

Welcome to today's CHBA Net Zero Webinar!



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The CHBA Net Zero Team





Housekeeping

For those who didn't attend the Net Zero Leadership Summit, this is an example of the caliber of speakers/content.

- **This webinar is being recorded.** CHBA Members can access the Net Zero webinar archive (recording + slide deck) at www.chba.ca/NZwebinars.
- **You will be in “listen-only” mode** for the duration of the webinar.
- **After the presentation we will have time for questions. Please use the question section of the dashboard** throughout the webinar and your questions will be relayed to the presenter(s).
- You can **change your screen view** by clicking on the  **View icon** in the top right corner, and by dragging the slider between sections to make the slideshow/webcams smaller/larger.

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- High Performance Building Envelope Solutions



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Our Next Webinar

February 10, 2022, from 10:30-11:30 PT / 1:30-2:30 ET

Insulation and radon gas control solutions for comfortable, durable and healthier basement living areas



Presented by Salvatore D. Ciarlo, P Eng. Technical Services and Building Enclosures Director, Owens Corning Canada

With more people working from home and having kids attending remote school from home, having a home office or other livable space in the basement has become a bigger priority for many households. Join us for this webinar to learn how you can unlock the potential of an added living space that is healthier, safe, comfortable, durable, and also minimizes radon ingress.

Join us to learn about Owens Corning's innovative next generation Fiberglas and Foam insulations made with 100% wind powered electricity and our Foamular Radon abatement system.

Learn more and register at chba.ca/NZwebinars



Today's Webinar



January 19, 2022, from 12:00-1:00 PT / 3:00-4:00 ET

New Study Results on Embodied Carbon in Materials



Presented by Chris Magwood
Executive Director at The Endeavour Centre & Builders for Climate Action

