

High-Performance Housing for the “Missing-Middle”

Planning and Policy Tools for the City of New Westminster

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Executive Summary

Commercial, residential and institutional buildings are the largest source of emissions worldwide¹ and in order to reduce climate impacts and urban air pollution, the construction that is projected to take place offers both challenges and opportunities. If the current construction standards do not evolve, emissions from the building sector are projected to double by 2050². An approach to reduce emissions from buildings while also improving comfort, resilience and durability is to improve the thermal performance of building enclosures through increasing insulation and air tightness of walls, roofs and windows³.

The City of New Westminster is developing land use planning and regulatory approaches to support local adoption of the new BC Energy Step Code. To date, projects such as Energy Save New West that provides support to local builders, designers and architects in pursuing high performance. The aim of this project is to help inform City staff on preferred planning policy and regulatory options specific to what is sometimes referred to in BC's Lower Mainland as 'missing middle' housing. These types of housing are strongly encouraged in New Westminster's new Official Community Plan 2041. This research project was done in two major phases, the first phase allowed for background research to be conducted and in the second phase three key informants, from different local municipalities (put forward by the project mentor) were interviewed.

Adopted in October 2017, "Our City 2041" is the Official Community Plan (OCP) of New Westminster. The OCP addresses the limited housing options and the need to construct ground-oriented dwellings. More importantly, these new types of housing not only need to be energy-efficient, but they need to make sure that they are affordable for everyone. To inform these types of buildings being built, the uptake of the BC Energy Step Code is necessary by the City of New Westminster.

The key Informants interviewed informed three major key themes. The first emerging theme is that, the City of New Westminster should look at adopting the step code with prescriptive minimums. In order to achieve the higher steps Developers have to use the performance approach, this means that each project has custom performance specifications. Therefore, enforcement becomes difficult as the Energy Inspector has to spend more time at each site to make sure that each project has actually achieved the goal they set out. If the step code is adopted with prescriptive minimums, it will allow for speedier on-site energy inspection.

The second emerging theme is to, ensure that City staff have had an opportunity to fully understand the upcoming changes to the policies. With policy changes, while it is important to

¹ Frappé-sénéclauze, Heerema, and Tam, "Accelerating Market Transformation for Building Enclosures House."

² Frappé-sénéclauze, Heerema, and Tam.

³ Frappé-sénéclauze, Heerema, and Tam; Perkins + Will, "Passive House."

make sure that city staff are engaging with the community at large, it is also very important for the staff to make sure that their colleagues are also on the same page. A resource that the City of New Westminster should look into is the book, *Dialogue Gap: Why Communication Isn't Enough and What We Can Do About It, Fast* by Peter Nixon. In the book, Nixon explores the growing disconnect and its significance in an increasingly globalized world where the ability to engage with others (to address issues like climate change) has become essential.

The final emerging theme is to, energy standards have to be calibrated in a manner to ensure they support the objectives of the OCP. Housing affordability is a pressing issue in Metro Vancouver with almost half of the city residents being renters, they cannot make building upgrades that deliver the biggest savings. Which can mean that landlords may roll utility costs into monthly rents, when utility expenses go up, so do bills and so may rents. For low-income households, even a slight increase in housing costs can mean families must choose between basic necessities like food and medical care.

Introduction

Commercial, residential and institutional buildings are the largest source of emissions worldwide accounting for approximately one third of energy related emissions; and in Canada these buildings make up one fifth of the carbon pollution making them the largest source of emissions in North America⁴. It is estimated that 900 billion square feet of commercial, residential and institutional buildings will be built and rebuilt in urban areas by 2030 with fifteen percent of this growth happening in U.S. and Canada⁵. In order to reduce climate impacts and urban air pollution, the construction that is projected to take place offers challenges and opportunities. If the current construction standards do not evolve emissions from the building sector are projected to double by 2050⁶. An approach to reduce emissions from buildings while also improving comfort, resilience and durability is to improve the thermal performance of building enclosures through increasing insulation and air tightness of walls, roofs and windows⁷.

