

Proposed Changes to Part 9 Energy Step Code Requirements

April 20, 2023



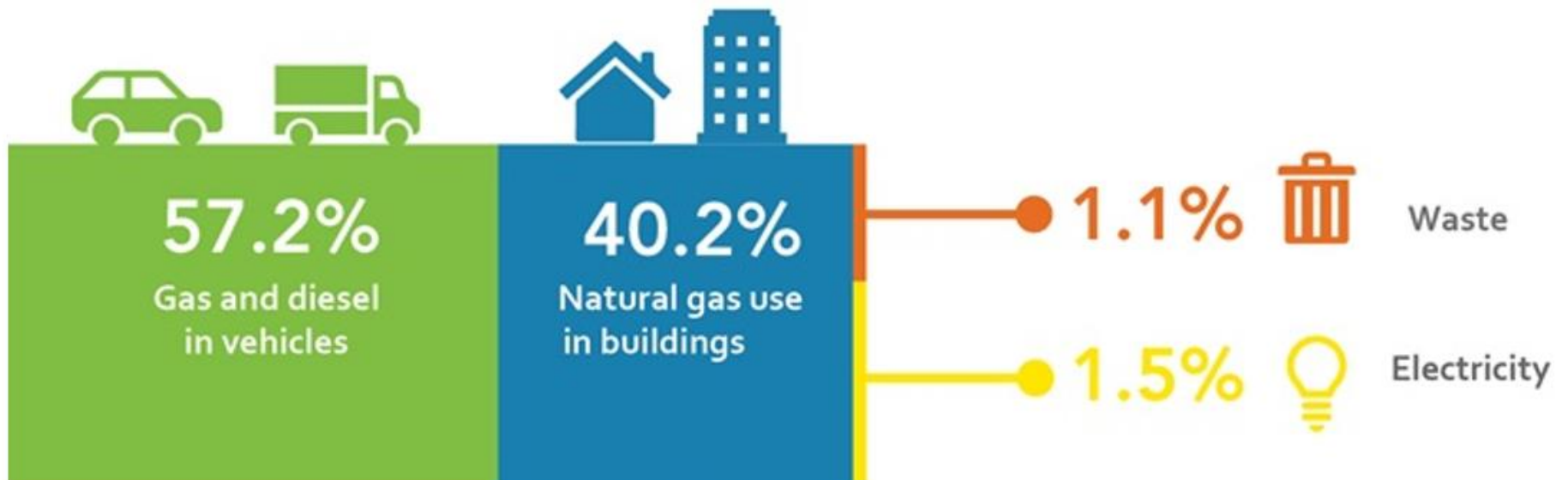
Agenda

1. Welcome and Introductions
2. Background to BC Energy Step Code
3. Overview of Proposed Changes to North Shore Energy Step Code Requirements for Part 9 Buildings
4. Technical Skills and Training Programs for the Upper Steps
 - Mary McWilliam, BCIT
5. Discussion
6. City of North Vancouver's Proposed New Mechanical Permit

Climate Action Goals

North Shore municipalities' climate target:

- Net zero by 2050



Sources of emissions in the City of North Vancouver (2020 data)

Provincial Context

Zero-carbon new construction by 2030

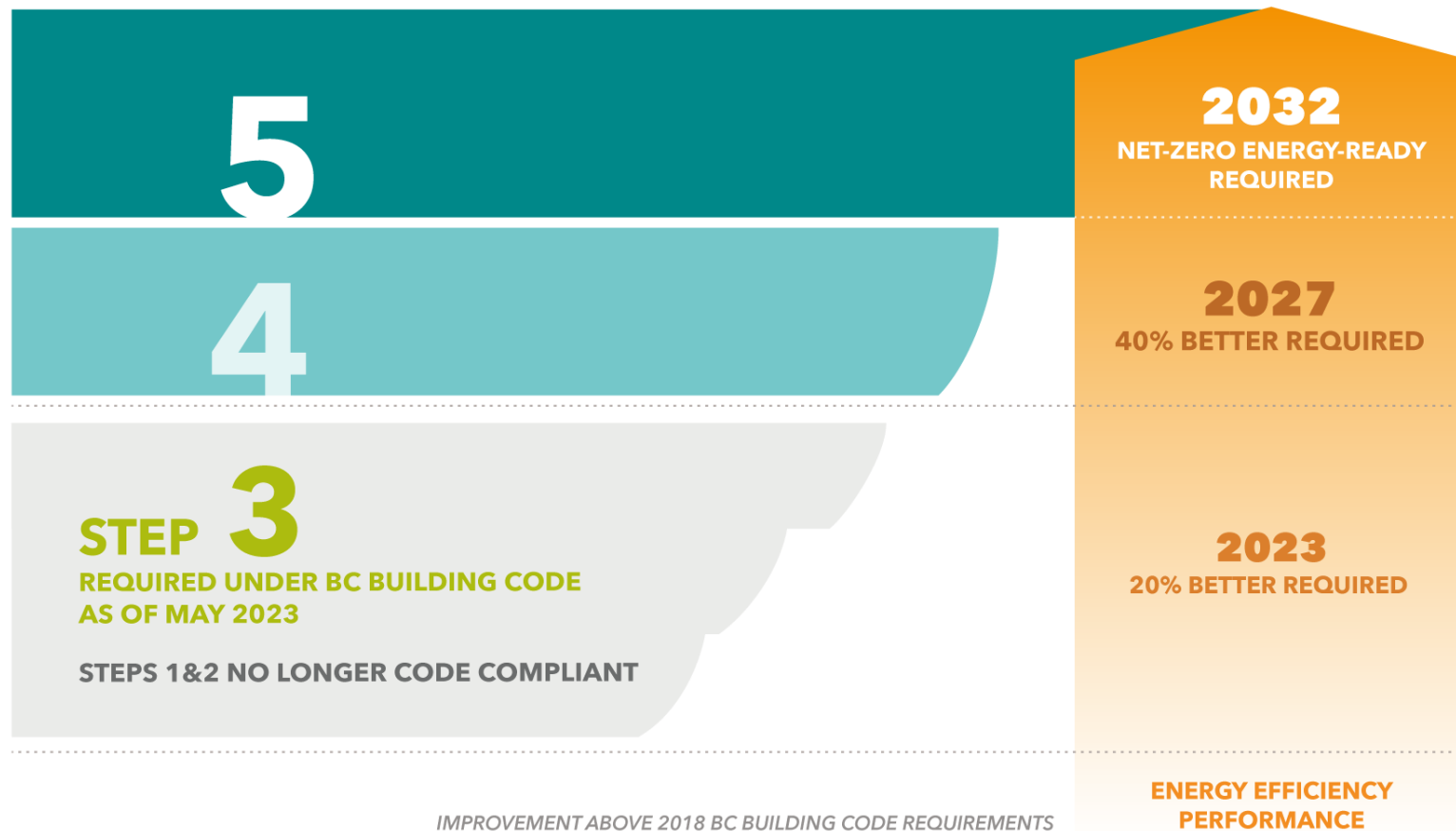
Net zero energy ready new construction by 2032



