

Vancouver's Greenest City Action Plan Enabling Deep Efficiency Improvements

Andrew Pape-Salmon, RDH Building Engineering Ltd.

Rachel Moscovich, Integral Group

John Madden, Light House Sustainable Building Centre

ABSTRACT

Cities are leading on policy development to support deep energy retrofits and outcome-based new construction standards. In 2011 Vancouver's Greenest City Action Plan set two targets: (1) a 20% reduction in energy and emissions from buildings below 2007 levels by 2020, and (2) that all buildings constructed from 2020 onward should be carbon neutral in operations. The Vancouver Charter provides the City with unique jurisdiction for its own building code, differing from the BC Building Code. All cities have levers to influence building developers, owners, managers and occupants on improving energy efficiency for new construction and existing buildings.

Vancouver's 2014 Energy Retrofit Strategy for Existing Buildings, informed by analysis and best practices, includes actions pertaining to awareness and capacity building through building energy benchmarking, leadership, partnerships with utilities and associations and the application of the Vancouver Building Bylaw (energy code) to existing buildings. The strategic retrofit approach is to focus on the highest opportunity sectors and apply specific approaches to support voluntary action. For example, it targets "deep energy retrofits" of multi-unit residential buildings with emissions higher than 3.5 tonnes per residential unit. It targets a reduction in greenhouse gas emissions by 160,000 tonnes and lowers energy costs for consumers by \$99 million in 2020.

On the new construction side, design teams for buildings seeking rezoning are required to declare the energy use intensity (EUI) of new buildings. After the new building has been used for a period of time, the original design EUI could be compared benchmarking data.

Introduction

This paper provides an overview of policy actions and market transformation measures proposed by the City of Vancouver (Vancouver) to achieve deep energy savings for new and existing buildings in 2014 leading up to its 2020 emission reduction targets.

Building operations and industrial processes generate 55% of greenhouse gas (GHG) emissions in Vancouver (COV, 2014). Other emissions are from transportation and solid waste. Energy retrofits to buildings are fundamental to Vancouver's ability to achieve its target of reducing city-wide emissions by 33% by 2020. Based on 2008 data from BC Assessment, there are 90,000 properties in Vancouver, including 77,000 houses, 5,700 multi-unit residential buildings (MURBs) and 5,200 commercial, institutional and industrial buildings (Ibid). Each year, square footage increases by an average 0.85% and 1.6% of existing buildings are replaced with new construction (COV 2014(2)).

In 2010, Vancouver announced its ambition to be the world's greenest city by 2020. It developed an action plan that included measurable targets to be achieved over the course of ten

years. The “Greenest City 2020 Action Plan” (GCAP) addresses urban sustainability under ten distinct focus areas including “Green Buildings”, with the goal of leading the world in green design and construction. The green buildings targets are as follows: (1) all new construction is to be carbon neutral in operations in 2020 and (2) reduce energy consumption and greenhouse gas emissions from existing buildings by 20% (over 2007 levels) by 2020.

Figure 1 illustrates the sources of 2007 emissions from buildings and industrial processes, totaling 1.57 million metric tonnes, with detached houses emitting the largest share (0.48 Mt).

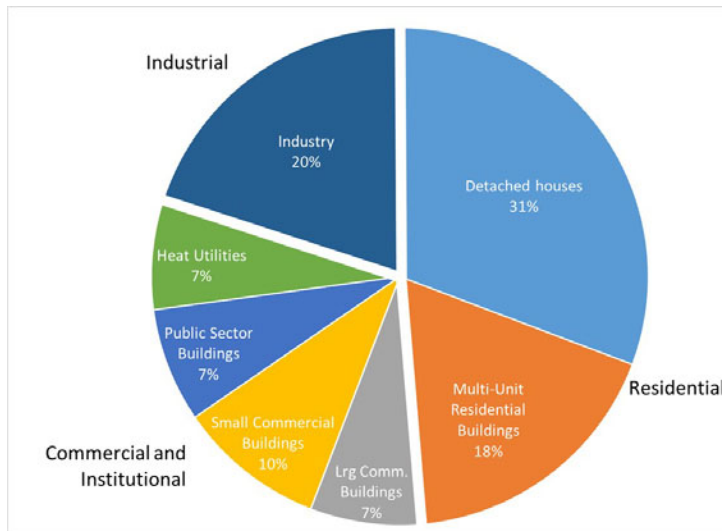


Figure 1. 2007 Greenhouse gas emissions from buildings and industry (excluding transportation and solid waste). *Source:* City of Vancouver, 2013.

