CANADIAN HOME BUILDERS' ASSOCIATION
netzero home
LEADERSHIPSUMMIT

FINDING THE EMISSIONS SWEET SPOT. How much is too much?

Sonja Winkelmann
Senior Director, Net Zero Energy Housing, CHBA

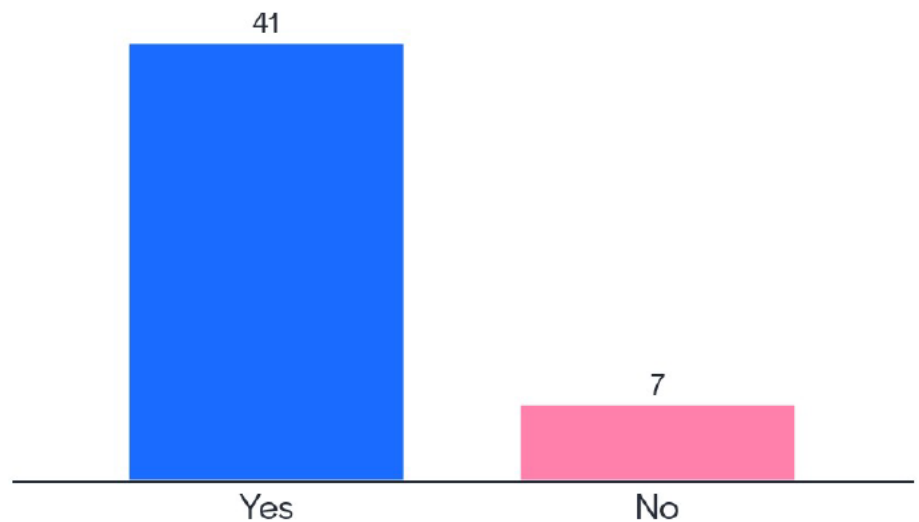
Andy Oding
Vice President, Director of Building Science, Building Knowledge Canada Inc.

Leigh St. Hilaire
Executive Director, Volta Research

Laureen Chung
Senior Manager, Low Carbon Homes Task Force, NRCan

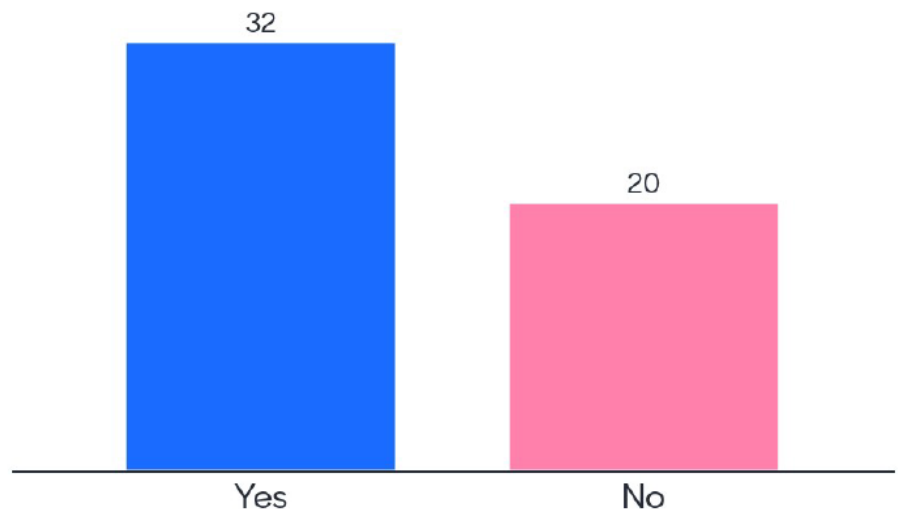
Jay Wilson
Director, Net Zero and Electrification, Electricity Canada

Builders/Renovators: Have you measured the energy consumption of your homes?



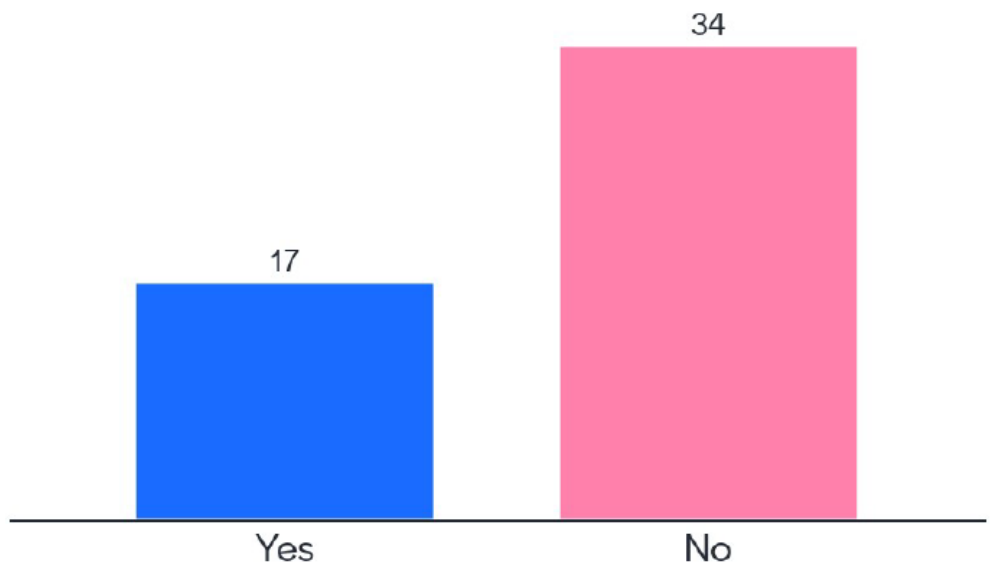
SESSION 2 - FINDING THE EMISSIONS SWEET SPOT

Builders/Renovators: Have you measured the operational emissions of your homes?



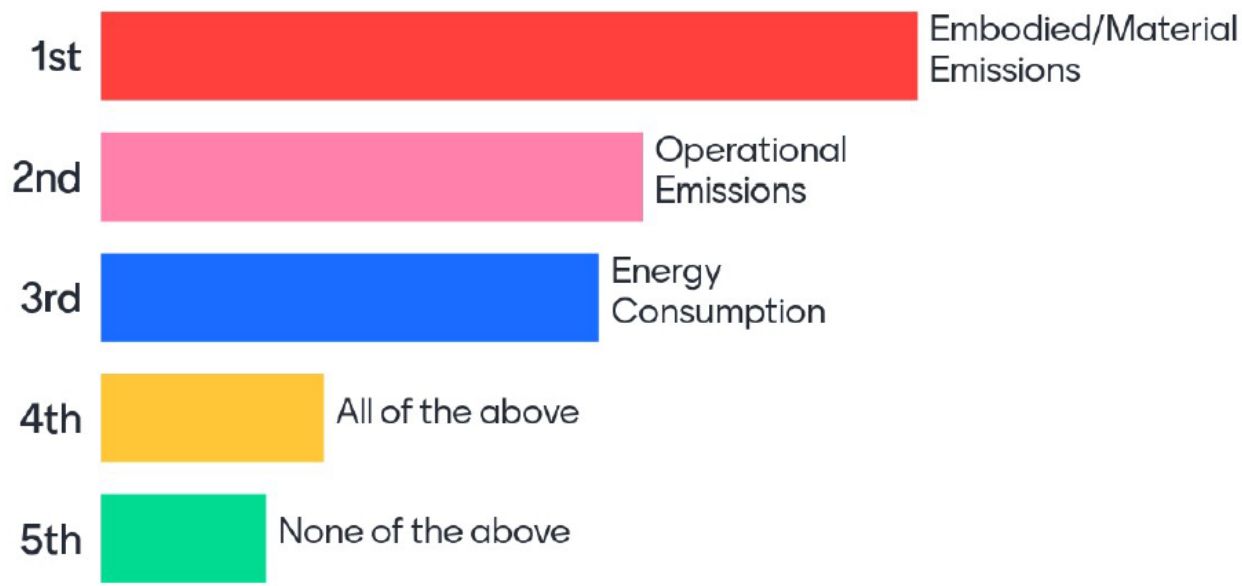
SESSION 2 - FINDING THE EMISSIONS SWEET SPOT

Builders/Renovators: Have you measured the embodied/material emissions of your homes?



SESSION 2 - FINDING THE EMISSIONS SWEET SPOT

Which of these scares you the most?



CANADIAN HOME BUILDERS' ASSOCIATION
netzero home
LEADERSHIPSUMMIT

Sonja Winkelmann, Senior Director, Net Zero Housing, CHBA

CHBA Net Zero Council

2024-2026 Strategic Plan

Canadian Home Builders' Association

NZC STRATEGIC PLAN 2024-2026

Canadian Home Builders' Association

NZC Key Priorities

1. **A Labelling Program** to distinguish and recognize Net Zero and Net Zero Ready Homes (detached, attached, and MURBs), Renovations, and Neighbourhoods, and the participating builders/renovators - focused on both energy efficiency and emissions reductions. To support industry adoption of this voluntary program, the following efforts will be delivered:
   - **Technical & Administrative Requirements** that support market preparedness for the implementation and compliance of the highest feasible tiered energy codes, and for operational and embodied emissions planned for the 2025 and 2030 codes.
   - **Marketing & Communications initiatives** to strengthen the Net Zero Home Labelling Program brand, build awareness and understanding of the value of CHBA Net Zero Homes, and stimulate market demand.
   - **Educational initiatives** to bridge the knowledge gap, support cost-optimization, and accelerate the industry's capacity to capitalize on Net Zero, such as training (which utilize the CHBA manuals), webinars, and the Net Zero Leadership Summit.
   - **Financing solutions** using program information/data to inform the development of innovative and effective financing mechanisms by key industry players to address the initial cost, helping accelerate voluntary adoption of Net Zero/Ready Homes.

Canadian Home Builders' Association

NZC Key Priorities

2. **Applied Research, Development, and Demonstration (RD&D) initiatives** (including LEEP field trials) working with industry leaders to identify and prioritize barriers and seek innovative solutions for cost-effective Net Zero levels of performance focused on both energy efficiency and emissions reductions for all housing forms, including multi-family and renovations, and for neighbourhoods. Initiatives support energy efficient construction by enabling builders and renovators to reduce their time and risk identifying, exploring, and adopting innovations in the residential construction industry. Efforts contribute to and leverage CHBA RD&D work in Climate Change Mitigation, Adaptation and Resilience guidelines and standards.

GOALS INFLUENCED BY:

Canadian Home Builders' Association

NET-ZERO EMISSIONS BY 2050 - GLOBAL EFFORTS

To keep global warming to no more than 1.5°C – as called for in the Paris Agreement – **emissions need to be reduced by 45% by 2030 and reach net zero by 2050.**

https://www.un.org/en/climatechange/net-zero-coalition

United Nations

NET-ZERO EMISSIONS BY 2050 - CANADA'S COMMITTMENT

To avert the worst impacts of climate change, the Government of Canada is committed to achieving **net-zero emissions by 2050**.

https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html

Canada

NBC

NBC 2020: Tiered Energy Code

NBC 2025: Operational Emissions

NBC 2030: Embodied Emissions & Resilience

NZC STRATEGIC PLAN 2024-2026

Canadian Home Builders' Association

NZC 3HAG:
3 Year Highly Achievable Goal (to end of 2026)

Expand the labelling program to include an option for operational and embodied emissions reductions.

- Develop a Net Zero Operational Emissions option by 2025.
- Develop a Net Zero Embodied Emissions option by 2028.

RENOS: A Net Zero Reno Roadmap including ROPs (Renovator Option Packages).

NZC BHAG:
10 Year Big Hairy Audacious Goal (to end of 2033)

Qualified Net Zero Builders can build Net Zero/Ready for zero additional total cost of ownership compared to a Tier 1 2023 home.

RENOS: A network of Qualified Net Zero Renovators that are renovating homes to Net Zero/Ready levels of performance across the country.

NEW NRCAN FUNDED PROJECT 2024-2027 HIGHLIGHTS

Canadian Home Builders' Association

WAITING FOR MINISTERIAL ANNOUNCEMENT TO COMMUNICATE PROJECT

Capacity Building & Training

- Net Zero Ready "Builder Option Packages" (exploring how to include opGHGs & emGHGs)
- Develop training on Section 9.36 for builders
- Offer Net Zero Home Labelling Program training courses at a discounted fee

Emissions & Resilience Working Group (ERWG)

- To assess the feasibility of integrating emissions and resilience aspects into the CHBA Net Zero Home Labelling Program:
  - Develop a Net Zero Operational Emissions option by Dec 31/24
  - Develop a Net Zero Embodied Emissions option by Dec 31/26
  - Develop Resilience Best Practice Guidelines by Dec 31/26

Looking Ahead

- Net Zero Ready Case Study Houses in NB
- PCF 2004: Performance Requirements
- What about solar?

netzero home
The ultimate in comfort and efficiency

Typical NZr Home in NB

SPECIFICATIONS

Climate Zone: 6 (Fredericton, NB)

Heated Floor Area: 3,000 ft²

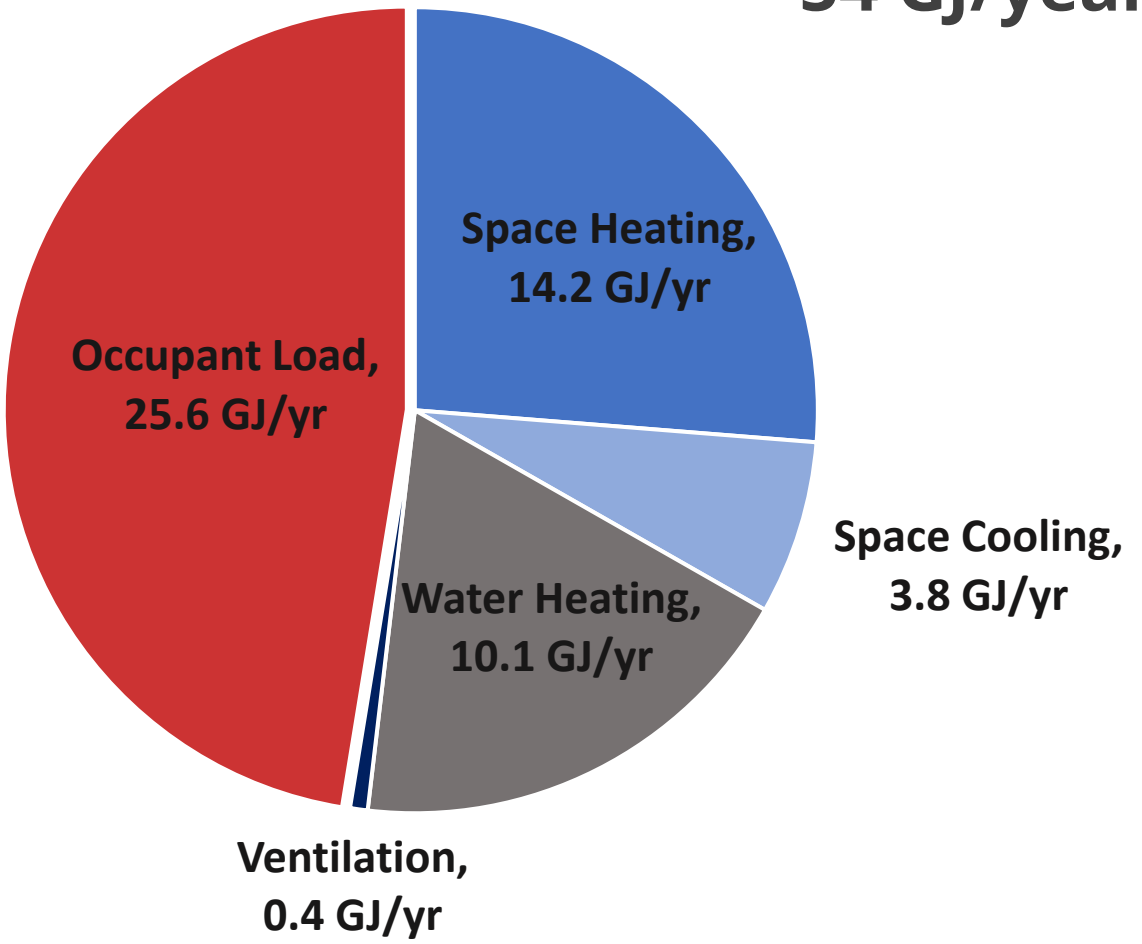
Heating & Cooling: ASHP + Gas Furnace

Water Heating: Gas Instantaneous

Envelope: 51% better than ref. house.