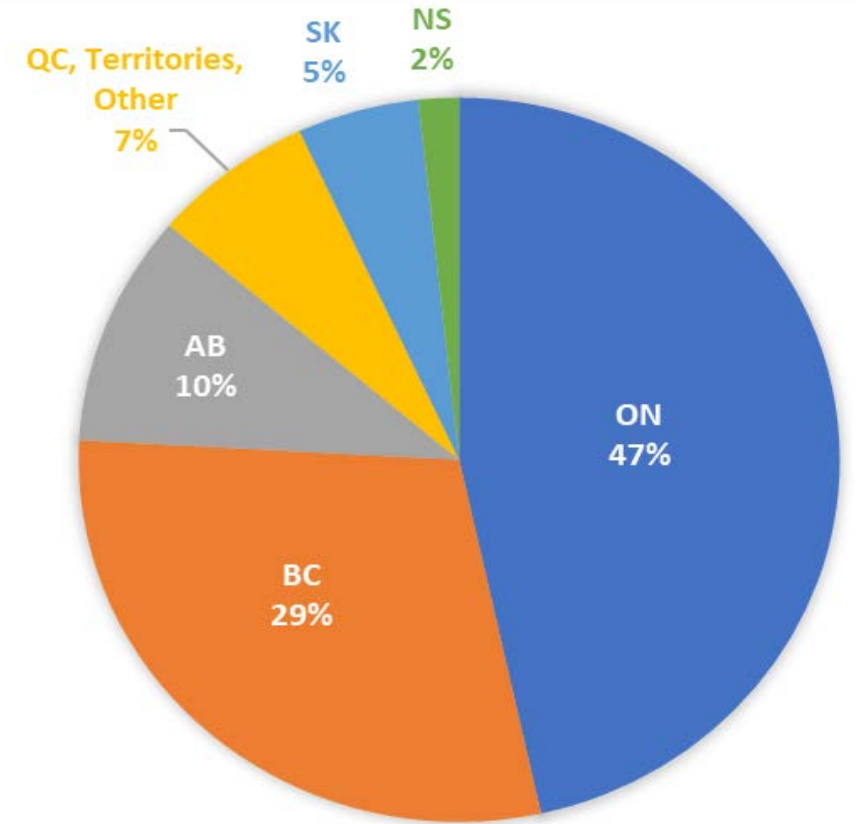
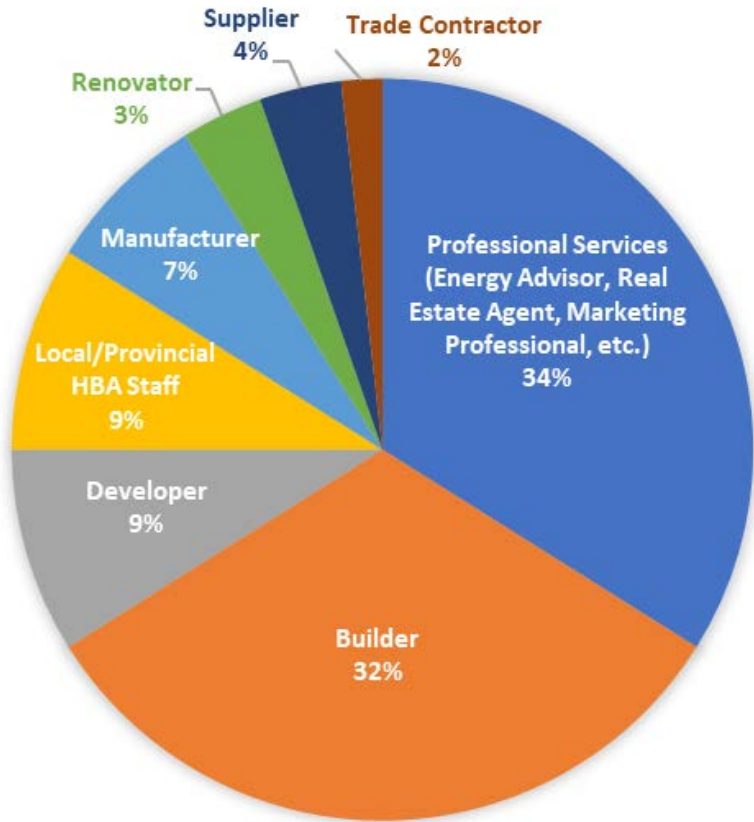
During the 2020 Net Zero Leadership Summit last year, Chris Magwood, Executive Director at The Endeavour Centre & Builders for Climate Action, provided a very informative presentation on the work he has been doing on the impact of embodied carbon in materials. His presentation was so well received that we invited him back to provide an update on his work during the 2021 Summit, specifically the results of a new study that he completed for NRCan this year. Chris was unable to make the Summit, but he's delivering the information during this special online session.

Join us to learn about the main takeaways from this study, including what the material carbon emissions "range" is, how the material carbon emissions could be brought to zero or even be negative (net carbon storing) using conventional, code-compliant materials, and how reducing material emissions by one "tier" has a much larger impact on overall emissions than increasing energy efficiency by one tier in the NBC.

