PEMBINA institute

Pathways to Net-Zero Buildings in B.C.

Getting new Part 3 buildings net-zero ready

Policy Proposal

August 2015

real estate foundation BRITISH COLUMBIA

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BC hydro powersmart

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Acknowledgements

The Real Estate Foundation of British Columbia, TD Bank Group, Mountain Equipment Co-op, BC Hydro, Pacific Institute for Climate Solutions, DIALOG, the U.S. Consulate, BCIT and the Climate Action Secretariat provided funding or in-kind support for the Pathways to Net-Zero Buildings in B.C. Thought Leader Forum.

The authors would like to thank the following reviewers, whose comments were helpful in preparing this summary: Dave Aharonian, Cimarron Corpe, Jeff Fisher, Nat Gosman, Katherine King, Zachary May, Jonathan Meads, Andrew Pape-Salmon, Hurrian Peyman, Murray MacKinnon, John Nicol, Donna Sandford and Graham Takata.

Cover photo: David Dodge, Green Energy Futures

Introduction

Along with its Pacific Coast Collaborative partners — the states of California, Oregon and Washington — British Columbia has committed to "lead the way to 'net-zero' buildings."[1] B.C. recently increased the energy efficiency requirements for Part 3 buildings by adopting the ASHRAE 90.1-2010 and NECB 2011 standards into the B.C. Building Code, but it has yet to set a net-zero target and a roadmap to get there.

To test key elements of a roadmap to net-zero, the Pembina Institute hosted a thought leader forum on "Pathways to Net-Zero Buildings in B.C." on June 4 and 5, 2015. The forum focused on policies and regulations to drive energy efficiency for new, complex (i.e. Part 3) buildings, with a target for all new Part 3 buildings to be net-zero ready by 2030 or so.[2]

Two white papers were distributed to participants and released publicly soon after the event. The first focused on the history of energy efficiency requirements in B.C., and compared the approach taken to that with that of Ontario.[3] The second articulated the rationale for net-zero ready buildings, and key policies needed to support this market transformation.[4] This report builds on the conversation held at the forum and on these two white papers to articulate a pathway to net-zero ready for Part 3, including targets, policies, and timelines. These are Pembina's recommendations, and do not necessarily reflect the views of all forum participants.

Market barriers versus policy barriers

Two types of barriers were generally identified in conversations at the forum: market barriers and policy barriers. Market barriers explain why the market is not adopting all economically viable or socially desirable energy efficiency measures on its own. They include issues such as split incentives, the low cost of energy and a lack of consumer awareness. These are the barriers that public policy is attempting to resolve. Policy barriers articulate obstacles to the design, adoption or implementation of effective public policies.[5] Market barriers have been abundantly discussed in the literature.[6] Some of the most commonly cited barriers are summarized in

Table 1, alongside the policy tools that aim to address them.

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[1] Pacific Coast Collaborative, *Pacific Coast Action Plan on Climate and Energy* (2013).

[2] For a summary of the event, see Tom-Pierre Frappé-Sénéclauze, Annie Russell, Karen Tam Wu *Pathways to Net-Zero Buildings in B.C.: Getting new Part 3 buildings net-zero ready — Summary from the June 2015 Thought Leader Forum* (Pembina Institute, 2015). http://www.pembina.org/pub/pathways-to-net-zero-bc-policy-2015

[3] Tom-Pierre Frappé-Sénéclauze, Josha MacNab, *Evolution of Energy Efficiency Requirements in the B.C. Building Code* (Pembina Institute, 2015). http://www.pembina.org/pub/evolution-of-energy-efficiency-requirements-in-the-bc-building-code

[4] Tom-Pierre Frappé-Sénéclauze, Maximilian Kniewasser, *The Path to "Net-Zero Energy" Buildings in BC – The case for action and the role of public policy* (Pembina Institute, 2015). http://www.pembina.org/reports/pembina-path-to-net-zero-energy-buildings-in-bc.pdf

[5] Of course, there is overlap between the two, as market barriers also complicate uptake and acceptance of programs and policies.

