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April 6, 2017

B.C. Sustainable Energy Association
c/o William J. Andrews, Barrister & Solicitor
1958 Parkside Lane
North Vancouver, B.C.
V7G 1X5

Attention: Mr. William J. Andrews

Dear Mr. Andrews:

Re: FortisBC Inc. (FBC)

Project No. 3698896

2016 Long Term Electric Resource Plan (LTERP) and Long Term Demand Side Management Plan (LT DSM Plan)

Response to the B.C. Sustainable Energy Association and Sierra Club of British Columbia (BCSEA) Information Request (IR) No. 1

On November 30, 2016, FBC filed the Application referenced above. In accordance with the British Columbia Utilities Commission Order G-197-16 setting out the Regulatory Timetable for the review of the Application, FBC respectfully submits the attached response to BCSEA IR No. 1.

If further information is required, please contact Joyce Martin at 250-368-0319.

Sincerely,

FORTISBC INC.

Original signed:

Diane Roy

Attachments

cc (email only): Commission Secretary
Registered Parties

A. Chapter 1 – Introduction

1.0 Topic: Long Term Resource Planning Objectives

Reference: Exhibit B-1, section 1.3, p.5 (pdf p.26)

"The objectives of the LTERP are as follows:

- Ensure cost-effective, secure and reliable power for customers;
- Provide cost-effective demand side management, and
- Ensure consistency with provincial energy objectives (for example, the applicable CEA objectives)."

During the October 27, 2016 meeting of the FBC Resource Planning Advisory Group FBC sought input regarding the statement of objectives. At the meeting, BCSEA-SCBC expressed the view that the first of the stated objectives of the LTERP should be extended along the following lines: "Ensure cost-effective, secure and reliable power for customers <u>in a socially and environmentally responsible manner</u>."

1.1 Please explain why FBC chose not to refer to social and environmental responsibility in the first stated objective of the LTERP.

<u>Response:</u>

FBC has chosen not to refer to social and environmental responsibility in the first stated objective of the LTERP because the third stated objective of ensuring consistency with B.C.'s energy objectives would include objectives provided in the *Clean Energy Act* such as reducing GHG emissions and promoting socio-economic development.

B. Chapter 8 – Resource Options

2.0 Topic: Simple Cycle Gas Turbine (SCGT)

Reference: Exhibit B-1, Volume 1, Appendix J, Supply-Side Resource Options Report, section 2.1.2 B.C. Climate Leadership Plan, pp.3-4 (pdf p.391-392); section 3.2.1 Natural Gas-Fired Generation – SCGT, p.28 (pdf p.416)

"B.C.'s CLP was released in August 2016 and reaffirms the provincial target to reduce annual GHG emissions to 80 percent below 2007 levels by 2050. The CLP requires that, <u>going forward, 100 percent of the supply of electricity acquired by BC Hydro in British Columbia for the integrated grid must be from clean or renewable sources, except where concerns regarding reliability or costs must be addressed.</u> While this requirement is not aimed directly at FBC, <u>FBC considers this in its long term resource planning</u>." [pp.3-4, underline added]

2.1 Does FBC agree that inclusion of an SCGT as a supply-side resource option in the preferred portfolio in the absence of justification regarding reliability or costs is inconsistent with the BC Climate Leadership Plan?

<u>Response:</u>

No. The CLP reference to the 100 percent clean or renewable resources requirement is specifically directed to BC Hydro and not to FBC. However, as noted in Table 9-2 of Section 9.3.6 of the LTERP (Exhibit B-1, Volume 1, p. 126), the inclusion of a SCGT plant in the preferred portfolio does not materially contribute to B.C.'s GHG emissions as it would be required for limited, peak demand periods beginning in 2033.

3.0 Topic: Wood-Based Biomass

Reference: Exhibit B-1, Table 8-1: FBC Demand-Side and 1 Supply-Side Resource Options, p.96 (pdf p.117)

"The *CEA* defines clean or renewable resources as including biomass, biogas, geothermal heat, hydro, solar, ocean, wind or any other prescribed resource."

3.1 Please confirm that FBC's consideration of "Wood-Based Biomass" as a clean or renewable resource did not include electricity generated from the combustion of creosote or pentachlorophenol contaminated rail ties.

<u>Response:</u>

The FBC resource options are evaluated at a high level. In its economic modelling, FBC did not make any specific assumptions about the source of biomass.

However, the biomass generation options were developed using clean biomass fuel availability data from a biomass study produced for BC Hydro and FBC by Industrial Forestry Service Ltd. as part of the 2015 joint resource options inventory review process. Four sources of woodwaste biomass were examined in the study including sawmill woodwaste, roadside woodwaste, pulp logs and standing timber. Surplus supplies of municipal solid waste, as well as woodwaste from demolition and construction etc., were not reviewed.[1]

[1] Wood Based Biomass in British Columbia and its Potential for New Electrical Generation. Industrial Forestry Service Ltd, July 2015, pages i-ii.

C. Chapter 9 – Portfolio Analysis and Long Run Marginal Cost

4.0 Topic: Long Run Marginal Cost

Reference: Exhibit B-1, section 9.2, Long Run Marginal Cost, p.118 (pdf p.139); Appendix K, Long Run Marginal Cost, pdf p.436; Exhibit A-3, BCUC IR 35.3; Table 8-1: FBC Demand-Side and Supply-Side Resource Options, p.96 (pdf p.117)

"The LRMC values represent the cost to FBC of incremental resources needed to meet load requirements over the planning horizon. The LRMC includes both energy and capacity generation components. FBC's LRMC values are outcomes of the portfolio analysis and are dependent upon which demand-side and supply-side resource options are included within a particular portfolio." [Exhibit B-1, p.118 (pdf p.139)]

FBC states its definition of LRMC as follows:

> "FBC has updated its definition of Long Run Marginal Cost to be **the incremental cost to build, contract, and/or procure reliable power to meet incremental long term forecast load requirements**. The LRMC is stated in real dollars (2015$)3 at the point of interconnection to FBC's system. The LRMC includes both an energy and a capacity component." [Exhibit B-1, Appendix K, p.1 (pdf p.439), emphasis in the original]

"While BC Hydro and FBC both investigate B.C. generation opportunities, it is not possible to draw a direct comparison between BC Hydro and FBC's stated LRMC values. There are notable timing differences for required resources, locational differences in load and generation, volume differences in capacity and energy requirements, and differences in governing policy that can cause BC Hydro and FBC to consider different resource options. BC Hydro has indicated that resources are required in the near to medium term to meet forecast load and has identified specific resources, both demand side and supply side, that will be used to address this requirement. In contrast, FBC's resource needs are further into the future, as identified in the LTERP, Section 9. To identify prospective future resources, FBC developed a collection of resource options and performed portfolio analysis, which is a fundamentally different approach from BC Hydro." [pdf p.442]

In BCUC IR 35.3, staff ask FBC: "Does FBC consider that the LRMC of Portfolio Option A4 ($96/MWh on page 125 of the Application) is the appropriate utility cost to estimate the effect of alternative DSM portfolios on residential bills and rates?"

In the October 27, 2016 Resource Planning Advisory Group workshop, FBC said, in the context of the analysis of varying DSM levels, that: "In the short to medium term, the high DSM scenario replaces more cost effective PPA and Market resources." [slide 68]

During the workshop, DSM and PPA were described as "swing resources" in the resource portfolio development.

"FBC ramped the High [DSM] scenario, beginning in 2021, from the 66% Base case to an 80% load growth offset, to optimize utilization of tranche 1 energy from the Power Purchase Agreement with BC Hydro under Rate Schedule 3808 (BC Hydro PPA) and thus minimize rate impact." [pdf p.497]

4.1 Please explain (again?) how FBC determines the avoided cost of DSM in order to develop DSM scenarios for use in the resource options portfolios (including both supply- and demand-side resources) from which the respective LRMCs are determined. How is the apparent circularity dealt with?

Response:

As discussed in Section 9.2 of the LTERP, FBC's LRMC values are outcomes of the portfolio analysis and are dependent on each portfolio's specific resources.

Portfolio B1 contains no DSM resources and only supply-side resources, and is used solely to determine the LRMC for the purposes of evaluating cost-effective DSM. This portfolio was not a portfolio considered for the preferred portfolio as it contains no new DSM resources.

Once the preferred level of DSM was determined, FBC then included this level of DSM, along with other supply-side resource options, to determine alternative portfolios and the preferred portfolio, along with their respective LRMC values.

4.2 Put another way, is the LRMC of a particular resource portfolio (including both supply- and demand-side resources) sensitive to the avoided cost figure used in defining the DSM component of the resource portfolio?

Response:

The LRMC of portfolio B1, which is a portfolio without any DSM, was used to develop the different DSM levels discussed in Section 8.1.1 of the LTERP. Depending on the portfolio, one of the three levels of DSM is included in the resource stack (Base DSM, High DSM, or Max DSM). The LRMC of a particular resource portfolio that includes both supply- and demand-side resources is sensitive to the Total Resource Costs associated with the level of DSM resources included in that portfolio, but portfolio B1 is not impacted by the outcome of any other particular portfolio scenario.

4.3 Please clarify what is meant by DSM and PPA being "swing resources" in the development of resource portfolios.

Response:

DSM and PPA energy are flexible, or "swing resources", meaning it is possible to increase or decrease the utilization of these resources over the planning horizon.

4.4 Please confirm, or otherwise explain, that in the High DSM scenario the ramp up beginning in 2021 to optimize utilization of tranche 1 PPA energy is in effect displacing cost-effective DSM with PPA purchases.

Response:

Confirmed. Once load growth increases such that PPA Tranche 1 energy is further utilized, the DSM load growth offset helps to reduce the need for more costly incremental resources.

4.5 Should FBC's resource portfolio analysis recognize the value to B.C., or to BC Hydro and its ratepayers, of reduced PPA purchases by FBC?

Response:

No. Table 1-3 of the LTERP provides a list of the applicable CEA objectives relevant to the LTERP. The objective stated at s. 2(f) of the CEA, is "to ensure the authority's rates remain among the most competitive of rates charged by public utilities in North America". FBC believes this is specific to BC Hydro with FBC's obligation being to FBC ratepayers.

The PPA was reviewed by the Commission and was accepted in Decision G-60-14 on May 6, 2014. It is a complex agreement that seeks to protect the interests of both FBC and BC Hydro ratepayers. As such many trade-offs exist within the agreement and it is simply not possible to separate out any one area for change without impacting other areas. This was recognized by both FBC and BC Hydro as referenced by the Commission on page 2 of the decision. The

Commission provides an example of this complexity on page 49 of the decision where it states, "*As a result, the Panel finds it would have been fair under the Bonbright Principles evaluation, all else being equal, for the capacity limit and associated energy to increase to 232 MW to reflect an increase in FortisBC's load growth to serve from 1993 levels.*" Yet the Commission then goes on to state, "*This finding does not mean that the New PPA, when considered in its entirety, is unfair to FortisBC…*" If FBC were to be restricted in its use of the PPA for the benefit of BC Hydro ratepayers, then the fundamental basis of the PPA is undermined and FBC ratepayers would not receive the benefits that they should be receiving.

From the provincial perspective, on page 57 of the Decision, "*The Commission determines that the New PPA passes the Bonbright Efficiency Principle evaluation, as it results in a net improvement in efficiency from the entire British Columbia perspective compared to the 1993 PPA.*" Restrictions on how the PPA is used by FBC that are in addition to the requirements under the PPA are not required as part of the LTERP.

4.5.1 Is this accomplished in FBC's portfolio analysis? If so, please explain how. If not, why not?

Response:

Please refer to the response to BCSEA IR 1.4.5.

5.0 Topic: Preferred Portfolio, SCGT

Reference: Exhibit B-1, section 9.3.6 Preferred Portfolio

Portfolio A4 is labeled "93% Clean with SCGT." It includes Market (31%), Wind (65%), Biogas (3%) and SCGT (1%).

Portfolio C4 is labeled "100% Clean." It includes Market (31%), Wind (65%), Biogas (3%), Biomass-Solar (1%).

Climate Leadership Plan, page 28 Exhibit B-1, Appendix B, pdf page 202:

"B.C.'s clean electricity supply is activating numerous opportunities to reduce GHG emissions across our industrial sectors. When an industry switches to electricity instead of fossil fuels, their emissions go down. The CLT recommended that we increase the target to 100 per cent clean energy on the integrated grid by 2025, while allowing for the use of fossil fuels for reliability. BC Hydro will focus on acquiring firm electricity from clean sources.

"Going forward, 100 per cent of the supply of electricity acquired by BC Hydro in British Columbia for the integrated grid must be from clean or renewable sources, except where concerns regarding reliability or costs must be addressed. Acquisition of electricity from any source in British Columbia that is not clean or renewable must be approved by government through an Integrated Resource Plan, where it will be aligned with the specific reliability or cost concerns."

5.1 Please confirm that neither the "93% Clean with SCGT" portfolio nor the "100% Clean" portfolio includes an SCGT within the four-year action plan. Alternatively, please explain.

<u>Response:</u>

Confirmed.

D. Chapter 10 – Stakeholder and First Nations Engagement

6.0 Topic: Consultation

Reference: Exhibit B-1, Chapter 10, Stakeholder and First Nations Engagement

6.1 Please identify any significant differences between LTERP and LT DSM Plan in the Application and the draft LTERP and draft LT DSM Plan presented by FBC at the October 27, 2016 workshop of FBC's Resource Planning Advisory Group.

Response:

The significant difference between the LTERP and LT DSM Plan submitted to the Commission for filing and the draft results presented at the October 27, 2016 RPAG workshop relates to the DSM target levels. At the RPAG workshop, FBC presented preliminary DSM target levels of 50 percent, 66 percent and 100 percent of load growth offset. The submitted LTERP and LT DSM Plan includes 50 percent (Low scenario), 66 percent (Base scenario), 66 percent ramping up to 80 percent (High scenario) and ramp up to 100 percent (Max scenario) target offset levels. The DSM levelized costs presented in the RPAG were also preliminary and were updated in the submitted LTERP and LT DSM Plan based on the updated DSM target levels. As a result, the energy and capacity Load-Resource Balances after DSM presented in the workshop were updated in Section 8.1.2 of the LTERP and the results of the portfolio analysis presented in the workshop were updated in Section 9 of the LTERP for the changed DSM target levels and costs.

E. VOLUME 2 – LONG-TERM DEMAND-SIDE MANAGEMENT PLAN

7.0 Topic: Long-Term DSM Plan, DSM Scenario Development

Reference: Exhibit B-1, Volume 2, section 3, DSM Scenario Development, pdf p.497

"Both the BC Energy Plan and the *CEA* express DSM targets as a load growth offset (DSM offset)." [pdf p.497, underline added]

CEA s.2(b) states: "(b) to take demand-side measures and to conserve energy, including the objective of the authority reducing its expected increase in demand for electricity by the year 2020 by at least 66%;" [underline added]

7.1 Please provide FBC's definition of "load growth offset (DSM offset)."

Response:

The DSM scenarios FBC considered are based on offsetting FBC's forecast load growth over the planning horizon: total DSM savings as a percentage of FBC's total load growth over the LTERP planning horizon. The calculation of the load growth offsets for each of the DSM scenarios is shown in the response to BCSEA IR 1.7.7.

7.1.1 Please clarify whether "load growth offset" is an annual concept or a cumulative concept, and if it is cumulative, over what period.

Response:

Please refer to the response to BCSEA IR 1.7.1.

7.1.2 Please confirm that FBC uses "load growth offset" and "DSM offset" interchangeably. If not, please explain.

Response:

Confirmed.

7.2 Please explain how FBC's use of the term "load growth offset" relates to the "by the year 2020" reference point in section 2(b) of CEA (albeit regarding BC Hydro).

Response:

In this case, FBC applies an objective for load growth reduction to the Base DSM scenario as follows: to reduce FBC's expected increase in demand for electricity (i.e. cumulative forecast load growth) by 66 percent by using DSM resources, and extends it over the LTERP planning horizon to 2035.

7.3 Is FBC's definition of "load growth offset (DSM offset)" the same as BC Hydro's?

Response:

FBC's definition of "load growth offset (DSM offset)" for the purposes of the LTERP applies to load growth from 2018 to 2035 whereas the CEA objective for BC Hydro to meet is applied to the year 2020.

> "The DSM offset is best used as a long run average (i.e. over the LTERP planning horizon) to smooth the short-term fluctuations shown in the load forecast, and reflected in annual sales." [pdf p.497, underline added]

7.4 Please explain what is meant by "The DSM offset is best used as a long run average (i.e. over the LTERP planning horizon)..."

Response:

Load growth varies from year to year. FBC uses a long run average DSM offset for annual consistency that smoothes the short-term fluctuations shown in the load forecast and reflected in annual sales. In its response to BCSEA IR 1.7.1, FBC describes the calculation of the load growth offset for the purpose of defining the DSM scenarios over the planning horizon.

7.4.1 Does this mean that there is a difference between the definition of "DSM offset" and how the DSM offset is used?

Response:

FBC believes that the definition of the DSM offset is consistent with its application.

7.4.2 Please define "long run average" as it is used here. Does it mean the cumulative DSM savings since the beginning of the planning period divided by the gross (pre-DSM) load growth since the beginning of the planning period?

Response:

Please refer to the response to BCSEA IR 1.7.1.

7.4.3 Does FBC use "long run average" to mean the same as "average load growth offset over the planning period"?

Response:

Please refer to the response to BCSEA IR 1.7.1.

"The key objective for LT DSM Plan is to determine the appropriate level of cost-effective DSM resource acquisition to match the Company's resource needs over the LTERP's planning horizon." [pdf p.487, underline added]

7.5 The planning horizon of the 2016 LTERP is the 20-year period from 2016 to 2035. [pdf p.11] Is the planning horizon of the 2016 Long Term DSM Plan the same as that of the 2016 LTERP by definition? Or do the two 2016 plans have the same planning period because that is what FBC proposes in the current application?

Response:

The LTERP and the LT DSM Plan have the same planning horizon as a result of requirements in the UCA. Section 1.1 of the LT DSM Plan identifies the following requirements for a long term resource plan in section 44.1(2) of the UCA that are specifically relevant to the LT DSM Plan:

(b) a plan of how the public utility intends to reduce the demand referred to in paragraph (a) by taking cost-effective demand-side measures;

(f) an explanation of why the demand for energy to be served by the facilities referred to in paragraph (d) and the purchases referred to in paragraph (e) are not planned to be replaced by demand-side measures.

Thus, the term of the LT DSM Plan must cover the timeframe of the LTERP.

7.6 Does FBC anticipate that future Long Term Electricity Resource Plans and Long Term DSM Plans will always have the same planning periods?

Response:

Yes. Please refer to the response to BCSEA IR 1.7.5.

"FBC ramped the High scenario, beginning in 2021, from the 66% Base case to an 80% load growth offset, to optimize utilization of tranche 1 energy from the Power Purchase

Agreement with BC Hydro under Rate Schedule 3808 (BC Hydro PPA) and thus minimize rate impact. Over the planning horizon the High case averages a 77% load growth offset."

"The Max DSM scenario exhibits a similar ramp-up to 100% average load growth offset, resulting in a DSM offset of 89% over the planning horizon." [pdf p.497]

7.7 Are the terms "load growth offset" and "average load growth offset over the planning horizon" used consistently in the above-quoted passages? For the High DSM scenario, the 80% figure is a "load growth offset" and the 77% figure is an "average load growth offset over the planning period." However, for the Max DSM scenario, the 100% figure is an "average load growth offset," and the 89% figure is a "DSM offset over the planning horizon.

Response:

For clarity, FBC provides calculations of the load growth offset targets in the table below.

The 66 percent, 80 percent, and 100 percent targets in the referenced instances refer to the *annual average load growth offset* which are approximations, since forecast load growth varies over time. The 77% and 89% figures refer to the entire *planning horizon load growth offset* (from 2018 to 2035), i.e. including the years prior to the ramp-up, which are calculated values.

Table 1: Annual DSM savings as a percent of load growth

Year	Load Growth (GWh)	Annual Savings (GWh)				Annual Savings Percent of load growth			
		Low	Base	High	Max	Low	Base	High	Max
2018	39.2	20.0	26.4	26.4	26.4	51%	67%	67%	67%
2019	41.4	20.0	26.4	26.4	26.4	48%	64%	64%	64%
2020	38.1	20.0	26.4	26.4	26.4	53%	69%	69%	69%
2021	34.4	20.0	26.4	28.4	28.4	58%	77%	83%	83%
2022	42.3	20.0	26.4	30.4	30.4	47%	63%	72%	72%
2023	44.5	20.0	26.4	32.0	32.4	45%	59%	72%	73%
2024	39.9	20.0	26.4	32.0	34.4	50%	66%	80%	86%
2025	41.1	20.0	26.4	32.0	36.4	49%	64%	78%	89%
2026	41.2	20.0	26.4	32.0	38.4	49%	64%	78%	93%
2027	39.4	20.0	26.4	32.0	40.0	51%	67%	81%	101%
2028	40.1	20.0	26.4	32.0	40.0	50%	66%	80%	100%
2029	40.4	20.0	26.4	32.0	40.0	50%	65%	79%	99%
2030	36.7	20.0	26.4	32.0	40.0	55%	72%	87%	109%
2031	38.5	20.0	26.4	32.0	40.0	52%	69%	83%	104%
2032	40.5	20.0	26.4	32.0	40.0	49%	65%	79%	99%
2033	41.2	20.0	26.4	32.0	40.0	49%	64%	78%	97%
2034	40.7	20.0	26.4	32.0	40.0	49%	65%	79%	98%
2035	41.2	20.0	26.4	32.0	40.0	49%	64%	78%	97%
Totals ('18-'35)	**720.7**	**360.4**	**475.7**	**554.8**	**639.4**	**50%**	**66%**	**77%**	**89%**

7.8 Please define and explain "load growth offset" and "average load growth offset over the planning horizon."

Response:

Please refer to the responses to BCSEA IRs 1.7.1 and 1.7.7.

7.9 Is the concept of load growth offset, or DSM offset, in FBC's LT DSM Plan such that by definition the only point in time when it can be determined if the defined objective has been met is at the very end of the LTERP planning period, i.e., 2035 in the present case?

Response:

FBC defines its DSM Scenario targets as total DSM savings as a percentage of total load growth over the LTERP planning horizon, as explained in the response to BCSEA IR 1.7.1. The concept of load growth offset, as a long run metric, originates in the 2007 BC Energy Plan that set an objective (for BC Hydro) of 50% load growth offset through DSM resources by 2020.

Although, as the response to BCUC IR 1.46.1.3 indicates, such a metric can vary significantly on a year-to-year basis as a result of variations in load growth, on a forecast basis the annual load growth offsets are fairly constant, as shown in the response to BCSEA IR 1.7.7. In FBC's view, the inherent variability in year-to-year load growth and the resulting variability in the annual DSM offset supports the use of a longer-term target as used in the LT DSM Plan.

8.0 Topic: LT DSM Plan Key Objective

Reference: Exhibit B-1, Volume 2, pdf p.487

"The key objective for LT DSM Plan is to determine the <u>appropriate level of cost-effective DSM resource acquisition</u> to match the Company's resource needs over the LTERP's planning horizon. The proposed DSM savings target is to offset 77 percent of load growth over this 20 year period. The savings target for the first three years of the LT DSM Plan (2018-2020) are largely an extension of the approved 2016 DSM Plan and 2017 DSM Plan, as filed, (approximately 26 GWh/yr). Thereafter the savings target is escalated to 32 GWh/yr and held there to the end of the LTERP planning horizon." [underline added]

8.1 In FBC's view, when the Commission approves an FBC LT DSM Plan, does the Commission approve an "appropriate level of cost-effective DSM resource acquisition...over the planning horizon"?

<u>Response:</u>

FBC considers the LT DSM Plan to be a component of the broader LTERP. The LTERP must include a DSM plan, and in determining whether to accept the LTERP the Commission under Section 44.1(8) must consider *"whether the plan shows that the public utility intends to pursue adequate, cost effective demand-side measures*". This requirement is reflected in FBC's objective of providing an appropriate level of cost-effective DSM resource acquisition.

8.2 If so, how is the approved "appropriate level of cost-effective DSM resource acquisition" defined? Is the definition the same or different for the planning horizon and for the first three years of the LT DSM Plan?

<u>Response:</u>

FBC considers that the "appropriate level of cost-effective DSM" is determined and defined through the assessment of alternative DSM scenarios as discussed in Section 3 of the LT DSM Plan and Section 9.3.1 of the LTERP. The preferred DSM level was based on the CEA requirement of 66 percent load growth offset (applicable to BC Hydro), which reflects FBC's current level of DSM offset, with ramping up to 80 percent to optimize use of PPA Tranche 1 energy. The preferred level of DSM was then included with other supply-side resource options in the portfolio analysis to determine the preferred portfolio of demand- and supply-side resources over the planning horizon.

The determination flows from the requirement in s. 44.1(2)(f) of the UCA that the utility provide an "explanation" in a long term resource plan "*of why the demand for energy to be served by the facilities referred to in paragraph (d) [facilities that the public utility intends to construct or extend] and purchases referred to in paragraph (e) [energy purchases from other persons that the public utility intends to make] are not planned to be replaced by demand-side measures*", as well as from the Commission's Resource Planning Guidelines, which provide that a resource plan should include "*several plausible resource portfolios ... each consisting of a combination of supply and demand resources needed to meet the gross demand forecast*". As the Commission has described in its decision regarding the FEU's 2014 Long Term Resource Plan, the Resource Planning Guidelines "set out an approach that should be followed to justify proposed DSM funding level" and the "alternative portfolios" that are developed under this approach "*would then be evaluated against the utility's stated resource planning objectives and a preferred resource portfolio selected*" (see Commission Order G-189-14, p. 25).

The definition and "appropriate level of cost-effective DSM resource acquisition" is for the entire LTERP planning horizon, including the first three years.

8.3 Is performance in terms of the achieved level of cost-effective DSM resource acquisition tracked against the approved level of cost-effective DSM resource acquisition in an approved LT DSM Plan? Is this done on an annual basis? Does the answer differ for savings targets for the first three years of the LT DSM Plan and for savings targets for the planning horizon? If not already stated, please confirm what metrics are used to define and track LT DSM Plan performance.

Response:

The achieved level of DSM resource acquisition is not tracked against the LT DSM Plan that is accepted as part of the LTERP filing. Instead, the DSM program results are tracked against the relevant DSM expenditure schedule, which is founded upon the accepted LTERP/LT DSM Plan. The Company also reports DSM activities and results in its annual DSM Report to the BCUC, which is posted in the public domain[2].

The 2016 LT DSM Plan is not an expenditure schedule, so funding levels by sector or by program were not determined. FBC anticipates filing its next DSM expenditure schedule, for 2018 onwards, later this year.

2 https://www.fortisbc.com/About/RegulatoryAffairs/ElecUtility/ElectricBCUCsubmissions/DemandSideManagement/Pages/DSM-Reports.aspx

9.0 Topic: Role of CPR in LT DSM Plan Development

Reference: Exhibit B-1, Volume 2, Section 2, DSM Plan Development, pdf p.493

Section 2.3 of the LT DSM Plan describes the assessment of technical and economic DSM potentials in the Conservation Potential Review (CPR). However FBC does not appear to describe how the economic DSM potentials in the CPR have been translated into proposed DSM programs.

9.1 Please describe how FBC used the economic DSM potentials in the CPR to inform its DSM plan.

Response:

Please refer to the response to BCUC IR 1.41.2 for a discussion of how FBC used the 2016 FBC CPR results to inform the development of the DSM scenarios.

The 2016 LT DSM Plan is not an expenditure schedule, so funding levels by sector or by program were not determined. FBC anticipates filing its next DSM expenditure schedule, for 2018 onwards, later this year.

