currently in the United States Commercial PACE programs are being developed San Francisco, Los Angeles, Ann Arbor and Washington, DC.<sup>36</sup>

### 3.2.3 PUBLIC SECTOR CASE STUDIES

**Jurisdiction: Public Sector (Provincial and Municipal Governments)**

**Barrier(s) Addressed: Financing, Readiness/Capacity**

While the economic benefits of energy efficiency retrofits appear to be a matter of common sense, there is little data that demonstrates the value of these projects. This has much to do with the lack of baseline data against which comparisons can be made. In addition, the number of case studies in existence is fairly low and the validity of these can be hard to translate from one region to the next due to differences in climate patterns, building uses, and energy costs.

<sup>32</sup> White, P. (2010) *.An Awakening in Energy Efficiency: Financing Private Sector Energy Retrofits*. Retrieved from Johnson Controls Inc. Website: [www.johnsoncontrols.com](http://www.johnsoncontrols.com).

<sup>33</sup> City of Vancouver (2009). *2020 Goals: Green Buildings*. Retrieved from <http://talkgreenvancouver.ca/goals/green-buildings>.

<sup>34</sup> Christmas, J., & Henderson, S. (2010). *Financing Retrofits in Large Commercial Buildings through PACE Loans: Implications for Building Owners*. Retrieved from <http://www.less-en.org/?page=FinancingRetrofitsinLargeCommercialBuildingsthroughPACELoans>.

<sup>35</sup> Lee, Jeff. (2010, December 9). U.S. Problems won't change energy retrofit plans. *Canada.com*. Retrieved from <http://www.canada.com/vancouver/news/westcoastnews/story.html?id=1e551425-7122-4921-8de6-1175202b7b37>.

<sup>36</sup> Christiano, Joey. (2011, May 2011). Can Commercial PACE Financing Drive \$2.5 Billion in Energy Efficiency Investments? *Triple Pundit*. Retrieved from <http://www.triplepundit.com/2011/05/commercial-pace-financing-drive-25-billion-energy-efficiency-investments/>

In order for energy retrofits to be successfully implemented on a large scale, there needs to be local, relevant case studies that can be used as examples for strategy development, technology usage, and implementation best practices. More than anything, these case studies need to be documented in such a way that the financial and environmental benefits are clear and credible. Once these cases are in place and well publicized, they can be used as a baseline to provide guidance to building owners as they pursue retrofit actions mandated by policy. This line of thinking has been put into practice through the European Union's Bringing Retrofit Innovation to Application in Public Buildings (BRITA in PuBs) program. This program is "an EU-supported integrated demonstration and research project that aims at increasing the market penetration of innovative and cost-effective retrofit solutions to improve energy efficiency and implement renewable energy in public buildings all over Europe."<sup>37</sup>

The documentation released by the BRITA in PuBs team contains details on how to benchmark, model and measure emissions to create before and after scenarios during the design process, has details on the various technologies that can be employed in order to make these emission reductions a reality, and provides details on various financial strategies that have been used within the different member nations. All of this serves as a knowledge base on energy retrofits that allows building owners to find cases that are applicable to them, understand at a glance what the value of a retrofit project may be, and then use as a best-practice in undertaking their own project.

Seeding the market through retrofitting of public buildings can also be an excellent way to provide on-the-job training to young people who will be needed in achieving the considerable increase in labour force required in order to retrofit the existing building stock in Vancouver and beyond. A partnership with training institutions for tradespeople such as the British Columbia Institute of Technology is something that could be beneficial on many levels in terms of providing young people with in-demand, economically relevant skills and helping to remove one of the barriers discussed above.

The **BRITA in PuBs** team provide information on:

- how to benchmark, model and measure emissions to create before and after scenarios during the design process
- details on the various technologies that can be employed in order to make these emission reductions a reality, and
- provides details on various financial strategies that have been used within the different member nations.

<sup>37</sup> Morck, Ove. (2006). *BRITA in PuBs – Bringing Retrofit Innovation to Application in Public Buildings: Handbook of design guidelines, tools and strategies for low energy refurbishment of public buildings*. Retrieved from <http://www.annex46.org/kd/cache/files/05C37FD136434B5D9A5D27363A19B3A6.pdf>

Vancouver's Greenest City plan touts "Continued Leadership in Civic Facilities" as one of the actions in its Capacity Building strategy. The description on the Talk Green Vancouver site stresses that "there should be continued leadership to build Carbon Neutral New Buildings within its own portfolio of facilities."<sup>38</sup> While this is an impressive goal, it does very little to seed the market with retrofit projects and, additionally through the focus on new construction, is severely limited in scope and has little impact on GHG emissions.

