

# BC Step Codes in Action

BOABC Conference

May 29, 2024



carbon wise  
sustainable innovation

zeb x

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carbon wise  
sustainable innovation



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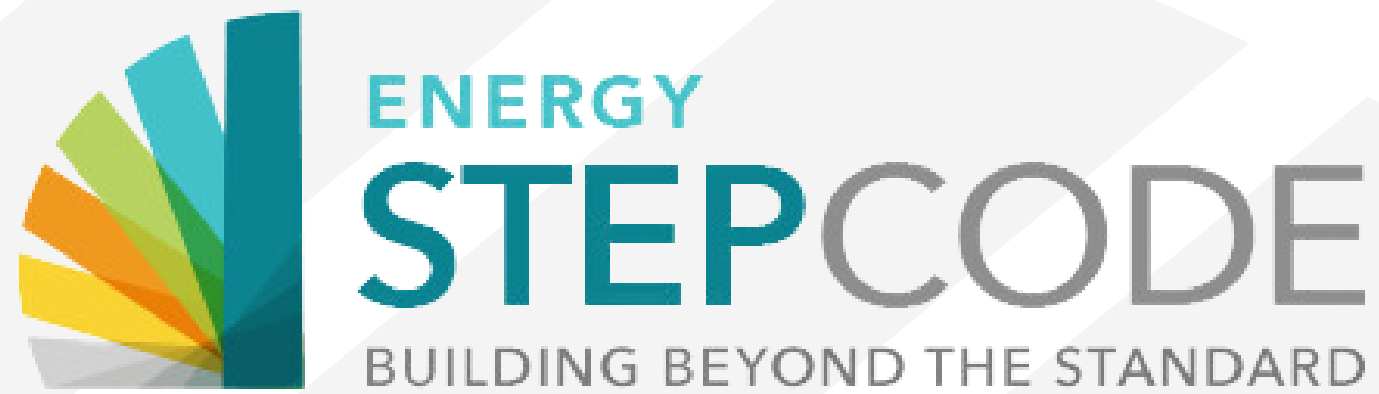
President  
TQ Construction

*Henri is also the chair of HAVAN  
(Homebuilders Association of Vancouver)*

# Let's get a sense of the room

How many of you would describe yourselves as familiar with the ZCSC?

How many of you are building officials or folks working in the front lines of development (plan checkers, etc.)?



