# Decarb Lunch serie



BC Hydro Power smart



# Reducing Embodied Carbon for Step Code Homes

Fri Jan 28, 2022, from 12- 1pm PST Free Webinar I zebx.org



Carbon Leadership Forum

mood provided by: Parra for Cuva song: Of Wonder

### RR-2



POLICY REPORT DEVELOPMENT AND BUILDING

 Report Date:
 July 5, 2016

 Contact:
 Sean Pander

 Contact No.:
 604.871.6542

 RTS No.:
 11195

 VanRIMS No.:
 08-2000-20

 Meeting Date:
 July 12, 2016

- TO: Vancouver City Council
- FROM: Green Building Manager, Sustainability Group
- SUBJECT: Zero Emissions Building Plan

#### RECOMMENDATION

- A. THAT Council approve the Zero Emissions Building Plan (attached as Appendix A) and adopt a target to reduce emissions from new buildings by 90% as compared to 2007 by 2025 and to achieve zero emissions for all new buildings by 2030 including intermediary time-stepped GHG emission and thermal energy demand targets as described in the Plan.
- B. THAT Council direct staff to report back with specific recommendations to reflect the first step of these limits in the Rezoning Policy for Green Buildings and Vancouver's Building Bylaw along with any synergistic updates to Neighbourhood Energy connection requirements by Q1 2017.
- C. THAT Council direct staff to build all new City-owned and Vancouver Affordable Housing Agency (VAHA) projects to be Certified to the Passive House standard or alternate zero emission building standard, and use only low carbon fuel sources, in lieu of certifying to LEED Gold unless it is deemed unviable by Real Estate and Facilities Management, or VAHA respectively, in collaboration with Sustainability and report back with recommendations for a Zero Emissions Policy for New Buildings for all City-owned and VAHA building projects by 2018.
- D. THAT Council direct staff, in consultation with industry, to develop a three year, \$1.625 million Zero Emissions Home Program for detached and row houses (\$325K in 2017 from the Climate Action Rebate Incentive Program Reserve, \$650K in 2018 and \$650K in 2019 from a funding source to be determined and reported back to Council), and report back to Council with specific recommendations for tools to catalyze leading builders to demonstrate cost effective approaches to building zero emissions homes by 2017.

F. THAT Council approves in principle \$700,000 over three years (\$300K in 2017, \$200K in 2018, and \$200K in 2019 from the City's 2017 Innovation Fund, subject to Council approval of the 2017 Innovation Fund budget) towards establishing a non-governmental Zero Emissions **Building Centre of Excellence** with the mission to facilitate the compilation and dissemination of the knowledge and skills required to design, permit, build and operate zero emission buildings in BC, and direct staff to engage partners, secure matching funding, consult with stakeholders and report back with recommendations for implementation in 2017.



August 30, 2018

### Vancouver launches Zero Emissions Buildings Exchange

As part of its Zero Emissions Building Plan, the City of Vancouver and its partners, including Pastive Huse Canada recently announced a Zero Emissions Building Exchange (ZEBx) – a local support centre located in Gastown, BC, to help the construction in ustry to most Varyouver's ambitious clean-building targets.

The Zero Emissions Building Plan, which requires most new buildings to be near zero emissions by 2025 and all new buildings to be net zero ready by 2032. Also, in 2017, British Columbia released the BC Energy Step Code, which sets the path for all new buildings to be net zero ready by 2032. ZEBx is *dedicate* is supporting the industry through this transition, acting as a catalyst that transforms the entire design and construction value chain, and at the same time

At rare

increasing



Credit: Suspencew

### The first of its kind in Canada, ZEBx aims to boost knowledge among residential and commercial building operators

The October civic election is destined to result in a new-look city council running Vancouver, but it's still been business as usual for Mayor Gregor Robertson and his team. For example, Robertson will be on hand on

#### VANCOUVER SUN

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Jul 26, 2018 • July 26, 2018 • 3 minute read • 💭 Join the conversation

### Zero Emissions Building Exchange opens in Vancouver

Peter Caulfield August 13, 2018



ZEBX — From left to right, Vancouver Mayor Gregor Robertson; Sean Pander, City of Vancouver green building manager; Fiona Famulak, VRCA president; Christian Cianfrone, ZEBx executive director; Eesmyal Santos-Brault, Regenerative Applications CEO; and Rob Bernhardt, Passive House Canada CEO.