BC Energy Step Code



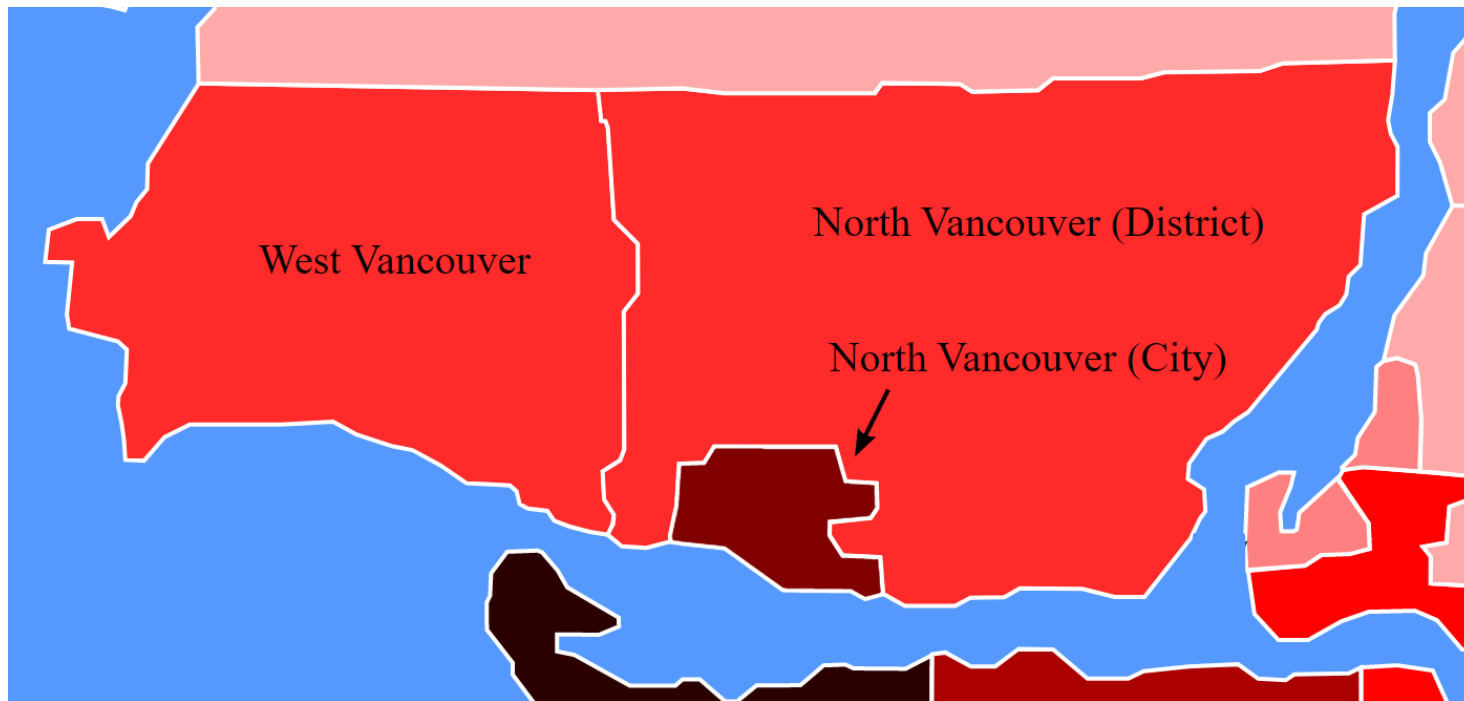
Province's Timeline



North Shore Step Code Adoption to Date

	Prior to 2017 (Density Bonus)	December, 2017	July, 2018	July, 2021
Part 9 Residential (Greater than 1200 sq.ft.)	1% Bond + EnerGuide 80	Step 2	Step 3	Step 5 Or Step 3 + Low Carbon

North Shore Inter-Municipal Alignment



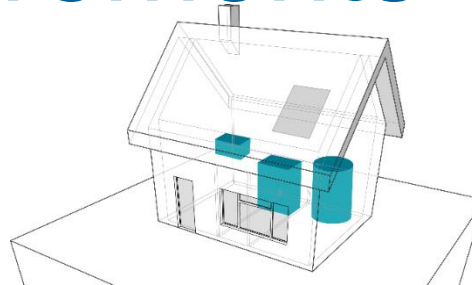
Proposed Changes for Part 9 Buildings: Moving to Step 4

	Current Requirement	Proposed Requirement Effective September 1, 2023
Part 9 Residential Buildings	Step 5 Or Step 3 + Low Carbon	Step 5 Or Step 4 + Low Carbon

Benefits:

- Improved efficiency
- Lower utility bills
- Increased comfort and resiliency

Step 4 Requirements



	Airtightness	Equipment and Systems Mechanical Energy Use Intensity (MEUI)	Building Enclosure Thermal Energy Demand Intensity (TEDI)
Step 4	$\leq 1.5 \text{ ACH}_{50}$	MEUI: 45 kWh/(m ² year)	TEDI: $\leq 20 \text{ kWh}/(\text{m}^2\text{year})$ Or Adjusted TEDI: 28 kWh/(m ² year) Or 20% better than reference house
Step 3	$\leq 2.5 \text{ ACH}_{50}$	MEUI: 55 kWh/(m ² year)	(TEDI): $\leq 30 \text{ kWh}/(\text{m}^2\text{year})$ Or Adjusted TEDI: 38 kWh/(m ² year) Or 10% better than reference house

