BC Energy Step Code and Zero Carbon Step Code

A Best Practices Guide for Local Governments

BRITISH COLUMBIA

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Photo: Passive House, Surrey BC (Part 9, Step 5).

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Step Code Council Members

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NRC · CNRC

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City of Vancouver | Greenest City

BC Hydro Power smart

BC Housing

FortisBC Energy at work

The University of British Columbia sustainability

zebx Zero Emissions Building Exchange Powered by zeic

HAVAN Homebuilders Association Vancouver

bcca British Columbia Construction Association

Aboriginal Housing Management Association Celebrating 25 Years

AIBC Architectural Institute of British Columbia

Canadian Home Builders' Association British Columbia

UNBC University of Northern British Columbia

ASTTBC Technology Professionals

BOMA Canada

UBCM

PIBC Planning Institute of British Columbia Forward Thinking Shaping Communities

LGMA Local Government Management Association of British Columbia

UDI Urban Development Institute

Building Officials' Association of BC

Engineers & Geoscientists British Columbia

Letter from the Chair of the Step Code Council

The BC Energy Step Code has transformed this province's construction landscape. Energy modelling, air tightness testing, and the envelope-first approach are now well-established as industry best practice.

Local government staff and elected officials now have ready access to the policies that can help them achieve their environmental, land use, and housing goals. Once a nascent subsector, a robust industry of consulting energy advisors now serves all climate zones to help builders achieve affordable energy efficiency. Higher-performance building products are now available, and the province's leadership has strongly influenced the national approach to energy-efficient building codes.

This transformation would not have been possible without cooperation and communication between all parts of the construction sector. Industry groups and trade associations, local governments, provincial staff, and other experts have organized or presented at literally hundreds of events and training courses, and produced stacks of resources, including technical and policy guides.

For much of this work, we can credit the Step Code Council. The multi-stakeholder advisory body serves as a "bridge" between the provincial government, utilities, local governments, and the building, development and design sectors, to help local governments adopt the BC Energy Step Code in a prudent and coordinated manner. Through regular meetings, it has resolved technical issues, provided policy input, and helped create energy efficiency requirements that are achievable in all climate zones.

In 2023, building on the lessons learned from the BC Energy Step Code—namely, its tiered, performance-based approach, shared ownership model, and regional coordination—the Province of British Columbia introduced the Zero Carbon Step Code. Like the BC Energy Step Code, it is also flexible enough to be used across all BC climates and construction contexts. The peer networks and educational resources that emerged to support the BC Energy Step Code have since adopted the Zero Carbon Step Code.

Like the rest of Canada, BC's local governments and construction industry are grappling with housing affordability. Numerous case studies of projects built across the province have demonstrated that energy-efficient buildings don't have to cost more than those built to previous "code minimum" requirements. In fact, in many cases, they cost less. Simpler building designs and increased housing density lower construction costs and energy consumption. The integrated design process, which brings contractors, local authorities, and the client together at the start of a project, improves communication and sets clear expectations. This in turn reduces uncertainty and the likelihood of last-minute change orders, all of which increase costs and construction time.

Everyone in BC's construction ecosystem has a role to play in improving housing affordability and addressing climate change. And although BC has made great strides, there is still work required to achieve the goals we've set out: zero carbon new construction by 2030, and net-zero energy ready construction by 2032. Countless people have helped make the Energy and Zero Carbon Step Codes possible by contributing their time and expertise to resources like this one. We hope this updated guide provides the clarity necessary for all involved to continue making cleaner, more energy efficient buildings.

Zachary May
Executive Director, Housing Innovations
Chair, Step Code Council
Ministry of Housing

Executive Summary

As of May 2023, six years after the Province of British Columbia first offered the BC Energy Step Code to local governments, most new buildings across the province must be 20 per cent more energy efficient than those built to previous requirements. At the same time, the Province introduced the Zero Carbon Step Code, providing a new means for authorities having jurisdiction to incentivize or require lower or zero carbon new buildings.

Similar to the BC Energy Step Code, it sets out a gradual timeline and technical requirements, and gives industry and local governments new tools, more certainty, flexibility, and a clear deadline.

The province's goals are twofold: All new construction must achieve zero operational carbon by 2030, and all new buildings must be net-zero energy ready by 2032. Together, the BC Energy and Zero Carbon Step Codes help us achieve those goals. To support market transition over the coming decade, the Province of British Columbia is gradually incorporating each of the step codes into the base BC Building Code, with interim requirements expected in 2024, 2027 and 2030.

This BC Step Code Best Practices Guide for Local Governments (Guide) is a significant update to the original edition first produced in 2018. Key building-sector participants contributed to this update, including leaders from industry, local government, utilities, and housing providers. It offers new guidance on the Zero Carbon Step Code and improved best practices informed from years of experience. However, the key principles that underpinned the original roll out of the Step Code Council are still valid today. Advance notice, gradual change, a clear timeline, and proactive conversation and education are all critical to ensuring smooth market transformation.

The recommendations in this Guide are not regulatory requirements and are not intended as legal advice regarding the authorities of local governments and Authorities Having Jurisdiction under the Local Government Act or the Community Charter. However, the Step Code Council strongly encourages local governments to follow the practices and processes outlined in this Guide.

With that out of the way, here are some of the most important considerations:

- The BC Energy and Zero Carbon Step Codes are two independent regulations that may be employed together or individually.
- Both step codes are performance-based regulations that establish measurable requirements for energy and carbon performance in new construction. To demonstrate compliance, a builder must prove to local building officials that the building meets or exceeds a set of defined metrics for building envelope, equipment and systems, and airtightness testing.
- Other jurisdictions have leveraged the technical research and policy development underpinning the BC Energy Step Code. Canada's National Energy Code for Buildings has introduced a series of four performance tiers on the path toward net-zero energy ready buildings by 2030.
- Local governments can select from a broad spectrum of policy tools including those that raise awareness, provide incentives, create bylaw requirements, remove barriers, and/or demonstrate leadership to support implementation of the step codes in their communities. Jurisdictions are free to select the tools that they feel are best suited to their community.
- Local governments interested in moving to upper steps of the BC Energy Step Code or advancing the Zero Carbon Step Code should establish a consultation process with appropriate parties to select a strategy that will be successful for their community, including obtaining input to define the policy and/or incentive tool(s), building type(s), geographic scale, and step(s).
- Local government staff and industry should allow for sufficient time and notification to prepare for change. This Guide details various scenarios and best practices.
- Local governments can demonstrate leadership by constructing new civic buildings to be lower or zero carbon and more energy efficient than required by the base building code and by encouraging those who oversee the development of new provincial and federal buildings in the community to follow suit.

We hope this document is a valuable resource for your local government as you reap the rewards of low-emission, high-performance buildings while ensuring your community's building industry is prepared for future changes to the BC Building Code.

For the latest updates and future resources, visit **energystepcode.ca**.

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1 Introducing the Step Codes

1.1 History and Purpose of the Step Codes

Cleaner, More Energy-Efficient Buildings in BC

The BC Energy Step Code and the Zero Carbon Step Code are two independent but related building code standards that aim to transition the province to a future of more energy efficiency and lower operating emissions from buildings. These tools will help the market transition toward zero-carbon new construction by 2030 and net-zero energy ready construction by 2032. These provincial commitments are critical to BC's 2030 greenhouse gas emission reduction target and commitment to reach net zero by 2050.[1] They also provide local governments with a simple and flexible set of regulations that support their energy conservation and greenhouse gas reduction goals without unduly burdening their construction industry.

The market transition is well underway. At least 65 local governments adopted the BC Energy Step Code in some form before it became a requirement under the BC Building Code, representing the vast majority of building permits. Effective May 1 2023, the lower steps are no longer a compliance option; most new construction must be 20 per cent more energy efficient than the previous code requirement.

BC Building Act and Building Act General Regulation

The Building Act and Building Act General Regulation, both established in 2016, assert that local bylaws cannot establish technical building requirements unless they are for "unrestricted matters." The BC Energy Step Code and Zero Carbon Step Code are both unrestricted matters. Local governments have been able to reference and enforce the former since April 2017, and the latter since May 2023.[2]

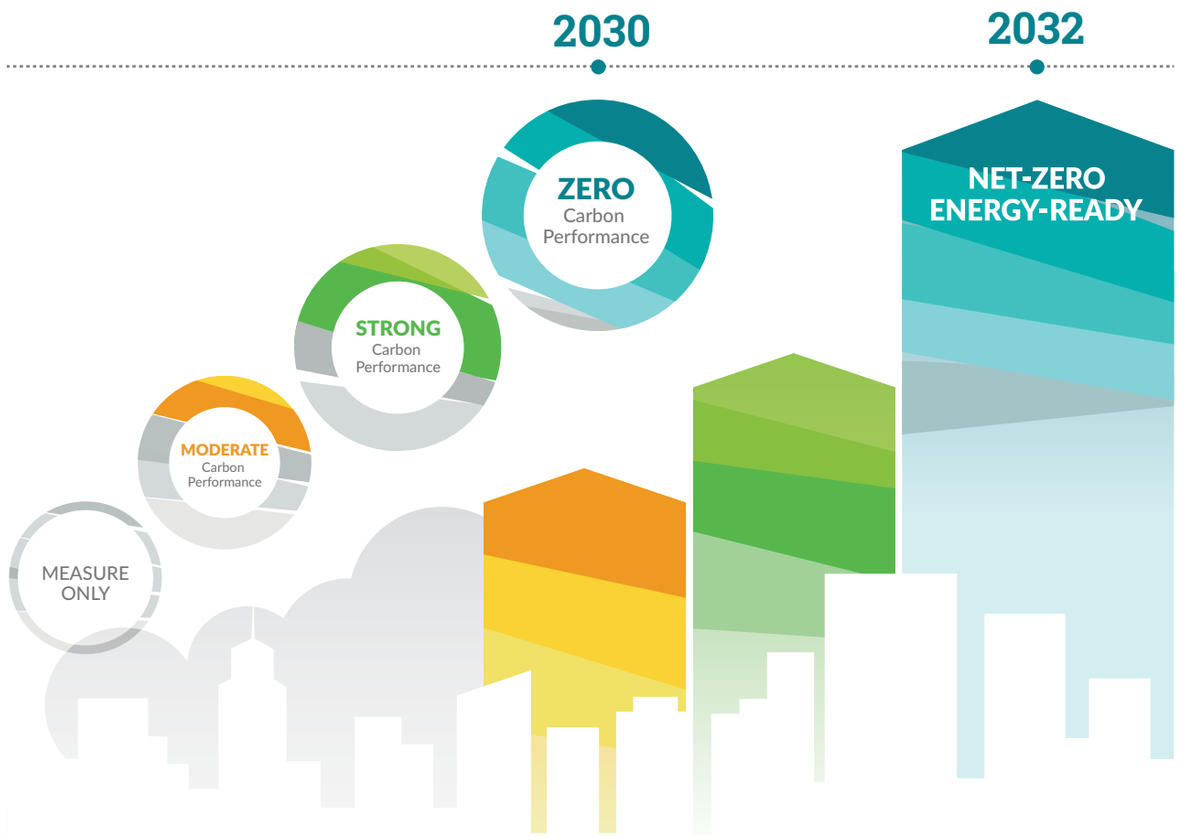


Diagram 1. Gradually incorporating the step codes into the BC Building Code

1 *Provincial commitments were made in CleanBC (2018) and CleanBC Roadmap to 2030 (2021):* ***cleanbc.gov.bc.ca.***

2 *A complete list of unrestricted matters may be found in the Building Act General Regulation.*

The Step Code Council

In 2017, the Province of British Columbia established the Step Code Council (SCC) to support the successful implementation of the BC Energy Step Code and the market transition to higher performance buildings. The SCC is composed of members representing industry professions and trades, local government and public sector organizations, and utilities and consumer interests (see Diagram 2). Staff from three provincial ministries provide guidance and input on financial incentives, building codes, and public sector building requirements. To support its commitment to zero-carbon new construction, the Province of British Columbia subsequently expanded the SCC mandate to include implementation of the Zero Carbon Step Code.

The role of the SCC is to:

- Share information and support the implementation of the Energy and Zero Carbon Step Codes in line with the Provincial Policy
- Advise and make recommendations on technical aspects of the step codes
- Provide input to the Province and local governments on policy and regulation related to the step codes
- Identify industry, local government, and provincial needs for the successful adoption of the step codes
- Monitor adoption of the step codes
- Coordinate and direct research, communication, and training related to the step codes

The SCC builds consensus between stakeholders. Consensus does not require unanimous agreement, but it does require working together to make decisions based on the areas of strongest alignment. Thanks to the relationships built and input provided by the SCC, the BC Energy Step Code has been thoughtfully implemented, with due care to appropriate incentives, industry capacity, affordability, and market conditions. This Guide provides updated tools and advice for continuing this successful legacy and expanding it to the Zero Carbon Step Code.

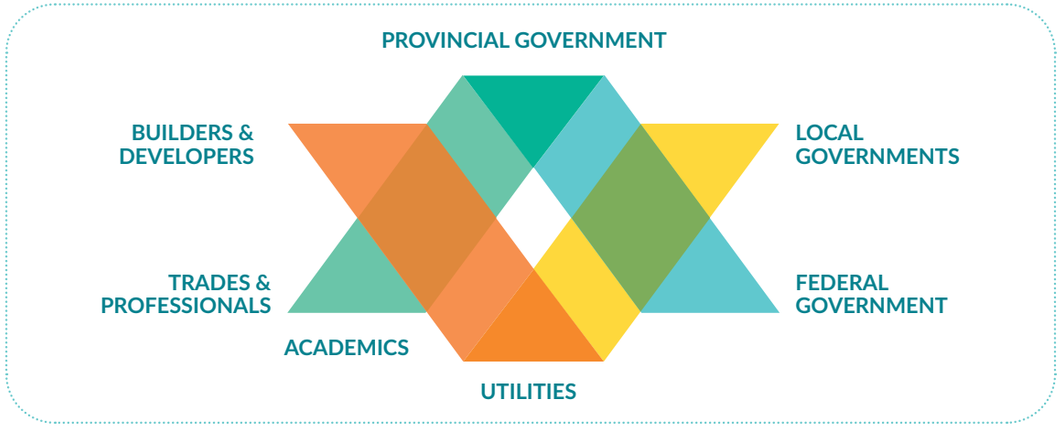


Diagram 2. The Step Code Council

WHO IS THIS GUIDE FOR?

This Guide is intended as a resource for all governments in British Columbia that would like to reference the BC Energy Step Code and/or the Zero Carbon Step Code in their policies, programs, or bylaws. For this Guide, the term "local governments" includes municipalities, regional districts, and the University of British Columbia Board of Governors that administers the BC Building Code on its Vancouver campus. The step codes apply to the same jurisdictions as the BC Building Code. They do not apply to construction on federal land, and may be implemented differently in the City of Vancouver due to the distinct Vancouver Building By-law. This guide could be relevant to First Nations who wish to enforce the BC Building Code, such as Treaty First Nations, or other communities that may wish to reference step code requirements in contracts or construction tender documents.

This Guide details suggested timelines and recommends effective engagement practices to develop a community-specific step codes strategy. While we strongly encourage local governments to adopt the best practices outlined here—with appropriate engagement, incentives, and industry capacity—local governments are autonomous in the exercise of their lawful authorities.

1.2 The Evolution of BC's Building Industry

Since the BC Energy Step Code launched in 2017, BC's building industry has been at the forefront of advancing energy efficiency across the province, and setting a new de facto standard for the whole country. Here's what's been done to date:

Embracing the Performance Approach

Until the introduction of the BC Energy Step Code, most new buildings used a "prescriptive" approach for energy efficiency requirements. Under this approach, buildings had to meet specific requirements for insulation, windows, furnaces, water heaters, lighting, and other equipment and systems. The approach focuses on individual elements, rather than ensuring the building functions as a system.