# Deep Emissions Retrofit Dialogue



BC Hydro Power smart

Deep Emissions Retrofits of Homes: How to Get it Right Tue, Oct 26, 2021 from 12.30pm - 2.30 pm PDT Free webinar I zebx.org







Building to Electrification Coalition We are a broad coalition working together to electrify buildings in British Columbia in order to reduce their climate impacts and reliance on fossil fuels.







COASTAL HEAT PUMPS



**Get Involved** 



#### **Become a Member**

Becoming a member of B2E is simple and free. As a member you will enjoy the following benefits:

- Numerous collaboration opportunities with industry leaders through working groups, subcommittees, B2E events, case study development, and publishing online articles;
- Early access to building electrification news, updates and events;
- Recognition on B2E website and acknowledgement that your organization is fully engaged in the decarbonization of the building sector.

### What is Building Electrification?

Building electrification is about making the shift away from fossil-fuels and using low-carbon electricity for space heating, hot water and cooking.

Instead of using natural gas or propane to run appliances like furnaces, kitchen stoves, washers and dryers, everything is electric.

Read more about building electrification on our FAQ page.

View FAQ

Join B2E

### b2electrification.org



https://raog.ca/climate-emergency-declarations-canada/









### NET-ZERO ENERGY-READY CHALLENGE PLAYBOOK SERIES

- Ventilation Strategies for High-Performance MURBs
- Planning Airtight Buildings
- LCA Practice to Estimate Embodied Carbon
- Thermal Bridging
- Low-Carbon Energy Systems
- Planning/for.zebx.org

### Season 1, Episode 2

Recorded at Past Event: Apr 30 @ 12:00 pm – 1:00 pm

#### Quantifying Embodied Carbon for Buildings of the Future



### Overview

Society is facing a climate crisis. Over 30 municipalities in British Columbia have declared a climate emergency so far and some have begun taking significant steps to address the climate crisis. The most effective way to address this climate crisis is to focus on greenhouse gas emissions. But which type? In the buildings sector, embodied emissions are the now. Operational emissions are the maybe later. With this in mind, some municipalities are beginning to buckle down on embodied emissions.















## The BC Green Building Calendar

Welcome to the BC Green Building Calendar.

Here you will find all of the latest events and training related to green building subject matter, including: emissions, energy efficiency, resiliency, high-performance design, and more.

If you would like to submit an event or for more details on submission guidelines, see the bottom of this page.

#### Filters January 2022 January 2022 Sun Mon Tue Wed Thu Fri Sat Presented by: HPSC Webinar 27 28 29 30 31 1 Jan 6 7 8 (P) HOME PERFORMANCE STAKEHOLDER COUNCIL 18 11 12 13 14 15 10 18 19 20 21 22 16 17 Home Performance Contractor Network: Q&A and Tuesday Feedback Session 1:00 - 2:00pm 23 24 25 26 27 28 29 30 31 Presented by: BCIT Course To submit events for your organization: Jan Join our community 18 BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY BCIT Tuesday CESA 1505 - Zero Energy Buildings All-In-1 6:00 - 9:00pm



## Tell us about yourself!

Three-part anonymous poll







Leadership Forum Vancouver

# Introduction to **Embodied Carbon Emissions**

### Zahra Teshnizi

Co-Chair, Carbon Leadership Forum, Vancouver Hub Senior Advisor, Mantle Developments



We accelerate the transformation of the building sector to radically reduce the **embodied carbon** emissions associated with building materials and construction.