### 3.2.4 ON BILL FINANCING

**Jurisdiction: Provincial Government (BC Hydro) and Private Sector (Terasen Gas)**

**Barrier(s) Addressed: Financing**

Another method of financing energy retrofits is on-bill financing through utility companies. These types of agreements are similar to PACE bonds except the financing comes from the utility company as opposed to the municipality and the payments are submitted via utility bills rather than property tax bills.<sup>39</sup> While this approach does have a level of simplicity in that the building owners continue to pay a bill to the utility every month and the amount of the bill will likely stay the same, it is complicated by the fact that in BC electricity and natural gas are provided from two different sources thus making the allocation of the financing and the bill payment process somewhat more complicated.

There are two types of utility bill programs that are currently in place in the United States - tariff programs and loan programs. The difference between the two is that tariff programs tie the financial obligation directly to the property so that it remains when a new owner takes possession. With the loan programs the obligation is linked to the building owner and does not transfer with the sale of a property.<sup>40</sup> In situations where building owners do not hold properties for very long a tariff program would likely work best as it would remove the time horizon as an impediment to undertaking a retrofit projects with a longer payback period. Another attractive feature of tariff programs is that they do not necessarily involve a debt being assigned to the building owner which is attractive both for governments who may not have the ability to assume debt as well as shell corporations who do not have any credit history.

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<sup>38</sup> City of Vancouver (2009). *2020 Goals: Green Buildings*. Retrieved from <http://talkgreenvancouver.ca/goals/green-buildings>.

<sup>39</sup> White, P. (2010) *An Awakening in Energy Efficiency: Financing Private Sector Energy Retrofits*. Retrieved from Johnson Controls Inc. Website: [www.johnsoncontrols.com](http://www.johnsoncontrols.com).

<sup>40</sup> Brown, M. (2009). *Brief #3: Paying for Energy Upgrades Through Utility Bills*. Alliance to Save Energy. Retrieved from <http://www.ma-eeac.org/docs/On-BillFinancingASEBriefMatthewBrown.pdf>.

Utility bill financing programs have not been widely implemented mainly due to the reluctance of utilities to deviate from their core business and become financiers.<sup>41</sup> This is especially the case in the United States where utilities are mostly privately shareholder-owned and operated, and inherently less interested in diversifying. In BC, given that the Government of British Columbia owns BC Hydro, this may not be as much of an issue or barrier.

Of the two types of on-bill financing, loan programs have been more widely adopted than tariff programs. American utilities that have put loan programs in place include Southern California Edison, Connecticut Light and Power, and Western Massachusetts Electric among several others. Examples of utilities that have put tariff programs in place include two in New Hampshire (Public Service New Hampshire and New Hampshire Electric Cooperative- SmartSTART<sup>42</sup>) as well as Midwest Energy in Kansas.<sup>43</sup>

#### On Bill Financing

New Hampshire Electric Cooperative: SmartSTART (Savings Through Affordable Retrofit Technologies)

The program allows no out of pocket costs on the installation and retrofit of energy efficiency products and services installed in a business. The cost of the improvements is repaid over time, using the savings generated by the products themselves. For instance, let's say you've installed energy efficiency products worth \$1,000 and those products save you \$100 per month. The product is paid off through easy monthly payments on electric bill equal to ¾ of the savings, or \$75 per month. The business still realizes overall savings on the electricity bill while paying for energy efficiency improvements that will save money for years to come. If the business moves and the installed products stay, the obligation to pay for them ends. The next occupant will "pay as they save".

### 3.2.5 CAPITAL LEASES

**Jurisdiction: Private Sector**

**Barrier(s) Addressed: Financing**

Another method of reducing the need for a large capital investment upfront is for the building owner to lease the equipment installed and make payments over a period of time before assuming full ownership. This is essentially an installment plan where the building owner takes possession of the equipment and pays it off over time with legal title being transferred to them at the time the lease is completed. Capital leases are attractive because the owner is able to

<sup>41</sup> Brown, M. (2009). *Brief #3: Paying for Energy Upgrades Through Utility Bills*. Alliance to Save Energy. Retrieved from <http://www.ma-eeac.org/docs/On-BillFinancingASEBriefMatthewBrown.pdf>.