The City of New Westminster is developing land use planning and regulatory approaches to support local adoption of the new BC Energy Step Code. To date, the City has launched a community-based energy efficiency and GHG emission reduction initiative for new and existing buildings (more information can be found on the EnergySaveNewWest.ca website), that provides support to local builders, designers and architects in pursuing high performance. This project builds on the policy developed by the City in 2016-2017 laying out a set of Passive Design Exclusions for New Westminster's single-detached zones. These included Floor Space Ratio (FSR) increases to compensate for thicker insulated wall assemblies, height relaxations for deeper insulated foundations and roofs, which are tied to homes achieving the top 3 levels of the Step Code.

The aim of this project is to help inform City staff on preferred planning policy and regulatory options specific to what is sometimes referred to in BC's Lower Mainland as 'missing middle' housing. That is, policies relevant to ground-oriented wood-frame multi-residential buildings such as townhomes / row homes, duplexes, triplexes and quadraplexes, as well as multi-residential housing forms such as stacked townhomes and 4-6 storey mid-rise apartment buildings. These types of housing are strongly encouraged in New Westminster's new Official Community Plan 2041.

⁴ Frappé-sénéclauze, Heerema, and Tam, "Accelerating Market Transformation for Building Enclosures House."

⁵ Frappé-sénéclauze, Heerema, and Tam.

⁶ Frappé-sénéclauze, Heerema, and Tam.

⁷ Frappé-sénéclauze, Heerema, and Tam; Perkins + Will, "Passive House."

Research Approach

This research project was done in two major phases, the first phase allowed for background research to be conducted and in the second phase three key informants, from different local municipalities (put forward by the project mentor) were interviewed.

The background research in phase 1 allowed for information gathering on:

1. Reading and understanding the Official Community Plan, Community Energy and Emissions Plan, British Columbia Building Code, the British Columbia Energy Step Code
2. A scan of best practices from five local municipalities which has been summarized in a table in Appendix 1
3. A scan of academic research relevant to the project

In phase 2 interviewing the three key informants allowed for:

1. A better understanding of the findings from phase 1
2. To fill in knowledge gaps and answer questions that may have come up after completing the first phase
3. An opportunity for the key informants to advise on what they think the city of New Westminster could do

Background

New Westminster Official Community Plan⁸ and The Community Energy and Emissions Plan⁹

Adopted in October 2017, “Our City 2041” is the Official Community Plan (OCP) of New Westminster. The OCP states that in 2016, 95% of the city’s housing stock was in the form of detached dwelling and apartments. Figure 1, shows the housing stock in 2011. As a result of the limited housing options, New Westminster’s action item is to continue “to explore opportunities to increase the variety and stock of ground-orientated infill housing such as duplexes and triplexes” (Pg. 102). Examples of ground-oriented units include carriage and laneway houses, rowhouses, townhouses, duplexes, triplexes and single detached dwellings.

⁸ New Westminster, “Our City 2041.”

⁹ Stantec Consulting Ltd., “City of New Westminster Community Energy and Emissions Plan.”

Dwelling Type	Units	Percent
Single Detached Dwellings (including suites)	8,450	28%
Duplexes	115	<1%
Townhouses and Rowhouses	1,260	4%
Apartment (less than 5 storeys)	11,365	37%
Apartment (5 or more storeys)	9,315	31%
Other	75	<1%
Total Housing Units	30,580	100%

Figure 1: City of New Westminster housing stock in 2011. Retrieved from the City of New Westminster OCP

Metro Vancouver is already an expensive region and that means that market housing options are often not affordable to low- and moderate- income households. This also means that families and individuals may end up spending most of their income on housing costs including high utility bills, with little left over for other expenses such as food, clothing and transportation. Thus, a lack of affordable housing can contribute to stress and poor health for community members.

Moreover, the OCP states that 41% GHG emissions in the city are produced by buildings, with 39% at the emissions being produced by residential buildings. The city has the ability to influence energy use and GHG emissions in the built environment through the establishment of policy direction, zoning requirements and development permit guidelines for new buildings regarding energy efficiency. This city is committed to support programs to advance the technical skills and knowledge of local homebuilders and architects and designing and constructing high-performance homes and communicating the benefits to homebuyers.