Members can access the recording & slide deck at chba.ca/NZwebinars

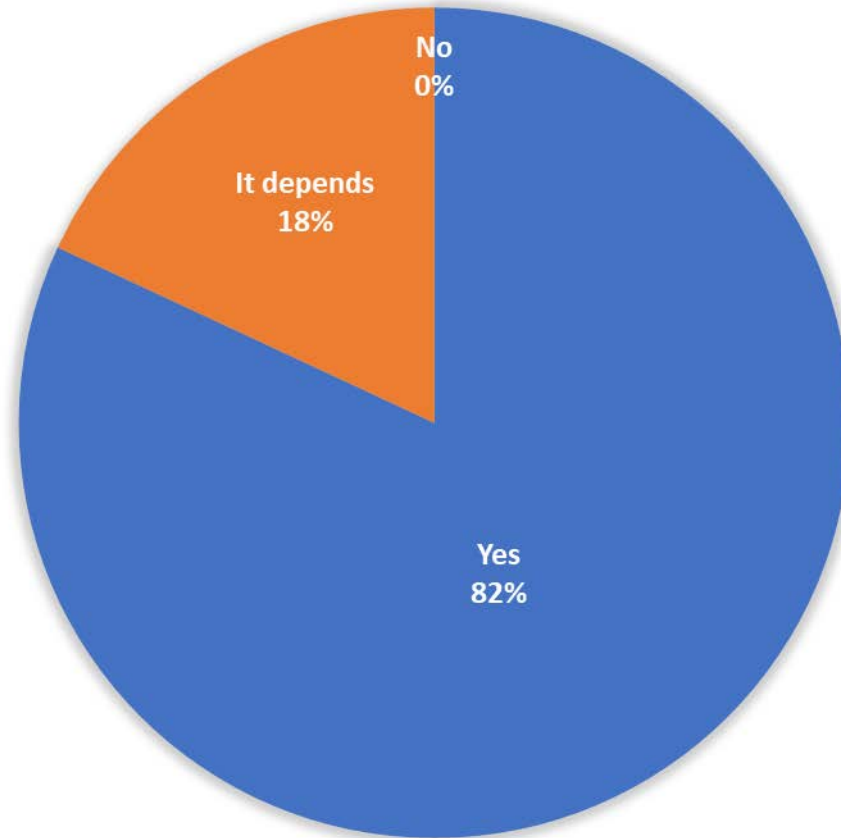


POLLS



POLL at the end of the presentation

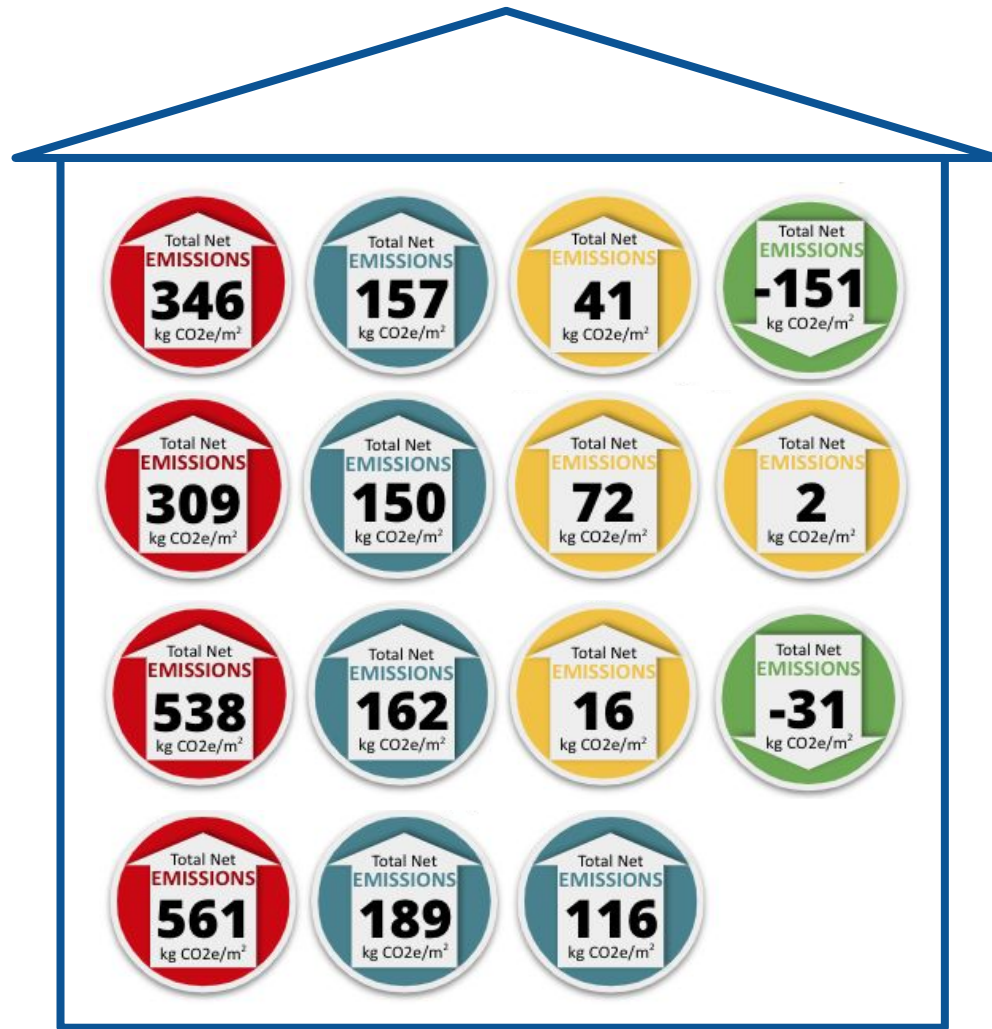
WOULD YOU BE INTERESTED IN ATTENDING A WORKSHOP ON EMBODIED CARBON AND THE MATERIAL CARBON EMISSIONS ESTIMATOR?