Technical Skills and Training Programs for the Upper Steps

Mary McWilliam, BCIT

Zero Energy/Emissions Buildings Learning Centre

School of Construction and the Environment



April 20, 2023 North Shore Energy Step Code Consultation

Topics

- About BCIT's ZEB Learning Centre
- Energy Step Code 3 to 4 – What does this mean?
- Knowledge and skills needed for Net Zero Energy-ready construction
- Courses and credentials

ZEB Learning Centre

Established to support industry transition to Net Zero (since 2016)

- Public and private training
- Industry events & workshops
- Support to other BCIT programs



Our Instructor Team

Industry expertise from a wide variety of roles in Part 3 & Part 9 design & construction



**2021 CaGBC Inspired
Educator of the year**



**2022 VRCA
Educational Leadership
Award**

Knowledge and Skills Needed

- Design features that affect compliance with performance metrics
- Building science issues & solutions in NZE-ready buildings
- Design and construction practices that reduce risk and provide value
 - Integrated design practices
 - Site supervision practices and responsibilities
 - Trades training
- Hands-on practice and solutions for detailing new assemblies and realizing Passive or Step 5 airtightness levels

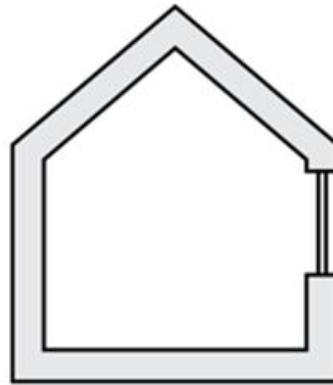
Step 3 to Step 4 - What is Changing?

The Metrics (Part 9 buildings)



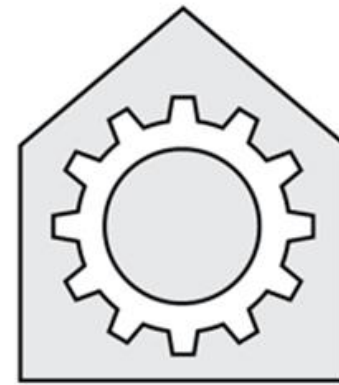
Airtightness

ACH50
Air Changes per House
@ 50 Pascals



Envelope

TEDI
Thermal Energy Demand
Intensity (kWh/m² yr)



Equipment &
Systems

MEUI
Mechanical Energy Use
Intensity (kWh/m² yr)

9.36.6 Energy Step Code Step 3 vs. 4

Airtightness

Note: May 1st BCBC code update - new additional NLR and NLA airtightness testing metrics – allows leniency for smaller homes




Airtightness

Table 9.36.7.4.
Airtightness Levels
Forming Part of Sentence 9.36.7.4.(1)

	<u>Airtightness Levels</u>	<u>Airtightness Metrics</u>		
		<u>ACH₅₀</u>	<u>NLA₁₀, cm²/m²</u>	<u>NLR₅₀, L/sxm²</u>
		<u>Maximum Airtightness Values</u>		
STEP 3	<u>AL-1</u>	<u>2.5</u>	<u>1.20</u>	<u>0.89</u>
STEP 4*	<u>AL-3</u>	<u>1.5</u>	<u>0.72</u>	<u>0.53</u>
STEP 5*	<u>AL-4</u>	<u>1.0</u>	<u>0.48</u>	<u>0.35</u>
Passive House Standard		≤ 0.6		

Airtightness - What is Possible?

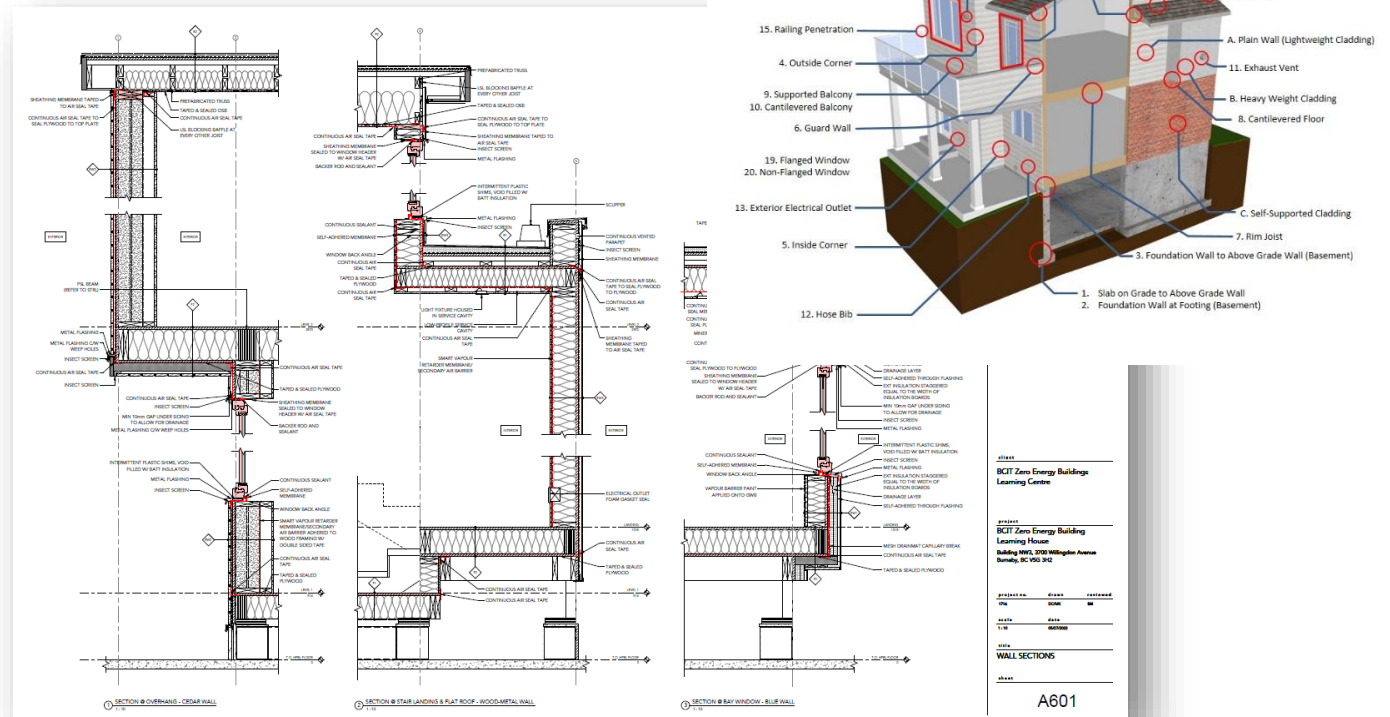
Even small houses can achieve exceptional airtightness