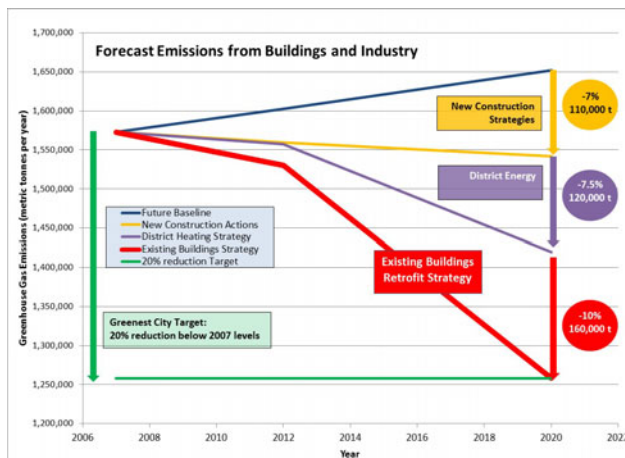


Figure 2. Emission projection (metric tonnes) and targeted Strategy impacts (2007-2020). *Source:* City of Vancouver, 2013.

Figure 2 illustrates the projected emissions from buildings and industrial processes to 2020, estimating the impact of new square footage and replacement of existing buildings with new construction. Vancouver’s Greenest City target is to reduce building related emissions by 20% below 2007 levels, in such a way that there will be no additive emissions resulting from new construction, and 20% of the historical emissions will be eliminated. The chart illustrates the

targeted achievement of three strategies, two of which are covered in this paper (new construction and existing buildings retrofit), complemented by an additional strategy that will see growth in renewable energy based district energy.

Existing Buildings Retrofit Strategy

The existing buildings 20% emissions and energy reduction target is ambitious, and will be challenging to achieve for a variety of reasons. First, a number of persistent market barriers that are well defined in the literature and summarized in Turner 2011, need to be addressed. Second, Vancouver has limited influence on existing buildings, as municipal powers pertain primarily to new construction, and thus policies and regulations apply only at the time of development or building renewal. Finally, in contrast to the powers of many U.S. cities (e.g., New York City, see NYC 2013), Vancouver's powers are limited, as the Province of British Columbia (BC) defines the policy and regulatory powers under the *Local Government Act* and *Vancouver Charter* by reference, not by exception.

A number of principles were adopted to develop the Strategy, namely:

- Address market barriers;
- Use data to focus efforts, help tailor policy and build on best practices;
- Focus on limited initiatives per sector;
- Build on Vancouver's existing policy levers and demonstrate leadership;
- Focus on the largest emitters / consumers;
- Minimize the number of buildings / facilities affected; and,
- Foster market transformation

The Energy Retrofit Strategy for Existing Buildings (COV 2014) was approved by Vancouver's City Council on June 25, 2014. The strategic retrofit approach is to focus on the highest opportunity sectors, apply specific approaches to support voluntary action and utilize the Vancouver Building Bylaw (VBBL) energy code. The Strategy relies upon voluntary and regulatory tools in four key sectors, including: (1) large industry; (2) large commercial and institutional buildings; (3) multi-unit residential buildings; and (4) houses.

This section of the paper outlines: (1) the application of the VBBL energy regulations to existing buildings and (2) specific Vancouver actions in the highest opportunity sectors.