9.2 Please describe any other data sources (i.e., other than the CPR) used by FBC in developing its DSM scenarios and its preferred scenario.

Response:

FBC did not use any other data sources.

9.2.1 Please provide any such data sources.

Response:

Please refer to the response to BCSEA IR 1.9.1.

9.3 Did FBC develop an assessment of ‘achievable’ DSM potentials?

Response:

FBC developed an interim estimate of market potential to inform the 2016 LT DSM Plan.

9.3.1 If so, please provide the assessment.

Response:

Please refer to the response to BCUC IR 1.41.4 for a discussion of the method, assumptions, and data sources used to develop the interim market potential.

9.4 Please describe the process by which FBC used the CPR, any other data sources, and any assessment of achievable DSM potential to develop its DSM scenarios.

Response:

Please refer to the response to BCUC IR 1.41.4 for a discussion of the assumptions and data sources used to develop the interim market potential.

9.4.1 How were FBC’s projected costs for the different DSM scenarios developed?

Response:

Please refer to the response to BCUC IR 1.41.2 on how the 2016 CPR results (which formed the basis for FBC’s projected costs) have informed the development of the DSM scenarios.

9.4.2 What is FBC's view of whether the cost estimates in the DSM scenarios could be higher or lower than what might be required to achieve the savings levels in each scenario?

Response:

FBC utilized the best available information, namely the BC CPR measure savings and costs estimates, plus a program administration adder (based on the approved 2017 DSM expenditure schedule) to develop the cost and savings estimates for each DSM scenario.

The 2016 LT DSM Plan is not an expenditure schedule, so funding levels by sector or by program were not determined. FBC anticipates filing its next DSM expenditure schedule, for 2018 onwards, later this year.

10.0 Topic: Long-Term DSM Plan, DSM Scenario Development

Reference: Exhibit B-1, Volume 2, Table 3-1: Key DSM Scenario Data, p.14, pdf p. 500; Exhibit A-3, BCUC IR 38.2, 38.2.1

In Table 3-1: Key DSM Scenario Data, FBC provides energy savings (by average per annum, percentage of load growth, and total 2016 to 2035), resource cost, and incremental cost including program costs, for each of the Low, Base, High and Max DSM Scenarios.

In BCUC IR 38.2, staff list key DSM metrics (annual savings in GWh, % of load growth and % of total load, annual DSM funding levels, utility incentive levels as a percentage of the TRC, TRC, and utility cost of energy savings).

In BCUC IR 38.2.1, staff ask FBC to provide data for these metrics for the past 10 years of historical actual and historical forecasted (as approved under s. 44.1) DSM, and 5 years of projected DSM based on the proposed DSM portfolio in the 2017 LT DSM Plan.

10.1 Please provide data for the listed DSM metrics by program.

Response:

FBC considers this data request to be beyond the scope of what is required for the purpose of the LT DSM Plan, which is to determine the appropriate level of annual DSM energy savings. The 2016 LT DSM Plan is *not* an expenditure schedule, so funding levels by sector or by program were not determined. FBC anticipates filing its next DSM expenditure schedule, for 2018 onwards, later this year – at which time the level of detail of the requested data may be relevant.

However, much of the requested data is available in FBC's Annual DSM Reports, dating back to 2007, which can be found on the FortisBC website at the following URL:

https://www.fortisbc.com/About/RegulatoryAffairs/ElecUtility/ElectricBCUCsubmissions/DemandSideManagement/Pages/DSM-Reports.aspx

The following tables, taken from the aforementioned Annual Reports, provide the Company's historical DSM results containing many, but not all, of the requested metrics. FBC considers that assembling all of the requested detail is too onerous a task and, again, beyond what is required to determine the annual DSM savings targets going forward pursuant to the LT DSM Plan.

APPENDIX B - HISTORICAL SUMMARY OF FORTISBC'S DSM COSTS AND ENERGY SAVINGS

Table 15 - Historical FortisBC DSM Costs and Energy Savings 2007- 2008

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		2007 (Actual)							2008 (Actual)						
		Spend ($000s)			Energy Savings (MWh)			TRC[3]	Spend ($000s)			Energy Savings (MWh)			TRC[3]
		Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)
1	**Residential**														
2	Home Improvements	98	78	20	500	500	-	1.5	135	62	73	385	331	(54)	0.8
3	Building Envelope[1]														
4	Heat Pumps	513	651	(138)	6,200	9,600	3,400	1.6	446	682	(236)	4,889	8,444	3,555	1.4
5	Residential Lighting	170	116	54	2,200	2,700	500	5.6	156	151	5	1,796	2,562	766	4.1
6	New Home Program	424	458	(34)	1,700	2,500	800	2.3	286	340	(54)	1,332	1,596	265	2.8
7	Appliances[1]														
8	Electronics[1]														
9	Water Heating[1]														
10	Low Income[1]														
11	Behavioural[1]														
12	*Residential Total*	**1,205**	**1,303**	**(98)**	**10,600**	**15,300**	**4,700**	**1.9**	**1,023**	**1,236**	**(213)**	**8,401**	**12,933**	**4,531**	**1.7**
13	**Commercial**														
14	Lighting	257	240	17	3,000	5,500	2,500	2.8	257	375	(118)	3,000	5,960	2,960	2.4
15	Building and Process Improvements	469	499	(30)	6,200	4,900	(1,300)	1.5	497	506	(9)	6,103	5,081	(1,022)	1.6
16	Computers														
17	Municipal (Water Handling)[2]														
18	Irrigation[2]														
19	*Commercial Total*	**726**	**739**	**(13)**	**9,200**	**10,400**	**1,200**	**2.0**	**754**	**881**	**(127)**	**9,103**	**11,042**	**1,939**	**1.9**
20	**Industrial**														
21	Compressed Air	37	30	7	700	400	(300)	1.0	58	22	36	700	210	(490)	1.2
23	EMIS														
22	Industrial Efficiencies	131	153	(22)	1,300	1,800	500	1.6	142	124	18	1,285	3,083	1,798	2.3
24	*Industrial Total*	**168**	**183**	**(15)**	**2,000**	**2,200**	**200**	**1.5**	**200**	**147**	**53**	**1,985**	**3,294**	**1,309**	**2.3**
25	**Programs Total**	**2,099**	**2,225**	**(126)**	**21,800**	**27,900**	**6,100**	-	**1,977**	**2,264**	**(287)**	**19,489**	**27,268**	**7,779**	-
26	Supporting Initiatives	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Planning & Evaluation	375	324	51	-	-	-	-	378	419	(41)	-	-	-	-
28	**Total**	**2,474**	**2,549**	**(75)**	**21,800**	**27,900**	**6,100**	**1.9**	**2,355**	**2,683**	**(328)**	**19,489**	**27,268**	**7,779**	**1.8**

[1] These programs were included in Home Improvements program

[2] Water Treatment and Wastewater Handling infrastructure were part of Building and Process Improvement

[3] Benefits calculated using RS3808 applicable at the time

Table 16 - Historical FortisBC DSM Costs and Energy Savings 2009-2010

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		2009 (Actual)							2010 (Actual)						
		Spend ($000s)			Energy Savings (MWh)			TRC[3]	Spend ($000s)			Energy Savings (MWh)			TRC[3]
		Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)
1	**Residential**														
2	Home Improvements	273	145	128	1,024	1,032	8	1.4	294	434	(140)	953	4,948	3,995	3.1
3	Building Envelope[1]														
4	Heat Pumps	515	677	(162)	5,642	3,188	(2,454)	0.7	624	749	(125)	6,377	3,239	(3,138)	1.2
5	Residential Lighting	263	306	(44)	2,822	3,349	526	2.8	243	278	(35)	2,383	2,589	206	2.4
6	New Home Program	341	496	(155)	1,216	1,735	518	2.2	254	247	7	1,392	477	(915)	1.1
7	Appliances[1]														
8	Electronics[1]														
9	Water Heating[1]														
10	Low Income[1]								100	131	(31)	1,000	385	615	0.7
11	Behavioural[1]														
12	*Residential Total*	**1,391**	**1,624**	**(233)**	**10,705**	**9,304**	**(1,401)**	**1.3**	**1,515**	**1,838**	**(323)**	**12,105**	**11,638**	**764**	**1.9**
13	**Commercial**														
14	Lighting	724	422	302	5,505	7,638	2,133	3.0	722	526	196	5,304	7,971	2,667	3.5
15	Building and Process Improvements	563	639	(75)	6,095	8,713	2,618	1.8	658	597	61	6,751	6,685	(67)	1.5
16	Computers														
17	Municipal (Water Handling)[2]														
18	Irrigation[2]														
19	*Commercial Total*	**1,287**	**1,060**	**227**	**11,600**	**16,351**	**4,751**	**2.2**	**1,380**	**1,123**	**257**	**12,055**	**14,655**	**2,600**	**2.1**
20	**Industrial**														
21	Compressed Air	71	41	30	811	398	(413)	0.9	87	25	62	938	114	(823)	0.7
23	EMIS														
22	Industrial Efficiencies	274	195	79	2,189	2,305	116	1.6	302	216	86	2,412	2,853	441	2.1
24	*Industrial Total*	**345**	**236**	**109**	**3,000**	**2,703**	**(297)**	**1.5**	**389**	**241**	**148**	**3,350**	**2,967**	**(383)**	**2.0**
25	**Programs Total**	**3,023**	**2,920**	**103**	**25,305**	**28,358**	**3,053**	**-**	**3,284**	**3,203**	**81**	**27,510**	**29,261**	**2,981**	**2.1**
26	Supporting Initiatives	141	141	0	-	-	-	-	148	155	(7)	-	-	-	
27	Planning & Evaluation	503	402	101	-	-	-	-	519	354	165	-	-	-	-
28	**Total**	**3,667**	**3,464**	**204**	**25,305**	**28,358**	**3,053**	**1.7**	**3,951**	**3,712**	**239**	**27,510**	**29,261**	**2,981**	**2.0**

[1] These programs were included in Home Improvements program

[2] Water Treatment and Wastewater Handling infrastructure were part of Building and Process Improvement

[3] Benefits calculated using RS3808 applicable at the time

Table B-2: Historical FBC DSM Costs and Energy Savings 2010-2014

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		2012 (Actual)							2013 (Actual)							
		Spend ($000s)			Energy Savings (MWh)			TRC	Spend ($000s)			Energy Savings (MWh)			TRC	mTRC
		Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	(B/C)
1	**Residential**															
2	Home Improvements	1,719	637	1,082	7,620	4,656	(2,964)	1.7	1,961	725	1,236	8,680	5,222	(3,458)	1.7	1.8
3	Building Envelope[1]															
4	Heat Pumps	703	636	67	3,397	2,161	(1,236)	1.0	698	532	166	3,397	2,100	(1,297)	1.3	1.9
5	Residential Lighting	328	337	(9)	2,530	2,599	69	1.8	313	473	(160)	2,467	3,300	833	1.4	1.4
6	New Home Program	43	314	(271)	90	1,040	950	1.4	45	782	(737)	93	3,000	2,907	1.9	1.9
7	Appliances[1]	247	332	(85)	690	1,248	558		267	241	26	739	578	(161)		
8	Electronics[1]															
9	Water Heating[1]															
10	Low Income	677	308	369	1,774	1,054	(720)	1.3	660	415	245	1,570	2,000	(430)	1.6	1.6
11	Behavioural[1]															
12	*Residential Total*	**3,717**	**2,564**	**1,153**	**16,101**	**12,758**	**(3,343)**	**1.5**	**3,944**	**3,168**	**776**	**16,946**	**16,200**	**(1,606)**	**1.6**	**1.8**
13	**Commercial**															
14	Lighting	1,157	2,152	(995)	7,390	14,256	6,866	2.2	1,170	1,235	(65)	7,140	7,600	460	2.0	2.0
15	Building and Process Improvements	659	612	47	3,410	1,959	(1,451)	1.3	738	594	144	3,730	2,600	(1,130)	1.6	1.6
16	Computers															
17	Municipal (Water Handling)	383	255	128	2,580	1,677	(903)	2.6	177	80	97	1,110	700	(410)	1.4	1.4
18	Irrigation[2]															
19	*Commercial Total*	**2,199**	**3,019**	**(820)**	**13,380**	**17,892**	**4,512**	**2.0**	**2,085**	**1,909**	**176**	**11,980**	**10,900**	**(1,080)**	**1.8**	**1.8**
20	**Industrial**															
21	Compressed Air															
23	EMIS	27	10	17	190	-	(190)	2.0	41	17	24	290	-	(290)	-	-
22	Industrial Efficiencies	323	163	160	2,290	937	(1,353)	-	323	307	16	2,290	2,500	210	1.0	1.0
24	*Industrial Total*	**350**	**173**	**177**	**2,480**	**937**	**(1,543)**	**1.9**	**364**	**324**	**40**	**2,580**	**2,500**	**(80)**	**1.0**	**1.0**
25	**Programs Total**	**6,266**	**5,756**	**510**	**31,961**	**31,587**	**(374)**	**1.8**	**6,393**	**5,401**	**992**	**31,506**	**29,600**	**(2,766)**	**1.9**	**2.0**
26	Supporting Initiatives	725	816	(91)	-	-	-	-	725	706	19	-	-	-	-	-
27	Planning & Evaluation	740	728	12	-	-	-	-	760	748	12	-	-	-	-	-
28	**Total**	**7,731**	**7,300**	**431**	**31,961**	**31,587**	**(374)**	**1.6**	**7,878**	**6,855**	**1,023**	**31,506**	**29,600**	**(2,766)**	**1.6**	**1.7**

[1] These programs were included in Home Improvements program

[2] Irrigation was included in Municipal (Water Handling)

Table 17 - Historical FortisBC DSM Costs and Energy Savings 2011

		1	2	3	4	5	6	7
		2011 (Actual)						
		Planned	Actual	Variance	Planned	Actual	Variance	TRC[3] (B/C)
1	**Residential**							
2	Home Improvements	2,145	479	1,666	8,960	3,692	(5,268)	1.6
3	Building Envelope[1]							
4	Heat Pumps	694	532	162	3,397	2,257	(1,140)	1.0
5	Residential Lighting	438	239	199	3,420	3,308	(112)	2.2
6	New Home Program	54	205	(151)	105	689	584	1.0
7	Appliances[1]							
8	Electronics[1]							
9	Water Heating[1]							
10	Low Income	305	245	60	540	1,447	(907)	1.0
11	Behavioural[1]							
12	*Residential Total*	**3,636**	**1,700**	**1,936**	**16,422**	**11,393**	**(6,843)**	**1.3**
13	**Commercial**							
14	Lighting	1,114	1,995	(881)	7,370	20,577	13,207	2.3
15	Building and Process Improvements	572	606	(34)	3,010	1,386	(1,624)	0.7
16	Computers							
17	Municipal (Water Handling)	432	231	201	3,560	2,199	(1,361)	1.6
18	Irrigation[2]							
19	*Commercial Total*	**2,118**	**2,832**	**(714)**	**13,940**	**24,162**	**10,222**	**1.9**
20	**Industrial**							
21	Compressed Air							
23	EMIS	10	9	1	80	-	(80)	-
22	Industrial Efficiencies	603	128	475	9,280	794	(8,486)	2.5
24	*Industrial Total*	**613**	**137**	**476**	**9,360**	**794**	**(8,566)**	**2.4**
25	**Programs Total**	**6,367**	**4,669**	**1,698**	**39,722**	**36,349**	**(5,187)**	**1.8**
26	Supporting Initiatives	725	658	67	-	-	-	-
27	Planning & Evaluation	750	590	160	-	-	-	-
28	**Total**	**7,842**	**5,918**	**1,924**	**39,722**	**36,349**	**(5,187)**	**1.6**

[1] These programs were included in Home Improvements program

[2] Irrigation was included in Municipal (Water Handling)

[3] Benefits calculated using RS3808 applicable at the time

Table B-3: Historical FBC DSM Costs and Energy Savings 2010-2014

		1	2	3	4	5	6	7	8
		2014 (Actual)							
		Spend ($000s)			Energy Savings (MWh)			TRC	mTRC
		Planned	Actual	Variance	Planned	Actual	Variance	(B/C)	(B/C)
1	**Residential**								
2	Home Improvements	295	391	(96)	1,881	1,299	582	1.5	1.5
3	Heat Pumps	158	252	(94)	553	865	(312)	1.6	1.6
4	Residential Lighting	176	291	(115)	2,136	3,411	(1,275)	1.5	1.5
5	New Home Program	67	254	(187)	98	733	(635)	2.7	2.7
6	Appliances[1]	-	-	-	-	-	-		
7	Water Heating	99	3	96	425	92	333		
8	Low Income	242	502	(260)	707	2,286	(1,579)	1.9	1.9
9	Behavioural[1]			-			-		
10	***Residential Total***	**1,037**	**1,694**	**(657)**	**5,800**	**8,686**	**(2,886)**	**1.7**	**1.7**
11	**Commercial**								
12	Lighting	510	646	(136)	3,359	3,353	6	2.0	2.0
13	Building and Process Improvements	592	533	59	2,641	1,926	715	1.4	1.5
14	Municipal (Water Handling)	-	5	(5)	-	-	-		
15	Irrigation	32	-	32	200	-	200	0.0	0.0
16	***Commercial Total***	**1,134**	**1,184**	**(50)**	**6,200**	**5,279**	**921**	**1.6**	**1.7**
17	**Industrial**								
18	Compressed Air[2]			-					
19	Industrial Efficiencies	148	188	(40)	800	614	1,121	1.2	1.2
20	***Industrial Total***	**148**	**188**	**(40)**	**800**	**614**	**2,041**	**1.2**	**1.2**
21	**Programs Total**								**2.0**
22	Supporting Initiatives	190	207	(17)					-
23	Planning & Evaluation	492	579	(87)					-
24	Recoveries from 2013		(378)	378					
25	**Total**	**3,001**	**3,473**	**(472)**	**12,800**	**14,580**	**75**	**1.6**	**1.7**

[1] These programs were included in Home Improvements program
[2] Compressed Air was included in Industrial Efficiencies

Table A-1: FBC DSM Summary Report for Year Ended December 31, 2015

Program Area	2015 Approved Plan Savings (MWh)	2015 Actual Energy Savings (MWh)	Lifetime savings (MWh)[2]	Incentive Expenditure ($000)	Non-Incentive Expenditure ($000)	2015 Actual Spend ($000s)	2015 Approved Plan ($000s)	Benefit/Cost Tests			Levelized cost (¢/kWh)
								TRC	UCT	RIM	
Residential											
Home Improvement	3,106	231.2	6,326	62.0	136.8	198.7	884	1.7	1.7	0.7	7.1
Behavioural	888	0.0				-	85				
Watersavers	850	4.6	64	0.3	1.8	2.2	387	1.5	3.2	1.0	10.8
Appliances	288	51.9	865	23.3	47.7	71.0	96	1.2	1.5	0.9	17.9
Lighting	1,569	4,144.4	50,893	167.9	30.1	198.0	193	5.3	26.5	1.1	2.1
Heat Pumps	1,618	569.0	17,561	138.4	44.1	182.5	302	1.5	4.3	0.9	7.9
New Home Program	1,179	356.2	12,366	37.6	73.2	110.8	390	1.1	5.1	0.9	10.2
Low Income Housing	2,598	281.8	1,827	97.5	189.9	287.3	824	1.3	0.9	0.6	9.7
Residential Total	**12,096**	**5,639.0**	**89,903**	**526.9**	**523.5**	**1,050.4**	**3,160**	**2.9**	**7.0**	**1.00**	**4.0**
Commercial											
Lighting	7,445	4,089.3	71,188	404.4	331.0	735.4	1,485	2.0	5.7	1.0	6.0
Building Improvement	3,454	1,605.9	41,841	175.8	367.3	543.0	842	1.6	4.3	1.0	8.3
Computers	378	0.0		-	-	-	55				
Municipal (WWTP)	759	186.6	4,900	24.5	11.7	36.2	79	2.3	5.5	0.9	5.0
Irrigation	490	0.0		-	9.0	9.0	69				
Commercial Total	**12,526**	**5,881.8**	**117,929**	**604.7**	**719.0**	**1,323.7**	**2,530**	**1.8**	**5.2**	**1.0**	**6.7**
Industrial											
Industrial Efficiency	1,537	1,086.8	27,937	146.2	79.8	226.0	202	2.0	6.2	1.0	5.7
Industrial Total	**1,537**	**1,086.8**	**27,937**	**146.2**	**79.8**	**226.0**	**202**	**2.0**	**6.2**	**1.0**	**5.7**
Total Programs	**26,159**	**12,607.6**	**235,769**	**1,277.8**	**1,322.3**	**2,600.1**	**5,892**	**2.2**	**6.0**	**1.0**	**5.3**
Portfolio Level Activities											
Planning & Evaluation	-	-		-	584.9	584.9	725				
Supporting Initiatives	-	-		-	346.3	346.3	675				
Total Portfolio	**26,159**	**12,607.6** [1]	**235,769**	**1,277.8**	**2,253.5**	**3,531.3**	**7,292**	**2.0**	**4.4**	**0.9**	**6.0**

[1] Commensurate Demand Savings are 2.6 MW

[2] Lifetime savings are energy savings over the lifetime of the measure

10.2 Please also provide participant numbers and FBC estimates of the number of eligible participants by program, if available.

Response:

Depending on the program, FBC tracks the number of measures or projects on which rebates are given, which is generally not the same as the number of participants. FBC does not track participant numbers or eligible participants for reasons that are illustrated as follows.

For example, residential lighting incentives are available to all (approximately 147 thousand) residential customers. The program is cost-effectively delivered as point-of-sale product rebates at participating stores, which then apply to the Company for reimbursement of the rebates disbursed. The stores do not provide data on the number of participants or whether any of those participants returned to buy additional product. Thus for every 100 qualifying LED lamps that are sold, FBC does not know whether four participants each bought 25 lamps, or twenty participants each bought 5 lamps, or any other combination thereof. So, the number of participants is unknown.

For larger key accounts, participants may participate in a number of program offers and in different projects over the years. If so, they could be counted as a single participant, or as an additional participant each time they participate with another eligible project.

11.0 Topic: Long-Term DSM Plan, Reliability

Reference: Exhibit B-1, Volume 1, p.104 (pdf p.125); Volume 2, p.15 (pdf p. 501); Exhibit A-3, BCUC IR 39.3

In the 2016 LTERP Application on p. 104 FBC says that "DSM is neither available on demand nor as reliable as a supply-side resource option because DSM programs require voluntary participation by customers… [A]n over-reliance on DSM could leave unexpected gaps in LRB that still need to be filled to meet customer load requirements."

On page 15 (pdf p.501) of the LT DSM Plan, FBC says that "The Max scenario presents: higher risks of insufficient customer participation or incurring higher costs if load growth falls short of expectations..."

In BCUC IR 39.3, staff asks: "Please identify any key concerns FBC would have with spending that achieves savings that offsets 100% load growth. Please specifically identify whether concerns include: lack of cost-effective DSM opportunities, difficulty in scaling-up DSM programs, timing of Commission approval received, rate impact."

11.1 Does FBC mean by the statements quoted above that in its view investing in DSM is riskier than investing in supply options? If so, please provide the evidence to support that view.

Response:

FBC believes that DSM savings are a reliable but non-firm (i.e. non-dispatchable) resource,. Please also refer to the response to Shadrack IR 1.11iii.

11.2 Is FBC aware that some jurisdictions, such as Vermont,[3] adjust avoided costs in DSM benefit-cost analysis to account for <u>reduced</u> risk from DSM compared with supply options? In FBC's view, would such an approach be appropriate for FBC?

Response:

This approach would not be appropriate for FBC. The BC DSM Regulation has no provision for modifying avoided costs in the manner used by Vermont. The State of Vermont is a different

[3] http://psb.vermont.gov/sites/psbnew/files/doc_library/order-re-eeu-avoided-cost-2016-2017.pdf, pages 9-11.

jurisdiction with different policies and drivers. For instance the state is only 40%[4] electricity self-sufficient and relies on imports for the majority of its electricity supply.

11.3 By saying that in the Max DSM scenario there is a "risk of incurring higher costs if load growth falls short," is FBC suggesting that with Commission approval of a long-term DSM plan involving the Max DSM scenario FBC would be locked into an approved level of DSM investment with no ability to adjust if market conditions change (i.e. load growth falls short)?

Response:

Given the annual variability that can occur in loads, it would be difficult to adjust DSM investment decisions to match lower than expected loads without a trajectory to indicate that such lower loads were a consistent trend. As discussed in Section 9.3.4 of the LTERP, until such time as that could occur, FBC would adjust its resources to reduce the amount of energy and capacity taken from the PPA or other sources to match the lower load requirements. There may or may not be additional costs associated with such actions.

4 https://www.eia.gov/state/?sid=VT#tabs-1

12.0 Topic: Long-Term DSM Plan

Reference: Exhibit A-3, BCUC IR 40.2, 40.2.1

In BCUC IR 40.2, staff ask if "FBC's definition of 'cost-effective' DSM is the same as that used by BC Hydro in its 2013 IRP?"

In BCUC IR 40.2.1, staff ask "Please explain how environmental and non-energy benefits are incorporated into the 'cost effective' DSM definition."

12.1 Please compare FBC's methodology for incorporating environmental and non-energy benefits of DSM into the benefit-cost analysis with BC Hydro's use of the Modified TRC set out in the DSM Regulation.

<u>Response:</u>

Please refer to the response to BCUC IR 1.40.2.1.

FBC understands that all of BC Hydro's programs pass the standard TRC, so the modified TRC is not currently required to improve the benefit-cost analysis of any program. As a result, BC Hydro reports on the modified TRC value but does not currently use it for decision making.

FBC's method was similar for the approved 2017 DSM expenditure schedule filing and, in prior filings, FBC has used the modified TRC on both a plan and reporting basis to incorporate non-energy benefits for measures that otherwise fail the TRC.

13.0 Topic: Long-Term DSM Plan

Reference: Exhibit A-3, BCUC IR 45.1, 47.1

In BCUC IR 45.1, staff ask FBC to replicate Table 3-2 for all the DSM scenarios considered.

In BCUC IR 47.1, staff ask FBC to "Please calculate, for each DSM portfolio considered, (i) DSM spend as a percentage of FBC revenues and (ii) DSM energy savings as a percentage of energy sold."

13.1 Please provide a version of the table produced in response to BCUC IR 45.1 that has two additional columns, one showing the expected customer sales or load for each year, and one showing new DSM annual savings as a percent of sales by year.

Response:

Please refer to the response to BCUC IR 1.38.2.

14.0 Topic: Long-Term DSM Plan

Reference: Exhibit B-1, Volume 2, 2016 Long-Term DSM Plan, section 2.3 Conservation Potential Review, p.7 (pdf p.493)

14.1 Does the CPR provide expected measure penetration rates by measure, by year? If so, please provide these results or indicate where they are in the filed evidence.

Response:

The results provided for the CPR do not include expected measure penetration rates by measure.

14.2 Did FBC consider expected measure penetration rates by measure, by year, in developing the four different DSM scenarios? If so, please provide a table showing how the measure penetration rates were considered for each of the four DSM scenarios. If not, please explain how the four DSM scenarios were developed.

Response:

No, please refer to the response to BCUC IR 1.41.2 for a discussion of how FBC used the 2016 FBC CPR results to inform the development of the DSM scenarios.

15.0 Topic: Long-Term DSM Plan

Reference: Exhibit B-1, Volume 2, 2016 Long-Term DSM Plan, 2.4 The TRC and FBC Avoided Costs, p.8 (pdf p.494)

FBC states: “The measures’ energy and demand savings are grossed-up by the avoided transmission and distribution energy losses (line losses) value of 8%, before the benefits are calculated.”

