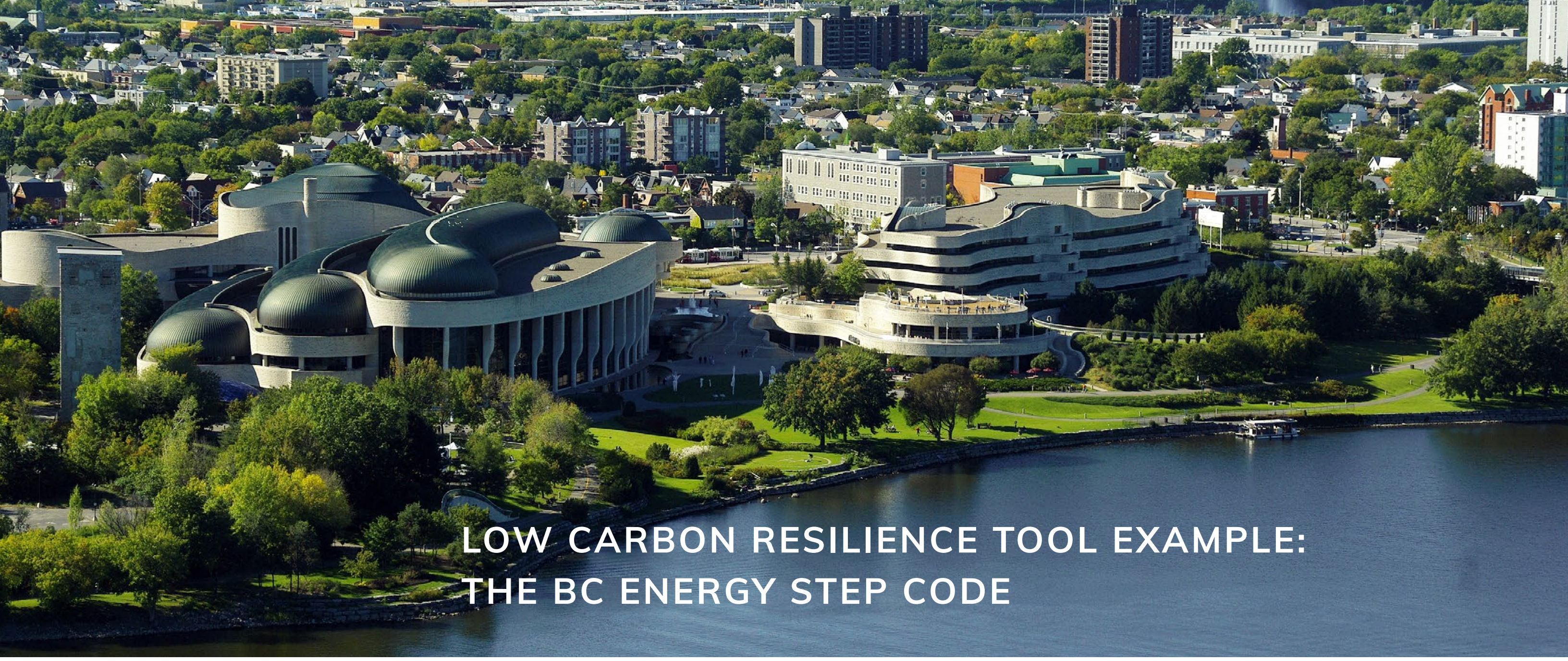


LOW CARBON RESILIENCE TOOL EXAMPLE: THE BC ENERGY STEP CODE

> "Buildings must be designed with BC's current and future climate in mind if they are to meet energy efficiency goals.

This case study illustrates how low carbon resilience (LCR) might be incorporated into an existing tool, the BC Energy Step Code. It demonstrates that synergies and trade-offs between reducing emissions and building resilience can be achieved at the building scale, and highlights how practitioners using the code might increase efficiency and effectiveness by considering future climate in building design and operation.