Strategy 1: Apply Vancouver Building Bylaw to Existing Buildings

The City of Vancouver is the only municipality in British Columbia that has its own building code, empowered by the provincial *Vancouver Charter* legislation. Other municipalities are governed by the *Community Charter*. Until 2014, the Vancouver Building Bylaw (VBBL) did not address energy use in existing buildings – it applied only to new construction and major redevelopment. September 2013's report to council (COV 2013(2)) brought forth a new proposal for mandating incremental upgrades to existing buildings as a condition of issuance of a renovation permit.

The recent amendment to the VBBL builds upon an existing mechanism, the permit trigger system – traditionally used to require fire-safety and seismic upgrades – to achieve energy efficiency improvements and emission reductions. A permit is required for a building repair, renovation, reconstruction, addition or change of occupancy (COV 2014(3)). Effective January

1, 2015, the energy requirements complement existing standards pertaining to fire and life safety, structural and non-structural improvements and accessibility.

The process works as follows: when a building owner (applicant) approaches the City to obtain a permit, depending on the type of project and building and ‘permit value’ in the case of houses, they are required to implement a range of measures. The requirements differ for one and two family dwellings (houses); and all other buildings.

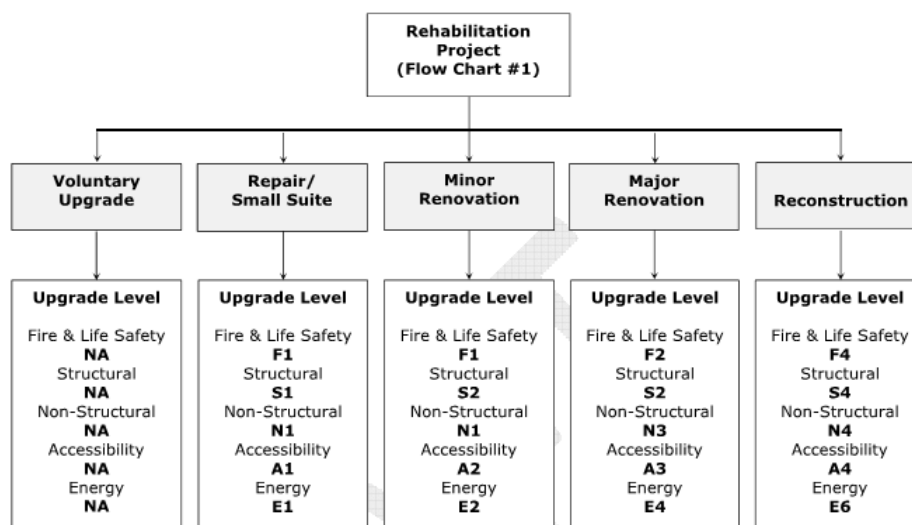
For detached houses the requirements at the time of permit are, from smallest to largest where permit values range from less than \$5,000 to over \$50,000: (1) procure a third-party energy assessment of the house; (2) upgrade to condensing furnace or boiler (when being replaced); (3) perform air sealing to reduce air-leakage in the home; and (4) insulate attic to meet code for new construction.

The bylaw requires energy efficiency upgrades for all other building types, triggered by an application for a building permit for an addition, rehabilitation (including renovation and repair), or change of major occupancy classification. The requirements are less prescriptive than those that apply to detached housing, in that the owner can select efficiency upgrades from a menu of options. The menu includes upgrades to envelope systems, upgrades to HVAC systems or components, upgrades to lighting systems or components, and/or enrollment in a third-party building energy performance certification program (BOMA BEST).

The scope of the upgrade is contingent upon the scope of building permit application, as per Table 1 below, with increasing energy upgrades as the reference increases from E1 to E6. It is noted that E3 applies to change of occupancy and E5 applies to major vertical additions.

For example, a major renovation is defined as work within or exterior to multiple tenant spaces (COV 2014(3)). The E4 menu requires the review and improvement of an integrated energy efficiency system and the implementation of two “L3”, two “L4” and one “L5” upgrades to the entire building, not just the space affected.

Table 1. Vancouver building bylaw application to existing buildings



Source: City of Vancouver, 2014(3).