Seeks to address energy consumption via increased energy efficiency measures

Part 9: Section 9.36  
Part 3: Section 10.2

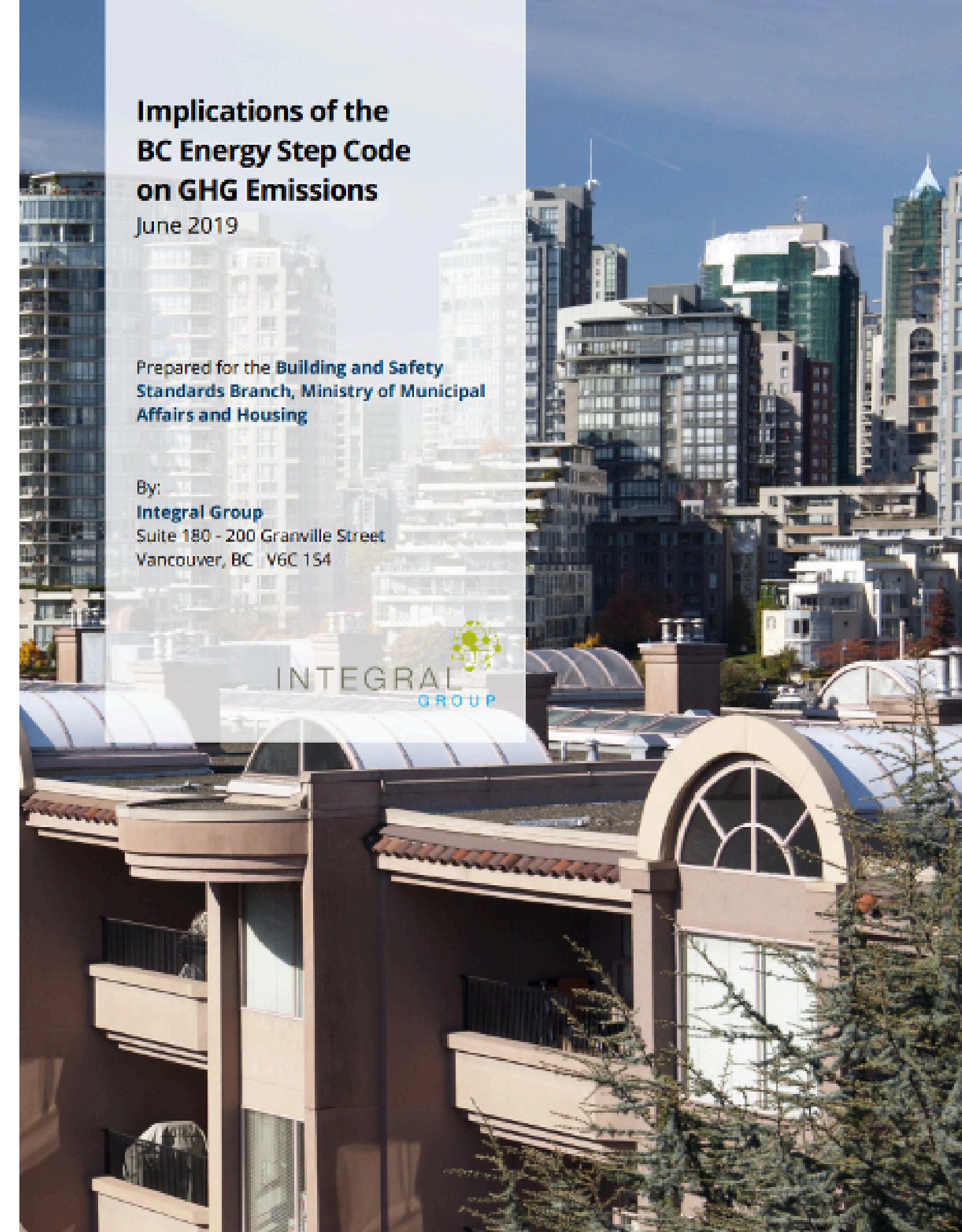


Seeks to address energy source emissions via encouraging mechanical systems that use energy sources with a lower emissions factor.