### **CLF Community & Resources**



THE CARBON CHALLENGE WHO WE ARE WHAT WE DO TOOLKITS OUR SPONSORS

#### Research Project: Embodied Carbon Benchmark Stu

#### **Research Question:**

What are the typical magnitudes and ranges of embodied carbon in buildings?

#### About

The Embodied Carbon Benchmark Study is the first stage of the LCA for Low Carbon Construction project funded by The Charles Pankow Foundation, Skanska USA and Oregon Department of Environmental Quality. Life Cycle Assessment (LCA) is the method used to quantify the carbon emissions that occur when extracting materials and making building products, otherwise known as 'embodied carbon'. Although there is growing recognition of the need to track and reduce embodied carbon emissions, building industry professionals need better data and guidance on how to implement low carbon methods in practice.

This project compiled the largest known database of building embodied carbon and created an interactive database. This stage of the project established consensus on the order of magnitude of typical building embodied carbon, identified sources of uncertainty and outlined strategies to overcome this uncertainty. The report summarizes the key findings of this research and provides the foundation for stage two of this project, the development of an *LCA Practice Guide*.



#### Embodied Carbon Benchmark Study

https://carbonleadershipforum.org

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CLF Carbon Leadership Community		+ New Topic	: Q	
all categories • all tags • all • Latest New (1) Unread (4) Top Categories	Docs		+	New Topic
Торіс		Replies	Views	Activity
<ul> <li>News You Can Use</li> <li>News</li> <li>News You Can Use is a timely digest of webinars, events, recent news, research, resources, and discussion from across the building industry focused on driving the radical reduction of building construction and materia read more</li> </ul>	2	6	1.7k	Jun 3
F □ Welcome to the Community     Sign up for a user account and password If you are not logged in, you will see a button at the top of this     page. Your account must be approved by @clf-admin before you can participate in this forum. You'll     begin rec read more	Œ	1	2.3k	Apr '20
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□ I am giving a lecture at Princeton UniversityI ■ News event	F 🕲	3	59	2d
□ IECC 2024 comments	R 😭 🛯 🕞	5	112	2d

#### CLF Online Community

https://community.carbonleadershipforum.org





500+ Local Industry Professionals 15+ Past Events 30+ Cities Inspired to Start Local Hubs <u>www.CLFVancouver.com</u>



### What are **Embodied Carbon Emissions** of Buildings?



#### **Operational Carbon**

Operational Emissions (emissions from energy consumed to operate the building: lighting, plug loads, heating and cooling, equipment, etc)





Image: S. Smedley Skanska



### What are **Embodied Carbon Emissions of Buildings**?



Image: S. Smedley Skanska



### **Embodied Carbon Emissions are Significant**



**Global Energy-related CO**<sub>2</sub>e Emissions by Sector (2019)

Source: <u>Global Status Report for Buildings and Construction</u> (2020)



### **Embodied Carbon Emissions are Upfront** & will become the Majority



Sources:

London Energy Transformation Initiative. <u>LETI Embodied Carbon Primer</u> (2019) One Click LCA. <u>The Embodied Carbon Review: Embodied carbon reduction in 100+ regulations and rating systems globally</u> (2018)



### **Embodied Carbon Emissions Policies & Regulations are Coming**







### For more information visit:

https://carbonleadershipforum.org

clfvancouver.com

Zahra Teshnizi zahra.teshnizi@mantledev.com

### **ZEBx** Decarb Lunch Series

## Reducing Embodied Carbon for Step Code Homes

A Case Study from the Kootenays

Presented by **Chris Magwood**, Builders for Climate Action **Natalie Douglas**, City of Nelson



**Test** whether there was or was not a correlation between high Step Code homes and high material carbon emissions **Assess** how our MCEs compare to other cities, what this means, and what actions we can take immediately **Introduce** the topic to the building community and gather some preliminary feedback on program and policy development In 2016, **~76%** of households in Nelson resided in Part 9 buildings.