A major challenge outlined in the Community Energy and Emissions Plan (CEEP) is that since almost half of the dwellings in the city are rented, retrofitting existing buildings is tougher. This may be because in older buildings, heat and water costs are included in the rent thus, there is a lack of direct financial incentive for residents to change the energy consumption behavior. Moreover, tenants are less inclined to make energy efficient investments in dwellings where they may be living temporarily.

Therefore, it is important for the City to develop incentives and policies to encourage and require *new* Part 9 buildings to attain higher energy performance standards. Since new construction in New Westminster will focus on ground-oriented residential buildings this will result in the City having higher energy performance than communities were projected growth is largely in single-family dwellings.

*British Columbia Building Code*¹⁰

BCBC is a provincial building regulation that applies to the construction of new residential, commercial, institutional and industrial buildings, and to the alterations and additions to existing buildings. The BCBC also sets minimum standards for health, safety, fire and structural protection, accessibility and energy and water efficiency. The BCBC regulates buildings into main categories simple buildings commonly called Part 9 and complex buildings commonly called Part 3. Based on their use and size difference the building requirements vary for each type of building. Table 1 shows the differences between Part 9 and Part 3 buildings. Therefore, ground-oriented units that have been outlined in the OCP can be classified as Part 9 buildings.

	MAIN TYPES OF BUILDINGS	
	Part 3 Buildings (Complex)	Part 9 Buildings (Simple)
Size	All buildings over three storeys in height or over 600 square metres in footprint. Some buildings three storeys or less in height or under 600 square metres in area that are of a specific use.	Most buildings three storeys and under in height and with a footprint of 600 square metres or less.
Description	Buildings intended for public gatherings, residential care, detention or high-hazard industrial activities. Some larger buildings intended for residential, commercial or medium-to-low hazard industrial activities.	Small buildings intended for residential, commercial or medium-to-low hazard industrial activities.
Examples	Shopping malls Office buildings Condos Apartment buildings Hospitals Care facilities Daycares Schools Churches Theatres Restaurants	Houses and duplexes Small apartment buildings Small commercial buildings with stores or offices Small industrial shops

Table 1: A description of the main types of buildings regulated by the BCBC. Retrieved from: Understanding B.C.’s Building Regulatory System

¹⁰ Office of Housing and Construction Standards, “Understanding B.C.’s Building Regulatory System.”

What is the British Columbia Energy Step Code?¹¹

The British Columbia Energy Step Code (the step code) is a voluntary provincial standard enacted in 2017 to provide an incremental and consistent approach to achieve more energy-efficient buildings that would go beyond the requirements of the BCBC. The step code supports the Province’s commitment to increase energy-efficiency requirements within the BCBC to ensure that buildings are net-zero ready by 2032.

The step code provides a series of measurable energy-efficiency requirements for construction which builders can choose to build to. As seen in figure 2, the regulation sets performance targets for new construction by grouping them into “steps”. The Lower Steps are relatively straightforward to meet while the Upper Steps are more ambitious. Communities may voluntarily choose to adopt the step code into the bylaws and policies.



Figure 2: The BC Energy Step Code is divided into 5 steps. The lower steps are easier to achieve while the upper steps are more ambitious.

When the BCBC introduced energy efficiency in 2008, builders and developers used two main approaches, the prescriptive approach or the performance approach. The prescriptive approach is the more common approach where, buildings must meet specific requirements for insulation, windows, furnaces, water heaters, lighting and other equipment systems. However, this has meant that the building does not perform as well as it is intended to do so.

The second approach to comply with energy efficiency is known as the performance approach. This approach establishes a desired outcome and allows the team to decide how they want to approach it. To comply with the step code, Builders must use energy software

¹¹ Province of British Columbia, “BC Energy Step Code.”

modelling and on-site testing to prove that the building design and constructed building meet the requirements of the standard. This approach echoes green-building certification processes such as Passive House Institute, Natural Resources Canada’s Energy Star for New Homes and R-2000 programs.

What is Passive House?