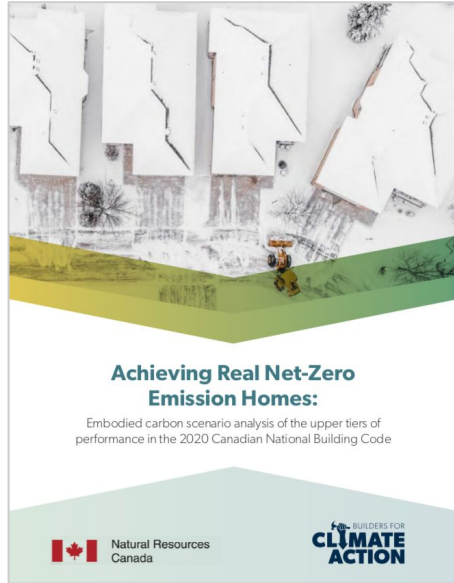
Carbon emissions & material selections:

What we know today

Chris Magwood,
Director of Research, Builders for Climate Action
CHBA Net Zero Energy Housing webinar,
January 19, 2022



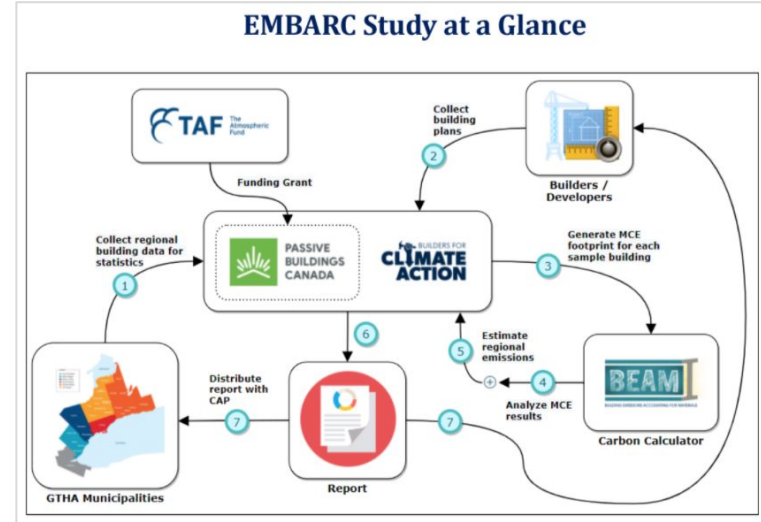
Three Studies:



NRCan
190 models



Nelson/Castlegar
34 homes



EMBARC
503 homes

One case study:



Trent University Forensic Crime Scene Facility
Zero Carbon building, 2020

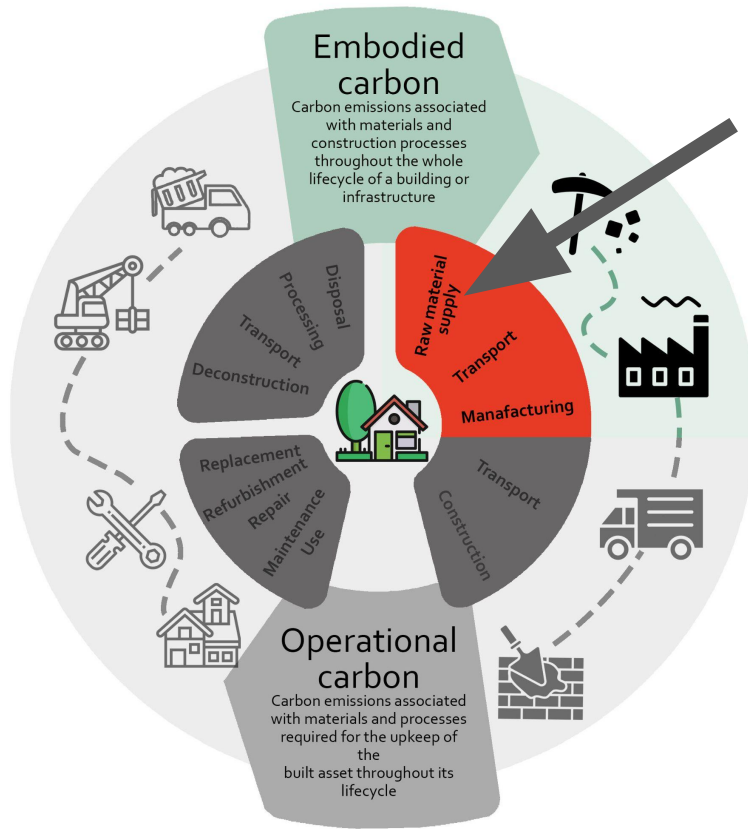
EPDs



Estimator Tools



Material Carbon Emissions *Estimate*

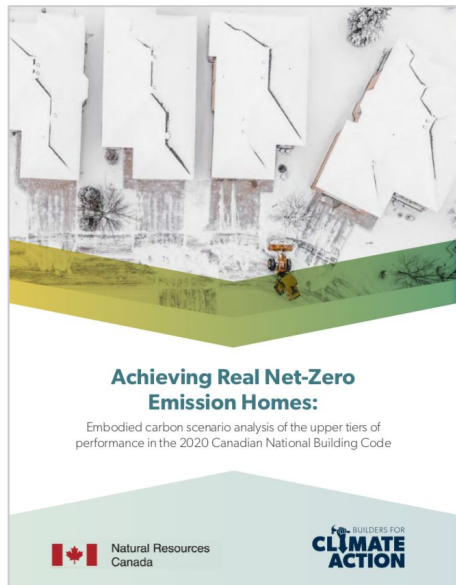


Material Carbon Emissions Estimators:

1. Data based on available EPDs, not comprehensive
2. Calculations may not reflect your practices
3. No waste factors included
4. Does not include MEP, fixtures, flashing, sealants, barriers, appliances, millwork, stairs, paints
5. Does not include transportation to site or site emissions
6. Does not include end of life emissions

70-80% of material life cycle impacts happen at the “product phase”