#### Between 2016-2021:

56% of all new residential units were single unit dwellings
78% of new build dwelling permits came from single unit dwellings
92% of renovation permits came from single unit dwellings

NELSON

# Nelson Next:

NELSON



"New buildings are net zero ready, **have low embodied carbon**, and are resilient against a changing climate."

Aspiration 2, Strategy 1 of Nelson Next



Results from MCE study of 34 Part 9 homes:



Results from OCE study of 34 Part 9 homes:



# **23 years** before today's OCE matches MCE average



### lowest

### **205 years** before today's OCE matches MCE average



### **Results by Material Carbon Intensity**

(gross emissions/heated floor area)



Compensates for different building sizes by using kg CO2e/m<sup>2</sup> metric

Step Code Material Carbon Intensity (kg  $CO_2/m^2$ )

Step code level was not a predictor of Material Carbon Intensity (MCI)



309.1



What about other metrics that may be more aligned with other priorities (e.g., densification)?



### Material Carbon Intensity by Function Metric



#### Material Carbon Intensity by Function Metric



MCI<sub>F-1</sub> = CABA<sub>h</sub>  $C = net MCE in t CO_2e$ A = gross area in  $m^2$ B = number of bedrooms $A_{h}$  = heated floor area in m<sup>2</sup>

= 28.8

<b>Concrete</b> 346.9 tCO <sub>2</sub> e <b>35.5%</b>	<b>Cladding</b> 122.6 tCO <sub>2</sub> e <b>12.5%</b>	<b>Interior Surfaces</b> 119.6 tCO <sub>2</sub> e <b>12.2%</b>	Average of all materials from all homes in study			
	<b>Windows</b> 111.0 tCO <sub>2</sub> e <b>11.3%</b>		<b>Roofing</b> 23.9 tCO <sub>2</sub> e <b>2.4%</b>			
<b>Insulation</b> 149.7 tCO <sub>2</sub> e <b>15.3%</b>	<b>Framing</b> 103.7 tCO <sub>2</sub> e <b>10.6%</b>		Structural Elements 0.5 tCO <sub>2</sub> e >0.1%			

### **Possible Substitutions** for the Highest MCI house

#### Change to **Best Conventional** Materials Change to **Best Possible** Materials

309.1	→	<b>151.3</b> kg CO <sub>2</sub> e/m <sup>2</sup>	309.1	→	<b>55</b> kg CO <sub>2</sub> e/m <sup>2</sup>
Mineral wool roof insulation	÷	Cellulose	Mineral wool roof insulation	÷	Cellulose
Hardwood floors	$\rightarrow$	1/2 Linoleum flooring	Hardwood floors	÷	Linoleum & cork flooring
XPS continuous insulation	$\rightarrow$	Wood fiberboard	Mineral wool cavity insulation	$\rightarrow$	Straw bale
insulation	$\rightarrow$	Cellulose	EPS ICF	$\rightarrow$	Treated wood foundation
EPS ICF	$\rightarrow$	Wood chip ICF	Average concrete	$\rightarrow$	High SCM concrete
Average concrete	$\rightarrow$	High SCM concrete EPS sub slab insula		ງ →	Foam glass gravel

### **Case Study: Laneway House**

By Mike Coen

(Project Manager at Pacific West Builders)



#### **Operational Emissions**

Tonnes CO<sub>2</sub>e/yr Tonnes CO<sub>2</sub>e/30 years **0.14** 

### **Material Emissions**

Tonnes CO<sub>2</sub>e Kilog **0.10 2.** 

Kilograms CO<sub>2</sub>e/m<sup>2</sup>

= 6.4 tonnes of total emissions by 2050!