- R61 Ceiling
- R27 Above Grade Walls
- R25 Foundation (ICF)
- 0.78 ACH@50

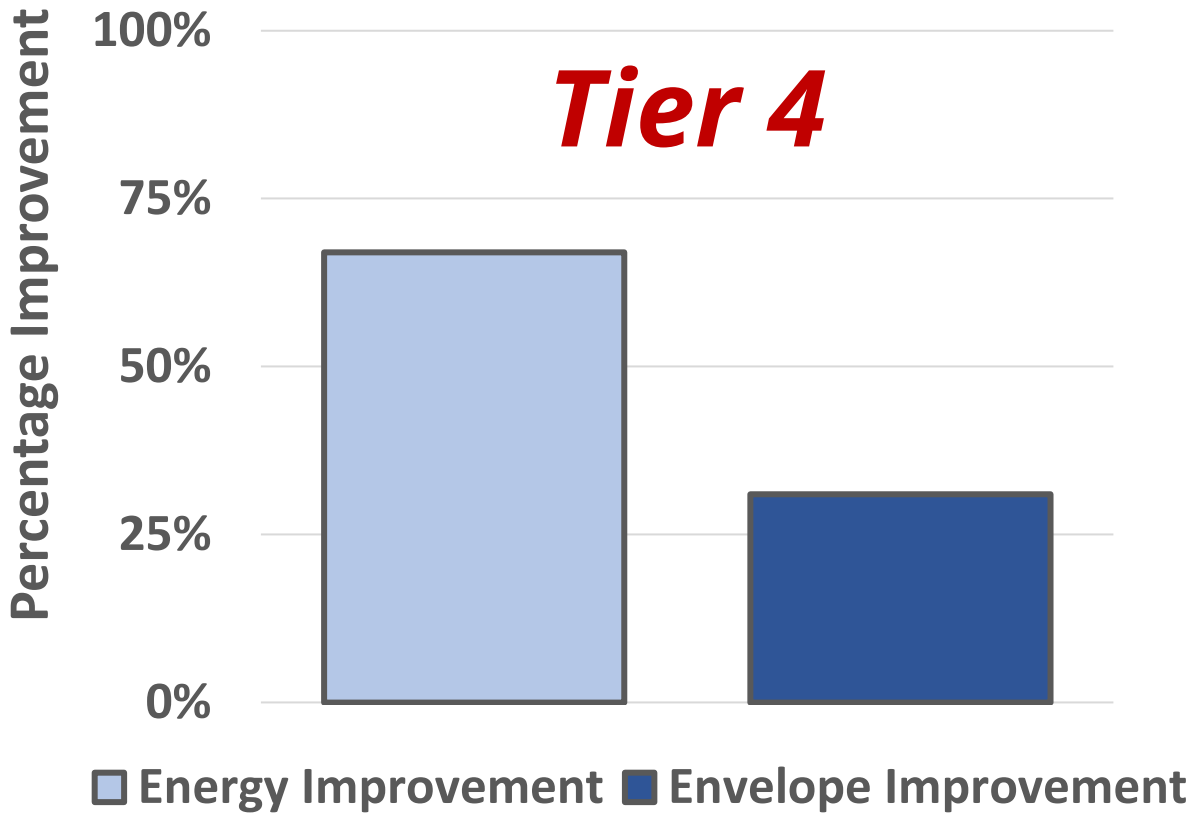
54 GJ/year



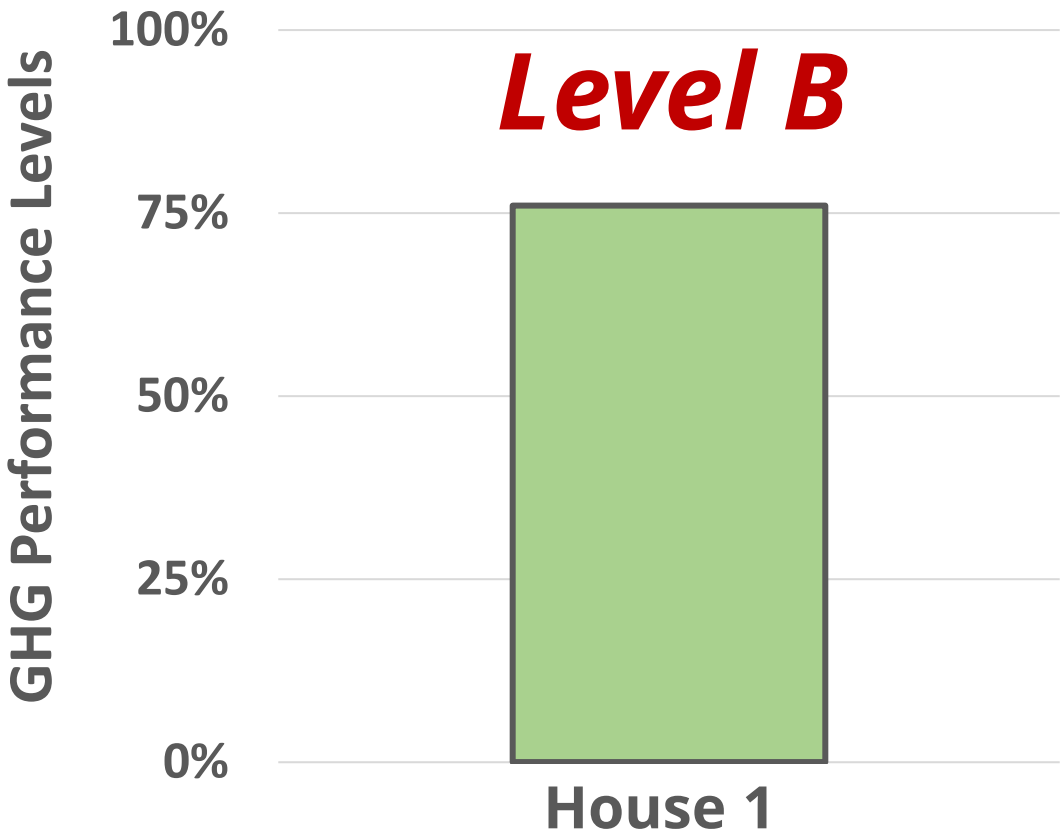
CHBA NZr: NBC Comparison

New Brunswick Edition

NBC 2020: Energy Performance Tiers

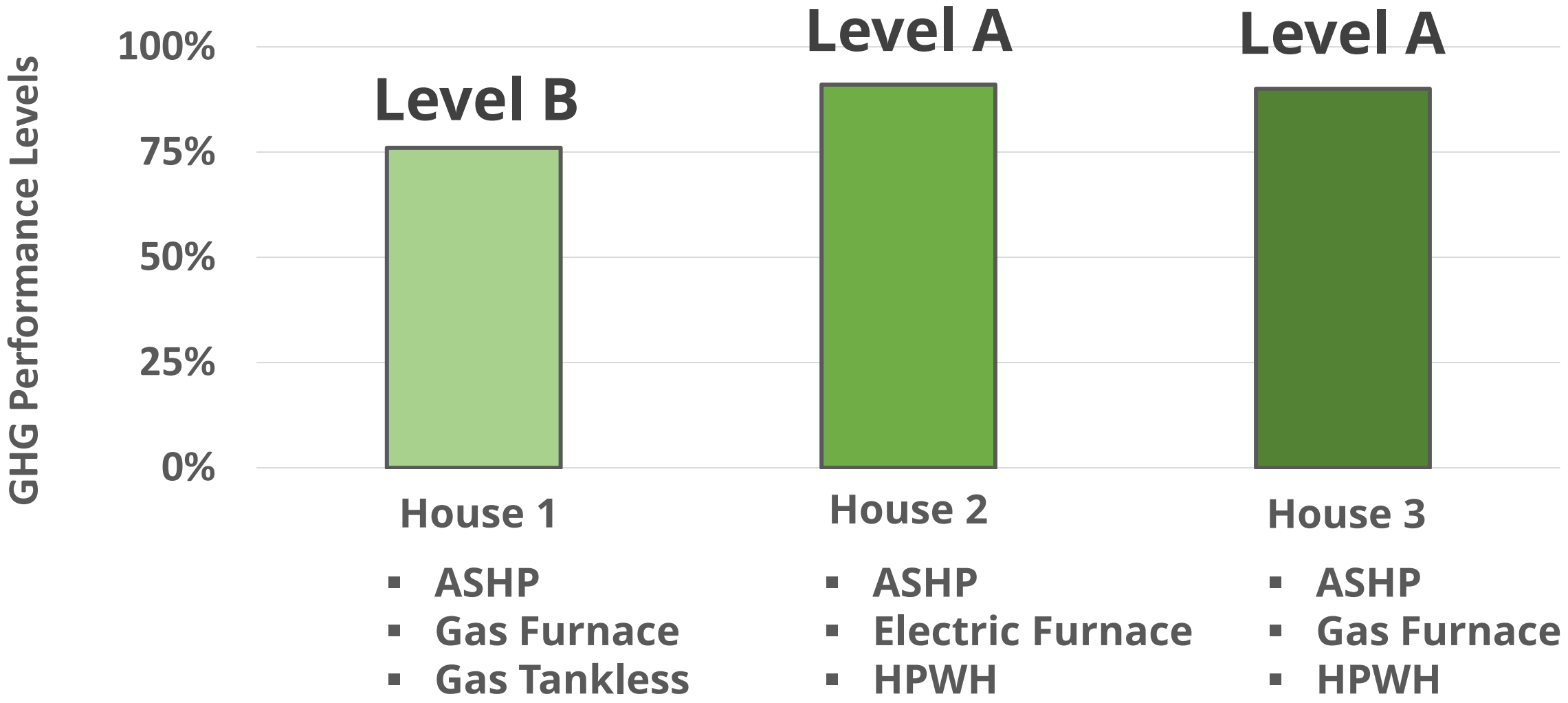


NBC 2025: GHG Emissions Performance Levels - PCF 2004



GHG Emissions Performance Levels

PCF 2004 Review: New Brunswick Edition



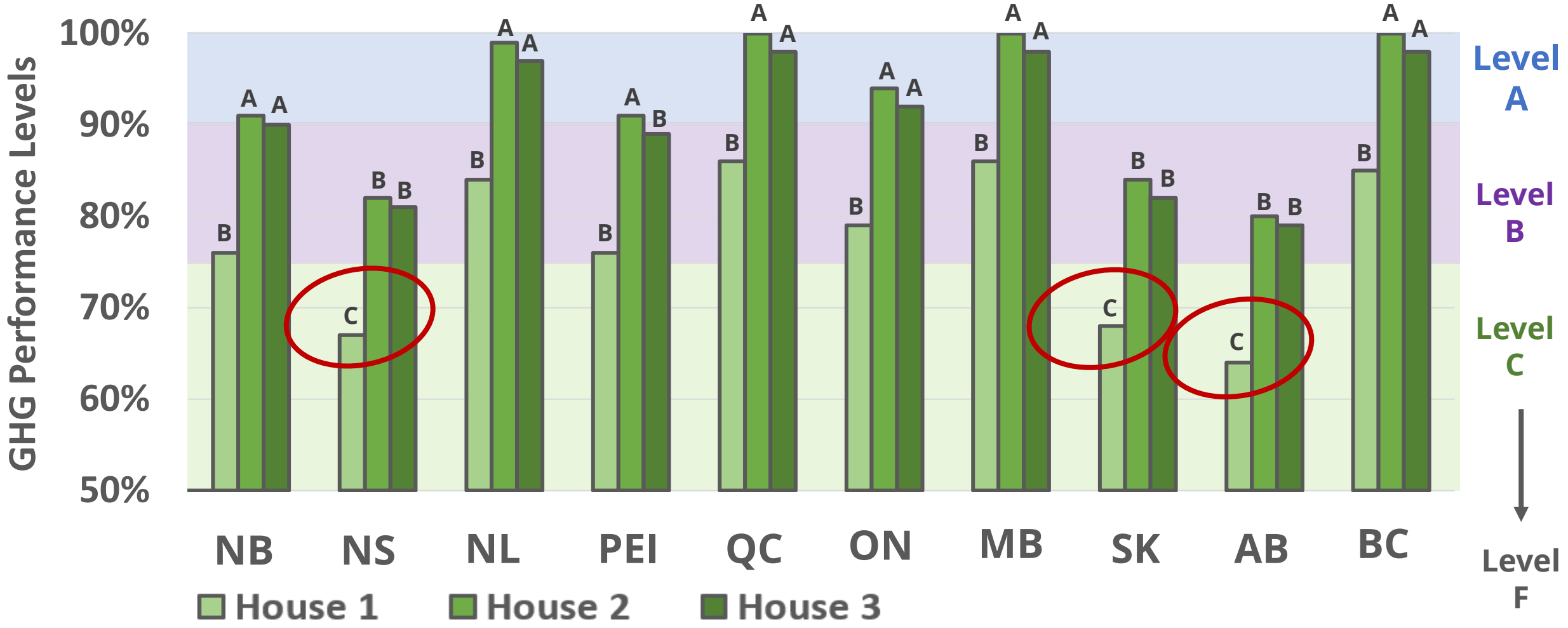
- ASHP
- Gas Furnace
- Gas Tankless

- ASHP
- Electric Furnace
- HPWH

- ASHP
- Gas Furnace
- HPWH

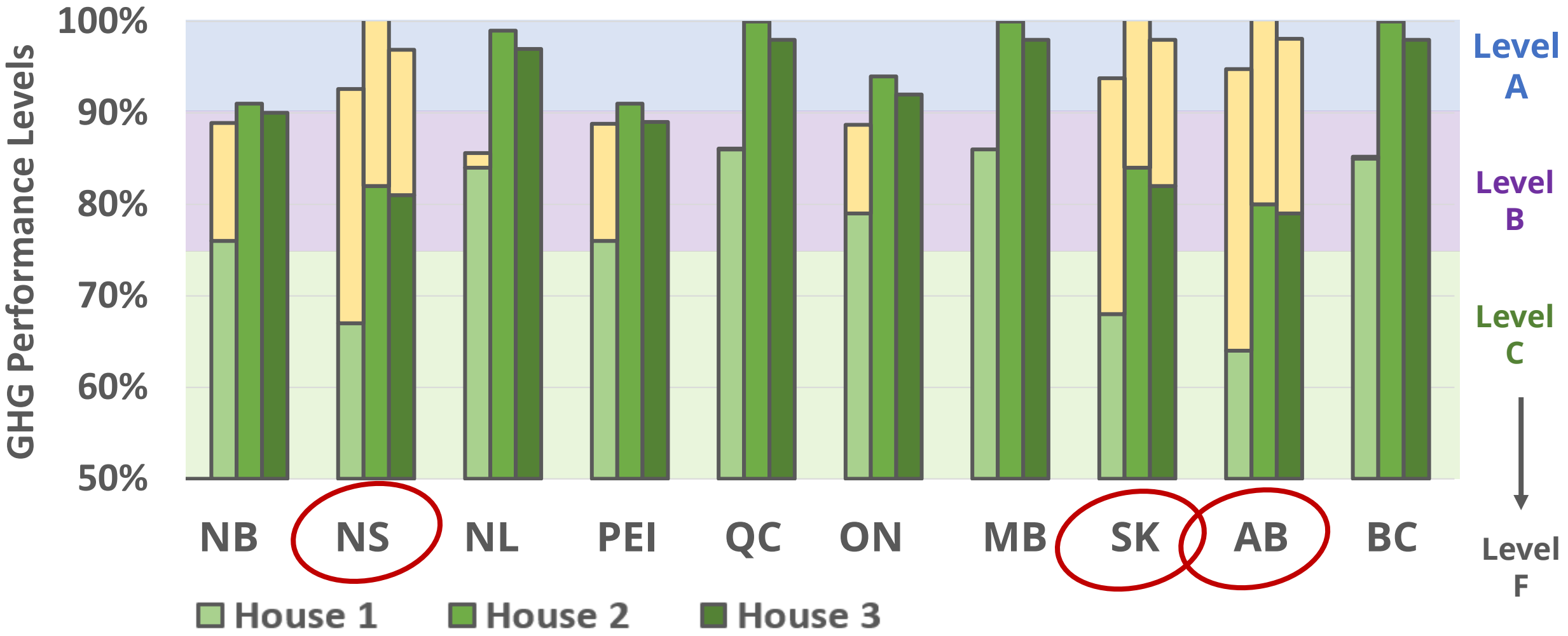
GHG Emissions Performance Levels

PCF 2004 Review: Provincial Edition



GHG Emissions Performance Levels

PCF 2004 Comment Review: 5kW Solar PV Offset



CANADIAN HOME BUILDERS' ASSOCIATION
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LEADERSHIPSUMMIT

Andy Oding, Vice President, Building Knowledge Canada

THE HOME THAT SCIENCE BUILT

NBC 2025 & 2030
Operational Emissions & Embodied Emissions
Looking for the sweet spot (with a complex grid and a challenging future)

2024 CHBA Net Zero Summit

BUILDING KNOWLEDGE CANADA INC.

Andrew Oding MEA, NZQEA, LEED AP, BSSO
Vice President

1986

Since 1986, helping the Canadian home building industry, through building science, to design and construct homes that people LOVE to live in.

BUILDER 360°

Building Energy Performance Evaluation & Consulting Services

- Building Science Consulting and Engineering (Design and Forensics)
- Building Science Training: Course Development and Delivery
- HVAC Design, consulting and Forensics
- Professional IDP/Design Charette Facilitation Services: Residential
- Energy Modeling **Ontario Building Code SB12 and National Building Code NBC 9.36**
- EnerGuide Rating System Evaluation Services
- ENERGY STAR® Evaluation & Compliance
- Net Zero Hometm Evaluation & Compliance
- Net Zero Renovation Evaluation and Compliance
- R-2000 Evaluation Services
- LEED® for Homes Project Management
- Industry Incentives Program Compliance
- Existing Home Energy Evaluation
- Air Tightness / Blower Door Testing & Building Diagnostic Services
- Large Building Air tightness testing
- Building Science Training & Facilitating
- Advanced Residential Quality Control Services
- Manufacturer & Utility Client Services

Proudly a member of:

CHBA Member
Canadian Home Builders' Association

Ontario Home Builders' Association

CACEA
Canadian Association of Consulting Energy Advisors

WHERE are the energy codes?

NBC 9.36 – Low Rise Residential, 3 story's >

NECB 3/10 large buildings, commercial

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THE 2020 TIERED ENERGY CODE PART 9.36

OBSERVATIONS FROM A HOMEBUILDERS PERSPECTIVE

Tiered Performance Path 9.36.6

Table [9.36.6.2.]

Energy Performance Tiers for *Buildings* or Houses
Forming Part of Sentence 9.36.6.2.(1)

			Applicable Energy Performance Tier				
Volume V_T	Target Metrics		1	2	3	4	5
> 300 m^3 and where volume is not determined	Percent Heat Loss Reduction (1)		n/a	≥ 5%	≥ 10%	≥ 20%	≥ 40%
	or	Percent Improvement (2)	≥ 0%	≥ 10%	≥ 20%	≥ 40%	≥ 70%
		Percent House Energy Target (3)	≤ 100%	≤ 90%	≤ 80%	≤ 60%	≤ 30%
≤ 300 m^3	Percent Heat Loss Reduction (1)		n/a	≥ 0%	≥ 5%	≥ 15%	≥ 25%
	or	Percent Improvement (2)	≥ 0%	≥ 0%	≥ 10%	≥ 30%	≥ 60%
		Percent House Energy Target (3)	≤ 100%	≤ 100%	≤ 90%	≤ 70%	≤ 40%

ENVELOPE TARGET

TOTAL ENERGY TARGET

WHERE ARE CANADIAN BUILDING CODES GOING IN THE FUTURE

ENERGY REDUCTION ONLY

NBC 2020
2020-2025

EXISTING HOMES & BUILDINGS ENERGY REDUCTION

AND
OPERATIONAL CARBON REDUCTION

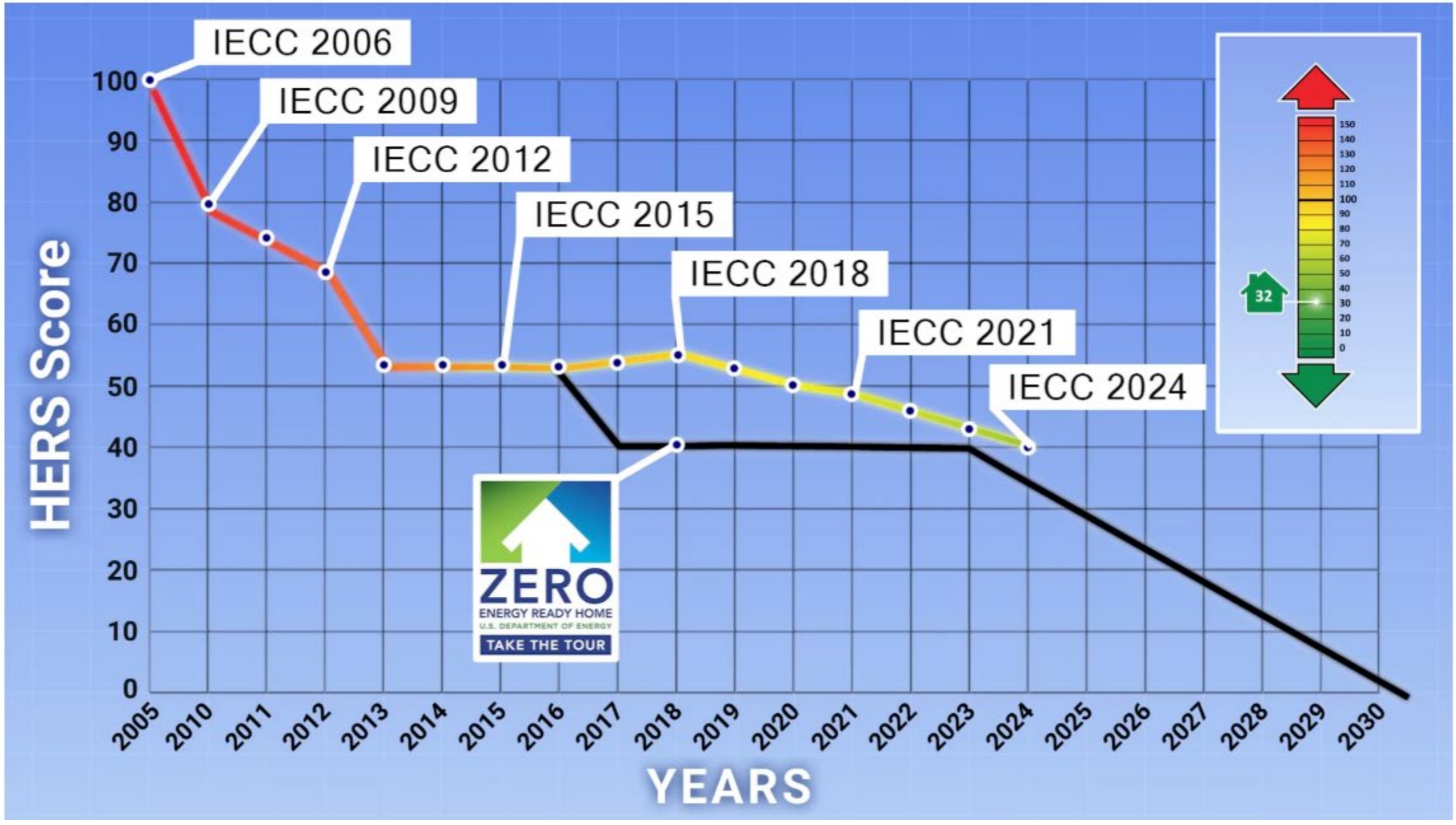
NBC 2025
2025-2030

RESILIENCY (EXTREME HEAT, WIND, FIRE, FLOOD)

EMBODIED CARBON REDUCTION

NBC 2025
2030-2040

US Codes - IECC International Energy Conservation Code



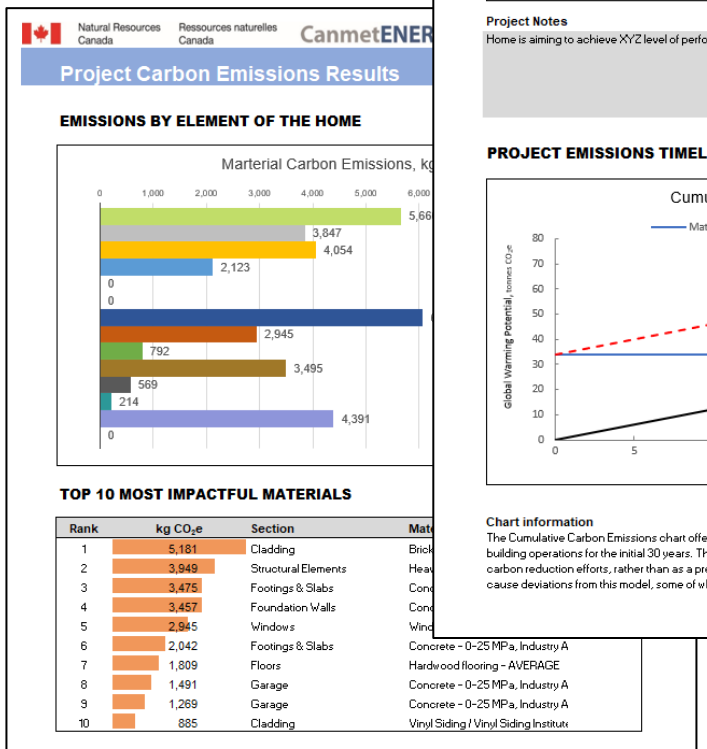
HOME LABELING PROGRAMS LEANING INTO CARBON

BUILDING KNOWLEDGE CANADA INC.