In contrast, the BC Energy Step Code advanced an alternate "performance" approach that established desired measurable outcomes and left it to design and building teams to decide how to achieve them. The approach requires whole-building energy modelling and on-site testing to demonstrate how the design—and the completed building—meets the requirements in the code. But it does not specify materials or construction methods. Since its introduction, the building industry has worked to integrate these techniques into many new buildings, which set the stage for all new buildings to use a performance approach as of 2023, with some exceptions (see section 1.3).

As a result, buildings are now more airtight, and industry has greater access to higher-performance materials and components such as windows and insulation. Homebuilders and developers collaborate with energy advisors and modellers early in the process to identify the most cost-effective and energy-efficient solutions. Airtightness tests also provide a level of quality assurance, ensuring a given building performs as designed and meets airtightness expectations.

Investing in Training and Resources

The SCC underscored the importance of developing clear and effective resources and delivering timely training across the province. Examples include:

- The British Columbia Institute of Technology, University of Northern British Columbia, and Vancouver Island University offer hands-on courses to teach building industry professionals how to build more energy-efficient buildings
- BC Housing incorporated the BC Energy Step Code into its continuing professional development requirements for homebuilders
- Engineers and Geoscientists BC (EGBC) and the Architectural Institute of BC (AIBC) created compliance tools, templates, and professional practice guidelines
- The Community Energy Association's Step Code Peer Network, and the Zero Carbon Step Code Implementation Cohort, are online learning forums open to local government staff including planners, building officials, climate and sustainability staff, and senior managers
- The Building Officials Association of BC (BOABC) and the Canadian Home Builders' Association - British Columbia (CHBA-BC) now include both step codes in their training
- The SCC and its subcommittees support implementation with research and guidance
- ZEBx and the Zero Emissions Innovation Centre provide ongoing resources for industry and local governments
- The City of Vancouver's Energy Modelling Guidelines provided a technical foundation for the BC Energy Step Code

More Affordable Energy Bills

Improving energy efficiency and airtightness creates more comfortable buildings that stay warm in the winter and cool in the summer, are quieter year round, and have lower utility bills. Heat pumps are very efficient at providing heating and cooling, further lowering utility bills.

Canada-wide Standards Follow BC's Lead

Over the course of 15 years, the Province of British Columbia is steadily integrating the BC Energy Step Code into the base BC Building Code. This provides generous lead time for both the market and regulators to prepare. Other jurisdictions have since leveraged the technical research and policy development underpinning the BC Energy Step Code. For example, Canada's National Energy Code of Canada for Buildings (NECB) has introduced a series of four performance tiers on the path toward net-zero energy ready buildings by 2030.

What is a Net-Zero Energy-Ready Building?

Net-zero energy buildings produce as much clean energy as they consume. They are up to 80 per cent more energy efficient compared to minimum requirements from 2018, and use on-site (or near-site) renewable energy systems to produce the remaining energy they need. A net-zero energy-ready building is so energy efficient that it could, with the addition of solar panels or other on-site renewable energy technologies, achieve net-zero energy performance.

Photo: Station Avenue development in Langford includes a 6-storey building with 40 units of affordable housing designed to meet Step 4 of the BC Energy Step Code

Credit: Low Hammond Rowe Architects

1.3 Purpose and Scope of the Step Codes

Consistency and Flexibility

By gradually adopting one or more steps of either step code, local governments can increase building performance requirements in their communities. They are free to choose the step(s) that will apply in their jurisdictions, and their conditions or circumstances. This allows local governments to select an appropriate pace for their context, enabling demand to grow, the market to mature, and industry capacity to increase as services and products for the design and construction of higher-performing buildings become more widely available.

Local governments may adopt the step codes separately or use them together. This offers them greater assurance that their new buildings will be designed for energy efficiency and/or reduced greenhouse gas emissions, and that they will be constructed as proposed.

Meanwhile, builders can voluntarily use the step codes as a pathway for demonstrating compliance with the energy efficiency, space heating, and hot water heating requirements of the BC Building Code. The step codes provide builders with a set of performance requirements that are consistent across the province, and flexibility in how they achieve them.

Gradual Integration into the BC Building Code

Some local jurisdictions are ready to adopt higher requirements for energy efficiency and zero carbon construction earlier than others. In doing so, they pave the way for governments and industry across the province to meet these requirements over time, at their own pace. To support the market transition toward zero-carbon and net-zero energy ready new construction, over the coming decade the Province of British Columbia is gradually incorporating the steps from each of the step codes into the base BC Building Code.

Supporting Zero-Emission and Resilient Communities

Communities across BC are responding to the climate emergency, and they need tools to support their net-zero emission targets, while also adapting to a changing climate. The BC Energy Step Code helps to reduce energy demand (and related emissions) in buildings, which lowers heating and cooling needs and makes buildings more resilient to changing temperatures. The Zero Carbon Step Code goes further, moving toward eliminating operational emissions because it requires a zero-carbon energy source like clean electricity. New buildings meeting Zero Carbon Step Code requirements will likely feature heat pumps, which can provide efficient heating and cooling during episodes of extreme temperatures.

The Province of British Columbia and utility companies are investing in the electrical system to increase its capacity and resiliency to meet increasing demands. This includes modernizing and decarbonizing the electricity grid.

Scope and Application

BC Building Code users typically separate buildings into two basic categories: Part 9 and Part 3. The step codes are defined according to these building types, so it is important to understand the difference between them. The regulations for both step codes were developed for new construction only. Designers and enforcement officials should exercise discretion and judgement when applying the step codes to existing building alterations.

> “Having clarity and consistency in energy and performance expectations across jurisdictions is crucial for those of us in the non-market housing realm. As we are often juggling federal, provincial, and local government partner requirements, having clarity from those entities issuing our Building Permits when we first conceive of a project saves time and money in iterative design and valued engineering. Further, it raises the bar for all – from trades on the ground to the design teams to Owners, this new guide makes it clear that over time, the capacity and knowledge around energy performance and how to achieve it will diffuse across all aspects of the industry.
>
> **Kaeley Wiseman, Wiser Projects**

Photo: Energy Star-certified Clayton townhome development in Surrey, BC (Part 9, Step 3)

What is a Zero-Carbon Building?

For the purposes of the Zero Carbon Step Code, a Zero Carbon building emits little to no greenhouse gas during its operation. This typically requires the decarbonization of space heating and domestic hot water systems — the two most significant end uses of energy in current buildings that contribute to greenhouse gas emissions.

Photo: Two infill homes by a builder participating in Natural Resources Canada's Local Energy Efficiency Partnership (LEEP), New Westminster, BC (Part 9, Step 4; Energy Star Rating; R-2000 Rating).

What are Part 9 and Part 3 Buildings?

Photos: Top: Townhome in Township of Langley, BC.

Bottom: 10-storey residential building in Vancouver, BC. Photo by Derek Lepper Photography.

Part 9—Houses and small buildings

These buildings are one to three storeys and have a building area or "footprint" of less than or equal to 600 square metres (approximately 6,500 square feet). This category includes single-family homes, duplexes, townhomes, small apartment buildings, and small stores, offices, and industrial shops.

Part 3—Large and complex buildings

These buildings are four storeys and taller and greater than 600 square metres in footprint. This category includes larger apartment buildings, condos, shopping malls, office buildings, hospitals, care facilities, schools, churches, theatres, and restaurants.

These classifications have been simplified for the purposes of this Guide. For enforceable definitions of Part 9 and Part 3 buildings, please consult the BC Building Code.

2 The BC Energy Step Code

2.1 Overview

The BC Energy Step Code is a provincial regulation introduced in 2017 that establishes performance requirements for energy efficiency in new construction. The BC Energy Step Code groups these requirements into increasingly stringent "steps" that collectively represent a path to net-zero energy-ready buildings.

In May 2023, the BC Building Code began requiring most new buildings to meet 20%-better energy efficiency. As a result, the lower steps of the BC Energy Step Code (Steps 1 and 2 for Part 9 buildings and Step 1 for Part 3 buildings) no longer meet minimum energy efficiency requirements and are listed as "Reserved" in the BC Building Code.

Local governments may still incentivize or require builders to achieve the upper steps. Builders and developers may also voluntarily choose to build to these higher steps. By 2032, the BC Building Code will require all new buildings to meet the requirements of the upper steps (see Diagram 3).

As noted previously, the BC Energy Step Code does not apply on federal land, and may be implemented differently in the City of Vancouver due to the distinct Vancouver Building By-law.

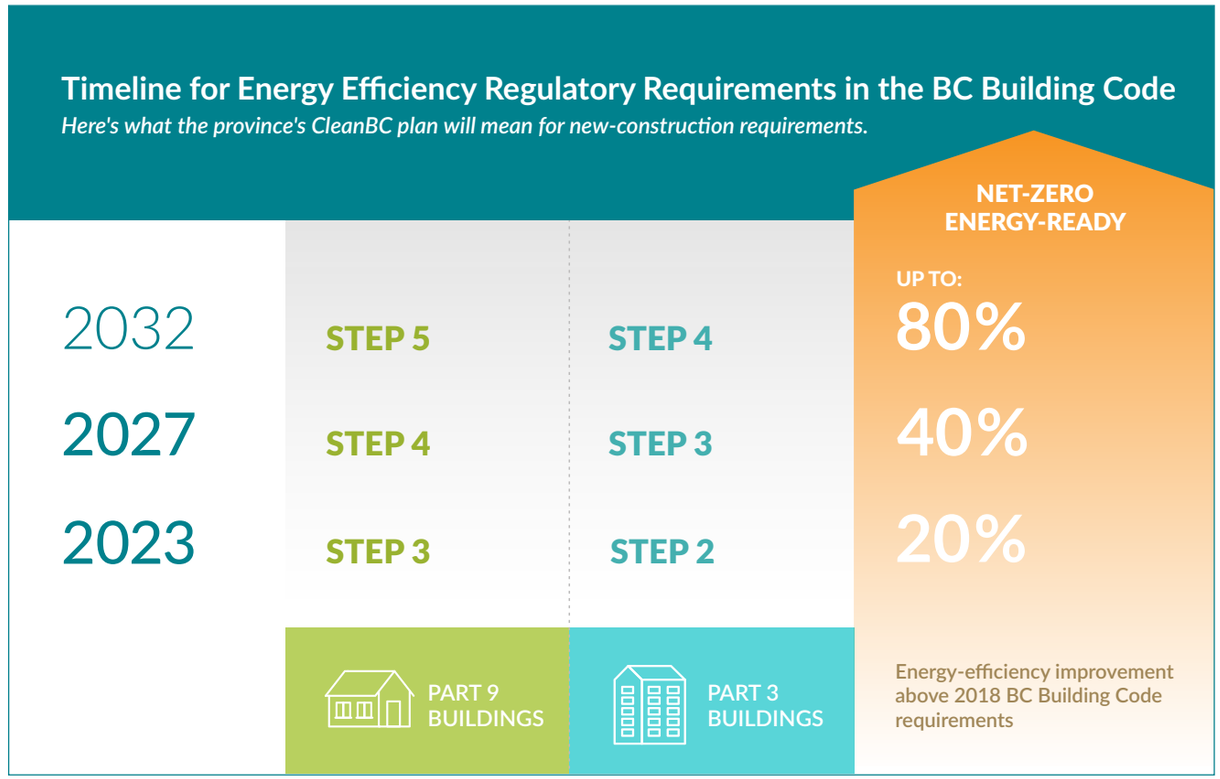


Diagram 3. Timeline for Energy Efficiency Regulatory Requirements in the BC Building Code

2.2 How it Works

The BC Energy Step Code establishes requirements for whole-building energy modelling, including modelling the performance of building envelopes and equipment and heating systems. The energy model must demonstrate how the building design will meet a set of requirements that represent increasing levels of energy efficiency. Once constructed and before occupancy, the building must undergo on-site airtightness testing to ensure the building meets expectations.

We offer a primer on each of these key elements in Section 6 to help local governments better understand the regulation's technical requirements. The many resources available on energystepcode.ca provide in-depth guidance.

As more local governments began referencing the BC Energy Step Code in their bylaws, the industry has increased its capacity to provide air tightness testing and energy modelling services. Similarly, builders and developers have increased their knowledge of the materials and strategies needed to deliver high-performance buildings. The lower steps propelled early market transformation, and the Province of British Columbia has since incorporated their requirements into the base building code.

To achieve the upper steps, builders and designers will adopt a more integrated approach to building design and may need to incorporate more substantial changes in layout, framing techniques, equipment selection, and materials. These techniques and materials will become more common and cost effective with industry's growing experience and confidence.

Geographic Application

The BC Energy Step Code is available to communities in all climate zones across British Columbia for both Part 9 and Part 3 buildings (see Diagram 4). Climate zones impact the target performance for the metrics described above.

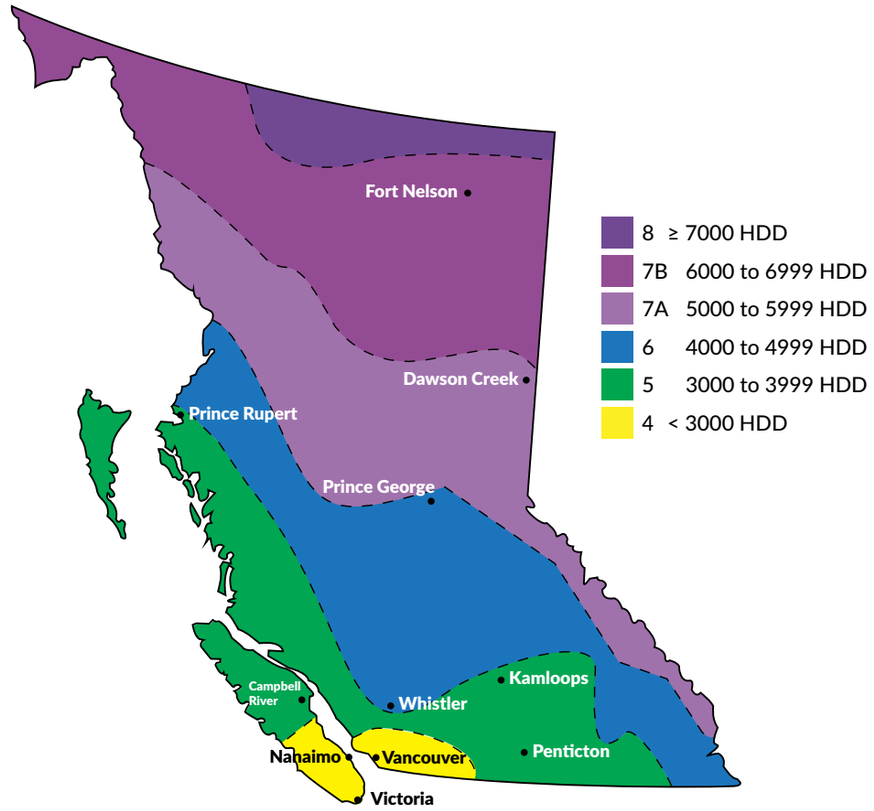


Diagram 4. Map of BC Climate Zones, where zones are defined by the number of Heating Degree Days (HDD)

Photo: Bella Bella Passive House provides staff housing for employees at the ƛ'uxválásu'ilas Heiltsuk Hospital in Bella Bella, BC. The prefab structure includes six, two-story attached townhomes.

Credit: Vancouver Coastal Health

Compliance Paths for Part 9 Buildings

By default, most new Part 9 residential projects in BC now require energy modelling and airtightness testing. These requirements are described in section 9.36.6. of the BC Building Code.