15.1 Is the avoided T&D line losses value (8%) an average line loss value or a marginal line loss value? Please explain why the chosen metric was selected.

<u>Response:</u>

The avoided T&D line losses value (8 percent) is an average value across the FBC system. The main function of the line loss value is to translate (gross up) the measures’ energy savings at the customers’ premises to the FBC point of generation, or interconnection, before multiplying by the avoided costs to determine the DSM benefits of a measure.

It is appropriate to use the average line-losses value since measures may be installed anywhere in the FBC service area.

16.0 Topic: Long-Term DSM Plan

Reference: Exhibit B-1, Volume 2, 2016 Long-Term DSM Plan, 3.2 Preferred DSM Scenario, p.14 (pdf p.501)

FBC says that the High DSM scenario "includes the majority of cost effective DSM from an LRMC perspective."

16.1 How does FBC define "the majority" in this context?

Response:

FBC defines the majority as greater than 50%, in this case. Please refer to the response to BCSEA IR 1.16.2 for the actual percentages.

16.2 Please provide a table showing the percentage of cost-effective DSM from an LRMC perspective included in each of the four DSM scenarios, or for each of the scenarios for which this data is available.

Response:

The following table shows DSM savings as a percentage of the interim estimate of market potential from 2018 to 2035. FBC has engaged Navigant to prepare a market potential study in 2017, based on the 2016 FBC CPR, which will update these values, and will be filed with FBC's next DSM expenditure schedule. The figures in the table below coincide with the load growth offset targets over the planning horizon; the interim estimate of market potential is comparable to the total estimated load growth from 2018 to 2035.

Table 1: DSM Savings as a Percentage of Interim Estimate of Market Potential from 2018 to 2035

Metric	DSM Scenario			
	Low	Base	High	Max
Percent of interim estimate of market potential	50%	66%	77%	89%

16.3 Please explain the basis on which FBC determined how much cost-effective DSM to include or exclude from each DSM scenario.

Response:

Please refer to the response to BCUC IR 1.41.2 on how FBC used the 2016 FBC CPR results to inform the development of the DSM scenarios.

16.4 Please describe and provide anticipated costs and savings values for a scenario that includes all the cost-effective DSM from an LRMC perspective.

Response:

Please refer to the response to BCUC IR 1.33.1 for a hypothetical scenario where DSM activities offset 100 percent of load growth, which is approximately equivalent to the total interim estimate of market potential.

17.0 Topic: FBC Conservation Potential Review

Reference: Exhibit B-1, Volume 2, Appendix A, FBC Conservation Potential Review, Figure 3-8. Electric Energy Technical Savings Potential by End-Use (GWh/year), pdf p.589

The term "Whole Facility" is used in Figure 3-8 and elsewhere.

17.1 Please explain the term "Whole Facility." Is it equivalent to 'building envelope'? Is the term used differently for the Residential, Commercial and Industrial sectors?

<u>Response:</u>

The definition of "Whole Facility", also known as Whole Building, measures for each of the three principal customer sectors, are contained in Appendix B.1 (End Use Definitions) of the 2016 FBC CPR, which is filed as Tab A of the LT DSM Plan, and are provided below.

Segment	End-Use	Definition
Residential	Whole Building	The whole building end-use reflects the total customer load. The residential whole building end-use is used to characterize measures that impact overall energy consumption such as home energy reports, and new construction home/building measures such as ENERGY STAR and Net Zero homes.
Commercial	Whole Building	The whole building end-use reflects the total customer load. The commercial whole building end-use is used to characterize measures that impact overall energy consumption such as building automation controls, new construction measures, occupant behavior, and retro-commissioning.
Industrial	Whole Building	The whole building end-use reflects the total customer load. The Commercial whole building end-use is used to characterize measures that impact overall energy consumption such as energy management, and new plant measures.

The term is not equivalent to "building envelope", as those measures (e.g. insulation, draft-proofing) are reflected in the end-use where the energy savings will accrue, i.e. space heating (and cooling, if applicable).

18.0 Topic: Long-Term DSM Plan, FBC CPR Next Phase

Reference: Exhibit B-1, section 6.3 Anticipated System Reinforcements, p.87 (pdf p.108); Executive Summary, pp. ES9-DS10 (pdf pp.19-20); Exhibit A-3, BCUC IR 23.2.1; Exhibit B-1, Volume 2, Appendix A, FBC Conservation Potential Review, pdf p.527

In BCUC IR 23.2.1, staff ask “Please explain whether targeted regional DSM programs could defer the requirement for the anticipated network system reinforcements.” BCSEA-SCBC look forward to FBC’s response to BCUC IR 23.2.1.

In addition, while FBC’s response to BCUC IR 23.2.1 could potentially include capacity-focused DSM, BCSEA-SCBC want to address capacity-focused DSM directly. In addition, BCSEA-SCBC want to ask about the next phase of the FBC CPR.

The FBC CPR states:

“Next Steps
This report contains the Technical and Economic potential savings results, which comprise the initial and fundamental phase of the broader BC CPR. The next, and final, phase of the BC CPR includes additional scope services, namely Market potential, Fuel Switching potential, Demand Response (DR) and the requisite supporting calculations including total thermal demand as well as customization and enhancements to Navigant’s DSMSim model specific to BC, and utility staff training.” [pdf p.527]

18.1 Please confirm that the FBC Conservation Potential Review filed as Appendix A does not address capacity-focused DSM.

Response:

The 2016 FBC CPR study includes the capacity savings commensurate with the energy savings measures listed, but did not address capacity “only” measures.

18.2 Please confirm that FBC expects that a next and final phase of the BC CPR will be carried out for FBC, as described in the quotation from the FBC CPR above.

Response:

Confirmed. The BC CPR additional scope services contract with Navigant was signed on March 1st, 2017 and is now underway.

18.3 When does FBC expect the next module of the FBC CPR to be completed?

Response:

The BC CPR additional scope service deliverables are anticipated mid-summer of 2017. The results will inform the next DSM Expenditure Schedule to be filed later this year.

18.4 Please provide updated information on the topics that will be addressed in the next module of the FBC CPR.

Response:

The "Next Steps" paragraph quoted above encapsulates the nature of the BC CPR additional scope services.

18.5 Please provide as much detail as is available on what aspects of capacity-focused DSM will be addressed in the next module of the CPR.

Response:

The following table outlines the capacity-focused DSM measures that will be explored as part of the Demand-Response potential review.

#	Customer Sector	Program Type	End Use	Technology
1	Residential	Direct Load Control	Space Heating	Thermostat
2				Switch
3			Water Heating	Switch
4	Small Commercial		Space Heating	Thermostat
5			Water Heating	Switch
6	C&I	Interruptible Rate/ Curtailable Load	HVAC, Lighting, Process, Etc.	Manual Control
7				Automated DR (Auto-DR)
8	Residential	Pricing Program*	HVAC, Lighting, Process, Etc.	With or without technology
9	C&I			

18.5.1 Will the next module of the CPR address specific locations within FBC's system where capacity-focused DSM could defer transmission or distribution investments?

Response:

Please refer to the response to BCUC IR 1.23.2.1.

18.6 Has FBC (or Navigant) examined, outside of the CPR process, DSM measures focused on capacity benefits? If so, please provide the results.

Response:

No, the Company believes the capacity savings commensurate with energy saving measures in the 2016 FBC CPR study to be robust. It is anticipated that additional capacity-only results will be forthcoming from the Demand Response potential study now underway.

18.7 Is FBC aware of BC Hydro's development of capacity-focused DSM measures?

Response:

FBC understands that BC Hydro is undertaking a number of pilot projects on capacity-focused measures.

Also, both FBC and BC Hydro are proceeding with the Demand Response potential study as part of the BC CPR additional scope services work.

18.8 Please confirm, or otherwise explain, that the 2016 Long-Term DSM Plan does not mention FBC developing DSM measures focused on capacity benefits, immediately or over the course of the plan period.

Response:

Not confirmed.

The DSM scenarios presented in the LT DSM Plan contain capacity savings commensurate with the energy savings measures, which are utilized in the LRB model to create the various resource portfolios examined in the LTERP.

18.9 Does FBC intend to examine capacity-focused DSM measures over the course of the 2016 Long-Term DSM Plan period? If so, should this be acknowledged in the Plan? If not, why not?

Response:

Please refer to the responses to BCSEA IR 1.18.6 and 1.18.9.1.

FBC considers itself to be long on capacity over the planning horizon, as is illustrated in LTERP Figure 8-4: Capacity-Load Resource Balance after DSM at page 102 of the LTERP(see Exhibit B-1, p. 102), and thus there is no requirement for capacity-focused DSM measures.

18.9.1 Does FBC intend to wait until the development of its next long-term DSM plan to begin considering capacity-focused DSM measures? If so, why?

Response:

Please refer to the responses to BCSEA IRs 1.18.6 and 1.18.9.

In addition to the DR measure characterization and potential results expected in the next phase of the BC CPR work, the Company may consider a DR pilot project(s) in its next DSM expenditure schedule filing.

19.0 Topic: Long-Term DSM Plan, Street Lighting

Reference: Exhibit B-1, Volume 2, section 4.2 Commercial Sector Programs, pdf p.506; Conservation Potential Review, Table 2-13, pdf p.546; Table 2-28, pdf p.573; pdf p.546

FBC includes street lighting within the DSM portfolio.

BC Hydro has three types of street lighting situations: BC Hydro owned street lights (RS 1701), customer owned street lights on customer owned poles (RS 1702), and customer owned street lights on BC Hydro owned poles (RS 1703). For BC Hydro owned street lights, BC Hydro is exploring conversion from high-pressure sodium (HPS) to light emitting diode (LED) in order to reduce energy consumption and to reduce costs to the customers. BCSEA-SCBC understand that this conversion program would be outside of BC Hydro's DSM portfolio. [BC Hydro Rate Design Application Module 2, Presentation March 3, 2017]

19.1 Does FBC own and operate street lights on its own poles for municipal or private customers (as BC Hydro does)?

Response:

Yes, FBC owns and operates street lights on its own poles. These lights are billed as Type III (Company-owned and maintained) under Rate Schedule 50 of FBC's Electric Tariff.

19.2 If so, is it FBC's responsibility to consider converting them to LEDs, i.e., outside of the DSM portfolio?

Response:

In the case where FBC owns and maintains street lights for municipal customers, these customers have discretion to choose the fixtures from those currently available and with an approved set of rates. FBC does not currently have a Commission approved rate under which to install and bill for Company-owned and maintained lighting that includes LED fixtures, but is currently examining the opportunity and expects to file an application with the Commission for a Company-owned LED street light rate in 2017. Should such a rate ultimately be approved, the decision to pursue conversion to LED fixtures would rest with the account holder.

19.3 If so, does FBC have plans to convert its street lights to LED? If so, please describe them. If not, why not?

Response:

Please refer to the responses to BCOAPO IR 1.19.2 and BCSEA IR 1.19.2.

20.0 Topic: Planning Environment, Low Carbon Fuel Switching

Reference: Exhibit B-1, Volume 1, section 2.2 Energy and Environmental Policy, p.16 (pdf p.37), et seq.; Appendix B, BC Climate Leadership Plan; Volume 2, section 5.1 Fuel-Switching, pdf p.510; Appendix C, Fuel Switching Analysis, pdf p.682; Exhibit A-3, BCUC IR 9

"In August 2016, the B.C. government released the Climate Leadership Plan which outlined action items to reduce GHG emissions while promoting development and creating jobs." [p.17, pdf p.38]

"FBC has addressed relevant items from the CLP in its load scenarios, market price forecasts and portfolio analysis. FBC discusses scenarios involving fuel switching between natural gas and electricity, increased electricity demand and increased use of electric vehicles in its load scenarios in Section 4 and includes clean and renewable resources in its alternative and preferred portfolios in Section 9."

"As part of the development of the 2016 Conservation Potential Review (CPR), FortisBC Inc. ("FortisBC Electric") retained Navigant to identify and assess the financial and economic attractiveness of selected fuel switching measures for the Residential and Commercial sectors. Specifically, Navigant assessed the economics of switching from gas to electricity." [pdf p.682]

20.1 Did FBC retain Navigant, or some other consultant, to identify and assess the financial and economic attractiveness of selected fuel switching measures for the <u>Industrial</u> sector? If so, please provide the results. If not, why not?

<u>Response:</u>

No. The scope of Commission Directive #9 in Order G-186-14 regarding FBC's 2015-2016 DSM expenditure schedule required FBC to undertake:

- a cost-benefit analysis (including supporting assumptions) showing whether FBC can allow customers with gas as their primary heating source to access FBC's DSM programs and still be compliant with the DSM Regulations.

Navigant was engaged to perform this analysis as part of the BC CPR process and delivered its findings pursuant to the memorandum, dated November 28, 2016, which can be found at Appendix C to the LT DSM Plan.

A more comprehensive review of fuel-switching potential is being undertaken as part of the BC CPR additional scope services phase, with a focus on mass-market opportunities. Industrial process heating was considered as a fuel switching measure but not pursued because it is too specific and must be evaluated on a case by case basis.

FBC notes the underlying marginal cost difference (the avoided cost of electricity is much higher than that of natural gas) would apply to all customer sectors, including industrial.

> "Navigant and FortisBC Electric selected the fuel-switching measures based on commercially available electric and gas space heating technologies that were characterized as part of the broader BC CPR study. These electric and gas heating technologies are potential fuel-switching alternatives, but may or may not be economic." [pdf p.682]

20.2 Please confirm that the low carbon electrification analysis addressed only one residential measure (air source heat pump) and one commercial measure (commercial rooftop unit).

Response:

Confirmed.

20.3 What criteria did Navigant and FBC use in selecting the gas to electric fuel-switching measures for assessment? Please provide a table showing the measures considered for assessment and the measures selected for assessment.

Response:

Please refer to the response to BCSEA IR 1.20.1.

Also please refer to the response to BCSEA IR 1.18.5 for a table of fuel switching measures that are being considered.

20.4 Did Navigant and FBC consider any fuel oil to electric fuel switching measures?

Response:

No. Please refer to the responses to BCSEA IR 1.20.1 and 1.20.4.1.

20.4.1 Does FBC have an estimate of the number of its customers who heat their homes or businesses with fuel oil? If so, please provide it.

Response:

FBC's residential customer research found that 0.7 percent or approximately one thousand residential customers used fuel oil for space heating. The Company has no comparable data for commercial usage.

20.5 Did FBC (or Navigant) explore any early retirement measures, or only 'replace on burnout' measures? If the former, please provide the results.

Response:

No early retirement measures were explored because they are more costly than replace on burnout measures.

20.6 Did FBC (or Navigant) explore any low carbon electrification fuel switching measures in new construction? If so, please provide the results. If not, why not?

Response:

No. Please refer to the response to BCSEA IR 1.20.1.

20.7 The CPR reports electric energy technical savings potential in 2025 for residential ductless mini split heat pump of 14.7 GWh/year [pdf p.592] and 5.6 MW for electric demand technical savings in 2015 [pdf p.593]. Did FBC explore low carbon electrification fuel switching measures using ductless mini-split heat pumps? If so, what were the results? If not, why not?

Response:

No. The methodology described in Navigant's Memorandum quoted above (Appendix C of the LT DSM Plan) was based on a central heat pump, which is the most suitable replacement technology for a forced air gas furnace. The ductless mini split heat pump referred to is the appropriate DSM solution for customers with electric baseboard heaters.

20.8 In comparing the cost-effectiveness of low carbon electrification fuel switching measures did FBC (or Navigant) include any benefits associated with increased cooling efficiency from heat pumps compared with central air conditioning units?

Response:

No, as the cooling efficiency ratings are the same for like makes/models of heat pumps and central air conditioning units for new installations. Also in the case of retrofits, where a new heat pump replaces an aged central air conditioning unit, the incremental savings from the increased cooling efficiency are minimal (approximately an order of magnitude smaller than space heating savings) and thus would not improve the fuel-switching TRC test results sufficiently to pass.

20.8.1 If so, did the comparison include the capital costs of central air conditioning along with the capital costs of a furnace or rooftop unit?

Response:

Please refer to the response to BCSEA IR 1.20.8.

20.9 To what extent are there opportunities for low carbon fuel switching from non-transportation fossil fuels other than natural gas to electricity within FBC's service territory? Were these examined? Will they be examined during the course of the LT DSM Plan?

Response:

In addition to the limited market for fuel oil conversions (please refer to the response to BCSEA IR 1.20.4.1) FBC estimates there are about two thousand residential customers with propane heating. In total, FBC estimates there is a small fraction of approximately 2 percent, or three thousand residential customers, out of a total of 147,000 residential customers that use fossil fuels other than natural gas.

FBC has undertaken some preliminary calculations for propane and fuel oil heating customers to fuel switch to electricity, and found the operating (fuel) costs are approximately the same for an electric furnace, and approximately half for an air source heat pump.

FBC considers fuel switching to be load building, and as such is not within the scope of the LT DSM Plan.

20.10 Does FBC see low carbon electrification measures as falling exclusively within FBC's DSM portfolio? Are there any low carbon electrification measures that are outside FBC's DSM portfolio?

Response:

FBC considers fuel switching (aka low carbon electrification) measures to be outside of the DSM portfolio, since they are load building in nature.

FBC also notes that by the BC government's recent Order-in-Council No. 101, dated March 1, 2017, enacted pursuant to s. 18(1) of the *CEA*, fuel switching measures were included under the "prescribed undertaking – electrification".

Please refer to the response to BCUC IR 1.8.1 for a discussion on the Company's strategy regarding EVs.

21.0 Topic: Long-Term DSM Plan, Low-Carbon Fuel Switching

Reference: Exhibit B-1, Volume 2, section 5.1 FUEL-SWITCHING, pdf p.510

"Directive 9 in the 2015-16 DSM Plan Decision (Order G-186-14) required:

a cost-benefit analysis (including supporting assumptions) showing whether FBC can allow customers with gas as their primary heating source to access FBC's DSM programs and still be compliant with the DSM Regulations.

The B/C analysis was completed by the BC CPR consultants and is attached as Appendix C of the LT DSM Plan. The finding was that the fuel switching measure failed, on a TRC basis, which is the governing test under the DSM Regulation. Since the measure is uneconomic the Company will not propose a gas to electric fuel switching measure or program."

21.1 Given that FBC/Navigant assessed only two gas to electricity fuel switching measures (residential air source heat pump and commercial rooftop unit) in Appendix C would FBC agree that it would be premature to conclude that there are no cost-effective low carbon fuel switching measures available to FBC over the course of the Long Term DSM Plan?

Response:

The space heating fuel switching measures reviewed in Section 5.1 of the LT DSM Plan were in response to the referenced Commission Directive. FBC believes those measures to be indicative since the fundamental driver, i.e. "*the higher commodity cost of electricity relative to gas*", is likely true for other fuel switching measures.

21.2 Does FBC see value in assessing other gas to electricity fuel switching measures for cost-effectiveness and GHG emissions reduction potential? If so, is this part of the long term DSM plan? If not, why not?

Response:

Please refer to the response to BCSEA IR 1.20.10.

A more comprehensive review of fuel switching potential will be undertaken as part of the BC CPR additional scope services now underway.

22.0 Topic: Proposed Energy Step Code under the Building Act

Reference: Exhibit B-1, Section 2.2.1.4 Climate Leadership Plan (pdf p. 40):

"The CLP also encourages the development of net zero buildings, including accelerating increased energy requirements in the B.C. Building Code by taking incremental steps to make buildings ready to be net zero by 2032." [footnote removed]

Reference: Exhibit B-1, Section 2.2.3 Municipal Policy Actions (pdf p. 41):

"Many municipalities in B.C. and across Canada are using their municipal powers to take policy actions aimed at reducing greenhouse gases. This can range from building code and zoning by laws placing restrictions around building energy use, to municipalities investing in energy efficiency and conservation programs, or municipal investments in renewable energy generation."

Reference: Exhibit B-1, Section 2.3.5.1 Climate Change and Regulatory Requirements (pdf p. 50):

"With increasing B.C. building code baselines and the anticipated adoption of "stretch" building codes to improve the energy performance of new homes in B.C., it will become more challenging to achieve energy savings within DSM programs. Increased customer communications, more creative program planning and higher rebate values may be needed to drive greater participation and to move market transformation." [underline added]

Reference: Exhibit B-1, Appendix B, Climate Leadership Plan, (pdf p. 211):

"Developing energy efficiency requirements for new buildings that go beyond those in the BC Building Code, called Stretch Codes, that interested local governments could implement in their communities." [underline added]

Reference: Exhibit B-1, Section 4.4 Supporting Initiatives, Subsection 4.4.2, Community Energy Planning (pdf 508):

"This element of Supporting Initiatives provides financial assistance to local governments and qualified institutions to facilitate energy efficiency planning activities like the development of community energy efficient strategic plans, energy efficient design practices and organizational policies like energy efficiency building code bylaws."

Reference: Government of British Columbia web page: Energy Step Code, http://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/energy-efficiency/energy-step-code:

"The Climate Leadership Plan released in August 2016 states that the Province is implementing a number of policies to encourage the development of net-zero buildings. One of those policies is to develop energy-efficiency requirements for new buildings that go beyond those in the BC Building Code.

"The Building and Safety Standards Branch convened a Working Group to examine how such a 'Step Code' could be implemented. The proposed Step Code supports the Building Act, by providing a consistent provincial standard for energy efficiency to replace the wide range of existing policies and programs developed by local governments.

"The proposed Step Code also supports consumer choice, by allowing designers and builders to use natural gas, electricity, or other energy sources for their project without imposing a penalty on this decision. This 'fuel neutral' approach provides builders with the flexibility to make energy-efficient buildings using all available technologies.

"The Building and Safety Standards Branch is pleased to share the results of this policy work.

"Read the full report of the working group (PDF, 1.6MB)

"While the Building and Safety Standards Branch is directly involved, the report also recommends actions by other parties with a stake in this policy. This highlights the need for collaboration and the report can form the basis for ongoing consultation with those stakeholders. In the meantime, the Branch is reviewing the multi-stakeholder consensus recommendations found in the report.

"Intended next steps include the development of Energy Step Code technical requirements that will be enacted by Regulation in the coming months, but followed only as a voluntary measure to allow stakeholders to gain familiarity with the content.

"The Branch is also supporting the reconstitution of the Energy Efficiency Working Group as an Advisory Committee. The balanced interests represented on this Advisory Committee will provide advice to the Branch as the Province works towards the goals of the Climate Leadership Plan and the ongoing implementation of BC's new Building Act."

22.1 Please confirm that FBC participated in the Energy Efficiency Working Group that examined how a 'Step Code' could be implemented.

Response:

FBC was represented by FEI at the Energy Efficiency Working Group. FBC is participating in the technical sub-committees on the Part 3 and Part 9 implementation phase of the provincial “Step Code”.

22.2 Please file the Energy Step Code Implementation Recommendations Final Report, August 2016 of the Stretch Code Implementation Working Group.

Response:

Please refer to Attachment 22.2 for a copy of the requested report.

22.3 Please confirm that the “’stretch’ building code” referenced in Section 2.3.5.1 of the Application and the *Climate Leadership Plan* is the same as the “Energy Step Code” referred to by the Building and Safety Standards Branch.

Response:

Confirmed.

22.4 Please discuss the immediate and longer term implications for FBC’s DSM measures and planning of the implementation of an Energy Step Code as contemplated by the Building and Safety Standards Branch in the quotation above.

Response:

FBC anticipates that B.C. utilities will play an important role in the market transformation of new building stock that is more energy-efficient, as envisioned through the Energy Step Code. That role may include customer awareness, in-kind technical support, building incentives, and trades training.

FBC anticipates that its next DSM expenditure schedule for 2018 onwards, which will be filed later this year, may include additional details on measures and plans related to the Energy Step Code.

22.4.1 Would the implementation of an Energy Step Code create opportunities for FBC to promote energy efficiency to local governments in its service area? Please discuss.

Response:

FBC considers that the implementation of an Energy Step Code does create opportunities to promote energy efficiency to local governments. FBC supports local governments, through its Strategic Community Energy Efficiency Planning program, to develop energy plans that include energy efficiency corporate and community policies and bylaws. In 2017, in collaboration with FEI, FBC is implementing a pilot project that provides funding for Senior Energy Advisors whose primary mandate is to develop and deliver corporate and community energy efficiency policy and bylaws.

22.4.2 How has the possible implementation of an Energy Step Code been factored into the Long Term DSM Plan?

Response:

The Energy Step Code has not been factored explicitly into the LT DSM Plan because sufficient details were not available on its implementation when the inputs were being generated for the CPR. However, some changes in the code were anticipated. The 2016 FBC CPR mapped the progression of more stringent energy-efficient building prototypes that were found to be cost-effective over the planning horizon.

22.4.3 Do any supporting initiatives in the proposed DSM plan provide support to local governments in relation to an Energy Step Code? If so, please describe the type of support being offered and the proposed budget.

Response:

Yes, the supporting initiatives in the LT DSM Plan do provide support to local governments in relation to an Energy Step Code. The Strategic Community Energy Efficiency Planning program provides funding to local governments to develop corporate and community energy plans that include development of policies and bylaws.

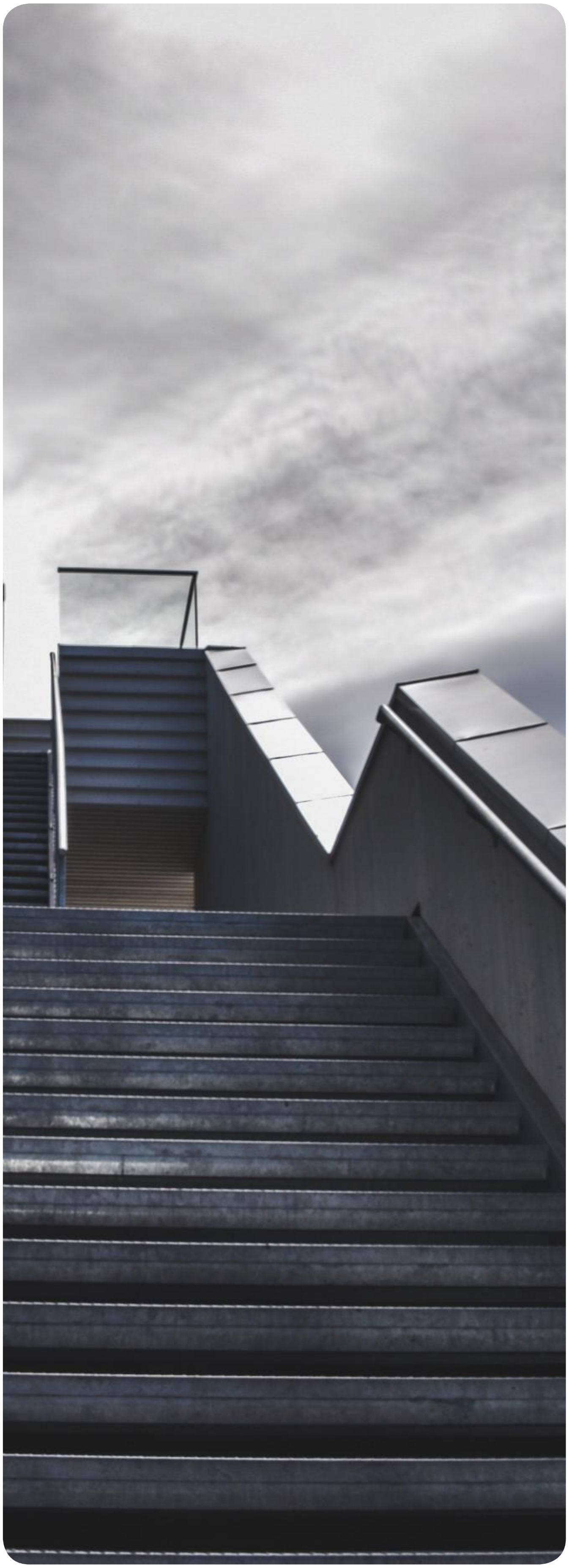
The 2016 LT DSM Plan is not an expenditure schedule, so funding levels by sector or by program were not determined. FBC anticipates filing its next DSM expenditure schedule, for 2018 onwards, later this year.