[6] See for example: Jens Laustsen, *Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings* (EIA, 2008).https://www.iea.org/publications/freepublications/publication/Building_Codes.pdf ; M. Rosenberg, R Hart, J Zhang, and R Athalye, *Roadmap for the Future of Commercial Energy Codes* (2015). http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24009.pdf; Jennifer Thorne Amann, *Energy Codes for Ultra-Low-Energy Buildings: A Critical Pathway to Zero Net Energy Buildings* (American Council for an Energy Efficient Economy, 2014). http://aceee.org/research-report/a1403

Rather than repeating work that has already been done and re-articulating market barriers, this document primarily focuses on policy barriers: how policies can be designed to minimize them and actions needed to advance these solutions.

Table 1: Barriers to energy efficiency in new buildings and the public policies proposed to address them

Barrier	Description	Public policies
Focus on incremental costs rather than total/future costs	• Involved parties are often only interested in the construction budget and may be unwilling or unable to account for future running costs • Actors don't have training to analyze a building's lifecycle costs and guide improvements • Construction companies are rarely involved in paying energy bills; occupants are rarely involved in design	• Operational and asset-based • Benchmarking and disclosure • Financing mechanisms • Public sector leadership
Insufficient efficiency awareness among consumers and designers	• Unpracticed buyers are unaware of the cost of low energy efficiency • Energy advisors are not extensively involved in the early design process	• Operational and asset-based • Benchmarking and disclosure • Public sector leadership
Cost structures and lack of capacity	• Specialized, expensive or delayed equipment affect the likelihood of efficient construction • Some builders are unwilling to invest in training	• Energy code roadmap • Stretch codes • Training programs and helpdesk support
Performance gap	• Buildings do not meet the level of performance they were designed to meet • Many buildings do not comply with minimum energy codes	• Commissioning • Operational benchmarking • Outcome-based codes • Compliance and administration
Split incentives, brief occupancy and difficulties marketing efficiency	• Total costs may be reduced by efficiency but the expense is covered by builders while the reward is reaped by owners • Many buildings have short occupancy times; the occupants won't witness benefits • Uncertainty of future profit means the cost of efficiency is rarely included in transactions	• Financing mechanisms • Incentives • Benchmarking and disclosure
Energy is invisible	• Only the status and comfort of using energy are visible • As energy costs are only a small part of the budget for many operations, increasing energy prices might reduce this barrier	• Carbon pricing • Equipment regulation and habitant engagement on plug loads
Building codes set the minimum and maximum standards	• New buildings are rarely better than what building codes require — particularly in the residential sector — even though codes are intended to be a minimum • Building code writing processes are conservative and lean towards the lowest common denominator	• Stretch codes • Incentives • Benchmarking and disclosure

Adapted from Laustsen[7]

The target: making new Part 3 buildings net-zero ready by 2030

Net-zero buildings are generally defined as highly efficient buildings that produce as much energy as they use when averaged over the course of a year. **"Net-zero ready" buildings — also sometimes called near-net-zero or "ultra-low energy" buildings — are highly efficient buildings where the total annual energy use has been reduced to such a level that it *could* be generated on site**. There is no common operational definition for being net-zero ready in the literature. A working definition was proposed for the forum: 70% below the 90.1-2004 standard, or a total energy use intensity of 65 kWh/m^2/yr or less.

Participants of the forum were almost unanimously in support of B.C. setting an aspirational target for all new Part 3 buildings to be net-zero ready by 2030 or so. Some argued that the target should be sooner.

The main area of contention was how this end target should be operationalized; should it be set as an Energy Use Intensity (EUI) target, or based on performance above a certain standard (e.g. ASHRAE 90.1 or NECB)? Several participants insisted on the importance of the target being able to reflect differences in building types and occupancies. Some suggested a neighborhood approach — where targets are set by area rather than for individual buildings — that would allow both differentiation between buildings to look for synergies between neighboring buildings, and also facilitate the integration of renewables. Generally, there was broad consensus that building performance targets should focus primarily on maximizing energy efficiency and not require on-site generation (i.e. require buildings to be net zero ready, but not necessarily net-zero).