**Part 9: Section 9.37**  
**Part 3: Section 10.3**

# Why was it developed?

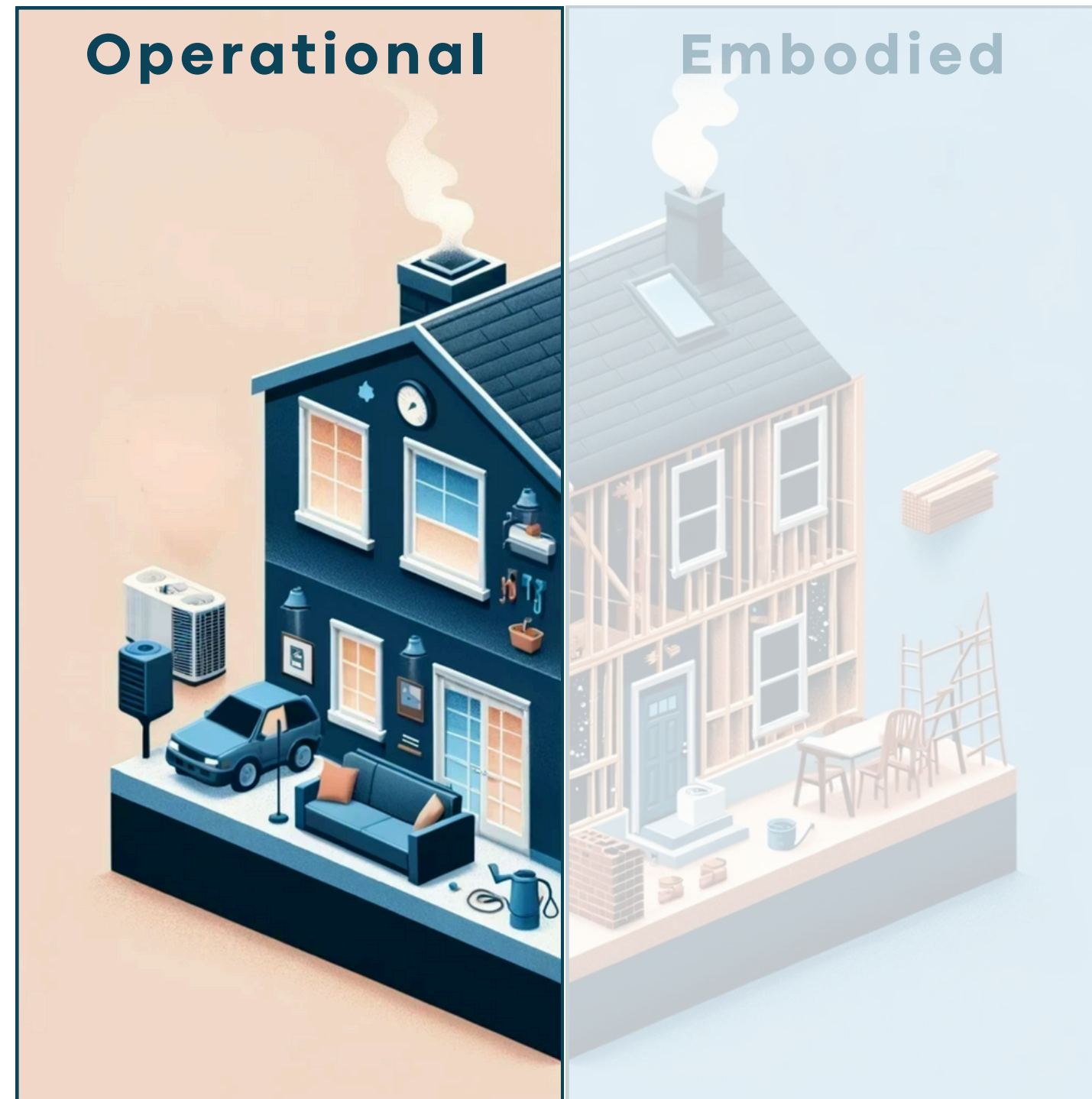
...significant variation in the greenhouse gas intensity associated with the Energy Step Code's efficiency standards. The Zero Carbon Step Code **was established to reduce greenhouse gas emissions**.