22.4.4 What is FBC's view of the opportunity presented by an Energy Step Code for FBC to actively increase the energy efficiency of new construction in its service territory?

Response:

The Company believes that the Energy Step Code offers an opportunity to align the energy efficiency objectives, goals, and programs of the B.C. Ministries, public utilities, builder community, and municipalities involved in new construction. The Step Code is designed to be easy to understand, communicate, and flexible, which FBC anticipates will increase the energy efficiency of new buildings. This approach to promoting energy-efficient new construction will create consistency for builders and increase awareness, availability, and affordability to make participation easier for new home purchasers, i.e. customers.

Attachment 22.2



Stretch Code Implementation Working Group

Energy Step Code Implementation Recommendations

Final Report

August, 2016

Prepared by Pinna for
Building and Safety Standards Branch
Office of Housing and Construction Standards

Pinna Sustainability

British Columbia Office of Housing and Construction Standards

Acknowledgements

The Building and Safety Standards Branch (BSSB) wishes to acknowledge the work of two organizations that provided significant content, knowledge and facilitation expertise to the consultation process and the development of this report.

- **Pinna Sustainability** provided facilitation, process design, and authored the final report for the Stretch Code Implementation Working Group.
- **Integral Group** provided facilitation, process design and authored the final report for the Part 3 Subcommittee, as well as the foundational white papers for the Part 3 and the Part 9 Subcommittees.

BSSB would also like to acknowledge the contributions of the organizations that were part of the stakeholder consultations. These include:

Local Governments – City of Burnaby; City of Chilliwack; City of Colwood; City of Kamloops; City of New Westminster; City of North Vancouver; City of Richmond; City of Surrey; City of Vancouver; City of Victoria; District of Saanich; District of Squamish; District of West Vancouver; Local Government Management Association; Municipality of North Cowichan; Regional District of East Kootenay; Regional Planning Advisory Committee; Town of Sidney; Union of British Columbia Municipalities; University of British Columbia

Building Industry – Britco; Canadian Home Builders' Association of British Columbia; Greater Vancouver Home Builders' Association; Urban Development Institute; Victoria Residential Builders' Association

Professional/Technical Organizations – Architectural Institute of British Columbia; Association of Professional Engineers and Geoscientists of British Columbia; Aviva Canada; BC Housing/Homeowner Protection Office; Building Officials Association of British Columbia; Canada Green Building Council; Canadian Association of Certified Energy Advisors; Community Energy Association; Integral Group; International Building Performance Simulation Association – BC; Passive House Canada; Pembina Institute; Planning Institute of British Columbia; Travellers Insurance

Utilities – BC Hydro; FortisBC

Provincial Government – Climate Action Secretariat; Ministry of Community, Sport and Cultural Development; Ministry of Energy and Mines; Ministry of Technology, Innovation and Citizen Services

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Executive Summary

The Energy Step Code is a set of incremental performance steps for new buildings that go from the BC Building Code to Net Zero Energy ready buildings. The Province of British Columbia has committed to introducing the Step Code for voluntary use by local governments in the Province's Climate Leadership Plan. In addition to supporting action on climate change, the Step Code will improve consistency of building requirements across BC because it will replace existing requirements that are unique to each local government, as mandated by the *Building Act*.

The Step Code, as proposed in this report, is the result of consensus recommendations from a broad range of stakeholders who participated in a series of working groups and committees over the past two years. The technical recommendations focus on outcomes-based requirements that provide industry with the flexibility to innovate, while ensuring that buildings achieve the performance outcomes expected by local governments and the Province.

The technical requirements include the same performance measures in each step, which means that builders of conventional buildings can measure their performance in the same way as high performance builders. This will remove barriers to developing industry capacity and transparency. The Step Code also includes objective indicators of a building's performance, like an airtightness test, which offers quality assurance to builders and building owners that the building should perform as expected. This voluntary Step Code includes the majority of new buildings in BC, from single family houses to high-rise apartment buildings.

All stakeholders involved in the development of the Step Code agreed that the most important success factor is not the technical requirements of the Code, but the details of how this voluntary Code is required or encouraged by local governments. Specific recommendations include the creation of an Advisory Committee to provide oversight for local government implementation of the Step Code, and a Best Practices Guide that will provide local governments with clear guidelines on what all stakeholders agree 'successful' implementation looks like.

Where industry is familiar with high performance buildings and market conditions are supportive, local governments are likely to require Step Code buildings more widely, with a limited number of projects required to achieve the highest steps. Where industry capacity is still developing, and the market is more sensitive, local governments are likely to implement fewer steps as requirements, and allow builders to pursue the higher steps voluntarily.

Significant support will be required to ensure the successful implementation of the Step Code over the next three to five years, including training and awareness, development of new incentives and financial mechanisms, and continued analysis of technical issues related to high performance buildings. This work will require resources and funding from all stakeholder groups and leadership from the Province to ensure that the Step Code is a success.

Part1: Recommendations

Recommendations to the Building and Safety Standards Branch

- Adopt the Step Code into a voluntary provincial regulation as per the technical appendices for Part 3 and Part 9 buildings.
- Create a process for local governments to reference the Step Code consistent with Section 2.4 of this report. Provide a clear link between performance requirements of the Step Code and future building code requirements.
- Designate and commit resources to support provincial coordination of the ongoing implementation and uptake of the Step Code.
- Designate and commit resources to support an advisory committee to play an ongoing role in implementation for local governments and the development community, as well as monitoring and reporting.
- Make any necessary changes to the Step Code over time, as recommended by the committee.
- Establish an alternative solutions process to streamline the use of new and innovative materials and assemblies used in high-performance buildings.
- Consult with other Provincial departments to adopt changes to Demand-side Measures Regulation that enable utilities to provide incentives for the Step Code that is enacted by bylaw.
- Demonstrate leadership by consulting with other Provincial departments to require higher step requirements for Provincial buildings/public sector.
- Support training and capacity development of industry and local governments to implement the Step Code.
- Work with partners to ensure adequate incentives are in place to support successful implementation of the Step Code.
- Align policy across Ministries to incent Step Code implementation.
- Coordinate discussion and efforts with other Ministries to develop supports required to advance Step Code implementation.
- Consult with other Provincial departments to use the Energy Efficiency Act to improve the industry’s adoption of more energy efficient devices, such as windows for both current and new stock.
- Designate funding and resources to accomplish the Step Code 18-month work plan (Section 3.7).
- Support local governments in establishing a standardized approach and database for benchmarking of actual energy use in buildings.

Recommendations to Utilities

- Work with the advisory committee to align existing incentive programs with the Step Code to support market transformation.
- Communicate and provide guidance on how programs and incentives support the Step Code.
- As new incentive programs are developed, consider providing appropriate financial and non-financial supports to enable market transformation.
- Align timing and availability of new programs to Step Code requirements.

Recommendations to Local Governments

- Proactively engage in capacity development opportunities to ensure planning and building inspection readiness to recognize and inspect for new requirements of the Step Code.
- Follow the Local Government Implementation Guide (more detail in Section 3.2).

Recommendations to Industry

- Engage and share communications materials on Step Code technical requirements, training opportunities, incentives, and industry best practices across the building industry.
- Proactively engage in capacity development opportunities to ensure readiness for offering services that support energy performance requirements in communities that have adopted the Step Code.

Part 2: Context

2.1 Report Purpose and Scope

The Stretch Code Implementation Working Group (SCIWG) was convened by the Province's Building and Safety Standards Branch (BSSB) to seek stakeholder input and offer guidance on how to best implement an Energy Step Code (Step Code) to achieve consistent building energy performance beyond the BC Building Code. The working group met five times between May and August, 2016. The purpose of this report is to:

1. Summarize specific recommendations from the SCIWG on how to implement the Step Code in BC.
2. Identify stakeholder perspectives regarding how the Step Code should be implemented in BC.
3. Identify potential partners and their roles in implementation.
4. Provide specific recommendations to the Building and Safety Standards Branch to enable the implementation of the Step Code.

This report summarizes the technical recommendations for implementing a Step Code throughout BC for simple buildings (Part 9 of the BC Building Code) and larger complex buildings (Part 3 of the BC Building Code), and provides guidance and recommendations on how to successfully implement the Step Code across the province. In British Columbia, the BC Building Code (BCBC) applies to all construction in the province, except in the City of Vancouver, which administers the Vancouver Building Bylaw under the *Vancouver Charter*, and on First Nations and Federal land. The University Of British Columbia Board Of Governors is included as a body that regulates building construction. Where adopted by local authorities, a Step Code would add new requirements or require a higher level of performance

<u>The **BC Building Code** and the **Building Act**</u>

The **BC Building Code** provides standards of construction for buildings throughout the province (except in Vancouver, which has its own building bylaw, and on First Nations and Federal land). The BC Building Code is set by the Province, and Authorities Having Jurisdiction (i.e., municipal and regional governments) enforce the Code. Historically, local governments could also set certain building standards within their communities.

In 2015, the Province introduced the **Building Act**, a dedicated act to govern building and construction in BC. The Act provides consistency by clarifying that the Province is the only authority that may set building requirements. Once in force, local government bylaws will no longer be able to set building standards specific to their communities. Visit the Province's website for more details (http://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/building-act).

than the BCBC.

2.2 What is the Step Code?

The Step Code, as proposed in this report, is the result of consensus recommendations from a broad range of stakeholders who participated in a series of working groups and committees over the past two years. The Step Code is a set of voluntary requirements or standards that local governments can use to achieve building energy performance beyond the building code. It is also an indicator of future code requirements and therefore can add transparency and predictability for the construction industry. Benefits of a Step Code include:

- Province-wide consistency in how energy performance in buildings is pursued.
- Opportunities for local governments or regions to demonstrate leadership on energy efficiency and greenhouse gas emissions reductions.
- Alignment of financial mechanisms and incentive programs between different levels of government.
- Opportunities for utilities to align their demand-side management programs and incentives to support market transformation to high energy performance buildings.
- Alignment with future iterations of the BC Building Code.
- Coordinated education and capacity building in the industry.

A growing number of jurisdictions in the United States and Canada interested in energy conservation are employing policy tools known as “stretch” or “reach” codes. Similar codes for energy efficiency in buildings have been adopted in other jurisdictions including Ontario, Massachusetts, Oregon, California, Vermont, and the City of Seattle.

The term ‘Step Code’ was selected for the proposal outlined in this report because it indicates a linear progression from the current Building Code towards the highest levels of energy efficiency in buildings. The terms ‘reach’ or ‘stretch code’ are more often used for aspirational guidelines or a single-step program that offers one level beyond the Building Code.

2.3 Why A Step Code for BC: Stakeholder Perspectives

With the changes emerging in provincial building regulation, many stakeholders have volunteered their time to ensure the Step Code is designed and implemented in a way that meets their multiple, often shared objectives. An overview of key stakeholders and their perspectives is offered below.

One shared objective for all stakeholders is housing affordability — This included upfront building costs, affordable ongoing operational costs, long-term maintenance costs tied to building durability, and use of innovative financing tools.

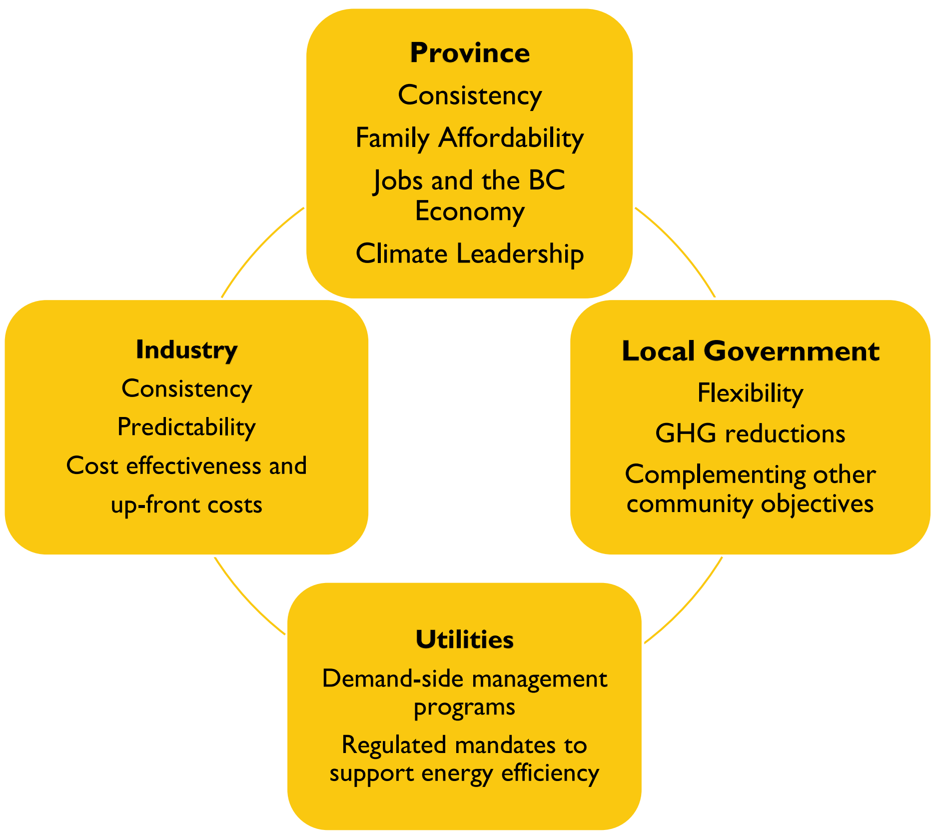

Figure 1: Key Stakeholders

The Province's Perspective

The *Building Act* (the Act) received Royal Assent on March 25, 2015. One of the key objectives of the Act is to bring greater consistency to building requirements across the province. Under Section 5 of the Act, only the Province can establish enforceable "building requirements"; that is, technical requirements for construction methods, materials, etc. for buildings that are being constructed, altered, repaired, or demolished. Section 5, which will take effect on December 15, 2017, makes building requirements enacted in local government bylaws of no legal force.[1]

In addition to the objective of consistency, the *Building Act* calls for competency and innovation. This includes ensuring building officials are qualified to interpret, apply, and enforce provincial building regulations. A properly designed Step Code will help the Province meet the *Building Act* objectives of consistency, innovation, and competency. Additionally, the Step Code is designed to be consistent with broader government objectives, including affordable housing, supporting the BC economy, and action on climate change.

Local Governments' Perspective

Under the *Local Government Act*, the province requires that all local governments in BC include greenhouse gas emissions (GHG) targets, policies, and actions in regional growth strategies and official community plans.[2] Further, the majority of local governments in British Columbia have signed on to the provincial *Climate Action Charter*, which encourages communities to create complete, compact, and energy efficient communities. Supported by provincial regulation and programs, local governments are also pursuing healthy communities, clean air, and lower energy costs for residents over the long term. Buildings represent a significant opportunity to reduce GHG emissions and achieve these multiple benefits, and many local governments are identifying policies and programs to improve the energy efficiency of buildings without compromising local development opportunities. The changes in the *Building Act* have prompted a need to define a clear method for local governments to pursue energy efficient buildings in support of their efforts to reduce GHG emissions, which they have committed to in their regional growth strategies and official community plans. **From the local government perspective, the primary goal for the Step Code is to reduce GHG emissions from buildings in concert with other community interests including healthy communities initiatives, consumer protection, energy resilience, development viability, and community character**.

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1 Section 5 came into force on December 15, 2015. Section 43, which came into force on the same date, specifies that Section 5 will not apply until two years after it comes into force.

2 The Step Code applies to UBC, but not to the City of Vancouver, which has its own building bylaw and energy performance requirements for future buildings.

Communities in British Columbia are diverse and require **flexibility** to adopt the Step Code in a manner that is appropriate to the local development context and capacity. The Step Code is an opportunity to become more consistent in application of energy efficiency requirements in buildings across the province, but to be successful, the Step Code must be flexible enough for local governments to adopt in a manner that does not increase their administrative burden and allows them to continue to make decisions that meet the needs of their local development cultures and contexts.

Industry's Perspective

When pursuing development projects, industry desires consistent, reachable standards across communities that do not increase the burden of development. The building sector also desires the ability to plan and prepare for transition to new standards, in order to provide the skills and equipment necessary to meet these requirements.

The development industry is interested in a predictable, attainable, affordable path towards energy efficient buildings. This means that future requirements are communicated well in advance of coming into force, in order to develop and deploy training resources. Industry is also interested in seeing incentives and financial mechanisms in place to ensure additional costs associated with advanced building are not borne exclusively by developers and building owners. Ideally, the Step Code is an early indication of future requirements in the BC Building Code, helping industry anticipate what is coming and build capacity over time. **From the development industry's perspective, the primary objectives of the Step Code are improved consistency and market acceptance of advanced building standards across jurisdictions, and the ability to enhance capacity to meet future requirements.**

The development industry also has some specific concerns that some local governments may implement the Step Code too quickly, beyond market acceptance and the capacity of local industry. This could increase the cost of development, slow development timelines, and prevent industry to meet consumer demand in a timely manner. An additional concern is that implementing the Step Code before capacity is available could lead to localized unintended consequences in building performance.

The Utilities' Perspective

The Province's 2010 *Clean Energy Act* requires BC Hydro to meet 66% of the province's incremental electricity needs through efficiency and conservation by 2020. Demand-side management programs offered by utilities must be approved by the BC Utilities Commission (BCUC). The Provincial Demand-Side Measures Regulation sets out the rules to assist the BCUC in this by defining select rules in assessing demand-side management programs' adequacy and cost effectiveness. The Step Code will identify new building energy performance requirements to which utilities can align demand-side management programs and initiatives to drive market transformation towards high performance buildings.

2.4 BC's Proposed Step Code

Three subcommittees were established to develop the technical requirements of the Step Code, and to provide advice to the SCIWG regarding implementation issues of a technical nature: the Part 3 Subcommittee, the Part 9 Subcommittee, and the District Energy Task Group. The Part 3 Subcommittee addressed large and complex buildings, with a focus on residential and commercial buildings in the Lower Mainland and Southern Vancouver Island. The Part 9 Subcommittee addressed houses and small buildings, with a particular focus on residential construction. The Part 3 and Part 9 Subcommittees (made up of technical, local government, utility, and industry representatives) prepared reports that make specific recommendations for the technical content of the Step Code (see Appendix A and Appendix B). The District Energy Task Group focused on the relationship between community district energy systems and the proposed building-scale energy efficiency requirements of the Step Code, and is preparing a consensus-based report that summarizes issues local governments should evaluate when considering district energy systems or policy alongside building-scale energy efficiency requirements. District energy and alternative energy will be further discussed in the Local Government Implementation Guide.

The Part 3 and Part 9 Subcommittees have proposed a set of stepped performance targets according to the following principles originally developed by the Part 3 Subcommittee. The proposed steps of the Step Code will:

- Lead to an actual reduction of energy demand in buildings.
- Focus first on building envelope design and second on equipment and systems.
- Provide flexibility to meet the changing needs and abilities of local governments.
- Deliver measureable feedback on building and program performance.
- Be compatible with local low-carbon and renewable energy systems.
- Provide capacity for local governments to pursue a long-term vision for the future of the energy efficiency of buildings and related climate action initiatives.
- Align key stakeholders.

The proposed Step Code establishes progressive performance targets that support market transformation from the current BC Building Code, with steps all the way to the highest level of performance. A key feature of the Step Code is that every level of performance is evaluated using the same metrics. This is intended to create a consistent way of measuring and understanding energy use in all buildings, regardless of their level of performance.

The first step in the Step Code is named the "Enhanced Compliance Step", which allows the builder to satisfy the minimum expectations of the BCBC using the tests and metrics required for all higher performance steps. In this way, the Enhanced Compliance Step allows builders to see what is involved in building to the higher performance steps, without the risk of failure. This involves analyzing building performance using a computer energy modelling program, which is a common approach to all high-performance building, and testing the air leakage rate of the building during construction, which is an indicator of a building's energy efficiency.

In addition to energy modelling and airtightness testing, all steps of the Step Code use metrics that measure the efficiency of the building envelope (insulation, air leakage, doors and windows, etc.), and the efficiency of the systems and equipment inside the building (heating, ventilation, etc.). To satisfy a step of the Step Code, a builder needs to demonstrate that they have satisfied both the envelope target and the equipment and systems target.[3]

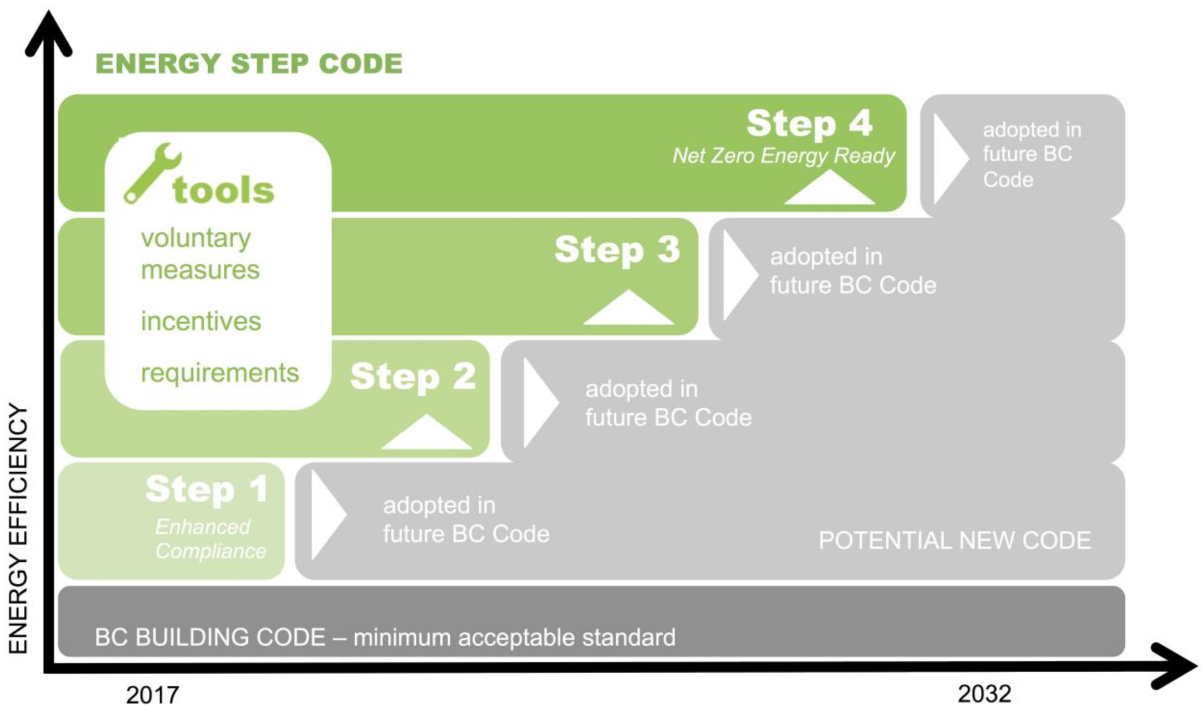

Figure 2: The Energy Step Code provides incremental performance steps from the base BC Building Code to Net Zero Energy ready, which the Province has committed to using as the base Building Code by 2032.
<u>Note</u>: For Part 9 buildings (small buildings and houses) there are 5 incremental steps towards Net Zero Energy ready, while for Part 3 (large and complex buildings) there are 4 steps.

The targets in each step are summarized in Tables 1 through 4 below. The Part 3 targets (Table 1) have a single envelope and single equipment and systems metric. The Part 9 targets (Tables 2 through 4) provide builders with the option of choosing one of two envelope targets, and one of two equipment and systems targets, which will allow some flexibility for builders with unique building types or situations. Additionally, the Part 9 targets include minimum airtightness targets, while the Part 3 targets require airtightness to be tested and incorporated into the energy model. A full description of the

[3] Future discussions will explore the role district energy and renewables may have in accommodating Step Code performance requirements.

metrics and how to satisfy each step is provided in the Part 3 and Part 9 reports (see Appendix A and Appendix B).

Metrics

The following metrics of building performance are used in the Step Code: Total Energy Use Intensity and Thermal Energy Demand Intensity for Part 3 buildings, and Mechanical Energy Use Intensity, Percentage-Better-Than EnerGuide Rating System (ERS) Reference House, Thermal Energy Demand Intensity, and Peak Thermal Load for Part 9 buildings. A brief description of each metric is provided in this report. For a more detailed summary of the metrics see Appendix A and Appendix B.

Total Energy Use Intensity (Part 3)

Total Energy Use Intensity (TEUI), is an energy use intensity (EUI) metric that includes most energy expected to be consumed in a building in a year, normalized per m^2 (i.e., in $kWh/m^2/yr$) of heated space inside the building. This includes most “plug” and “process” loads (such as the energy used by appliances and electronics) and lighting loads, as well as energy used by basic building systems, for example, heating or ventilation. For unique building uses and equipment, such as swimming pools or computer server rooms, some exceptions allow these unusual loads to be excluded. With very few exceptions, if energy is being used in a building, it is included in the total energy use. Lower TEUIs indicate more efficient buildings.

Mechanical Energy Use Intensity (Part 9)

Mechanical Energy Use Intensity (MEUI) is an energy use intensity (EUI) metric that includes energy used by space heating and cooling, ventilation, and domestic hot water over a year, normalized per square metre (i.e., in $kWh/m^2/yr$). Lower MEUIs indicate more efficient buildings. This metric does not include lighting, plug loads, and consumer appliances, such as clothes washers and dryers.

Percentage-Better-Than ERS Reference House (Part 9)

Percentage-Better-Than ERS is a metric that is specific to the most recent version of Natural Resources Canada’s EnerGuide Rating System (ERS). This metric allows a builder to use energy modelling software to compare their building to the performance of the same building built to the minimum Building Code. This metric identifies how much more efficient a proposed building is relative to the current Building Code. This metric measures overall energy efficiency and is currently available for small residential buildings only.

Thermal Energy Demand Intensity (Part 3 and Part 9)

Thermal Energy Demand Intensity (TEDI) is a metric of building envelope performance that is used by voluntary high performance standards like Passive House. TEDI provides a measure of a building's insulation, door and window performance, air leakage, and other elements of a building's envelope over a year, normalized per square metre (i.e., in kWh/m^2/yr). A lower TEDI indicates more efficient building envelope.

Peak Thermal Load (Part 9)

Peak Thermal Load (PTL) measures the amount of energy required to heat or cool a building, on the coldest or hottest day of the year, respectively. Design Heat Loss is another name commonly used for this metric. A lower PTL reflects a better-performing building.

