ZERO CARBON STEP CODE

Adoption

June 7, 2023

Zero Carbon Step Code Public Information Session

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Purpose

- Step Code Recap
- Zero Carbon Step Code Adopted Timeline
- Implementation & Compliance
- Communication

Step Code Recap

BC Energy Step Code

- Regulates energy efficiency of new buildings
- Compliance Metrics: MEUI, TEDI and ACH

BC Zero Carbon Step Code

- Regulates greenhouse gas (GHG) emissions of new buildings
- Compliance Metrics: kgCO2e/year and kgCO2e/m2/year

Previously “Carbon Pollution Standard”

Energy Step Code

Provincial Timeline

Timeline for Energy Efficiency Regulatory Requirements in the BC Building Code

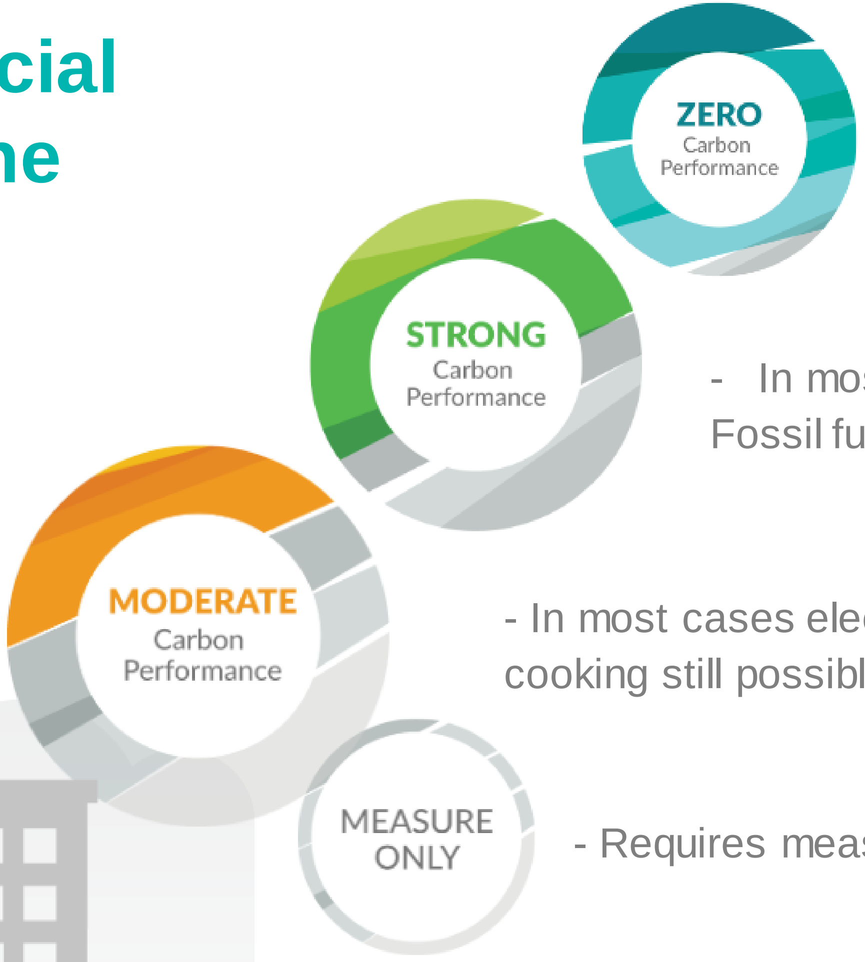
Here's what the province's CleanBC plan will mean for new-construction requirements.

	PART 9 BUILDINGS	PART 3 BUILDINGS	Energy-efficiency improvement above 2018 BC Building Code requirements
2032	STEP 5	STEP 4	NET-ZERO ENERGY-READY UP TO: 80%
2027*	STEP 4	STEP 3	40%
May 1, 2023	STEP 3	STEP 2	20%

*NEW TARGET DEADLINES

Zero Carbon Step Code

Provincial Timeline



2030

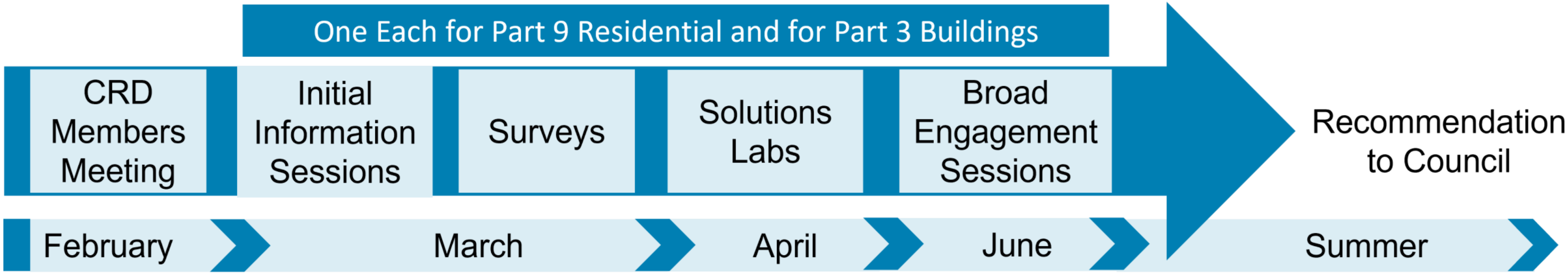
- In most cases no fossil fuels

- In most cases electrification of space heating and water heating. Fossil fuel water heating and cooking still possible based on design

- In most cases electrification of space heating. Fossil fuel water heating and cooking still possible

- Requires measurement of building emissions without reductions

2022 Engagement Summary



2022

Adopted Timeline

- Harmonized with the Provincial timeline for the BC Energy Step Code

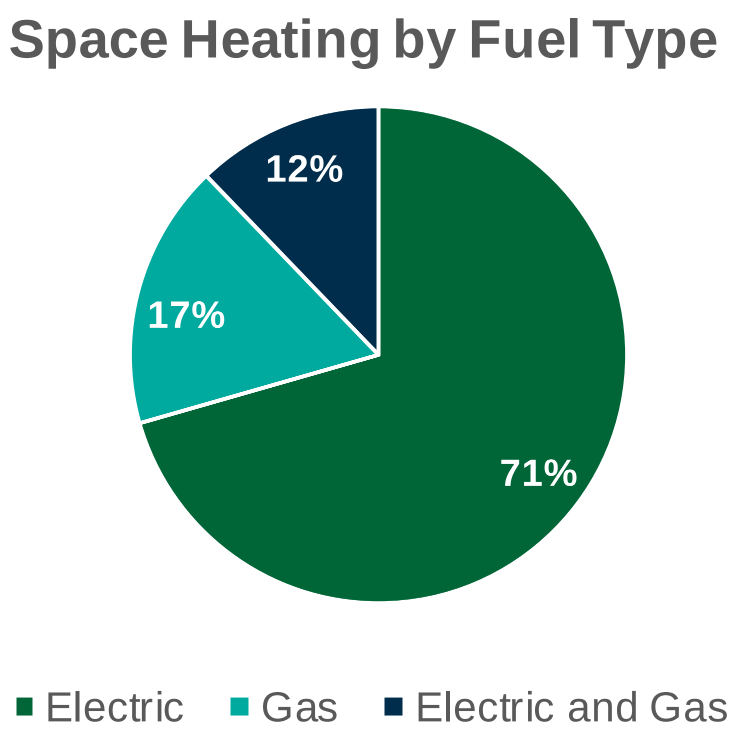
Zero Carbon Performance Level	Implementation Date		
	Part 9 Buildings	**Part 3 MURBs* 6 storeys or fewer**	**Remaining Part 3 Buildings**
Measure Only (GHG Emission Level 1)	May 1, 2023		
Zero Carbon Performance Level (GHG Emission Level 4)	Nov 1, 2023	July 1, 2024	Nov 1, 2024

- Labelling - prior to occupancy, EnerGuide Rating System Label submitted to the District of Saanich & affixed to the building (e.g. electrical panel)

Implementation

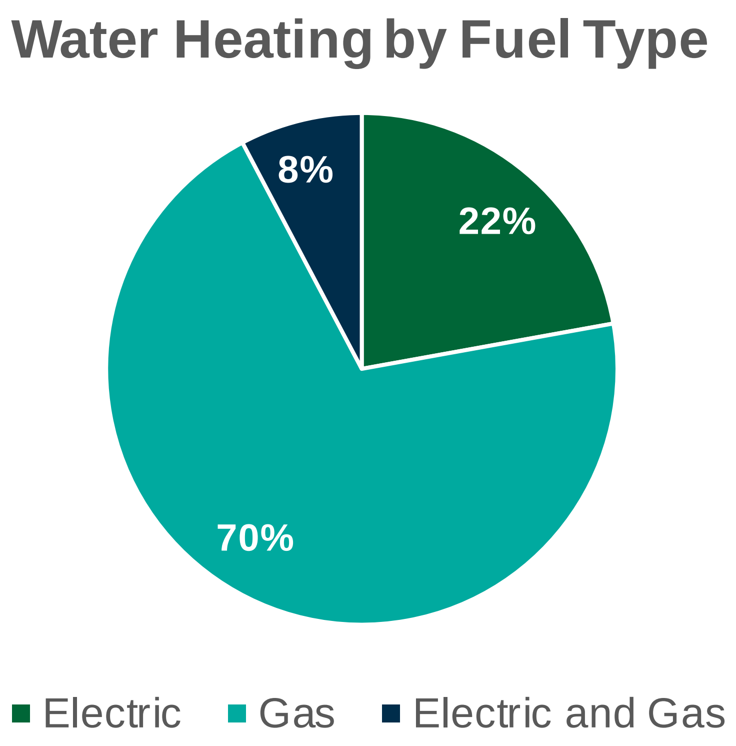
- Implementation at the Building Permit Application Stage
- Information provided to applicants at the Rezoning & Development Permit Application stage
  - As with BC Energy Step Code, it is recommended that applicants and design teams familiarize themselves with the requirements of the Zero Carbon Step Code early in the development and design process.
- No allowances for in-stream DP/RZ applications
- No allowance for Renewable Natural Gas (RNG) for compliance

Compliance Approaches to Date (regional)