ENERGY STAR NextGen CERTIFIED HOMES & APARTMENTS
BUILT FOR A CLEAN ENERGY FUTURE

netzero home
The ultimate in comfort and efficiency

netzero readyhome
The ultimate in comfort and efficiency


Natural Resources Canada | Ressources naturelles Canada | CanmetENER

Project Carbon Emissions Results

EMISSIONS BY ELEMENT OF THE HOME

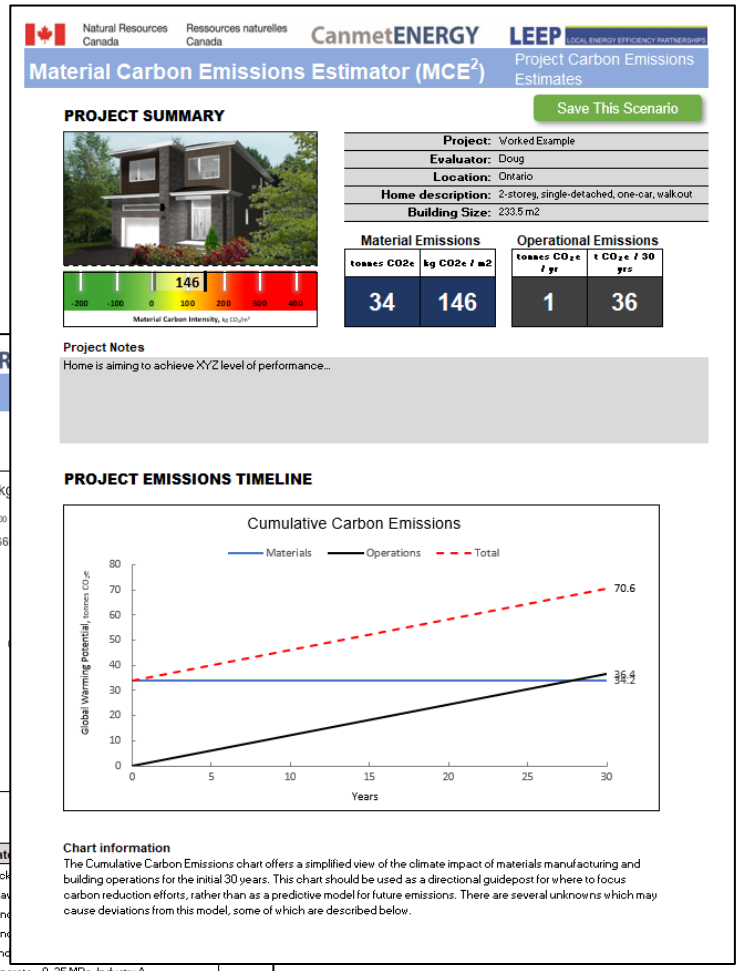
Marterial Carbon Emissions, kg

0 1,000 2,000 3,000 4,000 5,000 6,000

5,66
3,847
4,054
2,123
0
0
2,945
792
3,495
569
214
4,391
0

TOP 10 MOST IMPACTFUL MATERIALS

Rank	kg CO_2e	Section	Mat
1	5,181	Cladding	Brick
2	3,949	Structural Elements	Hea
3	3,475	Footings & Slabs	Conc
4	3,457	Foundation Walls	Conc
5	2,945	Windows	Wind
6	2,042	Footings & Slabs	Concrete - 0-25 MPa, Industry A
7	1,809	Floors	Hardwood flooring - AVERAGE
8	1,491	Garage	Concrete - 0-25 MPa, Industry A
9	1,269	Garage	Concrete - 0-25 MPa, Industry A
10	885	Cladding	Vinyl Siding / Vinyl Siding Institute


Natural Resources Canada | Ressources naturelles Canada | CanmetENERGY | LEEP LOCAL ENERGY EFFICIENCY PARTNERSHIPS

Material Carbon Emissions Estimator (MCE²) — Project Carbon Emissions Estimates

Save This Scenario

PROJECT SUMMARY

Project:	Worked Example
Evaluator:	Doug
Location:	Ontario
Home description:	2-storey, single-detached, one-car, walkout
Building Size:	233.5 m2

146
-200 -100 0 100 200 300 400
Material Carbon Intensity, kg CO_2e/m^2

Material Emissions		Operational Emissions	
tonnes CO_2e	kg CO_2e / m2	tonnes CO_2e / yr	t CO_2e / 30 yrs
34	146	1	36

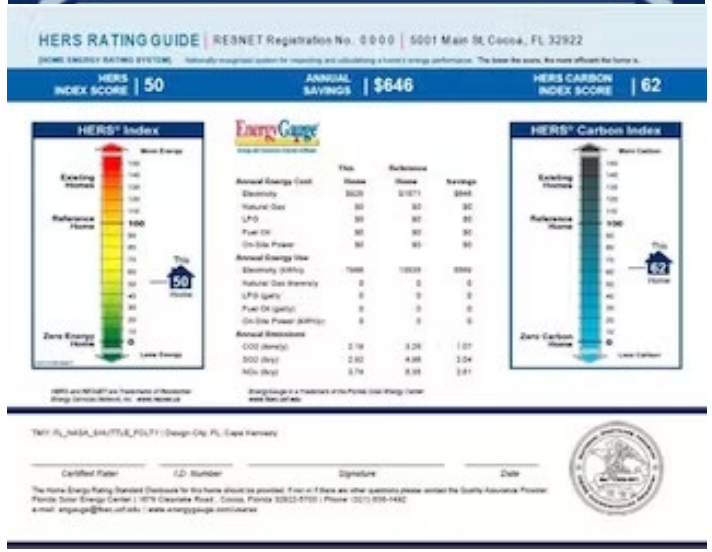
Project Notes

Home is aiming to achieve XYZ level of performance...

PROJECT EMISSIONS TIMELINE

Chart information

The Cumulative Carbon Emissions chart offers a simplified view of the climate impact of materials manufacturing and building operations for the initial 30 years. This chart should be used as a directional guidepost for where to focus carbon reduction efforts, rather than as a predictive model for future emissions. There are several unknowns which may cause deviations from this model, some of which are described below.



Carbon Benchmarking, Reporting & Reduction

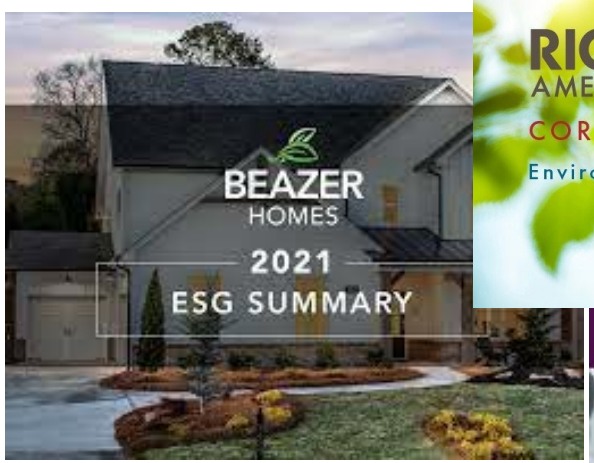
Embodied Carbon + Operational Carbon

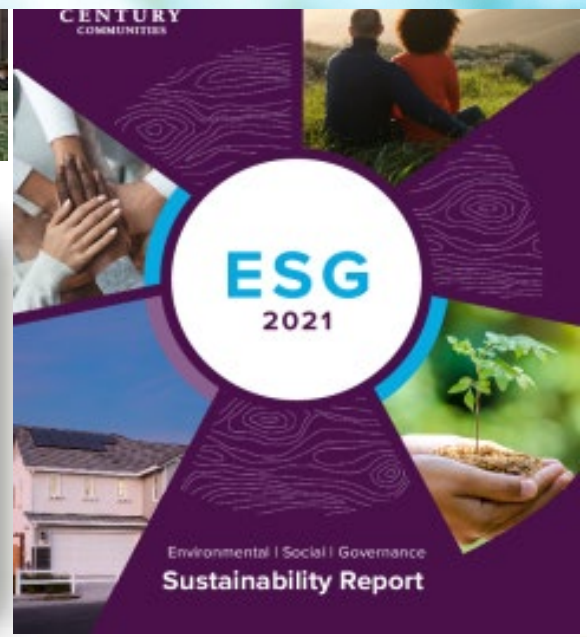
mattamy ASSET MANAGEMENT

Daniels
love where you live

Brookfield Properties

DOUG TARRY HOMES





CARBON EMISSIONS. THE NEW CODE TARGET

CBHCC Canadian Board for Harmonized Construction Codes | CCHCC Comité canadien de l'harmonisation des codes de construction

*Approximately **27% of Canada's GHG emissions are due to buildings** and so addressing GHG emissions in the Codes is an important step to enable action towards climate goals.*

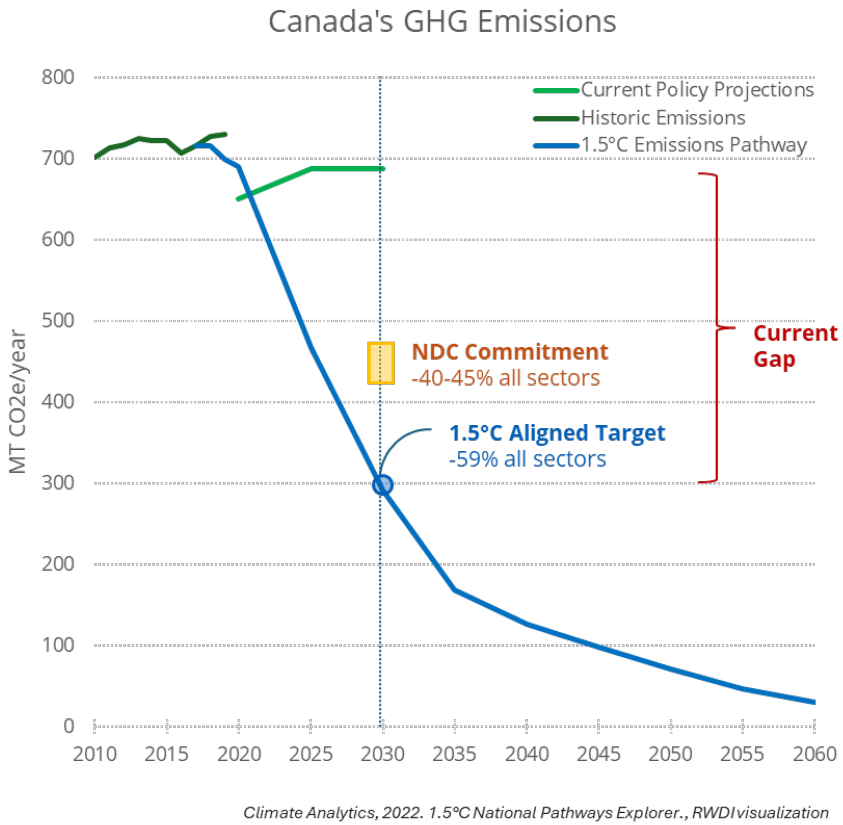
November 2022_CBHCC adopted the direction set by Canadian Commission on Building and Fire Codes, including:

- developing **objective(s) to address GHG emissions for inclusion in the 2025 National Model Codes**;
- developing proposed technical requirements related to **operational GHG emissions for inclusion in the 2025** National Model Codes;
- developing proposed technical requirements related to **embodied GHG emissions for inclusion in the 2030** National Model Codes; and
- undertaking policy work, and objective and technical development in parallel.

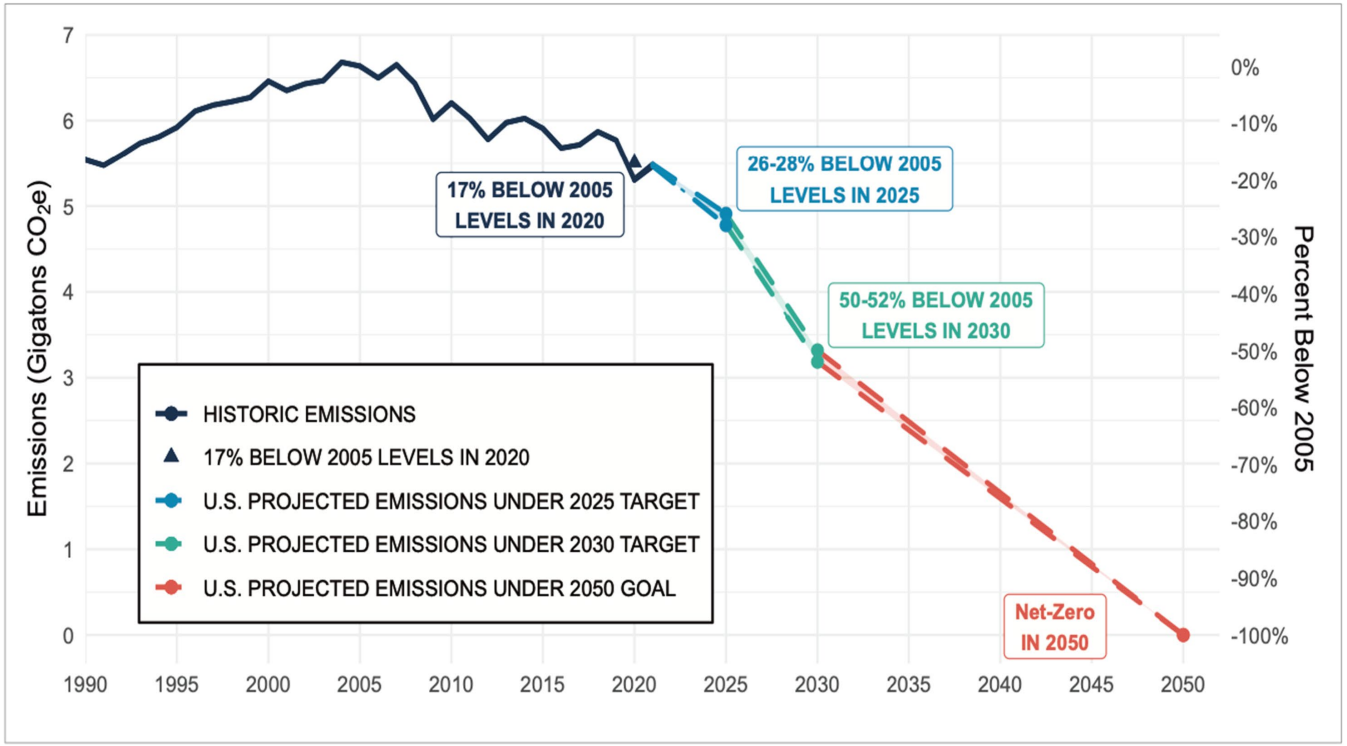
Proposed NBC 2025 Tiered Operational Carbon Emissions Reduction

Canadian National targets:

- Emissions reduction target of 40 percent below 2005 levels by **2030**
- Zero or near zero operational GHG emissions across provinces and territories by **2050**



Climate Analytics, 2022. 1.5°C National Pathways Explorer., RWDI visualization



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Proposed NBC 2025 Tiered Operational Carbon Emissions Reduction

Key 2025 NBC Proposed Changes

- **PCF 2004**
- **PCF 2026**

- Electric utilities are shifting away from coal power generation, while gas utilities are experimenting with new technologies to lower emissions through use of hydrogen and renewable biogas sources
- Some provincial utilities expect to reduce electric emissions by 60% or more by 2030.
- The **proposed emission requirements/targets are based on the best available future looking forecasts for utility emissions, averaged for the years 2031-2035**
- Natural gas utilities: Such projections are expected in future years, and could be incorporated into the code at a later date

2020 GHG Emissions in the Residential and Building Sectors
Source: CBHCC

Proposed NBC 2025 Tiered Operational Carbon Emissions Reduction

NBC 2025 PCF 2004 Provides Operational Carbon Emission Reduction Tiers

- Canadian National targets: emissions reduction target of 40 percent below 2005 levels by **2030**
- Zero or near zero operational GHG emissions across provinces and territories by **2050**

GHG Emission Performance Level	% Building GHG Emissions Target	% Improvement
A	0%	≥ 100%
B	≤ 10%	≥ 90%
C	≤ 25%	≥ 75%
D	≤ 50%	≥ 50%
E	≤ 75%	≥ 25%
F	≤ 90%	≥ 10%
G	≤ 100%	≥ 0%

OPERATIONAL + EMBODIED EMISSIONS

BALANCING ACT
&
MYTH BUSTING

7 Critical Lessons Learned

Point #1: OC + UEC –We Need To Address Both

UPFRONT EMBODIED CARBON BECOMES MORE IMPORTANT WITH TIME (BUT OPERATIONAL STILL MATTERS)

