Proposed Changes to Part 9 Energy Step Code Requirements

April 20, 2023

city of north vancouver

DISTRICT OF NORTH VANCOUVER

westvancouver

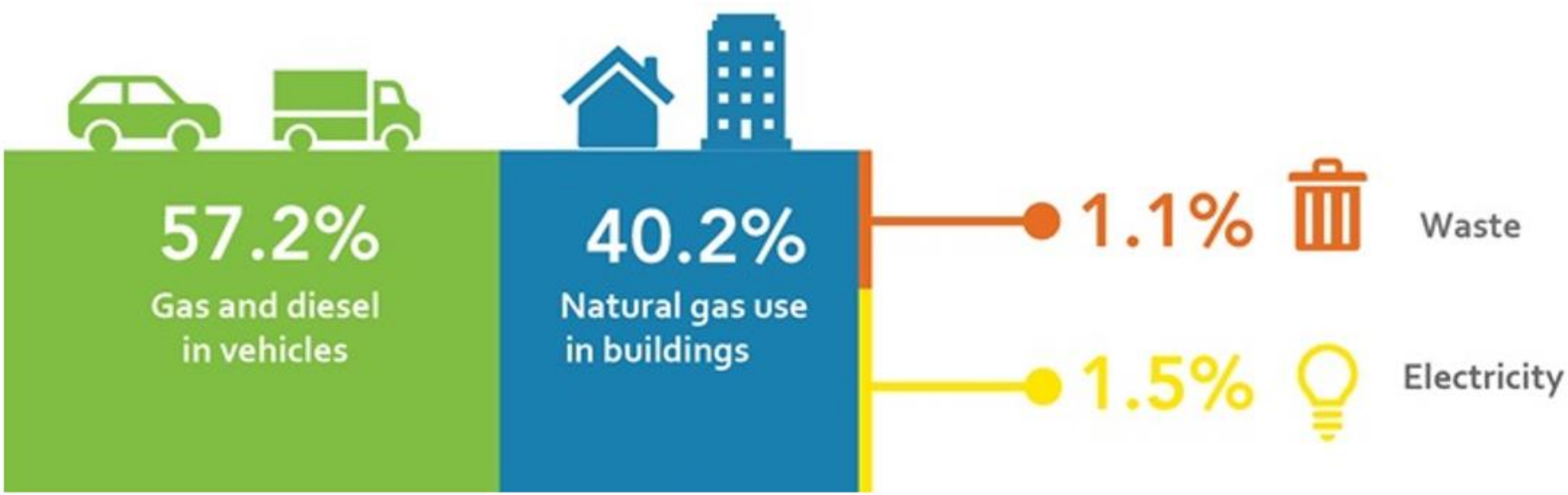
Agenda

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



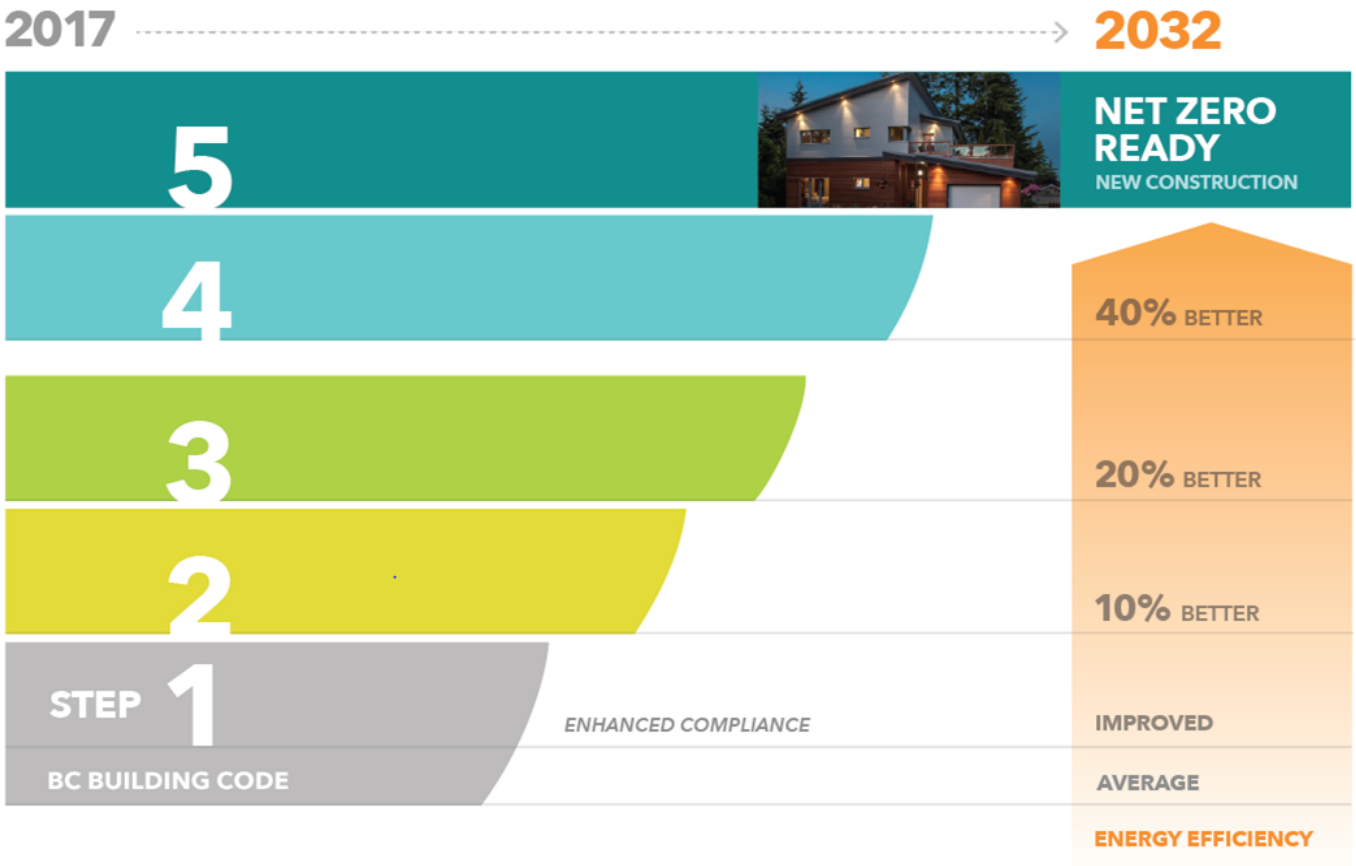
Sources of emissions in the City of North Vancouver (2020 data)