Common Space Heating Equipment

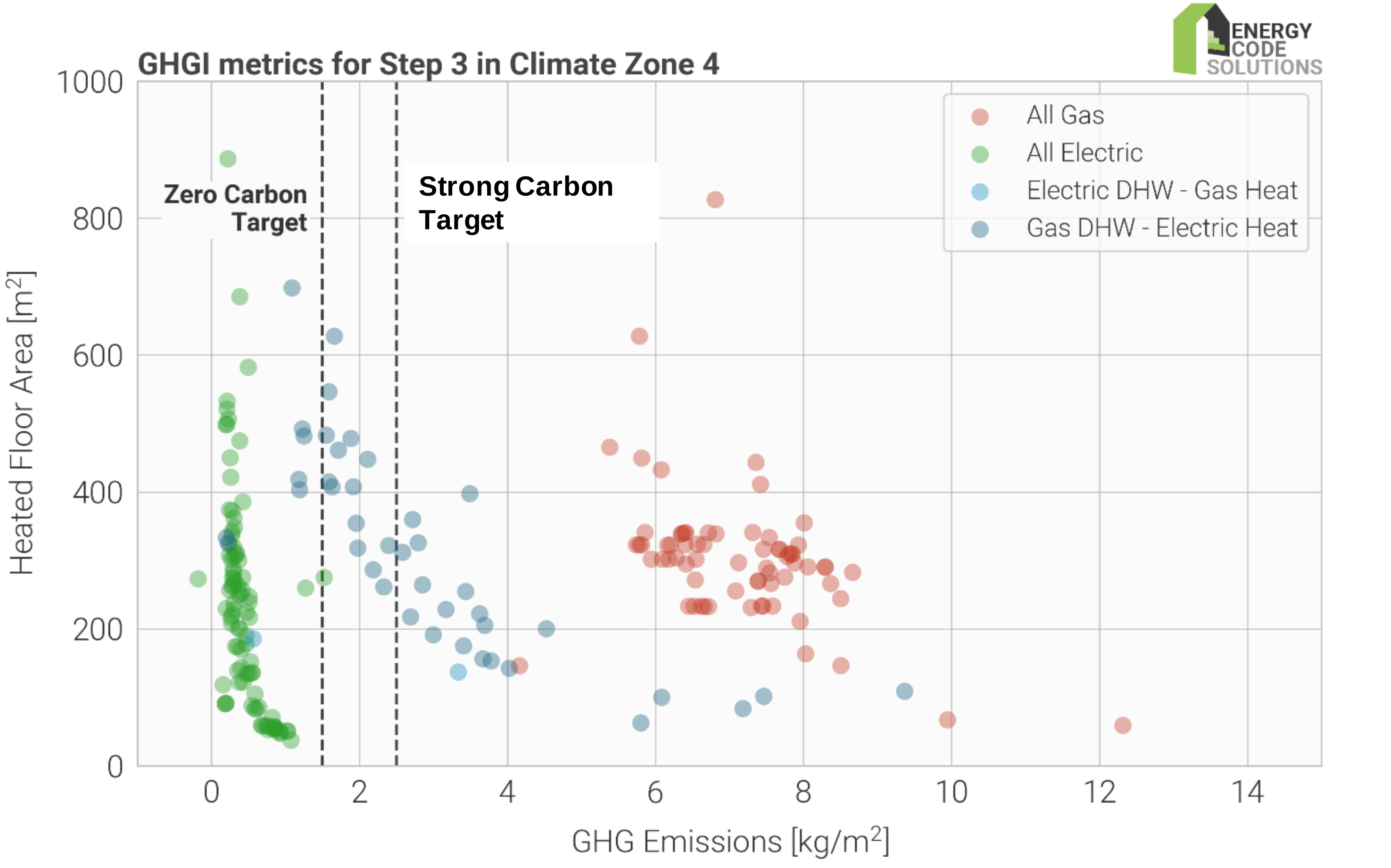
- Air Source Heat Pumps 57%
- Electric Baseboards: 13%
- Combination NG: 12%



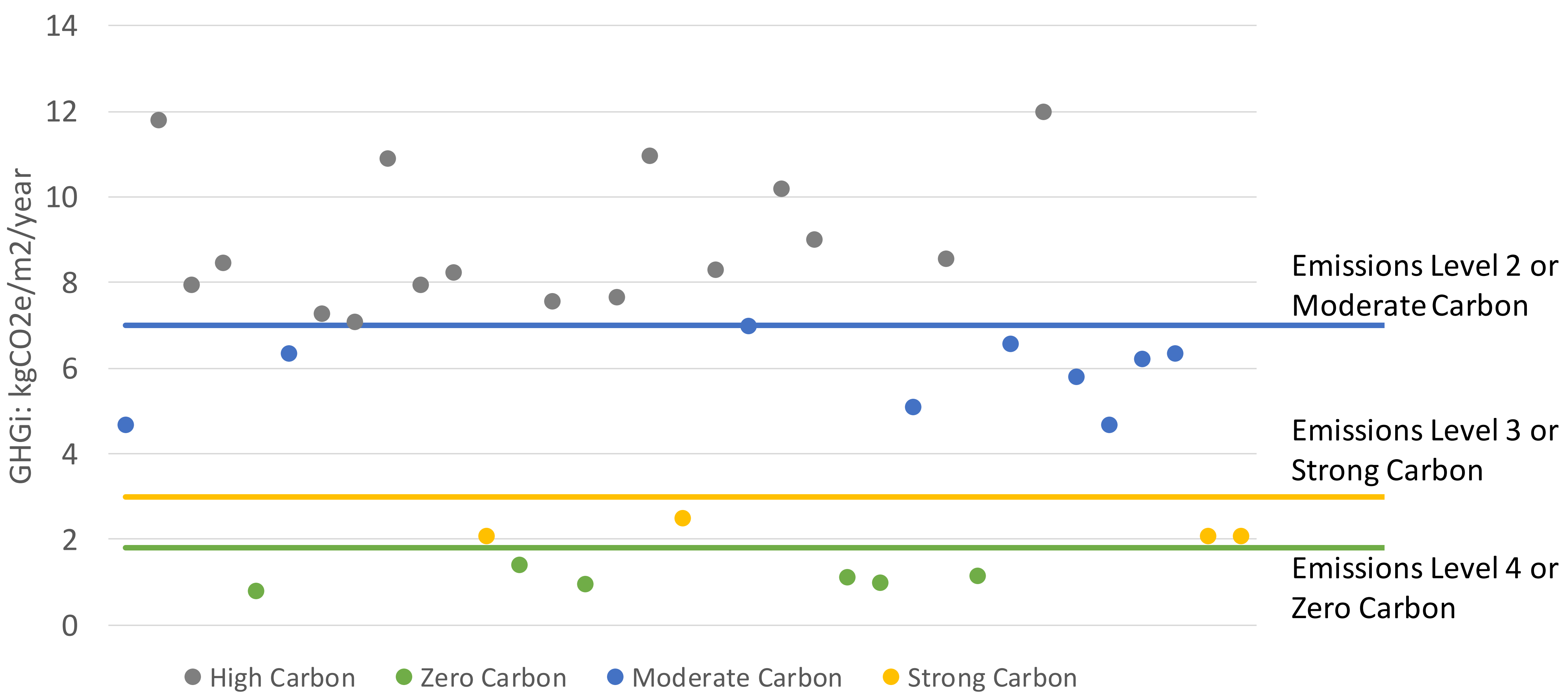
Common Hot Water Heating Equipment

- Natural Gas On-demand: 70%
- Electric tanks: 20%

Zero Carbon Compliance Approaches



MURBs and Mixed Use Part 3 Buildings GHGi and Approximate Carbon Pollution Standard Thresholds



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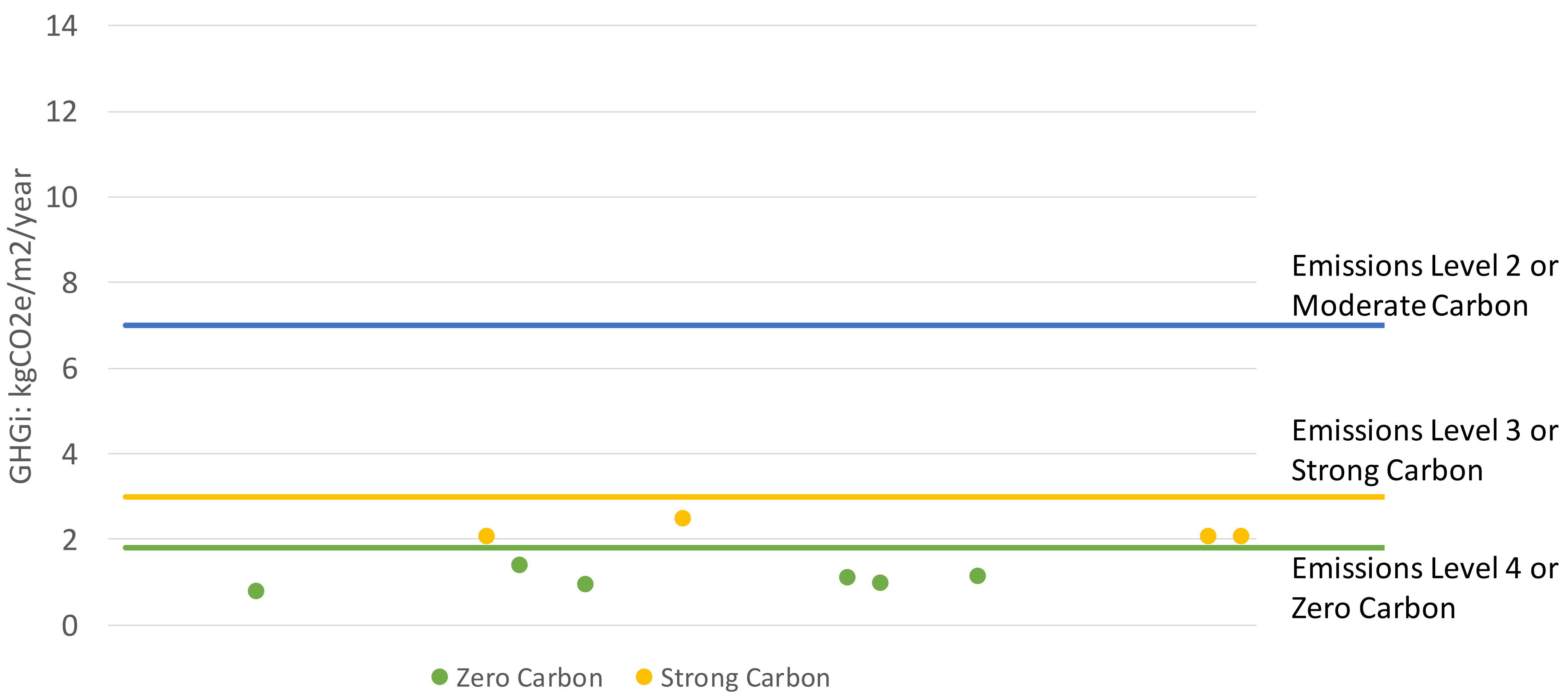