<sup>42</sup> New Hampshire Electric Co-Op. (2010) *SmartSTART*. Retrieved from [http://www.nhec.com/business\\_energysolutions\\_smartstart.php](http://www.nhec.com/business_energysolutions_smartstart.php)

<sup>43</sup> Brown, M. (2009). *Brief #3: Paying for Energy Upgrades Through Utility Bills*. Alliance to Save Energy. Retrieved from <http://www.ma-eeac.org/docs/On-BillFinancingASEBriefMatthewBrown.pdf>.

take a tax deduction for depreciation of the equipment as well as the interest payments made on the lease and the terms of the financing are generally less restrictive than a conventional mortgage.<sup>44</sup>

### 3.2.6 MUNICIPAL LEASES

**Jurisdiction: Municipal (may require authorization from Provincial Government)**

**Barrier(s) Addressed: Financing**

Municipal Leases are essentially a hybrid of PACE Bonds and Capital Leases. In these sorts of arrangements, it is the municipality that leases the equipment to the building owner and collects the payments for the agreed upon amount of time.<sup>45</sup> These agreements are attractive because they can be handled at the municipal level, which may reduce the amount of coordination required with other levels of government.

### 3.2.7 UTILITY RATES

**Jurisdiction: Provincial Government/BC Hydro**

**Barrier(s) Addressed: Financing, Priority Levels**

As mentioned above, utility rates in British Columbia are among the lowest in Canada. These low rates can be seen as a disincentive to conserve and could hurt the chances of an energy efficiency program getting buy-in from the private sector. Based on this, it should be explored whether it would make sense to increase the cost of energy in buildings in order to make the business case for retrofits even more apparent. Of course, this is not within the City of Vancouver's jurisdiction and would require cooperation from regulators as well as government and privately owned organizations.

BC Hydro has a mandate from the BC Government's Clean Energy Act to acquire 66% of BC's incremental power needs through conservation and efficiency.<sup>46</sup> These "demand side management" initiatives are defined as those where the cost incurred are equal to, or lesser, than the cost of increasing supply.<sup>47</sup> Under these terms, an incentive to conserve from BC Hydro could go a long way toward improving the payback calculations for building owners involved in these projects. This could be in the form of a direct subsidization of project costs, low or no cost financing in a utility bill financing program, or a direct rebate tied to the effectiveness of conservation efforts.

<sup>44</sup> United States Environmental Protection Agency: Office of Air and Radiation. (2008). *ENERGY STAR Building Upgrade Manual*. Retrieved from. [http://www.energystar.gov/index.cfm?c=business.bus\\_upgrade\\_manual](http://www.energystar.gov/index.cfm?c=business.bus_upgrade_manual).

<sup>45</sup> United States Environmental Protection Agency: Office of Air and Radiation. (2008). *ENERGY STAR Building Upgrade Manual*. Retrieved from. [http://www.energystar.gov/index.cfm?c=business.bus\\_upgrade\\_manual](http://www.energystar.gov/index.cfm?c=business.bus_upgrade_manual).

<sup>46</sup> BC Hydro. (2010). Annual Report. Retrieved from [www.bchydro.com/annual\\_report\\_2010.html](http://www.bchydro.com/annual_report_2010.html).

<sup>47</sup> Government of British Columbia. (2009). *The BC Energy Plan*. Retrieved from [www.energyplan.gov.bc.ca](http://www.energyplan.gov.bc.ca).

As mentioned previously, one of the primary goals of BC Hydro's Smart Meter program is enable and encourage conservation. The program promises to "reduce wasted electricity through voltage optimization" and mentions that savings will be passed along to customers through lower rates.<sup>48</sup> While any conservation that results from the Smart Metering program is a positive development, maintaining British Columbia's subsidized electricity rates may not provide incentive for businesses and consumers to make behaviour changes or invest in efficiency. The Frequently Asked Questions section of the BC Hydro's Smart Metering site mentions that changes to the rate structure are being considered including "rate structures that will offer incentives for customers to use less electricity".<sup>49</sup> Changes in the rate structure are strongly recommended as a means of encouraging conservation and improving the business case for building retrofits.

### 3.2.8 CARBON TAX<sup>50</sup>

**Jurisdiction: Provincial Government, Federal Government**

**Barrier(s) Addressed: Financing, Priority Levels**

Similar to a rise in utility rates, an increase to British Columbia's carbon tax could be something that helps to force the hand of building owners and improve the business case for a retrofit project. BC's carbon tax contains measures for a planned increase through 2012<sup>51</sup> and the government should look into the effectiveness of increasing this as a catalyst for retrofit projects. The effectiveness of the carbon tax in BC buildings is somewhat limited due to the majority of electricity being derived from hydroelectric power plants<sup>52</sup> and thus not having a carbon footprint.