Considerations for energy code design are discussed in the preceding white papers and were briefly discussed at the forum, though the effort was focused more on appropriate pace and scale of energy code changes rather than on specific code mechanics. Defining the code requirements (e.g. how should energy code targets be defined and measured) will require further engagement with the design community; however, from conversations at the forum certain characterstics were identified as desirable:

- **Predictability:** There should be clarity on the desired end goal as well as on the level of performance expected in next code iteration, at the least.
- **Flexibility:** Targets should be adapted to different building types. Variability in climate and regional capacity should also be considered either in performance requirements or in rollout dates.
- **Time to adapt:** Industry needs time to prepare for changes, which is facilitated by having clarity about long- and medium-term targets. Small steps are better than large, and fewer steps are better than many. Ultimately, whether a step is considered small or large depends on the level of familiarity and comfort with the technology, hence the importance of pilot projects.
- **Pilot projects:** An incentive program is needed to create a range of new net-zero ready demonstration projects covering various building types in regions across the province. Public buildings can be used to increase initial demand and educate the public.
- **Data-gathering and case studies:** More research is needed on the cost-effectiveness and economic viability of high-performance buildings, including study of actual building performance. Demonstration projects should be paired with research projects.
- **Provincial stretch code:** Provide a shared basis to align incentives from local governments, utilities and the province. Allow both harmonization and differentiation while increasing industry familiarity with the next code steps (see below for details).

[7] *Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings*.

- **Short-term targets:** Set meaningful targets within current mandates and define the roadmap beyond that to mitigate concerns about political changes interfering with target success.
- **National standard:** There is a fundamental tension between the desire to move fast to keep up with Washington and California, as well as meeting B.C. targets, and the desire to align with a national standard that tends to be more conservative.
- **Change management:** There is a lack of consensus on which strategy would be best for industry. However, there is consensus on the need for a change management plan to coordinate with industry, limit pushback, ensure appropriate training and mitigate unintended consequences.

These suggestions were considered in shaping the current proposal.

The role of stretch codes

There was general support in the room for the creation of a provincial stretch code. This stretch code would create a common framework for utilities, the Province and local government to offer incentives for higher-performance building.

There was general acknowledgement that more than one tier of stretch performance was likely needed to meet the needs of different local governments and play different roles along the market transformation curve — though some expressed concern with having too many distinct levels of code to enforce. Stretch codes corresponding to one or two "steps" above the base code already exist: for example, the City of Vancouver's Green Rezoning and Higher Buildings policies. Most (60%) of large residential and commercial construction projects in Vancouver go through rezoning, showing there is already significant capacity to meet Stretch Level A in the Lower Mainland.

Most participants considered it important to create incentives for net-zero ready demonstration projects. This could be done by defining a net-zero ready stretch code to be used as criteria to access incentives, and eventually as a requirement for new public buildings. It could also be done through design competitions similar to what was done in Brussels under the BatEx program. In that case, it may not be necessary to define the net-zero ready stretch targets explicitly, because a jury selects them rather than going through a formal compliance process. The general criteria for eligibility and selection could suffice.

Some participants also flagged the need for stretch codes to consider issues beyond energy — particularly indoor air quality and water conservation.