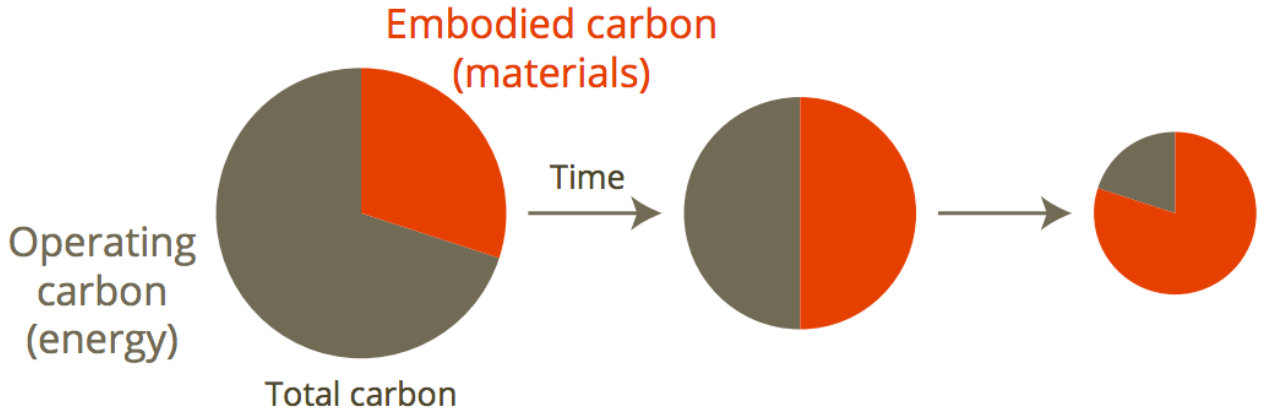
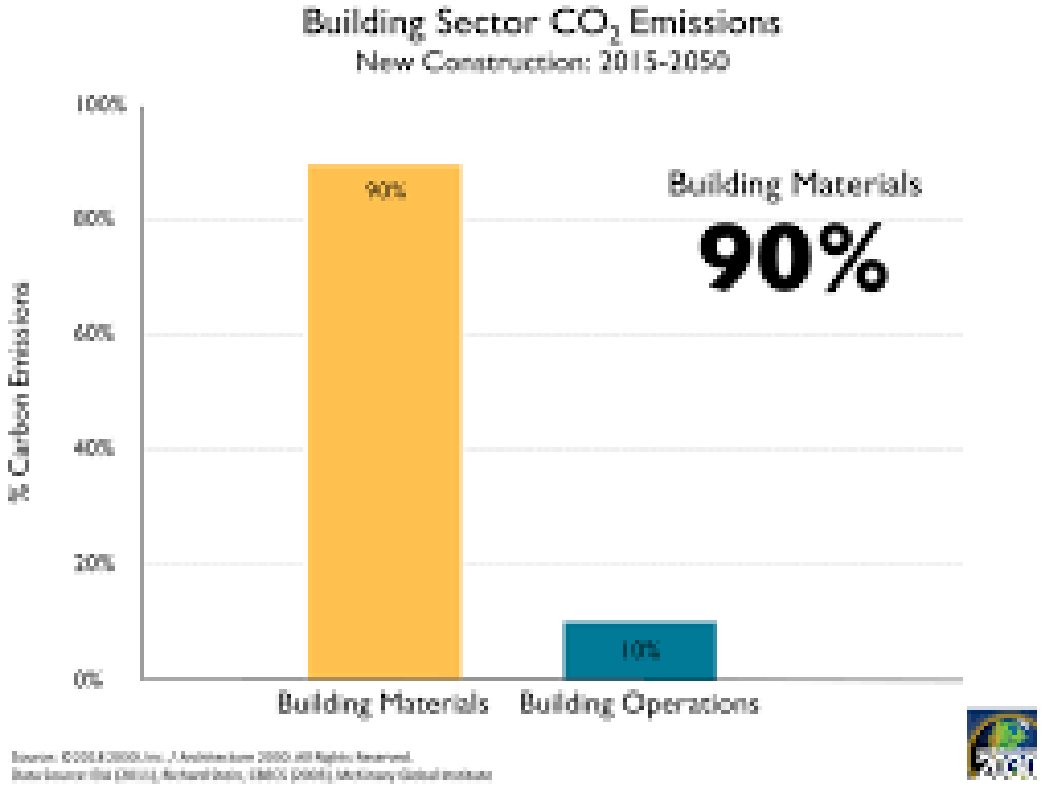
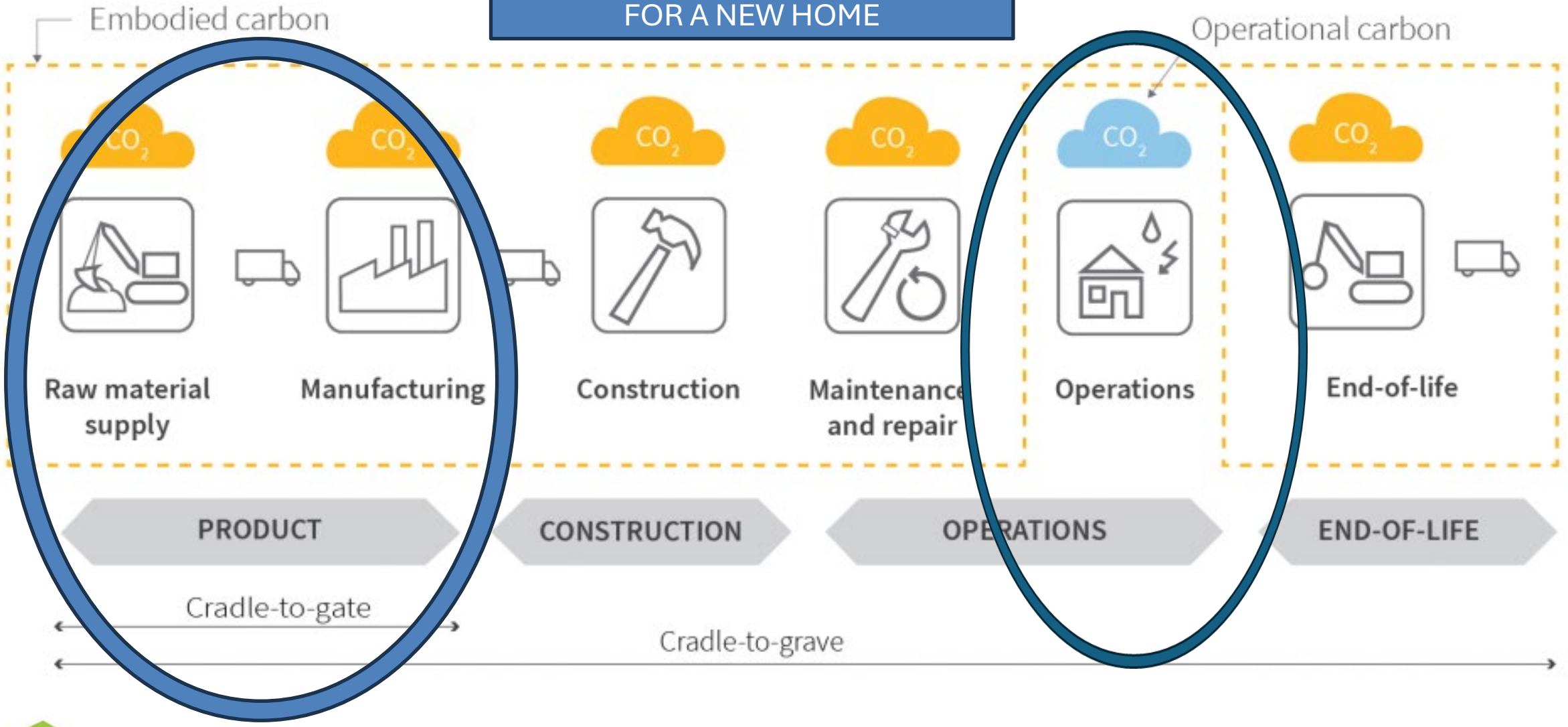


Figure 1. Growing importance of embodied carbon as building operational energy decarbonizes



Point #2: We Know Enough To Start Making A BIG Difference

80%< TOTAL CARBON EMISSIONS FOR A NEW HOME



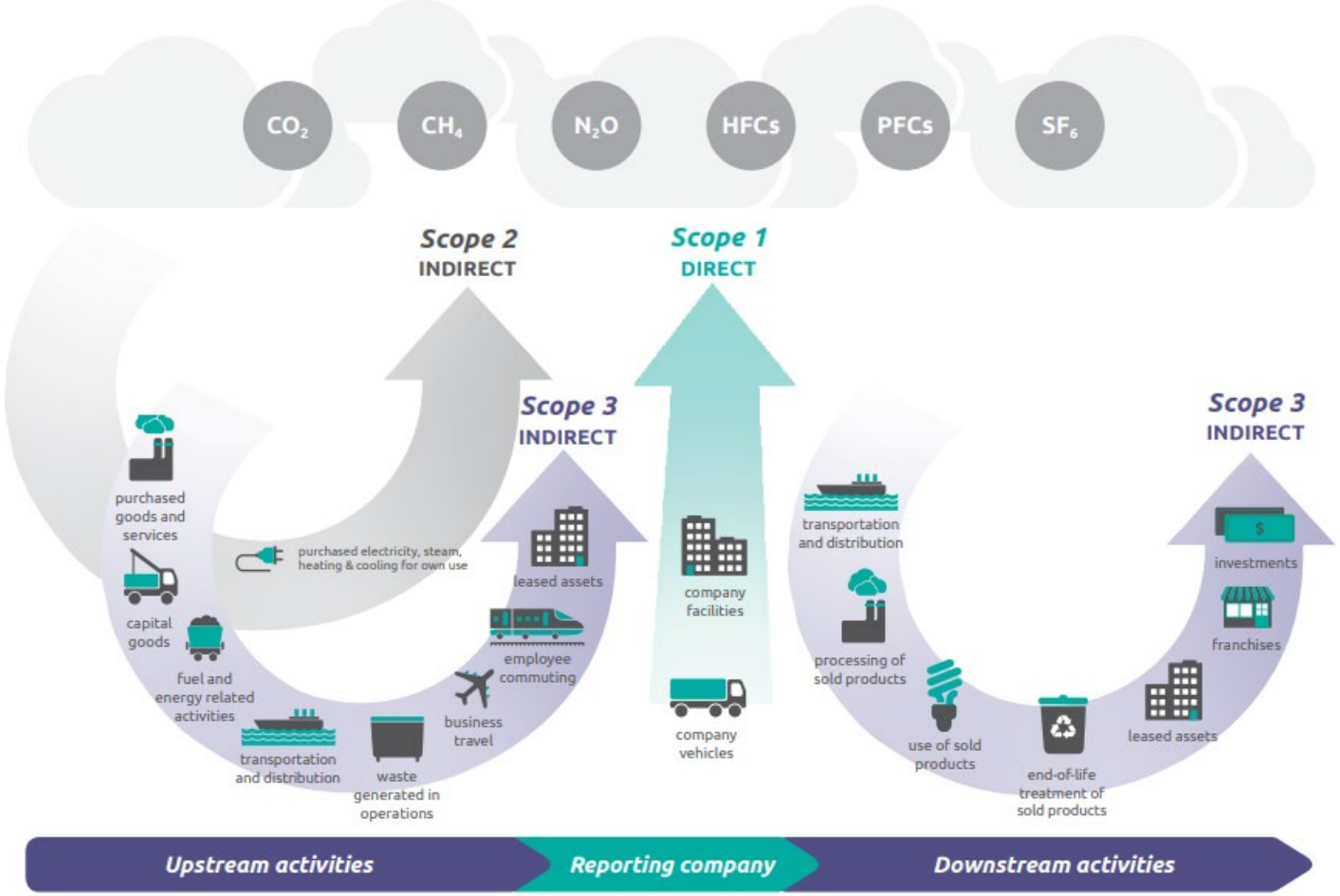
Carbon Emission Estimate Tools: For Low Rise Residential Construction

NRCan MCE$_2$ TOOL$_{tm}$ & BEAM$_{tm}$ TOOL

Point #3: Focus Efforts Where It Matters

Emissions Scope 1,2,3 – Know Your Impact As a Homebuilder

Figure [5.2] Overview of GHG Protocol scopes and emissions across the value chain



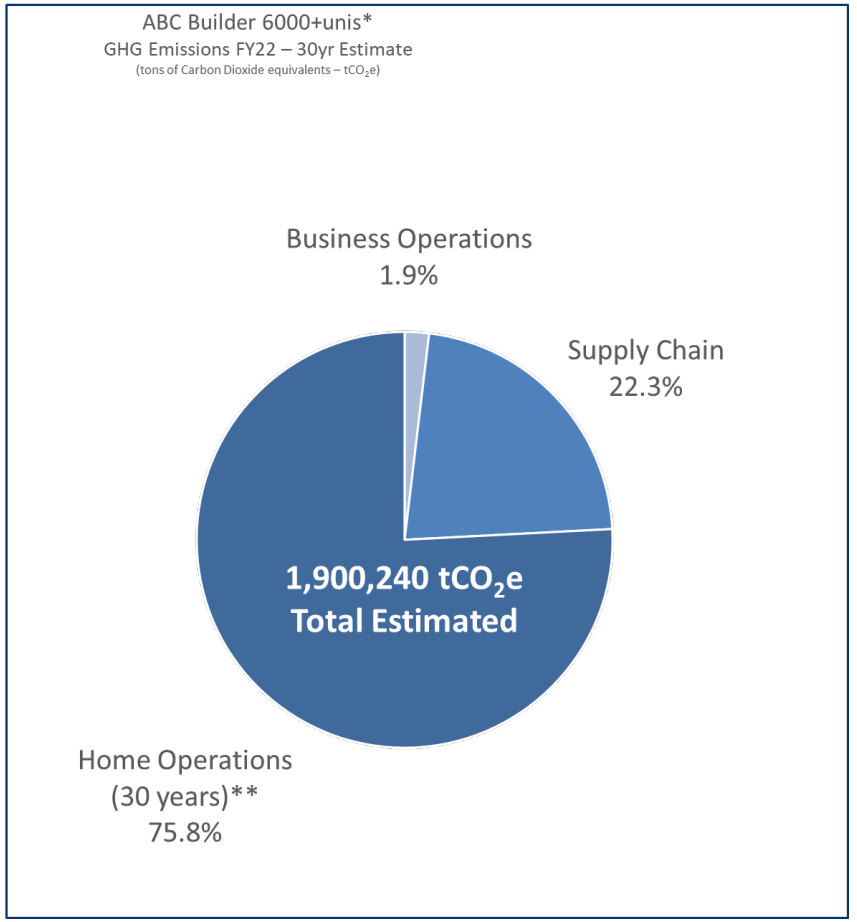
2021 World Economic Forum

Information provided courtesy of Mattamy Asset Management

Point #3: Focus Efforts Where It Matters

	Business Operations	
Scope 1 - Direct Control	Scope 1	Natural Gas
		Fleet Fuel
Scope 2 - Indirect Control	Scope 2	Electricity
		Steam (66 Wellington ONLY)
Scope 3 - All Other Emissions	Scope 3a	Air Travel
		Hotels
		Car Rentals
		Employee Commute
	Supply Chain	
	Scope 3b	Purchased Goods & Services
		Energy Related Activities
		Transportation & Distribution
		Waste & Recycling
	Home Operations	
	Scope 3c	Natural Gas – Heating
		Electricity – Heating/ Cooling/ Plug Loads

Estimate for FY22 based on FY20 results and estimates for Supply Chain and Home Operations



Information provided courtesy of Mattamy Asset Management

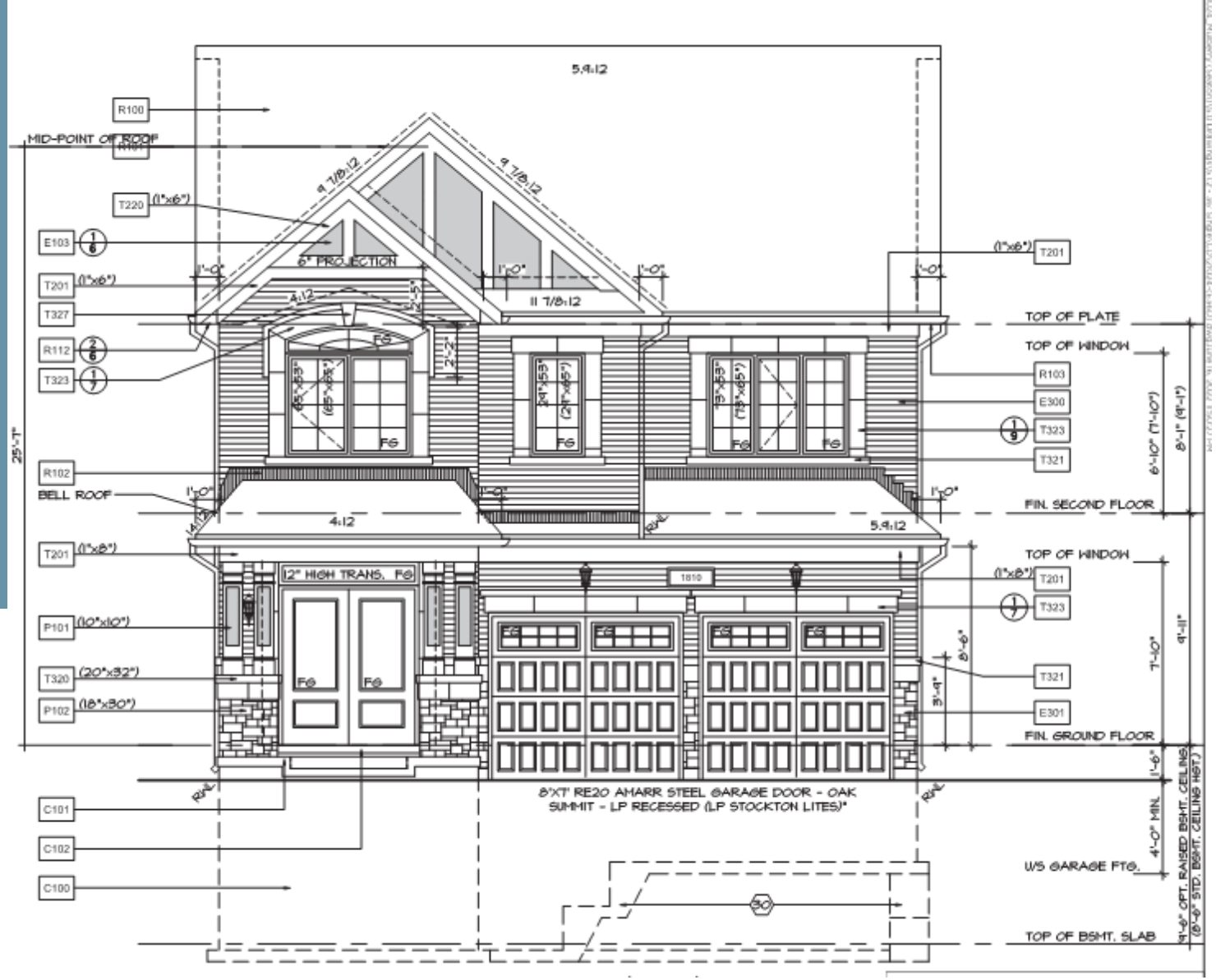
Archetype 1:

36’ Single Detached

Cladding

GTA: 95% Brick, 2% Fiber Cement, 2% Aluminum Panel
OTT: 84% Vinyl, 8% Fiber Cement, 8% Brick
ALB: 60% Vinyl, 20% Fiber Cement, 20% Brick

mattamy
ASSET MANAGEMENT



Information provided courtesy of Mattamy Asset Management

BUILDING KNOWLEDGE CANADA INC.

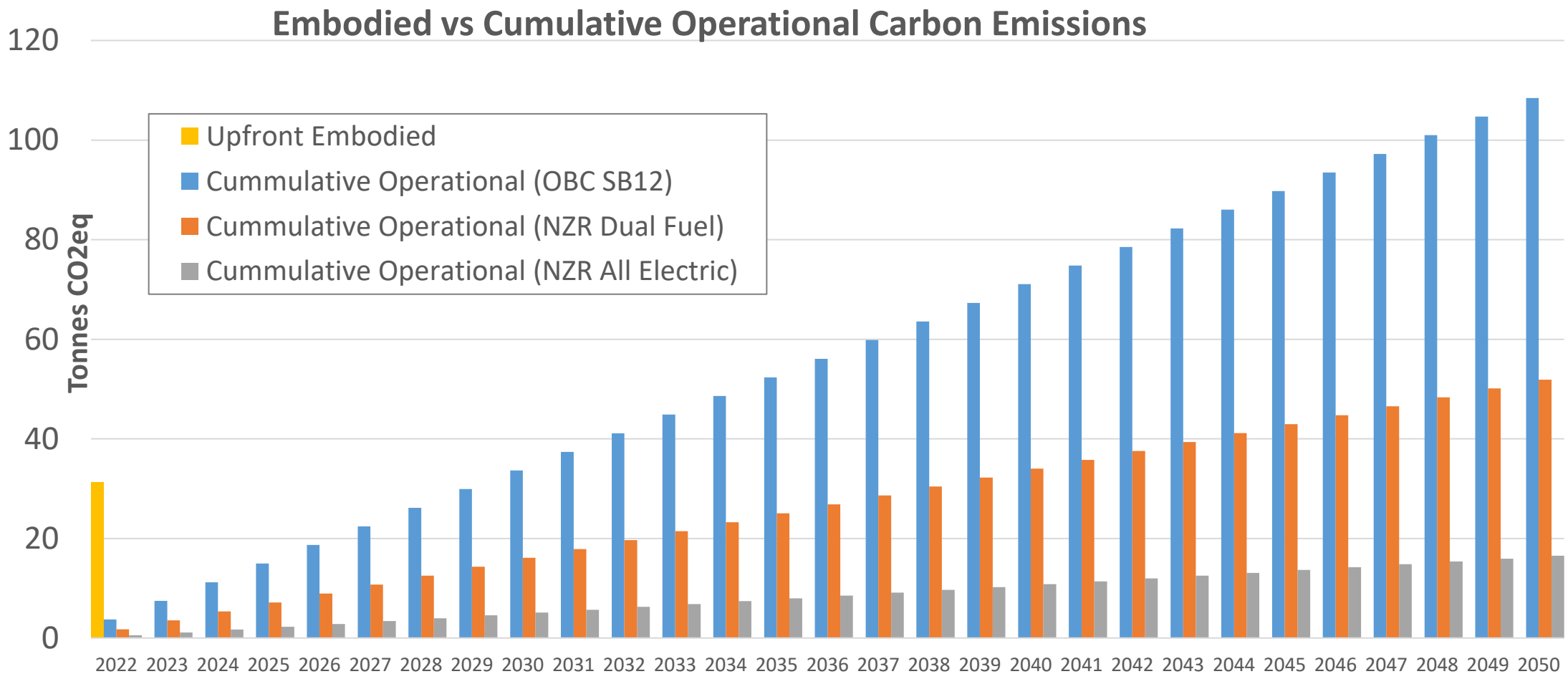
When it comes to Operational Grid Emissions…

Point #4: The Emissions (and peaks) of Tomorrows Grid Matters **Today.**

…Can’t stop thinking about tomorrow !