However, some local governments have amended their building bylaw to permit an additional prescriptive code compliance path that makes applicable Part 9 buildings about 20 per cent more energy efficient without hiring an energy advisor. Although this option is potentially available, in most cases its inherently higher material costs make the performance path the more cost-effective option. The SCC strongly encourages builders to run a cost-benefit analysis to determine whether the increased material costs will offset the savings they'd achieve by skipping energy modelling and airtightness testing. This option is expected to remain until 2027, when minimum energy efficiency requirements rise again. **Local governments must adopt a bylaw to use this approach**, and the performance approach to energy efficiency must also be permitted.[3] Further information may be found in **Technical Bulletin B23-01.**

The provincial government also provides additional compliance paths for log homes, seasonally occupied homes, mixed-use buildings, and non-residential Part 9 occupancies of different sizes, as shown in Diagram 5.[4]

Diagram 5. Additional compliance paths for specific types of Part 9 buildings

Building type	9.36.6. Energy Step Code	Prescriptive option[5]	9.36.5. Energy Performance Compliance	National Energy Code of Canada for Buildings
Log homes	✓	✓	✓	✓
Mixed-use		✓		✓
Seasonal homes	Exempt			
Part 9 Non-Residential ≤ 300 m²		✓		✓
Part 9 Non-Residential > 300 m²				✓

3 *Province of British Columbia. Ministry of Housing. Building and Safety Standards Branch Information Bulletin No. B23-01. "20% Better Energy Efficiency & Zero Carbon Step Code British Columbia Building Code 2018 - Revision 5." May 1, 2023.*

4 *For more information, refer to the Information Bulletin from **May 1, 2023 - 9.36.1.3. Compliance Pathway.***

5 *The prescriptive compliance path refers to the pre-existing prescriptive tables set forth in Tables 9.36.2.6.-A to B, 9.36.2.7.-A to C, and 9.36.2.8.-A to B.*

3 The Zero Carbon Step Code

3.1 Overview

About 12 per cent of British Columbia's overall greenhouse gas emissions come from building emissions. At a local level, buildings often represent one of the leading contributors to a given community's emissions. Fossil fuel-powered space and water heating equipment generates about 98 per cent of building-sector operational emissions.

The Zero Carbon Step Code is a new tool to help local governments and the provincial government meet their climate change objectives and greenhouse gas emission reduction targets—including the provincial CleanBC commitment to zero-carbon new construction by 2030. It focuses on decarbonizing building operations via space and hot water heating systems, and in some cases cooking equipment.

The Zero Carbon Step Code is currently optional for local governments, and the provincial government will provide further guidance later in 2024 about phasing in these requirements over time as described in the CleanBC Roadmap to 2030.

The Zero Carbon Step Code has a tiered approach similar to the BC Energy Step Code (see Diagram 6). Local governments can choose which levels to apply, and under what conditions or circumstances. In many ways, the Zero Carbon Step Code is simpler to implement than the BC Energy Step Code. Proven technology is available to meet the requirements across the province, and it doesn't require any major changes in building design or construction practices.

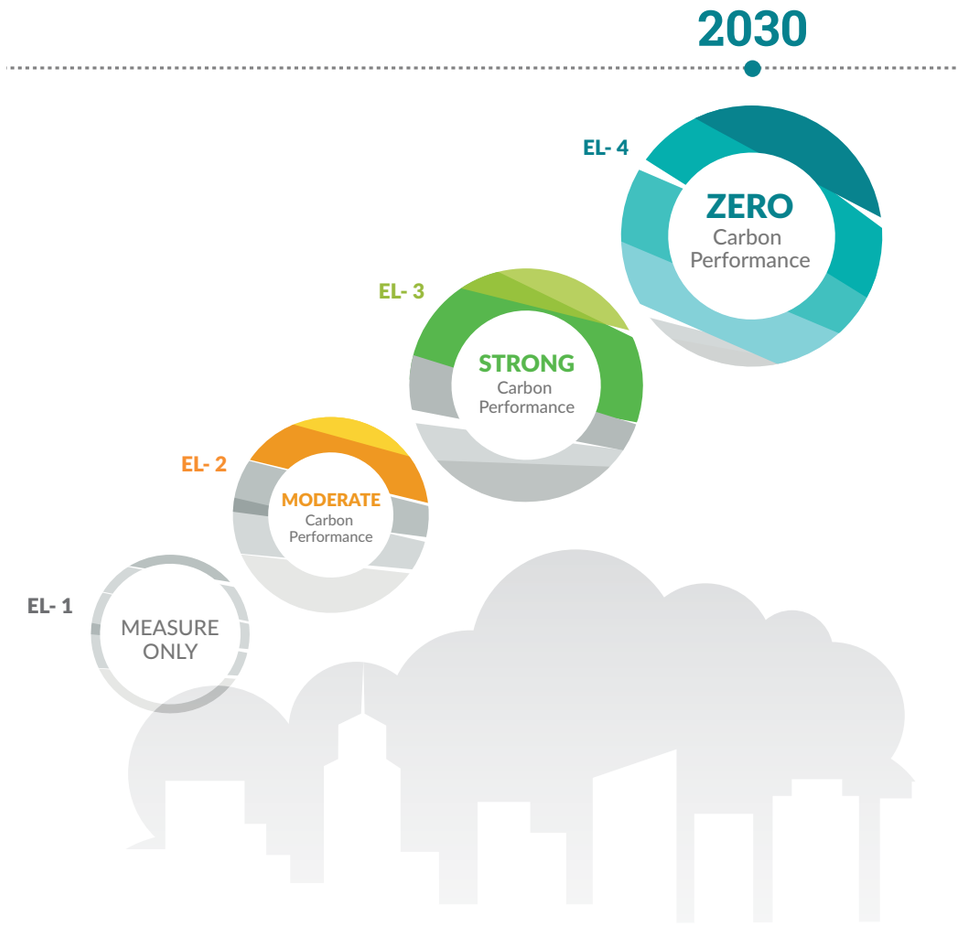


Diagram 6. Four levels of the Zero Carbon Step Code

ZERO CARBON STEPCODE
ACCELERATING CLEAN BUILDINGS

3.2 How it Works

Four Steps to Zero Carbon

There are four emission levels (EL) in the Zero Carbon Step Code, starting with a "measure only" level (EL-1). At that level, a builder must measure and report the amount of greenhouse gas emissions that their proposed project will produce. This first level provides local governments with a formal mechanism to track greenhouse gas emissions from new buildings, but does not actually reduce them.

The SCC describes the other three performance levels as "moderate," "strong," and "zero carbon." The metrics to achieve the highest step (EL-4), or zero carbon, do not actually go to zero because BC's integrated electricity grid still generates greenhouse gas emissions—though they are very low and continue to decline in line with the Roadmap to 2030 commitment to a 100% Clean Electricity Delivery Standard for the BC Hydro grid.[6]

Tables 1 and 2 provide an overview of the emission reductions that would be expected from a selection of building types, ranging from 20% to 94% decrease in emissions, depending on the climate zone and the level achieved.

Table 1. Modelled greenhouse gas emission reduction scenarios for **Part 9 buildings**, relative to EL-1 base case[7]

Building Type	Climate Zone	EL-2	EL-4
Medium-sized single-family dwelling	CZ4 (Vancouver)	62% decrease	93.5% decrease
Medium-sized single-family dwelling	CZ6 (Cranbrook)	70.5% decrease	94.25% decrease
Quadplex	CZ4 (Vancouver)	36% decrease	90% decrease
Rowhome	CZ6 (Cranbrook)	20% decrease	94% decrease

Table 2. Modelled greenhouse gas emission reduction ($kgCO_2e/m^2/yr$) scenarios for **Part 3 buildings**, relative to EL-1 base case[8]

Building Type	Climate Zone	EL-2	EL-4
Low-rise MURB	CZ4 (Vancouver)	50.4% decrease	90.7% decrease
Low-rise MURB	CZ6 (Cranbrook)	41.8% decrease	88.2% decrease
High-rise MURB	CZ4 (Vancouver)	72.6% decrease	89.7% decrease
High-rise MURB	CZ6 (Cranbrook)	41.8% decrease	88.2% decrease

6 *CleanBC Roadmap to 2030,* ***cleanbc.gov.bc.ca***

7 *Source: Derived from the Technical and financial data tables in the* ***Draft Building Carbon Pollution Standard for Part 9 buildings in British Columbia****, p11 onward, where all buildings meet Step 3, the "base case" meets EL-1 with natural gas systems, "medium" meets EL-2 and "zero-carbon ready" meets EL-4.*

8 *Source: Derived from the Technical and financial data tables in the* ***Draft Building Carbon Pollution Standard for Part 3 buildings in British Columbia****, p11 onward, where all buildings meet Step 2, the "base case" meets EL-1 with natural gas systems, "medium" meets EL-2 and "zero-carbon ready" meets EL-4.*

How Emissions are Calculated

The Zero Carbon Step Code affects principal heating systems—those designed to accommodate a building's heating load. This may include supplementary heating equipment used to meet the load if and when the principal system exceeds its capacity. The regulation excludes redundant, backup, and decorative heating systems that have been equipped with controls and that have not been designed to meet the building's space conditioning load. The Zero Carbon Step Code does not account for emissions from wood stoves or fireplaces, and may account for emissions from gas cooking stoves or fireplaces depending on the size of the building.

This step code only applies to the greenhouse gas emissions produced by new buildings during their operation and not their embodied emissions (see inset). Further, it only regulates equipment that serves the inside of a building; it does not restrict outdoor grills, heated driveways, pools, etc.

Two Compliance Pathways: Prescriptive or Performance

Like the BC Energy Step Code, the Zero Carbon Step Code also has a prescriptive option alongside a performance-based default for Part 9 buildings. Unlike the BC Energy Step Code, the prescriptive option for emissions exists for all levels of the Zero Carbon Step Code, and it is not opt-in, meaning a builder may follow the prescriptive or performance path for the Zero Carbon Step Code, and an AHJ must accept either path provided it meets the minimum emissions level.

In general, the performance path for the Zero Carbon Step Code is more flexible than the prescriptive path when considering emissions. However, the prescriptive path may be useful for a Part 9 builder who decides not to engage an energy advisor.

See Section 6.2 for more information about the requirements for the prescriptive and performance paths for the Zero Carbon Step Code.

Clarifying Operational Versus Embodied Emissions

Operational emissions refer to those associated with the energy consumption used in a building, including heating, cooling, lighting, appliances, etc. This is the focus of the Zero Carbon Step Code.

Embodied emissions refer to those associated with the extraction, production, transportation, manufacturing and disposal of materials used to construct a building. These are not included in the Zero Carbon Step Code. Local governments may consider developing embodied emissions policies and programs to support and incentivize lower embodied emissions, complementing their step code strategies. The Community Energy Association and Zero Emissions Building Exchange have co-created a local government Embodied Emissions Peer Network, as well as a local government guide highlighting policies, programs and incentives for reducing embodied emissions.

Photo: Passive House, Surrey BC (Part 9, Step 5).

4 Planning for Step Codes in Your Community

While the step codes provide a standardized approach to increased building performance, every community is at its own point on the journey to high energy efficiency and zero carbon buildings. All new buildings will need to meet these standards by 2030 (zero carbon) and 2032 (net-zero energy), though local governments may require it sooner, and builders may opt to achieve it sooner.

This section recommends the key steps to take to consult on, prepare for, and implement the selected path in your community—allowing time for everyone to plan and prepare for the coming changes.

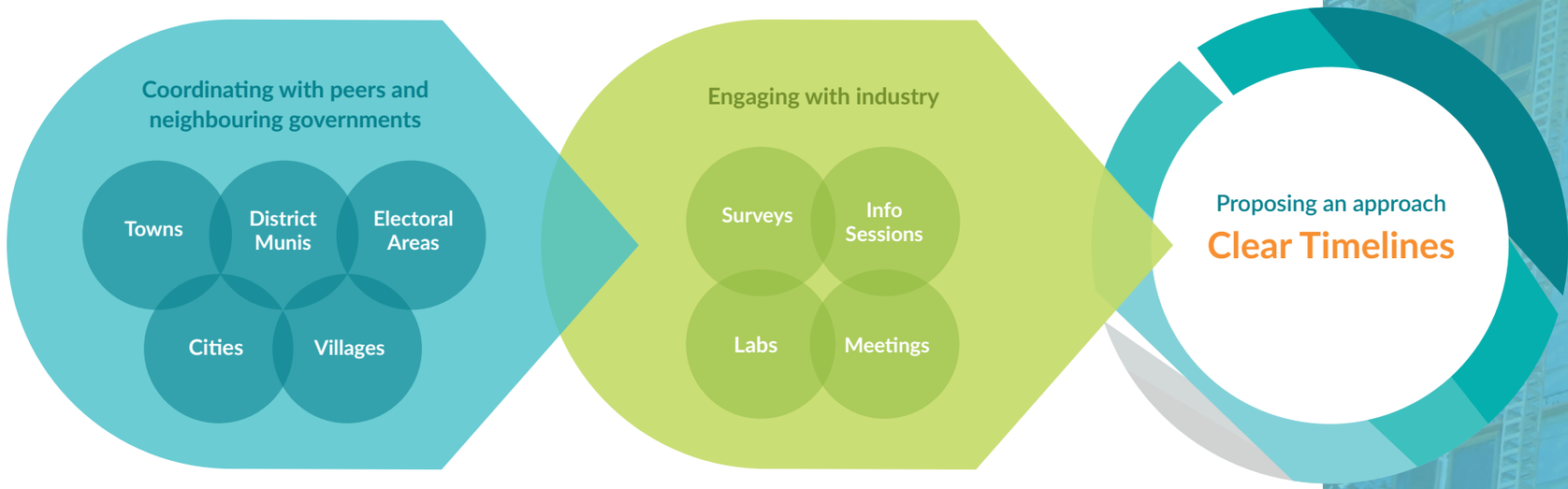


Diagram 7. Developing an approach to the step codes in your community

Photo: The Budzey Building–a partnership between BC Housing, the City of Vancouver, and RainCity Housing, provides supportive rental housing as part of the Provincial Homelessness Initiative in Vancouver BC (Part 3, at least Step 3).

4.1 Where to Start

Join the Step Code Peer Network

The Step Code Peer Network is a great resource for local governments that may be considering, planning for, or implementing either of the step codes. Run by the Community Energy Association, this peer network brings local government staff together to support peer learning and knowledge sharing. To join, email **peernetworks@communityenergy.ca**.

Local governments may also contact the Building and Safety Standards Branch, Ministry of Housing (**building.safety@gov.bc.ca**) with questions when considering adopting either step code, to ensure access to the latest information.

Review Your Community's Readiness

Here are some key factors to consider when gauging your community's readiness for the various levels of each step code. If local governments answer "no" to the prompts below, or are otherwise unsure about their community's readiness, they can partner with industry associations, education providers, utilities and others to build relationships and increase local industry capacity and readiness.[9]

READINESS CHECKLIST:

- Do you have a climate action plan that seeks to improve energy efficiency or reduce greenhouse gas emissions from buildings?
- Have you previously implemented a green building policy?
- Have you established a working relationship with your local development and building industry?
- Have you engaged with your local utilities to understand implications of increased electrification of vehicles and buildings, particularly for current or future high-growth areas?
- Are there enough energy advisors who service your community?
- Are local builders and trades familiar with energy-efficient building techniques?
- Are local trades trained to offer quality and properly-sized heat pump installations (e.g. certification with the Home Performance Contractor Network)?
- Are building officials trained and ready to inspect for step code compliance?
- Are front desk staff, plan checkers and planners trained and ready to support building applications?

Photo: Participants providing input to a planning process through an energy charrette in Surrey BC.