Low Carbon Resilience and Buildings

Climate change has already altered temperature and precipitation patterns in BC and these trends are expected to intensify in coming decades[1] Buildings must be designed with BC's current and future climate in mind if they are to meet energy efficiency goals. The Energy Step Code is an important advance in the Government of British Columbia's strategy to reduce greenhouse gas emissions; however, it does not currently incorporate projected climate impacts. Taking an LCR approach by considering climate change adaptation and emission reduction in a single integrated process could improve the future performance of buildings being planned and assessed using the Energy Step Code.

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all greenhouse gas (GHG) emissions today.[2] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[3] Low carbon resilience (LCR) is a lens designed to achieve strategic systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date. Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[4] will help align climate action goals and advance the transition toward a more energy efficient, resilient, and sustainable future.

The BC Energy Step Code

The Government of British Columbia created the Energy Step Code in 2017 to improve the energy efficiency of newly constructed and retrofitted buildings.[5] The code is intended to reduce the greenhouse gas emissions generated by building operations, with the ultimate goal of constructing "net zero energy-ready" buildings by 2032.[6] The code establishes five steps based on a series of measurable, performance-based indicators.[7] The first step introduces energy performance modelling and air tightness, but only requires compliance with the standards in the basic BC Building Code, while Step 5 requires a "net-zero energy ready" standard that only today's most efficient buildings can meet.[8]

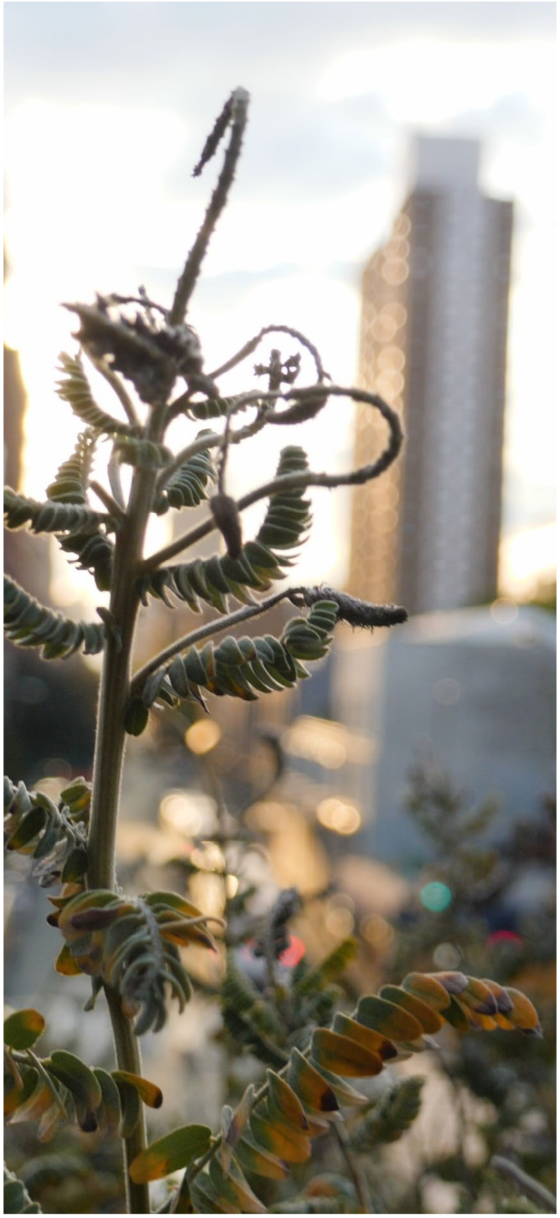
The code is not provincially required – builders and communities can choose to opt in to its performance standards. However, some BC municipalities have already passed bylaws requiring specific steps be met;[9] for example, the Township of Langley, the City of Victoria and a number of communities across the province are adopting the code for certain categories of buildings.[10] In December 2017, the City of North Vancouver became the first municipality to require all new buildings to use the BC Energy Step Code.[11]

Buildings & Climate Change Adaptation

There are two main ways climate change adaptation might be considered in building design, construction, and energy use for the duration of the intended life of the building. The first is to ensure buildings are resilient to climate change impacts such as increased temperature and extreme weather events, altered precipitation and flooding patterns, sea-level rise, and other challenges, while remaining healthy places for occupants. The second is to ensure that technologies and techniques to advance energy efficiency are adaptive and continue to be effective as the climate changes. Both are important challenges that can be addressed with an LCR approach. The following sections highlight approaches to addressing the second challenge: adaptive energy efficiency.