The list of L4 building envelope upgrades is provided in Table 2 below, largely referencing standards in the ASHRAE 90.1 (2010) Energy Efficiency Standard for Buildings, except Low-Rise Residential Buildings.

Table 2. Vancouver building bylaw “L4” building envelope upgrades

Envelope	<p>1) Reduce air leakage of entire Building Envelope (per 5.4.3 of ASHRAE 90.1 - 2010); reduce air leakage of all Fenestration & Doors (per 5.4.3.2 of ASHRAE 90.1 - 2010)</p> <ul style="list-style-type: none"> • Reduce air leakage of all Loading Dock Doors (per 5.4.3.3 of ASHRAE 90.1 - 2010) • Reduce air leakage of all Vestibules (per 5.4.3.4 of ASHRAE 90.1 - 2010) <p>2) For single retail/tenant spaces < 500 sq.m.) Perform an Air Leakage / Blower test and remediate</p> <p>3) Upgrade all Roof Insulation (per 5.5.3.1 of ASHRAE 90.1 - 2010)</p> <p>4) Upgrade all Above-Grade Wall Insulation (per 5.5.3.2 of ASHRAE 90.1 - 2010)</p> <p>5) For single retail/tenant spaces < 500 sq.m.) Replace storefront window(s) to meet the By-law.</p> <p>6) Reduce total vertical Fenestration/Glazing Area to 40% of gross wall area (per 5.5.4.2.1 of ASHRAE 90.1 - 2010)</p> <p>7) Upgrade all Fenestration/Glazing Performance (per 5.5.4.3 and 5.5.4.4 of ASHRAE 90.1 - 2010)</p> <p>8) Inspect and remediate roof systems including membrane, parapets, scuppers, drains, gutters, downspouts and drains.</p>
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Source: City of Vancouver, 2014(3).

The objective of the policy is to improve existing buildings in a practical manner on a continuum of improvements that maximize at the “L6” standard which is the current code for new construction (i.e. toward a new baseline).

ICF-Marbek (Light House 2013) predicted the energy savings that will accrue from the VBBL existing buildings provisions for commercial buildings, highlighted in Table 3. The average 6% natural gas and 3.6% electricity savings are based on an assumption that 40%, 30%, 20% and 10% of VBBL permits will trigger the E1, E2, E3 and higher than E3 upgrades respectively.

Table 3. Estimated energy savings from VBBL provisions

Efficiency Upgrade Level	Estimated Individual Average Savings		Estimated Percent of Permits	Estimated Weighted Average Savings	
	Natural Gas	Electricity		Natural Gas	Electricity
E1	1.5%	1.2%	40%	0.6%	0.5%
E2	2.0%	2.3%	30%	0.6%	0.7%
E3	13.0%	6.3%	20%	2.6%	1.3%
E4-6	21.8%	12.0%	10%	2.2%	1.2%
Total Estimated % Savings				6.0%	3.6%

Source: Light House, 2013.

The specific upgrade measures will evolve as Vancouver introduces incremental amendments to the VBBL through to 2020. With each bylaw update, the requirements for

upgrades to existing buildings will be ratcheted up to require a greater improvement in energy performance.

Strategy 2: Specific Vancouver Actions in the Highest Opportunity Sectors

One of the key measures for consideration in the Strategy is a proposed program for annual building energy benchmarking and reporting, which comprises a number of tactics. Vancouver's objective is to collect and analyse building energy use data that is not available due to utility data privacy requirements. More specifically, the benchmarking data will be used to:

- Identify the highest consuming buildings to target for improvement;
- Inform partnerships with utilities, industry and owner associations, other governments;
- Populate energy use maps to raise public awareness;
- Inform policy and program design; and,
- Evaluate effectiveness of Building Retrofit Strategy (measure progress over time).

To demonstrate leadership Vancouver recently completed energy benchmarking of 54 facilities and buildings with the US Environmental Protection Agency's ENERGY STAR[®] Portfolio Manager tool. Portfolio Manager normalizes building data by size, use, occupancy, climate and other factors in order to generate an energy use intensity measurement (energy consumption per unit area), and, for many building types, a score between 1-100, thus benchmarking the building's energy performance as compared to similar buildings.