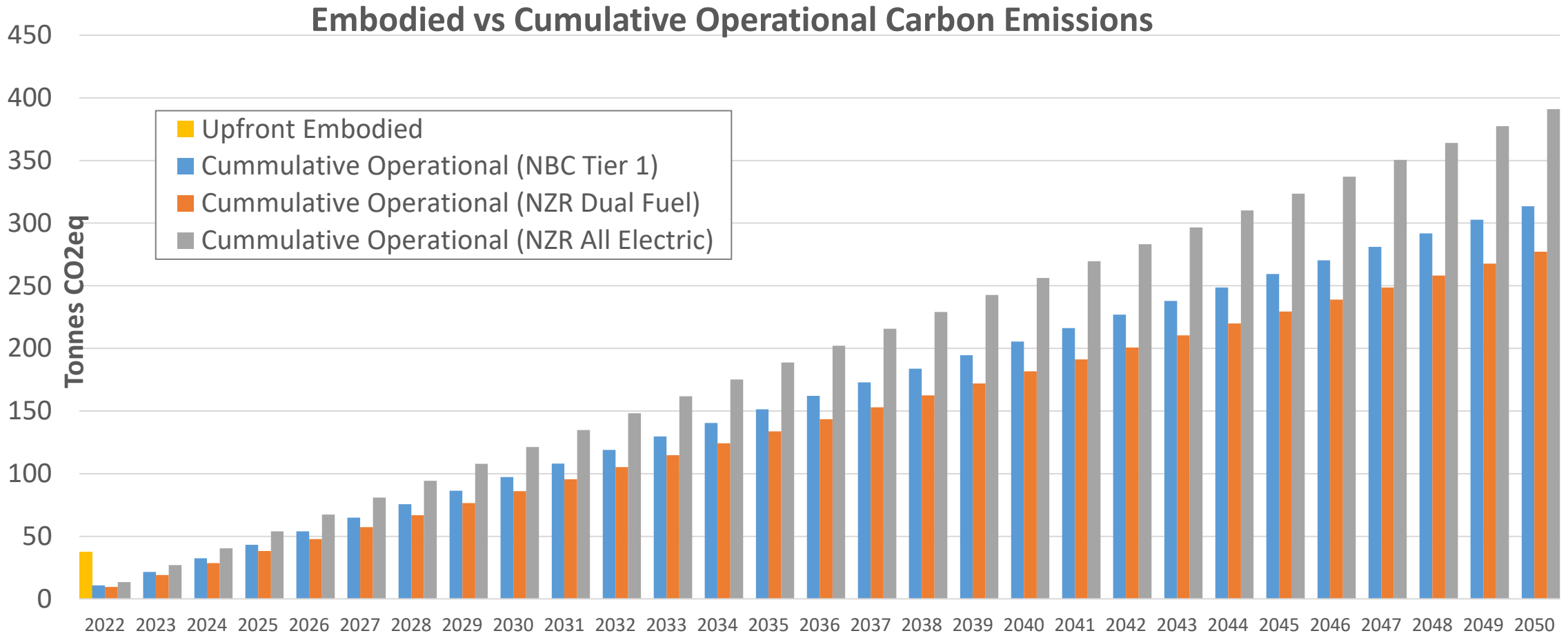
Point #4: The Emissions (and peaks) of **Tomorrows** Grid Matters **Today**

Ottawa – 36’ Single Detached –**Todays** Grid Emissions…

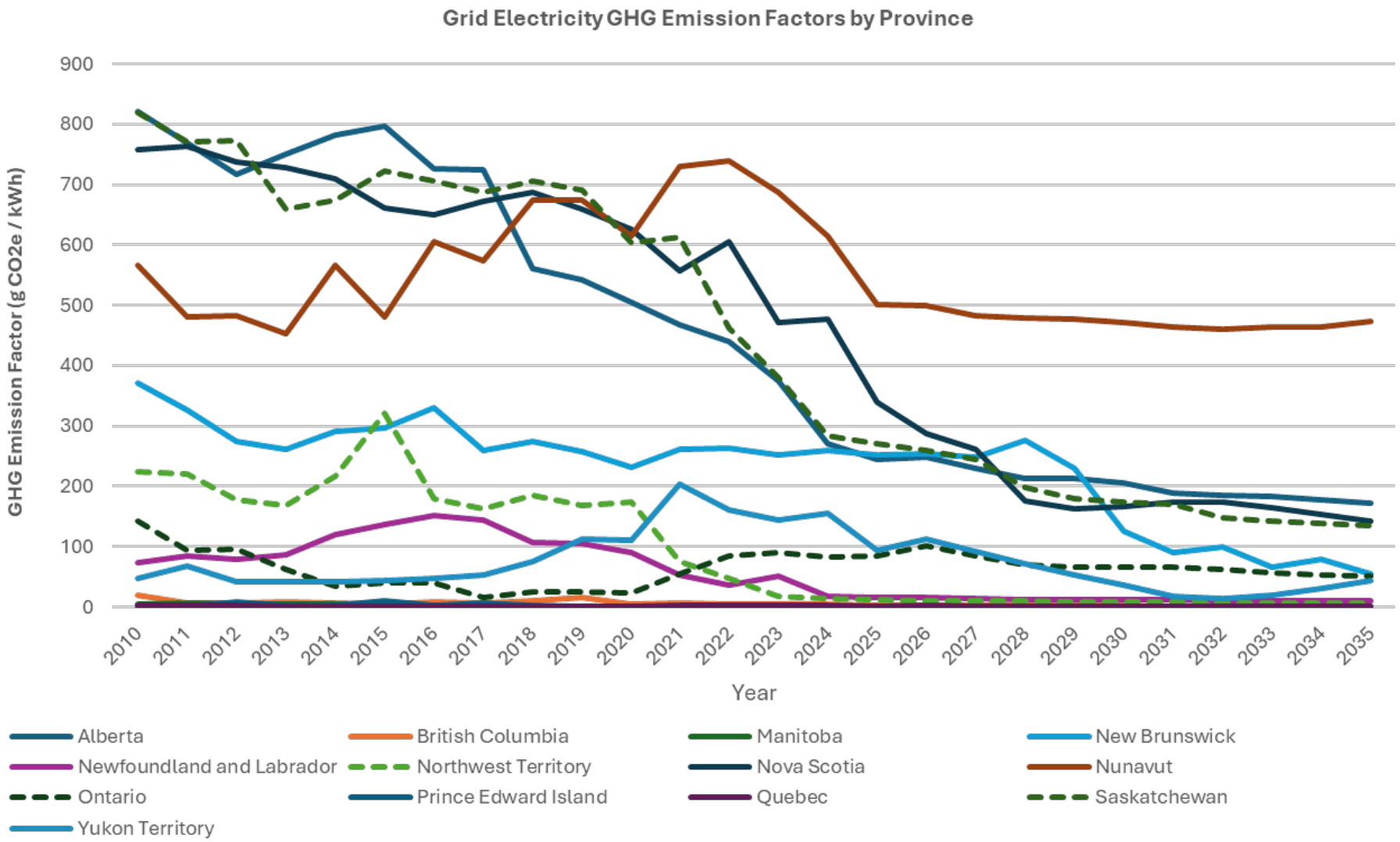


Point #4: The Emissions (and peaks) of **Tomorrows** Grid Matters **Today**

Calgary – 36’ Single Detached Todays Grid Emissions…..



Point #4: The Emissions (and peaks) of **Tomorrows** Grid Matters **Today**



Data Natural Resources Canada, visualization by RWDI

Point #4: The Emissions (and peaks) of **Tomorrows** Grid Matters **Today**

NBC 2025 PCF 2026 GHG Emissions in the Residential and Building Sectors

- Provides projected electrical grid emission rates for Prov/Terri 2030-35

Classification of provincial/territorial electric grids

- **High:** Emission factor more than or equal to 100 g CO_2e/kWh
- **Moderate:** Emission factor more than 25 g CO_2e/kWh and less than 100 g CO_2e/kWh
- **Low:** Emission factor less than or equal to 25 g CO_2e/kWh

NBC 2025 proposed

Province/Territory	Grid GHG Emissions	2030<Grid GHG Emissions Factor (g CO_2e/kWh)	Current Grid GHG Emissions Factor (gCO2e/kWh)
Alberta	High	181.86	800<
British Columbia	Low	1.32	10<
Manitoba	Low	0.00	3<
New Brunswick	Moderate	77.88	250<
Newfoundland and Labrador	Low	11.08	
Nova Scotia	High	161.64	700<
Northwestern Territory	Low	6.82	
Nunavut	High	465.16	
Ontario	Moderate	57.90	30>
Prince Edward Island	Moderate	80.42	
Quebec	Low	0.38	2>
Saskatchewan	High	146.60	700<
Yukon Territory	Low	25.00	

Source: CBHCC _PCF 2026

Point #5: Embodied Carbon; It's all about the BIG HITTERS

Ottawa – 36' Single Detached

TOP 10 MOST IMPACTFUL MATERIALS

Rank	tonnes CO2e	Section	Material
1	7.568	Foundation Walls	Concrete / 0-25 MPa
2	2.349	Windows	Window / Double Pane / Vinyl Frame
3	2.246	Footings & Slabs	Concrete / 0-25 MPa
4	1.882	Floors	Carpet / Average
5	1.730	Footings & Slabs	Concrete / 0-25 MPa
6	1.681	Garage	Concrete / 0-25 MPa
7	1.291	Cladding	Vinyl Siding / Vinyl Siding Institute
8	1.248	Garage	Concrete / 26-30 MPa
9	1.202	Cladding	Brick / US - Canada Industry Average
10	0.983	Structural Elements	Steel Post / Generic

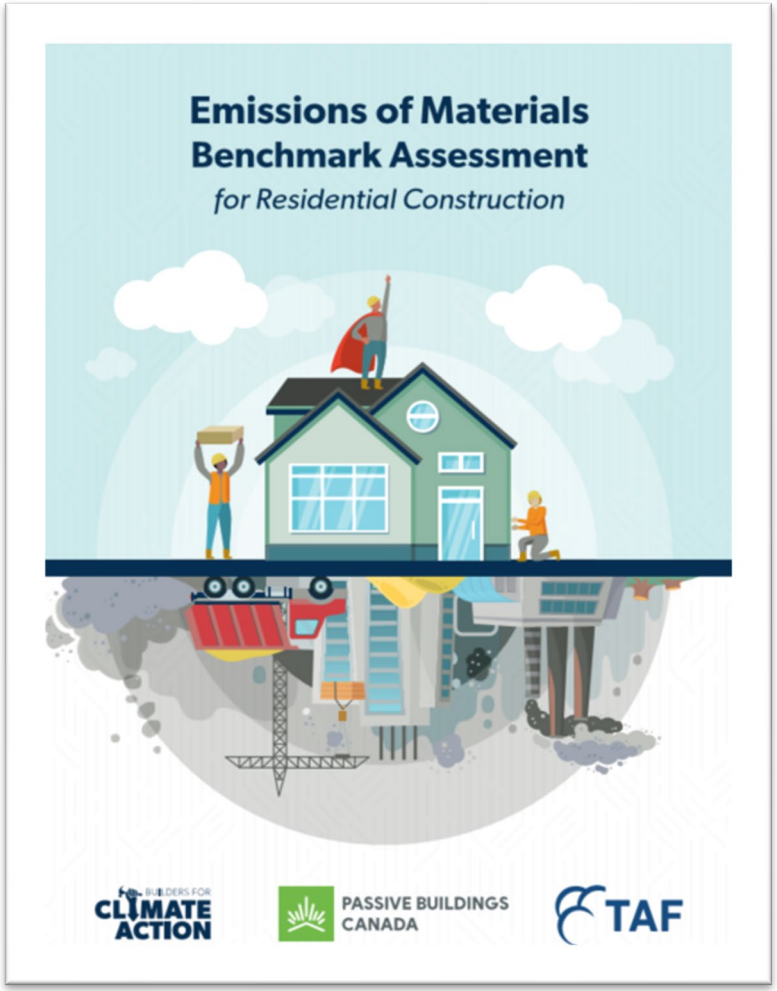
Point #5: Embodied Carbon; It's all about the BIG HITTERS

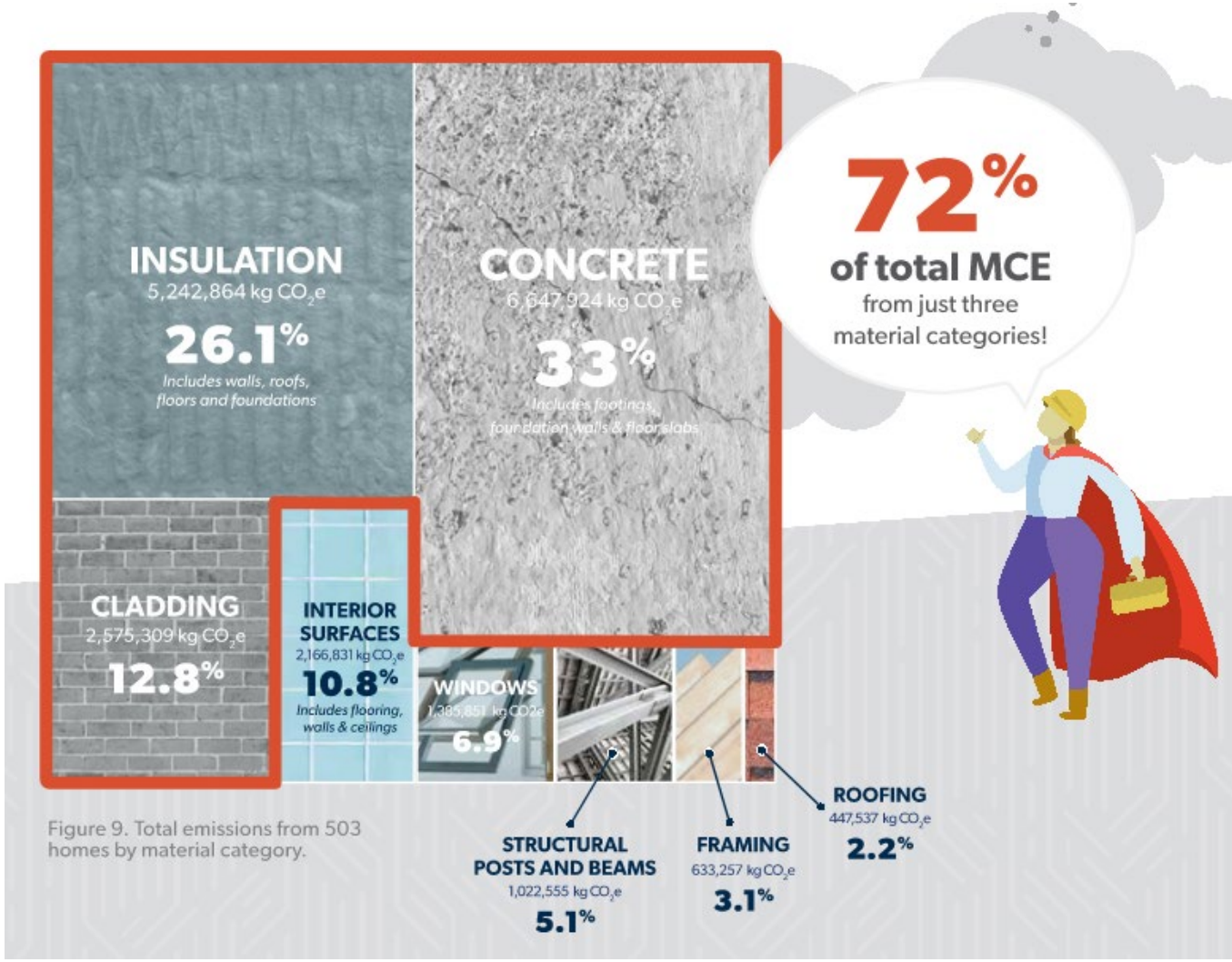
Calgary – 36' Single Detached

TOP 10 MOST IMPACTFUL MATERIALS

Rank	tonnes CO2e	Section	Material
1	8.199	Foundation Walls	Concrete / 31-35 Mpa / 30-40% Fly Ash
2	3.007	Cladding	Brick / US - Canada Industry Average
3	2.349	Windows	Window / Double Pane / Vinyl Frame
4	2.133	Footings & Slabs	Concrete / 0-25 Mpa / 15-29% Fly Ash
5	1.874	Footings & Slabs	Concrete / 31-35 Mpa / 30-40% Fly Ash
6	1.578	Garage	Concrete / 26-30 Mpa / 30-40% Fly Ash
7	1.568	Floors	Carpet / Average
8	1.226	Ext. Walls	OSB Sheathing / Canadian Wood Council
9	1.211	Floors	Spray Polyurethane Foam / Closed Cell (HFC)
10	1.158	Garage	Concrete / 26-30 Mpa / 15-29% Fly Ash

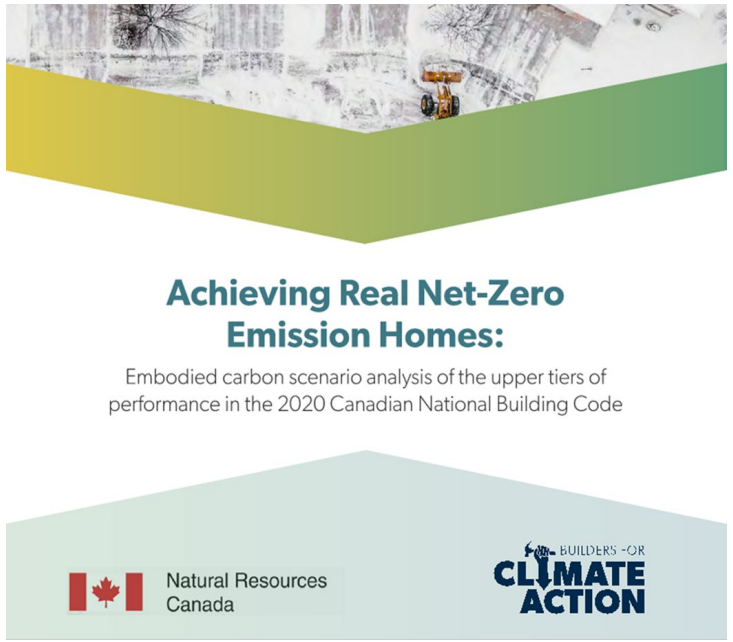
Point #5: Embodied Carbon; It's all about the BIG HITTERS





https://www.buildersforclimateaction.org/report---embarc-report.html

Point #6: Know The Optimal Solution On Your Horizon: **Draw-Down Homes**



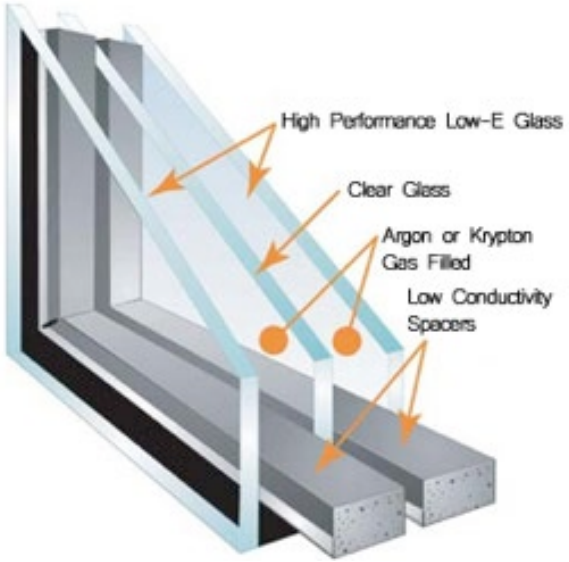
- BUILDINGS CAN BE PART OF THE ANSWER
- "DRAW-DOWN" HOMES AND BUILDINGS
- NEW BIO-BASED PRODUCTS ARE BEING DEVELOPED