	Name	Location	TFA	Stories	ACH@50 Pa
	West Bay House	West Vancouver	295 m ² (3176 sqft)	3	0.4
	3612 Point Grey	Vancouver	148 m ² (1597 sqft)	2	0.19
	North Vancouver Passive House - Moodyville	North Vancouver	270 m ² (3300 sqft)	2 + basement	0.29

Airtightness 2.5 ACH to 1.5 ACH

Trends

- Improved architectural designs
- Simplification of AB details
- Shift towards more resilient AB solutions



Airtightness 2.5 ACH to 1.5 ACH

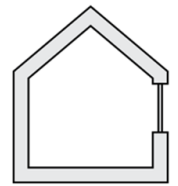
Trends

- Increased use of higher performance AB materials, accessories, and airtight components
- Diligent site supervision with AB oversight
- Enhanced coordination of work and trades work interfaces
- Crew and sub-trade training



9.36.6 Energy Step Code Step 3 vs. 4

Thermal Energy Demand Intensity (TEDI)



Envelope

Table 9.36.6.3.-A
Requirements for Buildings Located Where the Degree-Days Below 18°C Value is less than 3000⁽¹⁾
 Forming Part of Sentence 9.36.6.3.(1)

	Step	Airtightness ⁽²⁾	Performance Requirement of <i>Building</i> Equipment and Systems	Performance Requirement of <i>Building</i> Envelope
STEP 3	3	AL-1	The applicable mechanical energy use intensity requirements in Table 9.36.6.3.-H	Thermal energy demand intensity $\leq 30 \text{ kWh}/(\text{m}^2 \cdot \text{year})$, <i>or</i> thermal energy demand intensity not exceeding the value calculated in accordance with Sentence (4)
STEP 4*	4	AL-3	The applicable mechanical energy use intensity requirements in Table 9.36.6.3.-H	Thermal energy demand intensity $\leq 20 \text{ kWh}/(\text{m}^2 \cdot \text{year})$, <i>or</i> thermal energy demand intensity not exceeding the value calculated in accordance with Sentence (4)
STEP 5*	5	AL-4	The applicable mechanical energy use intensity requirements in Table 9.36.6.3.-H	Thermal energy demand intensity $\leq 15 \text{ kWh}/(\text{m}^2 \cdot \text{year})$, <i>or</i> thermal energy demand intensity not exceeding the value calculated in accordance with Sentence (4)

Notes to Table 9.36.6.3.-A:

⁽¹⁾ See Sentence 1.1.3.1.(1) and Table C-2 in Appendix C.

⁽²⁾ See Table 9.36.7.4

Passive House Standard

$\leq 15 \text{ kWh}/\text{m}^2 \text{ yr}$

Most Common Solutions to Reduce TEDI

WHAT ARE THE MOST COMMON ENERGY SAVING MEASURES (ESMS)?

Building envelope:

- ▶ The most common ESMS used were better air tightness (90%), improved insulation (72%), reduced thermal bridging (64%), and use of high-performance windows and doors (61%).



90%

Used better air tightness



72%

Used improved insulation



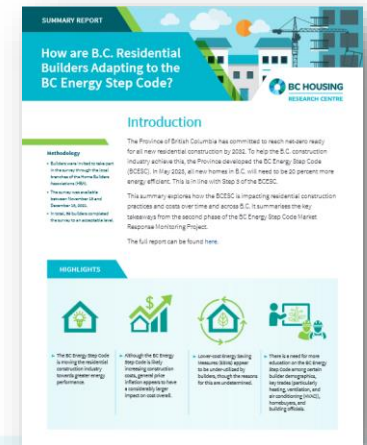
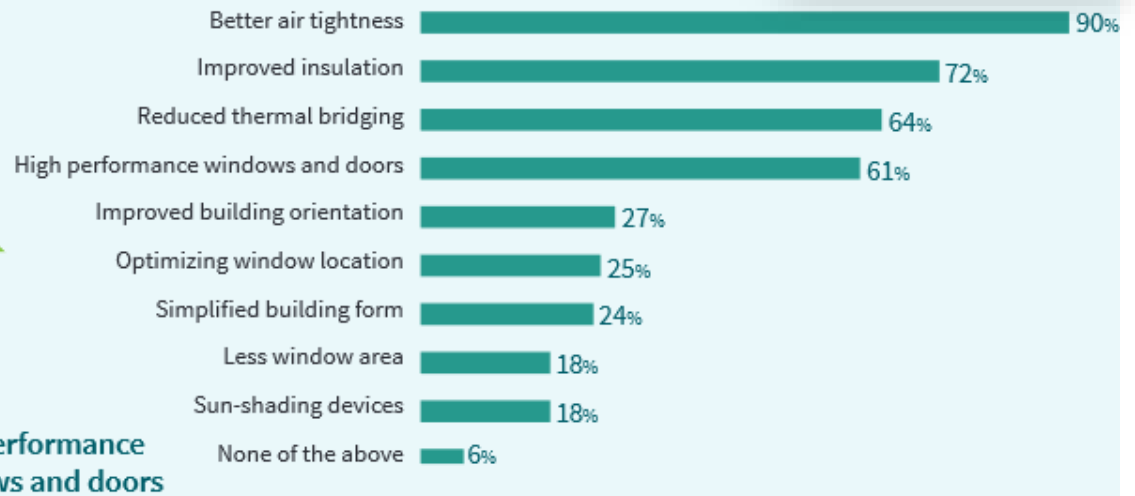
64%