<sup>48</sup> BC Hydro. (2011). *Smart Metering and Infrastructure Program Business Case*. Retrieved from [http://www.bchydro.com/etc/medialib/internet/documents/smi/smi\\_business\\_case.Par.0001.File.smi\\_business\\_case.pdf](http://www.bchydro.com/etc/medialib/internet/documents/smi/smi_business_case.Par.0001.File.smi_business_case.pdf).

<sup>49</sup> BC Hydro. (2011). *Smart Metering Infrastructure Program: FAQs*. Retrieved from [http://www.bchydro.com/planning\\_regulatory/projects/smart\\_metering\\_infrastructure\\_program/faqs](http://www.bchydro.com/planning_regulatory/projects/smart_metering_infrastructure_program/faqs).

<sup>50</sup> A carbon tax is an environmental tax that is levied on the carbon content of fuels.<sup>[1]</sup> It is a form of carbon pricing.

<sup>51</sup> Government of British Columbia: Ministry of Small Business and Revenue. (2008). *British Columbia Carbon Tax*. Retrieved from [www.bcenergyblog.com/uploads/file/British\\_Columbia\\_Carbon\\_Tax.pdf](http://www.bcenergyblog.com/uploads/file/British_Columbia_Carbon_Tax.pdf)

<sup>52</sup> Natural Resources Canada. (June 2007). *Commercial and Institutional Consumption of Energy Survey*. Retrieved from [oee.nrcan.gc.ca/Publications/statistics/cices06/index.cfm](http://oee.nrcan.gc.ca/Publications/statistics/cices06/index.cfm)

### 3.2.9 CARBON OFFSETS<sup>53</sup>

**Jurisdiction: Private Sector, Provincial Government/Pacific Carbon Trust**

**Barrier(s) Addressed: Financing**

Another area that could help to support the business case for owners is the ability to issue carbon credits after completing a retrofit project. BC's participation in the Western Climate Initiative cap-and-trade program will hopefully begin to open up a market for offsets to be sold and create a lucrative revenue opportunity that, in addition to the utility savings, will aid in the cost-benefit attractiveness of retrofit projects.

### 3.2.10 GREEN LEASES<sup>54</sup>

**Jurisdiction: Private Sector**

**Barrier(s) Addressed: Incentive Structures**

As mentioned in the Barriers section, Green Leases are a method of removing the agency issues that come from the owner/tenant relationship with regard to who pays for energy efficiency, which could range from upgraded HVAC systems to recycling programs to floor finishes. Leases are key to the Tenant and Landlord relationship, while playing a critical role in building maintenance and provides an opportunity(ies) to retrofit and upgrade commercial spaces. However

“Leases have to be viewed as a major potential constraint to greening office buildings. If you don't get the rights and responsibilities, aspirations and collaborations, and standards and target certifications right at the outset, both Landlords and Tenants are going to feel that their hands are legally tied at some point in the relationship.”

S. Michael Brooks  
Chief Executive Officer, REALpac

there is general resistance to the green lease most stemming from a range of issues including a lack of knowledge, funding, and building expertise. While municipalities and governments in general may not have jurisdiction over these matters, the removal of these incentive misalignments will be crucial to the successful adoption of energy retrofits at a large scale.

<sup>53</sup> A carbon offset is a reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for or to offset an emission made elsewhere or rather *a unit of carbon dioxide-equivalent (CO<sub>2</sub>e) that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere*”.

<sup>54</sup> A “green lease” seeks to remove disincentives in a commercial lease to reduced energy, water and raw material consumption, increased recycling, as well as the use of sustainable materials in tenant improvements, and encourages sustainable practices by both the landlord and the tenant. A Green Lease works to ensure that tenants and landlords are required to adopt environmentally friendly practices. (REALPac 2010)

## 4.0 RECOMMENDATIONS

As mentioned previously, this paper is not meant to be a specific policy recommendation piece. That being said, when looking at energy retrofits from the perspective of barriers versus solutions, certain things have become clear and are noted below. Achieving energy efficiency in Vancouver's building stock is a massive opportunity for the city to do its part in mitigating GHG emissions. Despite this massive opportunity, a complex web of owners, tenants, energy service companies, financial institutions, workers, and various levels of government are all going to need to pull together and implement a combination of measures in order to realize the potential of an energy efficient building stock. The city's ambitions in this area are immense but it will need to find ways to get buy-in from many stakeholders and do so in a way that ensures that, in the short run, the city remains economically competitive and is not punished for taking a progressive stance on energy efficiency. In order to do this careful attention must be paid toward ensuring that owners see a net reduction in costs while creating local jobs and further stimulating Vancouver's green economy.