9 *Toolkits to support local governments with these efforts:* ***Building a Legacy*** *and* ***Building a Legacy North***

Consider Different Policy Packages

The following hypothetical approaches demonstrate how different local governments may opt to apply the step codes using a combination of tools appropriate for their circumstances—each demonstrating how to incrementally apply the Energy and Zero Carbon steps. Tools are discussed in more detail in Section 5.

	LOCAL GOVERNMENT A	LOCAL GOVERNMENT B	LOCAL GOVERNMENT C
Highest tiers of the step codes	Creates education program, and top-up incentive for higher levels and steps	Gives notice to meet EL-4 in 2 years	Gives notice to meet EL-4 in 6 months for Part 9 Gives notice to meet EL-4 in 1 year for certain Part 3
	Tracks performance to determine timing for EL-2	Gives notice to meet EL-2 in 6 months	Provides "step-up" "step-down" options for Energy Step Code
	Requires EL-1 immediately	Requires EL-1 immediately	Requires EL-1 immediately
BC Building Code (Base)	Allows prescriptive energy efficiency approach for Part 9 residential buildings		

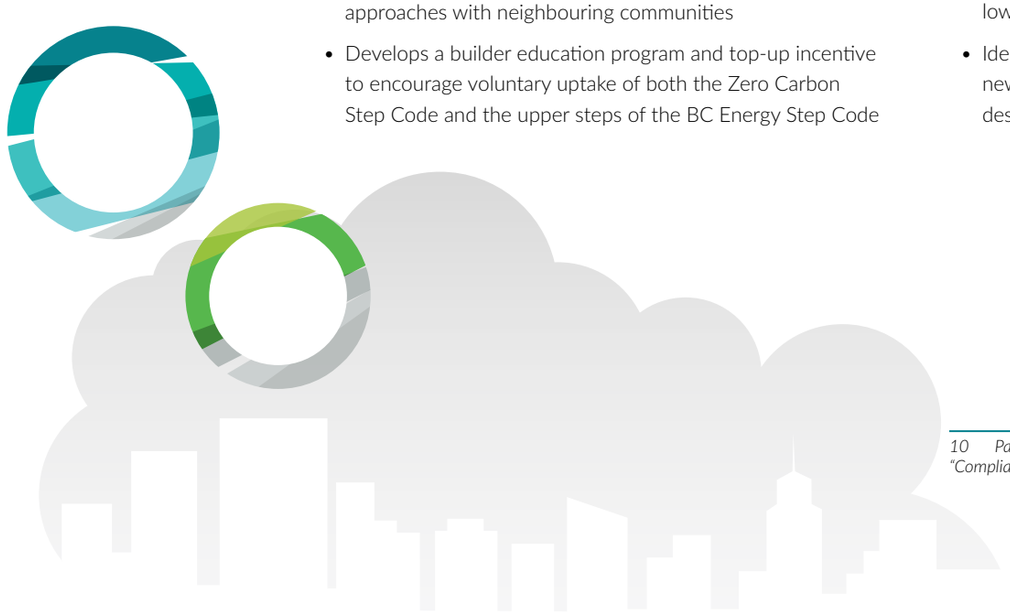
Diagram 7: Three examples of step code policy packages for local governments

LOCAL GOVERNMENT A

Local Government A did not previously reference the BC Energy Step Code for early adoption, but is interested in reducing greenhouse gas emissions from new buildings.

This government:

- Uses the base BC Building Code for Part 9 and Part 3 buildings
- Has not yet incentivized energy-efficient or low-carbon buildings
- Consults with industry and concludes it has limited capacity to deliver on the requirements of higher steps of either step code, at least in the near term
- Decides to permit the prescriptive approach to compliance for Part 9 buildings and to implement EL-1
- Tracks carbon performance of new construction to determine whether a future move to EL-2 or higher would be an undue barrier for industry
- Joins the Step Code Peer Network and discusses potential approaches with neighbouring communities
- Develops a builder education program and top-up incentive to encourage voluntary uptake of both the Zero Carbon Step Code and the upper steps of the BC Energy Step Code



LOCAL GOVERNMENT B

Local Government B was an early adopter, requiring the lower steps of the BC Energy Step Code before it became a province-wide requirement. Now it's considering options to reduce greenhouse gas emissions from buildings.

This government:

- Previously required Part 9 buildings to meet Step 3, and Part 3 buildings to meet Step 2 – which have become the minimum energy efficiency requirement for most buildings
- Has a climate action plan that identifies opportunities to reduce emissions from new buildings
- Accepts the standardized Energy and Zero Carbon Checklist and reviews the educational videos and written guidance[10]
- Consults with its industry and utilities to determine timelines to implement additional steps
- Based on consultation, develops a plan to adopt Zero Carbon Step Code EL-2 in six months and EL-4 in two years
- Decides to require all buildings to immediately meet the lowest level of the Zero Carbon Step Code ("measure only")
- Identifies potential opportunities to support zero-carbon new construction (EL-4) in the near term, such as the ones described in Section 5.2

10 *Part 9 and Part 3 checklists are available on energystepcode.ca under "Compliance Tools"*

LOCAL GOVERNMENT C

Local Government C has prioritized climate action by requiring the top step of the BC Energy Step Code, with a relaxation if the builder installed a low-carbon energy system. They are now ready to align with provincial technical requirements.

This government:

- Currently requires all applicable new buildings to meet steps 3-5 of the BC Energy Step Code, but relaxes those requirements if a low-carbon energy system is installed
- Has developed a strong relationship with its local construction industry through its experience with the BC Energy Step Code and, through consultation, determines there is adequate capacity to achieve zero-carbon new construction with sufficient notice
- Consults with utilities to ensure a resilient supply of electricity to meet the demands of planned new development
- Decides to require the Zero Carbon Step Code in line with SCC guidance (outlined in 5.1):
    - Part 9 buildings to meet EL-4 (zero carbon) in six months
    - Certain Part 3 buildings to meet EL-4 in one year
- Simplifies its Energy Step Code requirements by maintaining "step-up, step down" options for builders while removing "low-carbon energy system" technical requirements[11]

11 *As the BC Building Code now contains technical building requirements for energy efficiency and greenhouse gas reductions, local bylaws which regulate the same matters are of no legal force due to the 2015 Building Act.*

4.2 Recommended Steps to Develop Your Community Approach

If your local government is interested in moving ahead with a step code policy, the SCC recommends these five actions to successfully plan and implement step codes in your community:

1 Review resources

- Review publications, training resources and webinars available at **energystepcode.ca**
- Contact the Canadian Association of Consulting Energy Advisors (CACEA) to understand how many energy advisors serve your jurisdiction
- Join a Local Government Peer Network for Step Code implementation

2 Consult on your program details

- Determine who you need to engage and why (see 4.4)
- Meet with the applicable utilities in your area
- Develop clear timelines and objectives as a starting point for engagement
- Re-engage as needed, being sure to incorporate sufficient time should your approach change after consultation

3 Prepare your program details

- A. Consider appropriate tools (see 5.2)
  - Identify tools to reduce barriers, provide incentives, mandate changes, and/or demonstrate leadership in civic buildings (see 4.4)
  - Use the standard compliance checklists available at **energystepcode.ca**
- B. Review policies and processes
  - Protect mid-stream development approvals
  - Minimize the impact on building permit approval timelines (see 4.4)
  - Harmonize with district or alternative energy policies (see 4.4)
- C. Identify communications and awareness needs
  - Which staff, elected officials and advisory members need training?
  - How can your local government support industry to connect with training resources?
  - What local communication materials need to be updated or created?

4 Notify the SCC once plan is approved and ready

5 Launch and administer the step code(s) as defined for your community

4.3 Regional Coordination

The SCC strongly encourages local governments to plan alongside neighbouring communities, as similar timelines, technical requirements and administrative requirements reduce confusion for builders and trades who work across neighbouring jurisdictions. To accomplish this, local governments could engage regional districts as coordinators to foster unity and effectiveness in step code training, education and adoption.

A regional district may play a coordinating and facilitating role, opening up lines of communication and helping local governments in a region get on the same page. Additionally, it may consider the applicability of adopting higher building requirements when it administers and enforces the BC Building Code.

Although each member municipality will determine an appropriate approach for its community, the regional district can keep members informed of activities, successes, challenges, and other important information. It can help coordinate policies, timelines and administrative requirements across the region. Where industry works across several municipal boundaries in a region, a regional district can host conversations to support coordinated or staggered implementation of requirements, considering capacity across the broader region.

Participation in the Step Code Peer Network can help strengthen this coordination.

Additionally, building officials within a given region might wish to share knowledge and experience through monthly BOABC Zone Meetings, where step code updates can be added to the regular agenda, or through the Building Officials Peer Network (a subgroup of the Step Code Peer Network).

The **Capital Region** Zero Carbon Step Code Engagement and Adoption project was a deeply collaborative effort; each member of an inter-jurisdictional team made significant contributions throughout the process. Each local government body played a unique role, which distributed the workload to each member at different times:

- The Capital Regional District provided all the engagement event planning and facilitation
- The District of Saanich provided strategic guidance, developed and delivered presentations, and refined documents from rough drafts to finished products
- The District of Central Saanich provided building code technical expertise and reviewed documents
- The City of Victoria coordinated the project, drafted many of the project documents, and developed and delivered presentations

The team also collaborated with local industry to plan out the engagement, and to acquire data on the performance of all-electric buildings relative to their higher carbon counterparts.

Engagements in the process included:

1. Three information sessions, including one for all local governments in the region, with support from subject matter experts
2. A survey
3. An in-person Part 9 solutions lab to workshop the policy options and identify challenges
4. An in-person Part 3 solutions lab to workshop the policy options and identify challenges
5. A final industry information session where the three local governments presented their recommended policy option (i.e. phased in EL-4 of the Zero Carbon Step Code)

The Regional District of East Kootenay ran a multi-year engagement and education program to elevate the literacy of builders about the BC Energy Step Code called Building A Legacy. As a result, builders in the region advocated for early adoption of Step 1 in preparation for forthcoming BC Building Code changes. Transitioning to Step 3 with the code changes was much easier for the industry as a result of this program and early adoption of the lower step. The Community Energy Association and the Canadian Home Builders Association of Northern BC have since launched a similar initiative to support high performance building with both step codes for builders in Northern BC.

Photo: North Park Passive House condominium development, Victoria BC, photo by Ryan Hamilton (Part 9, Step 5).

4.4 Consultation

Diagram 8. Recommended timelines for new requirements

Consultation timelines when instituting new requirements

You'll need to provide industry and internal staff (in particular, the planning department and building officials) with sufficient lead time to prepare for change. The SCC recommends the following advance notification periods from the time you first advise the SCC of your intent, to the time you plan to launch and enforce step code requirements:

- **Experienced communities that have referenced the BC Energy Step Code in policy should provide at least six months' notice** before either implementing additional steps of that regulation or requiring steps beyond EL-1 (Measure-Only) of the Zero Carbon Step Code
- **Communities new to the step codes should provide at least one year's notice** before implementing requirements beyond measurement
- **All communities may require the lowest "measure only" level of the Zero Carbon Step Code without notice**
- Communities transitioning between step code requirements should consider ways to protect in-stream projects so buildings do not have to be redesigned mid-way through the review process

Who to Engage and Why

Clear and early engagement with the appropriate interested parties will help ensure your approach to increased building performance will align with your community's building industry capacity and experience, while readying the industry for the province-wide requirements coming into place by 2030 and 2032. The level of engagement needed will vary by community and by the ambition of the policy, program, or bylaw you're considering.

Meaningful engagement also helps raise awareness and prepare industry for upcoming changes in your community and across the province. Below, we offer an overview of important groups to consult and their role in strategy development and implementation.

- **Staff**: Planning, development, and building compliance staff should all help define your strategy. Staff can identify potential alignments or conflicts with existing policies, processes, and bylaws, and identify preferred policy tools. They can also identify opportunities for communicating about the changes with the community—for example, through front desk inquiries, at pre-application meetings, and during building permit applications.
- **Elected officials and approval bodies:** Elected officials need to understand the step codes' purposes and objectives, be briefed on the outcomes of the consultation process, provide support for the program, and communicate the community's approach and priorities for energy-efficient and zero-carbon new construction. Approval bodies, including design review panels and planning commissions, will need to understand the purpose and objectives, and how increasing energy efficiency may change the form and design of new buildings.
- **Utilities:** Local governments should inform energy utilities of their plan to adopt the Zero Carbon Step Code as soon as possible. Local governments should also share where they are directing growth in their communities, especially high-density growth. This will help utilities to plan and prioritize distribution system upgrades so that it can continue to reliably deliver energy when and where it will be needed. Likewise, utilities can share information with local governments on current distribution capacity and planned infrastructure upgrades. BC Hydro can be contacted at **sustainablecommunities@bchydro.com**. In Fortis Electric Service territory, please contact Fortis at **energy.solutions@fortisbc.com.**
- **Industry**: Representatives from the appropriate building sector or sectors (Part 3, Part 9, or both)—including designers, builders, energy professionals, trades, and suppliers) should be key participants as your plan takes shape. Designers, homebuilders, developers, energy professionals, trades, and suppliers can all advise on the policy tools and incentives appropriate for the proposed requirements, and can help identify potential conflicts with existing policies, processes, and bylaws. As a best practice, local governments may also consider using forums to facilitate connections among energy advisors and modelers, builders, designers, construction companies, and suppliers.
- **Neighbouring local governments**: Many industry professionals and trades work across several municipalities. To properly assess industry capacity to deliver services in your community, you need to understand the existing and anticipated demand for those services across the region. Neighbouring communities can provide information on the type and scale of programs being put in place, and may be interested in aligning programs to enhance regional consistency.
- **Public**: Public engagement helps share messages, gauge support for new objectives, and gather input during strategy development. The public should be introduced to alternative building designs that may appear more frequently, the benefits of energy-efficient buildings, and the benefits of zero-carbon heating and hot water equipment.

The series included free seminars featuring industry leaders discussing high-performance building strategies such as passive cooling, airtightness, ventilation, and heat pumps.

Ideas and Resources for Engaging Interested Parties

- **Resources**: The SCC is pleased to provide many resources, including webinars, presentations, and customizable templates, to local government staff and elected officials. Download these from the "Resources" section of energystepcode.ca
- **Internal Training**: Train staff in the permitting department (particularly front desk staff) to provide current information about upcoming changes, and to notify any proponents with in-stream applications of any potential impacts on their projects
- **Workshops and Seminars**: Organize workshops and seminars covering the technical and practical aspects of the step codes, in coordination with local builder associations or local educational institutions. Tailor these sessions to different expertise levels
- **Breakfast Learning Sessions**: Conduct informal learning sessions, encouraging open discussions and sharing experiences related to the step codes. Invite experts to share their insights, and ask local chambers of commerce if they wish to coordinate these sessions
- **Project Tours**: Organize on-site tours of local buildings that meet the requirements–both during and post construction–hosted or supported by the project builder or energy advisor who can share lessons
- **Webinars and Online Courses**: Develop and host webinars and online courses for remote learning. Cover various topics from basics to advanced technical aspects of the codes
- **Community Engagement Forums**: Facilitate forums where interested parties can share experiences, challenges, and successes related to step code implementation
- **Notifications**: Have building officials attending site visits alert the builder of the upcoming changes, providing handout materials and other communication materials. Create information boards or notices to post in your municipal hall and at local building centres, plumbing suppliers, and other areas that interested parties may convene or frequent
- **Coordinate Regionally**: Save costs by organizing events in a central location accessible to builders throughout the region
- **Develop Case Studies**: Spotlight local builders that are willing to showcase their builds to others in the region. Use the SCC customizable templates for case studies

In 2018, the Township of Langley began a Builder Forum Series to help its local construction industry meet BC Energy Step Code requirements.