#### **Achieving Real Net-Zero Emission Homes:**

Embodied carbon scenario analysis of the upper tiers of performance in the 2020 Canadian National Building Code

Natural Resources Canada



### **NRCan Study**

Canadian Averages of 3 Archetypes at Tier 3



- Toronto
- Quebec City
- Halifax

### **EMBARC Study**

Preliminary Results (503 as-built homes)



Comparing MCI for heated floor area in 3 studies

NRCan	(Tier 3 avg)		Nelson	EMBARC
<b>High</b> Carbon Materials	<b>513</b> kg CO2e/m <sup>2</sup>	<b>Highest</b> Home Emissions	<b>309</b> kg CO2e/m <sup>2</sup>	<b>561</b> kg CO2e/m <sup>2</sup>
<b>Moderate</b> Carbon Materials	<b>150</b> kg CO2e/m <sup>2</sup>	<b>Average</b> Home Emissions	<b>150</b> kg CO2e/m <sup>2</sup>	<b>189</b> kg CO2e/m <sup>2</sup>
<b>Best</b> Available Materials	2 kg CO2e/m <sup>2</sup>	<b>Lowest</b> Home Emissions	<b>72</b> kg CO2e/m <sup>2</sup>	<b>116</b> kg CO2e/m <sup>2</sup>
Best Possible Materials	-50 kg CO2e/m <sup>2</sup>	Best Performing *Outside Study	2 kg CO2e/m <sup>2</sup>	



### Material emissions + Operational emissions

### Carbon Use Intensity w/ time factor

### Material emissions + Operational emissions for a number of years







What do these numbers tell us about Nelson and Castlegar's **alignment** with Canada's 2030 GHG Reduction Targets?





#### Home with best MCE and OCE can far exceed target. This is close to zero by 2050.

**Test** whether there was or was not a correlation between high Step Code homes and high material carbon emissions

> High Step Code homes can have high MCEs but it is not inevitable

**Assess** how our MCEs compare to other cities, what this means, and what actions we can take immediately

There are accessible material substitutions and actions we can take right now **Introduce** the topic to the building community and gather some preliminary feedback on program and policy development

>>>

### Which stakeholders were most engaged?



#### Change the MARKET + RULES

#### **Programmatic Supports**

(e.g., awards, incentives, regulations, policies, etc.)

#### CULTURE

#### **Consumer Supports**

(e.g., material guides, training workshops, etc.)

#### CONTEXT

#### **Peripheral Supports**

(e.g., advocacy to higher tier governments, policy alignment work etc.)

- Labour costs to conduct MCE calculations
- Time cost due to expended development review process
- Program should offer guidance re: Part 3 buildings and retrofits

- Data either doesn't exist (e.g., EPDs) or is hard to find
- Lack of educational supports and absence of educational content in schools (e.g., some trades programs)
- Many homeowners don't know about the concept either

- Lack of EPDs from local manufacturers (e.g., concrete, mass timber etc.)
- The Greener Homes Grant seems to be promoting deep retrofits without consideration of MCEs
- FireSmart recommendations sometimes contradict low MCE material recommendations

**Programmatic Supports** (e.g., awards, incentives, regulations, policies, etc.) **Consumer Supports** (e.g., material guides, training workshops, etc.) **Peripheral Supports** (e.g., advocacy to higher tier governments, policy alignment work etc.)

#### **Barriers/Worries**

- Labour <u>costs</u> to conduct MCE calculations
- Time <u>cost</u> due to expended development review process
- Program should offer guidance re: <u>Part 3</u> buildings and <u>retrofits</u>

- **Data** either doesn't exist (e.g., EPDs) or is hard to find
- Lack of <u>education</u>al supports and absence of educational content in schools (e.g., some trades programs)
- Many homeowners don't know about the concept either

- Lack of <u>EPDs</u> from local manufacturers (e.g., concrete, mass timber etc.)
- The Greener Homes <u>Grant</u> seems to be promoting deep retrofits without consideration of MCEs
- Other <u>climate resiliency</u> work (e.g., FireSmart recommendations) sometimes contradicts low MCE material recommendations

**Programmatic Supports** (e.g., awards, incentives, regulations, policies, etc.) **Consumer Supports** (e.g., material guides, training workshops, etc.) **Peripheral Supports** (e.g., advocacy to higher tier governments, policy alignment work etc.)