The Passivhaus Institut (PHI) was founded in Germany, in 1996 and through the fundamentals of building physics, the standard of achieving Passive House certification was developed¹². A building can be certified as a Passive House building by meeting a series of technical requirements. The performance-based energy standards used in building construction are done so with the primary goal of achieving exceptional energy efficiency whilst maintaining inhabitant comfort¹³. Passive House applies to both new and existing buildings as the certification criteria provide a proven and financially viable methodology for energy retrofits¹⁴

Design teams have the ability of developing their own design strategies as long as the requirements are met and validated. The focus on passive measures in the building design is of utmost importance. ‘Passive’ measures are those that are built into the design of the building to achieve high performance levels, whilst conventional ‘active’ systems require the use of energy. Passive measures result in buildings that consume 50 percent less overall energy than a typical building in North America¹⁵.

Furthermore, with passive measures it is possible to reduce the energy used for heating a building by up to 90 percent compared to conventional practices¹⁶. Along with meeting lower energy standards, passive house buildings are also required to meet specific ventilation and comfort criteria. The ventilation system must avoid condensation, be efficient and providing exceptional comfort and air quality¹⁷.

In order to qualify for the certification, a building has to meet the following criteria:

Primary Energy: 30-60 kWh/m ² yr	• Airtightness Overheating:
Space Heating Demand: 15 kWh/m ² yr	0.6 ACH@50Pa
Space Cooling Demand: 15 kWh/m ² yr	• Overheating (over 25°C) ≤
Space Heat load: 10 W/m ²	10%

¹² Perkins + Will, “Passive House.”

¹³ Perkins + Will.

¹⁴ Passive House Canada, “A Developer’s Guide to Passive House Buildings: An Industry Resource for Designing and Constructing Passive House (Passivhaus) Buildings in Canada.”

¹⁵ Perkins + Will, “Passive House.”

¹⁶ Frappé-sénéclauze, Heerema, and Tam, “Accelerating Market Transformation for Building Enclosures House.”

¹⁷ Passive House Canada, “A Developer’s Guide to Passive House Buildings: An Industry Resource for Designing and Constructing Passive House (Passivhaus) Buildings in Canada.”

Discussion

Having conducted the key informant interviews and the necessary background research this report brings forward three emerging themes for the City of New Westminster to consider when developing energy-efficient policies for ground-oriented, Part 9 buildings. It should be noted that by no means is this an exhaustive list and more research and engagement is encouraged. The first emerging theme is that, the City of New Westminster should look at adopting the step code with prescriptive minimums. The second emerging theme is to, ensure that City staff have had an opportunity to fully understand the upcoming changes to the policies. The final emerging theme is to, energy standards have to be calibrated in a manner to ensure they support the objectives of the OCP

1. Adopting the step code with prescriptive minimums

As mentioned earlier, to date many developers have used the prescriptive approach to address energy efficiency in Part 9 buildings. However, in order to achieve the higher steps Developers have to use the performance approach, this means that each project has custom performance specifications. Therefore, enforcement becomes difficult as the Energy Inspector has to spend more time at each site to make sure that each project has actually achieved the goal they set out. If the step code is adopted with prescriptive minimums, it will allow for speedier on-site energy inspection because you either meet the minimum requirements or you do not. The key informant did not specify how the prescriptive minimums would be established.

2. Ensuring that City Staff have had an opportunity to fully understand the upcoming changes to the policies

With policy changes, while it is important to make sure that city staff are engaging with the community at large, it is also very important for the staff to make sure that their colleagues are also on the same page. This means engaging all the City Staff that will be affected by the policy change right from the beginning so that there is no confusion when the policy is adopted. A critical way this can take place is through dialogue and creating a safe space for city staff to discuss their fears and concerns.

A resource that the City of New Westminster should look into is the book, *Dialogue Gap: Why Communication Isn't Enough and What We Can Do About It, Fast* by Peter Nixon. In the book, Nixon explores the growing disconnect and its significance in an increasingly globalized world where the ability to engage with others (to address issues like climate change) has become essential. The book will help the reader understand the difference

between communication and dialogue. It also explores the make-up and causes of the dialogue and what constitutes as “good” dialogue. Finally, it identifies the most common reasons people do not dialogue effectively and provides helpful tips on how to engage in more effective and productive dialogue.