The series included free seminars featuring industry leaders discussing high-performance building strategies such as passive cooling, airtightness, ventilation, and heat pumps.

Having organized 11 events to date, with attendance ranging from 100 to more than 200 participants, the series initially adopted a "builder breakfast" format that offered complimentary meals for networking before live presentations. Attendance increased during the pandemic, when the Township transitioned to webinars. Participant survey results consistently show the offering is hitting the mark. More than 90 per cent of attendees expressed satisfaction, and 80 per cent reported enhanced confidence in building to meet step code requirements.

View materials from past Builder Forum series at **www.tol.ca/learngreen.**

4.5 Prepare policies, bylaws, incentives

Based on the outcomes from the consultation process, staff will need to prepare specific policies or bylaws (e.g., amend the building bylaw) for elected officials to consider. Remember to identify clear timeframes for immediate steps, as well as indicating future intentions to help the industry and community prepare. This is also a good time to ensure existing policies or design guidelines are not creating any barriers that may affect the smooth implementation of the new requirements, and to prepare for any planned incentive programs. See Section 5.2 for more details about policy tools available to support step code implementation.

In-Stream Applications

At the time a local government enacts the step codes, applicants that have previously initiated an application for a new building with detailed design drawings are considered "in-stream" and should be permitted to build to the standards in place at the time of application, as long as they have submitted an application for a full building permit within one year. Planners need to highlight new provisions as early as possible when discussing complex applications that are not ready for development application submission prior to enforcement of new step codes.

4.6 Notify and launch

Before you roll out one or both of the step codes, be sure to communicate the program's pending launch to the community, focusing on key interested parties. Consider accessing all of the channels that reach industry members in your community. This is a great time to launch training programs or connect industry with available educational resources.

In addition, notify the SCC once the plan is approved and ready to launch.

Changes for Building Officials, Permits, and Inspections

Local buildings officials are crucial players when introducing, enforcing, and educating industry about the step codes. It will be important to coordinate with building officials to understand any enforcement implications before introducing or modifying requirements to either regulation.

The BC Energy Step Code Handbook for Building Officials has proven a valuable resource since its introduction in 2019; it can still offer important insights into technical requirements, enforcement methods, and suggested workflows. This Guide will be updated by members of the Building Officials Association of British Columbia (BOABC) in collaboration with the Province of British Columbia in 2024.

Note: The BOABC offers **step code resources on its website**, as well as a peer network for building officials in partnership with the Community Energy Association.

> "The City of Kamloops developed an Energy Step Code implementation strategy in consultation with the local building community including the Canadian Home Builders' Association – Central Interior, TRU School of Trades and Technology, and the Southern Interior Construction Association. Adopted by City Council in July 2019, the strategy featured an incentive program offering Part 9 builders $3,000 for voluntarily achieving Energy Step Code-Step 3. More than 60 homes were built to Step 3 before it became mandatory in 2022, allowing industry and the City's Building Inspection Division time to build capacity and adapt their practices to the requirements of the performance-based Step Code.

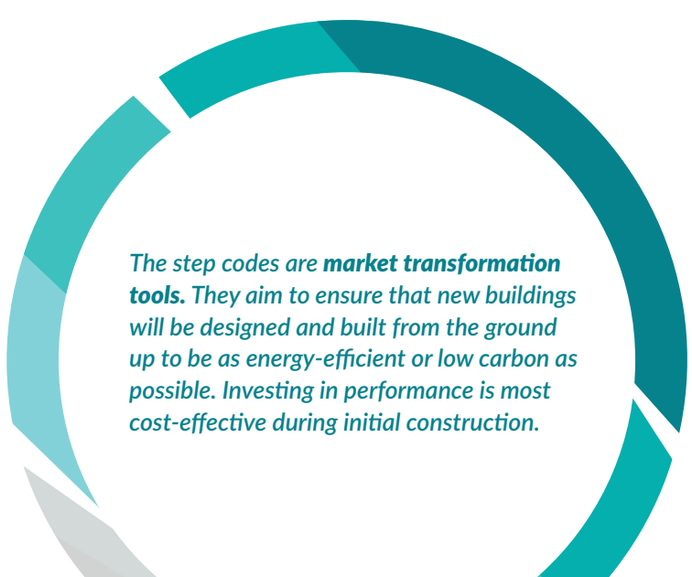
Glen Cheetham
Climate and Sustainability Manager

Photo: Foundation for a Passive House, North Vancouver BC (Part 9, Step 5).

5 Policy Tools and Options for Advancing Step Codes in Your Community

In establishing the BC Energy and Zero Carbon Step Codes, the SCC took care to define an incremental series of building regulations that would perform across diverse regions and circumstances.

Some of these requirements are cost effective and achievable today, while others require new capacity, training, or higher initial costs. Because communities face varying capacity, building costs, affordability and housing supply issues, and land market conditions, local governments will need to consider the tools and approaches that work best for their circumstances. This section discusses the potential benefits and costs associated with the step codes, and provides an overview of the policy tools local governments can employ to implement, incentivize and otherwise support step code adoption in their communities.



5.1 Efficient, Zero Carbon and Affordable Housing

Benefits of the Step Codes

Higher performance buildings benefit home and building owners, occupants, industry, and the community. Occupants often prefer these buildings as they better manage:

- Temperature, improving comfort
- Fresh air throughout the building, improving health, and
- Soundproofing, reducing exterior noise

Of course, they also require less energy, which lowers utility bills. If installed, heat pumps provide the added benefit of efficient cooling during increasingly frequent and intense episodes of extreme summer heat. High-performance buildings are also desirable to owners or occupants who wish to reduce their environmental impact.

Having a consistent set of requirements outlined as a series of steps or levels also provides industry with predictability as the province moves to zero carbon new buildings by 2030 and net-zero energy-ready new buildings by 2032. In this environment, construction industry practitioners, vendors, and manufacturers can invest in developing or distributing products, services, and best practices to deliver competitive services and products for high-performance buildings.

The benefits to occupants and industry combine with a more robust green economy, which benefits communities across the province. The regulations also help both the Province of British Columbia and local governments meet their climate goals and targets.

Costs of Meeting the Higher Standards

The step codes are market transformation tools. They aim to ensure that new buildings will be designed and built from the ground up to be as energy-efficient or low carbon as possible. Investing in performance is most cost-effective during initial construction.

However, communities are sensitive to any regulations that could increase builder costs in addition to other fees such as development cost charges, the new amenity cost charge and other building code changes which could impact the pace or cost of construction. Where available, it is useful to look at real-world, local examples of building-specific costs and savings of building to above-code performance requirements. Where this information isn't available, modelled data can provide good information to project the costs for different applications and contexts.

We provide examples of these evidence-based approaches below.

Costs: BC Energy Step Code

In 2017, in an effort to better understand the financial implications of the BC Energy Step Code, BC Housing published one of the most sophisticated high-performance building cost assessments ever undertaken in Canada. The report was significantly updated in 2022. The assessment reveals how the various steps may impact construction costs across multiple building types and climate zones.[12] Key findings of the 2022 update closely mirrored those of the original, and include the following:

- It is generally easier and more cost-effective to achieve energy efficiency if buildings have simple forms and share common walls, such as townhomes and apartments
- A building's form and orientation will significantly impact its performance. A simple design, with southern exposure, will have an easier time meeting the requirements of the steps than an identical building facing north
- Wood-framed multi-unit residential buildings will meet the requirements more easily than similar concrete buildings

12 *BC Energy Step Code Metrics Report Update, Evoke and e3 (2022).* ***energystepcode.ca/reports/#technical***

Part 9 buildings

- The Incremental Capital Costs (i.e. the cost change when compared to a Step 1 building) are broadly similar today when compared to 2018[13]
  - A Step 3 medium-sized single-family home[14] tends to cost about 1.1-1.2% more to build in all B.C. climate zones
  - A Step 5 medium-sized single-family home tends to cost about 2.9-3.1% more to build in all B.C. climate zones
  - A Step 3 row-home tends to cost about 0.6-0.7% more to build in all B.C. climate zones
- Engaging a registered Energy Advisor may identify cost-effective opportunities to meet Energy and Zero Carbon Step Code requirements that could help offset the cost of energy modelling and air testing services, such as by reducing the size of the heating system or simplifying the building form
- Smaller homes have a higher relative incremental capital cost because some measures do not scale with home size (e.g. typically one heat recovery ventilator is needed per home regardless of size)
- More complex shapes, such as multiple dormers or bump-outs, result in higher costs (e.g. a 50 per cent increase in surface area ratio doubles costs). Higher window-to-wall ratios also impact costs, but not as significantly. Local governments should examine existing design guidelines to minimize or remove these types of requirements

13 *A summary of cost impacts to Part 9 buildings may be found on p. 105 of the* ***2022 Metrics Research Report.***

14 *The "Medium single-family dwelling" as modelled in the Metrics Research Report is a two-storey, 2,500 sq. ft home with a full basement. Costs will vary depending on the shape and size of the building.*

Part 3 buildings

- The Incremental Capital Costs (i.e. the cost change when compared to a Step 1 building) are broadly similar today when compared to 2018
  - A Step 2 high or low-rise multi-unit residential building tends to cost either the same or less to build than a similar Step 1 building
  - Going to Step 3 tends to cost 0.4-0.9%[15] more to build than a similar Step 1 building
  - A Step 2 office or retail building tends to cost less (2.3-9.1% savings) to build than a similar Step 1 building
- For Part 3 buildings, energy modelling and airtightness testing are more complex and require a more significant investment than for Part 9 buildings. However, the BC Energy Step Code does not require the extensive paperwork associated with many green building certification and labelling programs
- Building to the upper steps will involve more investment in training and building components, and costs vary more widely
- Urban design guidelines can have a significant impact on costs; reducing the need for glazing, articulation and balconies, and maintaining floor plate sizes through all storeys support lower costs

15 *Based on the average of the 10 lowest cost scenarios in Climate Zones 4-5, which covers Victoria to Prince Rupert. More detailed costing breakdowns may be found on p. 83 of the 2022 Update to the Metrics Research Report:* ***/BC-Energy-Step-Code_Metrics-Report_2022-09-29-R1-Compressed.pdf***

Size: 1,440 ft² home

Build cost: Under $350,000

Energy efficiency: 49.4% better than reference

Air tightness: 0.7 air changes per hour (significantly better than the 1.0 air changes per hour to achieve Step 5 of the BC Energy Step Code).

An Affordable Net-Zero Ready Home in Quesnel

One Part 9 builder continues to disprove the notion that you need a small fortune to build a high-performance home in Northern British Columbia.

Icon Homes co-founder Joe Hart and his team are based in Quesnel, BC, located in Climate Zone 6. They recently started a project with a goal of meeting Step 3 of the BC Energy Step Code, but quickly determined that the design would allow them to meet Step 5, the equivalent of a net-zero ready home.

Homeowners Neil and Heidi Mackay had earlier approached the company seeking affordability and coziness. Impressed by the simple design the Mackays selected, Hart embraced the opportunity to create a net-zero energy-ready home at an affordable price. Completed in 2023, the Mackay's home southeast of Quesnel reflects a modest yet efficient two-storey structure, prioritizing insulation and efficient equipment.

Central to the home's efficiency is the cold-climate heat pump, operating on electricity and functioning as both heat source and air conditioner. Airtight construction, coupled with an advanced ventilation system, optimizes indoor air quality. Despite an adjustment period for the Mackays, the heat pump yielded significant energy savings and enhanced comfort.

Icon Homes challenges preconceived notions, demonstrating that building an affordable, high-performance home in northern BC is not only possible but can also offer unparalleled comfort and energy efficiency.[16]

Photo: Rob van Adrichem, Community Energy Association

16 ***An affordable, cold-climate, northern, net-zero ready home**, Community Energy Association website, accessed 2024.*

Costs: Zero Carbon Step Code

The construction cost premium associated with meeting the requirements of the Zero Carbon Step Code are more predictable than those associated with those of the BC Energy Step Code. Meeting Zero Carbon Step Code requirements typically means installing a zero-emission heating and/or hot water system.

In a 2022 costing analysis, the Province of British Columbia compared incremental cost premiums for various building types across climate zones. The analysis assumed the buildings would meet the then-planned May 2023 increased energy efficiency requirements in the BC Building Code. We summarize the results for common residential building types key findings in Tables 3 and 4.

Table 3. Incremental capital costs ($/m²) for Zero Carbon Step Code (EL-4) in Part 9 buildings, by climate zone[17, 18]

	CLIMATE ZONES					
PART 9 - BUILDING TYPE	**4**	**5**	**6**	**7a**	**7b**	**8**
Small single-family dwelling (~100-200m²)	38.4	41.2	43.2	58.4	57.7	57.6
Medium single-family dwelling (~200-300m²)	13.2	17.8	18.6	24.4	24.9	24.9
Large single-family dwelling (>300m²)	7.7	8.2	8.6	57.9	11.5	11.5
Multi-family building (10 unit)	23.7	27.5	27.2	37.4	37.4	37.4
High-rise MURB	65	66.7	80.9			

Table 4. Incremental capital costs ($/m²) for Zero Carbon Step Code (EL-4) in Part 3 buildings, by climate zone[19]

	CLIMATE ZONES					
PART 3 - BUILDING TYPE	**4**	**5**	**6**	**7a**	**7b**	**8**
Low-rise MURB	70.4	66.7	80.3	80.8	105.5	105.6
High-rise MURB	65	66.7	80.9	80.8		

17 *Province of British Columbia. Ministry of Housing. Building and Safety Standards Branch. "Draft Building Carbon Pollution Standard for Part 9 buildings in British Columbia - Technical and financial data tables." September 2022.*

18 *Incremental Capital Costs for both the Energy and Zero Carbon Step Codes are not cumulative. Meeting one Step Code tends to reduce the cost of meeting the other one due to the co-benefits of equipment or material choice.*

19 *Province of British Columbia. Ministry of Housing. Building and Safety Standards Branch. "Draft Building Carbon Pollution Standard for Part 3 buildings in British Columbia - Technical and financial data tables." September 2022.*

Strategies to Maximize Benefits and Minimize Costs

Consider these tips to minimize the costs to industry, while maximizing the benefits for all:

- Review the policy tools cited Section 4.5 and consult with local industry to determine suitable targets, policies, and incentives for your community
- Provide a clear direction for the future so industry can prepare for upcoming changes to local building requirements
- Ensure that new regulations and permitting processes do not extend approval timelines
- Review design guidelines defined in your Development Permit Areas to ensure they don't hinder cost-effective and energy-efficient building forms
- Consider revising floor space ratio (FSR) requirements to avoid unintentionally penalizing builders for constructing thicker walls needed to meet increased energy performance
- Create exemptions from height limits and/or floor area for zero-carbon mechanical equipment (for example, rooftop heat pump condensing units)
- Support industry learning through builder forums, links to energy advisors in your area, promoting training events, etc.
- Review the updated metrics report to learn about the costs of different energy efficiency and greenhouse gas reduction targets[20]
- Review BC Housing's Illustrated Guide on Cost-Effective Tips and Optimization for High-Performance Homes and Buildings[21]
- Check the **CleanBC Better Homes** or **Better Buildings** websites for information about provincial government or utility incentives that may be available to industry

20 *See **energystepcode.ca/reports/#technical***

21 *See **energystepcode.ca***

5.2 Policy Tools and Options to Adopt and Support Step Codes

Local governments can access a number of policy tools to demonstrate leadership and support step codes adoption. They variously remove barriers, incentivize builder uptake, and/or establish a requirement for specific step(s) by building type, geographic area, and/or approval mechanism. The SCC strongly encourages local governments to conduct a legal review prior to moving forward with one or more of these tools, particularly if they are being proposed for the first time.