NRCan Study



3 energy code tiers

- Tier 3
- Tier 4
- Tier 5

3 housing typologies

- Bungalow
- Two-storey
- Row house

5 cities

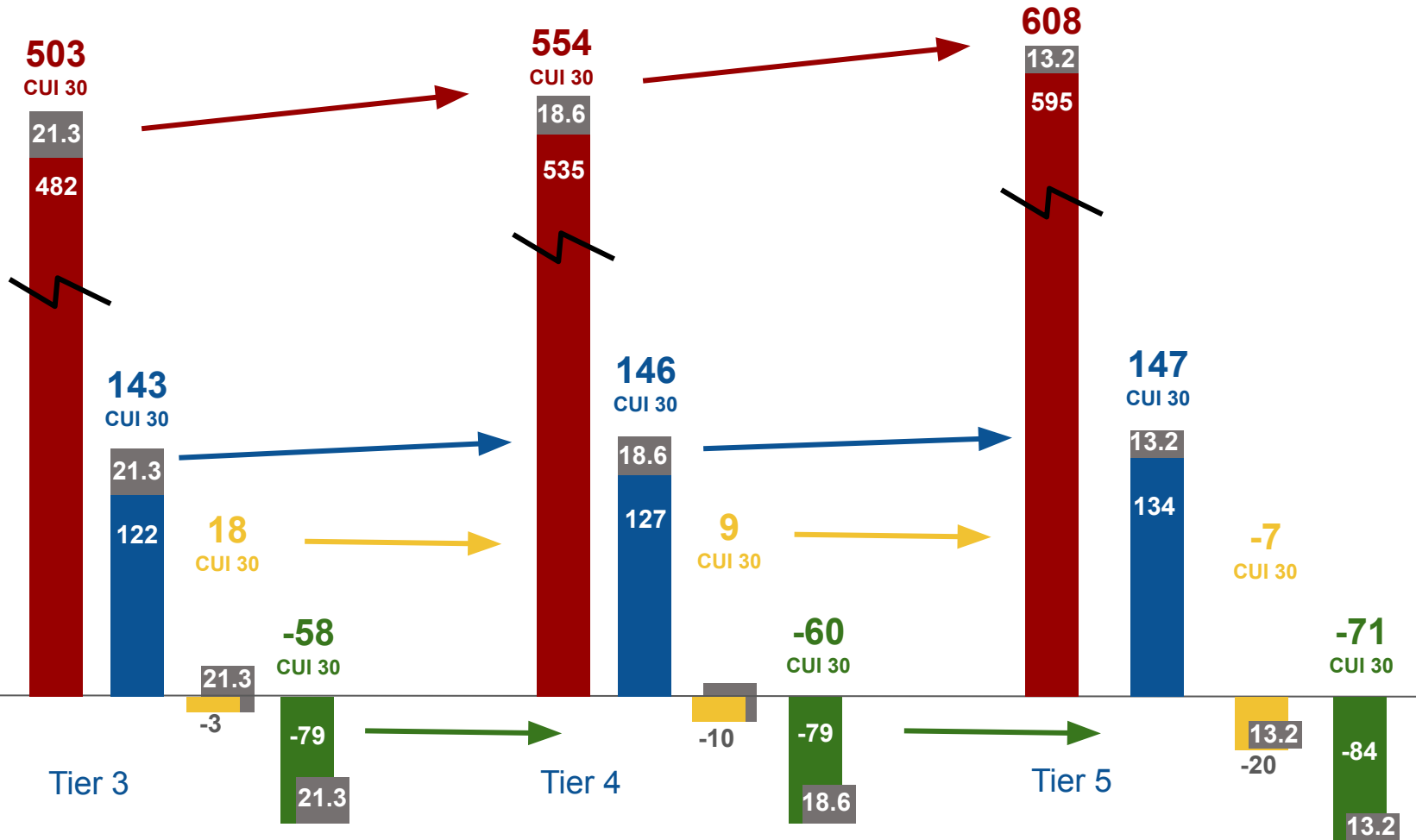
- Vancouver
- Prince Albert
- Toronto
- Quebec City
- Halifax