This leadership measure is aligned with the BC Climate Action Charter, initiated in 2007, which is a voluntary commitment for local governments to be carbon neutral in operations in 2012 and beyond. The Climate Action Revenue Incentive Program provides a refund on the Province's revenue-neutral carbon tax (\$30/tonne) for municipal operations, contingent upon reporting on the plan and progress toward meeting their climate action goals.

Once fully implemented, the benchmarking and reporting strategy will provide the foundation for investments in energy efficiency retrofits, supported by the following complementary measures:

- Utility demand-side management (DSM) programs;
- Energy audits;
- Retro-commissioning of buildings and systems;
- Capital asset renewal plans; and,
- Model green lease for high performance buildings.

Consultant Study with Analysis of Potential Policy Measures

The City of Vancouver, like many municipal governments across BC are confronted with the challenge of reducing energy and GHG emissions to meet Provincial Climate Action targets of 33% below 2007 levels by 2020. An analysis of existing policies, regulations and programs which Vancouver has adopted to date showed that new actions would be required to reach its defined target of reducing greenhouse gases by 160,000 tonnes by 2020. As a result, Vancouver initiated a consultant study (Light House 2013) to identify and assess potential combination of measures (policies, regulations, incentives, rebates, financial mechanisms, education and

capacity building) that, when combined, would enable Vancouver to reach its energy and emissions reduction targets.

An analysis of Vancouver's building stock highlighted the challenges and opportunities of undertaking a retrofit strategy. Detached houses represent the largest number of buildings, covering 75% of Vancouver's land area. Over 50% of the detached houses are over 50 years old, and many were built prior to the building code requiring wall insulation in 1991 (COV 2014(2)). Accordingly, the consultant study identified a combination of measures including further amendments to the VBBL in the housing and other sectors that require graduated energy efficiency upgrades based on the type or value of the renovation. For larger buildings, these upgrades include a requirement for retro-commissioning, estimated to reduce median, whole building energy demand by 16% (Light House 2013).

Another proposed measure for houses is to partner with utilities to augment the Home Energy Rebate Offer (HERO) that replaced the highly successful provincial LiveSmart BC program¹. Vancouver's involvement in HERO could include incentives to undertake deep retrofits of houses, targeting an average two metric tonne reduction in emissions per participant.

There are approximately 5,700 multi-unit residential building (MURB) properties in the City of Vancouver with approximately 174,000 residential units, representing approximately 62% of the households in Vancouver (COV 2014(4)).

While MURBs represent a significant amount of the building stock it is also one of the most difficult building sectors to address due to barriers such as split-incentives, lack of information and awareness, lack of applicable utility incentives and the large potential number of transactions resulting from energy efficiency programs (multiple owners/tenants within one building). There is a strong rationale for targeting rental MURBs to help address multiple public objectives, including housing affordability. In addition, landlords often have multiple buildings their portfolios, allowing for efficient program administration with broader reach.

Proposed measures to address MURBs include the amendments to the VBBL to require graduated energy efficiency based on value of renovation, as described in the previous section. Two pilot programs for each of rental (landlords) and owner-occupied (condominiums) MURBs include funding for energy benchmarking studies, energy audits and promotion of utility demand side management (DSM) programs aligned with capital investment cycles. An untapped, golden opportunity exists to complete energy benchmarking studies at the same time as "Depreciation Reports", which are now required under the *Strata Property Act* to plan for the repair, maintenance and replacement of common property assets. Energy audits and efficiency improvements (e.g., high efficiency boilers) can be integrated into the scheduled capital improvement projects rather than installing the regulated minimum standard equipment (e.g., 80% efficient boilers).