Canada-wide
NRCAN Study

Canadian average of three archetypes and 190 models

Point #6: Know Myth From Science. Do The Math

SAMPLE HOUSE + WINDOW UPGRADE w/ TRIPANE



Glazing	MMBTUs/yr	Operational CO_2e Tonnes/yr	Embodied CO_2e Tonnes
Double, Low E, Argon	108.1	7.82	71.2
Triple, 2 Coats Low E, Argon	103.9	7.55	71.7
Change		- 0.27 Tonnes/yr	+0.5 Tonnes

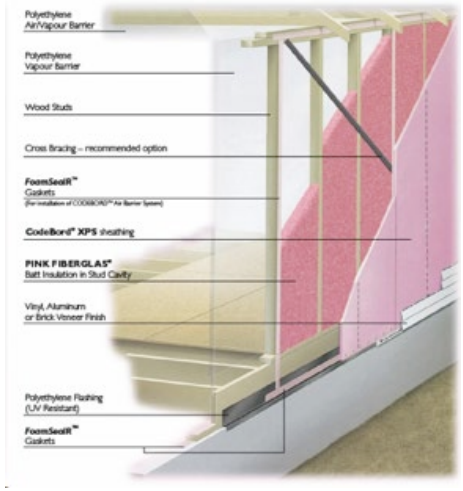
- Moderate Emission Grid factor more than 25 g CO2e/kWh and less than 100 g CO2e/kWh
- Climate Zone 5

A 2 year "return" on carbon investment

30 year carbon reduction potential:
8.1 Tonnes C02E

Point #6: Know Myth From Science. Do The Math

SAMPLE HOUSE + EXTERIOR INSULATION/LOW GWP XPS



- Moderate Emission Grid factor more than 25 g CO2e/kWh and less than 100 g CO2e/kWh
- Climate Zone 5

Insulated Sheathing	**MMBTUs/yr**	**Operational CO_2e Tonnes/yr**	**Embodied CO_2e Tonnes**
None	108.1	7.82	71.2
R5	103.5	7.57	72.4
R10	100.5	7.41	73.6
Change		-0.41 Tonnes /yr	+2.4 Tonnes

A 6 year "return" on carbon investment

30+ year carbon reduction potential:
-12.3 Tonnes C02E

Point #6: Know Myth From Science. Do The Math

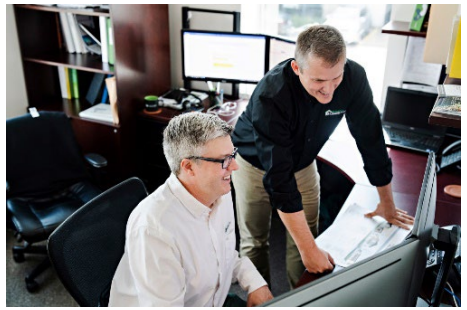
AIR TIGHTNESS / AIR TIGHTNESS IMPROVEMENT

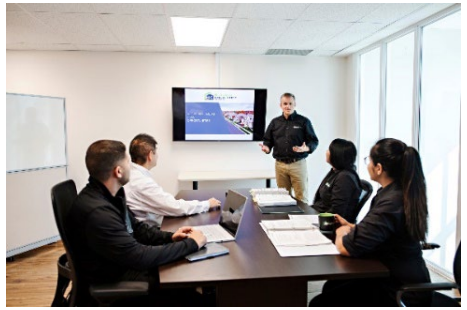
- Moderate Emission Grid factor more than 25 g CO2e/kWh and less than 100 g CO2e/kWh
- Climate Zone 5

Tightness ACH50	**MMBTUs/yr**	**Operational CO_2e Tonnes/yr**	**Embodied CO_2e Tonnes**
3.0	108.1	7.82	71.2
2.0	103.2	7.56	Neglible
1.5	100.9	7.44	Neglible
Change		-0.38 Tonnes/yr	Neglible

Less than 1 year "return" on carbon investment

30 year carbon reduction potential:
-11.4 Tonnes C02E

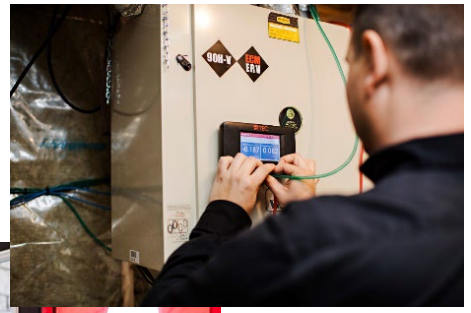


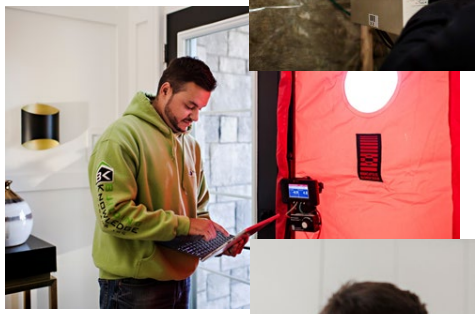


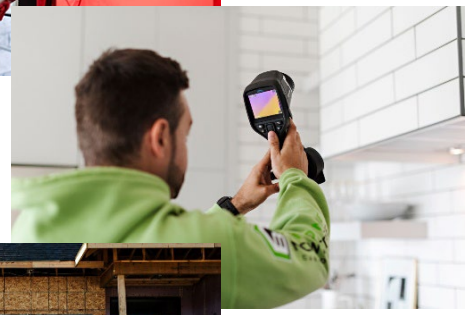
THANK YOU

HOME 360° ™

THE HOME THAT SCIENCE BUILT







ENERGUIDE

BuiltGreen

ENERGY STAR

LEED FOR HOMES

R-2000

netzero readyhome
The ultimate in comfort and efficiency

netzero home
The ultimate in comfort and efficiency

CANADIAN HOME BUILDERS' ASSOCIATION
netzero home
LEADERSHIPSUMMIT

Leigh St. Hilaire, Executive Director, Volta Research

Operational Emissions: Current and Future

volta RESEARCH

Volta Research

A Brief History

OUR TEAM

- Founded as a not-for-profit in 2018 with a mission to reduce energy use and emissions in Canada
- Small team that supports and utilizes recent graduates and new entrepreneurs
- Stakeholder-driven with aim of building capacity to talk about and reduce energy use and emissions

OUR IMPACT

- Research, development, analysis, and technical consulting on energy and emissions reduction processes, practices, and tools
- Focus on demographic, economic, and wider societal relationships with energy usage and emissions in Canada

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Operational Emissions

An Introduction

What are Operational Emissions?

- Emissions that result from the operation of the building (HVAC, DHW, lighting, loads, etc.)
- Now in the 2025 NBC & NEBC
- The emissions values per energy unit that we use for each energy type (electricity, gaseous fuel, liquid fuel, etc.) are standardized

Operational Emissions

An Introduction

Current Provincial Values:

- National Inventory Report: Greenhouse Gas Sources and Sinks in Canada

Future Provincial Values:

- Proposed Change 2004 - Operational GHG Emissions: Tiered Performance Requirements in the NBC and Tiered Prescriptive Requirements in the NBC

Operational Emissions

Current and Future Values

GHG Emissions Factor by Energy Source, g CO_2e/kWh				
	Electricity		Utility Gas	
Province or Territory	2022	2030 (PCF)	2022	2030 (PCF)
British Columbia	**15**	**1.32**	**190**	**190**
Alberta	**490**	**181.86**	**190**	**189**
Saskatchewan	670	146.6	185	185
Manitoba	1.4	0	185	185
Ontario	**38**	**57.9**	**186**	**185**
Quebec	1.7	0.38	186	186
New Brunswick	**350**	**77.88**	**185**	**185**
Nova Scotia	700	161.64	185	190
Prince Edward Island	350	80.42	185	185
Newfoundland and Labrador	18	11.08	185	185
Northwest Territories	70	25	190	190
Yukon	190	6.82	190	185
Nunavut	820	465.16	190	190

Classification of provincial/ territorial electric grids:

- **High:** Emission factor more than or equal to 100 g CO_2e/kWh
- **Moderate:** Emission factor more than 25 g CO_2e /kWh and less than 100 g CO_2e /kWh
- **Low:** Emission factor less than or equal to 25 g CO_2e /kWh

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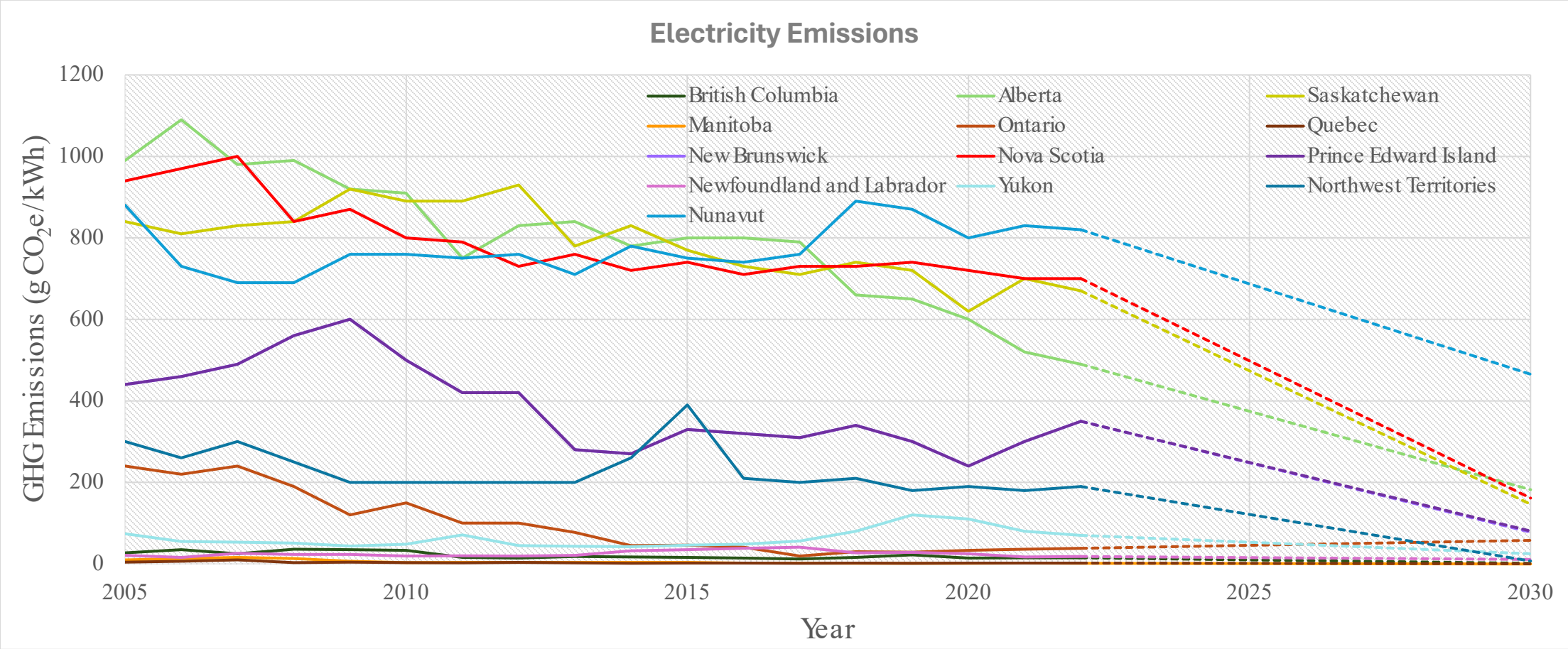
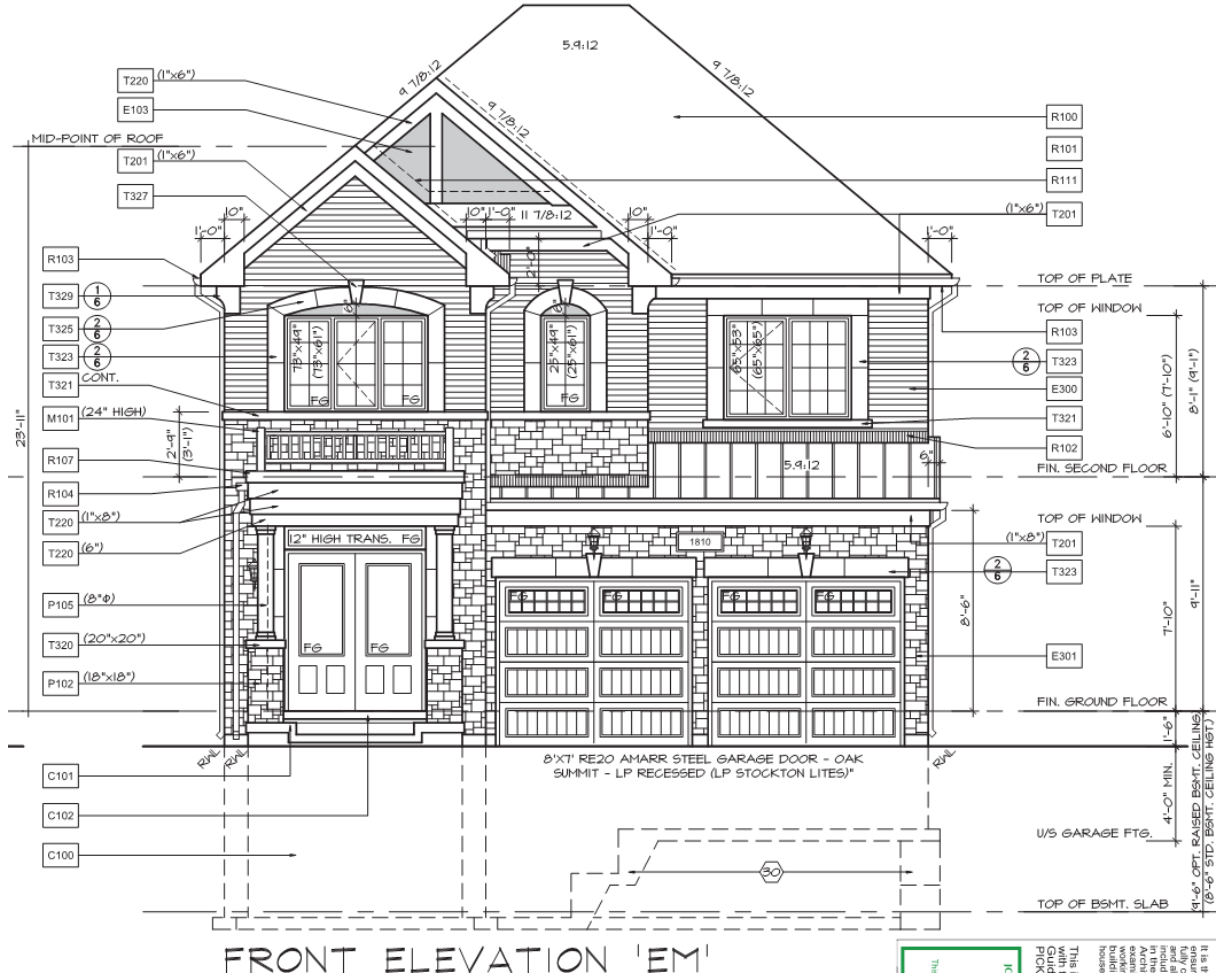
Operational Emissions

The Grid Getting Clean



Operational Emissions

A Case Study



Emissions Compared Between

- Tier 2 NBC (ON OBC)
- Tier 1 NBC
- Tier 4 NBC (NZ Ready)

Information provided courtesy of Mattamy Asset Management

mattamy ASSET MANAGEMENT

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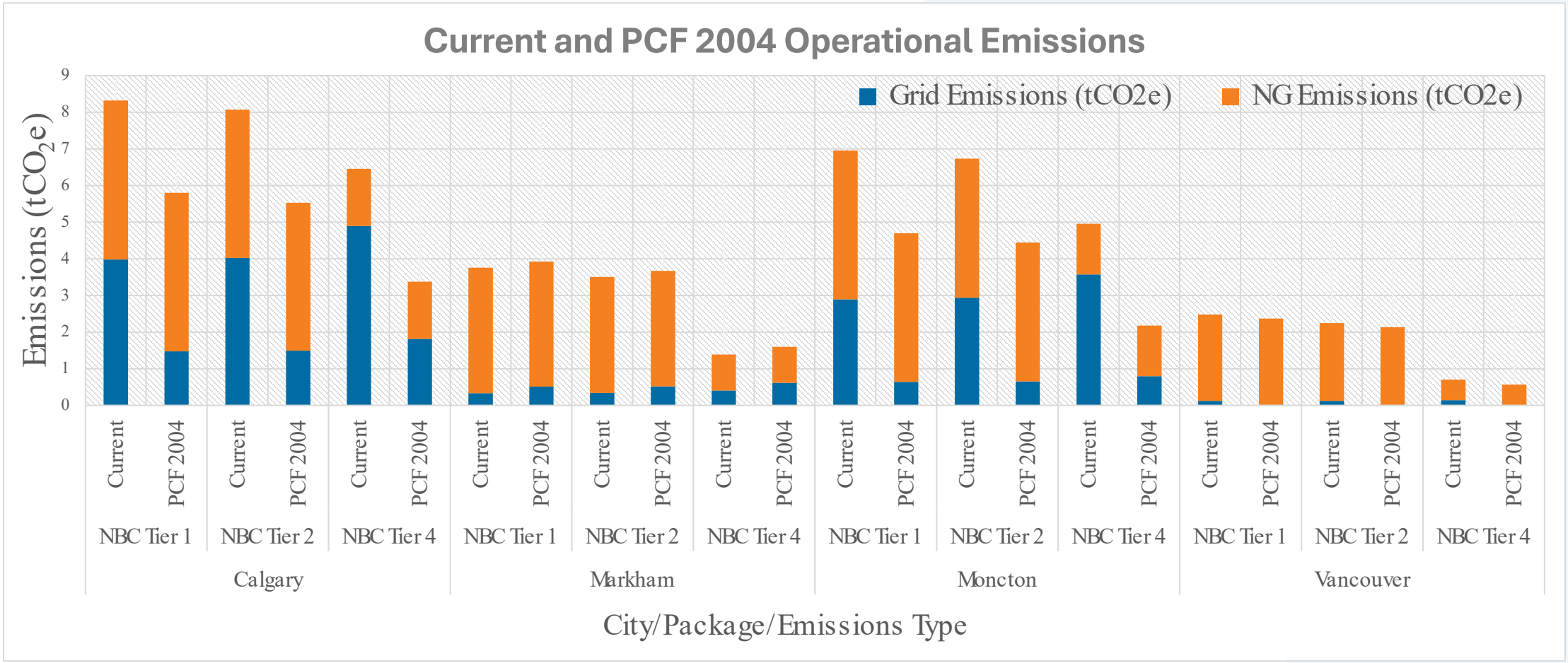
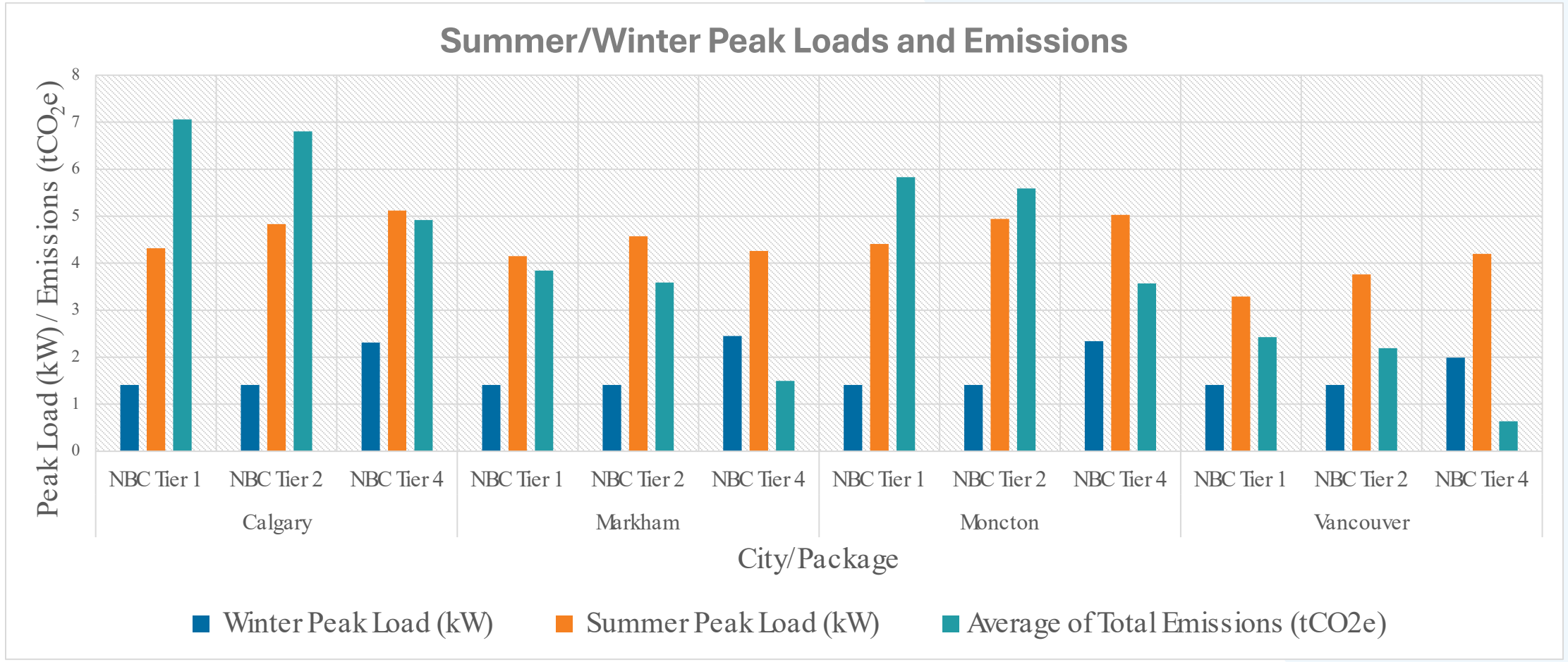
Operational Emissions