4 material palettes

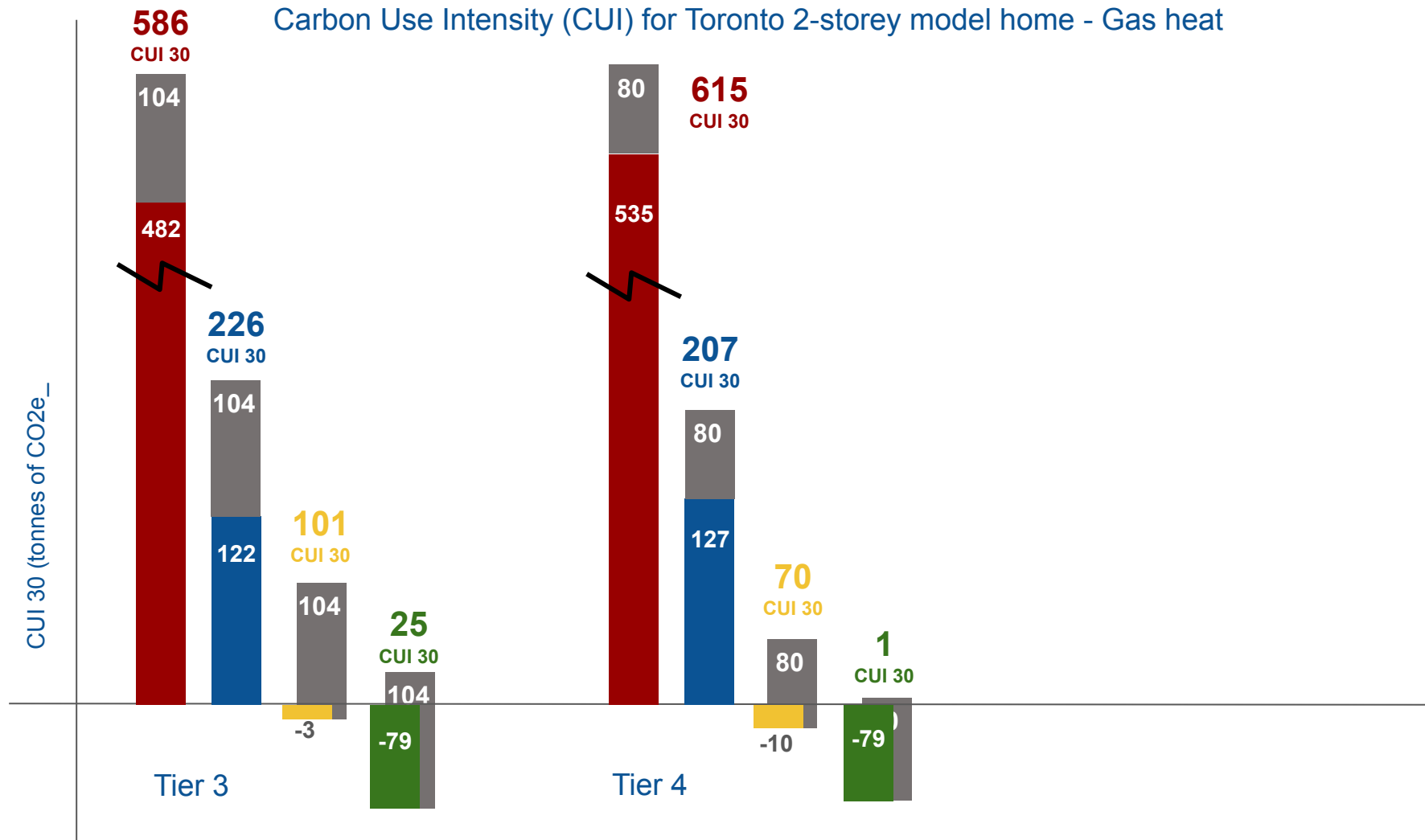
- High Carbon Materials (HCM)
- Moderate Carbon Materials (MCM)
- Best Available Materials (BAM)
- Best Possible Materials (BPM)