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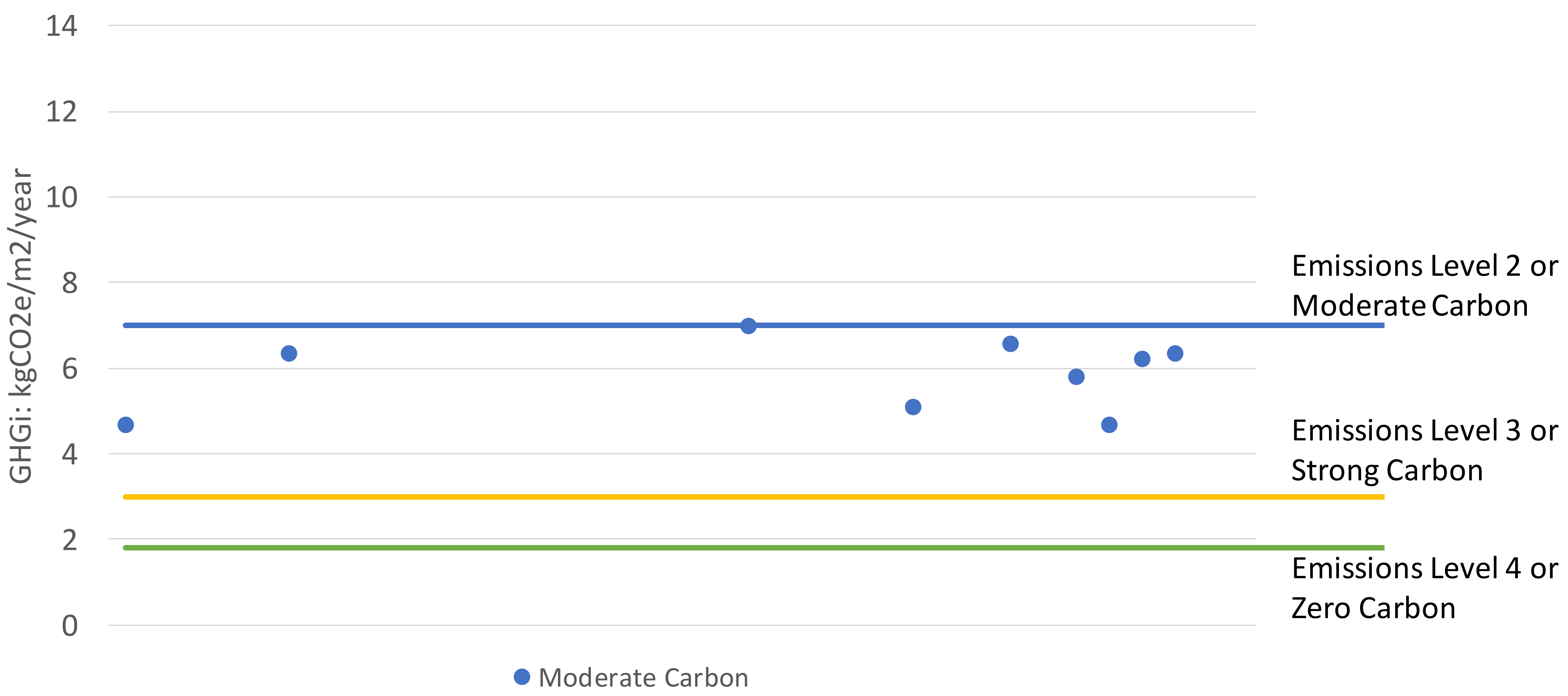

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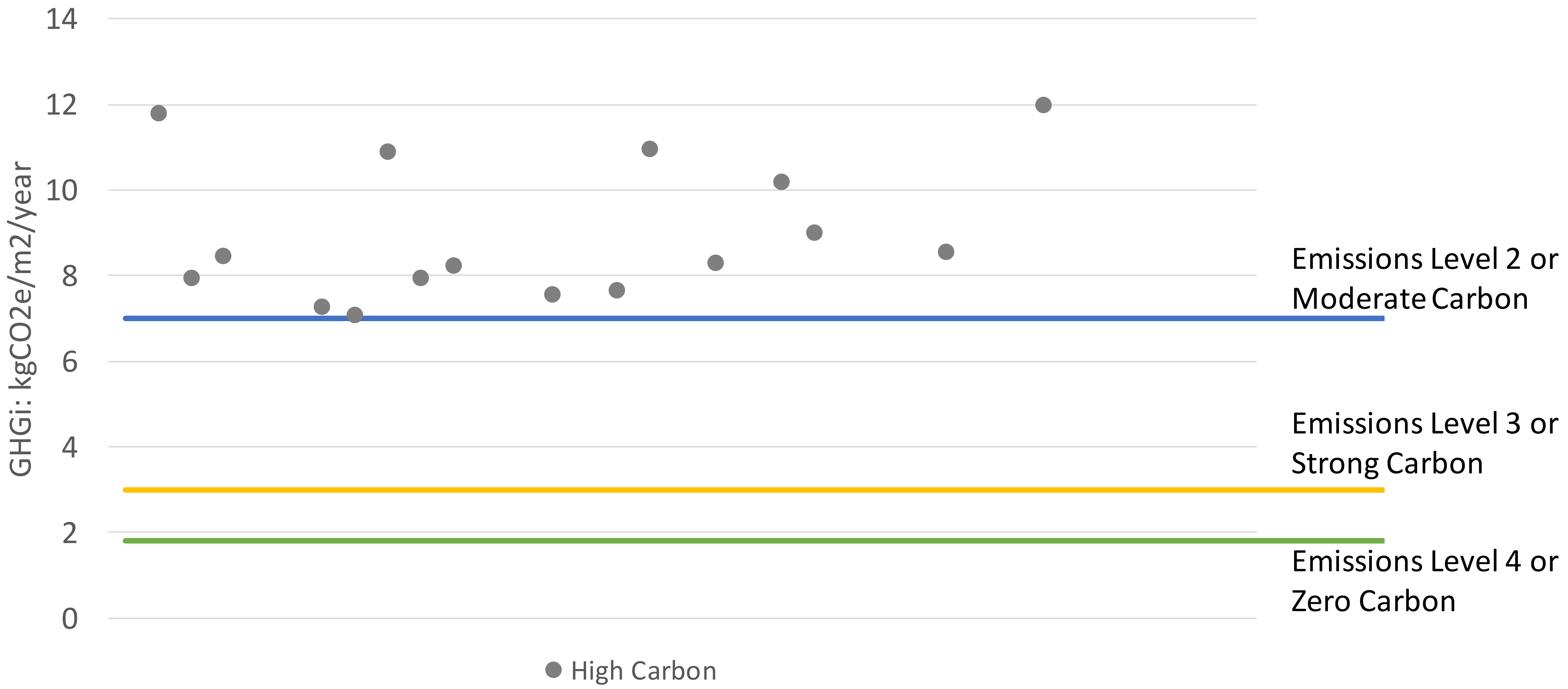

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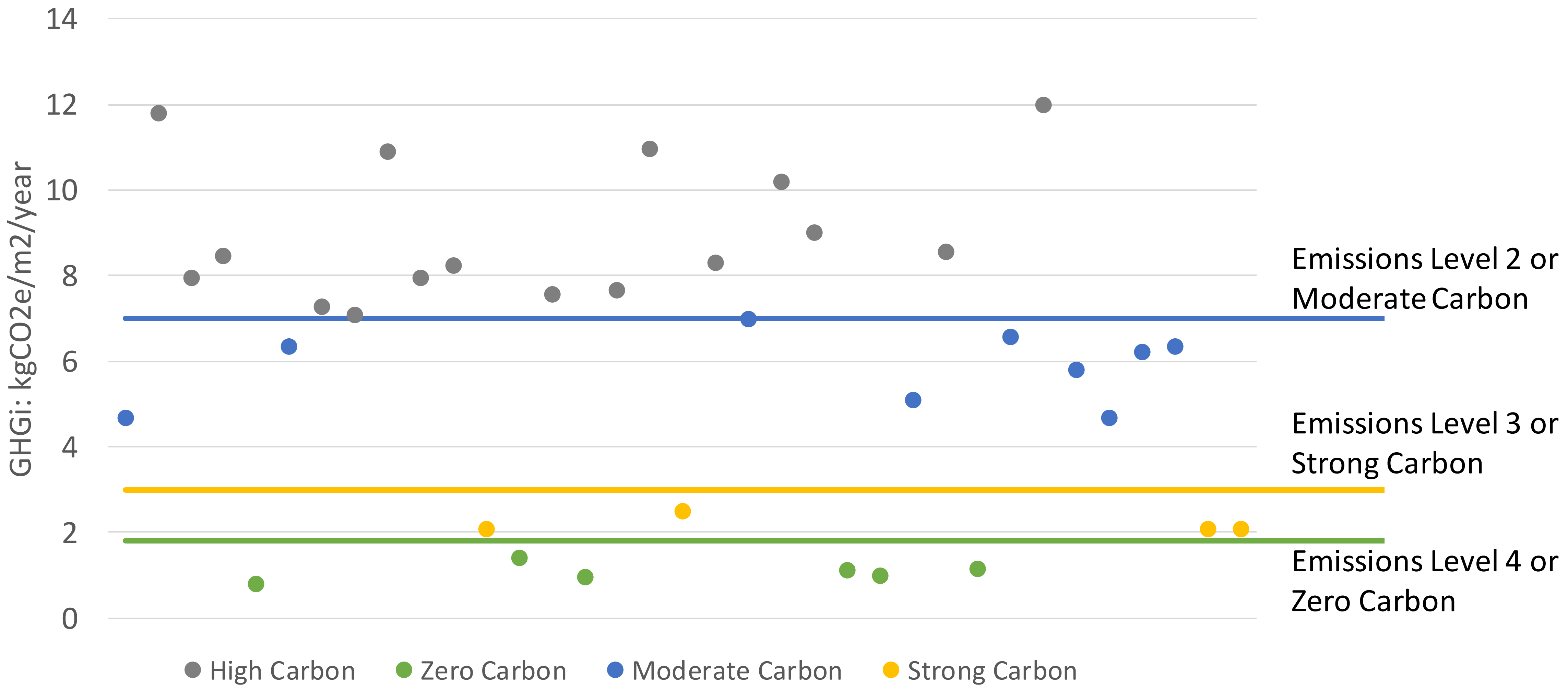