Provincial Context

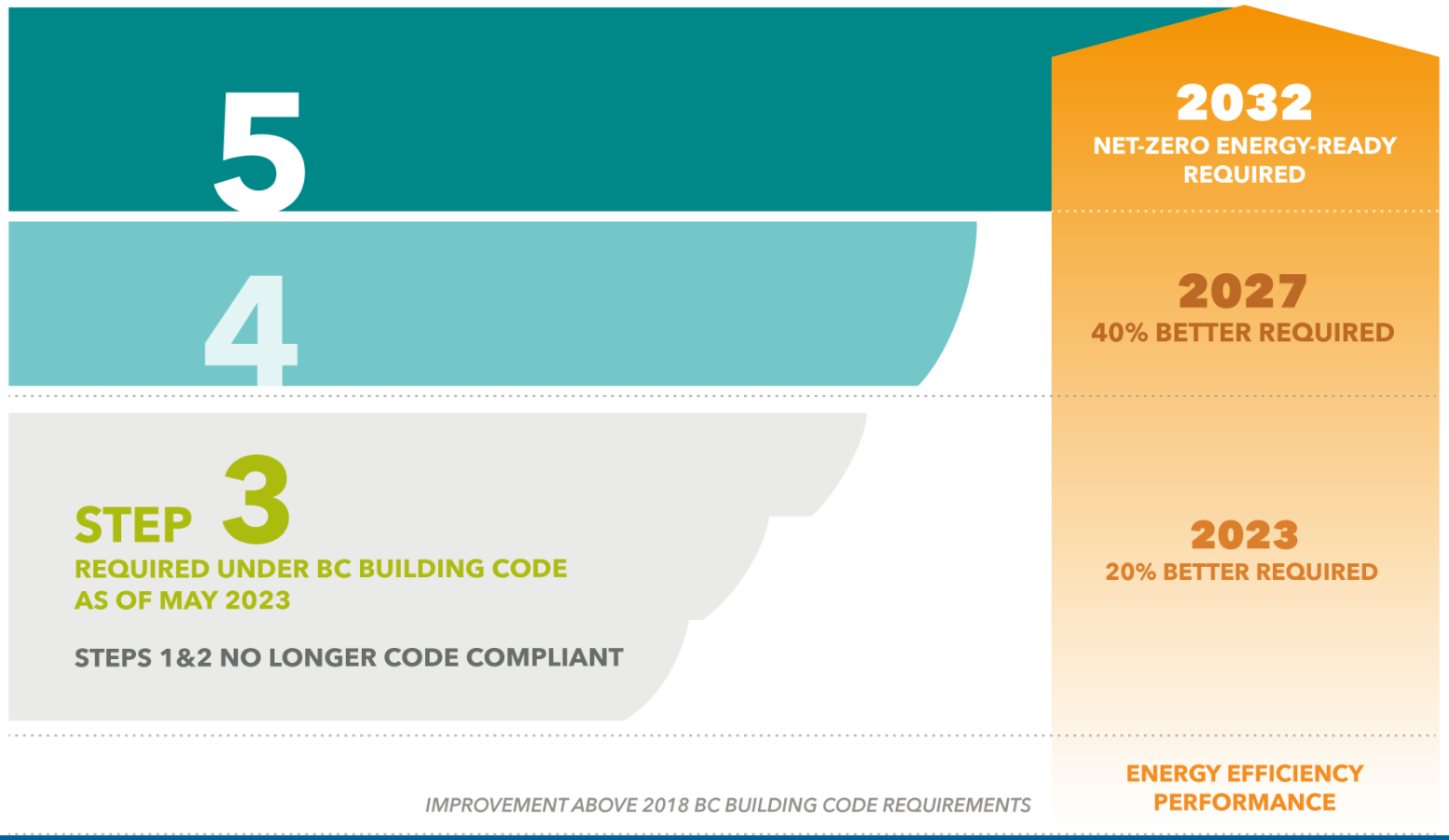
Zero-carbon new construction by 2030

Net zero energy ready new construction by 2032

BC Energy Step Code



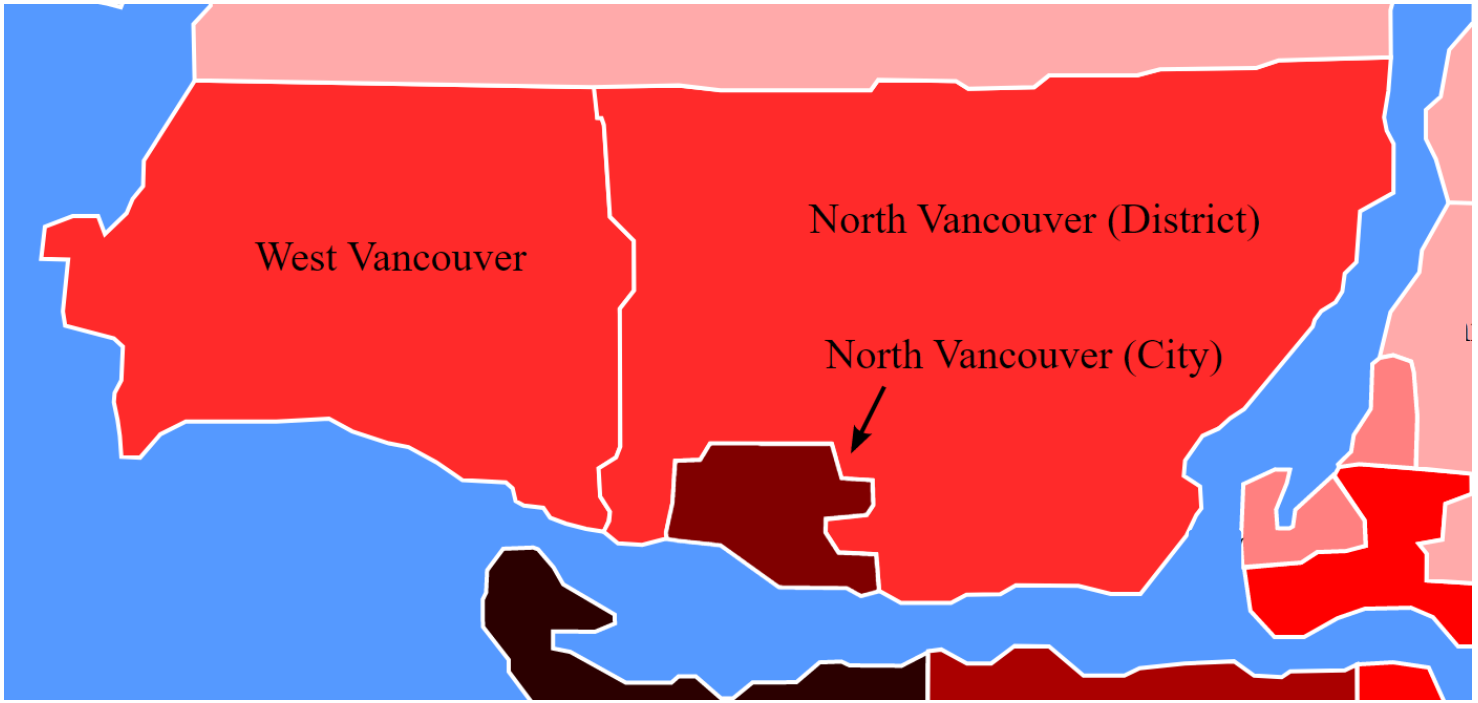
Province's Timeline



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



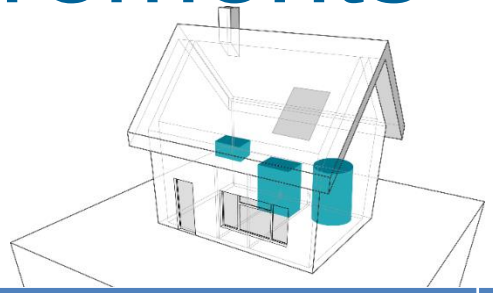
Proposed Changes for Part 9 Buildings: Moving to Step 4

	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	≤ 1.5 ACH_{50}	MEUI: 45 kWh/(m^2year)	TEDI: ≤ 20 kWh/(m^2year) Or Adjusted TEDI: 28 kWh/(m^2year) Or 20% better than reference house
Step 3	≤ 2.5 ACH_{50}	MEUI: 55 kWh/(m^2year)	(TEDI): ≤ 30 kWh/(m^2year) Or Adjusted TEDI: 38 kWh/(m^2year) 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

