



The BC Energy Step Code and the Zero Carbon Step Code

Prepared for the City of Maple Ridge
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The BC Energy Step Code is a progressive standard that allows local governments to require new buildings to meet higher **energy efficiency** than the base BC Building Code, reducing the **energy consumption associated with heating, cooling, and electricity use in structures**. It outlines a series of incremental "steps" aimed at achieving net-zero energy performance in all new buildings by 2032.

The Zero Carbon Step Code (ZCSC) is an extension of the Energy Step Code that goes beyond energy efficiency to address the **greenhouse gas emissions** associated with new buildings. Under the ZCSC, local governments can now require or incentivize builders to meet one of four increasingly stringent levels of emissions reduction.

The four carbon performance, or "emissions levels" (EL), of the Zero Carbon Step code are:

1. **Measure-only (EL-1)**: requires measurement of a building's emissions without reductions and is intended to build knowledge and capacity.
2. **Moderate Carbon Performance (EL-2)**: in most cases, will require decarbonization of either space heating or domestic hot water systems.
3. **Strong Carbon Performance (EL-3)**: in most cases, will require decarbonization of both space heating and domestic hot water systems.
4. **Zero Carbon Performance (EL-4)**: in most cases, will require the full electrification of a building.

The following report prepared for the City of Maple Ridge provides a high-level assessment of the Energy Step Code (Steps 4-5) and Zero Carbon Step Code based on Effort, Cost, and Greenhouse Gas reduction to help guide conversations at the City of Maple Ridge. Each section is assessed on a five-point scale based on the level of effort and impact with 1 being easier/low cost/low impacts and 5 being harder/more costly/higher impact.

Effort Analysis

Energy Step Code – Level of effort 4/5

Constructing to the upper steps of the Energy Step Code demands the implementation of advanced building envelope technologies, including well-insulated walls, roofs, and windows, as well as the integration of high-performance HVAC systems. Achieving airtight construction requires rigorous quality control measures and collaboration with design and build teams including energy advisors for assessments and guidance. Builders may need training to understand and execute the advanced building practices required for the upper steps of the Step Code.

Since the inception of the BC Energy Step Code, the construction industry has adapted and builders have gained more experience. It has been proven that the overall effort required for constructing high-performance buildings decreases with experience.

Zero Carbon Step Code – Level of effort 2/5

Building to the upper levels of the Zero Carbon Step Code (all-electric buildings) involves notably less effort for builders compared to conventional natural gas-heated homes. The simplicity comes from streamlined mechanical systems in all-electric setups, with fewer components and simpler infrastructure requirements, leading to a straightforward construction process. Builders also benefit from avoiding the complexities associated with gas lines, combustion systems, and venting. Builders should engage with trusted mechanical contractors early in the design process to ensure streamlined installations.

Cost Analysis

Energy efficiency and electrification **complement each other**, mutually reducing the reliance on complex and costly mechanical systems, consequently lowering both initial construction expenses and ongoing monthly bills for homeowners as energy efficiency increases.

Energy Step Code – Capital cost implication 4/5

The capital costs associated with building to the upper steps of the Step Code involve initial investments in advanced technologies, materials, and construction practices aimed at enhancing the home's building envelope. These costs include superior insulation, sometimes triple-glazed windows, and advanced heating, ventilation, and air conditioning (HVAC) systems. The [BC Energy Step Code Metrics study](#) reveals that reaching higher steps in energy efficiency, especially in all-electric structures, **can be cost-effective compared to baseline designs**. A [survey completed by 69 builders in the fall of 2021](#) (Page 2, section 2) indicates that general price inflation appears to have a considerably larger impact on cost overall, ranking the BC Energy Step Code number 8 on the list of cost drivers.

Energy Step Code – Operational cost implication 1/5

The long-term benefits often outweigh the initial investment and offer both immediate and long-term financial advantages, increased comfort, and reliability to homeowners and tenants. Operational cost analyses underscore the long-term benefits of energy-efficient systems, with **Air Source Heat Pumps demonstrating the lowest costs among various heating options**.

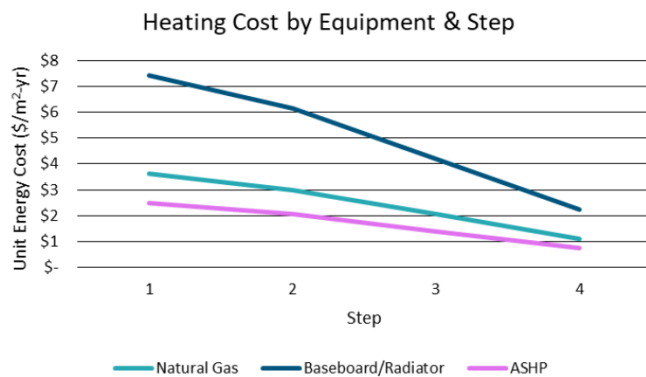


Figure 3: Unit of Energy Cost (\$/m²/year) for different Steps of the BC Energy Step Code.