Table 1. Step structure and targets for Part 3: Climate Zone 4

Step Level	Energy Modelling + Airtightness Testing	Equipment and Systems – Total Energy Use Intensity (kWh/m^2/year)	Envelope – Thermal Energy Demand Intensity (kWh/m^2/year)
Residential Buildings			
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	N/A	N/A
Step 2	Required	130	45
Step 3	Required	120	30
Step 4	Required	100	15
Commercial Buildings			
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	N/A	N/A
Step 2	Required	150	30
Step 3	Required	120	20

Table 2. Step structure and targets for Part 9: Climate Zone 4

Step Level	Energy Modelling	Airtightness	Equipment and Systems	Envelope
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	3.5 ACH_{50}	BCBC using 9.36.5. OR ERS v15 ref. house (MEUI of 80 kWh/m^2/year is likely, but not required)	Report on TEDI and PTL (TEDI 50 kWh/m^2/year is likely, but not required)
Step 2 **10% Beyond Code**	Required	3.0 ACH_{50}	10% better than ERS v15 ref. house OR MEUI – 60 kWh/m^2/year	TEDI – 45 kWh/m^2/year OR PTL – 35 W/m^2
Step 3 **20% Beyond Code**	Required	2.5 ACH_{50}	20% better than ERS v15 ref. house OR MEUI – 45 kWh/m^2/year	TEDI – 40 kWh/m^2/year OR PTL – 30 W/m^2
Step 4 **40% Beyond Code**	Required	1.5 ACH_{50}	40% better than ERS v15 ref. house OR MEUI – 35 kWh/m^2/year	TEDI – 25 kWh/m^2/year OR PTL – 25 W/m^2
Step 5 **50%+ Beyond Code**	Required	1.0 ACH_{50}	MEUI – 25 kWh/m^2/year (no ERS option)	TEDI – 15 kWh/m^2/year OR PTL – 10 W/m^2

Table 3. Step structure and targets for Part 9: Climate Zone 5

Step Level	Energy Modelling	Airtightness	Equipment and Systems	Envelope
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	3.5 ACH_{50}	BCBC using 9.36.5. OR ERS v15 ref. house (MEUI of 100 $kWh/m^2/year$ is likely, but not required)	Report on TEDI and PTL (TEDI of 65 $kWh/m^2/year$ is likely, but not required)
Step 2 **10% Beyond Code**	Required	3.0 ACH_{50}	10% better than ERS v15 ref. house OR MEUI – 90 $kWh/m^2/year$	TEDI – 60 $kWh/m^2/year$ OR PTL – 55 W/m^2
Step 3 **20% Beyond Code**	Required	2.5 ACH_{50}	20% better than ERS v15 ref. house OR MEUI – 75 $kWh/m^2/year$	TEDI – 50 $kWh/m^2/year$ OR PTL – 45 W/m^2
Step 4 **40% Beyond Code**	Required	1.5 ACH_{50}	40% better than ERS v15 ref. house OR MEUI – 45 $kWh/m^2/year$	TEDI – 40 $kWh/m^2/year$ OR PTL – 40 W/m^2
Step 5 **50%+ Beyond Code**	Required	1.0 ACH_{50}	MEUI – 25 $kWh/m^2/year$ (no ERS option)	TEDI – 15 $kWh/m^2/year$ OR PTL – 10 W/m^2

Table 4. Step structure and targets for Part 9: Climate Zone 6, 7a, 7b, and 8

Step Level	Energy Modelling	Airtightness	Equipment and Systems	Envelope
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	3.5 ACH_{50}	BCBC using 9.36.5. OR ERS v15 ref. house (MEUI of 115 kWh/m^2/year is likely, but not required)	Report on TEDI and PTL (TEDI 75 kWh/m^2/year is likely, but not required)
Step 2 **10% Beyond Code**	Required	3.0 ACH_{50}	10% better than ERS v15 ref. house OR MEUI – 100 kWh/m^2/year	TEDI – 70 kWh/m^2/year OR PTL – 55 W/m^2
Step 3 **20% Beyond Code**	Required	2.5 ACH_{50}	20% better than ERS v15 ref. house OR MEUI – 85 kWh/m^2/year	TEDI – 60 kWh/m^2/year OR PTL – 50 W/m^2
Step 4 **40% Beyond Code**	Required	1.5 ACH_{50}	40% better than ERS v15 ref. house OR MEUI – 55 kWh/m^2/year	TEDI – 50 kWh/m^2/year OR PTL – 45 W/m^2
Step 5 **50%+ Beyond Code**	Required	1.0 ACH_{50}	MEUI – 25 kWh/m^2/year (no ERS option)	TEDI – 15 kWh/m^2/year OR PTL – 10 W/m^2

It is important to note that the Step Code metrics in Tables 1–4 focus on the efficiency of the building, without considering the energy source. The Step Code does not account for the potential benefits of district energy systems or on-site renewable energy sources. Local governments are encouraged to consider connection to district energy systems or on-site renewable energy when determining appropriate steps. The investment required to build to the higher steps may make the costs of a district energy connection unreasonable. Equally, a local government may support builders building to a lower step if they are planning to include on-site renewables. The District Energy Task Group report, when complete, will provide a summary of the factors to be considered where district energy system connection and the Step Code are being considered for the same building.

The specific performance targets recommended in Tables 1–4 should be considered as preliminary. Members of the technical subcommittees will continue to evaluate these targets and their applicability to different building types, sizes, and climate zones after this report is finalized. The results of this analysis and any recommended changes to Tables 1–4 will be submitted to the Province for consideration as soon as they are available.

Part 3: Working Together to Implement the Step Code

Implementing the Step Code to provide consistency in building requirements will require significant effort for the first few years of implementation, with continued effort over a longer time period. Implementing the Step Code in an organized, consistent manner across the province over the coming three to five years will set the groundwork, create the resources, and build the relationships necessary for long-term success. In this section of the report, the SCIWG puts forward guidance to successfully implement Step Code in the short term, and to position us towards market transformation in the building sector in the future.

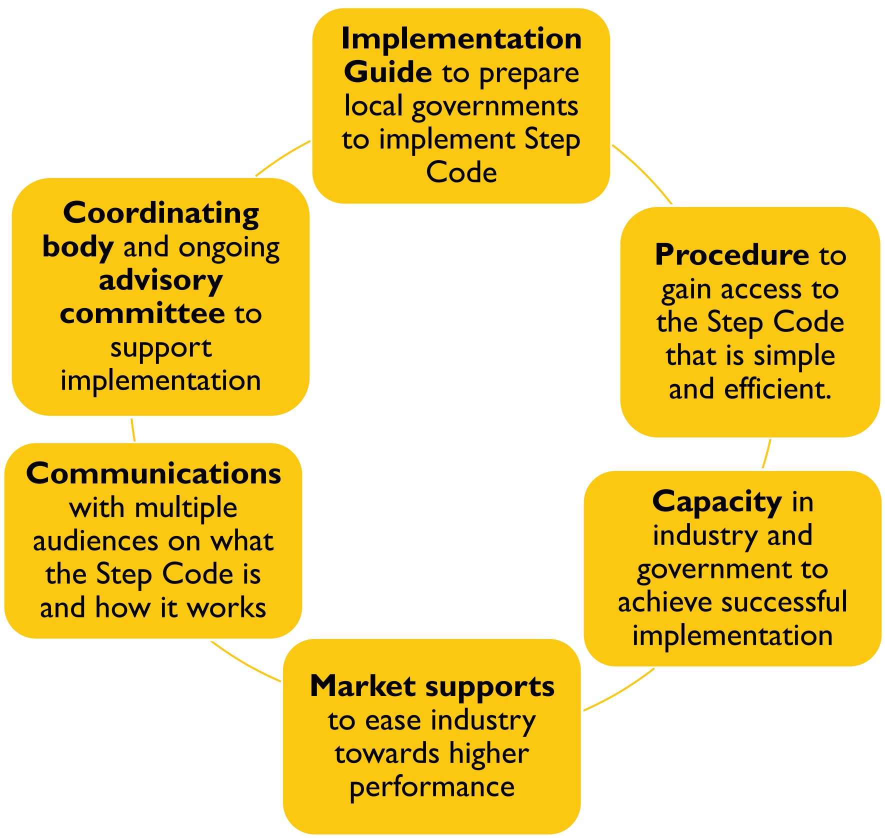

Figure 3: Critical Items for Successful Implementation

A Local Government Implementation Guide for the Step Code

Local governments play a role in ensuring sufficient local capacity exists before the Step Code requirements are enacted. Implementation includes communication and collaboration with local industry representatives in advance of adoption, setting policy intentions, developing appropriate financial mechanisms and incentives where appropriate, and preparing themselves to manage uptake (e.g., training municipal staff, building inspectors, and council).

A simple and efficient procedure for local governments to reference the Step Code in bylaw

Local governments differ in their development processes, organizational cultures, and preferred ways to incent and regulate development. It is important that the procedure to reference the Step Code in bylaw be simple and compatible with the range of different processes for managing development applications and the incentive regimes used by local governments.

Robust industry and local government capacity

Preparing industry, supply chain, and local governments to be well-positioned to take advantage of the opportunities presented by the Step Code requires a coordinated training program targeting various audiences. Developers, designers, builders, and municipal staff will all need to update their skills, and new energy advisors, technicians, and modellers will be needed across the province. This will involve assessing capacity gaps across the province and developing resources to meet them.

Market supports to ease industry towards higher performance

Achieving higher steps in the first years of implementation may require various supports to ensure capacity, knowledge, and financial mechanisms are available where needed, to understand and mitigate unforeseen risks, and to lower financial and technical barriers associated with higher energy performance.

Clear communication with multiple audiences on what the Step Code is and how it will work

This includes an organized communication strategy and outreach platform targeted to industry, all levels of government, associations, and other partners. This will serve to share training resources, implementation guidelines, and costing information, will connect professionals, and will disseminate lessons learned in an organized, centralized manner.

A coordinating body and ongoing advisory committee to support implementation

The advisory committee should meet regularly (monthly for 6 months, then quarterly, then twice a year) and would be tasked with providing advice to all stakeholders on the uptake and monitoring of the Step Code, including tools, incentives, financial mechanisms, training, communication, and other issues that emerge. This committee will help guide market transformation towards high performance buildings.

Further details on these are provided in the sections below, and will be further developed for the Local Government Implementation Guide.

3.1 Roles of Stakeholders

Achieving this will take deep collaboration between multiple stakeholders, many of which have been involved in the SCIWG to date, and have informed what is needed to achieve successful implementation of the Step Code. The table below offers an overview of high-level roles that each stakeholder will play when working towards successful implementation.

Stakeholders/Group	Role
Local Governments	• Create a policy and administrative environment that supports successful Step Code implementation. • Engage with industry to inform industry readiness. • Communicate anticipated future timelines for implementing and increasing the Step Code, to facilitate industry adaptation. • Prepare the community to use the Step Code. • As outlined in the Local Government Implementation Guide, consider and facilitate appropriate incentives and financial mechanisms to support implementation. • Demonstrate leadership in public sector buildings. • Continue to share knowledge and methods for implementation between local governments. • Send representative(s) to serve on advisory committee (through LGMA/UBCM). • Monitor and enforce the Step Code in own jurisdiction.
Development Industry	• Become educated on how to build to the Step Code. • Gain skills and equipment to build to the Step Code. • Act as leaders of innovation in the building stock. • Send representative(s) to serve on the advisory committee.
Supporting Organizations	• <u>Warranty providers</u> to incorporate the value the Step Code compliant buildings offer to consumers, and support market transformation with appropriate insurance products. • <u>Educational institutions</u> to support learning and training by supporting curriculum development and offering training across the province.
Professional Associations	• Provide training to members. • Communicate to members. • Promote and recognize innovation. • Recognize leadership. • Send representative(s) to serve on the advisory committee.
Utilities	• Support implementation of the Step Code with demand-side management programs. • Continue to support local governments in sharing knowledge and methods for implementation. • Send representative(s) to serve on the advisory committee.

Stakeholders/Group	Role
Province	• Provide ongoing support and coordination of Step Code roll-out. • Monitor, review, and amend the Step Code as required. • Support the development of an alternative solutions process for accommodating Step Code performance requirements that are beyond the acceptable solutions of the BCBC. • Provide funds and resources for a secretariat to coordinate Step Code implementation. • Send representative(s) to serve on the advisory committee. • Work with partners to create incentives and financial mechanisms to support Step Code implementation. • Demonstrate leadership in public sector buildings. • Conduct and share building research to support implementation. • Maintain alignment with other provincial policy objectives.

3.2 About the Local Government Implementation Guide

Orderly implementation of the Step Code across the province will require the creation of the Local Government Implementation Guide to inform local governments on how to adopt the Step Code in their communities and/or regions. The Implementation Guide will outline how local governments can adopt and use the Step Code to maintain and possibly enhance development and supply timelines for projects, and reduce new costs. It will also provide guidance on how to consult with industry as they consider how best to implement the Step Code in their jurisdiction. The SCIWG has agreed that the following guidance on how to implement the Step Code should be included in the Implementation Guide.

Preparing for Implementation

1. Review the Step Code guidance document, conduct regional capacity scans, and consult with industry before adopting the Step Code to understand local and regional capacity, potential training gaps, and incentive opportunities.
2. Assess the potential to apply different steps in the jurisdiction, and what incentive and financial mechanisms are appropriate to support construction to these performance levels.
3. Where appropriate, local governments could consider evaluating and/or implementing the Step Code at a regional level in order to achieve greater efficiencies in stakeholder engagement and enhanced capacity during ongoing implementation.
4. When necessary, facilitate the availability of local training and educational opportunities before requiring the Step Code.
5. Consider other energy provisions (e.g., district energy or on-site renewable) when determining step requirements.

Policy and Process Alignment

6. Local governments should replace existing energy requirements in bylaws with the Step Code, and ensure energy-related incentive programs are aligned with the Step Code.
7. Review land use and building regulations (e.g., zoning bylaw, building bylaw, form and character permit guidance, etc.) to remove barriers to green building and to find opportunities for mutual benefit for the development industry.
8. Ensure that local government development and building approvals processes are prepared to approve buildings constructed to the Step Code in an efficient and timely manner.

Timing Considerations for New Requirements

9. In early years (at least the first 3 years of implementation), only make reference to lower steps, except in situations with considerable incentives (e.g. if the land is receiving upzoning, or with density bonusing provisions) or on a voluntary basis.
10. For Part 9 residential construction, consider how to implement the Step Code to meet affordable housing and energy efficiency objectives. For example, consider implementing lower steps for smaller buildings and higher steps for luxury homes.

Supporting Local Market Transformation

11. Consider approaches for providing incentives to secure higher-level step performance. Ensure level of incentives is appropriate to the level of effort for achieving each step, which may vary by region.
    a. Understand the relative value of different incentives within local development markets.
    b. Coordinate with utility programs on incentives.[4]
    c. Understand what types of incentives are desired by the development community in the region, and when possible, develop these types of incentives.
12. Consider opportunities to lead by example in public buildings by committing to achieve higher steps for public facilities and/or development on publicly owned land. Share research and information about these projects with the industry.

Communication

13. Communicate the intention to achieve higher levels of performance in the future.
    a. As appropriate, seek Council endorsement for periodic Step Code policy reviews, in order to assess progress and update policy.
    b. Communicate long-term intentions to the development community.
    c. Consider Official Community Plan policies.
14. Educate the public about the value and co-benefits of more energy efficient housing.

[4] Note that this report recommends amendments to the Demand-Side Measures Regulation to allow energy utility incentives for the Step Code to be adopted in local government bylaw.

3.3 Recommended Procedure for Local Governments to Reference the Step Code in Bylaw

In order to be successful, the process for local governments to reference the Step Code in bylaw should be as simple and efficient as possible. The SCIWG members are recommending the following simple opt-in procedure for referencing the Step Code:

1. For the first three years of implementation, the local government must notify the Province of its intent to reference the Step Code by submitting a copy of a resolution in council. The resolution will take the form of a simple one-page checklist that demonstrates adherence to the Local Government Implementation Guide (to be developed by the Step Code advisory committee and other partners such as UBCM, as described in Section 2.8 of this report). The Province should accept applications at least twice per year.
2. The Province should name each local government that has opted into the regulation in a schedule to the Step Code regulation.
3. The Province should provide an avenue for industry and/or community members to raise concerns if a local government is not following the Local Government Implementation Guide.
4. Where appropriate, the Step Code advisory committee will monitor and review implementation concerns, and may make recommendations to the local government to address those concerns.
5. The Minister may at any time act to restrict access of a Local Government to the Step Code. The Advisory Committee will make recommendations when a Local Government is unable or unwilling to address concerns and implement the Step Code consistent with the Implementation Guide.
6. The Province will review the regulation on a regular basis and amend as necessary, considering input from the advisory committee.

3.4 Robust Industry and Local Government Capacity

A high-level scan of "what it will take" to achieve each step for Part 3 and Part 9 buildings was conducted by the SCIWG and it illuminates many opportunities to enhance the capacity of industry and local governments in advance of the Step Code coming into force. In order to develop a robust training program, it will be important to recognize differences in capacity and need across the province, and understand what resources are currently in place.

In the short term, there is particular interest in understanding the capacity of industry to meet the testing requirements set out in Step 1 (Enhanced Compliance) of the Part 3 and Part 9 Step Code. It will be important to identify potential leaders/mentors to train other trainers across the province. A provincial survey of industry capacity will need to be developed and conducted in the fall of 2016 to assess this and other critical skills including:

- Ability to conduct blower door tests and measure building performance.
- Ability to build "air tight" building envelopes.
- Ability to provide airtightness detailing.
- Ability to conduct energy modelling to design and sign off on higher-step Part 3 buildings.

Currently, there are **many valuable resources in place** that will contribute to the success in implementation. (See the table below for a list of resources, and tables 1 and 2 in Appendix D for further details). These include:

- Examples of Step Code equivalent buildings in place.
- Energy modelling software (NRCan HOT 2000 and others).
- Energy modelling capacity in some jurisdictions.
- Built Green program capacity to build to 3.0 air exchanges per hour.
- Utility incentives (e.g., BC Hydro New Commercial Construction).
- BC Housing enhanced licensing system for BC residential builders.
- Building Envelope Thermal Bridging Guide.
- City of Vancouver's Passive Design Guidelines.
- UBC's Residential Environmental Assessment Program (REAP).
- Canadian Wood Council's online calculator.
- R2000 training through CHBABC.
- Passive House Canada and GVHBA led industry training programs.
- Net Zero energy program led by CHBA national.
- BC Housing Building Smart training series.
- BCIT Graduate Certificate in Building Energy Modelling.

While some resources exist, other **resources will need to be developed** to support a comprehensive training effort. A preliminary list of new resources that will need to be developed or built upon include:

- A Best Practice Guide for **air barrier design, construction and testing** Process.
- **Modelling practice guidelines** to establish an industry standard for the Step Code.
- Professional **practice guideline for commissioning** that enhances consistency and covers which models to use under what circumstances.
- Training on **pre-occupancy commissioning.**
- Professional **practice guidelines for energy modelling** to help APEGBC and AIBC better regulate industry and improve consistency.
- An expanded **Building Envelope Thermal Bridging Guide** to include more Part 9 details.
- A **training package** for builders and trades to build tighter envelopes to achieve 3.5 air changes per hour (e.g., videos and/or brochures).
- A **how to complete airtightness detailing** training package (e.g., videos and/or brochures) for carpenters and trades.
- An **illustrated guide for builders on how to hit targets** by step.
- An **illustrated guide for installation, operation, and maintenance** of high-efficiency mechanical equipment.
- An **illustrated guide for 4- to 6-storey wood-framed** construction targeting the building community with prescriptive recommendations.
- An **integrated design guidance package** to enhance the capacity of teams to work together to identify barriers and opportunities early in the design process.

The working group recommends the development of BC-specific guidance on innovation to support implementation of the highest steps. Achieving the highest steps may be seeded by a province-wide design competition, and supported by a Centre of Excellence to house resources and innovation for market transformation.

Developing a robust training plan and program will involve key stakeholders with both expertise and broad reach, such as BC Housing, Canadian Home Builders Association, Victoria Residential Builders Association, Urban Development Institute, Union of British Columbia Municipalities and local colleges to understand the most effective curriculum and delivery models to access key markets across the province. An early, well-planned, comprehensive approach to training and capacity development, well in advance of the Step Code being required by local government, is a critical component of reducing real and perceived risks associated with Step Code implementation.

3.5 Market Supports to Ease Industry Towards Higher Performance

There is a significant amount of work that can be completed to support market transformation in parallel with Step Code implementation. This includes research on specific implementation questions, building relationships with important collaborators to align programs and policy, developing new processes and tools to support the Step Code, and Provincial leadership. These aspects are outlined in more detail in the table below.

Type of support	Activities
Research	• Investigate cost-effective approaches to achieving steps while overcoming potential unintended impacts. • Investigate incremental costs associated with higher-step construction, and strategies to minimize them. • Investigate potential financial mechanisms, including a regional assessment of industry capacity to support potential mechanisms. • Investigate potential unintended technical issues of high-performance buildings.
Relationships & Alignment	• Align modelling requirements between the Step Code and the utilities. • Link existing utility incentives with the Step Code. • Link existing provincial incentives with the Step Code (e.g., ICE Fund, CARIP). • Link new utility incentives and local government incentives with the Step Code. • Align warranty providers' objectives and financial incentives as they relate to the Step Code. • Engage warranty providers to explore recognition of value of higher quality buildings, as demonstrated by third-party review of all Step Code buildings' envelope performance, and documentation of related benefits beyond energy (e.g., GHG emissions). • Update Province's High Performance Building Strategy to support top steps.
Processes & Tools	• Develop process for approval of innovative products (e.g., non-CSA approved products). • Develop capacity for applying existing standards for airtightness testing with industry. • Develop financing mechanisms beyond incentives (e.g., incremental cost of higher steps passed on to building owners, low-interest financing). • Develop a process for determining what role alternative solutions may have in accommodating Step Code performance requirements.
Provincial Leadership	• Link any new provincial incentives with the Step Code. • Link future BC Building Code requirements with the Step Code. • Support research and education related to public sector leadership. • Update of Province's High Performance Building Strategy to support top steps. • Leadership from public sector buildings to reach Step Code standards, and to link current provincial public buildings' policy to equivalent steps.

3.6 Clear Communication on What the Step Code is and How it Will Work

Organized, coordinated communication is critical to the successful first three years of the Step Code. The following steps will need to be taken to ensure stakeholders are informed and prepared for implementation:

Target Audience	Messages
Local Governments	• Introduce the Step Code, and procedure for adoption. • Share Implementation Guide, and how to use it. • Offer training for staff/inspectors, with emphasis where additional support is needed. • Link to resources to help with implementation (e.g., communicating with Council, technical aspects of the Step Code, engaging industry, etc.), • Leadership being demonstrated with public sector buildings.
Developers & Builders	• Inform of new requirements related to their work. • Provide a primer about the Step Code and what this means to their business. • Inform of new incentives, financial mechanisms, training programs, and other opportunities to remove market barriers associated with higher performance. • Offer avenue to connect with mentors and other professionals to acquire skills and experience. • Share best practices.
Designers	• Inform of new requirements related to their work. • Offer avenue to connect with mentors and other professionals to acquire skills and experience. • Share best practice approaches for designing energy efficient buildings.
Technicians/ Trades	• Inform of new requirements related to their work. • Offer training programs to upgrade skills. • Offer avenue to connect with mentors and other professionals to acquire skills and experience. • Share best practices related to their trade/role.
Building Inspectors & Professional Organizations	• Inform of new requirements and roles for each profession. • Offer training programs to upgrade skills. • Offer avenue to connect with mentors and other professionals to acquire skills and experience. • Share best practices related to each profession.
Education Providers	• Introduce the Step Code, and role this will play in the building industry. • Invite educators as partners in capacity development.
Public/ Consumers	• Share health and cost benefits of high-efficiency housing. • Share information on incentives and financial mechanisms to support energy efficient housing purchases. • Share rational for energy efficient design.

3.7 An Ongoing, Supported Advisory Committee

Over the next three years, the advisory committee will require human and financial resources to oversee successful implementation of the Step Code. For the advisory committee to be effective, the Building and Safety Standards Branch will need to allocate resources to oversee tasks associated with implementation. The work plan below provides a list of work that will need to be completed over the short term. Many of these tasks will require budgets and resources to complete, while others can be led internally by members of the advisory committee.

Advisory Committee

The advisory committee that would meet on a regular basis (at least quarterly, monthly for sub-committees from September 2016 to December 2017, and twice annually thereafter), and would advise all stakeholders and the Province on the uptake of the Step Code, helping to guide market transformation towards high-performance buildings within BC. The committee would review trends in uptake; advise on technical aspects, training, capacity building and communications; profile innovative financing mechanisms; and consider any implementation issues as they arise. The committee would be chaired by a representative of the Building and Safety Standards Branch.

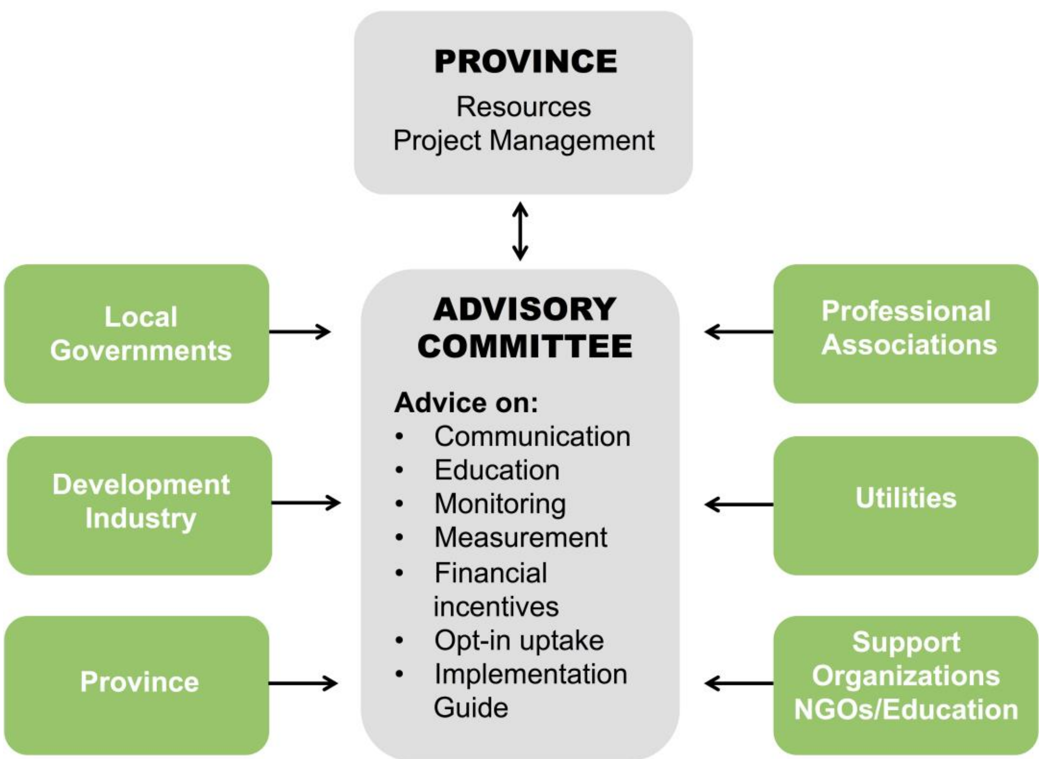

Figure 4: Proposed Structure of Advisory Committee

In addition to facilitating implementation, the advisory committee would be empowered to advise Building and Safety Standards Branch on necessary actions to ensure successful implementation across the province. Pursuant to procedure for local governments to reference the Step Code in bylaw (described above), the advisory committee would work with the Building and Safety Standards Branch to carry out recommendations that steps be restricted or removed locally, regionally, or across the province if there are serious issues in the market.