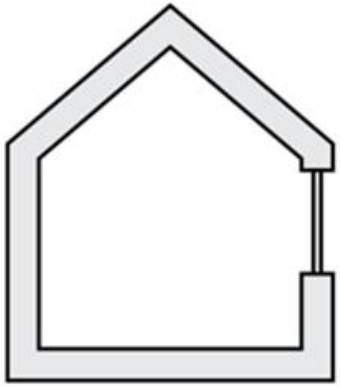
Step 3 to Step 4 - What is Changing?

The Metrics (Part 9 buildings)

Airtightness

ACH50

Air Changes per House @ 50 Pascals



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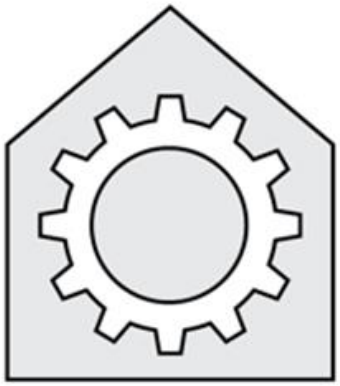
TEDI

Thermal Energy Demand Intensity (kWh/m^2 yr)



Equipment & Systems

MEUI

Mechanical Energy Use Intensity (kWh/m^2 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)

	Airtightness Levels	Airtightness Metrics		
		ACH_{50}	NLA_{10}, cm^2/m^2	NLR_{50}, L/sxm^2
		Maximum Airtightness Values		
STEP 3	AL-1	2.5	1.20	0.89
STEP 4*	AL-3	1.5	0.72	0.53
STEP 5*	AL-4	1.0	0.48	0.35
Passive House Standard		≤ 0.6		

Airtightness - What is Possible?