Communications

- Step Code webpages
  - www.saanich.ca/stepcode
  - BC Energy Step Code | Victoria
- Zero Carbon Step Code FAQ
  - On webpage (step code, building and development)
  - In Rezoning and DP application packages
- Emails to industry associations
  - CHBA, UDI, VICA, VRBA
- Zero Carbon Step Code Webinar(s)
  - Collaboration with City of Victoria, Saanich and CRD
- Presentations to industry as requested
- More Information – www.energystepcode.ca

Questions

Additional Slides

Zero Carbon Step Code – Building Code Requirements

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

GHG Emission Level	GHG Emission Compliance Options					
	Maximum GHG Emissions by House, Expressed in kg CO_{2e}/year	or	Maximum GHG Emissions by House[1]		or	Reduction of GHG Emissions by Energy Source of Building Systems[2]
			Maximum GHGI of the House, Expressed in $kgCO_{2e}/m^2$/year	Maximum GHG Emissions by House, Expressed in $kgCO_{2e}$/year		
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 $kgCO_{2e}$/kWh
EL-3	440		2.5	800		Energy sources supplying heating and service water heating systems have an emissions factor ≤ 0.011 $kgCO_{2e}$/kWh
EL-4	265		1.5	500		Energy sources supplying all building systems, including equipment and appliances, have an emissions factor ≤ 0.011 $kgCO_{2e}$/kWh

Notes to Table 9.37.1.3.:

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

(2) 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.

Comparison of Adoption Approaches

	Former Direction from Aug. 2022			Effective Timeline	Difference Notes
	Emissions Level 3 (Low Carbon)	Emissions Level 4 (Zero Carbon)		Emissions Level 4 (Zero Carbon)	
Part 9 Residential Buildings (600m2 or smaller)	July 1, 2023	January 1, 2025		November 1, 2023	• Delay initial adoption by 6 months. • No interim adoption of Low Carbon. • Accelerate adoption of Zero Carbon by 14 months.
MURB 6 Storeys or Fewer	July 1, 2024	July 1, 2025		July 1, 2024	• No interim adoption of Low Carbon. • Accelerate adoption of Zero Carbon by 12 months.
MURB 7+ Storeys and Commercial Buildings	July 1, 2024	July 1, 2025		November 1, 2024	• No interim adoption of Low Carbon. • Accelerate adoption of Zero Carbon by 8 months.

New Buildings vs. Existing Buildings

- Climate Plan modelling shows achieving Zero Carbon new construction = 4% of our climate target pathway
- Each new building using fossil fuels results in GHG emissions and requirement for future retrofit

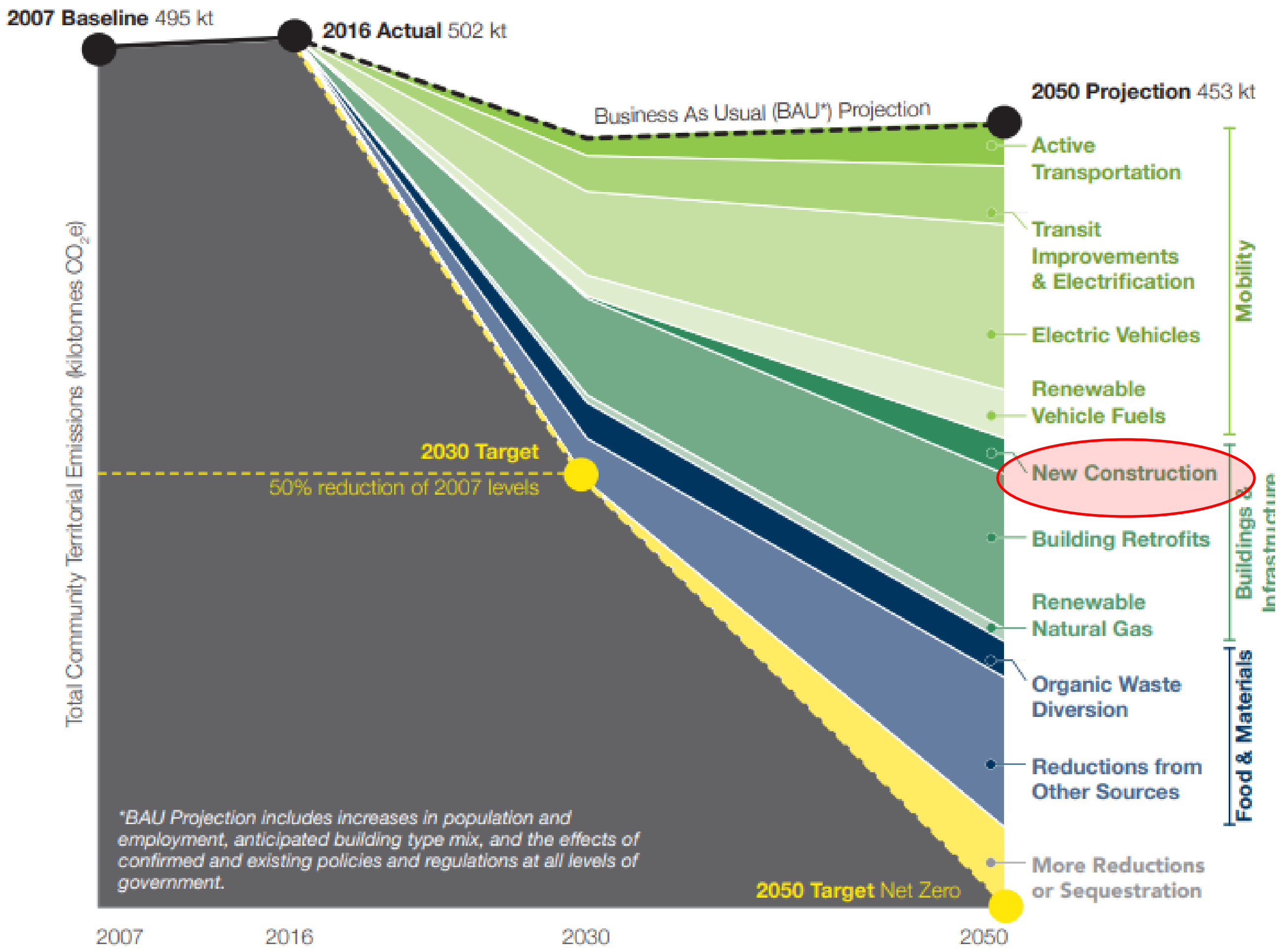

Figure 5. Modelled pathway for Territorial GHG emission reductions in Saanich

Costs

- Provincial & Vancouver costing studies summarized in Attachment 2
- Operational costs and affordability

Table 2: Incremental Construction Costs (% increase from Step 3) for Low/Zero Carbon and Higher Steps

Building Type	**Incremental Construction Costs** (% increase from Step 3)			
	Low Carbon (at Step 3)	**Zero Carbon** (at Step 3)	**Step 4**	**Step 5**
Small SFD (approx. 100-200m²)		0.6%	1.8% - 2.8%	7.1% - 8.8%
Medium SFD (approx. 200-300m²)		0.6%	1.0%	2.8%
Large SFD		0.4%	1.1%	2.9% - 3.7%
Multi-Family (6 storey or less)	1.3%	0% - 2.2%	2.6%	N/A

Costs

[Residential Hot Water Electrification | b2electrification.org]

Comparison of Regular Gas vs. Electric Water Heating Systems					
Attributes	**Regular Gas**		**Electric**		
System	**Standard Gas Tank**	**Tankless System**	**Standard Tank**	**Premium Tank**	**Heat Pump Hot Water System**
Annual Operation Costs Source: FortisBC Home Energy Calculator	$341	$230	$499	$488	$126 - $191
Annual Maintenance Costs	None	$100 Annually	None	None	$100 Annually
25-year Cost Projection Results (Includes purchase price, operational costs, maintenance fees. Does not include rebates)	7 yr. Tank $14,596 10 yr. Tank **$12,775**	**$13,250**	7 yr. Tank $15,689 10 yr. Tank $14,725	**$13,500**	**Mid-Efficiency (UEF2.3):** **$13,044** **High-Efficiency (UEF3.5):** **$11,419**

HOW WORRIED SHOULD INDUSTRY BE?