Participation of other provincial ministries is recommended, including the Ministry of Energy and Mines and the Ministry of Community, Sport, and Cultural Development. Representation from different-sized communities would be encouraged, and membership could be composed of (but not limited to):

- Urban Development Institute (UDI)
- Canadian Home Builders Association of BC (CHBA-BC)/GVHBA
- BC Housing
- Real Estate Association of BC
- Union of British Columbia Municipalities
- Local Government Management Association
- Representatives from specific local governments
- Planning Institute of British Columbia
- Building Officials Association of BC
- BC Hydro
- FortisBC
- Architectural Institute of BC
- Association of Professional Engineers and Geoscientists BC
- Victoria Residential Builders Association
- Canada Green Building Council
- NAIOP - Commercial Real Estate Developers Association
- Condominium Home Owners Association
- Buildings Owners and Managers Association – BC
- Education/research institutions
- Passive House Canada

Work Plan

A work plan has been developed to capture and propose sequencing, so that critical tasks are completed to support successful implementation of the Step Code over the next 3–5 years. There are key tasks that will need to be developed in the short term (over the next 6 months), and other tasks that are equally important and need to be developed over the medium term (6–18 months). The table below captures these key tasks, and more details on the medium-term tasks are given below.

It is important to note that this report captures a moment in time, and immediate work will need to continue over the next 3–6 months to ensure implementation runs smoothly.

Table 5: Short and Medium term work items

In Regulation (between Dec 2016 and Q1 2017) — In Force (after Q4 2017)

		2016				2017			
Short-term tasks		Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4
1	**Guidance and communications**								
1.1	Develop communication plan for local government, industry, public								
1.2	Roll out communications for various audiences								
1.3	Create a support resouce / web site to host all resources								
1.4	Develop and distribute the local government implementation guide								
2	**Preparing for capacity and training**								
2	Local/regional industry capacity scan to determine resource needs								
2	Develop a training plan based on the outcomes of the capacity scan								
2	Deliver training plan to identified audiences								
3	**Preparing a financial framework**								
3	Conduct life cycle financial assessment of building to each step								
3.2	Define level of incentive needed to enable each step								
3.3	Identify and begin to develop financial mechanisms beyond incentives								
3.4	Publish outline of incentives / financial mechanisms in development								
4	**Preparing the monitoring framework**								
4.1	Establish a registry structure and conduct survey of intended local uptake								
4.2	Establish an alternative solutions process								
4.3	Define monitoring framework and metrics to measure performance								
4.4	Develop monitoring/data management system								
Medium-term tasks									
5	Develop industry capacity and training resources for Part 3 buildings								
6	Develop industry capacity and training resources for Part 9 buildings								
7	Develop supportive market transformation tools								

The SCIWG members provided additional details to be considered when undertaking certain tasks above:

<u>Task 4.1 Establish a registry to track Step Code implementation:</u> A “registry” should be established that allows local governments to inform the Step Code advisory committee of how they are applying the Step Code on an annual basis. At minimum, the registry should include information of what step(s) are being used and how (e.g., a community-wide requirement, rezoning policy, density bonus, service area bylaws, etc.). This tracking will help efforts to scale

up industry capacity and training, inform ongoing market transformation efforts, and assist the evaluation of the Step Code.[5]

Task 4.3: Define a Monitoring Framework and metrics to measure performance: It will be important to define an ongoing monitoring program and develop metrics to measure successful implementation. A preliminary list of metrics may include:

- Number of communities to reference Step Codes, by region
- Change in time taken to process applications
- Construction costs, by region
- Construction activity, by region or municipality (e.g., # of new residential units and commercial floor space)
- Changes to warranty rates
- Use of incentives and financial mechanisms
- Number of public sector buildings built to higher steps
- Capacity of professionals and trades, by industry and by region
- Co-benefits, or unintended consequences that arise
- Actual energy use and GHG emissions reductions resulting from the Step Code

Task 5: Develop industry capacity guides and training resources for Part 9 includes:

- Continue expanding the Building Envelope Thermal Bridging guide to include more Part 9 details.
- Illustrated guide for builders to hit targets (review and update by advisory committee) Part 2: Meeting Step 3+.
- Create guidance package for integrated design to increase capacity.
- BC-specific guidance on innovation; design competition; Efficient Buildings Centre.
- Training to build envelopes to 3.5.
- Airtightness detailing training.

Task 6: Develop industry capacity guidance and training resources for Part 3 includes:

- Best Practice Guide for Air Barrier Design, Construction & Testing Process.
- Develop professional practice guideline for commissioning (i.e., which models to use when, consistency).
- Professional Practice Guidelines for Energy Modelling (to help APEGBC and AIBC better regulate industry).
- Continue expanding the Building Envelope Thermal Bridging guide.
- Create guidance package for integrated design to increase capacity.

[5] Work currently underway to develop a provincial online compliance tool for energy efficiency should be expanded in scope to support compliance with the Step Code. The use of this tool, and the database of user information, should be shared with industry, local governments, and other stakeholders to measure the pace and scale of projects using the Step Code.

- Develop illustrated guides for builders (prescriptive recommendations) for 4- to 6-storey wood.
- Provide professional guidance, webinars, and training to early adopter communities.
- BC-specific guidance on innovation; design competition; Centre of Excellence.
- Training on pre-occupancy commissioning.

Task 7: Developing supportive market transformation tools (financial, consumer, and alignment) includes:

- Review Letters of Assurance Process in BC Building Code to allow energy discipline focus
- Refine requirements for different Climate Zones, small homes, etc.
- Engage warranty providers to seek incentives (3rd party review of buildings) and document related benefits beyond energy.
- Policy or process for approval of innovative products (e.g., non-CSA approved products).
- BC Housing to review potential unintended consequences for approaches to meeting higher steps.
- Alignment modelling requirements between the Step Code and the utilities.
- Statement to link existing utility incentives with the Step Code.
- Link new utility incentives with the Step Code.
- Statement to link existing provincial incentives with the Step Code (e.g., ICE Fund, CARIP).
- Link any new provincial incentives with the Step Code.
- Leadership from public sector buildings.
- HPO research on potential impacts/cost effective approaches to achieving and overcoming issues.
- Process/policy for adopting innovative designs and products (e.g., non-CSA approved products).
- Update Provincial High Performance Building Strategy to support top steps.

Appendix A: Part 3 Buildings Report

Introduction

The Energy Efficiency Working Group (EEWG) was convened in September 2015 to develop recommendations that will allow local governments to require building energy efficiency requirements that go beyond the British Columbia Building Code (BCBC) and that are consistent across the province. This report outlines the engagement process, and presents the findings and recommendations developed for Part 3 buildings. This work served as a springboard for subsequent engagement on Part 9 buildings and an implementation framework of a stretch code for British Columbia.

The EEWG was convened to bring key stakeholders together to develop recommendations for energy efficiency requirements for Part 3 buildings that exceed the BCBC while improving the consistency of building requirements throughout the province. The goal of the working group was to replace the variety of energy efficiency policies and programs in the province with a single, optional set of tiered performance requirements. This above code framework, commonly referred to as a 'stretch code', is intended to improve the consistency of building requirements throughout the province while providing local governments the tools and flexibility they desire to pursue greenhouse gas (GHG) emissions reduction targets. After the completion of the EEWG, the working group was renamed to the Part 3 Subcommittee, reflecting the changes in the structure of the Energy Step Code process.

The Process to Develop the Energy Step Code

The purpose of the Part 3 Subcommittee was to develop recommendations for energy efficiency requirements that increased consistency throughout the province and addressed local government needs for Part 3 Buildings. The working group was convened and chaired by the Building and Safety Standards Branch (BSSB) of the Office of Housing and Construction Standards and meetings were facilitated by Integral Group. The working group was comprised of stakeholders representing local governments, the development industry, utilities, and professional associations (

Table 1). Representatives of the Ministry of Energy and Mines and the City of Vancouver participated in the roles of technical and policy advisors.

The working group met eight times between August 2015 and March 2016 to develop a set of technical recommendations for stretch codes for Part 3 buildings that could be enacted as a Provincial regulation under the *Building Act* and enforced by local governments on a voluntary basis.

Table 1. Energy Efficiency Working Group Participants

<table>
<tr><th>Sector</th><th>Participant</th><th>Voting Member</th></tr>
<tr><td rowspan="2">Professional Associations</td><td>Architectural Institute of British Columbia (AIBC)</td><td>Yes</td></tr>
<tr><td>Association of Professional Engineers & Geoscientists of British Columbia (APEGBC)</td><td>Yes</td></tr>
<tr><td rowspan="3">Local Government</td><td>Local Government Management Association (LGMA)
Represented by:
- Chilliwack Regional District
- City of Kamloops
- City of North Vancouver</td><td>Yes</td></tr>
<tr><td>Union of British Columbia Municipalities (UBCM)
Represented by:
- City of Surrey
- City of Richmond
- City of Victoria</td><td>Yes</td></tr>
<tr><td>City of Vancouver</td><td>No</td></tr>
<tr><td rowspan="2">Utilities</td><td>BC Hydro</td><td>Yes</td></tr>
<tr><td>Fortis BC</td><td>Yes</td></tr>
<tr><td>Energy Modellers</td><td>International Building Performance Simulators Association</td><td>Yes</td></tr>
<tr><td>Development Industry</td><td>Urban Development Institute (UDI)</td><td>Yes</td></tr>
<tr><td rowspan="2">Provincial Government</td><td>Building Safety Standards Branch (BSSB)</td><td>No</td></tr>
<tr><td>Ministry of Energy & Mines (MEM)</td><td>No</td></tr>
</table>

The Part 3 Subcommittee was augmented by participation of review committee members who were invited to listen to the deliberations via conference call and make comments midway and at the conclusion of each meeting (Table 2). The purpose of the review committee was to provide an opportunity for broader input from other key stakeholders. Both working group and review committee members were invited to provide written comments to the working group chair.

Table 2. Review Committee Participants

<table>
<tr><th>Sector</th><th>Participant</th></tr>
<tr><td rowspan="4">Environmental NGOs</td><td>Pembina Institute</td></tr>
<tr><td>Canadian Passive House Institute West (CanPHI West)</td></tr>
<tr><td>Canada Green Building Council (CaGBC)</td></tr>
<tr><td>Community Energy Association BC</td></tr>
<tr><td rowspan="2">Province of BC</td><td>Climate Action Secretariat (Ministry of the Environment)</td></tr>
<tr><td>Ministry of Community, Sport, and Cultural Development (CSCD)</td></tr>
<tr><td>Housing & Research</td><td>Homeowner Protection Office (HPO)</td></tr>
<tr><td>Construction Industry</td><td>BC Building Envelope Council</td></tr>
<tr><td rowspan="3">Local Governments</td><td>City of New Westminster</td></tr>
<tr><td>District of Saanich</td></tr>
<tr><td>District of Squamish</td></tr>
</table>

The Part 3 Subcommittee was also supported by three subcommittees: the district energy subcommittee, the local government subcommittee, and the energy modelling subcommittee. These subcommittees met in person or by teleconference to examine specific policy and/or technical issues relevant to the Step Code. The results of these meetings were discussed at subsequent Part 3 Subcommittee meetings and where appropriate, were put forth as recommendations.

Development of the Energy Step Code Framework

The Part 3 Subcommittee reviewed three fundamental approaches to energy regulation in buildings: the prescriptive approach, the reference building approach and the target based approach.

1. The Prescriptive Approach

This can generally be defined as an itemized list of building performance requirements that impact a building's energy usage. The approach includes requirements for building envelopes, mechanical systems, and electrical systems including lighting. The prescriptive approach is either the foundation or is included in some way in all modern energy codes such as ASHRAE 90.1 and the NECB 2011.[6]

The Part 3 Subcommittee did not pursue the prescriptive approach as an option for the stretch code because it does not provide a measurable performance expectation for buildings and may limit design flexibility and innovation. The limitations of a prescriptive approach were seen as inconsistent with the Part 3 Subcommittee's principles related to measurable outcomes and flexibility.

2. The Reference Building Approach

This is one of two methodologies to improve energy efficiency that can be defined as a 'performance approach' as it is based on overall performance of a building rather than its component parts. The reference building methodology requires a design team develop a 'reference building', usually defined by prescriptive elements within a given building code. The design team then proposes different design strategies that result in equivalent or lower overall energy use. The reference building approach is predominantly applied to performance standards in North America including both ASHRAE 90.1 and NECB 2011.[7]

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[6] Integral Group (2015). *Advanced Energy Efficiency Requirements to Buildings in BC.*

[7] Ibid.

The reference building approach was not pursued as a framework for the Energy Step Code as there is evidence to suggest that this methodology may be inhibiting better performance in new construction, and did not align with the principle of focusing "first on building envelope design and second on equipment and systems."

Target Based Approach

This approach defines an energy use or emissions target for a building, based on the total energy use of a building or energy consumption, often per unit of floor area expressed over time. The most common units for energy consumption targets are in kilowatt-hours per square meter per year, or kWh/m^2/yr. This approach is used in numerous European codes and energy standards.

Metrics

The following metrics of building performance were considered for the Part 3 Step Code: Total Energy Use Intensity, Thermal Energy Demand Intensity, Regulated Loads, Peak thermal Load and Carbon Intensity.[8]

Total Energy Use Intensity

What is the metric? – Total energy use intensity (TEUI), is an energy use intensity (EUI) metric that includes all energy expected to be consumed in a building in a year, normalized per m^2 (i.e., in kWh/m^2/yr). This includes 'plug' and 'process' loads, such as the energy used by appliances and electronics, lighting loads, as well as energy used by basic building systems, for example, heating or ventilation. Simply put, if energy is being used on site it is included in the total energy use. Lower TEUI's indicate more efficient buildings. This is the approach that Seattle, Washington has adopted as an 'outcomes-based' performance path in its building code.

What does it measure? – TEUI includes energy used by the building's operating systems, for example, heating, domestic hot water (defined as the use of hot water for drinking, food preparation, sanitation and personal hygiene, and not including hot water for space heating, swimming pool heating and commercial food preparation and clothes washing), ventilation, lighting, and plug and equipment loads.

What does it not measure? – TEUI measures most energy use on site, including energy intensive uses such as pools and servers. However, it excludes some unusual uses, such as spas, computer server rooms, and it does not take into consideration on site renewable energy generation.

[8] Ibid.

What does the metric encourage? – TEUI encourages efficient choices in domestic water heating, space conditioning and ventilation systems, improved building envelopes to reduce total energy use, and more efficient lighting, plug loads and appliances.

What does the metric not encourage? – TEUI does not address process loads that may exist in some commercial, and mostly in industrial buildings.

Thermal Energy Demand Intensity

What is the metric? – Thermal Energy Demand Intensity (TEDI) (kWh/m^2/yr) is a metric of building envelope performance that is used by voluntary high performance standards like Passive House. A lower TEDI indicates more efficient buildings.

What does it measure? – This metric includes the total amount of energy required to heat a building to maintain a stable, defined interior temperature, once all heat loss through the envelope and passive gains are accounted for.

To determine the TEDI of a building, all heat losses and gains through the envelope are considered, along with internal heat gains from occupants and equipment. It can be viewed as a net thermal energy loss intensity metric. Losses generally include the heat energy that is lost through wall, floor and ceiling/roof assemblies, as well as components in the assembly, such as doors, windows, and skylights. Losses through exhaust ventilation and air leakage through the building envelope are also accounted for. Heat gains included in a TEDI include solar gains through windows and skylights, as well as internal gains, which include heat generated by people and equipment inside the building which is not specifically designed for space heating. Equipment that commonly provides internal gains include refrigerators, dryers, cooking equipment, lighting, and other devices which generate heat as part of their operation.

When all heat losses and gains have been accounted for, the difference between the two numbers is the building's TEDI: how much energy is needed to maintain a comfortable indoor temperature.

TEDI can also be used for cooling requirements; however, in British Columbia, heating requirements are greater than cooling requirements across the province, so the Energy Step Code will focus on heating.

What does it not measure? – TEDI does not account for a building's heating system efficiency. This is captured in the TEUI metric. TEDI also does not include energy needed for ventilation or for process or plug loads (it does include the passive heat gains from process and plug loads).[9]

What does the metric encourage? – TEDI encourages improved thermal performance of the building envelope and optimized solar gains through windows. Envelopes with more insulation or high

[9] Source: http://www.integralgroup.com/wp-content/uploads/2015/05/Advanced-Energy-Efficiency-Requirements-for-Buildings-in-BC1.pdf, p. 7.

performance doors and windows will lose less energy than those with poor insulation and windows that are minimally Code compliant or worse. Buildings which have very high performance envelopes have less heat loss through the envelope, which typically results in a lower TEDI, because internal gains are able to replace a substantial portion of that heat loss.

What does the metric not encourage? – TEDI does not reflect the performance of the mechanical systems, so it does not encourage more efficient mechanical systems, and does not encourage the ventilation system, plug loads and lighting loads to be energy efficient (it may, in fact, slightly provide a disincentive to efficient equipment, depending on the assumptions for the passive gains from the equipment).

Regulated Loads

What is the metric? – Regulated Loads is similar to the Total Energy Use Intensity (TEUI) (kWh/m^2/yr) approach, except only measures the energy used that can be impacted by overall building design. This generally includes heating, cooling, ventilation, service water heating and lighting. The loads included in the regulated loads metric can vary by jurisdiction; for example, some jurisdictions include elevators in their standards, while elevators are excluded in other jurisdictions. The Regulated Loads approach is the most common approach to EUI target setting.

What does it measure? – Regulated Loads include energy used by the building's operating systems, for example, heating, domestic hot water, ventilation and lighting.

What does it not measure? – Regulated Loads do not include non-domestic hot-water usage, plug loads, appliance loads (e.g. dryers, refrigerators, etc.) and commercial process loads.

What does the metric encourage? – Regulated Loads encourage efficient choices in mechanical, ventilation, domestic water heating and lighting systems, as well as improved building envelopes to reduce total energy use.

What does the metric not encourage? – Regulated Loads do not encourage reducing appliance and plug load use, or addressing process loads.

Peak Thermal Load

What is the metric? – Peak thermal load (PTL) measures the amount of energy required to heat or cool a building, on the coldest or hottest day of the year, respectively. Design Heat Loss is another name commonly used for this metric. A lower PTL reflects a better performing building.

What does it measure? – Thermal load is a metric used by Passive House and other energy efficiency programs. In a heating-dominated climate, PTL measures the amount of heat needed to keep the space at a specified temperature (usually 21^{o}C) in Watts (W), divided by the floor area of the building in square metres (m^2), giving a W/m^2 metric. Peak load calculations take into consideration heat gain from internal sources (as described in the TEDI section) and solar gains, as well as the losses through the envelope (e.g. windows, doors, walls, ceilings, foundations and thermal bridges). It can be used to ensure the heating system is properly sized to meet thermal comfort requirements on a very cold day in that location (e.g. at the 1% or 2.5% design temperatures in January, as defined in Appendix C of the BC Building Code).

What does it not measure? – PTL does not measure the efficiency of the space heating and ventilation equipment, nor does it measure the efficiency of other equipment.

What does the metric encourage? – It encourages a tight, well insulated envelope with good windows and doors, and well placed windows and window shading to take advantage of solar gains during the winter.

What does the metric not encourage? – PTL does not reflect the performance of the mechanical systems, so it does not encourage more efficient mechanical systems, and does not encourage the ventilation system, plug loads and lighting loads to be energy efficient.

A proposal was put forward stating that peak thermal load (W/m^2) may be a more appropriate metric than annual Thermal Energy Demand Intensity (kWh/m^2/yr) to encourage an ‘envelope first’ approach to building design. However, a consensus decision to replace Thermal Energy Demand in kWh/m^2/yr with a W/m^2 metric was not achieved.

Carbon Intensity

What is the metric? – Carbon intensity differs from the other metrics in that the target is set not based on energy use, but on the amount of greenhouse gas (GHG) emissions associated with the type of energy used. It is a form of total EUI that converts the energy use of a building into GHG emissions by using an emissions factor for the fuels consumed by the building. Conversions from units of energy to other factors are found in other standards that are already in common use. ASHRAE 90.1’s Energy Cost Budget approach compares the relative cost of energy sources, providing a compliance path that achieves cost effective results for the building owner. Converting energy to carbon intensity provides a similar level of clarity on the GHG outcomes of different building designs.

What does it measure? – Carbon intensity measures the greenhouse gases emitted by a building through its operations, including the emissions from all of the energy use under consideration in the TEUI metric, given in kilograms of carbon dioxide equivalents per metre square per year (kg CO_2e/m^2/yr). Low carbon energy, on-site renewables and energy efficient envelope, equipment and components are favoured in a carbon intensity measure.

What does it not measure? – Carbon intensity does not measure the energy use of the site. One could have an energy inefficient building that is powered solely by renewable energy and have a very low carbon intensity.

What does the metric encourage? – The metric encourages energy efficiency and low carbon power and energy choices.

What does the metric not encourage? – The metric does not discourage energy efficient choices, but it does not require them, should energy demand be met through on-site renewable energy.

The working group did not reach consensus on using the carbon intensity metric.

The various approaches were evaluated for their alignment with the principles set out by the working group. The working group felt that a combination of EUI approaches could comprehensively address a range of needs and applications in various situations. Specifically the combination of total energy demand in conjunction with thermal energy demand was seen as a viable strategy. TEUI will provide the working group with a method to achieve an 'actual reduction of energy demand in buildings', and the TEDI target will ensure that there will be a, 'focus first on building envelope design and second on equipment and systems.' It is not uncommon in energy standards such as Passive House, for example, to use two targets in conjunction with one another to guide building design toward a desired outcome.

Choosing Metrics and Steps

To make a single stretch code that is applicable to a variety of jurisdictions across BC, there was general consensus from the working group that any proposal should have multiple steps that can be adopted by local governments over time. The primary step of the Energy Step Code should identify the foundational requirements for improved energy efficiency in buildings, such as key metrics and requirements, and the higher steps would improve the actual performance of buildings until it reaches roughly Passive House[10]-like performance. This level of performance was selected, as it is the highest level of performance that is consistently and widely achieved globally. The initial framework was to layout incremental steps of roughly 15% improvements between the steps, which were felt to be a reasonable assumption of the incremental levels between iterations of building codes.

The above noted framework was used as an initial guide for undertaking a thorough analysis of potential targets. The working group initially targeted a level of performance 22% better than ASHRAE 90.1 (2010), which is the current rezoning requirement for green buildings in the City of Vancouver. Energy modelling and third party costing showed that pursuing a more ambitious efficiency target could be cost effective and in some cases cheaper than using the City of Vancouver benchmark as a target.

The Energy Step Code Targets

Part 3 Subcommittee members pursued consensus on an array of targets for Part 3 multi-unit residential development in Climate Zone 4 (Lower Mainland and Southern Vancouver Island), summarized in Table 3. The subcommittee agreed that the feasibility of the targets discussed depends on the conditions of

[10] Passivhaus is an internationally recognized standard for super energy efficient buildings. There are over 3000 Passivhaus certified buildings internationally. It is supported globally by the Passivhaus Institute (http://passiv.de/en/) and is applicable to a broad range of construction types, including commercial and multi-family housing.

implementation, but the targets themselves are recommended as a reasonable path from current BC Building Code requirements. Note that the first step for compliance is not different than the current building code in terms of energy performance, but does have an 'enhanced compliance' approach that is detailed below. The subcommittee has also recommended that targets for other climate zones in British Columbia be developed as well.

In an effort to understand the practical implications, the targets in Table 3 were work-shopped through a parallel process hosted by the City of Vancouver and UDI. In the City of Vancouver's consultation, building designers and industry representatives suggested that the upper levels of the Energy Step Code (Steps 3-4) represent a significant shift from common practice and will require robust incentives. Workshop participants reviewed all aspects of the targets from a constructability and feasibility perspective and there was consensus that there is capacity in the Lower Mainland and Southern Vancouver Island today to achieve targets in Steps 2 and 3 with current technology. Participants suggested that significant incentives would be required for Step 4. Currently, there are only a few examples of wood frame projects built to Step 4 standards in BC, and no examples of concrete and steel projects.

Table 3: Proposed Step Code Targets – Part 3 Buildings in Climate Zone 4

	Energy Modelling and Airtightness Testing Required?	Thermal Energy Demand Intensity Target (in kWh/m^2/yr)	Total Energy Use Intensity Target (in kWh/m^2/yr)	Estimated Annual Energy Savings compared to BCBC Baseline	Estimated cost impact expressed in percentage increase in construction costs
Multifamily Residential (MURB)					
Step 1: Enhanced Compliance	Required	N/A	N/A	Up to 20%	0-2%
Step 2:	Required	45	130	Up to 40%	~2-5%
Step 3:	Required	30	120	Up to 50%	~5-10%
Step 4:	Required	15	100	Up to 60%	Insufficient data
Commercial (Group D and E)					
Step 1: Enhanced Compliance	Required	N/A	N/A	N/A	N/A
Step 2:	Required	30	150	N/A	N/A
Step 3:	Required	20	120	N/A	N/A

Enhanced Compliance Framework

A review of other global energy standards revealed that while technical requirements such as the performance targets noted above are important, there are also administrative requirements that encourage higher levels of compliance and correlate with improved performance. This includes guidance on energy modelling, airtightness testing, commissioning, and improved data collection, tracking, and reporting. Only modelled energy performance and airtightness testing will be required initially in the Part 3 Energy Step Code. The subcommittee agreed that a single set of administrative requirements is an important foundation for all performance steps, with the added benefit of enhancing building code compliance.

Energy Modelling

High performance buildings typically require some form of energy modelling to evaluate complex technical and design elements. The performance steps proposed by the working group emphasize complex building envelopes, which increases the need for energy modeling to understand how a building is likely to perform. Therefore, to ensure consistency and equity in complying with the proposed Energy Step Code, there was consensus that two conditions be met:

1. The ongoing 'professionalization' of energy modelling practitioners needs to continue. This has begun with preparation of Professional Practice Guidelines being co-developed by AIBC and APEGBC. These guidelines will enable professionals to better understand what their professional responsibilities are regarding energy modelling, and define the terms of bringing the practice of energy modelling into a jurisdiction. This will also allow for sign-off of energy models by design professionals.
2. Develop specific supporting guidance on how to develop and use energy models to be in compliance with the energy step code. Guidance will include standardized inputs and a definition of what has to be included in thermal loss calculations. There was consensus in the working group that International Building Performance Simulation Association – BC Chapter[11] should work with the Province to develop this technical guidance based on existing national standards.

Whole Building Airtightness Testing

The practice of testing a building's airtightness has been used in building codes in Vancouver for houses and in Washington State for all buildings for the last five, and three years, respectively. The process of mandatory testing the airtightness, or conversely, the air leakage in a building, has demonstrated that this practice tends to improve the quality of construction of building envelopes. Further, the improved quality of construction and reduced air leakage correlates to improved energy performance in a sample

[11] The BC IBPSA chapter can be found at: http://www.ibpsa.org/

of buildings reviewed in a recent study.[12] The same research has also indicated that, in Canada, the BC market is the most ready to enact airtightness testing requirements.

The subcommittee recommends, for the above reasons and for the purpose of improving data collection and advancing industry knowledge and awareness, that mandatory airtightness testing be integrated as part of the stretch code compliance framework. The working group also recommends that the Province work with industry to review existing standards such as United States Army Corps of Engineers or Canadian Standards Association for use in the Energy Step Code. Further, the working group recommends that this requirement be introduced with a grace period that requires testing, but does not require an applicant to achieve a specific target within the first two years of implementation. The subcommittee has also identified that mandatory airtightness testing requires significant industry capacity to implement on a wide scale, which should be considered before introducing the requirement outside of the Lower Mainland and Southern Vancouver Island. The subcommittee will continue to work on identifying and recommending airtightness testing standards and best practices, and develop a timeline on enforcement.

Ventilation

Ventilation is critical for maintaining air quality in airtight buildings. As airtightness improves, air leakage from the building will decrease, which can cause problems with moisture transfer into cavities in the building envelope, which can lead to mold in cavities. As well, the concentration of indoor contaminants can increase in airtight envelopes. It is proposed that mechanical ventilation must be provided directly to suites in residential buildings and commercial spaces. The ventilation shall be provided to the ASHRAE 62-2001 standard, as referenced in the Code.