#### **Opportunities/Actions**

- Develop a list of pre-reviewed prescriptive material combinations to facilitated widespread adoption
- Create building <u>awards</u> for lowest MCEs
- Begin building an <u>MCE tiered</u> program that compliments Step Code (including deciding on which <u>metric</u> we want to use)
- Investigate opportunities to develop financial **incentives**

- Liaise with building officials to develop pre-reviewed prescriptive material combinations
- Work with retailers to develop <u>educational content</u> available at building supply

stores

- Continue to improve the Material Carbon Emissions Guide
- Begin liaising with local schools to add MCE considerations to existing OCE content

- Liaise with major builders in town to encourage manufacturers to create
   <u>EPDs</u> and get involved with this work
- Work with with higher tier government and other BC communities to better align climate resilient work (e.g., FireSmart, Step Code, MCE, flood hazard, etc.)

#### **Materials Guide**

#### \*both will be freely available soon\*



# **AVITY & ATTIC INSULATION** nsulation emissions based on 100 m<sup>2</sup> (at R-13)

#### **Benchmarking Report**

#### Establishing the Average Up-Front Material **Carbon Emissions in New Part-9 Residential** Home Construction in the City of Nelson & the **City of Castlegar**

#### Prepared for

Meeri Durand, Manager of Planning, Development & Sustainability, City of Castlegar Sam Ellison, Senior Building Inspector, City of Nelson

#### Prepared by

Chris Magwood, Director, Builders for Climate Action Erik Bowden, Embodied Carbon Analyst, Builders for Climate Action Eve Treadaway, Research Assistant, Builders for Climate Action Javaria Ahmad, Sustainability Analyst, Builders for Climate Action Michele Deluca, Registered Energy Advisor, 3West Building Energy Consultants Natalie Douglas, Embodied Carbon Pilot Coordinator, City of Nelson

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d use the tools to refine design and

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ducing the size of garages. ssible, carbon-storing materials

immental Product

ctors and regulators

ires and air tightness and design

without unduly raising MCE,

 Inform clients of low-carbon material options and, where possible, carbon-storing options Contacting material manufacturers to encourage them to produce Environmental Product

- Declarations to add to the existing data set
- Maximize building efficiency through improved passive design features and air tightness and design mechanical systems that use renewable energy rather than fossil fuels
- · Engage in collaborative design process with designers, contractors and regulators

#### Insights for Builders/Contractors

Builders often make final material procurement decisions and since choices that favour low-carbon and carbon-storing options can have a dramatic impact on MCE, they play an integral role in reducing MCEs. Builders are also often an important point of contact with clients and can help to introduce or reinforce the importance of climate-friendly decisions. More specifically they can:

- · Employ tools such as the Material Guide to inform procurement decisions
- · Inform clients of low-carbon material options and, where possible, carbon-storing options · Contacting material manufacturers to encourage them to produce Environmental Product Declarations to add to the existing data set
- · Contacting retailers to encourage stocking of low-carbon and carbon-storing products
- Engage in collaborative design process with designers, energy advisors and regulators

### What's next for Nelson?



Regional Energy Efficiency Program

Integrate MCE considerations into concierge service for new builds and retrofits



Build tiered program, establish incentives, and compile supporting documents



Collaborate with others working on climate resiliency within City to align policy

- Liaise with local building material retailers and manufacturers
- Work with procurement staff at the City to discuss feasibility of implementing a low carbon policy (e.g., concrete)
- Investigate MCE retrofit methodology development and MEP impact consideration