Used reduced thermal bridging



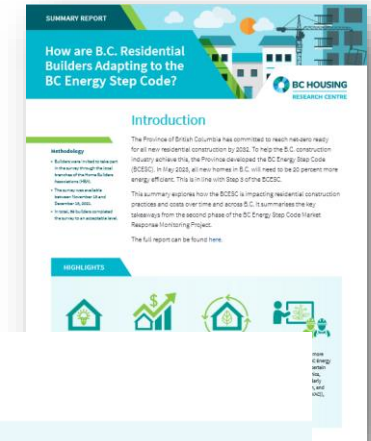
61%

Used high-performance windows and doors



Source: BC Energy Step Code Market Response Study (BC Housing 2020)

Lowest Cost Solutions to Reduce TEDI



WHICH ENERGY SAVING MEASURES IMPACT COMPONENT COSTS THE LEAST?

Building envelope:

▶ 75% or more reported either a decrease or no change in component cost when optimizing window location (86%), simplifying the building form (80%), less window area (80%), and improving the building orientation (75%).



86%
Optimizing window location



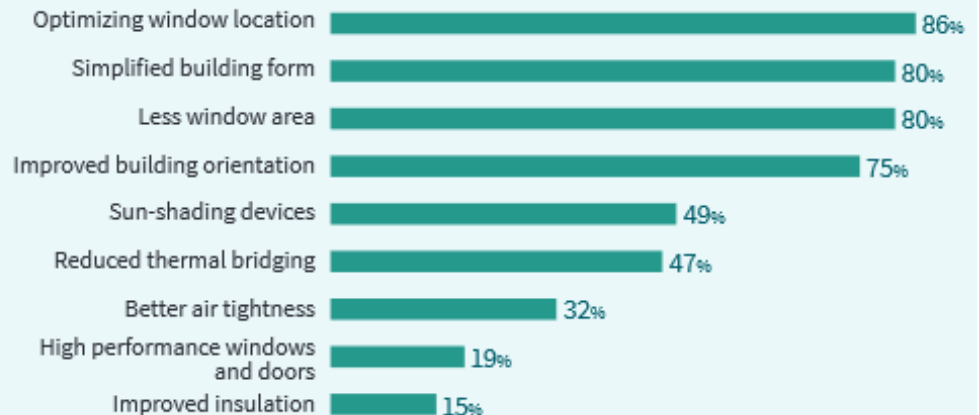
80%
Simplifying building form



80%
Less window area



75%
Improving building orientation

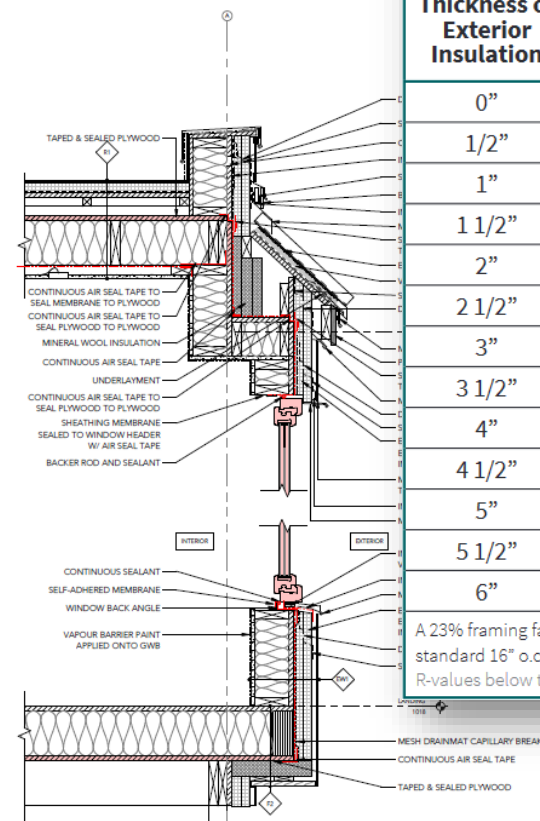


Source: BC Energy Step Code Market Response Study (BC Housing 2020)

TEDI ≤ 30 to ≤ 20 kWh/m² yr

Trends

- Simplified architectural designs
- Improved airtightness
- Improved thermal performance of windows and doors
- More insulation
- Trades training



Effective Assembly R-value of Split Insulation Wall Assembly [ft ² ·°F·hr/Btu]				
Thickness of Exterior Insulation	2x4 Stud Wall (R-12 Batts)		2x6 Stud Wall (R-19 Batts)	
	R-4.0	R-5.0	R-4.0	R-5.0
0"	11.3	11.3	16.2	16.2
1/2"	13.4	13.9	18.4	18.9
1"	15.4	16.4	20.4	21.4
1 1/2"	17.4	18.9	22.4	23.9
2"	19.4	21.4	24.4	26.4
2 1/2"	21.4	23.9	26.4	28.9
3"	23.4	26.4	28.4	31.4
3 1/2"	25.4	28.9	30.4	33.9
4"	27.4	31.4	32.4	36.4
4 1/2"	29.4	33.9	34.4	38.9
5"	31.4	36.4	36.4	41.4
5 1/2"	33.4	38.9	38.4	43.9
6"	35.4	41.4	40.4	46.4

A 23% framing factor is assumed which is consistent with standard 16" o.c. stud framing practices.
R-values below the R-22 requirement

TEDI ≤ 30 to ≤ 20 kWh/m² yr



Considerations

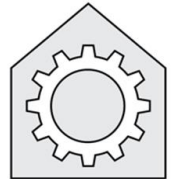
- Challenging for buildings with complex form:
 - Need enhanced enclosure performance
 - Expect problems with TEDI pathway