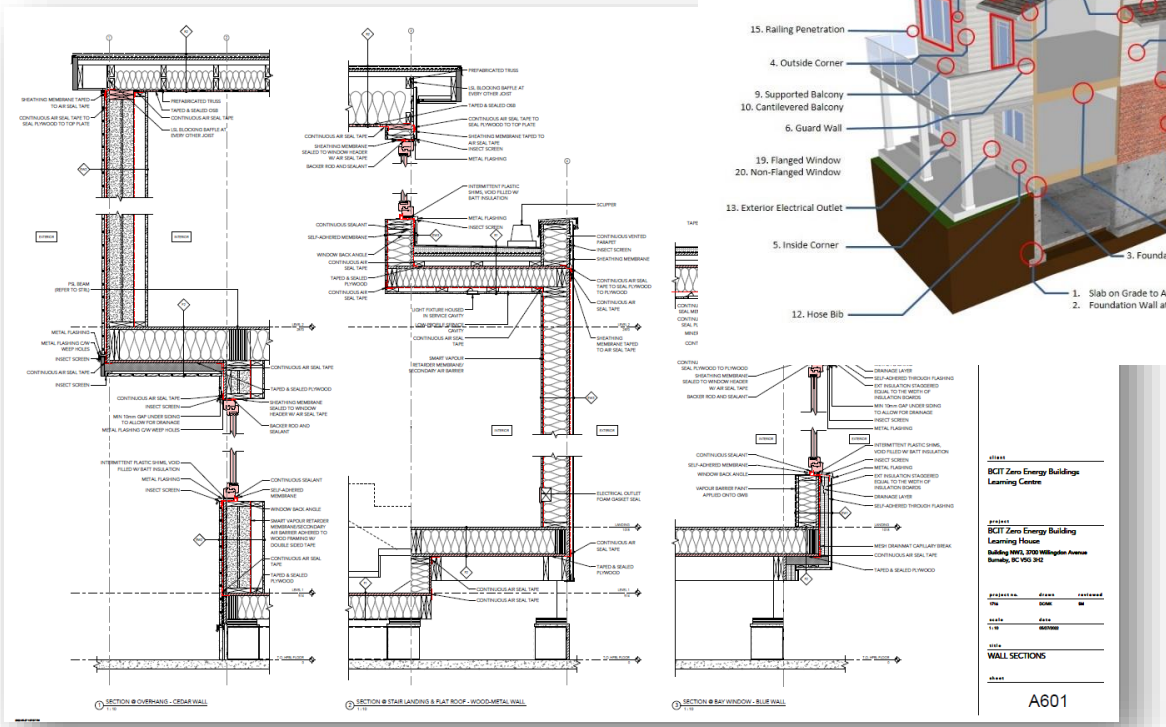
Even small houses can achieve exceptional airtightness

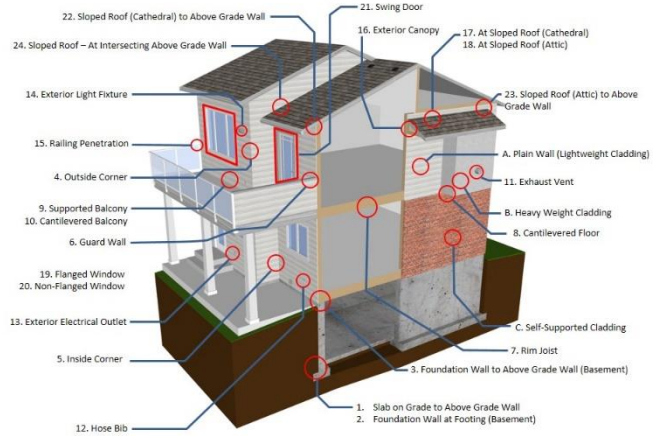
	Name	Location	TFA	Stories	ACH@50 Pa
	West Bay House	West Vancouver	295 m2 (3176 sqft)	3	**0.4**
	3612 Point Grey	Vancouver	148 m2 (1597 sqft)	2	**0.19**
	North Vancouver Passive House - Moodyville	North Vancouver	270 m2 (3300 sqft)	2 + basement	**0.29**

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)

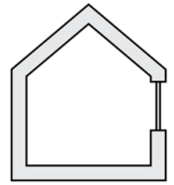


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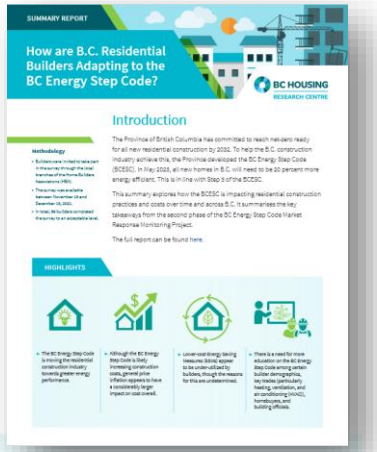
Table 9.36.6.3.-A
Requirements for Buildings Located Where the Degree-Days Below 18°C Value is less than 3000(1)
Forming Part of Sentence 9.36.6.3.(1)

	Step	Airtightness(2)	Performance Requirement of *Building* Equipment and Systems	Performance Requirement of *Building* Envelope
STEP 3	3	AL-1	The applicable mechanical energy use intensity requirements in Table 9.36.6.3.-H	Thermal energy demand intensity ≤ 30 kWh/(m²•year), or 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 ≤ 20 kWh/(m²•year), or 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 ≤ 15 kWh/(m²•year), or 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	≤ 15 kWh/m2 yr

Most Common Solutions to Reduce TEDI



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

Building envelope:

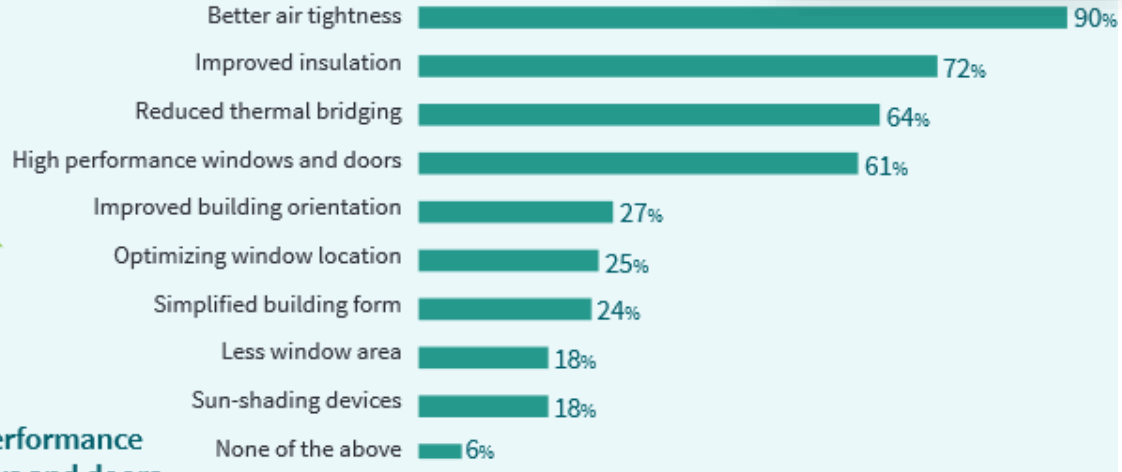
- The most common ESMs used were better air tightness (90%), improved insulation (72%), reduced thermal bridging (64%), and use of high-performance windows and doors (61%).

90% Used better air tightness

72% Used improved insulation

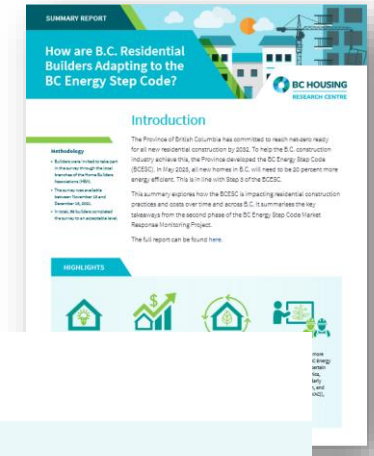
64% Used reduced thermal bridging

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:

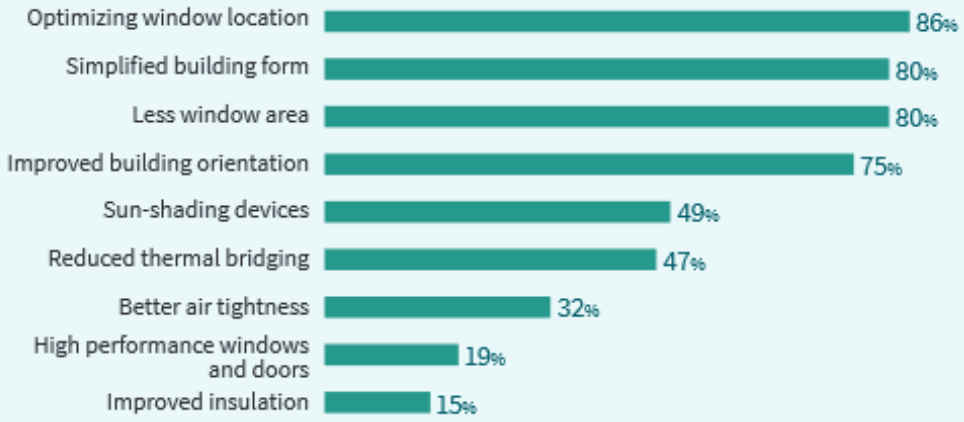
- 75% or more reported either a decrease or no change in component cost when optimizing window location (86%), simplifying the building form (80%), less window area (80%), and improving the building orientation (75%).

86% Optimizing window location

80% Simplifying building form

80% Less window area

75% Improving building orientation

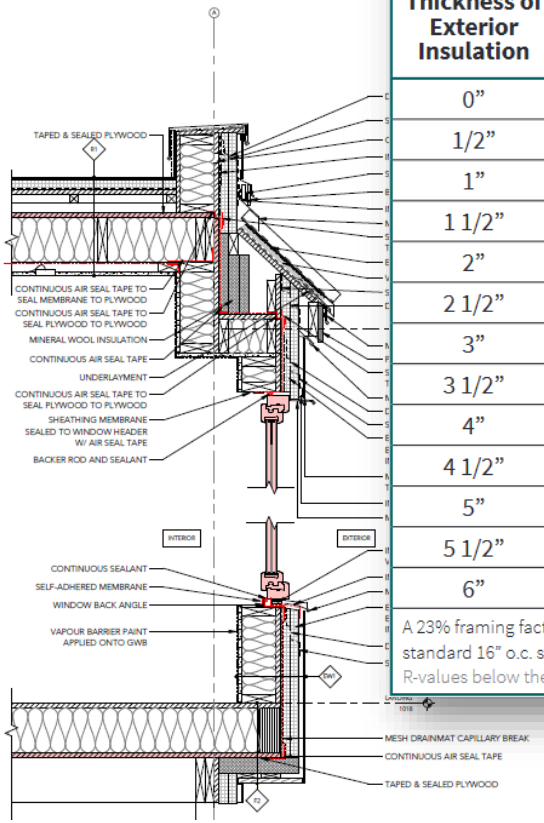


Source: BC Energy Step Code Market Response Study (BC Housing 2020)

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 [ft²·°F·hr/Btu]				
	2x4 Stud Wall (R-12 Batts)		2x6 Stud Wall (R-19 Batts)	
Thickness of Exterior Insulation	R-value/inch of Exterior Insulation			
	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

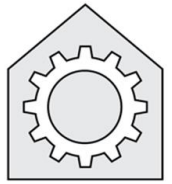
- Challenging for buildings with complex form:
  - Need enhanced enclosure performance
  - Expect problems with TEDI pathway

3,800 ft² 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/m2 yr - FAIL	**TEDI ≤20** **38 kWh/m2 yr - FAIL**	TEDI ≤**15** 24 kWh/m2 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* (m²)					
				≤ 50	51 to 75	76 to 120	121 to 165	166 to 210	> 210
				Mechanical Energy Use Intensity, kWh/(m²•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
	More than 50%		2	Reserved					
		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