Regulated benchmarking and reporting is proposed for MURBs with a gross floor area greater than 50,000 ft². Approximately 730 large MURB properties would be affected (13% of all MURBs), accounting for 54% of the residential units. Following the processing of data, Vancouver could release statistics on the city-wide average MURB energy performance to encourage voluntary retrofits of existing buildings based on improved market awareness. As noted earlier, cities in BC need to be empowered to introduce new regulations through provincial legislation. As a result, the Lower Mainland Local Government Association, comprised of 33 municipalities and 3 regional districts, endorsed a Vancouver benchmarking "Resolution" in

¹ <http://www.livesmartbc.ca/>

May 2014. The resolution requests the Province to introduce new legislated powers to enable building energy benchmarking, reporting and disclosure regulations (LMLGA 2014).

A targeted incentive program for “deep energy retrofits” would also be proposed to address the highest emitting buildings (i.e., over 3.5 tonnes/unit). Figure 3 highlights the results of a benchmarking study of over 60 MURBs, illustrating that such a program could target approximately 16,000 residential units on the far right of the chart (RDH 2013).

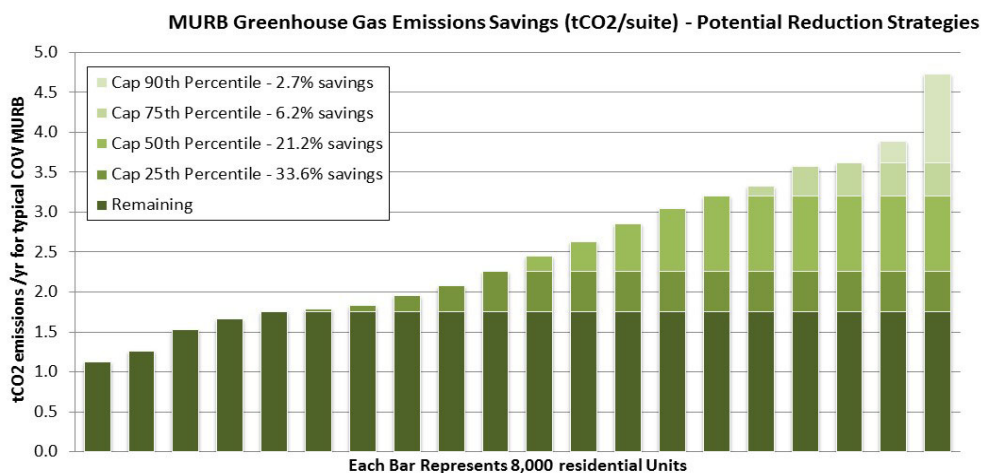


Figure 3. Estimate of emissions (metric tonnes per residential unit) of MURBs. *Source:* RDH 2013.


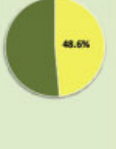

The commercial and institutional sectors includes 5,200 properties with over 114 million square feet of floor area. 420 properties larger than 50,000 ft² represent 61% of the total square footage (COV 2014(4)). The key Strategy measure for influencing emissions in this sector is a proposed benchmarking reporting regulation that would encourage voluntary retrofits of buildings based on improved market awareness of energy performance. For the institutional sector, reductions are based on significant leadership for public sector buildings, noted earlier.

The industrial sector represents approximately 20% of the city’s building-related emissions. The majority of energy and GHG emissions within Vancouver’s industrial sector come from five of Vancouver’s largest industrial production processes, not from operation of the actual buildings. This presents a challenge in terms of how to address emissions using available levers. Accordingly, the consultant report recommends an integrated approach to address not only building emissions through regulations but also process improvements through applying the “continuous improvement” principle (i.e. ISO 50001 and strategic technologies which would be encouraged through incentive/rewards program). Proposed amendments to the VBBL would include mandatory minimum equipment standards for boilers, air heaters, and ovens/dryers, furnaces at the time of replacement. The City would also promote partner-delivered incentives including DSM incentive programs offered by utilities.

The consultant report looked at the range of policy levers available to Vancouver of Vancouver, including regulations, incentives, awareness and education building as well as demonstration projects (technology). Table 4 illustrates the results of the policy analysis on the wide range of measures considered, noting the sector being affected, targeted building types, principles for Strategy design (noted “strategies” in figure), sample policy measures and a qualitative impact assessment (low, medium, high) pertaining to four categories: greenhouse gas

reductions; electricity savings (noting that electricity in BC has low-emissions); administrative efficiency for the City of Vancouver; and, technical feasibility (availability of capacity in the workforce to deliver).