Details of stretch code design were not discussed in details at the forum but were previously debated by a stretch code working group facilitated by Integral Group and funded by BC Hydro and the City of Vancouver. The final report and its recommendations were endorsed by UDI and the Pembina Institute:[8]

1. Create a performance-based platform that is based on EUIs that are derived from either "thermal demand" or "regulated loads" or some combination of both.
2. The stretch code should incorporate metrics for carbon intensity that would be used in conjunction with either a target or reference building approach to regulation.
3. In addition to the performance requirements, include the following mandatory prescriptive requirements:
    - Minimum lighting-power density values
    - Sub-metering protocol
    - Commissioning requirements

[8] Integral Group, *Advanced Energy Efficiency Requirements for Buildings in BC* (2015), 11. http://www.integralgroup.com/advanced-energy-efficiency-requirements-for-buildings-in-bc/

- Administrative requirement for mandatory air-tightness testing
- Mandatory third-party review of energy models

4. Adopt an array of stretch targets that can be adopted by different jurisdictions over time starting at 30% better than ASHRAE 90.1 2004.
5. Integrate benchmarking and reporting requirements into the stretch code in order to monitor and manage the program over time.
6. The stretch code should remain primarily a voluntary standard that can be attached to incentives offered by local governments and utilities.

While the working group agreed that the stretch code's primary interest was to offer a shared structure for incentivizing beyond-code performance, the group did not reach consensus as to whether local government should be enabled to adopt the stretch code as base code in some or all of their area of jurisdiction. This question was raised at the forum, and while the room was still divided, a majority of participants supported the idea.

Enabling local governments to adopt the stretch code as their base code would support leadership in regions where industry and permitting offices have sufficient capacity while maintaining a strong level of provincial harmonization. It would also facilitate adoption of upcoming energy code by increasing early uptake in leading areas. In the lower Mainland, it would support regional harmonization by allowing other Lower Mainland municipalities to coordinate policies with Vancouver. This local-driven approach was successfully implemented by the state of Massachusetts, where 140 local governments representing half of the state's population adopted a reach code.[9]

One of the main barriers to local governments adopting a stretch code as their base code is the risk of losing access to utilities incentives for new construction. According to the province's Demand Side Measures regulations, utilities are prevented from incentivizing measures that are required by code, to avoid free-ridership. Utilities may, however, be allowed to incent higher performance required by stretch codes adopted as based code if they are considered as increasing uptake of the future BCBC (considered then as a 'specified proposals').[10] Having an explicit link between stretch codes and the next iteration of the building code would help make the case for continuing to provide DSM incentives in local governments that adopt the stretch code as base code, as it could be argued that they are a specified proposal facilitating adoption of a new provincial regulation.

Proposed pathway to net-zero ready

This revised proposal builds on two options considered at the forum.[11] It proposes an incremental, market-driven approach to enable a jump to net-zero ready buildings. A key component of the revised proposal emphasizes significant investments in pilot project programs and other market transformation initiatives, including public procurement policy and ensuring supply of high performance components. In this revised proposal incentives are concentrated on the end goal rather than on incremental improvements.

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[9] Tom Berkhout. *Accelerating Energy Efficiency in BC's Built Environment: Lessons from Massachusetts and California* (PICS, 2015), 11. http://pics.uvic.ca/sites/default/files/uploads/publications/Berkhout_Accelerating%20Energy%20Efficiency.pdf

[10] Government of British Columbia, Utilities Commission Act Demand-Side Measures Regulation, Reg. 326/2008M271/2008, section 4 article 1.4.http://www.bclaws.ca/Recon/document/ID/freeside/10_326_2008

[11] See forum summary report.

This approach is strongly influenced by the example of Brussels[12], but adapted to the B.C. context based on input received during the forum. Between 2007 and 2012, Brussels–Capital Region went from zero to 358 Passive House buildings. A total of nearly 3000 Passive House buildings are estimated to be on-line by 2015. The Brussels experience is an international "overnight" success story of one jurisdiction successfully taking a great leap into energy efficient buildings. [13] Appendix A compares the timelines under the current proposal to those of Brussels; given that B.C.'s market is much more mature than Brussels' was at the begging of its green building journey, we consider that with sufficient support this rapid transition is doable.

The proposed road map and timeline are presented in Table 2 and described in more detail below.