3,800 ft ² Home, CZ4 – Achieving TEDI		
STEP 3	STEP 4	STEP 5
Complex form, slightly above Code minimum thermal performance	minimal improvement of assemblies thermal performance	enhancement of assembly performance – inline with VBBL minimums
TEDI ≤ 30 42 kWh/m ² yr - FAIL	TEDI ≤ 20 38 kWh/m ² yr - FAIL	TEDI ≤ 15 24 kWh/m ² yr - FAIL
Envelope 10% Better – 16%- PASS	Envelope 20% Better – 24%- PASS	Envelope 50% Better – 51%- PASS
ACH = 2.5	ACH = 1.5	ACH = 1.0

9.36.6 Energy Step Code Step 3 vs. 4

Mechanical Energy Use Intensity (MEUI)

Note: May 1st BCBC code update - new minimum efficiency requirements for HVAC equipment (9.36.3.10) and service water heating equipment (9.36.4.2)



Equipment & Systems

Table 9.36.6.3.-H
Mechanical Energy Use Intensity Requirements
 Forming Part of Sentence 9.36.6.3.(1)

Heating Degree-Days of Building Location ⁽¹⁾ , in Celsius Degree-Days	Amount of the Building's Conditioned Space Served by Space-Cooling Equipment	Step	Floor Area of Conditioned Space (m ²)						
			≤ 50	51 to 75	76 to 120	121 to 165	166 to 210	> 210	
			Mechanical Energy Use Intensity, kWh/(m ² •year)						
Less than 3000	Not more than 50%	2	Reserved						
		STEP 3	3	120	100	75	63	53	50
		STEP 4*	4	90	80	60	48	40	40
		STEP 5*	5	65	55	40	30	25	25
		2	Reserved						
	More than 50%	STEP 3	3	155	128	93	73	60	55
		STEP 4*	4	125	108	78	58	48	45
		STEP 5*	5	100	83	58	40	33	30
		2	Reserved						
		2	Reserved						

MEUI ≤ 55 to ≤ 45 kWh/m² yr

Considerations

- With ASHP MEUI requirements are not expected to be challenging
- DHW loads become more significant – system efficiency
 - *May 1st BCBC code update changes how DHW loads are calculated per dwelling unit (9.36.5.8)*
- Value of good HVAC design and right-sizing of equipment
- Focus on quality of HVAC installation

Comparison of 2 Homes, STEP 4 compliance



Complex form, slightly above Code minimum assemblies performance



Simplified form, enhanced assemblies performance

Most Common Solutions to Reduce MEUI

WHAT ARE THE MOST COMMON ENERGY SAVING MEASURES (ESMS)?

Mechanical System:

- ▶ The most common ESMS used were Heat Recovery Ventilators (HRVs) / Energy Recovery Ventilators (ERVs) (73%) and heat pumps for heating/cooling (72%).



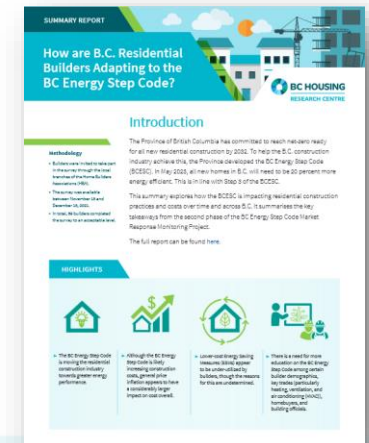
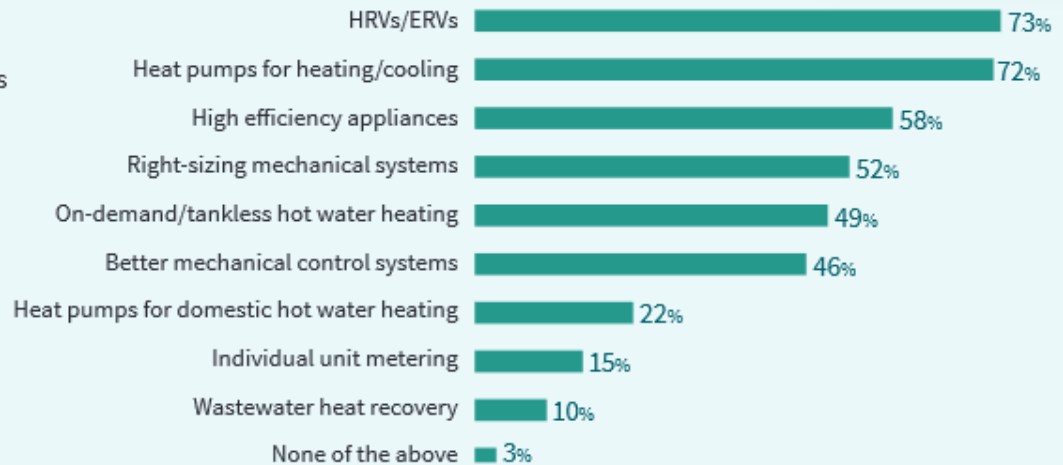
73%

Used HRVs/ERVs



72%

Used heat pumps



Source: BC Energy Step Code Market Response Study (BC Housing 2020)

Lowest Cost Solutions to Reduce MEUI

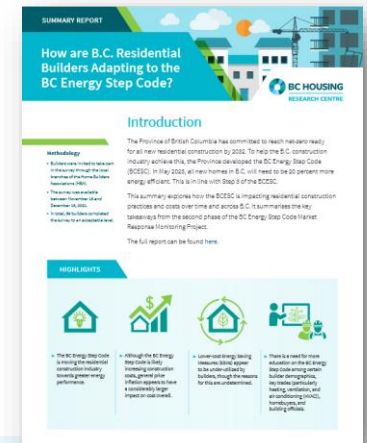
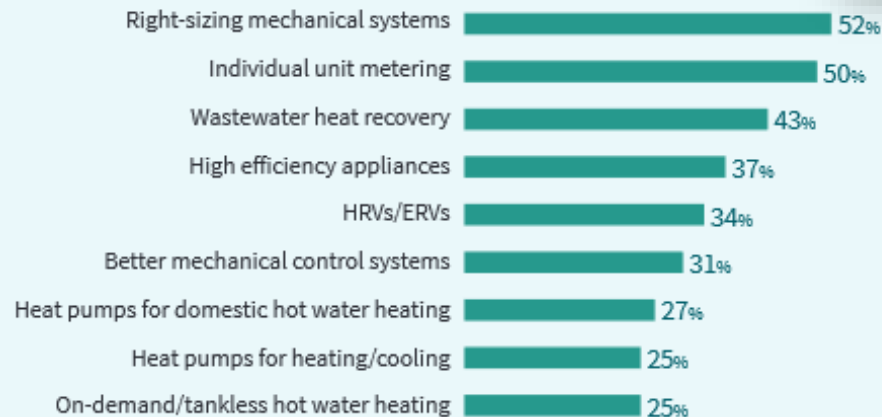
WHICH ENERGY SAVING MEASURES IMPACT COMPONENT COSTS THE LEAST?