As-Designed Building Energy Reporting

The requirement for 'as-designed' building energy reporting comes directly from the working group principle of delivering, "measureable feedback on building and program performance." Many green building programs implemented at the city level currently cannot track or monitor building performance. To assess the success of the Energy Step Code over time, a methodology needs to be developed to track the performance of participating buildings. For this reason, the working group recommends that part of the permitting process developed for any stretch codes include a requirement that applicants should be responsible for identifying relevant building attributes required for the Natural Resources Canada (NRCan) managed Portfolio Manager Database. Mandatory registration with Portfolio Manager was considered, but was ultimately rejected because of complications with partially-finished or

[12] ftp://ftp.cmhc-schl.gc.ca/chic-ccdh/Research_Reports-Rapports_de_recherche/eng_unilingual/Ca1%20MH%2013A34.pdf

occupied buildings at the time of occupancy. However, clearly identifying the required information for the creation of a Portfolio Manager file at the time of building design will significantly reduce the barrier to registration. This would not only allow for better building tracking under a stretch code program, but would also allow building owners to better understand and manage their operational energy use.

Commissioning Requirements

The subcommittee discussed the possible integration of commissioning requirements into the enhanced compliance package. Commissioning of building equipment and systems is a quality assurance process that ensures that systems are able to operate as designed. Commissioning requirements are currently included in energy codes in Seattle and California and have been used as part of green building policies by the City of North Vancouver. A group composed of the BSSB, BC Hydro, APEGBC, and AIBC reviewed possible approaches to including commissioning in the Energy Step Code. They concluded that, given other requirements for commissioning of other systems such as fire protection already exist in the BCBC, it would be more consistent to clarify energy commissioning expectations as an amendment to the BCBC Letters of Assurance process, rather than include it in the Energy Step Code. Further, the professional associations indicated that they would like to review the development of a professional practice guideline that will help define the use of commissioning for energy efficiency, which will further articulate how it can be implemented within building regulations. This could include the development of prescriptive administrative requirements related to commissioning, or reference to a commissioning standard.

Greenhouse Gas Intensity Targets

The subcommittee discussed the potential of having GHG intensity (GHGI) targets as a part of the framework. While not all stakeholders supported a GHGI target, local governments were interested in discussing GHGI targets. The GHGI target was seen as a way of explicitly stating that the Energy Step Code was designed to lower GHG emissions in each of the steps. Local governments also considered GHGI targets as being key to achieving the objective of having the capacity to “pursue a long-term vision for the future of energy efficiency of buildings and related climate action initiatives.”

Targets were considered and developed, but not included, for the Energy Step Code. There would be no targets for Step 1. Proposed targets for Steps 2, 3 and 4 were 7, 5 and 2 kg $CO_2e/m^2/yr$, respectively, for residential buildings. In commercial buildings, the GHG targets would be 5 and 2 kg $CO_2e/m^2/yr$ for Steps 2 and 3, without a target for Step 4.

Summary of Recommendations

1. **Multi-tiered stretch code**: general consensus that the Energy Step Code be scalable so that local governments in different regions of the province can adopt different steps as their capacity and needs develop over time.

2. **Enhanced Compliance Package**: agreement that this administrative requirement underpins industry capacity building and is a foundational component for all performance steps.

    a. **Energy Modelling**: consensus that the following conditions must be met to ensure consistency and equity:

        i. Ongoing 'professionalization' of energy modelling, e.g. Professional Practice Guidelines (APEGBC and AIBC), for professionals to better understand responsibilities for energy modelling and to allow for sign-off of energy models by design professionals.

        ii. The International Building Performance Simulation Association to work with the Province to develop technical modelling guidance on how to develop Energy Step Code compliant energy models based on standardized inputs and definitions of thermal loss.

        iii. APEGBC and AIBC to continue to develop professional practice guidelines for energy modelling for professionals.

    b. **Mandatory Whole Building Airtightness Testing**:

        i. Supports improved data collection to advance industry knowledge and awareness;

        ii. The Province to work with industry to review the existing standards of the Canadian Standards Association and/or the United States Army Corp of Engineers;

        iii. Require testing, but allow a two-year grace period for achieving specific targets; and

        iv. Allows time for industry to build capacity to undertake testing, especially outside of the Lower Mainland and Southern Vancouver Island.

    c. **As Designed Building Energy Modelling**: as part of the permitting process for any step of the Energy Step Code, applicants be responsible for entering building attributes in the Natural Resources Canada managed Portfolio Manager Database.

3. **Energy Performance Metrics:** broad agreement was achieved among working group members that the combination of total energy demand and thermal energy demand are a viable strategy for pursing an energy efficiency performance path.

Implementation Considerations

Considerations for implementation that were identified as being important for all stakeholders included:

- Development of a shared vision for 'success';
- Appropriate and timely communication for a range of audiences;
- A streamlined administrative process for local government to submit a request to the Minister to adopt Energy Step Code step(s);
- Specific mechanisms that local governments could use to implement the compliance and performance steps of the Energy Step Code;
- A clear understanding of how incentive programs and financial mechanisms would function with Energy Step Code adoption;
- An inventory of acceptable building archetypes;
- Consideration of industry and local government capacity to widely adopt higher-level steps; and
- Technical tools required to support implementation including capacity and training requirements for local governments and industry.

Conclusion and Next Steps

The accomplishments of the working group cannot be overstated. Within a relatively short amount of time consensus was achieved among representatives of industry, the professional design community, utilities, the Province, and local governments; agreeing on a long-term policy road map for improved energy efficiency performance for buildings. Targets for Climate Zones 5 through 8 should be developed and included in the regulation in the near future.

The working group recognized that an implementation framework must be prepared before the Province can consider enacting a stretch code model as part of the *Building Act* regulations. This includes further work to clarify how technical standards related to the implementation of district energy would be treated by both the *Building Act* and a possible stretch code.

The working group will reconvene to pursue the implementation considerations identified above, and make recommendations to the Province and local governments to formally adopt the technical steps identified in this report.

Appendix B: Part 9 Buildings Report

Introduction

The Stretch Code Implementation Working Group (SCIWG) Part 9 Buildings Subcommittee was convened in May and June 2016 to develop recommendations that will allow local governments to require building energy efficiency requirements that go beyond the British Columbia Building Code (BCBC) and that are consistent across the province. This work builds upon the previous stakeholder engagement on Part 3 buildings and has been used to develop an implementation framework for stretch codes in British Columbia.[13]

The Context for Developing a Stretch Code for BC

182 of the 190 local governments in British Columbia have signed on to the provincial *Climate Action Charter*, which encourages communities to reduce greenhouse gas emissions (GHG). Buildings represent a significant proportion of GHGs in local government areas in BC, which is why many local governments actively support policies and programs that encourage building owners and developers to improve the energy efficiency of their buildings. Local governments typically rely on authorities set out in the *Local Government Act* and the *Community Charter* to carry out these policies and programs.

The goal of the subcommittee was to replace existing energy efficiency policies and programs in municipalities in British Columbia with a single, optional set of tiered performance requirements for Part 9 buildings and to provide a framework for those municipalities wishing to require a higher level of building performance; it is not to introduce new building code energy targets to be applied across the province. This above code framework, commonly referred to as a 'stretch code', is intended to improve the consistency of building requirements throughout the province while providing local governments the tools and flexibility they desire to pursue greenhouse gas emissions reduction targets.

It is important to note that, unlike some 'green building' programs, such as LEED or ENERGY STAR®, the Energy Step Code for Part 9 in British Columbia will only establish requirements for the building envelope and operating equipment related to space conditioning and domestic hot water. Consistent with the scope of Part 9 of the BC Building Code, the Energy Step Code is intended to be referenced as part of broader programs, but is not intended to address all energy use in a building. For example, stoves, ovens, clothes dryers, and other appliances all have an impact on the actual energy use of a building, but the Energy Step Code will not address requirements for these devices as they are typically outside the scope of the BC Building Code.

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[13] This report built upon a summary report presenting the findings and recommendations of an engagement on beyond-Code building energy efficiency requirements for Part 3 buildings.

The Process to Develop a Step Code

The purpose of the subcommittee is to develop recommendations for energy efficiency requirements for Part 9 buildings, except for industrial occupancies (in the BCBC, F2 and F3 occupancies) that increase consistency throughout the province and address Local Government needs. The working group was convened and chaired by the Building and Safety Standards Branch (BSSB) in the Office of Housing and Construction Standards. The working group was comprised of stakeholders representing local governments, the development industry, utilities, and professional associations (Table 4). Representatives of the Ministry of Energy and Mines, Alternative Energy Division and the City of Vancouver participated in the roles of technical and policy advisors.

In May 2016, Integral Group and E3 Eco Group prepared a white paper on "Advanced Energy Efficiency Requirements for Homes in BC". The white paper was developed with the support of BC Hydro for their Advisory Group on Part 9 Energy Efficiency, with the input of local governments, utilities, home building industry representatives, and the provincial government. It included a proposal for three tiers for a stretch code for local governments, in order to assist them with their building energy performance goals. These tiers included prescriptive requirements, as well as a reference building performance-based framework, and built upon existing energy efficient home building programs. The report also undertook some costing to determine the upfront premium for meeting the three tiers. This white paper was used as the starting point for discussions by the Part 9 Subcommittee.

The subcommittee met five times in May and June 2016 to develop a set of technical recommendations for a stretch code for Part 9 buildings that could be enacted as a Provincial regulation under the *Building Act* and enforced by local governments on a voluntary basis. Consensus among stakeholders was sought, but not always achieved. The results of this process are intended to inform subsequent discussions on stretch code implementation.

Table 4. Part 9 Subcommittee Participants

Sector	Participant	Voting Member
Development Industry	Canadian Home Builders' Association – BC Victoria Residential Builders' Association Greater Vancouver Home Builders' Association Britco	Yes
Local Government	Local Government Management Association (LGMA) Represented by: - Fraser Valley Regional District - City of Kamloops - City of Chilliwack	Yes

<table>
<tr><th>Sector</th><th>Participant</th><th>Voting Member</th></tr>
<tr><td rowspan="4"></td><td>Union of British Columbia Municipalities (UBCM)
Represented by:
- City of Surrey
- City of Richmond
- City of Victoria
- District of Squamish
- District of Saanich
- City of North Vancouver</td><td>Yes</td></tr>
<tr><td>BOABC, Represented by:
- District of North Cowichan</td><td>Yes</td></tr>
<tr><td>Other Local Governments
- Regional District of East Kootenay
- City of New Westminster
- City of Colwood</td><td>Yes</td></tr>
<tr><td>City of Vancouver</td><td>No</td></tr>
<tr><td rowspan="3">Professional and Technical Associations</td><td>Architectural Institute of British Columbia (AIBC)</td><td>Yes</td></tr>
<tr><td>Association of Professional Engineers & Geoscientists of British Columbia (APEGBC)</td><td>Yes</td></tr>
<tr><td>Canadian Association of Certified Energy Advisors (CACEA)</td><td>Yes</td></tr>
<tr><td rowspan="3">Utilities and Housing Research</td><td>BC Hydro</td><td>Yes</td></tr>
<tr><td>Fortis BC</td><td>Yes</td></tr>
<tr><td>Homeowner Protection Office (HPO)</td><td>Yes</td></tr>
<tr><td rowspan="2">Provincial Government</td><td>Building Safety Standards Branch (BSSB)</td><td>No</td></tr>
<tr><td>Ministry of Energy & Mines (MEM)</td><td>No</td></tr>
</table>

The working group was augmented by participation of review committee members who were invited to listen to the deliberations via conference call and make comments midway and at the conclusion of each meeting (Table 5). The purpose of the review committee was to provide an opportunity for broader input from other key stakeholders. Both working group and review committee members were invited to provide written comments to the working group chair.

Table 5. Review Committee Participants

<table>
<tr><th>Sector</th><th>Participant</th></tr>
<tr><td rowspan="5">Non-Governmental Organizations and Industry Experts</td><td>Pembina Institute</td></tr>
<tr><td>Canadian Passive House Institute West (CanPHI West)</td></tr>
<tr><td>Community Energy Association</td></tr>
<tr><td>Integral Group</td></tr>
<tr><td>City Green Solutions</td></tr>
</table>

Discussion of Energy Step Code Framework Options

In discussion The Part 9 Subcommittee is reviewing three fundamental approaches to setting energy efficiency targets for Part 9 buildings: the prescriptive approach, the reference building approach and the target-based approach.

1. The Prescriptive Approach

This can generally be defined as an itemized list of building performance requirements that impact a building's energy usage. The approach includes requirements for building envelope assemblies and components, mechanical systems, and electrical systems including lighting. The prescriptive approach is generally either the foundation or included in some way in energy codes such as Section 9.36. of the BCBC and the National Energy Code for Buildings.

In Meeting 2, the subcommittee agreed to not pursue the prescriptive approach as an option for the Energy Step Code because it does not guarantee a measurable performance outcome for buildings and may limit design flexibility and innovation. However, members of the subcommittee identified that prescriptive solutions are effective at communicating compliance strategies to builders and should be considered in the preparation of communications and training materials.

2. The Reference Building Approach

This is one of two methodologies to improve energy efficiency that can be defined as a 'performance approach' as it is based on overall modelled performance of a building design rather than requirements for inclusion of specific component parts. The reference building methodology requires an energy modeller develop a 'reference building', usually defined by the prescriptive elements within the BCBC. The design team then proposes its design strategies and can compare overall energy use between the two models. The reference building approach is currently allowed as a performance path for compliance under Section 9.36.5 of the BC Building Code. The reference building approach has also been integrated into the new version of HOT 2000 (v11) and the EnerGuide Rating System, version 15 (ERS v15), which has been in use in British Columbia since April 1, 2016 for single detached, semi-detached and row houses.

This new software functionality automatically generates a reference house whose energy characteristics meet the requirements of the NBC/BCBC, based on the location and design of the specific house being proposed. This provides the energy modeller and builder with an easy to access proxy for the code reference house. Analysis by Natural Resources Canada and the Province of BC has determined that the new ERS v15 reference house software provides a valid reference house for use as a code proxy in British Columbia. Therefore, these automatically-generated reference houses, and performance comparisons to it, are being recommended as one path to setting and complying with targets in the Part 9 Energy Step Code steps.

Using the reference building approach, builders and owners can demonstrate that their building meets a step or a target through modelling, which would show that their building will use a certain percentage less energy than a reference building.

3. Target-Based Approach

This approach defines an energy use or emissions target for a building, based on the total energy use of a building or energy consumption, often per unit of floor area expressed over time. The most common units for energy consumption targets are in kilowatt-hours per square meter per year, or kWh/m^2/yr. This approach is used in numerous European codes and energy standards.

Metrics

The following four metrics of building performance are included in this report: mechanical energy use intensity, thermal energy demand intensity, peak thermal load and airtightness of the building envelope.[14] Targets have been set for each metric based on the performance step and the climate zone. Targets for greenhouse gas emissions, which are used in some jurisdictions, are not included in this Energy Step Code.

1. Mechanical Energy Use Intensity

What is the metric? – Mechanical Energy Use Intensity (MEUI) (kWh/m^2/yr) is an energy use intensity (EUI) metric that includes energy used by space heating and cooling, ventilation and domestic hot water over a year, normalized per square metre (i.e., in kWh/m^2/yr). Lower MEUI's indicate more efficient buildings. This metric does not include lighting, plug loads and consumer appliances such as clothes washers and dryers, which are referred to in the ERS v15 software as base loads. Base loads are not currently accounted for in the BC Building Code's energy modelling requirements for Part 9 buildings (Subsection 9.36.5.), and the Energy Step Code maintains this scope. Removing base loads ensures that MEUI is focused on equipment that the builder is able to influence and that building officials have the authority to inspect. Additionally, removing base loads provides improved fairness to small buildings, which have the same assumed base load energy requirements as larger buildings in ERS v15.

MEUI is terminology developed by the Part 9 Subcommittee and is not known to be in common usage in other jurisdictions. However, it describes a key metric that the committee agrees serves the Energy Step Code objectives.

[14] Ibid

What does it measure? – MEUI includes energy used by the building's operating systems, for example, heating, domestic hot water (defined as the use of hot water for drinking, food preparation, sanitation and personal hygiene, and not including hot water for space heating, swimming pool heating and commercial food preparation and clothes washing), and ventilation. It encompasses the equipment that is regulated under the BC Building Code.

What does it not measure? – MEUI does not include non-domestic hot-water usage, plug loads, appliance loads (e.g. dryer, refrigerator, etc.), lighting and commercial process loads.

What does the metric encourage? – MEUI encourages efficient choices in mechanical, domestic water heating and ventilation systems, as well as improved building envelopes to reduce total energy use.

What does the metric not encourage? – MEUI does not encourage reducing appliance and plug load use, addressing process loads, or lighting energy use. Note that the current BCBC/NBC performance path compliance methodology also does not measure or impact design choices related to these items.

2. *Thermal Energy Demand Intensity*

What is the metric? – Thermal Energy Demand Intensity (TEDI) (kWh/m^2/yr) is a metric of building envelope performance that is used by voluntary high performance standards like Passive House. A lower TEDI indicates more efficient buildings.

What does it measure? – This metric includes the total amount of energy required to condition a building to maintain a stable, defined interior temperature, once all heat loss through the envelope and passive gains are accounted for.

To determine the TEDI of a building, all heat losses and gains through the envelope are considered, along with internal heat gains from occupants and equipment. Losses generally include the heat energy that is lost through wall, floor and ceiling/roof assemblies, as well as components in the assembly, such as doors, windows, and skylights. Losses through exhaust ventilation and air leakage through the building envelope are also accounted for. Heat gains included in a TEDI include solar gains through windows and skylights, as well as internal gains, which include heat generated by people and equipment inside the building which is not specifically designed for space heating. Equipment that commonly provides internal gains include refrigerators, dryers, cooking equipment, lighting, and other devices which generate heat as part of their operation.

When all heat losses and gains have been accounted for, the difference between the two numbers is the building's TEDI: how much energy is needed to maintain a comfortable indoor temperature.

TEDI can also be used for cooling requirements; however, in British Columbia, heating requirements are greater than cooling requirements across the province, so this stretch code will focus on heating.

What does it not measure? – TEDI does not account for a building's heating system efficiency. This is captured in the MEUI metric. TEDI also does not include energy needed for ventilation or for process or plug loads (it does include the passive heat gains from process and plug loads).[15]

What does the metric encourage? – TEDI encourages improved thermal performance of the building envelope and optimized solar gains through windows. Envelopes with more insulation or high performance doors and windows will lose less energy than those with poor insulation and windows that are minimally Code compliant or worse. Buildings which have very high performance envelopes have less heat loss through the envelope, which typically results in a lower TEDI, because internal gains are able to replace a substantial portion of that heat loss.

What does the metric not encourage? – TEDI does not reflect the performance of the mechanical systems, so it does not encourage more efficient mechanical systems, and does not encourage the ventilation system, plug loads and lighting loads to be energy efficient (it may, in fact, slightly provide a disincentive to efficient equipment, depending on the assumptions for the passive gains from the equipment).

3. Peak Thermal Load

What is the metric? – Peak thermal load (PTL) measures the amount of energy required to heat or cool a building, on the coldest or hottest day of the year, respectively. Design Heat Loss is another name commonly used for this metric. A lower PTL reflects a better performing building.

What does it measure? – Heating load is a metric used by Passive House and other energy efficiency programs. In a heating-dominated climate, PTL measures the amount of heat needed to keep the space at a specified temperature (usually 21^{o}C) in Watts (W), divided by the floor area of the building in square metres (m^2), giving a W/m^2 metric. Peak load calculations take into consideration heat gain from internal sources (as described in the TEDI section) and solar gains, as well as the losses through the envelope (e.g. windows, doors, walls, ceilings, foundations and thermal bridges). It can be used to ensure the heating system is properly sized to meet thermal comfort requirements on a very cold day in that location (e.g. at the 1% or 2.5% design temperatures in January, as defined in Appendix C of the BC Building Code).

What does it not measure? – PTL does not measure the efficiency of the space heating and ventilation equipment, nor does it measure the efficiency of other equipment.

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15 Source: http://www.integralgroup.com/wp-content/uploads/2015/05/Advanced-Energy-Efficiency-Requirements-for-Buildings-in-BC1.pdf, p. 7.

What does the metric encourage? – It encourages a tight, well insulated envelope with high performance windows and doors, and well placed windows and window shading to maximize solar gains during the winter.

What does the metric not encourage? – PTL does not reflect the performance of the mechanical systems, so it does not encourage more efficient mechanical systems, and does not encourage the ventilation system, plug loads and lighting loads to be energy efficient.

4. *Airtightness*

What is the metric? – Airtightness provides a measure of a building's resistance to inward or outward air leakage through unintentional leakage points or areas in the building envelope. This air leakage is driven by differential pressures across the building envelope due to the combined effects of stack, external wind and mechanical ventilation systems.

An airtightness test is undertaken to determine the rate of air leakage into or out of a building enclosure. Typically in residential buildings, airtightness testing is done by depressurizing and/or pressurizing the inside of a building by 50 Pascals (Pa) compared to the exterior, and identifying leakage rates. The units are in air changes per hour at 50 Pa (ACH_{50}). Alternatively, the airtightness tests can provide results in equivalent leakage area (ELA), which is the equivalent area over which air is leaking, that is, if the leaks all happened in one location, the size of the hole in that spot, or normalized leakage area (NLA), which is the size of the ELA divided by the area of the entire envelope. A lower number for these three airtightness measures indicates a more airtight building.

What does it measure? –An airtightness test measures the rate of air leakage through a building's enclosure, and is an excellent indicator of a building's vulnerability to heat loss, moisture damage and issues of discomfort for occupants. It allows a builder or owner to know how well they have sealed up a building.

What does it not measure? – Airtightness testing does not measure the insulation values of a building, nor does it take into consideration the performance of mechanical equipment.

What does the metric encourage? – Airtightness testing encourages airtight construction, to prevent the passage of both air and vapour through the building envelope. This has energy, building quality and health implications; a building that permits leakage loses more energy, and may also enable condensation within the envelope, which can cause mould problems. It encourages builders and trades to improve their detailing skills and take greater care about where items are installed (such as plugs and vents) to limit leakage and reduce the risks associated with condensation inside the envelope.

Using the ACH_{50} metric may also inadvertently make it more difficult to build smaller buildings, as the same leakage area in a small building compared to a larger building would lead to a higher ACH_{50} rate.

What does the metric not encourage? – Airtightness testing does not necessarily encourage higher insulation values or more efficient equipment.

The Energy Step Code Targets

The goal of this subcommittee is to recommend metrics and technical requirements for a provincial stretch code for Part 9 buildings. These metrics and requirements:

- Should be appropriate for all Part 9 buildings except for industrial occupancies, as agreed to by participants in the Subcommittee;
- Should be adaptable for all climate zones in BC (Climate Zones 4 through 8);
- If signed by the Minister, the Energy Step Code would be immediately available to be referenced in incentive programs;
- Will be available for Local Governments to request to apply one or more Energy Step Code steps in their community;
- Will be optional for adoption by Local Governments; and
- In practice, it is anticipated that, in the first few years of the Energy Step Code, lower steps will be more widely adopted by local governments for reference as a requirement in a bylaw, while higher steps are likely to be implemented over a longer term, and more often through incentives and other supportive mechanisms.

The role of the Part 9 Subcommittee is to recommend the technical targets of the Part 9 Energy Step Code. The details around implementing the Energy Step Code targets are outside of the scope of this Subcommittee, and will be discussed in the SCIWG. The outcomes of this group will be brought to the SCIWG to consider in the implementation discussions.

Similar to the Part 3 Stretch Code Subcommittee, the goal of this subcommittee is to develop building energy performance steps (Figure 5) that provide consistent targets across those jurisdictions that adopt each step, while providing local governments with a tool to meet their Climate Action Charter goals flexibly. These steps will allow those local governments who wish to ensure that buildings in all or part of their jurisdiction are able to do so in a manner consistent with the rest of the province, while the base BC Building Code remains available to maintain the minimum acceptable standard for energy efficiency. It is also possible that the targets in the step structure will be adopted in future BC Building Codes; the Energy Step Code should be designed to prepare builders for future base building codes.

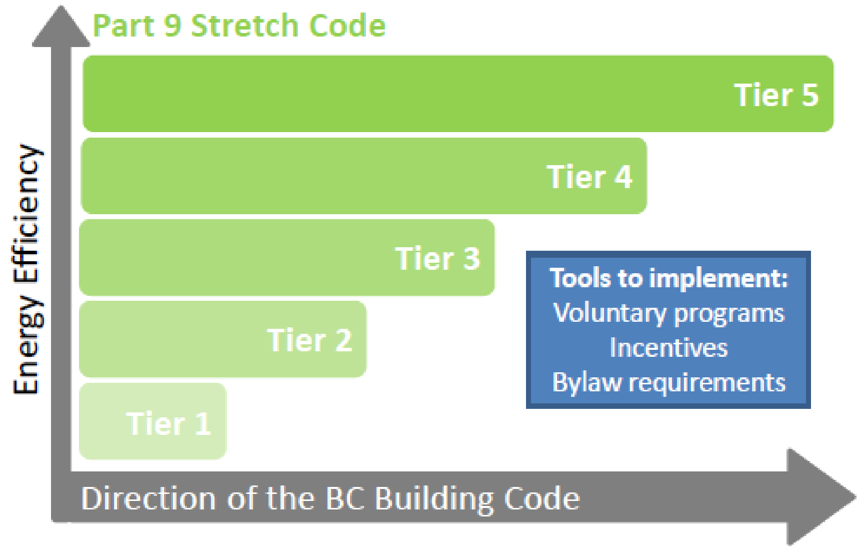

Figure 5. Step structure of the Part 9 Energy Step Code.

A mix of performance measures are suggested for the steps identified of performance in Part 9 construction. These include energy performance and airtightness performance measures.

Understanding the Reference Building Methodology

The reference building methodology that will be referenced below emerges from HOT2000 v.11 and ERS v.15, developed and maintained by Natural Resources Canada. It has been added for the expressed purpose of supporting programs such as stretch codes. An energy model automatically generates a "reference house" with a similar configuration that is compliant with Section 9.36. of the BCBC. The reference house provides a baseline comparison with a proposed design, and expresses relative performance of the modelled house as a percentage. Using the software, an energy modeller can determine how much higher or lower the energy performance of a proposed building is compared to the BCBC.

Energy Metric Parameters and Assumptions

Choosing performance requirements for the Steps will require decisions on how to define the metrics. They take into consideration energy use, in kilowatt-hours (kWh), and floor space, in square metres (m^2), over a period of time, in this instance over the year. For instantaneous heat load, the measurement is in Watts per unit of area of floor space (W/m^2). The following items are for discussion and determination within the group membership:

The Steps as defined have been selected based on a few assumptions:

1) Floor area is based on interior floor areas, i.e. the area of all of the space inside a house's exterior walls, except for unheated crawlspaces, commensurate with the EnerGuide Rating System's calculations of the space inside the house;
2) MEUI will be measured, in kWh/m^2/year;
3) TEDI will be measured in kWh/m^2/year;
4) Peak thermal load (PTL) will be measured in W/m^2;
5) Airtightness measurements are to be considered, on a basis air changes per hour at 50 Pa pressure differential (ACH_{50}) in a blower door test.

The building industry in BC has significant experience with several ways of determining the energy performance of buildings. These include the Built Green program and the previous 0-100 scale of the EnerGuide Rating System. As well, the Energy Star®, R-2000, Net-Zero Energy Ready and Passive House marks are recognized by members of the industry. Acceptance of the steps by industry and by local governments may be facilitated by comparing the steps with the experience of builders.