Spring 2023

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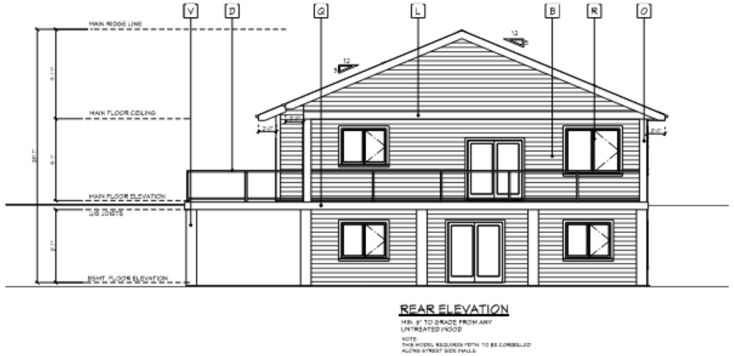
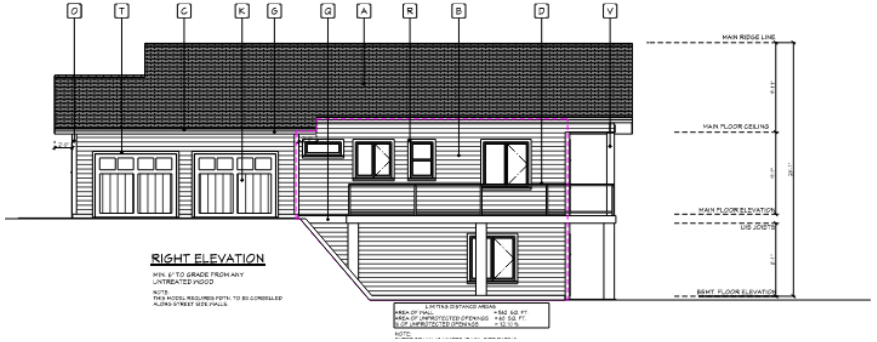
Hurko Residence Carbon Step Code Example





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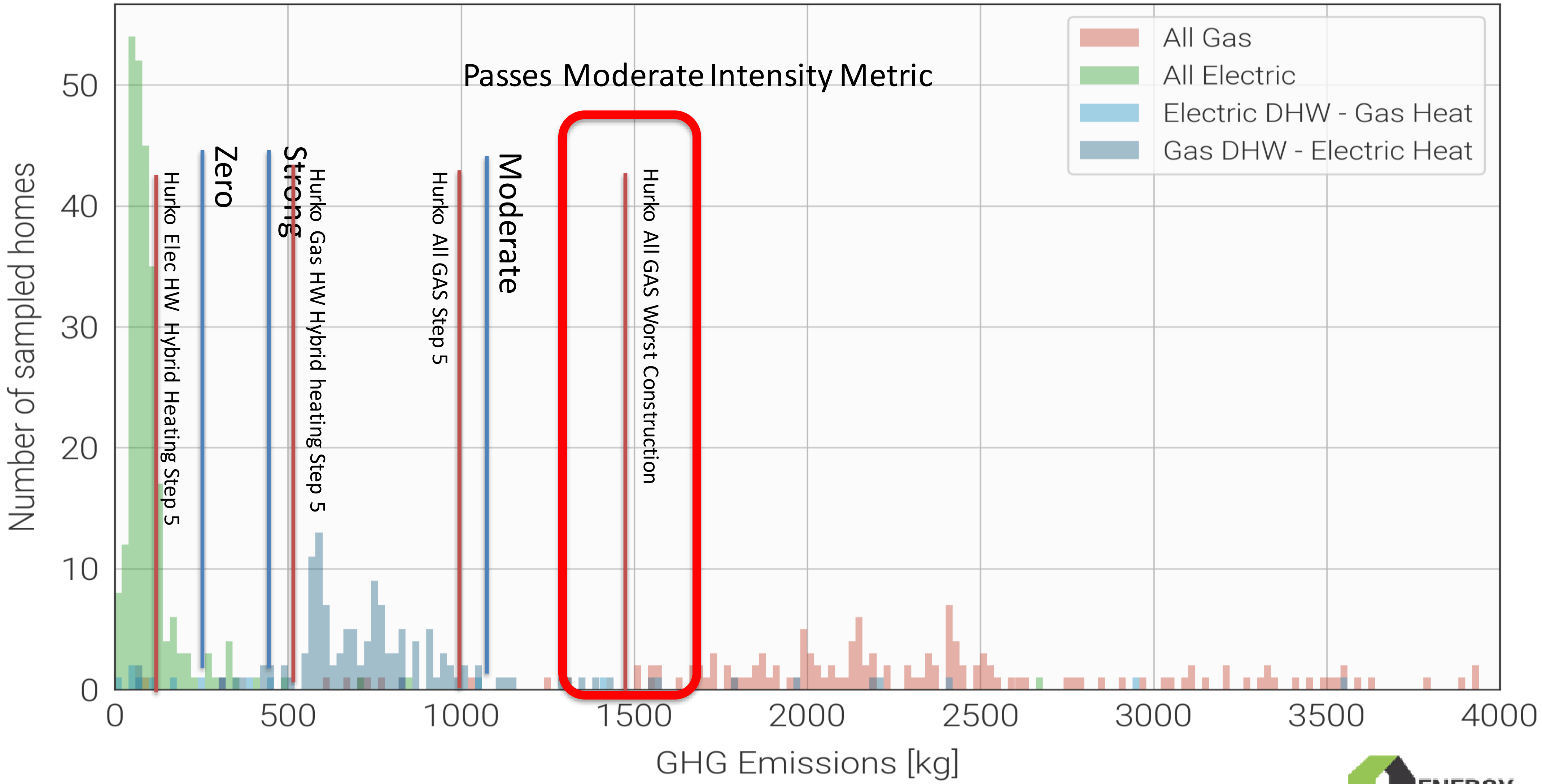

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ENERGY CODE SOLUTIONS

What is Counted and What is Not

- **Principal Heating System**
  - Heat Pump
  - Gas Furnace
  - Combo system
- **Supplementary Heating Equipment**
  - The Gas Side of the Hybrid
  - Electric Supplement in Heat Pump
- **Hot Water**
  - Tank
  - Boiler
- **Redundant and Backup Systems**
  - Generator
  - Gas fire place
  - Wood Fire place
- **Equipment and Appliances:**
  - Cooking
  - Laundry

Mostly Sort Of

Not really but a bit

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Gas Heating Economics

Running cost:

Gas sells for about half the price of electricity

So if your electric system is two times more efficient its cheaper to run

- Easy to reach with a standard heat pump

Install Cost:

On southern Vancouver Island heat pumps can run all year there is no need for supplementary heating.

- So why bother installing the gas system?

Keep this

No need for this

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Zero Carbon Sells
Island Examples

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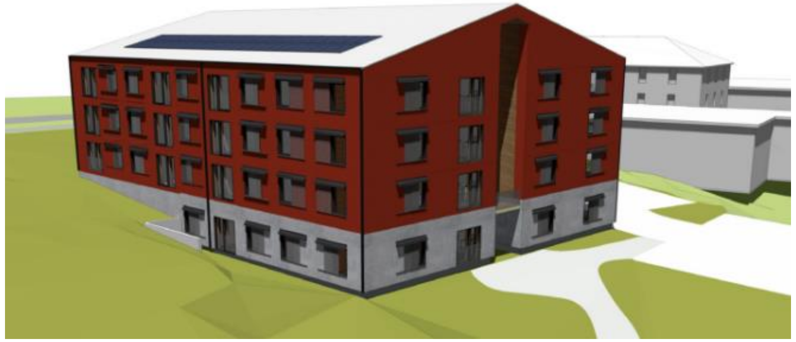
If it can be done here what is our excuse?

Part 9 Step 5
Zero Carbon
Northern BC

Total Build Cost under $400,000

ICON HOMES LTD.



WAYMARK ARCHITECTURE

Part 3 Step 4
Zero Carbon
Affordable Rental
Northern Nova Scotia

Total Estimated Build Cost 7.5 Million

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City of Victoria & District of Saanich

Zero Carbon Step Code In Part 3 Buildings

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Quick Intro

- 15+ Years, Mainland to Island
- Introba Victoria Office est. 2014
- MEP, Modeling, Sustainability Services
- Focus on High-Performance Commercial + Affordable Housing
- CRD Step Code Adoption 2018
- CRD Step Code Advancement 2022
- Victoria Resident
- Dad

Local Impact: Vancouver Island Case Studies

TELUS Ocean

Part 3 Office

Step 3, Zero Carbon

Image Credit:
Diamond Schmitt Architects

Discover Montessori School

Part 3 Commercial

Net Zero Energy

Image Credit:
Checkwitch Poiron Architects

Nigel House Residential Care

Part 3 Residential

Step 2, Fully Electric

Image Credit:
DAU Studio

Saanich Fire Stn #2 Replacement

Part 3 Commercial

Step 3, Net Zero Energy& Carbon

Image Credit:
hcma

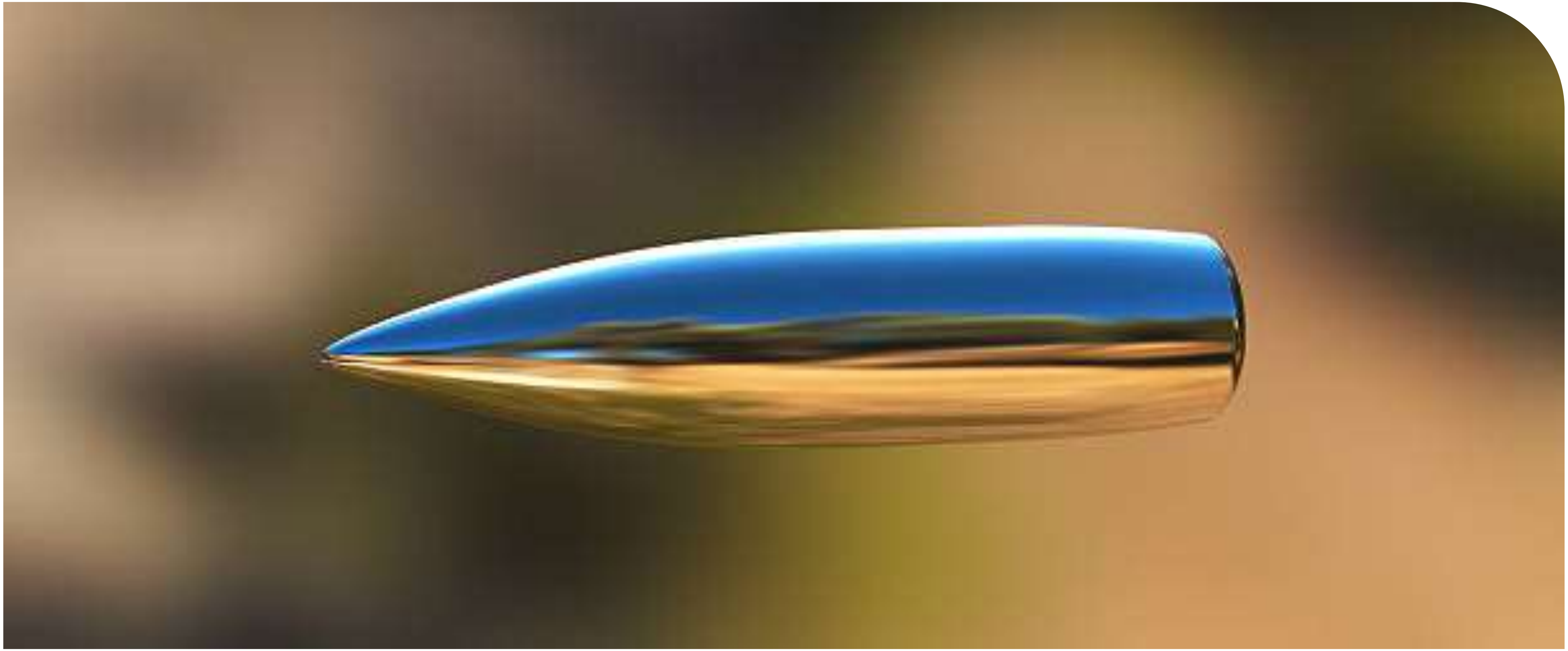
North Cowichan Seniors Housing

Part 3 Residential

Step 3, Fully Electric

Image Credit:
Low Hammond Rowe Architects

The costs and implications of getting to zero carbon?