Mechanical System:

- ▶ Half reported either a decrease or no change in component cost when right-sizing the mechanical system (52%).



52%
Right-sizing the mechanical system



Source: BC Energy Step Code Market Response Study (BC Housing 2020)

Preparing for Transition to Energy Step Code Steps 4 and 5 and Low Carbon Energy Step Code

ENERGY
STEPCODE
BUILDING BEYOND THE STANDARD



BCIT ZEB Learning Topics

- Passive House, Energy and Zero Carbon Step Code
- Airtightness and Low-TEDI Assemblies
- Mechanical Systems – Net Zero Part 9
- Net Zero & Passive House Site Supervision
- Electrical Systems – Net Zero Part 9
- Embodied Carbon and Whole Building LCA



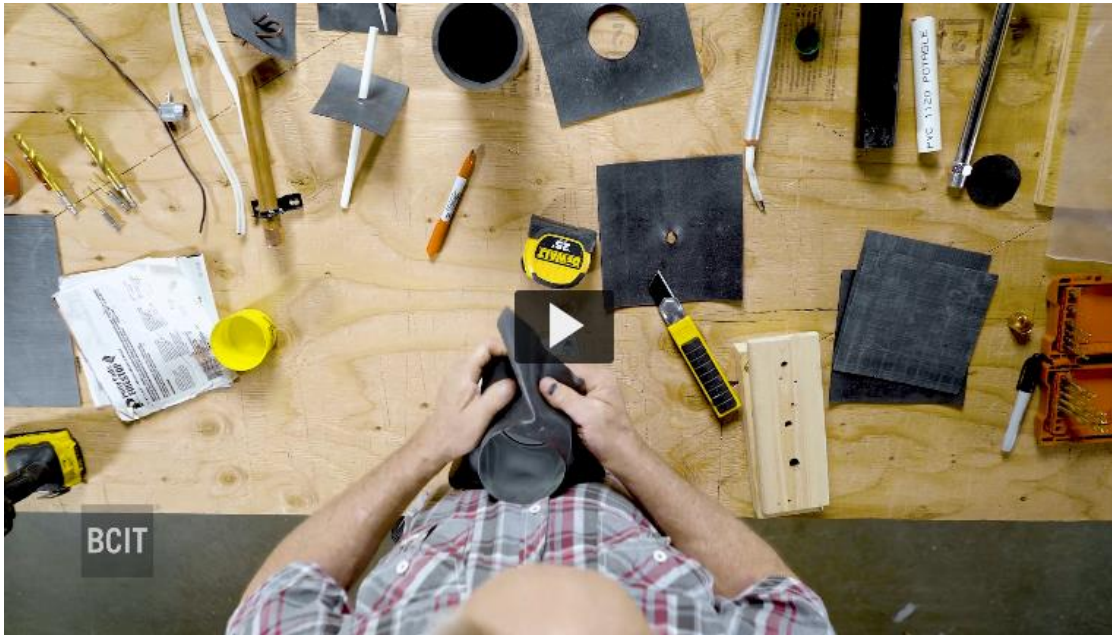
Hands-on Learning

- Library of mock-ups for demonstration and investigation
- Mock-up construction
- Testing of student work






Online Learning

- Live Filmed
- Library of How-to Videos



Courses by Topic

Eligible for Continued Professional Development Credits

- **Fundamentals** of Energy Step Code and Passive House Standard
 - [XZEB 1001](#) Fundamentals of Zero Energy/Emissions and Passive House Buildings  Mandatory ESC Training Modules 1,2
- **Airtightness and Low-TEDI Enclosures** of Zero Energy/Emissions and Passive House Buildings
 - [XZEB 1120](#) Airtightness and Low-TEDI Enclosures for Builders / Trades / Designers  Mandatory ESC Training Modules 3,4,5,7,8
 - [XZEB 1130](#) Airtightness and Low-TEDI Enclosures **hands-on Lab** for Builders / Trades / Designers
- **Mechanical and Electrical Essentials** for Zero Energy/Emissions and Passive House Buildings
 - [XZEB 1140](#) Introduction to Residential Mechanical Systems for Builders / Designers  Mandatory ESC Training Modules 2,6,8
 - [XZEB 1146](#) Mechanical and Electrical Essentials for Site Supervisors
 - [XZEB 1150](#) Intro. to Residential Integrated Solar Photovoltaic Systems for Builders / Designers
 - [XZEB 1143](#) Residential Air Source Heat Pump Installation Skills for Contractors
- **Supervision** of Zero Energy/Emissions and Passive House Construction
 - [XZEB 1171](#) Site Supervision of Zero Energy/Emissions and Passive House Construction
 - [XZEB 1173](#) Applied Project for Site Supervision of Zero Energy/Emissions and Passive House Construction



Passive House Tradesperson Course Provider



ARCHITECTURAL INSTITUTE OF BRITISH COLUMBIA

Recognized Educational Provider



Certifications

BCIT Microcredentials



Supervising Net-Zero and
Passive House
Construction

<i>Microcredential</i>	<i>Courses</i>	<i>Tuition</i>
Essentials of Net-Zero and Passive House Construction	4 (72 hrs)	\$1520
Supervising Net-Zero and Passive House Construction	5 (96 hrs)	\$2020
Whole-Building Life Cycle Assessment Professional	4 (90 hrs)	\$1890