Zero Carbon Step Code – Capital cost implication 1/5

The [BC Energy Step Code Metrics](#) study based on theoretical costing data and energy models, highlights that **all-electric structures are less expensive to construct than their gas-heated counterparts** for Step 1-3 in Part 3 buildings and for Step 3-5 in Part 9 buildings.

The [ZEBx Construction Cost Analysis](#) focuses on a limited number of real cases, comparing baseline code-compliant buildings to Step 4/Passive House structures. The results reveal that in Vancouver, **all-electric Passive House buildings are less expensive to build than hybrid ones.**

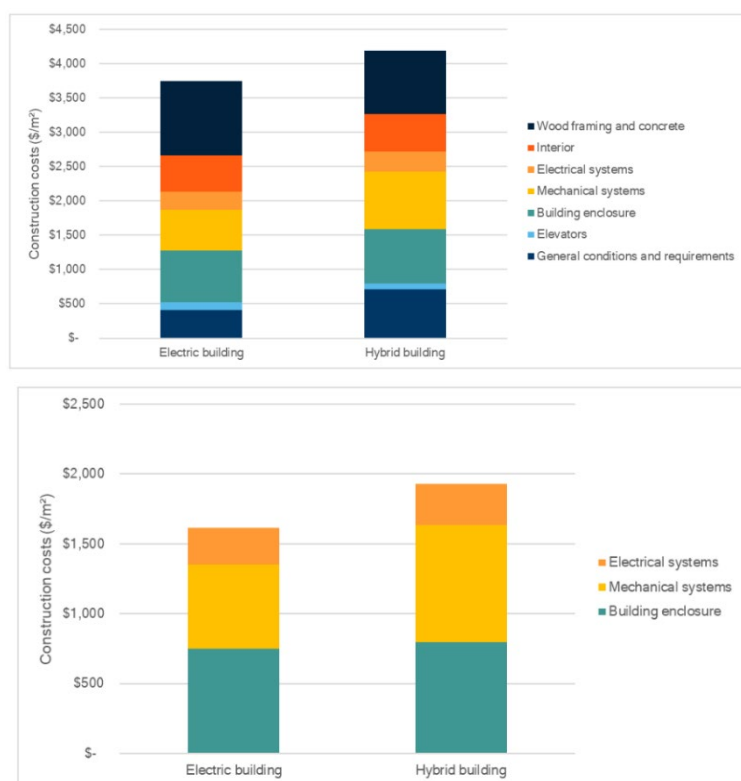


Figure 1 & 2: Cost comparison (\$) by building component (top) and for **energy-related components only** for all building types (bottom).

The [City of Vancouver Zero Emissions Building costing study](#) assesses the impact of electrifying Domestic Hot Water systems in reaching Zero Carbon, indicating that, while **slightly more expensive, electric systems for Domestic Hot Water have minimal cost increases** for all building types.

Zero Carbon Step Code – Operating cost implication 3/5

While the cost per unit of energy for electricity is higher compared to natural gas, real case studies done on all-electric Part 9 homes have shown that the annual utility expenses for an all-electric home are only 3%-7% greater than those for a natural gas-powered home, which translates into an extra \$30-\$200/year/home.

There are no real-case scenarios or studies showing a comparison of a gas-powered Part 3 building with an equivalent all-electric building. The [City of Vancouver Zero Emissions Costing Study](#) shows that there is a correlation between a reduced capital cost and the increase in overall operational cost when comparing standard electric domestic hot water systems (cheaper, less efficient equipment) with air to water heat pumps (higher upfront cost, more efficient equipment) showing +21% versus +5%, respectively, in operating costs. The more efficient the system, the lower the operating costs, which highlights the efficiencies of heat pumps over baseboards.

Looking ahead, we could anticipate a rise in natural gas prices driven by the impact of the carbon tax¹, particularly if policies are aimed at promoting the shift towards cleaner energy sources to achieve our CleanBC goal of reducing greenhouse gas emissions by 40% below 2007 levels by 2030. Consequently, this could result in **the cost of operating all-electric buildings becoming comparable to or even more cost-effective than fossil gas-powered structures.**

¹ [Province of BC, Clean Economy](#)

Greenhouse Gas Emissions Impact Analysis

BC Energy Step Code – Impact on GHG reductions 2/5

The [Implications of the BC Energy Step Code on GHG Emissions](#) report published by the BC Energy Step Code Council found that while the Step Code reduces overall *energy use* in buildings, its focus on energy efficiency results in buildings that **continue to emit significant emissions over their lifetime**.