Table 2: Roadmap and timeline to net-zero ready new Part 3 buildings

2016	B.C. government declares a goal for new Part 3 buildings to be net-zero ready by 2030[14] Develop and implement a multi-tiered, performance-based provincial stretch code Launch an exemplary building pilot project program, and research programs to study design options and the performance of occupied buildings Establish a net-zero ready requirement for new provincial public buildings (for major building types)
2018	Update energy code to ASHRAE 90.1-2016 or revised NECB-2015
2020	Require net-zero ready for rezoning in the City of Vancouver Review research on the first wave of exemplary building projects and earlier pilot projects Assess market readiness for a net-zero ready standard Announce a net-zero ready regulation and phased adoption schedule
2025	Adopt a net-zero ready standard in the lower mainland and south coast
2027	Adopt a net-zero ready standard in rest of the province
2030	Almost all new Part 3 buildings will be net-zero ready[15]

2016

- Declare a goal for new Part 3 buildings to be net-zero ready by 2030 and consider an equivalent goal for low-rise buildings,
- Conduct stakeholder consultations on a proposed roadmap drafted by the B.C. Building and Safety Standards Branch energy efficiency working group.
- Develop and implement a multi-tiered, performance-based provincial stretch code, setting interim targets along the path to net-zero ready. The stretch code includes three levels of stretch performance:

[12] For more information on the Brussels experience and its relevance to B.C. see Karen Tam Wu, *From Brussels to British Columbia: An analysis of the proliferation of Passive House in Brussels* (Pembina Institute, 2015). http://www.pembina.org/pub/from-brussels-to-british-columbia

[13] Ibid., 1.

[14] An equivalent goal should be considered for Part 9 buildings.

[15] This target assumes that a requirement phased in from 2025 to 2027 will have a four or five year delay between permitting and completion.

    - The first level is equivalent to the level of performance expected in the 2017-2018 base code, or equivalent to the Vancouver Green Rezoning policy (roughly 30% above the 2008 code).
    - The second level is equivalent to Vancouver Higher Building's policy (roughly 45% above the 2008 code).
    - The third level is a net-zero ready stretch level. The stretch code would include requirements for airtightness testing, commissioning, benchmarking and sub-metering, and would also be paired with additional incentives for measurement and verification programs.[16]
- Launch an "exemplary building" pilot program[17] that encourages early adoption of net-zero ready buildings and deep energy retrofits.
    - Focus the program criteria on low-cost, simple, reproducible solutions[18] that allow different building approaches (e.g. Passive House, Living Building).
    - Set key targets for the number of buildings to participate each year, representing a range of building types — schools, offices, residential, retail, etc. — across various regions in B.C., and then adjust the incentives based on annual uptake.
    - Ensure that the pilot program is in place for several years to allow for a substantial pool of buildings from which to learn from, and to drive market demand for products.
    - Provide appropriate training programs for trades, developers, architects and building managers.
    - Collaborate with universities and other research institutions to study design options adopted in exemplary buildings, and to monitor the actual performance of occupied buildings both before and during the program.
    - Conduct an outreach and education campaign to communicate the results of the exemplary building pilot program to the public and industry.
- As a key component of the exemplary building pilot program, mandate that provincial public buildings meet net-zero ready performance for new construction. Create a fund and program to support construction or renovation of other public buildings considering, in particular for the unique opportunities offered by social housing projects.
- Form a permanent stakeholder advisory committee to provide ongoing feedback on the roadmap to net-zero ready for Part 3 buildings, to advise on change management and to review outcomes from exemplary building projects and stretch codes. Ensure demand-side management (DSM) regulations and allow utility DSM programs to support these initiatives.
- Engage with Provincial/Territorial Policy Advisory Committee on Codes and national Standing Committee for Energy Efficiency to create a national net-zero ready stretch code.

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[16] *Advanced Energy Efficiency Requirements for Buildings in BC*, 11.