3. Energy standards have to be calibrated in a way that they support the objectives of the Official Community Plan¹⁸

Housing affordability is a pressing issue in Metro Vancouver and as it was stated before a lot of the dwellings in New Westminster are rented. As renters, cannot make building upgrades that deliver the biggest savings, and landlords may roll utility costs into monthly rents, when utility expenses go up, so do bills and so may rents. For low-income households, even a slight increase in housing costs can mean families must choose between basic necessities like food and medical care. Therefore, ever-increasing rents and utility bills can force low-income families from their homes and their communities, with devastating impacts to their economic, educational and emotional well-being.

If building owners have access to funding and the expertise needed to make energy- and money-saving upgrades, the benefits also go to tenants through stabilized rents and expenses. A study completed in 2015 by the non-profit *Energy Efficiency For All* suggested that implementing energy-efficiency programs across a spectrum of housing types could result in cost-effective energy savings of 15 to 30 percent and even at the low end would represent large reductions in usage and savings. Any construction, especially new housing, that does not include efficiency standards is neglecting the needs of families in those homes.

If two key objectives of the OCP are to make sure that all new housing developments meet high energy standards and are affordable. Then, it has been proven that energy-efficient housing is more affordable over its lifetime than non-efficient buildings. Furthermore, over their lifetimes, efficient homes are more affordable, healthier and provide better opportunities for residents than conventional buildings. An affordable housing program that doesn’t prioritize efficiency is falling short on its mission and wasting money.

¹⁸ Strauss, “To Make Housing Affordable For All It Must Be Energy Efficient”; Schweitzer, “Can Low-Income Housing Be Energy Efficient and Affordable?”; Deutsche Bank, “The Benefits of Energy Efficiency in Multifamily Affordable Housing”; World Green Building Council, “The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants.”

Recommendations & Next Steps

This project was completed in 250 hours which means that the research and interviews done in this project are limited. It is encouraged that the City of New Westminster take into the consideration the emerging themes from the key informant interviews.

1. Adopting the step code with prescriptive minimums

This emerging theme is the most technical out of the three and will require more information on what the prescriptive minimums could look like. This is also a question that could be asked at the “Builder Breakfasts” to see how developers and other industries feel about this approach.

2. Ensuring that City Staff have had an opportunity to fully understand the upcoming changes to the policies

It is encouraged that the City of New Westminster create an engagement session with the different departments that will be affected by the potential policy. The ideal engagement session would create a safe environment for internal City Staff to voice their concerns, ask questions and get to know to know more about the policy prior to adoption.

3. Energy standards have to be calibrated in a way that they support the objectives of the Official Community Plan

This is arguably the most important emerging theme as it address the question of housing affordability in the City. To fully understand this topic much more research needs to be done. Not only to make a stronger case for higher energy efficiency homes but to make a case for energy efficiency for low income populations. Moreover, the city of New Westminster should look at the following documents to make a stronger case for energy efficiency in affordable housing.

- Deutsche Bank. “The Benefits of Energy Efficiency in Multifamily Affordable Housing” 2012
- Energy Efficiency For All. “The Potential for Energy Savings in Affordable Multifamily Housing”
- World Green Building Council. “The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants”