Many communities have already put these tools to work to incentivize or require energy-efficient and/or zero-carbon new construction. This section also offers a few real-world examples of how and where local governments have put these tools into practice, for the benefit of others that may wish to follow their lead.

Requiring Step Code: Building Bylaw

Local governments may use building bylaws to regulate construction and administer and enforce the BC Building Code. Building bylaws apply across a community, but may have sections applicable only to specific building types and/or geographic areas.

A building bylaw is the most effective way to require new construction to meet the step codes. This method ensures that all new construction within the defined area adheres to the selected requirements. This tool offers several benefits:

- Legal Authority: A bylaw provides a legal foundation, making compliance mandatory and enforceable
- Uniform Application: Ensures consistent application of requirements across all new developments
- Clarity and Transparency: Clearly defined requirements offer transparency to builders and developers
- Regulatory Alignment: Aligns local building practices with provincial goals
- Ease of Policy Change: Amending a building bylaw is generally easier than changing a zoning bylaw, allowing for more agile policy adaptation

Update your building bylaw to identify and remove any procedures that unintentionally inhibit the step codes (e.g. those that detail prescriptive requirements).

Renovations and Additions

The technical targets in the BC Energy Step Code and Zero Carbon Step Code were specifically chosen to be achievable for new construction scenarios. Similar to other alterations, both the designer and the Authority Having Jurisdiction must exercise considerable caution and professional judgement when considering realistic energy efficiency and greenhouse gas reduction measures for existing buildings. Note A-1.1.1.2.(1) in Division A of the BC Building Code offers additional guidance on this topic.

Tools to Incentivize and Reduce Barriers to the Step Codes

TOOL	CONSIDERATIONS
Local governments may adopt **design guidelines** through **Development Permit Areas (DPAs)** to achieve certain objectives with new developments, including energy efficiency and greenhouse gas emissions reduction. DPAs can specify requirements exterior to buildings, including requiring proponents to site and orient their projects to capture solar energy, form and exterior design, landscaping, and machinery, equipment and systems outside the building (e.g. geothermal systems).	• Review to ensure guidelines do not unintentionally make steps more costly or unachievable (e.g., by encouraging building forms that are inherently energy inefficient, or through setbacks, building height restrictions or noise bylaws that constrain heat pump placement) • Align design guidelines with best practices in energy efficient and zero carbon design
Zoning bylaws define how specific areas of land can be used by implementing land use policies set out in official community plans (OCPs) and regional growth strategies. The provincial government defines local governments' core zoning authority in Section 479 of the Local Government Act. A rezoning is a legal change to the zoning bylaw to permit an alternate type of development. Rezonings typically occur in response to objectives set out in an OCP or neighbourhood plan. Local governments have considerable influence and opportunity to encourage sustainable development through rezoning. A rezoning policy sets out objectives or criteria that the local government wishes to achieve in projects undergoing rezoning.	• When used as an incentive mechanism, identify opportunities to obtain "new" density that goes above and beyond what is already available to the property for achieving specific steps. The incremental increase in property value should be commensurate with, or higher than, the builder's corresponding investment in energy efficient or zero carbon construction • See floor space ratio and density bonus tools below • *See the Appendix:* ***New Provincial Zoning Legislation Implications for recent legislation changes and how they relate to the step codes***
Floor Space Ratios (FSRs) are established in zoning bylaws and dictate the total floor area permitted in buildings based on the size of the subject properties. Often, FSR is calculated to the exterior perimeter of the building (including exterior walls). This can unintentionally penalize builders who specify thicker and more heavily insulated walls.	• Offer additional floorspace for projects that meet certain step code requirements • Provide as an incentive for buildings that achieve higher steps under both step codes
A **density bonus** allows development at a level of density that surpasses the allowable FSR under the OCP or neighbourhood plan in exchange for providing a community amenity. One may offer increased density in exchange for greener development, for example. Density bonuses must be established in zoning bylaws that set out the specific conditions needed in order to receive the increased FSR.	• Can provide a significant incentive, and may be useful for adopting either or both step codes • Especially effective where land values are high

Supporting Tools to Incentivize and Reduce Barriers to the Step Codes

TOOL	CONSIDERATIONS
Local governments may use a **revitalization tax exemption** (RTE) to achieve a range of social, economic, and environmental objectives by offering a property tax exemption for a prescribed term. A revitalization program may apply to a defined area, property type, activity, or circumstance, or across an entire jurisdiction. Section 226 of the Community Charter permits local governments to use RTEs for green building developments.	• Provide a moderate to high level of incentive to support the uptake of the step codes • May be suitable to encourage upper steps in some circumstances
Fast-tracking is an incentive that local governments can offer developers to achieve energy efficiency or zero carbon performance in new developments.	• Fast-tracking reduces permit processing wait times by removing steps in the application process (e.g. review by urban design panels) • Consider potential impacts on wait times for non-step code applications
A **building permit rebate program**, or "feebate," rebates a portion or all of a permit fee for projects that seek to achieve higher energy efficiency or zero carbon performance.	• Provide a modest incentive to support the uptake of the BC Energy Step Code or Zero Carbon Step Code • May be best used with other benefits to incent higher steps • Consider funding this via the Local Government Climate Action Program (LGCAP) grant
Provision of local government-owned land for re-development to meet OCP or neighbourhood plan objectives that are not likely to be achieved without support from the local government (for example, if the land requires remediation and renewal, or there is a desire for mixed-use development, social housing, energy efficiency, renewable energy, or other features that may be cost-prohibitive in the existing market). The land could be priced at a rate that is financially viable for both the local government and for the developer undertaking the project, while conforming to requirements of the Community Charter and Local Government Act.	• Include requirements in development approval for buildings to achieve the upper steps of either or both step codes • Help transform the local market by providing valuable experience with meeting either or both step codes

Taking Leadership in Civic Facilities

The SCC encourages local governments to consider specifying higher steps as a tender requirement for new public facilities such as community centres or recreation complexes. This is a proven strategy that helps prepare the local market for broader uptake. Both the Province of British Columbia and BC Housing are taking steps towards leadership in new public sector buildings and affordable housing projects.[22]

A public sector body can establish a corporate policy requiring all new civic buildings to meet a standard that in turn supports a corporate or community objective. Local governments can also work with provincial and federal agencies to encourage new institutional buildings to be built to higher steps, further supporting market transformation.

City of New Westminster's təməsew'txʷ Aquatic and Community Centre

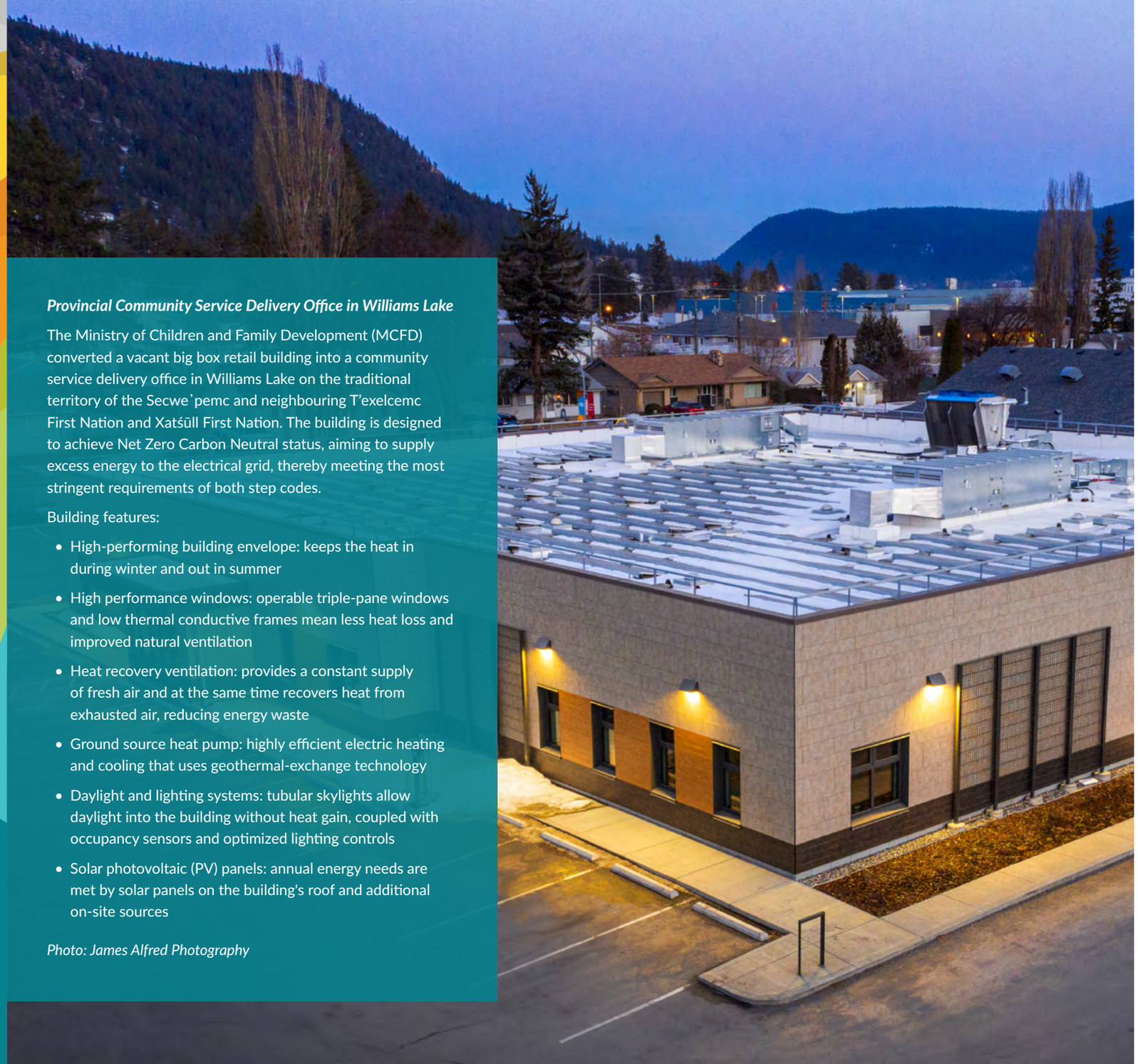
The təməsew'txʷ Aquatic and Community Centre in New Westminster BC aims to be the heart and soul of the community and a place for all to connect. Woven into the landscape with a dramatic unifying roof, the building makes a strong, civic statement while being sensitive to the natural environment and human-scale experience.

The centre has been designed for all ages and abilities, and for how communities engage in recreation today and into the future. It includes a four-pool aquatic centre with sauna and steam rooms, universal washrooms and change rooms, a fitness centre, gymnasia, community rooms, licensed childcare, administrative offices, as well as significant new plazas and greenspaces.

təməsew'txw Aquatic and Community Centre is Canada's first Zero Carbon-certified aquatic centre, aiming for a 90 per cent reduction in greenhouse gas emissions and eliminating fossil fuel emissions completely. The name təməsew'txw means "Sea Otter House" in hən'q'əmin'əm', and was gifted by an advisory panel of urban Indigenous people and local First Nations.

Photo: Miguel Orellana, hcma architecture + design

22 Projects sponsored by BC Housing are required to meet upper steps of the BC Energy Step Code with low greenhouse gas intensity. As of the time of writing, the Province of British Columbia was actively working to establish zero carbon requirements for new public sector buildings.



Provincial Community Service Delivery Office in Williams Lake

The Ministry of Children and Family Development (MCFD) converted a vacant big box retail building into a community service delivery office in Williams Lake on the traditional territory of the Secwe'pemc and neighbouring T'exelcemc First Nation and Xatśūll First Nation. The building is designed to achieve Net Zero Carbon Neutral status, aiming to supply excess energy to the electrical grid, thereby meeting the most stringent requirements of both step codes.

Building features:

- High-performing building envelope: keeps the heat in during winter and out in summer
- High performance windows: operable triple-pane windows and low thermal conductive frames mean less heat loss and improved natural ventilation
- Heat recovery ventilation: provides a constant supply of fresh air and at the same time recovers heat from exhausted air, reducing energy waste
- Ground source heat pump: highly efficient electric heating and cooling that uses geothermal-exchange technology
- Daylight and lighting systems: tubular skylights allow daylight into the building without heat gain, coupled with occupancy sensors and optimized lighting controls
- Solar photovoltaic (PV) panels: annual energy needs are met by solar panels on the building's roof and additional on-site sources

Photo: James Alfred Photography

District Energy Systems: Unrestricted Matter

To support climate action goals, some local governments have encouraged the development of renewable district energy systems and onsite renewable energy generation. Communities have developed district energy systems, and require certain adjacent buildings to connect. Other communities have encouraged or required developers to install a certain amount of on-site renewable energy generation. These requirements can require increased capital investment, beyond that needed to meet the base BC Building Code.

The BC Energy Step Code reduces a building's need for energy regardless of its source, which can also increase up-front investment (especially for the upper steps). Since highly energy-efficient buildings have much lower heat demand, such buildings may complicate the financial viability of a district energy system. Moreover, requiring investments on both the energy supply and demand sides may incur higher costs for a developer.

Local governments that require new buildings to connect to an existing renewable district energy system should carefully review the cost implications for industry before introducing BC Energy Step Code requirements. The provincial government already increased energy efficiency requirements by 20 per cent in 2023, and signalled it will do so again in 2027 (40 per cent more energy efficient) and again in 2032 (80 per cent more energy efficient).

Developers interested in pursuing certain building designs—for example, a south facing building designed with a high ratio of glass—may be challenged to meet the requirements of the upper steps of the BC Energy Step Code. In these cases, they may offer to invest in on-site renewable energy generation as an alternative to reaching higher energy efficiency standards. Local governments should develop policies that are flexible to accommodate these types of cases.

The City of Richmond's District Energy Systems

The City of Richmond has gained global recognition for its leadership in creating district energy systems aimed at reducing greenhouse gas emissions while providing cost-effective and reliable heating and cooling. The City's district energy company, the Lulu Island Energy Company (LIEC), serves three areas.

The Alexandra District Energy Utility services 2.4 million square feet of space across 13 buildings, primarily using geo-exchange fields and high-efficient air source heat pumps.

The City Centre District Energy Utility, including Oval Village District Energy Utility, currently services 17 buildings with 4,256 residential units. It operates on six interim energy plants using high-efficiency air source heat pumps and natural gas boilers. The permanent energy plant, set to be completed by 2028, will use sewer heat recovery technology. At full build-out, the system will service 176 developments, 28,000 residential units and approximately 48 million square feet of floor space. Five permanent energy centres will provide over 130 MW of heating and 115 MW of cooling capacity. The completed system is estimated to reduce greenhouse gas emissions by over one million tonnes compared to conventional service.

Additional Fuel Types

A list of emissions factors for additional fuel types is contained in Sentence 9.37.1.3.(2) and Sentence 10.3.1.3.(2) of the BC Building Code 2024. This list includes propane, light and heavy fuel oil, diesel and wood. These emissions factors were derived from the **National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada – Part 2**. Additional information may be found in **Information Bulletin B23-03**.

If a person wishes to use other fuel types to achieve a level of the Zero Carbon Step Code, they may request the use of an alternative solution as described in Section 2.3., Division C of the BC Building Code. AHJs may, at their discretion, review supporting documentation which demonstrates that the proposal will achieve at least the level of performance required.

6 A Primer on the Technical Requirements

6.1 BC Energy Step Code

Whole-Building Energy Modelling

By default, a proponent must commission a whole-building energy model of the proposed project to demonstrate to a building official that it would meet or exceed the local government's defined requirements. The only exception is if a local government enables the prescriptive approach for Part 9 residential buildings meeting Step 3, or if a building occupancy is not included in the Energy Step Code.