# Different types of GHG Emissions

## Top 3 sources of Operational Emissions

- 01 Fossil Fuel Space Heating
- 02 Fossil Fuel Domestic Hot Water Heating
- 03 Fossil Fuel Cooking Appliances



- 01 Concrete
- 02 Steel
- 03 Petroleum-based insulation

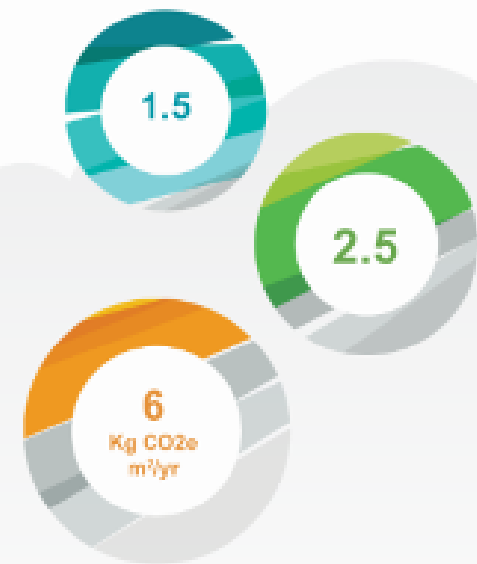
## Top 3 sources of Embodied Emissions

Quantity of carbon pollution



Maximum GHG Emissions per house per year

Intensity of carbon pollution



Maximum GHG Intensity per house per year

Part 9  
Section 9.37

Performance

**Table 9.37.1.3.**  
**Greenhouse Gas Emissions**  
Forming part of Sentence 9.37.1.3.(1)

Prescriptive

GHG Emission Level	GHG Emission Compliance Options			
	Maximum GHG Emissions by House, Expressed in kg CO <sub>2e</sub> /year	Maximum GHGI of the House, Expressed in kgCO <sub>2e</sub> /m <sup>2</sup> /year	Maximum GHG Emissions by House, Expressed in kgCO <sub>2e</sub> /year	Reduction of GHG Emissions by Energy Source of Building Systems <sup>2</sup>
EL-1	measure only	measure only		N/A
EL-2	1050	6.0	2400	Energy sources supplying heating systems have an emissions factor ≤ 0.011 kgCO <sub>2e</sub> /kWh
EL-3	440	2.5	800	Energy sources supplying heating and service water heating systems have an emissions factor ≤ 0.011 kgCO <sub>2e</sub> /kWh
EL-4	265	1.5	500	Energy sources supplying all building systems, including equipment and appliances, have an emissions factor ≤ 0.011 kgCO <sub>2e</sub> /kWh

**Notes to Table 9.37.1.3.:**

<sup>(1)</sup> Compliance for this option is demonstrated by meeting both the GHGI and the GHG emission requirements for each house.

<sup>(2)</sup> Redundant or back-up equipment for the systems and equipment listed in Sentence 9.36.5.4.(1), is permitted to be excluded, provided it is equipped with controls and is not required to meet the space-conditioning load of the house.

## SUPPLEMENTARY INFORMATION

Supplementary information is not required for Code Compliance but may be requested by the local municipality/district. Where applicable, all metrics within Section F are calculated with baseloads included. If required, complete the applicable sections below.

### F: OTHER ENERGY MODELLING METRICS

#	Metric	Units	Reference House	Proposed House
1	Normalized Leakage Area (NLA) @10Pa	cm <sup>2</sup> /m <sup>2</sup>	-	-
2	Rated Greenhouse Gas Emissions	kg/year	-	-
3	Rated Greenhouse Gas Intensity	kg/m <sup>2</sup> /year	-	-
4	Rated Energy Use Intensity	GJ/m <sup>2</sup> /year	-	-
5	Peak Thermal Load (PTL)	W/m <sup>2</sup>	-	-
6	% of the Building's Conditioned Space Served by Space-Cooling Equipment	%	N/A	-
7	% Lower Than Reference House With Baseloads Included	%	N/A	-

#	Energy Source	Reference House Energy Consumption (GJ/year)	Proposed House Energy Consumption (GJ/year)
8	Electricity	-	-
	Natural Gas	-	-
	Propane	-	-
	District Energy	N/A	-
	On-Site Renewables	N/A	-
	Other:	-	-
	<b>Total</b>		0

This isn't novel.