[17] The level of effort needed to pursue this roadmap is considerable and would require significant resourcing for incentives and increase in staff capacity. See Pembina's analysis of the Brussels experience for more details: http://www.pembina.org/pub/from-brussels-to-british-columbia

[18] Criteria under the Exemplary Buildings program in Brussels are: (1) be informed by passive building principles and reduce emissions as close to zero as possible; (2) prioritize the use of eco-friendly construction materials, and consider natural cycles (e.g. rainwater) and biodiversity; (3) demonstrate a high architectural quality, good visibility, and a satisfactory level of integration into existing stock; and (4) use simple and reproducible technology (in technical and financial terms) with reasonable payback timelines, rather than using high-tech solutions. Exemplary Buildings qualify a subsidy of 100 euros per m^2.

2018

- Revise energy efficiency targets for the next building code revision (2017-2018) based on the adoption of ASHRAE 90.1-2016 or revised NECB-2015, with both targeting about 30% above the 2008 code.

2020

- Require performance equivalent to the net-zero ready stretch code for rezoning in Vancouver.
- Synthesize the research completed on design solutions and business cases from the first wave of pilot projects, as well as actual performance for occupied high-performance buildings erected before the exemplary building program.
- Assess B.C.'s net-zero ready standard and announce phased adoption from 2025 to 2027. Consider the analysis of market readiness and progress made at the national level on the development of a net-zero ready stretch code (see below).

2025

- Adopt the net-zero ready standard in the Lower Mainland and south coast. Allow for leniency and flexibility in compliance over the first two years, as well as exemptions or relaxations for more complicated building types.

2027

- Extend the requirement to the rest of the province.

2030

- Given that there is a delay of up to five years between permitting and completion, a requirement phased in from 2025 to 2027 will ensure than most new buildings in 2030 will be net-zero ready.

Supporting policies and strategies with accompanying actions

In order for the proposed roadmap to a net-zero ready energy code to be successfully implemented — and to ensure that buildings achieve expected levels of performance — supporting policies and strategies are needed. We need to address market barriers, encourage market transformation and inform ongoing code development.

1. Improve energy code compliance

Increase the stringency of energy code compliance and establish the tools to do so.

- Implement spot checking to ascertain the compliance record of builders, engineers, architects and developers
- Require minimum training and ongoing education for building officials
- Require commissioning and airtightness testing (see below)

2. Provide incentives and innovative financing solutions

Well-designed incentives can offset some of the incremental costs and risks associated with new technologies, and motivate developers to go beyond code.

- Implement a Property Assessed Clean Energy program, learning from existing programs in Manitoba and the U.S.

- Remove tax disincentives for increased energy efficiency by addressing current issues, where higher capital costs lead to increased property transfer taxes or property taxes
- Remove barriers to transferring incremental capital costs to stratas or home owner associations
- Increase the carbon tax
- Provide tax incentives for owners, builders and contractors

3. Benchmark, report and disclose building energy performance

Requiring the tracking of performance, as well as reporting and disclosing data, will promote a better understanding and evaluation of building performance and the impacts of energy codes, which in turn accelerates market transformation.

- Research privacy issues to ensure that utilities can share information with owners and municipalities
- Commit to a provincial roadmap to mandatory public energy disclosure
- Identify how benchmarking can be embedded in broader policies
- Identify how and by whom benchmarking data will be collected and analyzed
- Improve communication of Portfolio Manager results to influence consumer behavior
- Conduct pilot asset-based benchmarking in Metro Vancouver

4. Require building commissioning and standardize modeling

- Include commissioning and air-tightness testing standards in the stretch code
- Educate building owners on the value of commissioning
- Standardize modeling guidelines and standards

5. Reduce plug loads

Because occupants install most plug loads, it is challenging to regulate their energy use through building codes. As the energy demand from regulated load decreases, plug loads will account for a growing fraction of building energy use. To reduce this demand:

- Include more consideration of plug loads in energy codes, such as controls or energy use feedback interfaces
- Develop stricter energy efficiency regulations to reduce energy demand from appliances and equipment.