Energy models are usually prepared by trained energy modellers who collaborate with designers, builders, and contractors to demonstrate how a proposed building will meet energy-efficiency performance requirements. This is already common practice in British Columbia; it is now the primary compliance path for meeting the energy-efficiency requirements in the base BC Building Code.

After construction, the responsible party must prepare documentation demonstrating that the building meets the specifications set out in the energy model. The responsible party varies depending on the building type:

- **Part 9 buildings:** The owner is responsible for preparing the appropriate documentation for the building official. In practice, this responsibility is often delegated to the designer, builder, or energy advisor
- **Part 3 buildings:** The qualified professional (an architect or engineer) is responsible for preparing letters of assurance for the building official

To improve consistency, transparency, and comparability, the BC Energy Step Code uses the same metrics for each step, with progressively increasing associated performance requirements. The metrics represent modelled energy use based on the proposed building envelope and mechanical and electrical designs under standard operating conditions.

What is an Energy Model?

An energy model calculates how much energy a proposed building is expected to use under standard operating conditions. It can be used to assess compliance with regulations, incentive or rating programs, and as a design tool in developing higher-performing buildings.

A trained energy modeller undertakes the work; they understand the needed software, construction documents, and code requirements. The model accounts for the size and geometry of the building, the local climate, the effective insulation and airtightness of assemblies such as walls, ceilings, and windows, the mechanical systems that heat, cool and ventilate the building, hot water heating loads, and could include other electrical end uses such as lighting, cooking loads, and the various plug loads such as computers and copiers.

The BC Building Code identifies acceptable modelling and airtightness tools and procedures.[23] The Joint Professional Practice Guidelines—Whole Building Energy Modelling Services from Engineers and Geoscientists BC (EGBC) and the Architectural Institute of British Columbia (AIBC) outline an energy modelling process that professionals registered with those regulatory bodies must follow. Other practitioners will also find them a helpful best practice guide.

Who Prepares Energy Models?

For Part 9 buildings, an energy advisor can provide both energy modelling and airtightness testing—the two compliance services needed for Part 9 buildings. Registered energy advisors are third-party consultants who have been trained and licensed through their service organization and Natural Resources Canada, and there are many registered in BC. Find one at **betterhomesbc.ca/ea**.

For Part 3 buildings, an architect, engineer, or trained energy modeller can provide energy modelling needed to achieve the steps, and numerous architectural and engineering consulting firms currently provide these services. Many new commercial buildings currently use this approach and are already capable of achieving all steps of the BC Energy Step Code.

23 For acceptable procedures for Part 3 buildings, refer to Part 8 of the National Energy Code of Canada for Buildings (NECB) and City of Vancouver Energy Modelling Guidelines.

The Building Envelope

A "building envelope" refers to the physical barrier separating a building's heated or cooled interior from the outside elements. It includes the walls, roof, floors, windows, skylights, and doors (see Figure 5). If the temperature inside a building is different from the outside, heat will naturally move through the envelope. If a lot of outdoor air seeps into the building, heating or cooling systems may kick in to bring the air to room temperature (especially if it is much colder or warmer outside compared to inside), which can use a lot of energy. A high-quality building envelope manages the heat and air that moves between indoors and outdoors, and reduces the requirements on a building's mechanical systems.

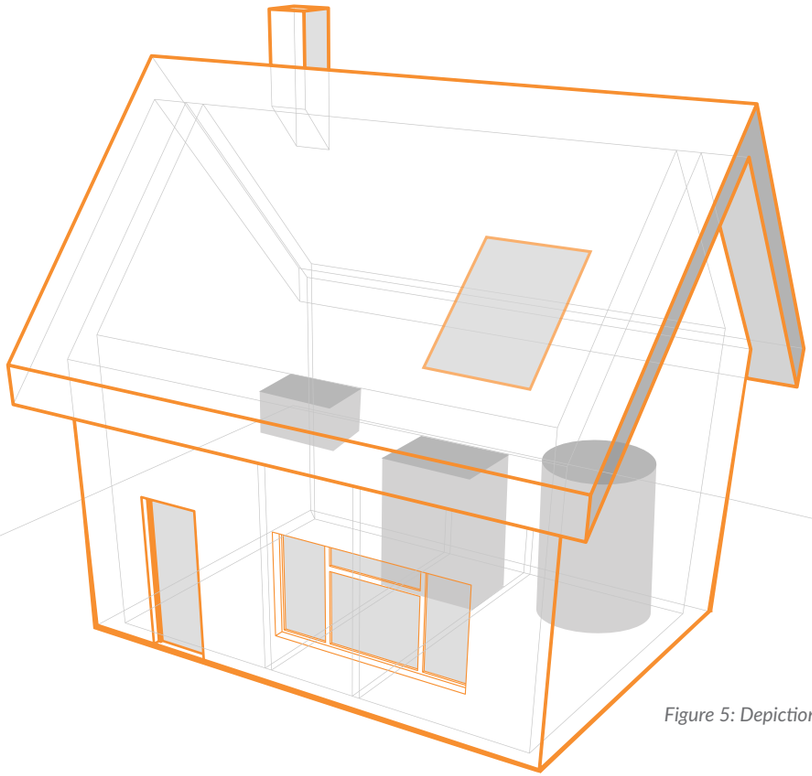


Figure 5: Depiction of the building envelope

The key characteristics associated with high-performance building envelopes could include:

- **Additional insulation** that helps to slow the movement of energy through the walls and keeps the building at a comfortable temperature—warm during cold months and cool during warm months
    - Continuous (unbroken) exterior insulation is best, as it "wraps" the building continuously, preventing heat from leaking out through points of lower insulation
- **Windows, doors, and skylights** that are positioned to make optimal use of sunlight and reduce heat loss on north-facing sides. They are also highly insulated to reduce flow of heat/energy through the glass and frames
- **Minimal thermal bridges**, that is, structures and components that would allow heat to transfer through the envelope. These can be reduced with particular framing techniques or continuous insulation as described above
- **An airtight design** with a continuous air barrier to reduce air leakage, especially at transition points, e.g. where windows and doors are installed within walls, floors intersect with walls, or corners occur between assemblies
- **Including a service cavity** to minimize exterior wall penetrations due to wires, venting, plumbing, exhaust, etc.

What is a Thermal Bridge?

A thermal bridge refers to a pathway that allows the transfer of heat between the inside and outside of a building envelope. It is a point of weakness in the thermal insulation of a structure, where heat can more readily flow, leading to increased energy consumption and potential issues with comfort and condensation.

For example, a metal-framed wall has a thermal bridge at each stud because metal transfers more heat than the insulation between the studs. A concrete balcony that is an extension of the floor slab is another common thermal bridge. Such features can transfer significant amounts of heat out of a building, much like fins on a motorbike radiator that cool the engine.

With appropriate training and materials, builders can learn to construct building envelopes that reduce or eliminate these bridges, reducing energy consumption.

Figure 6 shows the results of "thermal imaging," a tool for seeing where heat is being transferred through the building envelope. The top image reveals thermal bridges at every stud, as well as heat leaking around windows and through the roof. The lower image shows how an air barrier and continuous insulation has reduced thermal bridges and improved sealing around windows and doors.

Equipment and Systems

An energy-efficient building will minimize the energy needed to run all of the heating, cooling, ventilation, and hot water equipment, and lighting systems. By prioritizing a high-quality envelope, a builder will greatly reduce the energy they'll need for heating and cooling, which will in turn require less energy from equipment and systems.

Builders can also reduce loads on mechanical equipment, including:

- **Heat recovery between systems**; with more buildings requiring cooling, there is often an opportunity to reclaim rejected heat and preheat other systems such as domestic hot water. (We discuss heat recovery ventilation below)
- **Reducing hot water loads through efficient low-flow fixtures.** As buildings get more energy efficient and heating loads drop, the hot water consumption becomes a bigger piece of the "energy pie." Reducing the hot water demand can be an important step in design
- **Efficient LED lighting**

That said, there are still significant opportunities to reduce energy use with efficient equipment (see Figure 7 for a depiction of the equipment and systems in a building).

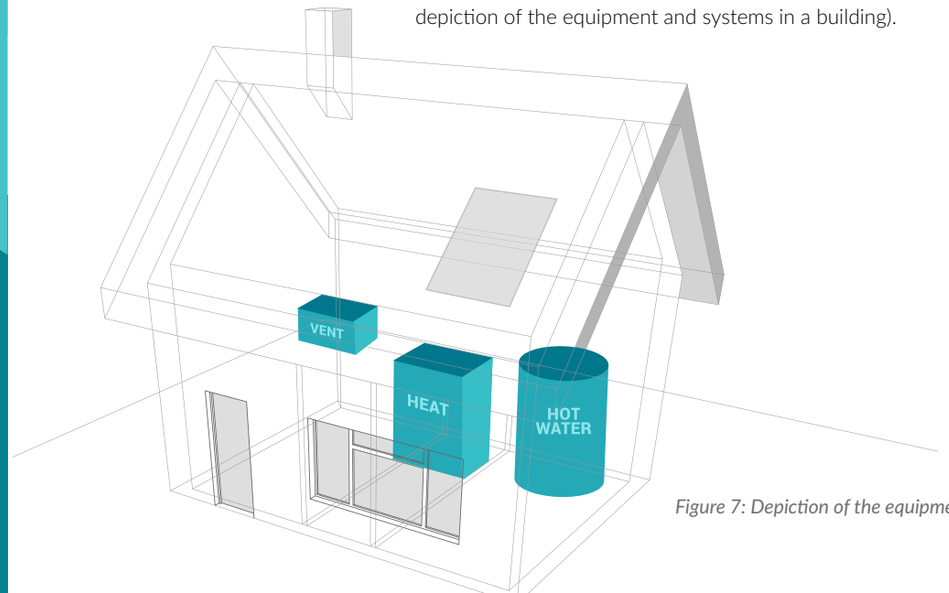


Figure 7: Depiction of the equipment and systems in a building

> ***Resource:*** **CSA SPE17,** *HVAC guide for Part 9 homes published in 2023, highlights best practices for design, sizing, installation and commissioning of HVAC systems.*

The key elements of high-performance equipment and systems include:

- **Heating systems** in efficient buildings vary greatly from high-efficiency furnaces and boilers to heat pumps to electric baseboard heaters. Heating systems must be sized to match the needs of the building
- **Cooling systems** have traditionally played a lesser role in energy use in BC, but that is changing. Starting in 2024, new residential buildings must have one room capable of staying under 26°C to keep occupants safer during hot weather, which may be achieved by active or passive means. In energy-efficient buildings, heat pumps are likely to be the most cost-effective active cooling option (see inset on active cooling). Builders can also reduce the need for active cooling with efficient building envelopes, operable windows, and exterior shading devices such as overhangs, awnings or shutters that block the sun's rays in the summer, while allowing them inside during the winter
- **Ventilation systems** are important for providing fresh air to a building. To be most energy-efficient, these systems will capture and transfer heat from the air exiting the building to the new replacement air entering the building through the use of a Heat or Energy Recovery Ventilator (HRV or ERV). This is also a chance to filter the new air to reduce pollutants
- **Hot water systems** in efficient buildings vary from high efficiency tanks and boilers, to on-demand systems that heat water only as needed, to heat-pump systems

Active cooling: Air conditioner or heat pump?

The evidence basis for choosing heat pumps over traditional central air conditioning units continues to grow. A 2022 report notes that nearly 7,000 Canadian households install a central air conditioner every week. If those homes had instead installed electric heat pumps, the authors conclude, they could have saved Canadians $10.4 billion in energy bills and cut the country's greenhouse gas emissions by 19.6 million tonnes—producing $12.6 billion in net benefits.[24]

Heat-recovery ventilators (HRV)/Energy recovery ventilators (ERV):
These systems are sometimes called "fresh air machines." They harvest the heat from stale outgoing air and use it to preheat incoming air, supplying filtered outside air to the building while reducing the amount of energy needed to bring it up to room temperature. ERVs can also help control indoor humidity levels. They are also growing increasingly important to protect occupant health during climate-driven wildfire smoke events, as their built-in filters can capture smoke particles and prevent them from entering a home.

24 Gard-Murray, A., Haley, B., Miller, S., Poirier, M. (2023). The Cool Way to Heat Homes: Installing Heat Pumps Instead of Central Air Conditioners in Canada. Building Decarbonization Alliance, Canadian Climate Institute, Efficiency Canada, Greenhouse Institute.

Photo: Spruce Grove house in Whistler BC, by Kristen McGaughey Photography.

Airtightness Testing

Airtight construction minimizes air leaks through holes, cracks, or gaps in the building envelope. In addition to reducing the loss of heated air, it also reduces drafts, making the building much more comfortable. Airtight construction involves maintaining a continuous air barrier around the building where possible, then sealing up any necessary seams—such as those around windows, doors, balconies, and other protrusions. This means paying attention to detail during the construction process to reduce or eliminate holes or gaps in the building's air barrier.

The BC Building Code now requires airtightness testing for almost all building types prior to occupancy, with some limited exceptions for Part 9 buildings that may meet prescriptive requirements. Part 9 buildings must meet escalating levels of airtightness at the higher steps. In homes, a "blower door test" is used to evaluate airtightness—see Figure 8 for a depiction of an airtightness test.

The BC Energy Step Code introduced required airtightness testing and reporting using specific methods for all Part 3 buildings, but did not require airtightness levels to comply with the requirements of the steps. Note that the building energy model must account for the result of the airtightness tests for Part 3 buildings.

Note: Part 3 test conditions differ from those of Part 9. Project proponents must follow one of the test procedures outlined in Article 10.2.3.5. of the BC Building Code.

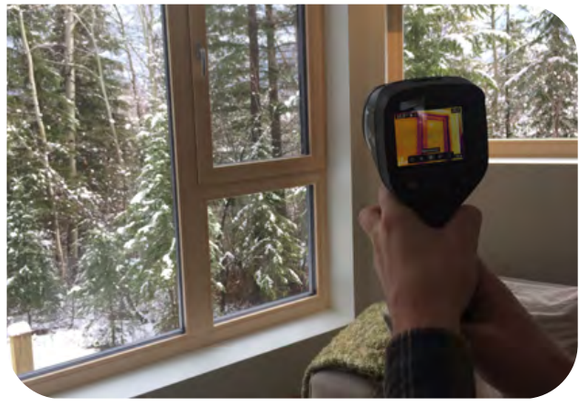
What is an airtightness test?

An airtightness test (or a blower door test in Part 9 buildings) is a standardized assessment of how tightly a building is sealed against air leakage and heat loss. To perform it, a technician closes all doors and vents and temporarily installs an air barrier in a doorway (see Figure 8). The door barrier includes an integrated fan that changes the pressure inside the building, allowing the technician to measure how quickly air is entering or leaving via cracks and leaks. The test results show how much air passes through the building envelope, when the building is at a specified pressure. While an airtightness test is required pre-occupancy, it may also be helpful midway through construction to ensure the builder has addressed any leaks in the envelope before drywall is in place.

Figure 8: Blower door test in action

Metrics used in the BC Energy Step Code

The following metrics in the BC Energy Step Code assess which step a building achieves. The building envelope metrics and the equipment and systems metrics are demonstrated through a whole-building energy model of the design, while the airtightness metric is demonstrated through an on-site test of the building before occupancy.



Building envelope metrics (Part 9 and Part 3)

Thermal Energy Demand Intensity (TEDI): The amount of annual heating load needed to maintain a stable interior temperature, taking into account heat loss through the envelope and passive gains (i.e., the amount of heat gained from solar energy passing through the envelope or from activities in the home like cooking, lights, and body heat). It is calculated per unit of area of the conditioned space over the course of a year and expressed in kWh/(m^2 • year).