Step 1: 'Enhanced Compliance' - Energy Modelling and Airtightness Testing of Buildings

The Energy Step Code should require that builders and designers model their building as required under Subsection 9.36.5. of the BCBC or the EnerGuide Rating System (ERS). Under the Energy Step Code, at least one airtightness test of the building's air barrier will be required.

This step will require that builders undertake energy modelling and post-completion airtightness testing to receive their building/occupancy permit. There will be no specific performance requirements other than meeting the Code's requirement of matching the reference building's energy performance.

The BCBC does not require any specific airtightness performance level; however, it assumes an airtightness of either 2.5 or 3.2 ACH_{50}, depending on the construction of the house (Sentence 9.36.5.10.(9)). The Vancouver Building Bylaw, meanwhile, requires builders do a blower door test and achieve an ACH_{50} at least 3.5 (Sentence 10.2.2.12.(2)). The Part 9 Subcommittee agreed to align the airtightness target with Vancouver's target of 3.5 ACH_{50}. It was proposed by some members of the Subcommittee that the implementation of the airtightness testing target be postponed for a period of one to three years in order to enable training for builders to meet the target.

Compliance with Step 1 of the Energy Step Code would replace other requirements in Section 9.36. of the BCBC.

Step 2 – Step 4: Performance Tiers

These steps are is intended to improve energy performance and building airtightness compared to the base BC Building Code.

As identified in Tables 3 through 5, builders and designers will have to meet three targets – airtightness, envelope performance (through TEDI or PTL) and mechanical (through MEUI or compared to an ERS reference house). Even if a builder meets and exceeds the requirements in, for example, the mechanical metric through efficient equipment, they still must meet the requirements for envelope performance through TEDI or PTL, and the airtightness requirements.

In Tiers 2 through 4, they can model their building's performance using compliant software tools (including NRCan's HOT2000 software) to determine building performance compared to a reference building built to the base BC Building Code. Details on the targets are available in

Table 6 through Table 8.

It should be noted that these energy performance thresholds recommended in the Energy Step Code are intended to generally align with the requirements in existing voluntary building performance standards (Tier 2 is roughly equivalent to EnerGuide 80 under the previous EnerGuide Rating System; Tier 3 is roughly equivalent to ENERGY STAR®; and Tier 4 approaches R-2000 performance). The intention of the Energy Step Code is to enable homes to register for, and participate in, these programs should they wish, but does not require it as a condition of meeting the Energy Step Code. Compliance with these programs does not guarantee compliance with the Energy Step Code or vice versa.

The targets currently in

Table 6 through Table 8 are based on early modelling. More modelling will be undertaken to review the values below, which may be revised if warranted based on further modelling.

Step 5: High Performance

This tier is intended to represent the highest level of performance being consistently and economically achieved in BC today.

As identified in

Table 6 through Table 8, designers and builders will have to meet airtightness, MEUI, and envelope performance targets. The ERS reference house approach is not available as a compliance path for MEUI.

Because buildings are designed as an integrated system, the shape and orientation of a building, airtightness standards, modelling protocols, component performance and installation, and other factors, are complexly interrelated at high levels of performance. Designing and building to this level requires proper training, a fundamentally different approach to design, and attention to detail during construction.

The targets currently in

Table 6 through Table 8 are based on stakeholder input. As walls become thicker to increase insulation values, the risks and consequences of inadequate airtightness go up. It is important to observe existing provisions for envelopes to prevent unintended consequences such as mould, which would have occupant health impacts.

Table 6. Step structure and targets for Climate Zone 4

Step Level	Energy Modelling	Airtightness	Mechanical Energy Use	Envelope
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	3.5 ACH_{50}	BCBC using 9.36.5. or ERS v15 ref. house (MEUI of 80 kWh/m^2/year is likely, but not required)	Report on TEDI and PTL (Peak Thermal Load) (TEDI 50 kWh/m^2/year is likely, but not required)
Step 2 **10% Beyond Code**	Required	3.0 ACH_{50}	10% better than ERS v15 ref. house OR MEUI – 60 kWh/m^2/year	TEDI – 45 kWh/m^2/year OR PTL – 35 W/m^2
Step 3 **20% Beyond Code**	Required	2.5 ACH_{50}	20% better than ERS v15 ref. house OR MEUI – 45 kWh/m^2/year	TEDI – 40 kWh/m^2/year OR PTL – 30 W/m^2
Step 4 **40% Beyond Code**	Required	1.5 ACH_{50}	40% better than ERS v15 ref. house OR MEUI – 35 kWh/m^2/year	TEDI – 25 kWh/m^2/year OR PTL – 25 W/m^2
Step 5	Required	1.0 ACH_{50}	MEUI – 25 kWh/m^2/year (no ERS option)	TEDI – 15 kWh/m^2/year OR PTL – 10 W/m^2

Table 7. Step structure and targets for Climate Zone 5

Step Level	Energy Modelling	Airtightness	Mechanical Energy Use	Envelope
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	3.5 ACH_{50}	BCBC using 9.36.5.; OR ERS v15 ref. house (MEUI of 100 kWh/m^2/year is likely, but not required)	Report on TEDI and PTL (Peak Thermal Load) (TEDI of 65 kWh/m^2/year is likely, but not required)
Step 2 **10% Beyond Code**	Required	3.0 ACH_{50}	10% better than ERS v15 ref. house; OR MEUI – 90 kWh/m^2/year	TEDI – 60 kWh/m^2/year OR PTL – 55 W/m^2
Step 3 **20% Beyond Code**	Required	2.5 ACH_{50}	20% better than ERS v15 ref. house; OR MEUI – 75 kWh/m^2/year	TEDI – 50 kWh/m^2/year OR PTL – 45 W/m^2
Step 4 **40% Beyond Code**	Required	1.5 ACH_{50}	40% better than ERS v15 ref. house; OR MEUI – 45 kWh/m^2/year	TEDI – 40 kWh/m^2/year OR PTL – 40 W/m^2
Step 5	Required	1.0 ACH_{50}	MEUI – 25 kWh/m^2/year (no ERS option)	TEDI – 15 kWh/m^2/year OR PTL – 10 W/m^2

Table 8. Step structure and targets for Climate Zone 6, 7a, 7b, and 8

Step Level	Energy Modelling	Airtightness	Mechanical Energy Use	Envelope
Step 1 **Enhanced Compliance** (BC Building Code Performance)	Required	3.5 ACH_{50}	BCBC using 9.36.5.; OR ERS v15 ref. house (MEUI of 115 kWh/m^2/year is likely, but not required)	Report on TEDI and PTL (Peak Thermal Load) (TEDI 75 kWh/m^2/year is likely, but not required)
Step 2 **10% Beyond Code**	Required	3.0 ACH_{50}	10% better than ERS v15 ref. house; OR MEUI – 100 kWh/m^2/year	TEDI – 70 kWh/m^2/year OR PTL – 55 W/m^2
Step 3 **20% Beyond Code**	Required	2.5 ACH_{50}	20% better than ERS v15 ref. house; OR MEUI – 85 kWh/m^2/year	TEDI – 60 kWh/m^2/year OR PTL – 50 W/m^2
Step 4 **40% Beyond Code**	Required	1.5 ACH_{50}	40% better than ERS v15 ref. house; OR MEUI – 55 kWh/m^2/year	TEDI – 50 kWh/m^2/year OR PTL – 45 W/m^2
Step 5	Required	1.0 ACH_{50}	MEUI – 25 kWh/m^2/year (no ERS option)	TEDI – 15 kWh/m^2/year OR PTL – 10 W/m^2

The performance targets established in Tables 3, 4, and 5 are the result of energy modelling and analysis that focused primarily on archetypes for residential, single family homes in climate zone 4 using HOT2000 v11.2. The targets established for Climate Zones 5 and above (Tables 4 and 5) were established using a similar approach, but using a smaller sample size.

It is important to note that these targets are considered most appropriate for single family homes between 200 and 350 square metres of floor area, the sizes of the buildings in the archetypes developed for Section 9.36 and tested for the preliminary assessments for the impact of a Step Code. These targets may be uniquely challenging for small buildings (laneway houses and garden suites) and may be somewhat easier to satisfy in larger buildings (large single family as well as multi-family residential). Some participants have proposed setting different targets or sliding targets based on building size. This proposal will be reviewed in the upcoming year, to determine if there is sufficient reason to create new targets.

It is important to note that while modelling and analysis suggests that these targets can be implemented successfully, the members of the Part 9 subcommittee recommend that further analysis be completed to understand the implications of applying these targets to a wider range of building types, sizes, and climate zones.

Enhanced Compliance Framework

Energy Modelling

Energy modelling will be required to demonstrate compliance with all five steps. Builders can take advantage of energy modelling to organize complex technical and design elements to create high performance buildings. The performance steps proposed by the working group emphasize complex building envelopes, which are particularly sensitive to the relationship between materials. This increases the need for energy modelling to understand how a building is likely to perform. To ensure consistency and equity in complying with the proposed Energy Step Code, two conditions should be met:

1. The ongoing professionalization of energy modelling should continue. Passive House also has a rigorous qualification system to become a Certified Passive House Designer or Consultant. Under the new EnerGuide v15 system, this has been taken into consideration. The required services are defined in documents covering technical requirements, service delivery and quality assurance, and are tested in an updated examination system. These include:
    a. The ERS v15 Standard
    b. Technical Procedures
    c. HOT2000 v11 User Guide
    d. Administrative Procedures
    e. Quality Assurance Procedures
    f. Additional Support Documents

2. Develop standardized administrative requirements related to energy modelling and reporting. This should include ensuring the use of the standardized inputs and assumptions for energy modelling, as well as standardized reports to demonstrate compliance. The Province should endorse a list of administrative reporting requirements that can be adopted by local governments as an enforcement tool for the Energy Step Code. A recommendation has also been made to ensure that the reporting requirements for the Energy Step Code identifies equipment design and installation requirements in other parts of the BC Building Code, such as heat loss calculations and duct design that conform to Sections 9.32. and 9.33.

Airtightness Testing

The practice of testing a building's airtightness has been used in building codes in Vancouver for houses and in Washington State for all buildings for the last five and three years, respectively. Mandatory testing of the airtightness of a building has been demonstrated to improve the quality of construction of building envelopes. Further, the improved quality of construction and reduced air leakage correlates to improved energy performance in a sample of buildings reviewed in a recent study. The same research has also indicated that, in Canada, BC is the most ready jurisdiction for enacting airtightness testing requirements.

The Subcommittee discussed in Meeting 2 that mandatory airtightness testing be integrated as part of the Energy Step Code performance compliance framework. In the Part 3 Subcommittee, the membership agreed that the Province work with industry to review existing standards such as the CAN/CGSB-149.10-M86 standard or other airtightness measurement standard for use in the Energy Step Code. The working group has also identified that mandatory airtightness testing requires developing extra industry capacity to implement on a wider scale, which should be considered before introducing the requirement widely, in particular outside of the Lower Mainland and Southern Vancouver Island.

There are costs to builders, and potentially homebuyers, for both airtightness testing and energy modelling. To minimize these costs, the requirements are that only one airtightness test needs to be undertaken. However, best practice suggests a pre-drywall test and a post-construction test, as the pre-drywall test may help identify leaks while it is still cost-effective to remediate them.

It has been suggested by some members of the Subcommittee that some builders may require extra training in order to be able to meet future airtightness targets. Further training will be needed on the Energy Step Code requirements for builders working in jurisdictions that will adopt the Energy Step Code.

Steps for Non-residential Buildings

The targets in

Table 6 through Table 8 are intended for Residential (Group C) Part 9 buildings. It is recommended that a committee be established and tasked with developing appropriate targets for non-residential buildings, and that these recommendations be complete by July 2017. Though the ERS and reference building approach does not have the flexibility to apply to non-residential buildings, by allowing a compliance path outside the ERS, this report leaves open a separate compliance path that can apply to non-residential Part 9 buildings with little or no modification.

Incentive Programs and the Energy Step Code

The steps of the Energy Step Code are intended to align with existing voluntary programs in the market, such as ENERGY STAR®, R-2000, Passive House, and others. However, it is important to note that the targets identified in

Table 6 through Table 8 are not automatically achieved by complying with voluntary programs aligned with each step. Modelling analysis has found that an equipment-focused approach may satisfy a voluntary program such as Energy Star, but the building may not achieve the minimum TEDI target identified in

Table 6 through Table 8. Additionally, some voluntary programs allow builders and designers to account for on-site renewables, while the metrics in

Table 6 through Table 8do not include renewables in the efficiency of the building.

Appendix C: Part 9 Buildings Implementation Considerations

Opportunity for Review of All Step Targets Prior to December 2017

- Many subcommittee members have agreed to the contents of this recommendation report on the condition that ongoing analysis of the specific targets in each step will be carried out by committee member organizations, industry and energy modellers. This analysis will be completed and reviewed no later than July 2017. If the analysis and review demonstrates that changes are required to the figures in the proposed Energy Step Code steps, a recommendation will be made to update the Energy Step Code regulation prior to Section 5 of the Building Act taking effect on December 15, 2017.

Cost and Benefits

- The building industry and utilities are interested in participating in and supporting a study of the costs and benefits as part of implementation decision making, which would then be made available to AHJs. Other Subcommittee members are interested in ensuring that this study considers lifecycle costs, including operating costs; greenhouse gas emissions; and potentially consideration of other values (comfort, noise levels, etc.).

Local Government Implementation of the Energy Step Code

- The ways that AHJs implement the Energy Step Code will have a significant influence on the success of the Energy Step Code. If the Energy Step Code is immediately adopted by jurisdictions representing a large proportion of the new Part 9 development in the province, then there may be significant challenges in industry capacity, and supply of energy advisors and airtightness testing services. Support for the Energy Step Code assumes that implementation occur at a pace related to the development of widespread capacity in the industry to achieve these targets, market acceptance, while minimizing impacts on affordability.
- The group identified at the outset that achieving the higher steps may require significant incentives, be they financial (e.g. reduced development costs, tax incentives) or other benefits a builder could receive (e.g. increased density, setbacks measured from the interior instead of the exterior wall, expedited permitting). Steps 1 and 2 could be implemented with minimal additional cost to builders, and thus with more modest, or no, incentives.
- Industry is interested in understanding the pace at which AHJs will roll out stretch codes and the mechanisms AHJs will use to implement Steps. A process should be developed for Local Governments to indicate long-term plans for implementing the Energy Step Code. Some Subcommittee members have recommended that higher steps only be implemented as requirements after sufficient time and success has been demonstrated with lower steps.
- Owners and builders would like to know the process through which AHJs will notify land owners of the Energy Step Code requirements in their jurisdiction. Increased knowledge amongst the general public and the home buying/building community will create greater appreciation for efforts such as the Energy Step Code, and may increase market acceptance/transformation to speed adoption of

high performance homes. In this respect, awareness building amongst the public can be a key element of any implementation plan.

- Industry and local governments are seeking clarity on how to apply the Energy Step Code for mixed use buildings with residential and Group D (Business and Personal Services) or Group E (Mercantile) occupancies. Further guidance is required to apply the Energy Step Code to non-residential and mixed-use buildings successfully.
- Standardized compliance documents for the Energy Step Code would enable learning and make the Energy Step Code more consistent; a consistent form will be easier for users. The Ministry of Energy and Mines is working with local government stakeholders, industry and Natural Resources Canada to create this compliance form that can be generated by users of HOT2000 v11 software, to demonstrate compliance with any of the proposed stretch code steps, and will make this available free of charge to all users in BC.
- Training for building officials is crucial to success. The new requirements in the Energy Step Code will require building officials to become more familiar with energy modelling and how to inspect for compliance. BOABC should be directly involved in development of training materials and Local Governments should be made aware of the internal capacity required to administer the Energy Step Code.
- The development of a commissioning guideline should be considered. Specifically, a guideline that identifies compliance with key elements of the Energy Step Code and existing requirements for ventilation and HVAC systems in the BC Building Code.

Incentives

- Utilities have expressed concern that their incentive programs may not align with the metrics of the Energy Step Code. Further analysis is needed to inform all stakeholders about which existing incentive programs may or may not be available through the Energy Step Code.

The Future of the Energy Step Code

- Members want to ensure that there is engagement so that when the base BC Building Code changes, the Energy Step Code is also updated in an iterative process. The ENERGY STAR® and R-2000 standards are updated when Codes change; it is expected that Step 1 would also change, since it is the performance path to building to Code. There is interest in making this change as smooth as possible.
- A transparent process should be developed to review and update the Energy Step Code over time. This should include all stakeholder groups involved in the development of the Energy Step Code.
- A committee should be created to develop recommendations on Energy Step Code targets for Group D and E occupancies prior to December 2017.

Builders and Capacity

- Some subcommittee members have asked to ensure that, where the requirement is to build to higher steps, unintended consequences are avoided. These include ensuring that airtightness requirements do not lead to envelope problems such as leakage through the exterior membrane and condensation travelling into the envelope and causing mould.
- Achieving more energy efficient envelopes require builders use products that perform better than conventional products easily available throughout the province. Engagement with suppliers will help ensure there are enough high performance building supplies available, especially in small markets. With the rapid evolution of equipment and products, building officials, energy advisors, and those in charge of developing the Energy Step Code will need to remain informed on new equipment and standards.
- Some members of industry may be able to hit the first three steps quickly, but many members will need time to build capacity in order to meet the lower as well as upper steps. Jurisdictions should be aware that mandating higher Steps could end up excluding some industry members from building in the jurisdiction without investments in capacity building and training.
- Outreach and education for Building Officials, elected officials, builders, trades and contractors is critical in enabling the industry to build to the Energy Step Code targets and provide advice and good policy making around the Energy Step Code.
- Some builders require extra training on building airtight envelopes. BC Housing's Technical Research team, with contributions from BC Hydro and City of Vancouver, will be providing airtightness training to builders in winter 2016-2017, and other training opportunities should be developed to ensure builders can meet both the targets of the Energy Step Code.
- Training and building costs will differ for smaller versus larger companies. Training to prepare for the Energy Step Code should consider how to reduce the impact on those companies who may have higher per unit training costs; and opportunities to reduce acquisition costs for high performance equipment in bulk/lower per unit cost should be explored.

Energy Advisors and Energy Modelling

- Include energy modelling programs that demonstrate their capability for modelling the building to the targets of the Energy Step Code.
- Professionalization and capacity building of energy modelling providers will increase confidence that reports reflect the targets –guidelines and 'certification' of qualified energy modellers and programs will enable this. Builders will rely on energy modellers' expertise to meet stretch code targets. NRCan and CACEA will be critical to enable builders to have the resources available to meet the Energy Step Code.
- Some Subcommittee members have recommended a change to the Community Charter to allow energy modellers to take legal responsibility for energy efficiency, similar to Part 3 structure with Letters of Assurance.

Affordable and Smaller Buildings

- It may be more difficult to construct small buildings to Steps 2 to 5 standards, relative to larger buildings. Some subcommittee members encourage considering relaxation, exemption, or separate steps for small buildings. This was previously done in Nova Scotia. Several stakeholders have agreed to work on developing specific targets for different building sizes and make recommendations by summer 2017.

Building Officials

- If there is increased demand on building officials, Authorities Having Jurisdiction (AHJs) may need to increase capacity in order to be able to sign off on those choosing to model to the ERS reference house. Limiting the extra demand on building officials' time will make stretch codes more acceptable.
- There is less of a structure of assurance for Part 9 buildings than there is for Part 3 buildings; building officials bear the onus for certifying a building compared to the requirements for professionals in Part 3 buildings. This may require more training for Part 9 building officials, or greater professionalization of energy advisors.
- Consistency between plan checking/approval staff and inspection staff, especially when performance approaches are employed, will provide industry greater assurance that approved plans will be passed at inspection stage.

Airtightness Testing

- The airtightness target could be reported in NLA or ELA, as opposed to ACH_{50} to reduce the penalization for smaller buildings.
- The chosen airtightness testing procedures should be clarified – will it be the CAN/CGSB-149.10 standard used in the Building Code or should it be a more stringent test that requires both pressurization and depressurization? Who should decide on the standard – the SCIWG, or a standards committee?
- One industry member mentioned their concern for letting the lower steps be governed by lower targets, particularly for airtightness, but not having the higher steps set closer to higher targets such as those set in high performance standard. They mentioned that airtightness failures in high performance buildings have greater consequences than in conventional buildings – condensation in the envelope will have a much greater impact on higher performance buildings, and the risks of condensation should inform airtightness targets.
- It was suggested by members of the subcommittee that an airtightness target only be brought into Step 1 when and where the building industry has the capacity to build tighter buildings. At least two stakeholders suggested that the airtightness requirement for Step 1 increase annually, from a less stringent target (e.g. 5 ACH_{50}) to a more stringent target after two years, e.g. 2.5 ACH_{50}).

Appendix D: Potential Supports Needed for Implementation of the Step Code

Table 9. Potential Implementation Supports for Part 3 Buildings

	Needs	Known Assets	Supports Needed (Who will do it)
Part 3			
Step 1	1. Airtightness testing (equipment and trained people) 2. Commissioning requirements 3. Energy modelling (qualified professionals) and consistency about which models to use 4. Potential for letters of assurance	1. Capacity exists in Seattle's well-developed market. Building Envelope Professionals could provide this with minimal lead time. 2. The commissioning market can be easily added to through current engineering firm capacity. Many projects are being commissioned through LEED with no issues. CSA commissioning guidelines. 3. Energy Modelling – With moderate uptake, there is capacity in the market, there is potential to free up the market capacity by cooperation on modelling standards and reports (i.e., doing 1 model instead of 4 to demonstrate compliance with Code, BC Hydro, density bonus etc.) 3. Building Envelope Thermal Bridging guide	1. The development of an airtightness testing procedural manual 2. The development of a professional practice guideline for Commissioning would be useful (which models to use when – consistency) 2. Training on pre-occupancy commissioning (depends on timing, etc.) 3. The development of Professional Practice Guidelines for Energy Modelling will help APEGBC and AIBC better regulate this industry IBPSA 3. Alignment of modelling requirements between the Step Code and the utilities would free up much capacity 4. Investigate letters of assurance need – energy discipline focus (coordination/mechanism) 4. Document related benefits beyond energy Warranty providers engaged → incentive
Step 2 Best Practices (heating 45 kWh/m²/yr)	1. Enhanced envelope construction practices (e.g., steel stud, Roxul insulation, concrete sandwich panels, wood) 2. Incremental cost ~(2-5% cost increase) 3. Potential conflict with DE / offset opportunity for renewable energy	1. All technologies required to meet these levels are currently available and being implemented in the local market (lower mainland) 2. City of Surrey to look at bus case DE vs. Step Code step compliance 3. City of Vancouver + IBPSA draft energy (modelling) guidelines	1. Continued expansion of the Building Envelope Thermal Bridging guide will help designers with improved envelope requirements 1. Illustrated guides (prescriptive recommendations) 1. APEGBC professional guidance, webinars, training 2. Enable LG to use tools to adopt Step Code 2. Financial mechanism and/or incentives
Step 3 High Efficiency Building (heating 30 kWh/m²/yr)	1. May require triple pane windows, etc. 2. May lead to increased construction costs (~10%) 3. May conflict with existing design guidelines 4. May need new innovative designs or products or whole new approach	2. BC Hydro – Commercial New Construction Program 2. Local government Density Bonusing Programs in a few areas 3. Surrey, Vancouver have guidelines to support design 4. International guidelines	2. Ensure clear link between utility incentive programs and Step Code steps 2. Financial mechanisms and incentives step 2+ 3. Review design guidelines, educate design panels 4. Process/policy for adopting innovative designs and products 4. BC specific guidance on innovation; design competition 4. Leadership from public sector buildings 4. HPO research on potential impacts/cost effective approaches to achieving and overcoming issues
Step 4 "Passive House-like" performance (heating 15 kWh/m²/yr)	1. Higher airtightness performance may require further training/equipment (not as prominent at this stage) → greater focus on training to improve design at this level – improve collaborative, iterative design approach 2. Improved performance of residential windows, and sliding doors 3. Incentives to cover incremental cost.	1. Passive House trades certification and HPO building smart training series 2. There are provincial incentives to assist the window industry to modernize in BC (Province developing checklists for compliance)	1. More HPO supported training on building airtightness detailing 1. Guidance for integrated design, increase capacity

Note: Points in lower steps also apply to higher ones

Table 10. Potential Implementation Supports for Part 9 Buildings

	Needs	Known Assets	Supports Needed
Part 9			
Step 1 Enhanced Compliance	1. Capacity to build airtight envelopes to 3.5 ACH 2. Airtightness testing (equipment and trained people) 3. Energy modelling (qualified people) in EnerGuide for New Houses (EGNH) 4. Capacity for compliance, checklist/forms – building officials, energy advisors	1. Projects currently building to this standard throughout the province 2. Lower mainland and southern Vancouver Island have greater access to testing 3. NRCan HOT 2000 Energy Modelling software and others (passive house) 4. Straw-dog standards for meeting compliance/commissioning needs to be developed shortly; also compliance checklists being created	1. Training to get to 3.5 (more focus outside lower mainland) 2. Training and equipment for airtightness testing by qualified persons (more focus for outside lower mainland) 2. Best practice guide for builders to hit targets (Pre-drywall testing) 3. Practice guidelines for energy modelling 4. Warranty providers – savings on rates due to 3rd-party oversights
Step 2 10% beyond code Roughly EGNH 80	1. Capacity to build airtight envelopes to 3.0 ACH 2. Awareness re: appropriate designs for T2 and construct as designed	1. Can be done within current market capacity in the lower mainland 1. GVHBA and Built Green Program 1. HPO enhanced licensing system for BC residential builders (20 hours training – not specifically code-related required, but portion must be technical)	1. Possible training programs to be offered by BCIT, GVHBA, and HPO on airtightness detailing (more focus needed outside lower mainland) 2. Clear communications to builders, building officials on requirements
Step 3 20% beyond code Roughly Energy Star	1. Industry knowledge and capacity on envelope packages to achieve R22 or better 2. May lead to increased construction costs for specific items – analysis to determine level of financial incentives needed 3. May be harder to meet under local government design guidelines (may conflict with heritage requirements); consider mechanism to recognize renewable energy "offset"	1. HPO R22 Building Guide (Vancouver) 1. NRCan ENERGY STAR® training (including BC program support) + ENERGY STAR® Brand 2. Utility incentive and industry support programs 3. Currently adding SFH details to HPO Thermal bridging guidance 3. City of Vancouver passive design guidelines	1. Possible training programs to be offered by BCIT, GVHBA, and HPO on airtightness detailing 1. Communication path/mechanism for other trades beyond carpentry, also for builders + best practice to assist builders 1. Municipal best practices for understanding regional capacity to meet T3 and potential costs (also for consistency between building officials, plan checkers, etc - BOABC) 1. Illustrated guides 2. Enable local governments to use tools to adopt the Step Code 2. Ensure clear link between utility incentive programs and Step Code steps 2. Financial mechanisms 3. Municipalities to review design guidelines to ensure not limiting steps (incorporate in best practices)
Step 4 40% beyond code Roughly R2000	Same as above May need innovative products (e.g., non-CSA) Additional guidance on building envelope designs	Same as above Canadian Wood Council's online calculator R2000 training through CHBABC	Same as above Policy or process for approval of innovative products (e.g., non-CSA) Training across the province
Step 5 50%+ beyond code Passive House & Net Zero Ready	1. Capacity to deliver super airtight buildings 2. Limited number of window manufacturers offer passive house level windows 3. Limited mechanical equipment (ERVs/HRVs)	1. Some prefab builders 2. Passive House Canada and GVHBA lead industry training programs 2. Net Zero energy program is led by CHBA national	1. HPO to review potential unintended consequences, techniques/approaches for cost-effective approaches to meeting steps