Appendices

Local Government Scans

Municipality	Policy for Part 9 buildings	Incentives	Additional Notes
City of North Vancouver	<p>Small residential buildings (under 1200 sq. ft.) – Step 1</p> <p>Large residential buildings (over 1200 sq. ft.) – Step 3</p>	<p>PATH \$300 rebate to support mandatory mid-construction blower door tests</p> <p>Floor Space exclusions for thicker walls</p>	<p>- Retrieved from: https://www.cnv.org/property-and-development/building-and-development/plans-and-programs/energy-efficient-buildings-initiative/energy-efficient-bylaws-for-new-buildings</p>
District of North Vancouver	All part 9 buildings	The achievement of higher steps allows for density bonuses	<p>- Retrieved from: http://www.dnv.org/property-development/energy-step-code</p>
City of Richmond	<p>Part 9:</p> <p>Detached homes – Step 1</p> <p>Townhouses – Step 3</p> <p>Low rise apartments – Step 1</p>	<p>Thick wall FSR exclusions</p> <p>Eligibility to take a one-day Airtightness Techniques Course free of charge.</p> <p>Higher steps negotiated on a case by case basis</p> <p>Free pre-drywall blower-door tests of detached houses, duplex and townhouse units under construction.</p>	<p>- Retrieved from: https://energy.richmond.ca/energy-step-code/</p>
City of Vancouver	<p>Part 9:</p> <p>All residential units – Step 3</p>	<p>Height, rear yard setback, building depth relaxations for Passive House</p> <p>Rezoning policies applicable for Step 4</p> <p>Floor area exclusions in order to accommodate</p>	<p>- Retrieved from: https://vancouver.ca/home-property-development/energy-efficiency-requirements-and-resources-for-homes.aspx</p>

		<p>improved building performance</p> <p>5% additional density allowance for high performance buildings</p>	
District of West Vancouver	<p>Coach houses – Step 1</p> <p>Single family – Step 3</p> <p>Multi-family – Step 3</p>	<p>Free reduction and faster permitting for Passive House</p> <p>For Step 4/5/Passive House: Floor area and site coverage increase, increase roof ridge height, a reduced front/ side/ rear yard setback</p> <p>BC Hydro rebate applied at permit</p> <p>application for use of an Energy Advisor</p> <p>Fortis BC rebate when natural gas is used for space and water heating</p>	<ul style="list-style-type: none"> - For FAR and roof ridge height increases and reduced setbacks each Step is associated with a different allowance - For the BC Hydro and Fortis BC rebates, each step is associated with a different monetary value - Retrieved from: https://westvancouver.ca/home-building-property/construction-renovating/building-permits/energy-step-code

References

- Deutsche Bank. “The Benefits of Energy Efficiency in Multifamily Affordable Housing,” 2012. https://www.db.com/usa/docs/DBLC_Recognizing_the_Benefits_of_Efficiency_Part_B_1.10.pdf.
- Frappé-sénéclauze, Tom-pierre, Dylan Heerema, and Karen Wu Tam. “Accelerating Market Transformation for Building Enclosures House,” 2016.
- New Westminster. “Our City 2041,” 2017. [https://www.newwestcity.ca/database/files/library/Our_City_2041_Official_Community_Plan___Adopted_Oct_2_2017___ONLINE_VERSION\(2\).pdf](https://www.newwestcity.ca/database/files/library/Our_City_2041_Official_Community_Plan___Adopted_Oct_2_2017___ONLINE_VERSION(2).pdf).
- Office of Housing and Construction Standards. “Understanding B.C.’s Building Regulatory System,” 2015. <http://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/building-act/building-act-guide>.
- Passive House Canada. “A Developer’s Guide to Passive House Buildings: An Industry Resource for Designing and Constructing Passive House (Passivhaus) Buildings in Canada,” n.d.
- Perkins + Will. “Passive House,” 2018. http://www.passiv.de/en/02_informations/01_whatisapassivehouse/01_whatisapassivehouse

.htm.

Province of British Columbia. “BC Energy Step Code,” 2018. <https://energystepcode.ca/how-it-works/>.

Schweitzer, Sophia V. “Can Low-Income Housing Be Energy Efficient and Affordable?” *Ensia*, 2016.

Stantec Consulting Ltd. “City of New Westminster Community Energy and Emissions Plan,” 2011. [https://www.newwestcity.ca/database/rte/files/NewWest CEEP Final.pdf](https://www.newwestcity.ca/database/rte/files/NewWest%20CEEP%20Final.pdf).

Strauss, Valerie. “To Make Housing Affordable For All It Must Be Energy Efficient.” *Energy Efficiency For All*, 2018. <https://www.nyeeffa.org/to-make-housing-affordable-for-all-it-must-be-energy-efficient/>.

World Green Building Council. “The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants,” 2013, 1–124.