Part 9 Buildings

Equipment and systems metrics

Per cent Improvement: An EnerGuide reference house establishes how much energy a home would use if it was built to minimum building code requirements. This metric identifies how much less energy, stated as a percentage, a given proposed new home would require compared to the annual energy consumption of the EnerGuide reference house.

Mechanical Energy Use Intensity (MEUI): The modelled amount of energy used by space heating and cooling, ventilation, and domestic hot water systems, per unit of area, over the course of a year, expressed in kWh/(m^2 • year).

Airtightness metrics

When the blower door test is performed, the reported airtightness value must meet or exceed the appropriate value in Table 9.36.7.4. of the BC Building Code.

Part 9 builders may choose from three airtightness testing pathways:

- Air Changes per Hour at a reference pressure of 50 Pa Pressure Differential (ACH_{50})
- Normalized Leakage Area at a reference pressure of 10 Pa (NLA_{10})
- Normalized Leakage Rate at a reference pressure of 50 Pa (NLR_{50})

A builder will meet the requirements of a given energy efficiency step if the reported airtightness value meets one of the three eligible metrics listed above. ACH_{50} is the most common airtightness testing metric, and most Part 9 buildings will meet their BC Energy Step Code target via this testing metric.

However, some buildings, particularly those smaller than 1,500 square feet, may have difficulty meeting the ACH_{50} target despite applying recommended energy conservation measures such as high-performance windows and well-insulated wall systems. A smaller dwelling unit also consumes less energy than a larger unit. Therefore, the BC Building Code and National Building Code of Canada now include two new pathways: NLA_{10} and NLR_{50}, which may prove a more viable compliance path for these smaller buildings.

Part 3 Buildings

Equipment and systems metrics

Total Energy Use Intensity (TEUI): The modelled amount of total energy used by a building, per unit of area, over the course of a year, expressed in kWh/(m^2 • year). It includes heating, cooling, fan, pump, hot water, lighting energy, and plug loads—appliances, entertainment systems, essentially, all of the utilities "metered" at the building. This metric may be challenging to achieve for specific buildings with inherently high process loads—for example, restaurants, hospitals, or supermarkets that serve hot food.

Note: The modelling guidelines referenced in the BC Energy Step Code regulation offer exceptions for unique situations. For example, electric vehicle charging is not included in plug load calculations.

Modelled floor area

The Modelled Floor Area (MFA) is the area of the building represented by the energy model. It is an important value because it forms the basis of several energy and GHG "budgets." The TEDI, TEUI, and GHGi are all "intensity" metrics, meaning that they limit the building's Thermal Energy Demand, Total Energy Use, and Greenhouse Gas emissions per square metre (m^2) of MFA. The full definition is contained in the Definitions section of the City of Vancouver Energy Modelling Guidelines v2.

Airtightness testing

Air Leakage Rate: A measure of the rate that air leaks through the building envelope per unit area of the building envelope, as recorded in L/(m^2) at a 75 Pa pressure differential, measured in accordance with one of the requirements in the BC Building Code.

Overheating

Any Part 3 building that is subject to BC Energy Step Code requirements, and that does not have active cooling, is required to undergo an overheating analysis. The analysis depends on the building's location and is performed during the summer months. The energy model is used to determine the number of "overheating hours" for each space that is not mechanically cooled. The limit is 200 hours, however, buildings that will house vulnerable occupants are recommended to be designed to no more than 20 hours. The full definition and supporting calculation are contained in the Passively Cooled Buildings section of the City of Vancouver Energy Modelling Guidelines v2.

For a detailed current listing of the BC Energy Step Code metrics and technical requirements, please visit **www.energystepcode.ca/requirements**

Kwayatsut concrete high-rise apartment building at Broadway and Fraser, Vancouver BC (Part 3, Step 3).

6.2 Zero Carbon Step Code

The Zero Carbon Step Code has four levels of increasing stringency:

1. **EL-1 ("Measure Only")** requires a builder to measure and report their proposed building's greenhouse gas emissions
2. **EL-2 ("Moderate")** likely requires decarbonization of either space heating or domestic hot water systems
3. **EL-3 ("Strong")** likely requires decarbonization of both space heating and domestic hot water systems
4. **EL-4 ("Zero Carbon")** indicates that the operation of the building is as close to zero emissions as possible

There are different compliance requirements for Part 9 and Part 3 buildings (outlined below). An energy model is used to identify key metrics for buildings being approved using a performance path (except where a prescriptive path is selected for compliance). To support consistency, a set of emission factors are provided for each energy type; they apply province-wide.

Part 9 Buildings

Part 9 homebuilders can choose one of two compliance pathways: prescriptive or performance.

The **prescriptive path** specifically requires the builder to install various combinations of zero carbon space heating, cooking, and water heating equipment. For the moderate carbon level (EL-2) a builder must install zero carbon domestic heating, but cooking and water heating may use higher carbon energy. To meet the strong carbon level (EL-3), the builder must select zero-carbon space and water heating systems, but can still choose higher carbon cooking equipment. To comply with the highest zero carbon level (EL-4), all of the proposed home's space, water heating, and cooking equipment must produce zero emissions. This path is less flexible, but may be useful for a builder who is not engaging an energy advisor.

In contrast, the **performance path** for Part 9 buildings requires emissions to be below certain requirements, and does not specify any particular equipment. However, most of a building's energy use is for heat and hot water, so it would be logical to decarbonize those end uses first. In the performance path, calculations only consider greenhouse gas emissions produced by home heating, cooling, ventilation, and domestic hot water equipment. This approach excludes emissions from ancillary end-uses such as natural gas cooktops, clothes dryers, and wood stoves. The calculation methodology for the performance path is based on the Mechanical Energy Use Intensity (MEUI) metric and reported as either absolute greenhouse gas emissions per year ($kgCO_2e$/year), or a greenhouse gas intensity (GHGi) metric calculated using building floor area ($kgCO_2e/m^2$/year). Where implementing both step codes, compliance via the performance path requires almost no additional administrative effort for the local government. This path is more flexible, and is likely to be the most popular option.

Part 3 Buildings

Meanwhile, Part 3 developers may use only a performance pathway expressed using a greenhouse gas intensity metric (GHGi). There are different targets for different building occupancy classifications because, for instance, a hotel is expected to use more energy for its laundry and indoor pool facilities than an office occupancy, which is unlikely to have either. Calculations consider heating, cooling, ventilation, and domestic hot water, plus cooking appliances and gas fireplaces.

Tip: *Use the Compliance Checklists to calculate these metrics because they have the factors built in:* **Part 9 Compliance Tools** and **Part 3 Compliance Tools**

Key Terms for Zero Carbon Step Code

The clarifications below are to be considered when demonstrating Zero Carbon Step Code compliance as per Division B, Article 9.37.1.3 of the BC Building Code.

Principal heating system

A principal heating system is the heating system that has been designed to accommodate the heating load of a building. It may include supplementary heating equipment, as defined below.

Supplementary heating equipment

Supplementary heating equipment is that which supplements the principal heating system when its capacity has been exceeded. The supplementary equipment is to be included when demonstrating compliance with Article 9.37.1.3. of Division B. Examples include a central ducted air-source heat pump (ASHP) with supplementary gas furnace, an air-to-water heat pump with supplementary gas boiler, and packaged dual-fuel system (electric heat pump with supplementary gas heater).

Redundant or backup equipment

Redundant or backup equipment refers to equipment installed in addition to and independent of the principal heating system, and that is not designed to meet the home's space conditioning load. Examples include wood burning stoves, gas fireplaces, and emergency back-up equipment.

Equipment and appliances

This refers to devices that convert fuel into energy. They include heating and cooling equipment, domestic hot water equipment, ventilation equipment, and cooktops and laundry drying appliances.

Greenhouse Gas Intensity (GHGi)

Total greenhouse gas emissions, expressed as $kgCO_2e$ per square metre of floor area of conditioned space per year. This metric is associated with the energy used by a building's systems and typically referred to as GHGi.

Mechanical Energy Use Intensity (MEUI)

This metric describes the modelled amount of energy used by space heating and cooling, ventilation, and domestic hot water systems, per unit of area, over the course of a year. It is usually expressed in $kWh/(m^2 \cdot year)$.

For a detailed current listing of the Zero Carbon Step Code metrics and technical requirements, please visit **www.energystepcode.ca/requirements**

Conclusion

With the adoption of the two step codes, British Columbia is well positioned to meet the provincial government's two big goals for new buildings: All zero-carbon new construction by 2030 and all net-zero energy ready performance by 2032.

The introduction of the BC Energy Step Code in 2017, and subsequent investments in education and training, has created a building industry that now delivers buildings that are 20 per cent more energy efficient right across the province. Buildings are now more airtight and supply chains now offer needed energy-efficient materials and components, such as high-performance windows and insulation. And the construction industry collaborates with energy advisors and modellers from a project's outset to identify the most cost-effective and energy-efficient outcomes.

The BC Energy Step Code set the stage for the Zero Carbon Step Code, which now offers local governments a policy tool to regulate greenhouse gas emissions in new construction. Groundbreaking policies and regulations like the BC Energy Step Code and Zero Carbon Step Code are helping create the conditions for a low-carbon, resilient economy.

Just like the BC Energy Step Code, the Zero Carbon Step Code recognizes that not all communities are ready to move at the same pace. Like its predecessor, the newer regulation is a flexible tool that local governments can implement in consultation with industry and in a manner that matches local needs and capacity in advance of adoption into the building code. Any effort to advance energy-efficient and zero-carbon new construction across the province—and the country—will depend on close collaboration with local interested parties.

Local governments that adopt the step codes are giving their builders and developers a head start on future revisions to the BC Building Code. It integrated the lower steps of the BC Energy Step Code in May 2023, and the Province of British Columbia has signalled its intent to roll the remaining steps into the base code between now and 2032. Similarly, the provincial government plans to add the requirements of the Zero Carbon Step Code into the base building code in increments leading up to its 2030 goal.

The Step Code Council is committed to ensuring local governments adopt the step codes in a coordinated and thoughtful manner, to the benefit of all involved. This is why the council produced this document and strongly encourages adherence to its offered guidance.

The Step Code Council also encourages continued local government leadership by requiring the highest steps for any public-sector building project that may be on the horizon, such as a community centre or public-safety complex. These buildings will serve as high-profile case studies—growing local industry capacity while demonstrating to the market what can be accomplished.

If you're a local government staff member or elected official and cannot find an answer to your concern or question in this Guide, please visit energystepcode.ca, where resources will continue to be shared as they become available. For policy and technical questions, please contact the Building and Safety Standards Branch at the Ministry of Housing, at **building.safety@gov.bc.ca.**

Photo: The City of Surrey, Clayton Community Centre (built to Passive House standard)

Appendix: New Provincial Zoning Legislation Implications

In December 2023, a series of provincial legislative amendments to encourage residential construction significantly changed the land use planning framework long used by BC local governments. We're including a summary of these changes in this Guide because they may have implications for local government policies that seek to incentivize and support the BC Energy Step Code and the Zero Carbon Step Code . Specifically, the Housing Statutes (Residential Development) Amendment Act and the Housing Statutes (Transit-Oriented Areas) Amendment Act include density bonusing or incentive provisions.[25] We summarize each of these below.

The Housing Statutes (Residential Development) Amendment Act

This law requires local governments to permit a minimum of two to six units of small-scale, multi-unit housing (SSMUH) in zones currently restricted to single-family and in some scenarios, duplex dwellings. The legislation calls these Restricted Zones. Updated zoning bylaws must permit a minimum of two to six housing units in Restricted Zones without the need for the applicant to rezone. A **Provincial Policy Manual with Site Standards** sets out provincial expectations for local governments in amending their zoning bylaws.

Where a zone must permit up to six dwellings, local governments may use conditional density bonus rules for one of the six homes. However, local governments may only establish the conditional density for the purposes of affordable or special needs housing (sections 482 (2) (b) and (c) of the LGA), and not for other types of amenities. Otherwise, local governments are not permitted to use conditional density bonus rules for the minimum requirements of the legislation.

Local governments may still use conditional density bonusing for densities that are higher than those required by the SSMUH legislation. They may also still use floor space ratios and other tools to limit the size of new dwelling units, provided the density and density of use are not unreasonably restricted or prohibited.

The Housing Statutes (Transit-Oriented Areas) Amendment Act

This legislation amended the Local Government Act and Vancouver Charter to incorporate legislative requirements for transit-oriented areas (TOAs). The changes enable the provincial government to prescribe transit stations and require local governments to designate land within certain distances around those stations as TOAs by bylaw. The associated regulations contain the prescribed transit zones, and set out the minimum allowable densities and applicable distances for TOA designations.

Within TOAs, with respect to land zoned to permit any residential use or another prescribed use, local governments are required to adhere to minimum densities when amending a zoning bylaw. Local governments may not deny rezoning applications based solely on the level of density or height proposed if it is at or below the density and height set out in the regulations.

Due to the complexity and scale of many transit-oriented development projects, it is expected that rezonings will still occur within transit-oriented areas. Therefore, there is no requirement for local governments to update their zoning bylaws and pro-actively zone to the minimum allowable densities established in the regulations.

In developing their zoning bylaws for transit-oriented areas, local governments must consider the **Provincial Policy Manual for Transit Oriented Areas.**

*25 For more information on these amendments, see **Local Government Housing Initiatives** at the Province of British Columbia's Planning and Land Use Management Branch.*

Relationship to Density Bonusing

The SSMUH legislation prevents local governments from using their authorities in a manner that unreasonably prohibits or restricts the use or density of use that the amended provincial legislation now requires them to allow. Under the TOA legislation, local governments must not use zoning powers to prohibit or restrict, in a TOA, a prescribed density of use, size or dimension of buildings where the land is zoned to permit any residential use or a prescribed use other than residential use.

The TOA legislation establishes minimum allowable height and density for lots close to designated transit facilities, ranging from four to 20 stories and at a much greater density than allowed for SSMUH-related development. New development in transit-oriented areas will likely be subject to Part 3 of the BC Building Code, while most SSMUH-related development will fall under Part 9.

When local governments update zoning bylaws to comply with the SSMUH legislation, it could remove certain opportunities that they now use to incentivize higher steps of the BC Energy Step Code. That's because there will no longer be a need to rezone for SSMUH densities. However, the type of incentives typically found in zoning bylaws, such as modest increases in floor area, should continue to be available so long as they do not unreasonably restrict or prohibit SSMUH compliant development.

New development in a transit-oriented area will still undergo a traditional rezoning process. Local governments can continue to use existing base densities established in their zoning bylaws to secure affordable and special needs housing units through density bonusing, even if the base densities are below the minimum allowable densities set out in the TOA regulation. It is anticipated that by mid-2024, local governments will transition to using new proactive planning tools to secure affordable housing and community amenities through TOA development, such as amenity cost changes and other tools under development. A local government could still apply a greater density than is required in a TOA if the proposed building furthers local climate and energy efficiency goals.

Other Authorities

Development applications in transit-oriented areas and SSMUH zones remain subject to all the usually applicable policies, regulations, and statutes. Local governments can use their building bylaw to require compliance with the Zero Carbon Step Code and higher steps of the BC Energy Step Code without necessarily providing incentives.

The SCC recommends that local governments consider if proposed step code requirements raise building costs (even while lowering long-term operating costs) and hamper the viability and/or affordability of SSMUH forms of housing or transit-oriented area development. As needed, local governments may wish to provide incentives using the tools outlined in the tables in this section.

For a detailed current listing of the Zero Carbon Step Code metrics and technical requirements, please visit **energystepcode.ca/requirements**