MEUI ≤55 to ≤45 kWh/m2 yr

Considerations

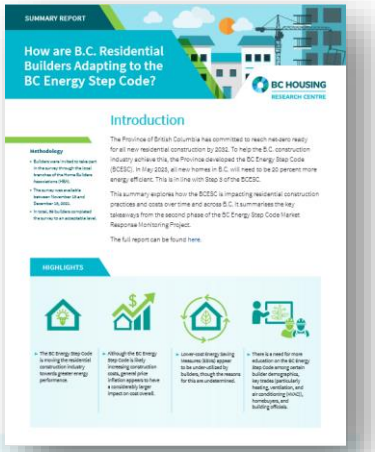
- With ASHP MEUI requirements are not expected to be challenging
- DHW loads become more significant – system efficiency
  - *May 1st BCBC code update changes how DHW loads are calculated per dwelling unit (9.36.5.8)*
- Value of good HVAC design and right-sizing of equipment
- Focus on quality of HVAC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



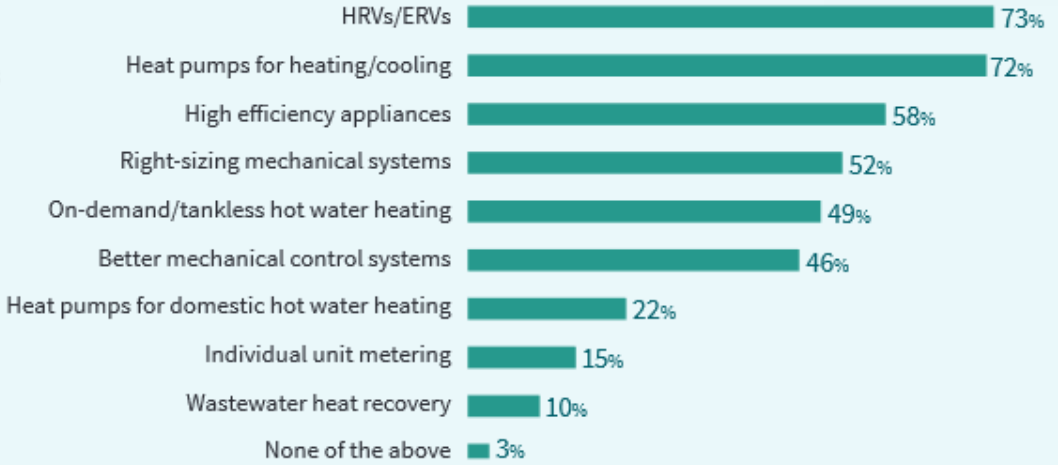
WHAT ARE THE MOST COMMON ENERGY SAVING MEASURES (ESMS)?

Mechanical System:

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

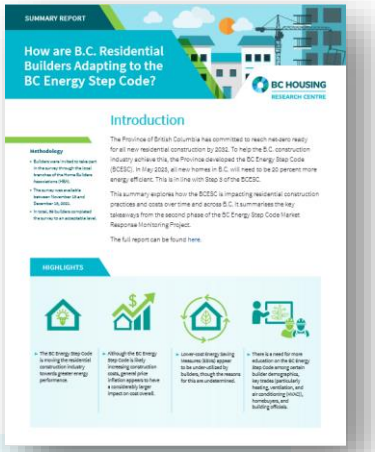
73%
Used HRVs/ERVs

72%
Used heat pumps



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

Lowest Cost Solutions to Reduce MEUI

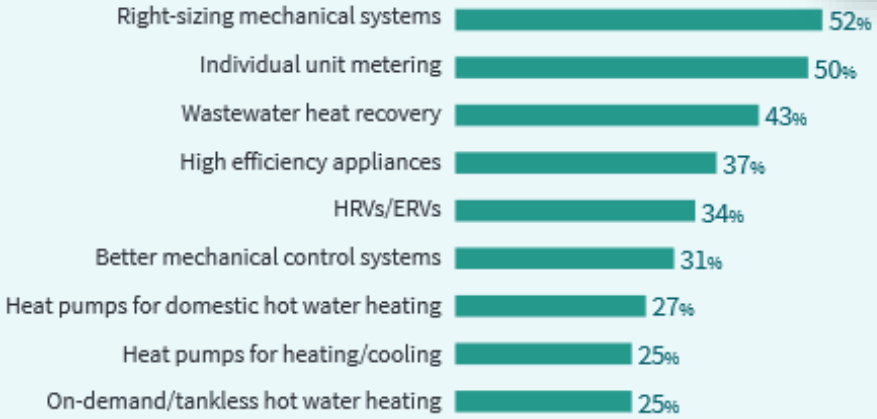


WHICH ENERGY SAVING MEASURES IMPACT COMPONENT COSTS THE LEAST?