A Case Study



Operational Emissions

A Case Study



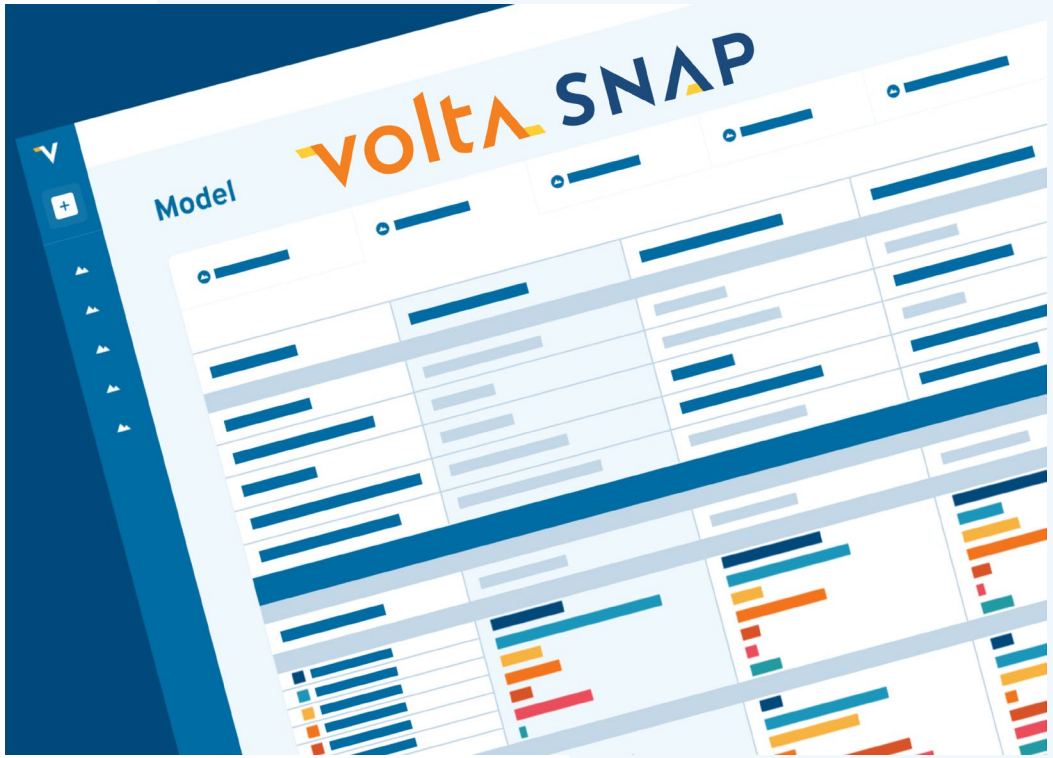
Operational Emissions

A Case Study

PCF 2004 - Operational Emissions Performance Level			
City	NBC Tier 1	NBC Tier 2	NBC Tier 4
Calgary	F (4.0%)	F (8.7%)	D (46.2%)
Markham	E (19.4%)	E (24.7%)	C (68.3%)
Moncton	E (16.2%)	E (20.9%)	C (62.5%)
Vancouver	D (32.3%)	D (39.2%)	B (84.5%)

Operational Emissions
What's Next

- Start to work with your consulting energy advisor on **operational emissions optimization** alongside compliance work
  - Tools coming (**Volta SNAP**) to help consultants more easily provide this to builders
- Providing **energy diversity** now (e.g. fuel switching) will help within the lifetime of current equipment



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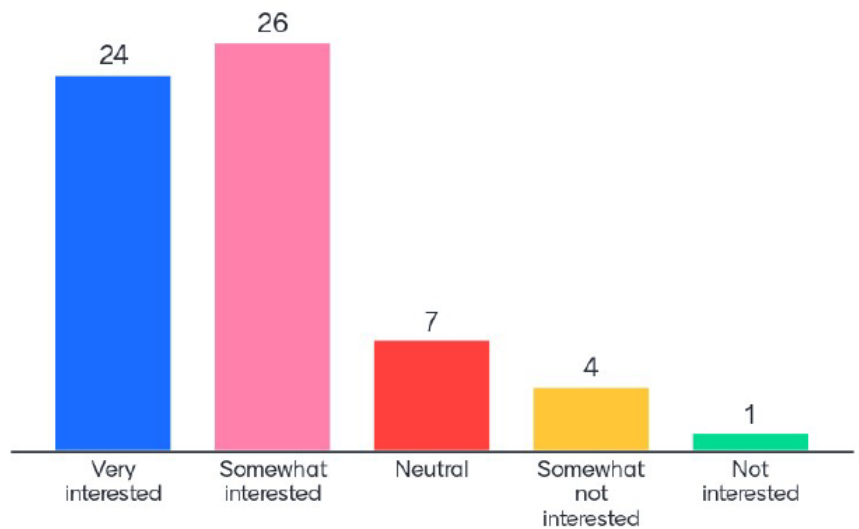
Operational Emissions

What's Next

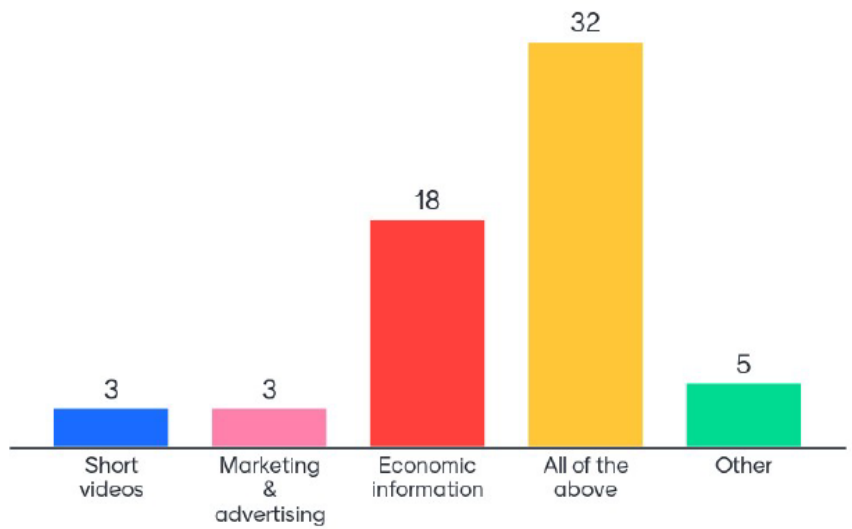
There is more to emissions than just those from building operations:

- Addressing the emissions that come from the materials and equipment in the building, ***embodied emissions***, can be much more impactful
- Important to reach a **"sweet spot"** that balances embodied and operational emissions to make the largest impact for dollars invested

How interested are the majority (>50%) of your perspective home buyers in installing an electric ASHP for space heating and cooling?



What additional information/tools do you need to help convince clients of the advantages of electric ASHPs?



SESSION 2 - FINDING THE EMISSIONS SWEET SPOT

What is the "other" info/tool that would help you to convince clients of the advantages of electric ASHPs?

24 responses

CANADIAN HOME BUILDERS' ASSOCIATION
netzero home
LEADERSHIPSUMMIT

Laureen Chung, Senior Manager, Low Carbon Homes Task Force, NRCan

THE VALUE PROPOSITION OF ELECTRIC HEAT PUMPS IN CANADIAN HOMES

Presentation to CHBA Net Zero Home Leadership Summit
June 11, 2024

Homes and Communities Division
Office of Energy Efficiency, Natural Resources Canada

CONTEXT - SPACE HEATING IN CANADA'S HOMES

KEY STATISTICS: EXISTING HOMES (CEUD, 2021)

Current space heating stock in Canada's homes

Electric resistance	Heat pumps	Natural gas & propane	Heating oil	Wood
5.7 M	0.9M	7.7 M	1.1 M	0.9 M
		23Mt	**3Mt**	**2Mt**

~16M dwellings*

37Mt from space (28Mt) and water heating (9Mt) annually

99% of homes' emissions are from space and water heating

~5% of Canada's total GHGs

*includes single detached, semi-detached, row, low-rise and high-rise.

WHAT ABOUT NEW HOMES?

5.8 million: new homes needed between now and 2030 to alleviate housing crisis.

Potential for significant additional emissions *if* those new homes are built following current trends, where ~50% use natural gas.

KEY TAKE AWAY:

Decarbonization of home heating is ESSENTIAL to achieve net zero in the buildings sector, and to meet Canada's emission reductions targets

A FEW NOTES ON OUR METHODOLOGY

Capital cost assumptions, includes: retail, materials, labour, electric upgrade for all-electric HP systems ($500 in new homes / $3,000 in existing), AC for non-HP systems:

Natural gas furnace w/ AC: ~$10,000

Hybrid, ASHP / Gas: ~$14,500

Hybrid, ASHP / Electric: ~$8,500 / ~$11,000

ccASHP / Electric: ~$17,500 / ~$20,000

GSHP / Electric: ~$35,500 / ~$38,000

Electric resistance w/ AC: ~$5,500

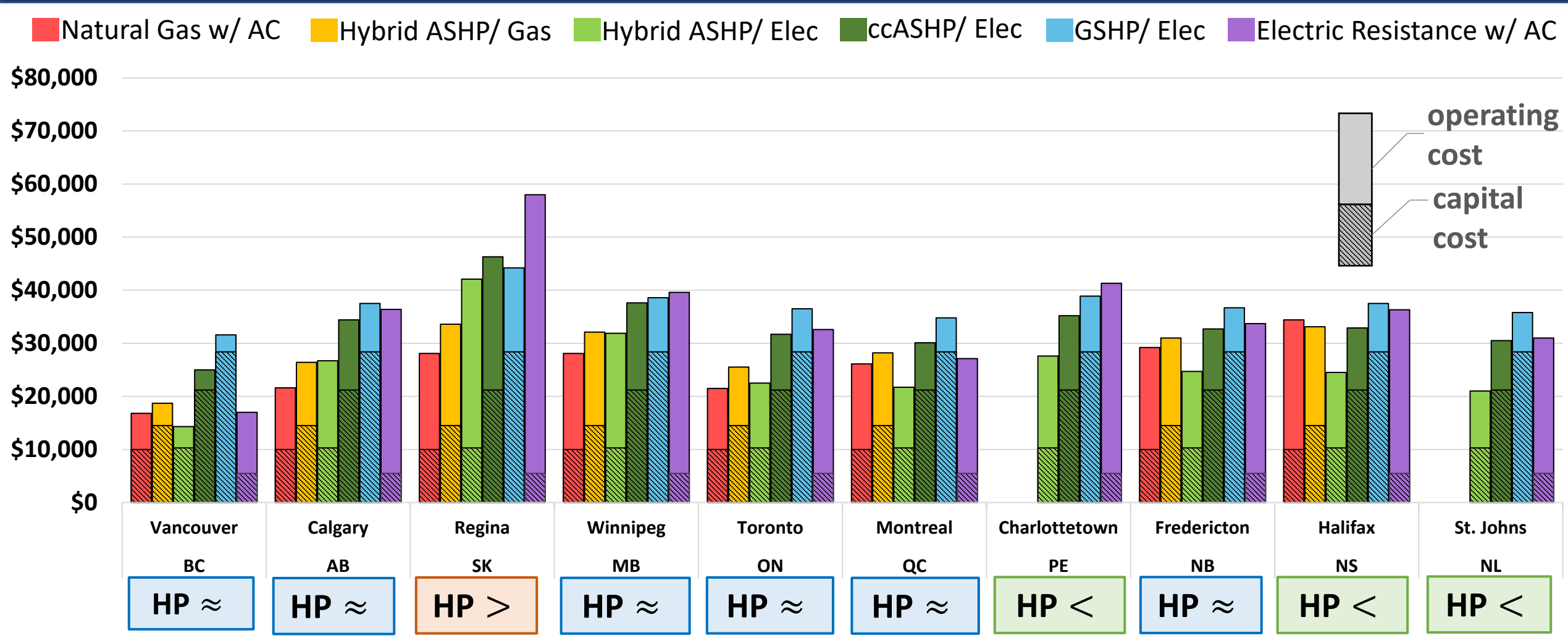
Energy use

- HOT2000 software
- single-detached 2,200 ft^2 archetype
- by selected vintage
- across 10 Canadian cities

Total ownership cost analysis:

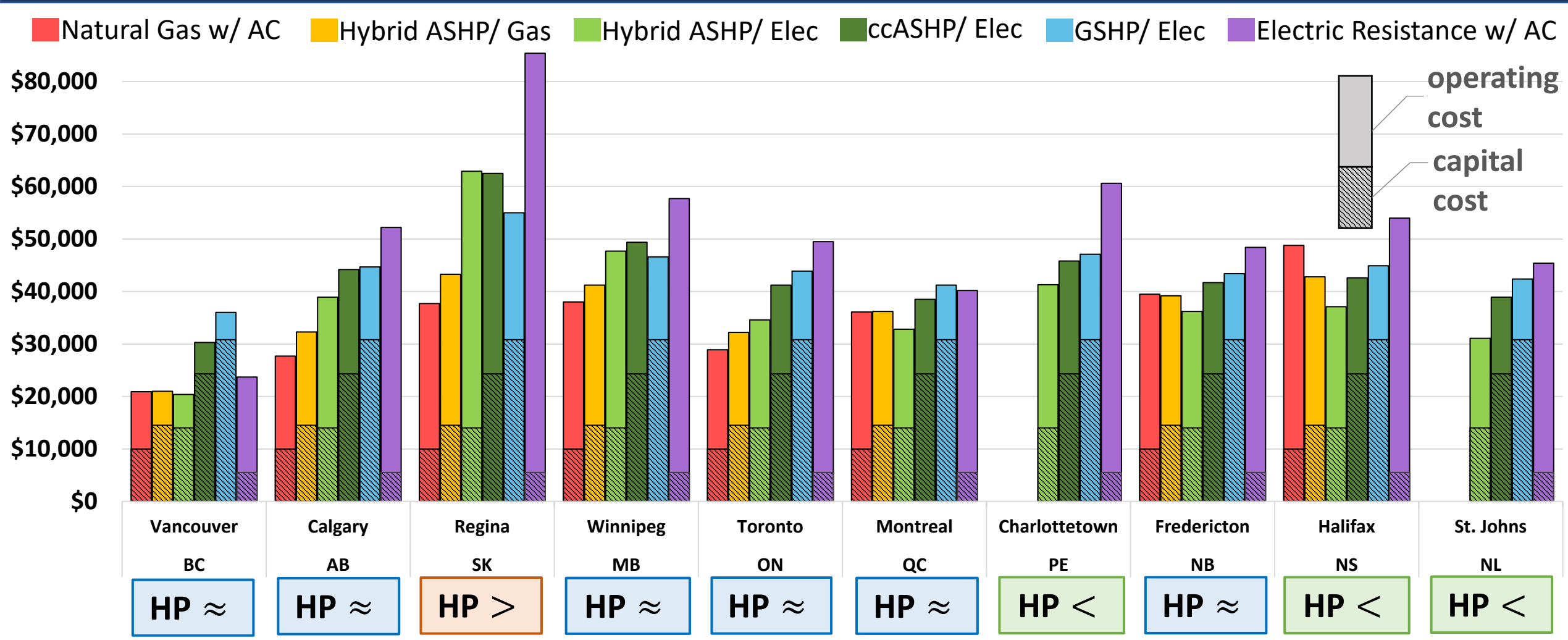
- 20-year outlook includes capital and operating costs
- Net Present Value (NPV), using 3% discount rate.
- ASHPs and ccASHPs assumed to have 15-year working life (re-capitalize after 15 years.)
- GSHPs assumed to have a 25-year working life (capital cost discounted)
- Energy price projections:
  - Natural gas from Canada Energy Regulator's (CER) *Energy Futures Outlook 2023 Report*
  - Electricity from Canadian Climate Institute, factors in CER, StatsCan and other models
- 2023 base year ($2023), rounded to nearest $100
- **Does not** include grants/incentives for heat pumps
- **Does not** discount gas connection cost for all-electric systems

FINDINGS: TOTAL 20 YEAR OWNERSHIP COST, NEW HOMES, STARTING IN 2024



KEY TAKE AWAY → In 2024, over equipment life, HPs cost the **same** (within $250/year) or **less** than natural gas in every province except **SK**

FINDINGS: TOTAL 20 YEAR OWNERSHIP COST, EXISTING HOMES, STARTING IN 2024



KEY TAKE AWAY → Bigger heating loads in older homes mean higher costs for all system types. Comparative **HP business case is the same** as for new build homes across all cities.

WHAT ABOUT HYBRIDS?

REASONS WHY A HEAT PUMP – NATURAL GAS FURNACE HYBRID MAY BE A GOOD CHOICE

Affordability Cost-resilience in the face of unpredictable gas and electricity cost fluctuations

Grid readiness Help mitigate peak demand on the electricity grid before it builds out capacity

Stepping stone Existing homes may have ducting size constraints for full heat pump conversion

Emissions impact Offset emissions before furnaces come to end of life

Access to cooling Access to cooling while also offsetting some natural gas use for heating

KEY MESSAGES FOR BUILDERS AND THEIR CLIENTS

A WIN-WIN-WIN FOR THE HOMEOWNER

Affordability → In most places in Canada, some form of heat pump system is at least on par with the cost of a natural gas furnace with AC system, over the 20-year equipment life.

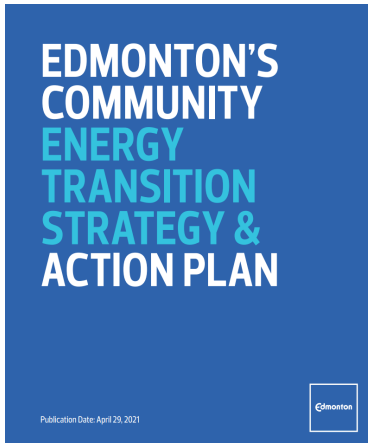
Decarbonisation → Deployment of heat pumps is our best pathway to decarbonise the biggest source of emissions in homes.