GHG emissions are dependent on the *energy source* for the space heating and domestic hot water systems. According to the [BC Best Practices Methodology for Quantifying Greenhouse Gas emissions](#), **1 GJ of natural gas has approximately 17 times higher global warming potential than 1 GJ of electricity**. This means that if a building uses 100 gigajoules (GJ) of natural gas in a year it produces 5.1 tonnes of carbon dioxide equivalent (tCO₂e). If it uses 100 GJ of electricity it produces 0.3 tCO₂e. The difference in global warming potential is exacerbated by the varying efficiency levels of electric and gas-fired equipment. Currently, the top-performing gas furnace operates at 96% efficiency, whereas heat pumps achieve an efficiency of 300%.

Zero Carbon Step Code – Impact on GHG reductions 5/5

The Zero Carbon Step Code was specifically created to fill the gap left by the BC Energy Step Code, which did not address GHG emissions directly, making it a powerful and targeted tool for achieving substantial emissions reductions in buildings.

Communities that have declared a Climate Emergency are utilizing the Zero Carbon Step Code as a tool to **expedite emissions reductions** by implementing EL-4 Zero Carbon performance earlier than the Provincial timeline.

The EL-4 Zero Carbon Performance caps emissions at:

- 500 kgCO₂e/year **and** <1.5 kg CO₂e/m²/year of GHG intensity for Part 9 buildings
- Between 1.5 - 2 kgCO₂e/m²/year of GHG intensity for Part 3 buildings.

This data-driven approach aligns with the monitoring and reporting requirements often stipulated in community climate action plans, reinforcing its significance in the pursuit of urgent climate action.

Roadmap to Upper Steps

Best Practices for moving from lower to higher steps with a focus on Zero Carbon Step Code

Local governments that are early adopters are fast-tracking EL-4 Zero Carbon implementation by skipping lower levels, relying on building permit data and engaging with industry in informed sessions, streamlining the process through early engagement and data-driven decision-making.

- Initial implementation involves reviewing permit data, making decisions based on current performance, and **conducting early engagement sessions with industry for feedback, facilitating smoother implementation** through data-driven decision-making.

Despite concerns about electricity supply challenges² and Renewable Natural Gas compliance, local governments see the Zero Carbon Step Code as an opportunity for enhanced resiliency, collaboration with BC Hydro, and inter-jurisdictional consistency.

- There are a lot of co-benefits (improved energy efficiency, indoor air quality, comfort, resilience, and future-proofing) to the adoption of the upper steps of both the Step Code and the Zero Carbon Step Code that provide **opportunities for collaboration** with stakeholders, internally and externally.
- BC Hydro presented their plan to meet energy

The builder permitting processes and regulatory requirements are unchanged from previous Step Code requirements and have been made easier thanks to the new Provincial forms ([Part 3](#) & [Part 9](#)) which includes the Zero Carbon metrics.

- It is recommended to use the Provincial form and to **convey this information to industry to alleviate concerns** about the upcoming changes.

A key to success for city staff is to encourage robust collaboration between the sustainability and building departments, ensuring a clear understanding of goals and metrics.

- Systems and workflows can be created to perform **in-house data analysis** on every single building permit application if staff from different departments collaborate.

² The number 1 question asked by builders and developers when introduced to the Zero Carbon Step Code is about BC Hydro's capacity to generate enough electricity. A dedicated [B2E webinar](#) from September 2023 provided a detailed plan from BC Hydro to meet future electricity needs.

The Energy Advisor plays a crucial role in achieving compliance with the upper steps and the Zero Carbon Step Code. Although metrics have evolved, **the compliance process remains unchanged for Energy Advisors.**

- **The Integrated Design Process should be incentivized** for design and build teams to collaborate early on to avoid costly delays during the construction phase.

Most communities are aligning the Zero Carbon Step Code with their existing pathways and climate goals.

- To facilitate adoption by industry, **being consistent** with previous Step Code targets and timelines is key.

The readiness and willingness of contractors to embrace changes in their methods and techniques for energy efficiency are crucial. In an industry traditionally resistant to change, highlighting what peers are accomplishing serves as a strong catalyst for change.

- Showcasing the challenges and successes of early adopters with **case studies** has proven useful, effectively conveying to hesitant participants that this transition is manageable and worthwhile.

Having a clear outline of what the requirements are going to be in the future has been widely supported by industry.

- Establishing future objectives with **a well-defined timeline stretching to 2032** and communicating this schedule early enables industry stakeholders to proactively prepare for impending changes.