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

Passive House Institute

BCIT ZEB Learning Topics

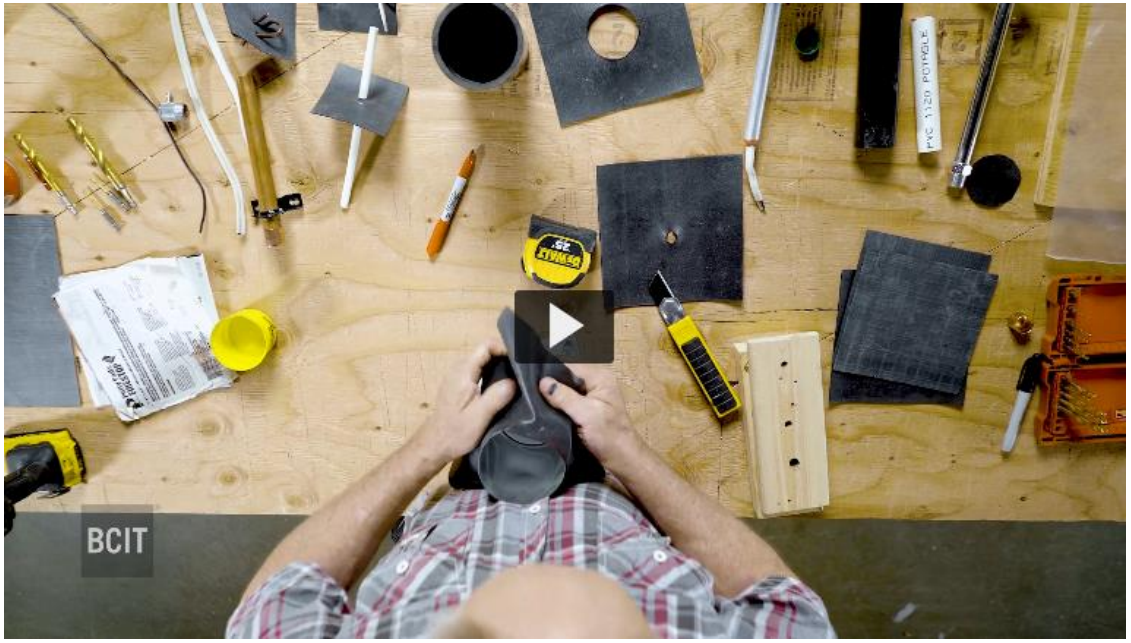
- Passive House, Energy and Zero Carbon Step Code
- Airtightness and Low-TEDI Assemblies
- Mechanical Systems – Net Zero Part 9
- Net Zero & Passive House Site Supervision
- Electrical Systems – Net Zero Part 9
- Embodied Carbon and Whole Building LCA

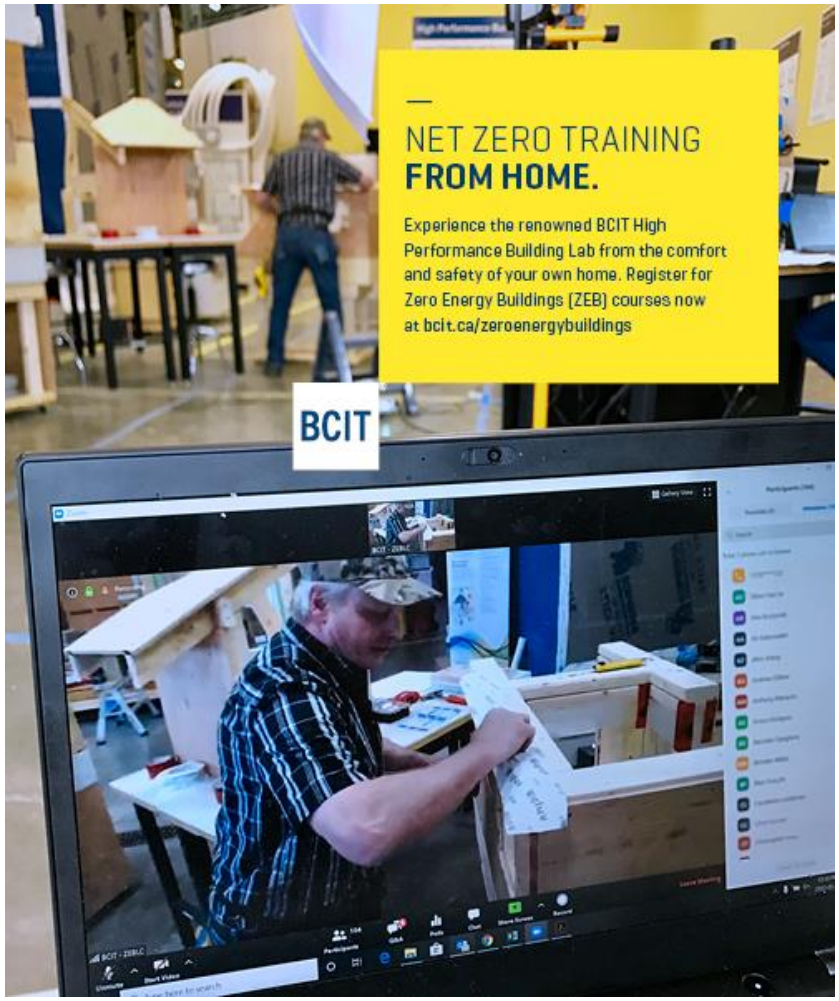
Hands-on Learning

- 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 Institute
Passive House Tradesperson Course Provider

AIBC
ARCHITECTURAL INSTITUTE OF BRITISH COLUMBIA
Recognized Educational Provider

Certifications

BCIT Microcredentials

Microcredential	*Courses*	*Tuition*
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 Institute
Passive House Tradesperson and Site Supervisor Course Provider

Plus, earn designation as:

- Certified Passive House Tradesperson
- Certified Passive House Site Supervisor

Learning Format

Online

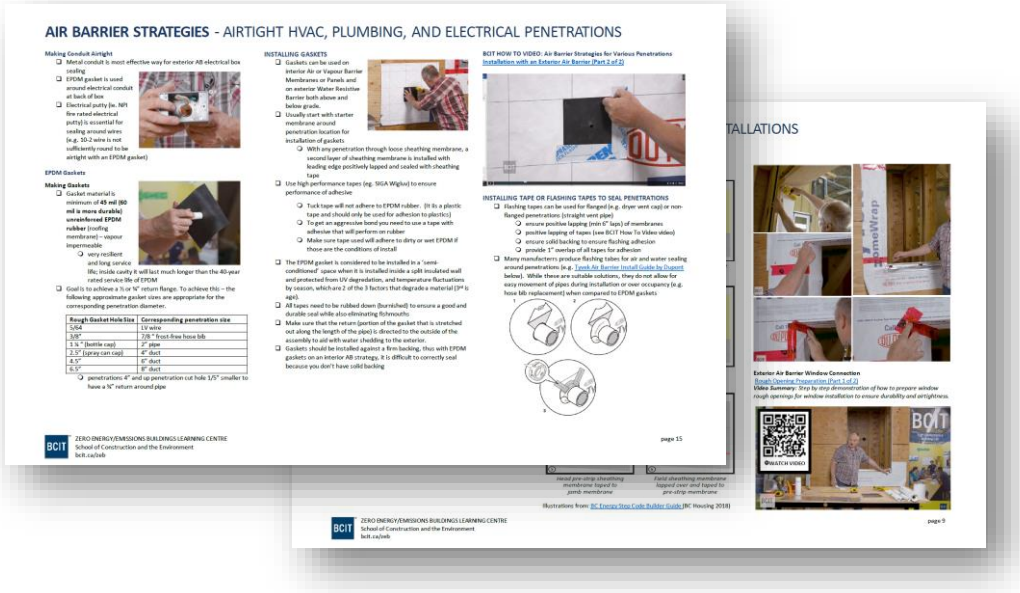
- Live interaction with instructors
- Front seat view of hands-on work
- Review of construction drawings and inspection of mockups