Table 4. Summary of analysis in consultant report

Sector	Targeted Building Types	% Emission (2007)	Strategies	Sample Measures	Mechanisms					Potential Impact*				
					Regulations	Incentives	Awareness	Education	Technology	GHG Reduction	Electrical Saving	Admin. Efficiency (CoV)	Technical Feasibility	
Heavy Industrial	<ul style="list-style-type: none"> Heavy Industrial Facilities Large Industrial Processes 		<ul style="list-style-type: none"> Focus on largest emitters Continuous Improvement Strategy Strategic Technologies & Upgrades 	VBBL Amendments (Reports, Benchmarking, RCx)	✓		✓			H	H	H	H	
				Targeted audits		✓	✓			M	M	H	M	
				Continuous Improvement (CEM, ISO 50001)			✓	✓			M	M	H	M
				Re-commissioning + Retro-commissioning (RCx)	✓	✓	✓				H	H	H	H
				Min. efficiency for equipment (Boiler program, performance)	✓				✓		M	M	H	M
Residential	<ul style="list-style-type: none"> Multi-unit Residential <ul style="list-style-type: none"> > 3 storey ≤ 3 storey Detached <ul style="list-style-type: none"> 1 + 2 Family Dwellings Row Houses 		<ul style="list-style-type: none"> Focus on rental housing stock Tie energy efficiency to Depreciation Reports Energy Efficient Checklist 	VBBL Amendments (Reports, Benchmarking, RCx)						H	H	M	M	
				Green Landlord Program			✓	✓		L	L	M	M	
				Condo Capacity Building			✓	✓			L	L	M	M
				Energy Neighbourhood Challenge		✓	✓	✓			L	L	H	H
				Partner with utilities to incent "ER"s (Energy Retrofits)		✓	✓				H	H	L	M
				"LiveSmart ER" (Proposed extension)		✓	✓	✓			H	H	L	M
Commercial, Institutional & Other Industrial	<ul style="list-style-type: none"> Large Commercial Small Commercial Institutional & Community Use Warehouses & Light Industrial 		<ul style="list-style-type: none"> Continuous Improvement Strategy Focus on largest emitters CoV Lead by Example (Civic Bldgs) 	Benchmark and audit all civic buildings	✓		✓			M	M	H	H	
				VBBL Amendments (Reports, Benchmarking, RCx)	✓					H	H	H	H	

Source: Light House 2013.

Table 5 summarizes the estimated impacts of a package of proposed measures, based on the analysis in the consultant report. It includes government leadership, building energy benchmarking, partnerships with utilities to encourage participation in demand-side management programs and co-fund key components (e.g., energy audits) and regulations under the VBBL.

Table 5. Summary of impacts of recommended measures

Sector	2020 Emission Reductions (tonnes / yr)	% of target	Avoided Annual Energy Costs (million \$)
Houses	31,000	19%	\$ 4
Multi-Unit Residential Buildings	29,000	18%	\$ 23
Commercial Buildings	40,000	25%	\$ 44
Public Sector Buildings	27,000	17%	\$ 22
Industrial Facilities	33,000	21%	\$ 6
TOTAL	160,000	100%	\$ 99

Source: COV 2013 and COV 2014

The largest emission reduction (25% of the total) is from the commercial sector, with 16,000 metric tonnes resulting from a proposed retro-commissioning policy. Avoided energy costs are conservatively stated, as they are based on 2013 BC Hydro and FortisBC rates, assuming no escalation.

New Construction Actions

Requiring new construction to be built to a higher standard of energy efficiency is relatively more straightforward than reducing energy use in existing buildings. On the other hand, the target for 2020 is that new buildings will be carbon-neutral in operations is ambitious, effectively an outcome-based standard.