… depends on what you are starting with.

Stuck on Brute Force Systems Approach

Image Credit:
Low Hammond Rowe Architects

Large Building Mechanical Approaches at a Glance…

Economy of Scale

1515 Douglas St

Victoria BC

Hybrid Air/Ground Source Heat Recovery Heat Pump

High Performance Commercial HVAC Equipment

Charter Telecom HQ

Langford BC

Central High-Performance HRV

Heat Recovery

Uptown Shopping Centre Whole Foods

Saanich BC

Refrigeration Heat Recovery

Greater Flexibility in System Types

750 Pandora BC Investment HQ

Victoria BC

Radiant Ceiling

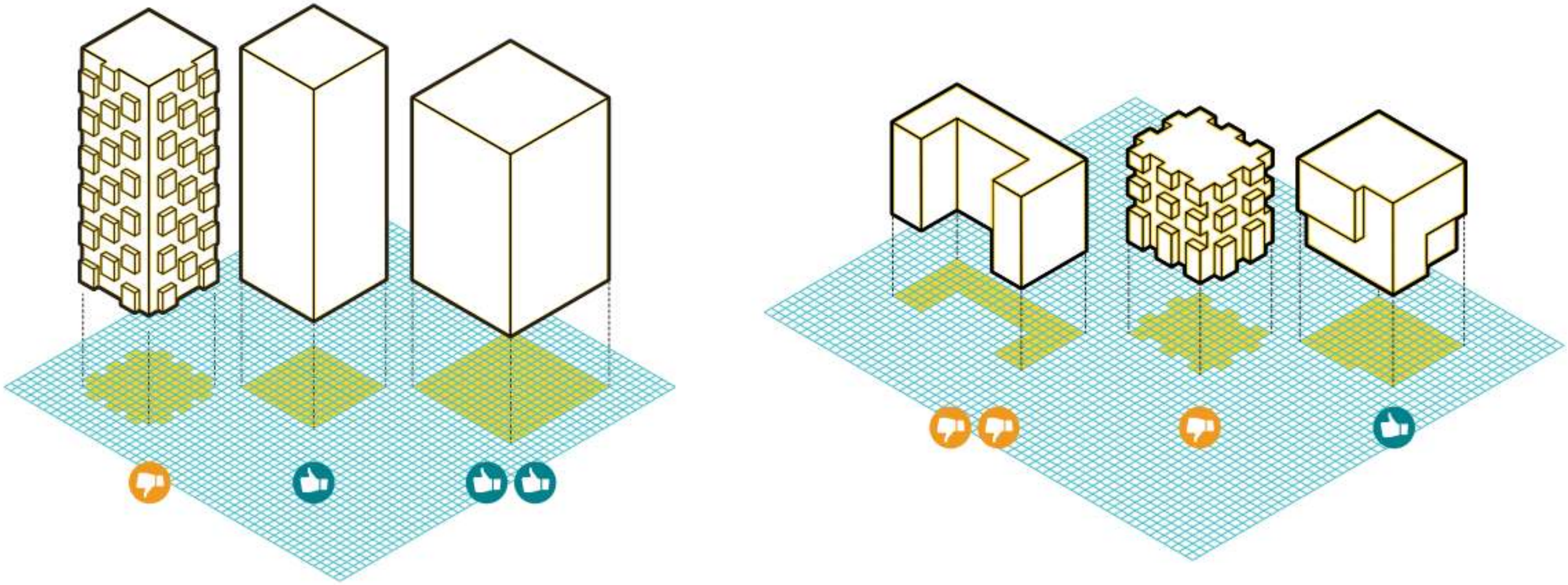
Innovative Ventilation Strategies

Reliable Controls HQ

View Royal BC

Natural Ventilation

But HVAC Systems Only Contribute So Much…



Higher Steps and Zero Carbon do not necessarily require more complex or expensive systems. Form and character of architecture becomes constrained at higher levels.

Thermal Energy Demand Intensity (TEDI)

MURB Case Study:

North Cowichan Seniors' Housing

- Wood-Frame Combustible Construction
- 4 Storey MURB, 52 Units
- Electric Baseboard Heating, No Cooling
- ASHP DHW + Elec Backup
- Central HRV (mid-range performance)
- Climate Zone 4
- 10% WWR, Double Glazed Vinyl

Image Credit:
Low Hammond Rowe Architects

Thermal Energy Demand Intensity (TEDI)

MURB Case Study: North Cowichan Seniors' Housing

Thermal Energy: where does it go?

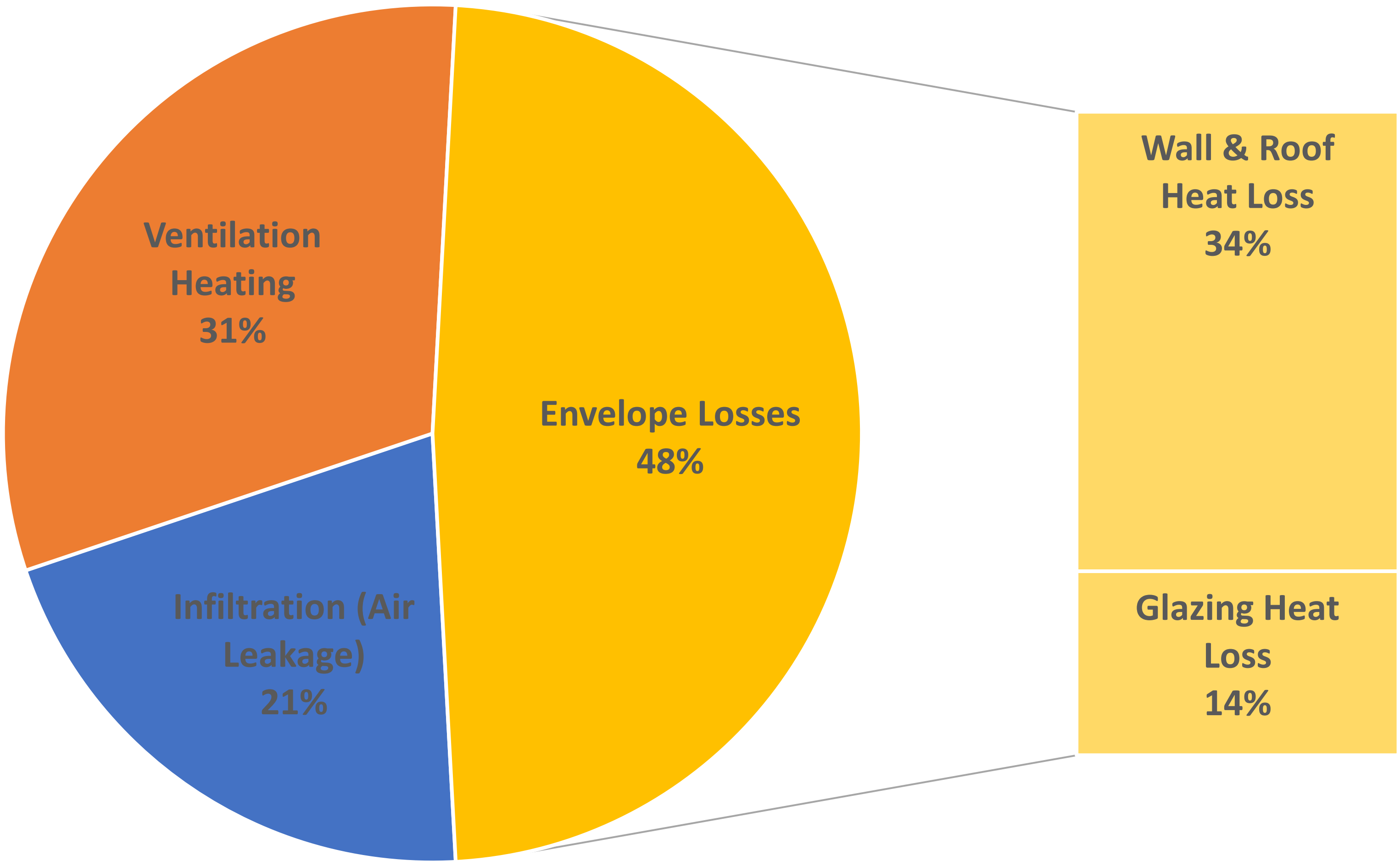
Design TEDI = 29 kWh/m²-yr

vs Part 3 Residential targets:

- Step 3 < 30 kWh/m²-yr
- Step 4 < 15 kWh/m²-yr

<u>**Takeaways:**</u>

- **Ventilation Heating already minimized to < 1/3 of TEDI with HRVs**
- **Envelope Losses ~ half of TEDI → Architecture has big impact, even with WWR already constrained at ~10%**
- **Infiltration at 21% is a wildcard**



Thermal Energy Demand Intensity (TEDI)

Commercial Case Study: TELUS Ocean

- Concrete Non-Combustible Construction
- Ground Floor Retail + 9 Storeys Office
- Fully Electric ASHP Heating, Cooling, DHW
- Central High-Performance HRVs
- 46% WWR, Triple Glazed Curtainwall
- Climate Zone 4

Image Credit:
Diamond Schmitt Architects

Thermal Energy Demand Intensity (TEDI)

Commercial Case Study: TELUS Ocean

Thermal Energy: where does it go?