# More reliance on these Hot2000 outputs.

**G: ZERO CARBON STEP CODE**

Proposed House Metrics			Unit	Proposed Level Requirement	Proposed Calculations	
					Proposed House Result	Proposed House Pass or Fail
Zero Carbon Step Code Level			EL-1 - EL-4	0.00		
Total GHG			kg CO <sub>2e</sub> /year	#N/A (max)	0	#N/A
	CO <sub>2e</sub> per floor area with max	Per Floor area	kg CO <sub>2e</sub> /m <sup>2</sup> /year	#N/A (max)	#DIV/0!	#DIV/0!
		Max	kg CO <sub>2e</sub>	#N/A (max)	0	
Prescriptive			Heating	#N/A	Zero Carb	Error
			Hot Water	#N/A	Zero Carb	
			All building systems, equipment and appliances	#N/A	Zero Carb	
					<b>Target Reached:</b>	#N/A

2030



**No fossil fuels allowed.**  
Space and water heating and cooking must be zero carbon.

EL-4

**STRONG**  
Carbon Performance



**Fossil fuel cooking allowed.**  
Space and water heating systems must be zero carbon.

EL-3

**MODERATE**  
Carbon Performance



**Fossil fuel water heating and cooking allowed.** Space heating must be zero carbon.

EL-2

2024



# Local Government Experience

2020-2022

**~60% met the ZCSC Minimum (with the majority of those meeting EL-4)**

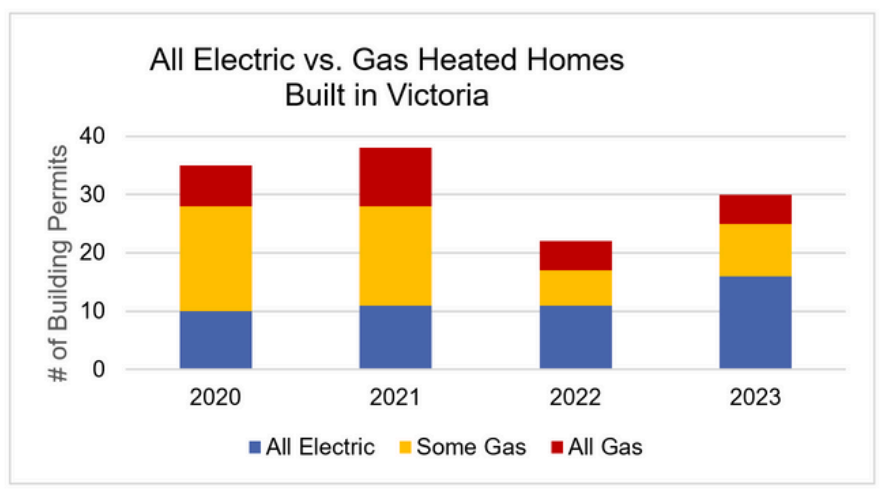


2021 - 2024

**~24% met the ZCSC Minimum (with the majority of those meeting EL-2)**

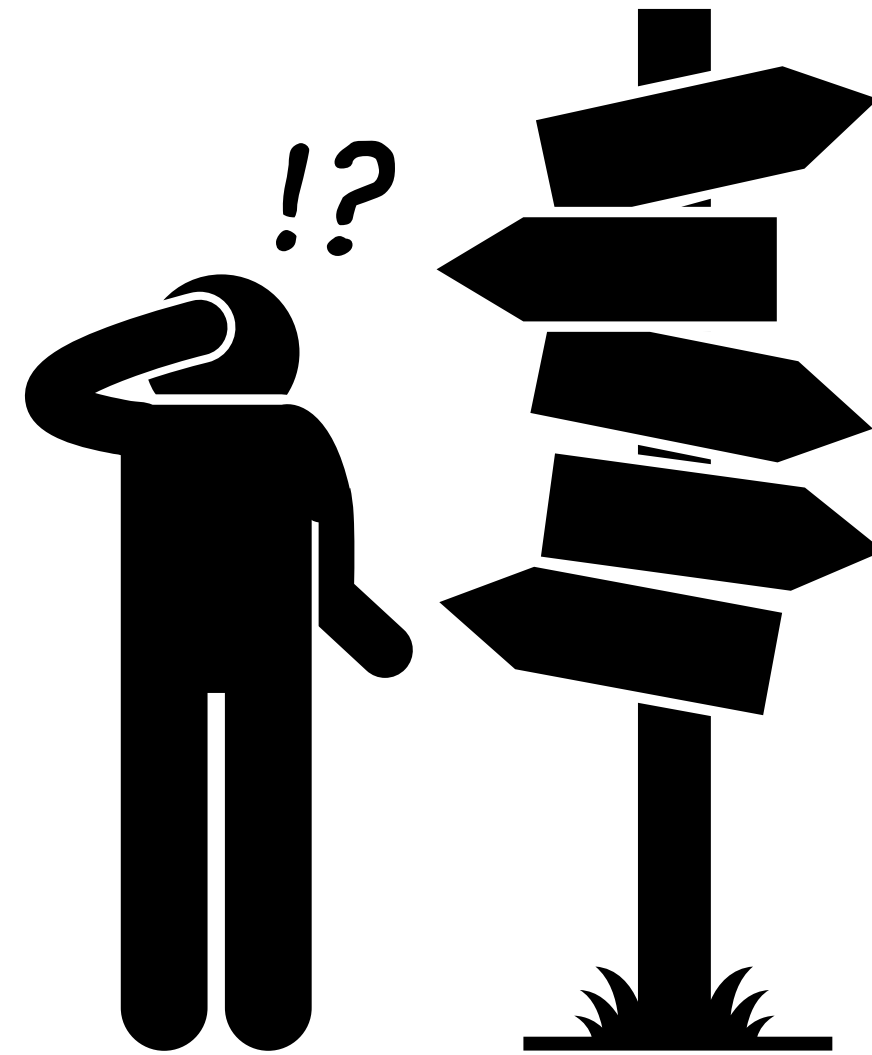


2020 - 2023



**~53% of new buildings in 2023 were all-electric (i.e., would meet EL-4)**





# Inlet Panorama

## 2021 completion

- Family purchased property to build forever home
- Durability + function to suit family
- Must haves: elevator, dual laundry, cooling, EV charging, maximize view
- Built step-5 for sound + overall comfort



# Inlet Panorama

## 2021 completion

- **Step 5, 0.98 ACH, E1-2**
- electric heating = HP
- Primary Heating + Cooling via electric Heat Pump
- Hot water via on-demand Gas boiler
- Further electrification limited by 200A service + family's long term needs
- Load management needed for EV charging to fit in service
- HVAC cost: ~ 40k



# Portland, Burnaby

## 2022 completion

- Modest plan for 3-4 generations to live in home
- Resilient & durable
- Designed for efficiency and longevity
- Don't like forced air
- Don't use their baseboards very much (feedback).
- Cooling in the summers is passive (heat dome) - overhang
- Not as wealthy of a family, funded project with equity + pooling resources



# Portland, Burnaby

## 2022 completion

- **Step 5, under 1 ACH, EL-3**
- HP hot water tank, house designed with passive cooling, homeowners didn't want air movement, electric baseboard heat
- comfortably under 200Amp
- Rarely turn on baseboard heat.
- Cooling in the summers is passive (heat dome) - overhangs + cross ventilation
- Cost for HVAC: \$25K