6. Address performance gaps through outcome-based policies

Demonstrate building performance and code compliance by analysing energy use data after occupancy, rather than by modeling or through a review of prescriptive requirements. Other code requirements or policies can also help the owner, operator and occupants run their buildings at maximum efficiency after construction. These include control strategies, graphic energy-use displays for troubleshooting by building managers and mandatory benchmarking.

- Tie performance to property tax and insurance costs or audits at the point of sale

7. Develop a change management strategy

This will facilitate a significant systemic change and ease the transition to high performance buildings across the industry.

- Create an ongoing multi-stakeholder panel to advise on energy efficiency in Part 3 buildings and assess gaps in the current change management system
- Set targets for existing and new buildings in Climate Leadership Plan
- Work with the Energy Efficiency Working Group to refine the roadmap to net-zero ready and design stretch codes

8. Invest in industry training and capacity

Fostering innovation as well as the knowledge and skills required to design, build and operate high-performance buildings is essential.

- Provide research and development funding for high-performance components made in B.C.
- Invest in mandatory training programs for industry groups

9. Create a network of professional advisors

- Provide technical, financial and management advice on best practices at no cost to developers, with a focus on disseminating information to key stakeholders and increasing their familiarity with high-performance standards for future projects

10. Develop a national net-zero ready stretch code

- Work with other provinces and the Energy Efficiency Standing Committee to create a net-zero ready national stretch code based on Passive House principles[19]

11. Increase the price on carbon

The low cost of energy and mild climate of B.C. make it more difficult to make the case for energy efficiency.

[19] Similarly to Provincial stretch codes, this national stretch code would support leading jurisdictions in developing net-zero ready incentive programs and regulations while ensuring a level of national harmonization. This net-zero ready standard should be performance-based (with some prescriptive elements). This standard is not a replacement for the prescriptive-based NECB, though uptake of the stretch code could inform future development of the NECB and eventually become the standard base code.

Appendix A: Comparison with Brussels timeline

Table 3: Comparative timeline of Brussels case study and revised proposal

B.C. proposal			Brussels case study	
2014	B.C. has one of the best energy codes in North America. About a dozen Passive House projects are in various stages of completion or construction, and there are several net-zero buildings.	**Year 1**	**2004**	Brussels has some of the worst insulations levels in Europe. There are zero passive or near net zero buildings. Brussels develops a framework to address energy and environmental concerns with the building sector.
2015	Draft climate leadership plan released.	**Year 2**	**2007-2009**	First phase of BatEx project: 117 projects, 265,000 m^2 built or planned, including 80,000 m^2 of passive buildings.
2016	Climate Leadership Plan announced. The B.C. government declares a goal for new Part 3 buildings to be net-zero ready by 2030.[1] A multi-tiered, performance-based provincial stretch code is developed and implemented. Launch of the exemplary building pilot project program and research programs. Net-zero ready requirement for new provincial public buildings (for major building types). Formation of an ongoing multi-stakeholder advisory. Engagement with PTPACC and Standing Committee for Energy Efficiency to create a national net-zero ready stretch code.	**Year 3**	**2009**	Government announced all new public buildings would be passive buildings by 2010, and all new buildings by 2015. BatEx program continued to 2014.
2018	Energy code updated to ASHRAE 90.1-2016 or revised NECB-2015.	**Year 4**	**2010**	All new public buildings required to be passive buildings.
2020	Net-Zero ready is required for rezoning in Vancouver. Review of research on the first wave of exemplary building projects and earlier pilot projects; assessment of market readiness for net-zero ready standard. Announce net-zero ready regulation and phased adoption schedule.	**Year 5**		

		Year 6	**2014**	Change in government, but the new government upholds previous commitments.
		Year 7	**2015**	Major building types required to be passive buildings, with leniency in roll-out and flexibility to accommodate complicated building types and sites.
2025	Net-zero ready standard adopted in Lower Mainland and south coast, with allowance for leniency and flexibility in compliance.	**Year 10**		
2027	Net-zero ready standard adopted in rest of the province.	**Year 12**		
2030	Almost all new Part 3 buildings are net-zero ready.[1]	**Year 15**		