Passive House Tradesperson and
Site Supervisor Course Provider



Plus, earn designation as:

- Certified Passive House Tradesperson
- Certified Passive House Site Supervisor

Learning Format

Online

- Live interaction with instructors
- Front seat view of hands-on work
- Review of construction drawings and inspection of mockups



Hands-on

- Practice skills and test work in lab
- Applied work projects

Independent

- Library of on-demand technical videos
- Job aids and checklists for reference

AIR BARRIER STRATEGIES - AIRTIGHT HVAC, PLUMBING, AND ELECTRICAL PENETRATIONS

Making Conduit Airtight

- Conduit is most effective way for exterior AB electrical box sealing
- EPDM gasket is used around electrical conduit at back of face
- Electrical gaskets are used for sealing around wires (e.g. 30-2 wire is not sufficiently sized for airtight with an EPDM gasket)

EPDM Gaskets

Making Gaskets

- Gasket material is minimum of 45 mil (BB) and is made of durable, unembedded EPDM rubber (needing membrane) - vapor impermeable
- very resilient and long service life, only degrades a small amount over the 40-year rated service life of EPDM
- Quality of adhesion is a key to success. To achieve this - the following approximate gasket sizes are appropriate for the corresponding penetration diameter:

Gasket Hole Size	Corresponding penetration size
3/4"	1 1/2" pipe
1 1/4"	2 1/8" flex flow hose (BB)
1 1/2" (flexible pipe)	2" pipe
2 1/2" (flexible pipe)	4" duct
4 1/2"	8" duct
6 1/2"	12" duct

- penetrations 4" and up penetration cut hole 1/2" smaller to leave a 1/2" return around pipe

INSTALLING GASKETS

- Gaskets can be used on interior Air or Vapor Barrier Membranes or finish and an exterior Water Resistive Barrier both above and below gasket.
- Utility start with starter membrane around penetration location for installation of gasket.
- With any penetration through loose sheathing membrane, a second layer of sheathing membrane is installed with leading edge positively lapped and sealed with sheathing tape.
- Use high performance tapes (eg. SIGA Wigluv) to ensure performance of adhesion.
- Tuck tape will not adhere to EPDM rubber. (It is a plastic tape and should only be used for adhesion to plastic)
- Use an aggressive hand sanding on a tape with adhesive that will perform on rubber.
- Make sure tape used will adhere to dirt or use EPDM if those are the conditions of install.
- The EPDM gasket is considered to be installed in a "temp-conditioned" space when it is installed inside a tight insulated wall and protected from UV degradation, and temperature fluctuations by means, selection of the factors that integrate a material (e.g. a gasket).
- All tapes must be ribbed down (buried) to ensure a good and durable seal while also allowing for movement.
- Make sure that the entire portion of the gasket that is installed out along the length of the pipe(s) is directed to the outside of the assembly to seal with water shedding to the exterior.
- Gaskets should be installed against a firm backing, this with EPDM gaskets on an interior AB strategy it is difficult to correctly seal because you don't have a backing.

BCIT HOW TO VIDEO: Air Barrier Strategies for Various Penetrations

INSTALLING TAPE OR FLASHING TAPES TO SEAL PENETRATIONS

- Flashing tapes can be used for flanged (e.g. short vent cap or non-flanged penetrations (in tight vent pipe)
- ensure positive lapping (min 2" laps) of membranes
- positive lapping of tapes (see BCIT How To Video video)
- ensure full lapping (no loose flashing adhesion)
- provide "T" overlap of all tapes for adhesion
- many manufacturers produce flashing tapes for air and water sealing around penetrations (e.g. [SIGA Air Barrier Installation by Robert Sellen](#)). While these are suitable solutions, they do not allow for easy movement of pipes during installation or over occupancy (e.g. house lift replacement) when compared to EPDM gaskets.

INSTALLATIONS

Exterior Air Barrier Window Connections

Exterior Window Connections (See L2-L3)

Video Summary: Step by step demonstration of how to prepare window rough openings for window installation to ensure durability and airtightness.

BCIT

ZERO ENERGY/EMISSIONS BUILDINGS LEARNING CENTRE
School of Construction and the Environment
bcit.ca/lab

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Net Zero and Passive House Continued Learning

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ZEB AND ENERGY MANAGEMENT > OPEN EDUCATIONAL RESOURCES

Open Educational Resources

ZEB AND ENERGY MANAGEMENT

BCIT's ZEB Learning Centre video series

The ZEB Learning Centre is producing a series of educational videos and everything is open source.

BCIT High Performance Buildings Lab

Open Ed. Resources

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ZEB AND ENERGY MANAGEMENT > PROGRAMS & COURSES

Programs & Courses

ZEB AND ENERGY MANAGEMENT

We offer courses and programs on the topics of Net Zero Energy and Passive House construction, Energy Modelling and Energy Management, including Building Controls and Building Retrofits.

HOW TO REGISTER

Programs & Courses

www.bcit.ca/zeb

Considering Codes, Standards, and Industry Guides

Building Codes are not “leading” documents, they react to research and experience



Guides present more recent research and better practices

- NRCan's LEEP Guides
- BC Housing's Canadian Codes previously addressed air leakage control for durability and moisture control, not energy conservation





Thank you

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Transition to Discussion Time

Municipal Staff Available to Answer Questions



Tim Ryce
Chief Building Official

Mike Friesen
Manager, Environmental Sustainability

Larisa Lensink
Environmental Sustainability Planner



Brett Dwyer
Assistant General Manager,
Regulatory Review and Compliance

Caroline Jackson
Director, Climate Action, Natural
Systems and Biodiversity

Adam Wright
Sustainability Planner



Colin Coulter
Plans Examiner, Building Department

Heather Keith
Senior Manager, Climate Action and
Environment

Discussion

1. What are the main challenges in moving from Step 3 to Step 4 requirements?
2. What additional training or resources would be helpful for you to have success at Step 4?



Thank you.

city
of north
vancouver

DISTRICT OF
**NORTH
VANCOUVER** 


westvancouver