Hands-on

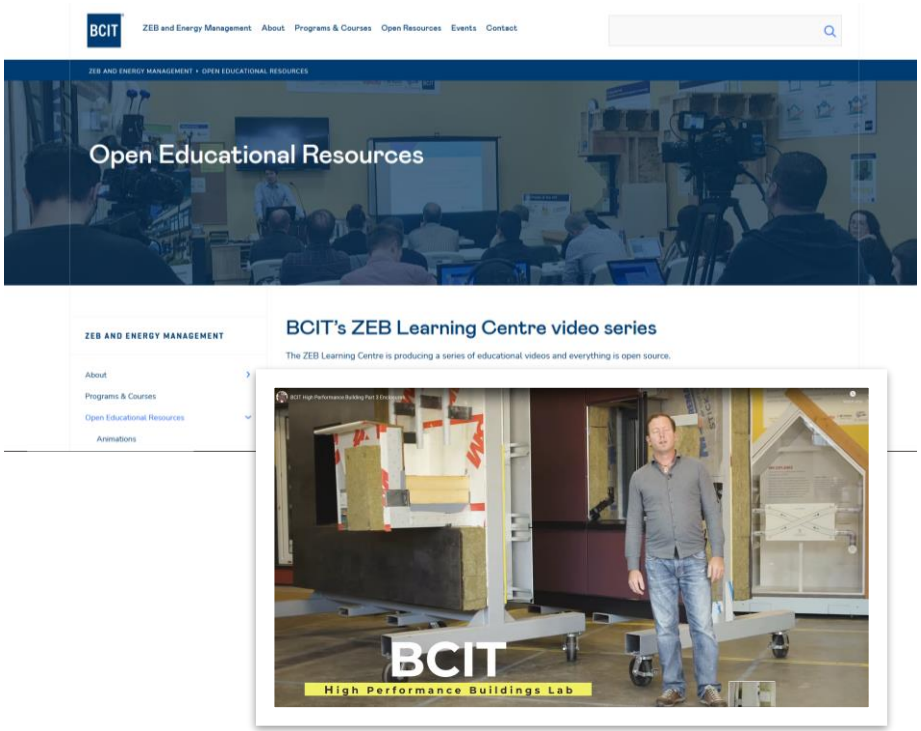
- Practice skills and test work in lab
- Applied work projects

Independent

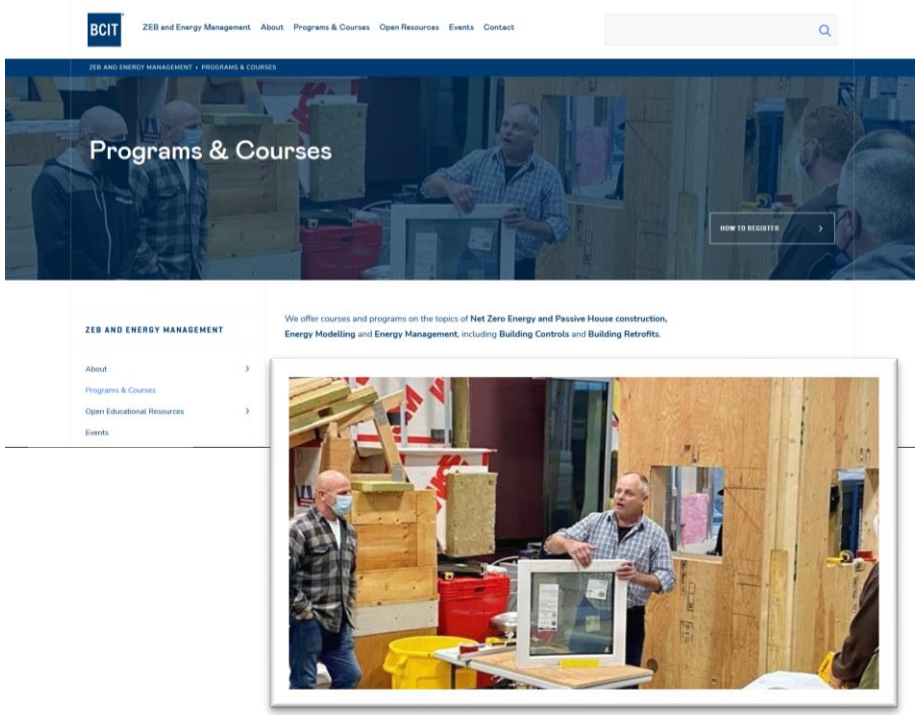
- Library of on-demand technical videos
- Job aids and checklists for reference



Net Zero and Passive House Continued Learning



Open Ed. Resources



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

Mary McWilliam
ZEB Learning Centre
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mmcwilliam3@bcit.ca

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?

city of north vancouver

DISTRICT OF NORTH VANCOUVER

westvancouver