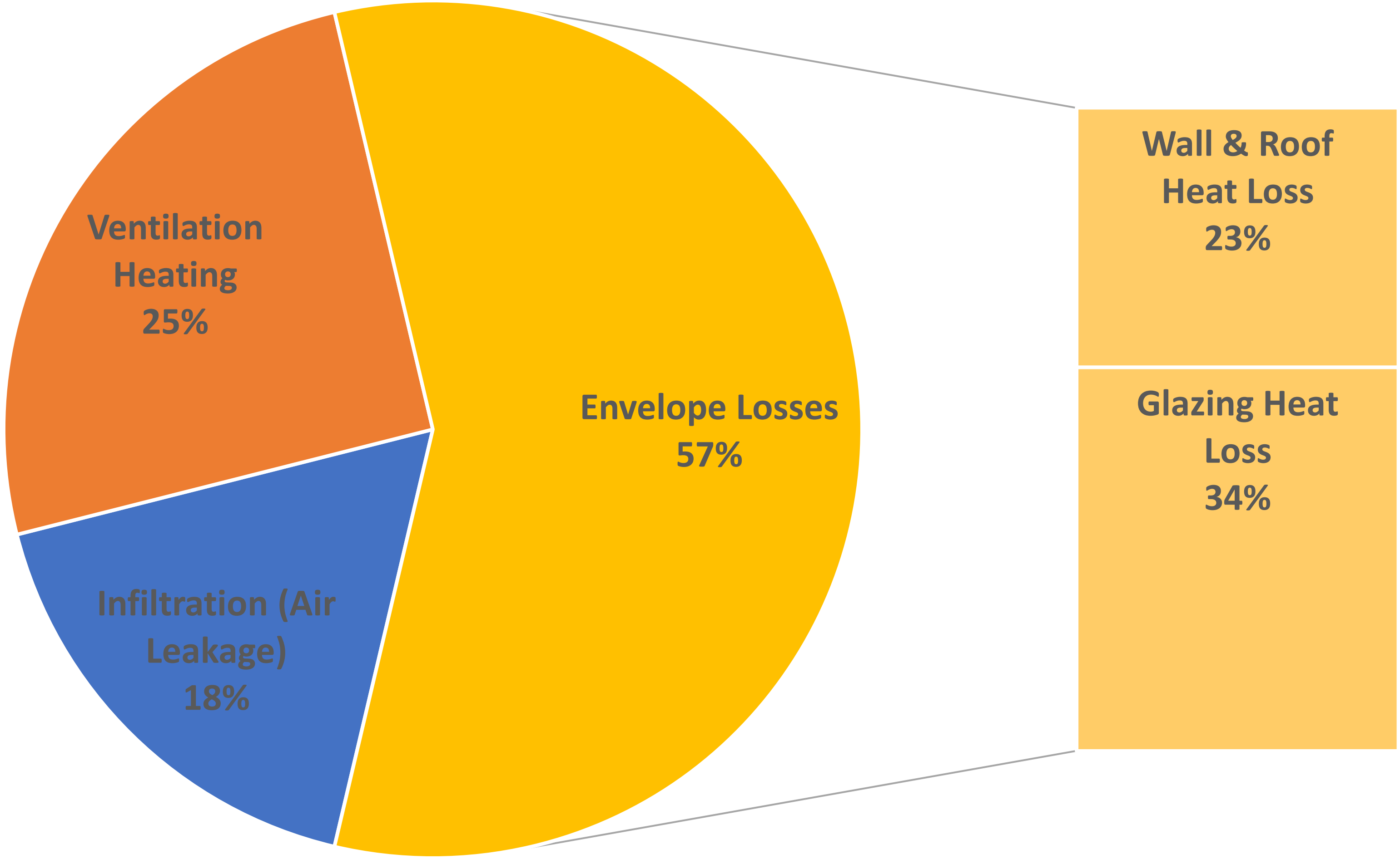
Design TEDI = 19 kWh/m²-yr

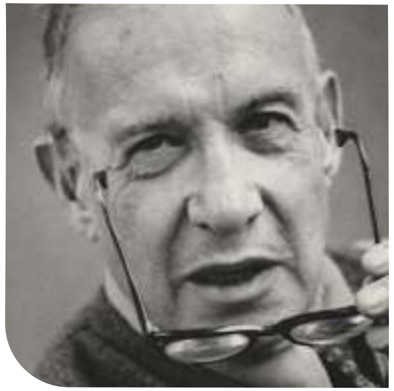
vs Part 3 Commercial Step 3 target

< 20 kWh/m²-yr (highest possible step)

<ins>**Takeaways:**</ins>

- **Ventilation Heating already minimized to < 1/4 of TEDI with top-of-line HRVs; can't get lower**
- **Envelope Losses ~ half of TEDI → Architecture has big impact**
- **Infiltration at 18% is a wildcard especially with aggressive target**





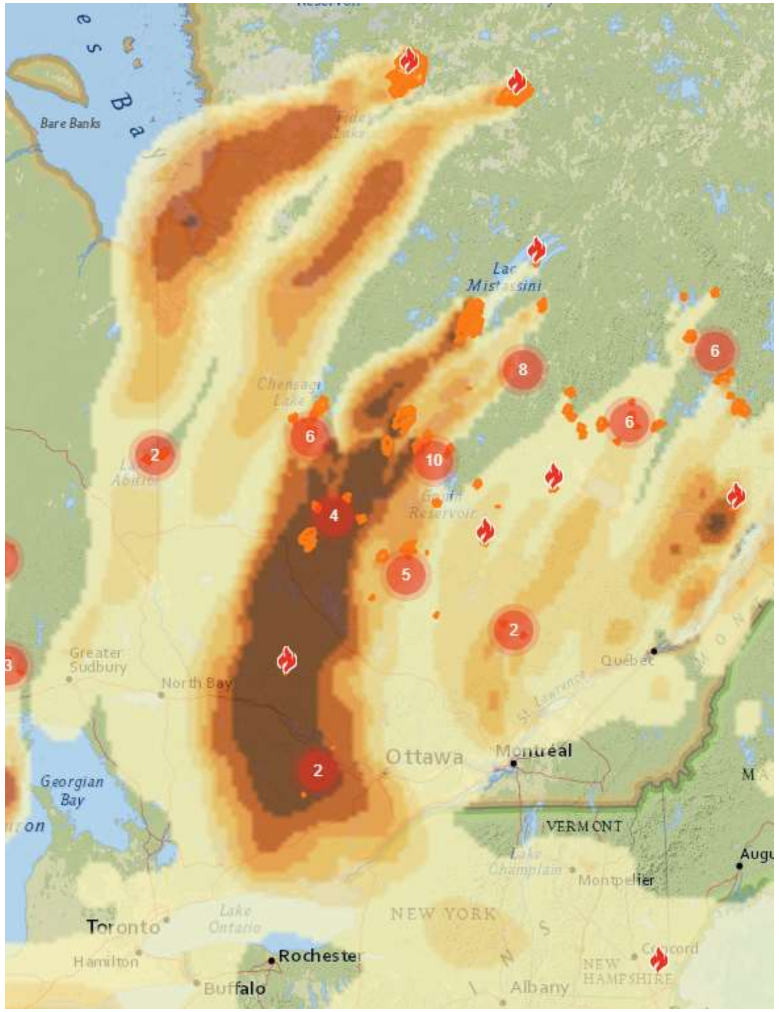
"What gets measured, gets managed."

Peter Drucker (1909-2005)

American Management Guru

Energy Efficiency ≠ Carbon Emission Reduction

EUI and TEDI Optimization ≠ Climate Change Mitigation



TEUI, TEDI... What about **GHGI**?

In British Columbia,

NATURAL GAS is

17x more

carbon-intensive

than ELECTRICITY

Table 1.2 Emissions Factors by Fuel Type	
Fuel Type	Emissions Factor ($kgCO_{2e}/kWh$)
Natural Gas	0.185
Electricity	0.011
District Energy System	as provided by utility[1,2]

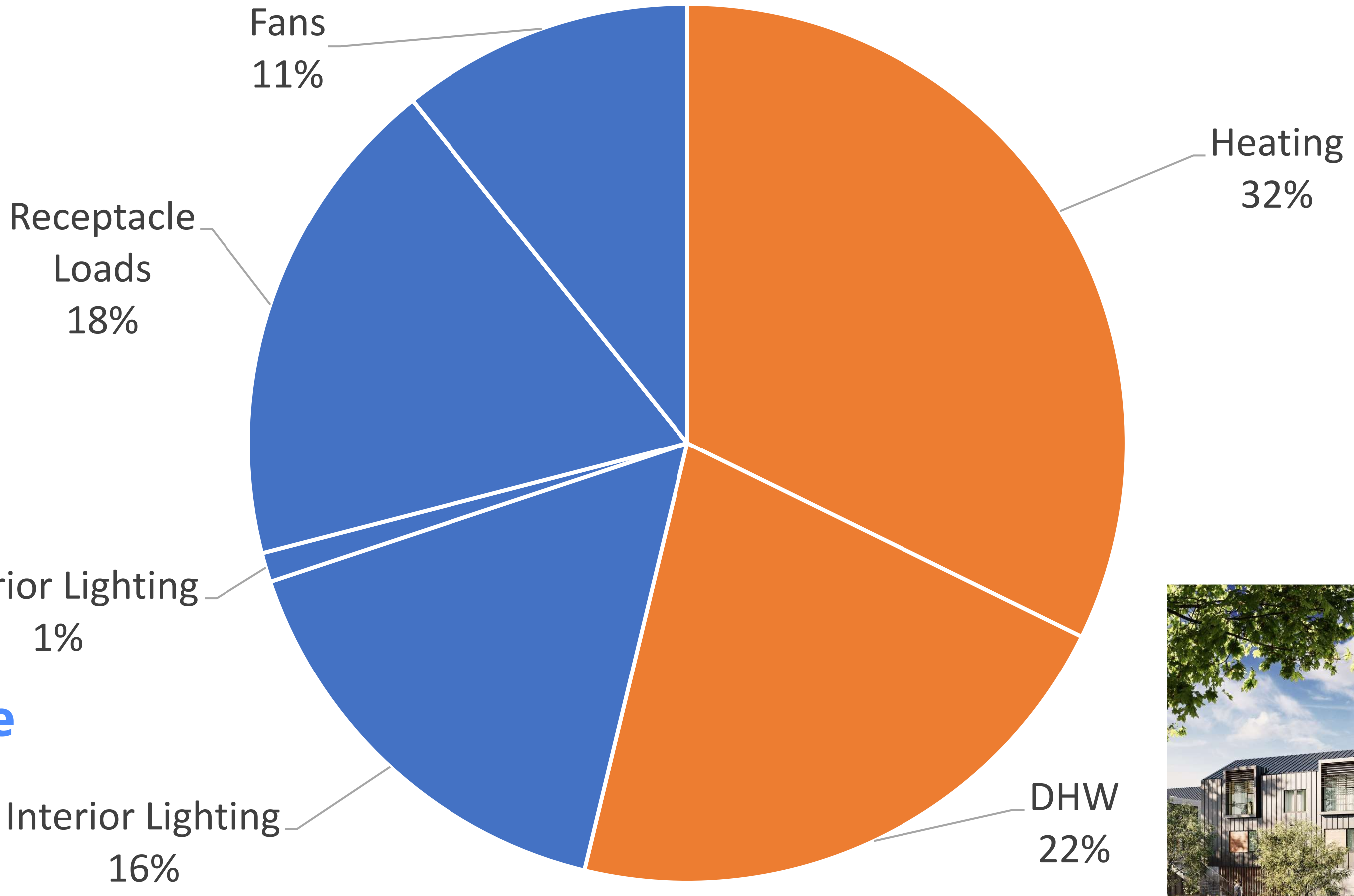
For British Columbia, DECARBONIZATION ≈ ELECTRIFICATION

TEUI x Fuel Type = Green House Gas Intensity (GHGI)

MURB Case Study: North Cowichan Seniors' Housing

- Step 4 TEUI < 100 kWh
- TEUI is also hard to hit… but not as hard as TEDI.