Vancouver's Building Bylaw (VBBL) is an effective tool for influencing new construction standards in Vancouver, by means of mandating prescribed design principles, or referencing energy efficiency standards such as ASHRAE 90.1 (2010) and the National Energy Code for Buildings (2011) as in the recently adopted 2013 version of the VBBL with an effective date of January 2014.

Some other key measures for new construction, outlined in the September 24, 2013 Council Report (COV 2013) include the following requirements for buildings:

- Master light control (green switch) in all apartment units in buildings containing 20 or more units;
- Overhead lights serving stairs and exit corridors are provided with occupancy based lighting sensor controls;
- Sub-metering of natural gas equipment is required in residential buildings with more than 20 units for:
 - hot water generated by a central hot water generation system,
 - natural gas consumption used for air handling systems in common areas, and,
 - natural gas used for domestic hot water in amenity spaces for pools and spas;
- Sub-metering of hot water generated by a central system and natural gas for air handling units in common areas, domestic hot water in amenity spaces, pools and spas, and,

The design teams for buildings that undertake rezoning will provide an assessment of the anticipated energy performance of the building. Following occupancy, these figures could be compared against the actual “in-operation” performance of buildings assessed as part of a building energy benchmarking policy (for existing buildings).

Table 6 provides an overview of the cost-benefit analysis that was conducted for the changes to VBBL, outlined in COV 2013.

Table 6. Impact of VBBL for new construction.

Building Type	Payback on Energy Upgrades	Energy Savings (%)	Incremental Capital Cost (% of Construction cost)	Incremental Capital (\$ per sq. ft.)
High-rise Residential (20 Storey)	2 years	7%	0.04%	\$0.10
Mid-rise Residential (5 Storey)	1 year	5%	0.02%	\$0.06
Mid-rise Mixed Use (with Ground Retail)	2 years	5%	0.05%	\$0.10
Low-rise Commercial (Stand Alone Retail)	2 years	19%	0.17%	\$0.30
High-rise Commercial (17 Storey Office)	2 years	16%	0.10%	\$0.20
Mid-rise Commercial (5 Storey Infill Office)	2 years	17%	0.17%	\$0.31
Wood Frame Mid-rise Residential	1 year	3%	0.04%	\$0.06

Source: COV 2013(2)

In addition, Vancouver has a policy that applies to large buildings that are constructed following a re-zoning application, essentially constructing outside of the original land-use designations. The requirements adopted in June 2014 require LEED Gold Certification plus 22% lower energy cost than the 2013 VBBL (based on ASHRAE 90.1 2010) (COV 2014(5)).

For one and two family dwellings and laneway houses, the VBBL amendments effective January 1, 2015 include a number of standards, namely:

- improved energy efficiency for walls, roofs, windows (i.e., a U-value of 1.4 W/(m²-K) or 0.245 BTU/hr-ft²-K) and skylights;
- energy efficient boilers and furnaces (AFUE 92%), hot water tanks and gas fireplaces;
- insulated hot water plumbing;
- mandatory air tightness testing and improved air-tightness (3.5 ach@50Pa);
- electric vehicle charging outlets in garages;
- heat recovery ventilators; and,
- energy efficient wood burning heating appliances.

Conclusions

Vancouver is on track for meeting its Greenest City Action Plan targets of: (1) all new construction is to be carbon neutral in operations in 2020 and (2) reduce energy consumption and greenhouse gas emissions from existing buildings by 20% (over 2007 levels) by 2020. A strategy has been developed to facilitate retrofits of existing buildings and reductions of industrial process emissions. A number of amendments to the Vancouver Building Bylaw with a menu of energy efficiency requirements will provide a foundation for reductions in emissions from new construction and upgrades to existing buildings. These, combined with comprehensive energy benchmarking for large buildings across the stock and implementation of other tools to encourage existing building retrofits, will target a 160,000 tonne annual emission reduction in 2020. On the new construction side, design teams for buildings seeking rezoning are required to declare the energy use intensity (EUI) of new buildings. After the new building has been used for a period of time, the original design EUI could be compared benchmarking data.

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