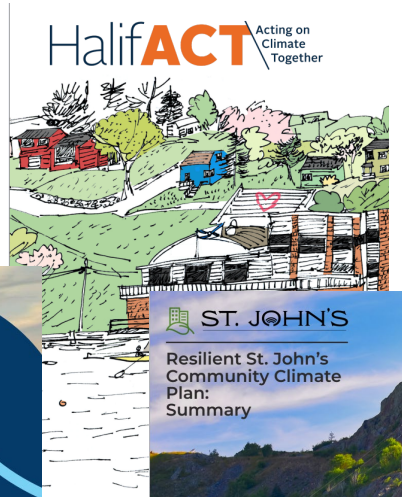
Climate resilience → Every home with a heat pump has cooling, an essential service in Canada's increasingly hot summers.

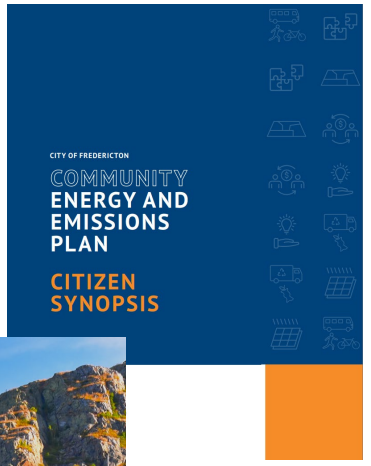
For the 16M existing homes, **complementary retrofit measures** can further reduce costs and emissions in existing homes

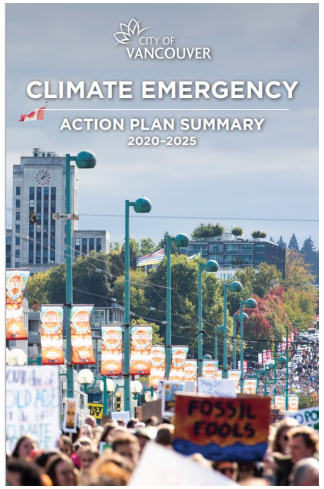
- Measures like improving insulation and air sealing can reduce peak demand by as much as **25%** in older homes.
- Deep energy retrofits, where a home is gutted or insulation is added on the exterior face, can reduce peak load demands by **50%** or more.

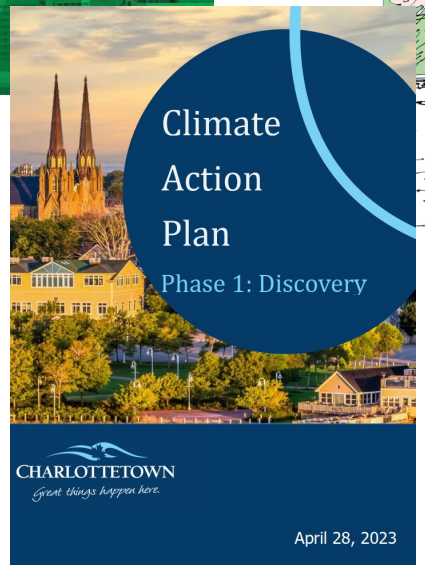
KEY MESSAGES FOR BUILDERS AND THEIR CLIENTS

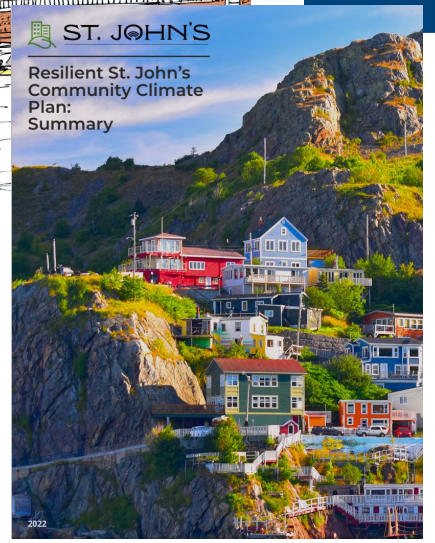












"I am interested in installing a heat pump in my home in the future"

For NRCan's Heat Pump Videos and Pamphlets:
www.canada.ca/heatpumps

Questions?

Laureen.chung@nrcan-rncan.gc.ca
Manager, Homes and Communities Division
Office of Energy Efficiency, Natural Resources Canada

CANADIAN HOME BUILDERS' ASSOCIATION
netzero home
LEADERSHIPSUMMIT

Jay Wilson, Director, Net Zero and Electrification, Electricity Canada

Electricity Canada

Our energy future

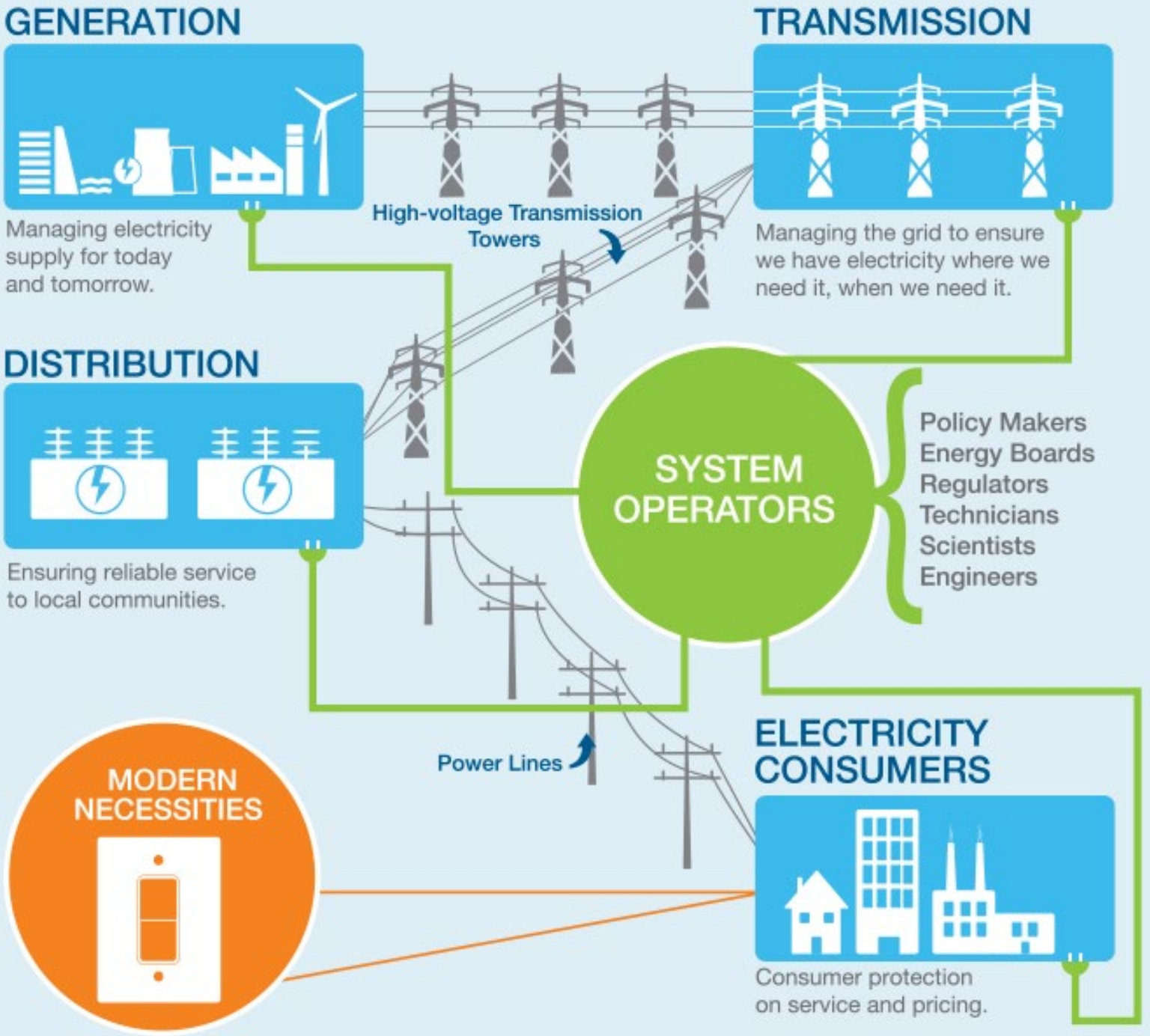
Électricité Canada

Notre avenir énergétique

How will the grid help us get to Net Zero?

CHBA Net Zero Leadership Summit
June 2024

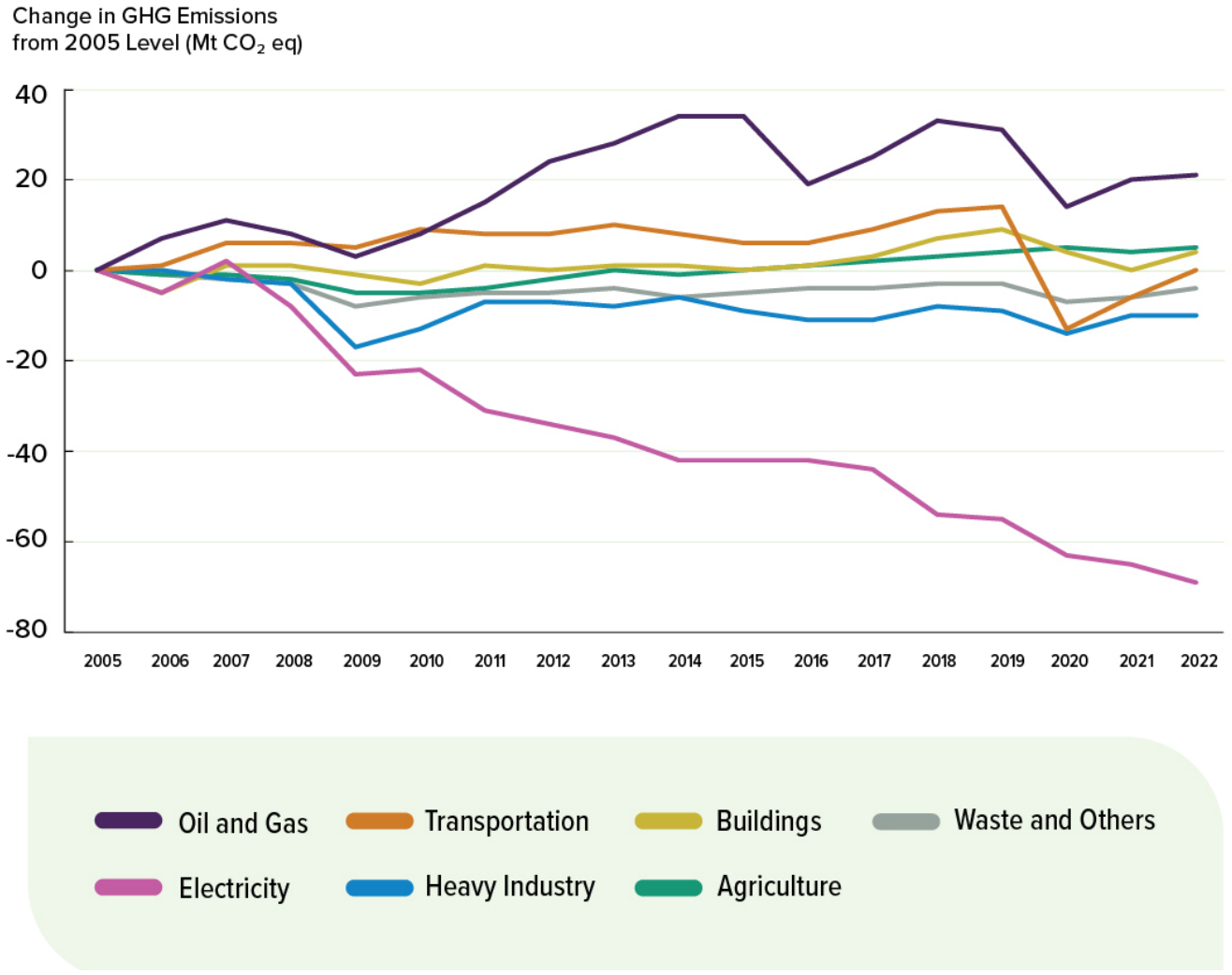
Electricity Canada | Électricité Canada


GENERATION
Managing electricity supply for today and tomorrow.
High-voltage Transmission Towers
TRANSMISSION
Managing the grid to ensure we have electricity where we need it, when we need it.
DISTRIBUTION
Ensuring reliable service to local communities.
SYSTEM OPERATORS
Policy Makers
Energy Boards
Regulators
Technicians
Scientists
Engineers
Power Lines
MODERN NECESSITIES
ELECTRICITY CONSUMERS
Consumer protection on service and pricing.

Grid Basics


Electricity Canada
Électricité Canada
Affordable
Reliable
Clean

Canada's 2024 National Inventory Report



Other sectors

Electricity sector CO_2 emissions

Source: Environment and Climate Change Canada. 2024

Two Targets, Two Different Challenges

Net Zero Electricity Grid: Canada's goal of having the electricity sector achieve no emissions of greenhouse gases (GHG) by 2035, or emissions that are offset by other actions that remove carbon from the atmosphere. This includes direct emissions and does not include lifecycle or upstream emissions.

Net Zero Economy: Canada's stated goal of having the Canadian economy achieve either no emissions of greenhouse gases (GHG) by 2050, or that all emissions are completely compensated for by removing carbon from the atmosphere (negative emissions) through other actions.

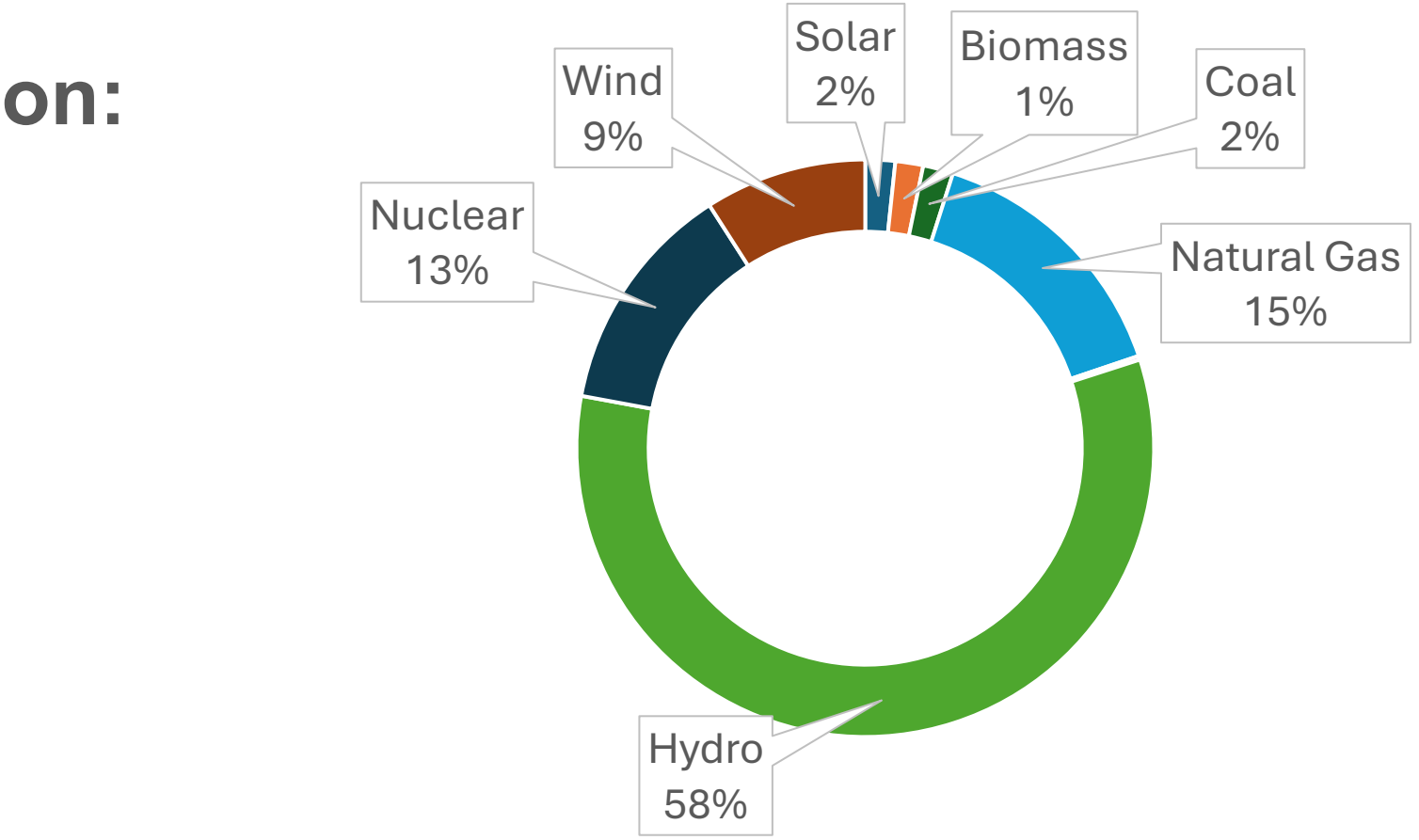
According to Government estimates, Canada will

need to produce up to 2-3x as much clean power as it does now to meet our Net Zero by 2050 commitments.

Canada's Generation Fleet Today

Total Generation:
637 TWh

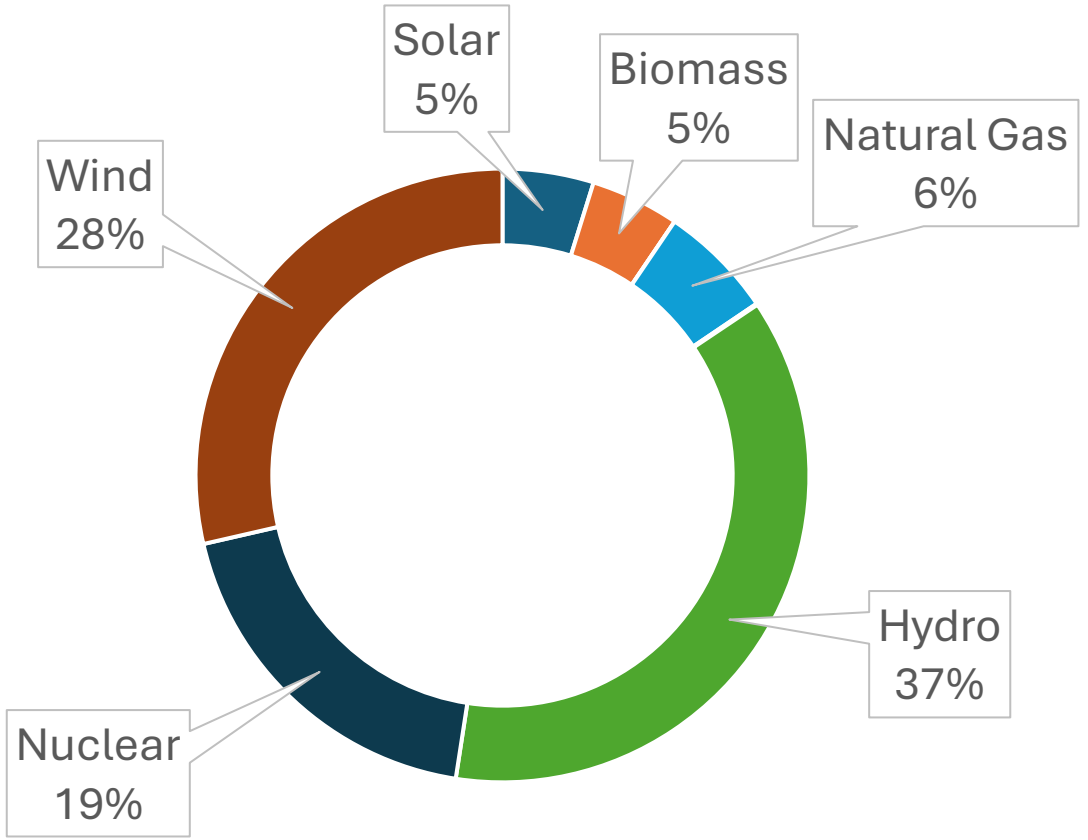
Non-emitting generation:
84%



Canada’s Generation Fleet in 2050

Total Generation (Projected): 1 292 TWh

Net Zero GHG emissions




Connecting new generation to load
More transmission within and between provinces

Modernizing Distribution

- Demand Side Management
- Distributed Energy Resources
- Smart Grids
- Electrification

The Affordability Challenge

It's clear from our research that electricity bills will go up.

We need to mitigate the impact.

What do we need?

Policy

Investment

Consistency

Questions?

Contact us at:

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