### 4.1 BOTH 'CARROT' AND 'STICK' ARE REQUIRED

Given the significant number of barriers standing in the way of large-scale adoption of energy retrofits in buildings, it is entirely unrealistic to imagine that a single policy initiative or market mechanism would circumvent them all. With this in mind, it is recommended that the City of Vancouver use a combination of enforcement and incentives in order to speed up adoption. From the enforcement side of the equation, this means an energy code that applies to existing buildings. As mentioned previously, new buildings account for a very small portion of the building stock and a building code that only focuses on them will have very little overall impact on the city's GHG emission mitigation efforts. The city has cited New York's PlaNYC initiative as an example and should follow through on this by implementing a similar policy with any required changes being made to suit any specific differences between the two cities.

The "encouragement" side of the equation could mean any one or combination of the market mechanisms discussed above. These may require cooperation from higher levels of government and/or the private sector but every effort should be made to ensure that any enforcement actions put into place are coupled with programs to help building owners to bring their facilities into compliance in an economically beneficial manner.

## 4.2 FOCUS ON ITEMS UNDER MUNICIPAL JURISDICTION

Many of the mechanisms for encouraging retrofits discussed in section 3 are beyond the jurisdiction of the City of Vancouver to implement on their own. With this in mind, the city should focus its short-term strategy on items where they are not dependent upon any other government body in order to act. At the same time, certain measures that require cooperation from other parties but are deemed to be desirable should still be pursued but not relied upon as an 'all or nothing' tool. By focusing on what it is able to control, Vancouver can ensure some quick wins in the short term while working to collaborate with other parties for longer-term success.

## 4.3 COLLABORATE BETWEEN MUNICIPALITIES

As mentioned above, Vancouver has special rights among British Columbian municipalities and is the only city in BC that has jurisdiction over its building codes. While the city's climate goals are inspiring, it needs to be noted that Vancouver hosts only a portion of the Lower Mainland's population and building stock, and that any changes made in Vancouver are limited in their effectiveness for the region unless other cities join them. For this reason the City of Vancouver should look at ways of involving other jurisdictions, particularly large suburbs such as Surrey, Richmond, and Burnaby in their discussions. This would also necessitate involvement from the BC Government who have jurisdiction over the building codes in all municipalities in BC other than Vancouver. Collaboration of this sort could go a long way in ensuring that the region as a whole is taking strides toward GHG emission mitigation, any codes or regulations put into place are uniform across the region which will make it easier to build the market for labour and ESCOs, and ensure that Vancouver does not push investment out of its boundaries and into less stringent suburban areas.

## 4.4 COLLABORATE WITH BC GOVERNMENT AND BC HYDRO

Many of the initiatives discussed above require some level of cooperation and enablement from the provincial government. In addition, activities that are undertaken only within Vancouver's city limits will have a limited impact considering the size and growth of the municipalities surrounding Vancouver. As BC's largest city and corporate centre, Vancouver has the opportunity to lead, and the overall impact of any programs implemented will be multiplied several times if the rest of the region follows suit.

At the same time, BC Hydro's role could be a major factor in determining whether or not Vancouver reaches its climate goals. The fact that BC Hydro is a provincially-owned Crown Corporation presents an opportunity for decisions to be made that might normally be discouraged by shareholders. Given that the Government of BC is the sole shareholder and regulatory body that BC Hydro reports to, the potential exists to put programs in place that can go a long way to simultaneously meet BC Hydro's conservation goals and Vancouver's Greenest City goals.

## **4.5 COLLABORATE WITH INDUSTRY, LABOUR, AND TRAINING FACILITIES**

As mentioned in section 2.5, there is currently a lack of capacity among construction firms to carry out building retrofit programs on a large scale. Also, because Vancouver is not a large city and is in a somewhat remote location, it is possible that the ESCOs needed do not have a sufficient local presence to see an initiative such as this one through. This creates a 'chicken and the egg' scenario where the retrofits require the presence of ESCOs and skilled labour but these elements may not gravitate to the city without the necessary demand. Based on this, it is suggested that the City of Vancouver begin to work with and collaborate with ESCOs, labour associations and training facilities in order to incentivise these crucial elements to come to the city. One way to do this may be through the pursuit of retrofit case studies in city-owned buildings as discussed in section 3.2.3.



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