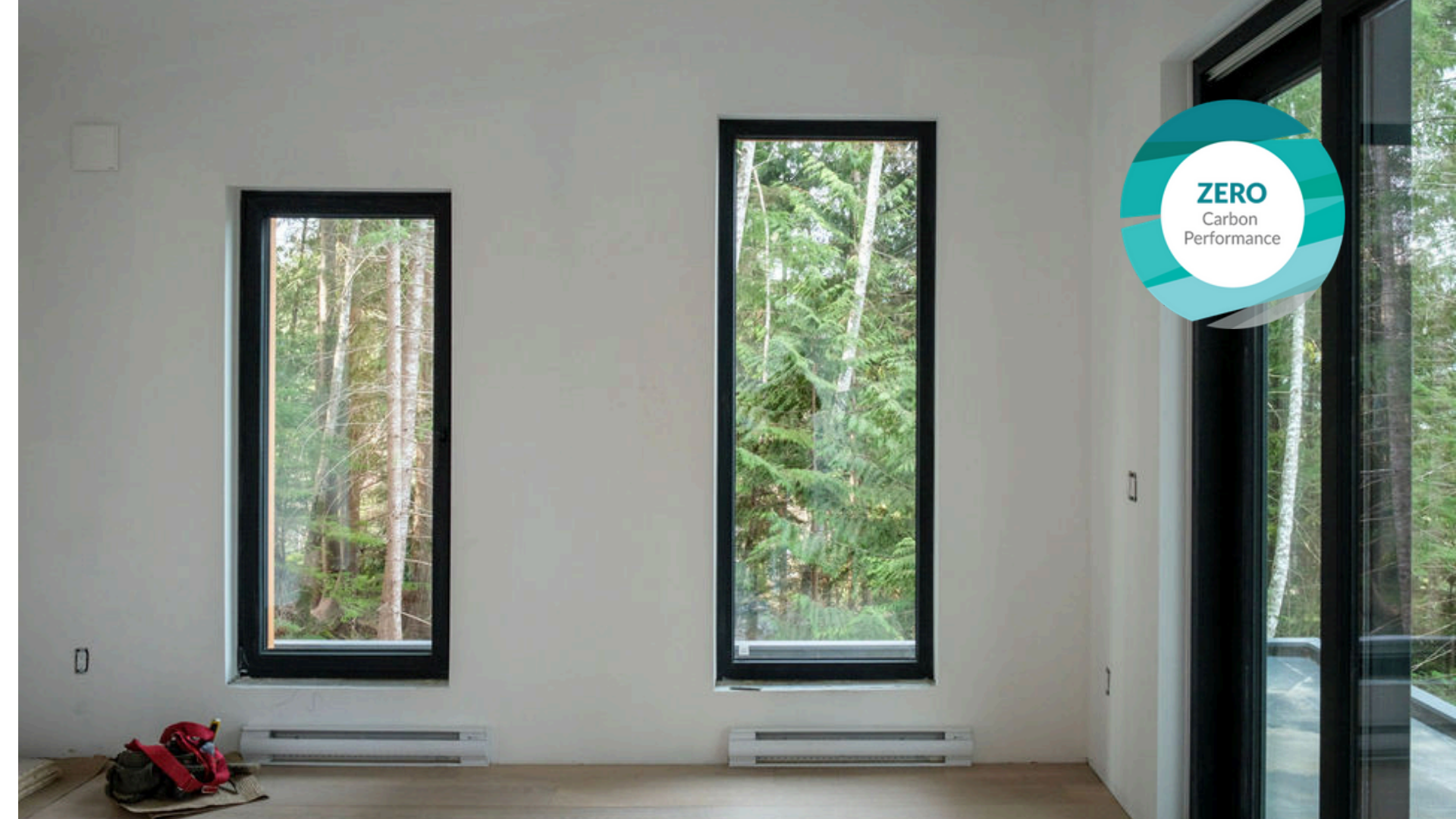
# Inlet View, Sechelt

## 2022 completion

- **Step 5, 0.9 ACH, EL-4**
- 1,200 sq ft
- GHG: 108.4 kgCO<sub>2</sub>e/year
- GHGi: 1.24 kgCO<sub>2</sub>e/m<sup>2</sup>/year



# Inlet View, Sechelt 2022 completion



## B: BUILDING CHARACTERISTICS SUMMARY (see BCBC Clause 2.2.8.3.(2)(b) of C

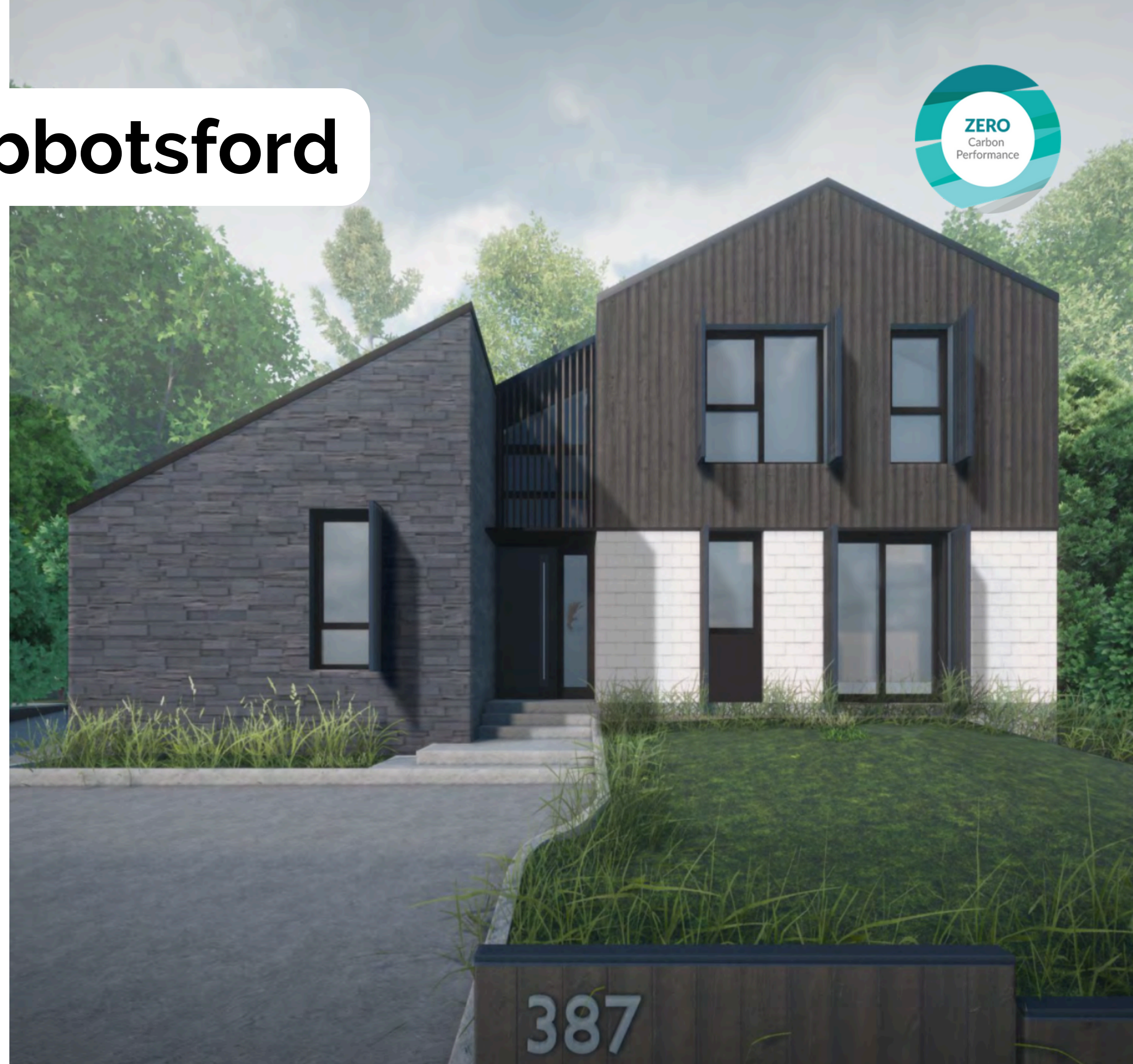
Details (Assembly / System Type / Fuel Type / Etc.)		Eff R <sub>SI</sub> , USI, SHGC, etc
Exterior Walls & Floor Headers	2x10 @ 24" o/c, 9.25" R-34 blown cellulose.	Effective R <sub>SI</sub> 5.28
Roof / Ceilings	14" TJI @ 24" o/c R-52 blown cellulose.	Effective R <sub>SI</sub> 7.97
Foundation Walls, Headers, & Slabs	N/A	Effective R <sub>SI</sub> N/A
Slab Is: <input type="checkbox"/> Below OR <input type="checkbox"/> Above Frost Line   <input type="checkbox"/> Heated OR <input type="checkbox"/> Unheated		
Floors Over Unheated Spaces	Above garage: 14" TJI @ 16" o/c R-40 batt. Main: 14" TJI @ 16" o/c, 14" R-52 blown cellulose.	Effective R <sub>SI</sub> 7.63
Fenestration & Doors	Triple glazed, vinyl frame, low-e coating and argon gas fill. <b>FDWR 18.89 %</b>	U <sub>SI</sub> 0.90 - 1.07 SHGC 0.20 - 0.26
Air Barrier System & Location	Exterior air barrier, pre-fab panels w/ taped sheathing.	
Space Conditioning (Heating & Cooling)	Electric baseboards	%, HSPF, &/or SEER 100%
Service Water Heating	AO Smith HPTU-50N 130 Integrated <b>Heat Pump Water Heater</b>	EF &/or % eff COP 3.83
Ventilation	1 x Lunos e2 HRV & 3 x Lunos eGo HRV (total 38 L/s max - alternative solution)	55% SRE (default), no HVI
Other Energy Impacting Features	<b>The building at the above-noted address does not have a fossil fuel connection or use.</b>	
Based on information provided by the builder, and a site evaluation completed on (YYYY/MM/DD):		17-Mar-23