Maintaining Energy Efficiency in a Changing Climate

Practitioners designing and constructing buildings need to consider the effects of climate change on building performance over the duration of the intended life of the building. Since buildings typically last 60+ years, it is crucial to incorporate future climate change projections such as increases in



temperature into weather data used to assess design and planned performance.[12]

This is becoming an important step in ensuring that buildings will continue to perform as expected over their lifetime as climate change will significantly alter heating and cooling demand patterns. Warming may be significant enough to shift peak energy demand in the Pacific Northwest from winter heating to summer cooling.[13] An LCR approach to this challenge requires ensuring that buildings are planned and retrofitted in ways that acknowledge changing temperatures and avoid increasing emissions.

Building design professionals could use a variety of strategies to meet these objectives. Integrating adaptation with emissions reduction requires reconsideration of conventional building design elements, such as reliance on air conditioning for cooling,[14] an important factor in BC, where rising average and daily maximum temperatures are expected to increase demand.[15] Design elements can be borrowed from pre-air-conditioned buildings, including evaporative cooling and solar chimneys, and taking advantage of lower nighttime temperatures for night-flushing.[16] The necessary cooling loads can be reduced with external albedo-increasing colour selection, strategically placed vegetation, and taking advantage of prevailing winds and the presence of water for evaporative cooling.[17]

Passive building design is another approach that can be used to adapt to increased temperatures while ensuring emissions reduction efforts remain effective. Passive design practices include increasing thermal mass, insulation, external shading and cross ventilation.[18] Buildings designed to operate passively can also incorporate alternative cooling technologies, utilize waste heat appropriately, and support measures (such as strategically placed vegetation) to reduce the urban heat island effect.[19] However, research suggests that passive cooling will likely not be sufficient as buildings become more air tight and efficient, and that some level of active cooling will likely be needed, necessitating a focus on highly efficient heat pumps, ventilators and other measures.[20]

> "Integrating adaptation with emissions reduction requires reconsideration of conventional building design elements, such as reliance on air conditioning for cooling ...

Using the Energy Step Code to Prepare for Future Climate

Practitioners could consider including climate change adaptation in the Energy Step Code to ensure future climate is considered in the design of new buildings and retrofits. Two examples follow of Energy Step Code components in which practitioners could incorporate projected temperature changes:

1. Building energy modelling: Including climate change projections in the thermal performance of buildings.[21] Practitioners could consider projected temperature changes when completing the modelling required under the first step of the code as the new practice normal, helping to ensure buildings continue to meet energy efficiency targets as temperatures increase. This approach is already being advanced by the City of Vancouver and the province of BC.

2. Consideration of the number of heating degree days (HDD) and cooling degree days (CDD) for which a building is designed. The Energy Step Code's requirements differ across the province based on BC's climate zones,[22] which are based on

the number of HDDs each year,[23] i.e., how much heating is needed to maintain a consistent temperature. Climate change has already altered the average number of HDDs and CDDs in BC,[24] and these shifts may become a significant factor in energy demand in coming decades.[25] Practitioners can build off the Energy Step Code's requirements to better prepare for climate change by considering their region's projected HDDs and CDDs in the design and operation of buildings.

Next Steps

Practitioners and policy-makers adopting the BC Energy Step Code are making an important commitment to climate action by ensuring buildings are designed and constructed to increase energy efficiency and decrease emissions. However, it is also important to consider future climate conditions over building lifetimes. Taking an LCR approach to the Energy Step Code would allow emission reduction and climate adaptation goals to be integrated into a single decision-making process that ensures buildings continue to be energy efficient as the climate changes.

"Taking an LCR approach to the Energy Step Code would allow emission reduction and climate adaptation goals to be integrated into a single decision-making process that ensures buildings continue to be energy efficient as the climate changes.

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