- **Orange slices** represent end-uses that *could* be natural gas, but have been electrified; potential swing of GHGI based on fuel source is very significant
- **All other end-uses (blue slices) are already electric**

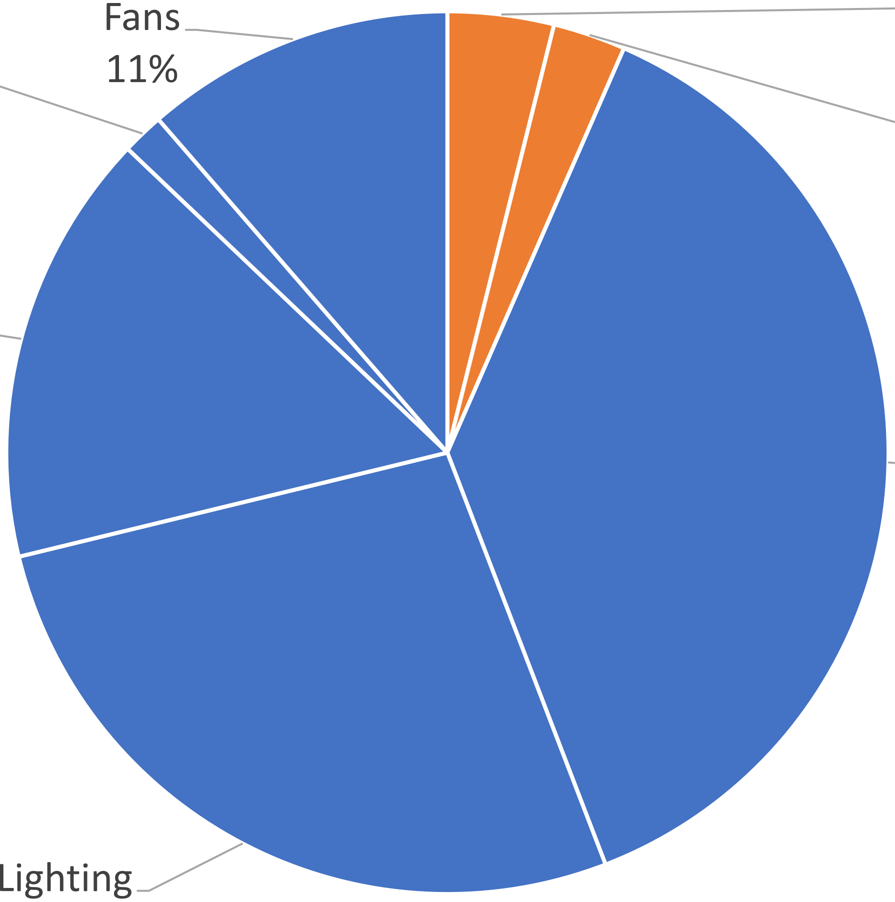


TEUI x Fuel Type = Green House Gas Intensity (GHGI)

Commercial Case Study: TELUS Ocean

- Step 3 TEUI < 101 kWh (blended)
- TEUI is also hard to hit… but not as hard as TEDI.

- **Orange slices** represent end-uses that *could* be natural gas, but have been electrified; compared with residential projects, GHGI swing less significant
- **All other end-uses (blue slices) are already electric**



TEUI x Fuel Type = Green House Gas Intensity (GHGI)

Case Study Summary

Low Hammond Rowe Architects

Diamond Schmitt Architects

North Cowichan Senior's Housing (MURBs)

- Space Heating + DHW account for 54% of total energy demand
- TEDI is challenging even when architectural form is already "well behaved"
- Passes TEUI target by a mile
- **Max GHG Impact → Decarbonize Heat + DHW Systems**

TELUS Ocean (Commercial + Mixed-Use)

- Space Heating + DHW = only ~7% of total energy demand
- HVAC systems already driven by cooling anyway (which was already electric)
- Lighting + Plugs are much more significant factor (65% of TEUI); majority of building load is already electric
- **Max GHG Impact → Electrify, Max Heat Recovery, Optimize Envelope**

Arch + Mech Integrated Design → Decarbonization Hierarchy

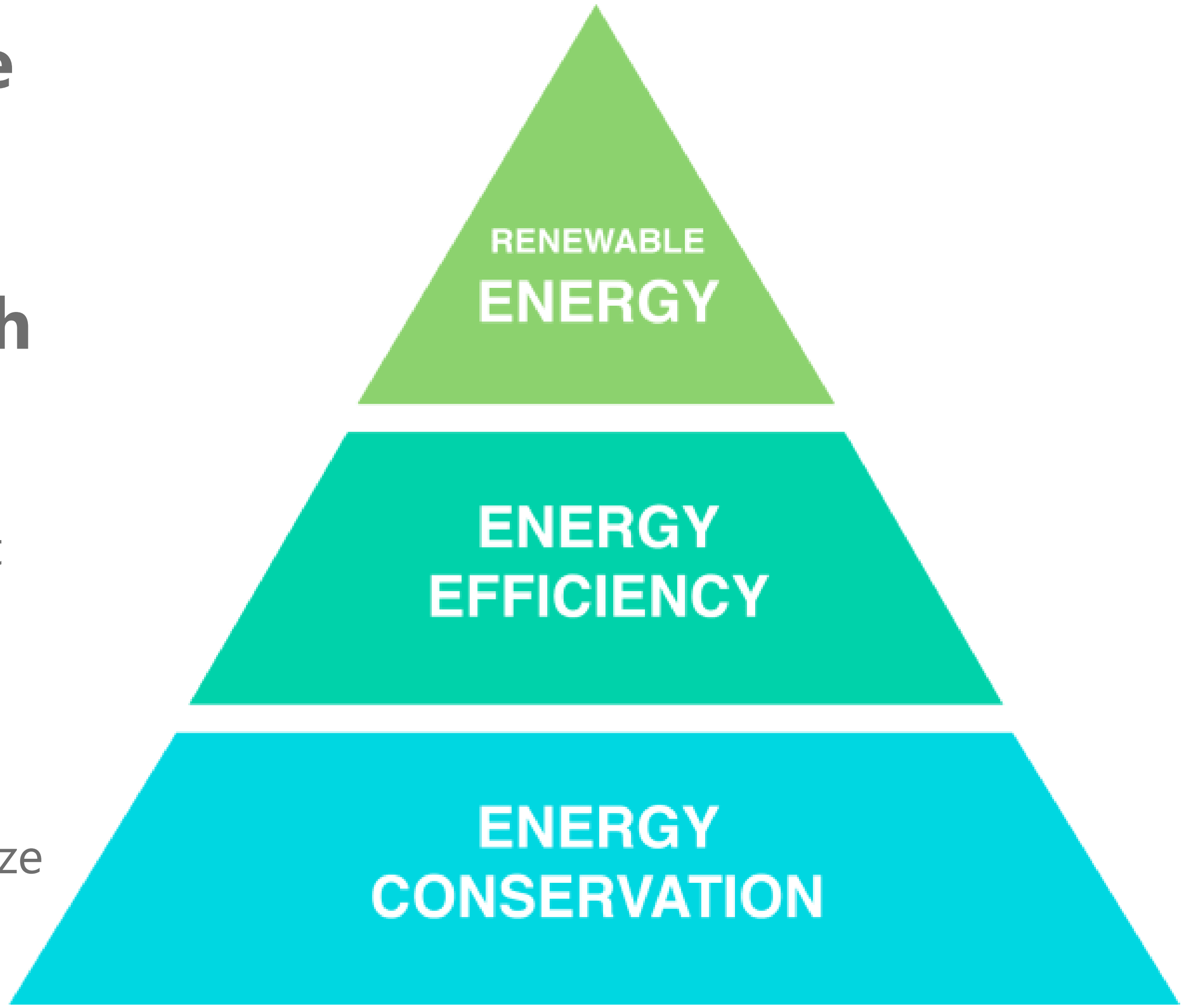
3. For what's left – use renewable sources and/or offset

2. Satisfy the remaining load with the smallest, most-efficient, and lowest-carbon-intensity practical

- heat recovery, heat pumps, innovative equipment

1. Reduce base demand through conservation measures

- Reduce waste, incorporate passive design, optimize envelope, demand control measures



We Have to Get Good at DWH without Gas, Fast… CO2 HP?

Energy Model is a Design Tool (Not just a Compliance Check)

- Test performance of options before committing to full design and/or capital costs…

  "Are we going to make it?"

- Explore and Refine Options, Cost/Benefit, and avoid Brute Force Overdesign
- **… or risk not making it to your destination.**

Bottom Line Takeaways

1. Market is Ready! Many Mech Solutions – but they only go so far.

2. Building Form & Architecture Play Critical Role at Higher Steps; Conservation First

3. Fuel Source is Critical to Carbon Emission Reduction; Emphasize and Plan for Electric Options

4. MURB projects must confront how to do DHW without gas

5. Energy Modeling as a Design Tool (not just a compliance check)