# Phoenix House, Abbotsford

## In Progress (2024)

- **Step 5, under 1 ACH, EL-4**
- 3,400 sq ft
- GHG: 149kgCO<sub>2</sub>e/year
- GHGi: 0.5kgCO<sub>2</sub>e/m<sup>2</sup>/year

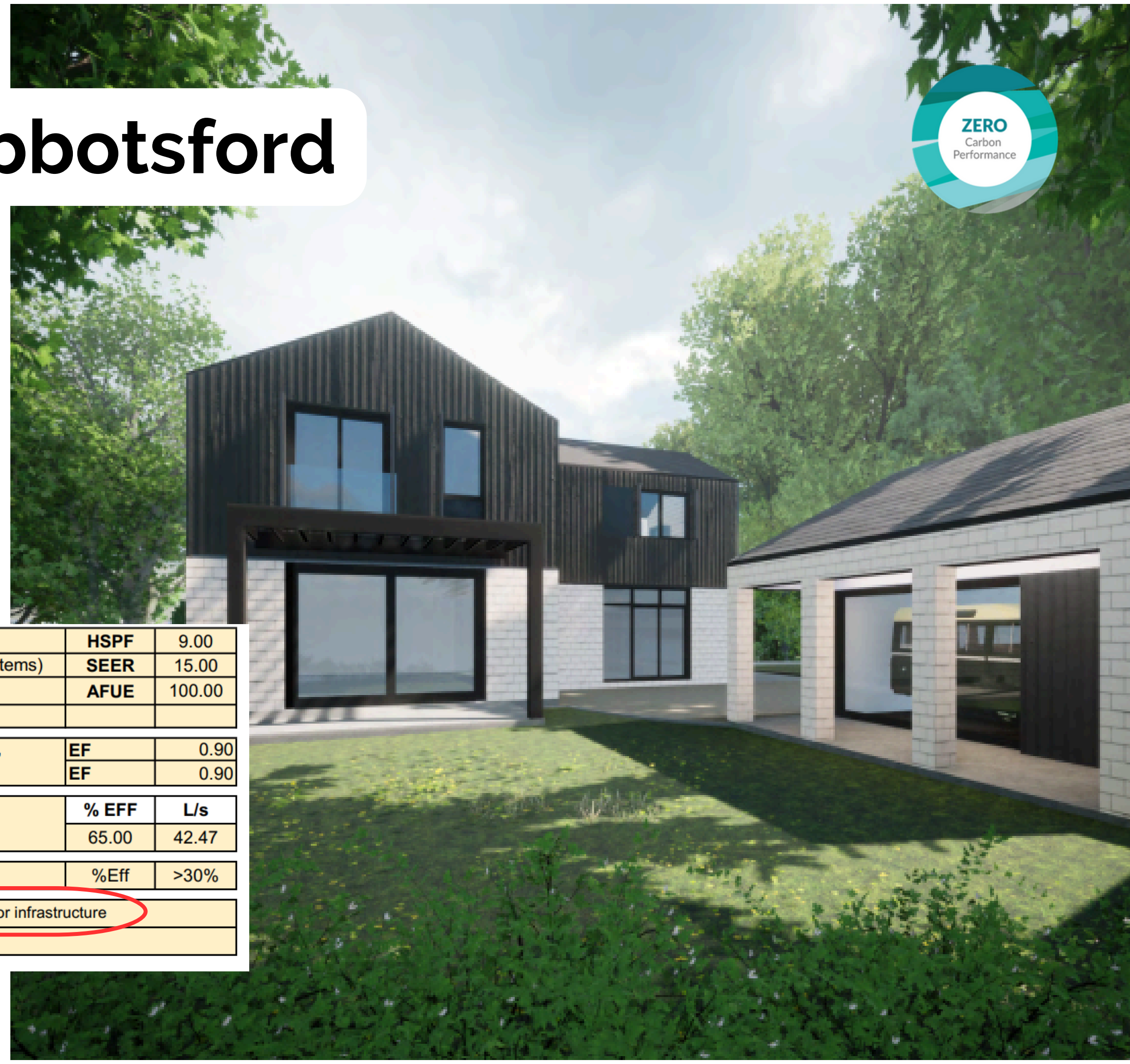


# Phoenix House, Abbotsford

## In Progress (2024)



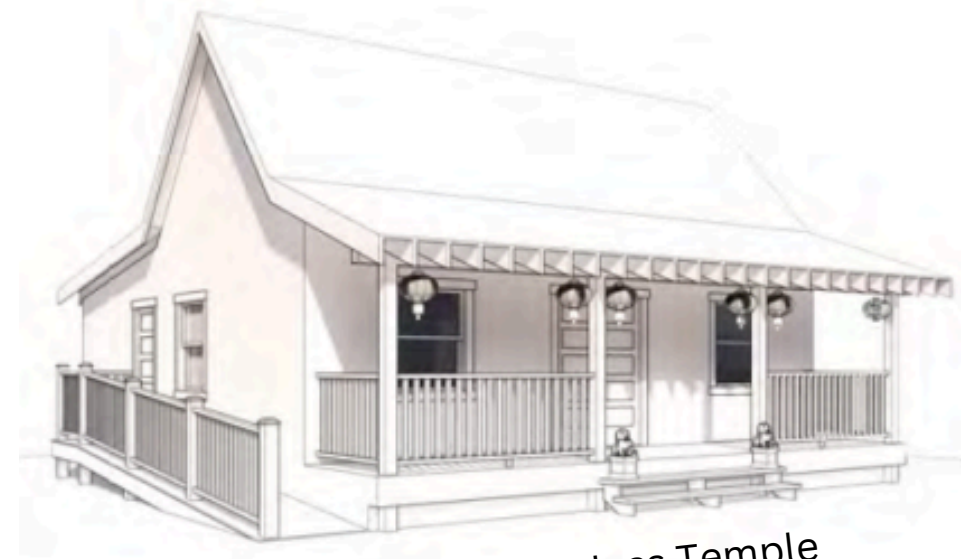
- No gas connection
- Multi-generational
- Load Management System
- Integrated Design Process



Space Heating/ Cooling	Principal	ASHP with electronic induction backup	HSPF	9.00
	(both principal unit and suite to have similar, but distinct, systems)		SEER	15.00
	Supplementary	Electronic induction backup to ASHP	AFUE	100.00
Domestic Hot Water	Heat Pump Hot water Tank - 50 US Gal in primary dwelling,		EF	0.90
	Heat Pump Hot water Tank - 40 Gal in Suite		EF	0.90
Ventilation	HRV X 2		% EFF	L/s
			65.00	42.47
Other	Drain water heat recovery		%Eff	>30%
Fossil Fuels	The building including all units is designed with NO fossil fuel use or infrastructure			

# Key Takeaways

- Energy & Zero Carbon Step Code are complementary
- Resiliency in mind
- Zero Carbon Step Code is accessible
- There are multiple ways to meet compliance



Original 1881 Joss Temple



Preserving the original form of the 29th century Joss temple with back and front expansions characteristic of methods of construction from this period