Carbon Use Intensity (CUI) for Toronto 2-storey model home - Electric heat

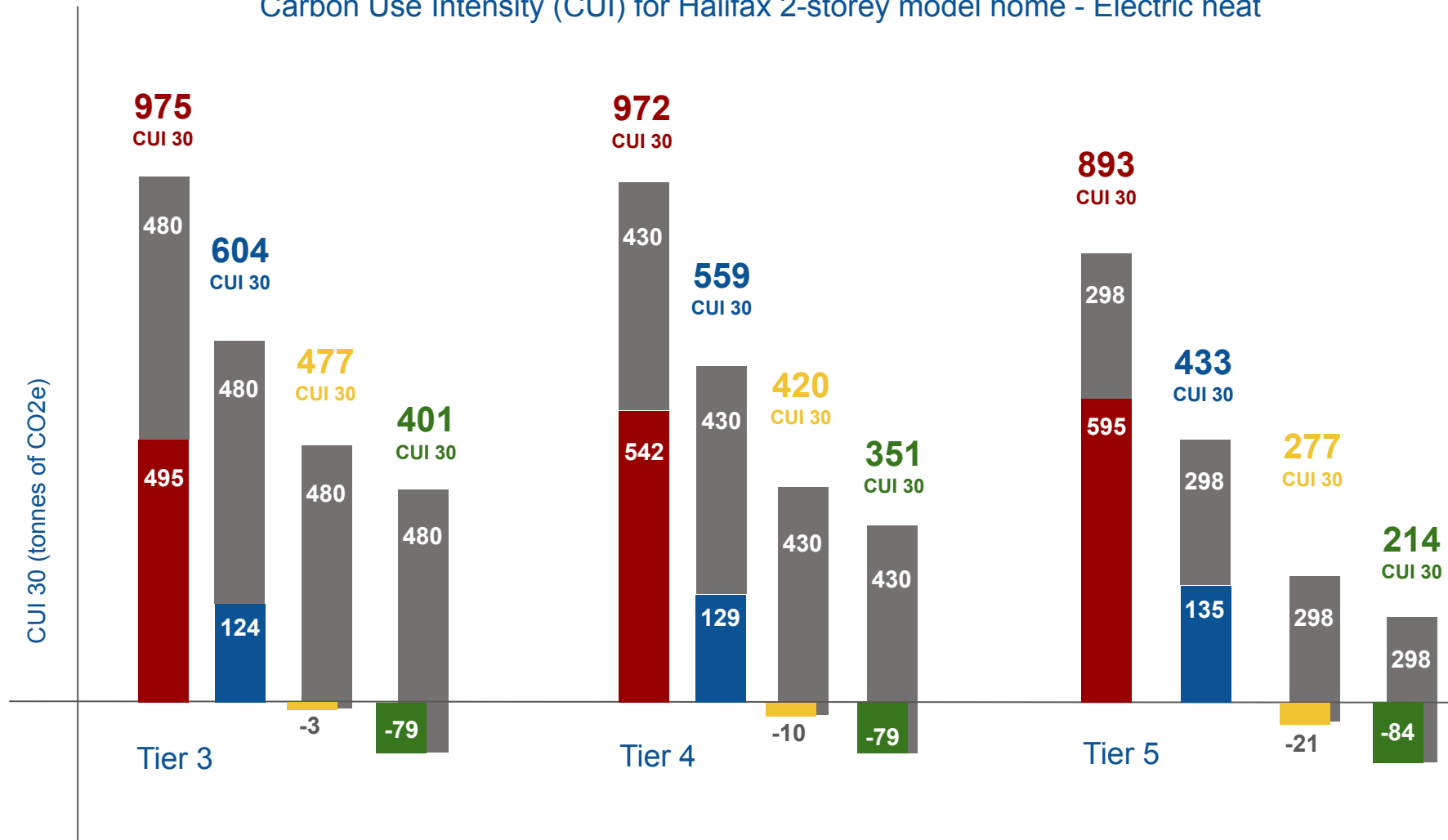
CUI 30 (tonnes of CO₂e)



Carbon Use Intensity (CUI) for Toronto 2-storey model home - Gas heat



Carbon Use Intensity (CUI) for Halifax 2-storey model home - Electric heat



Nelson/Castlegar

Building Better:

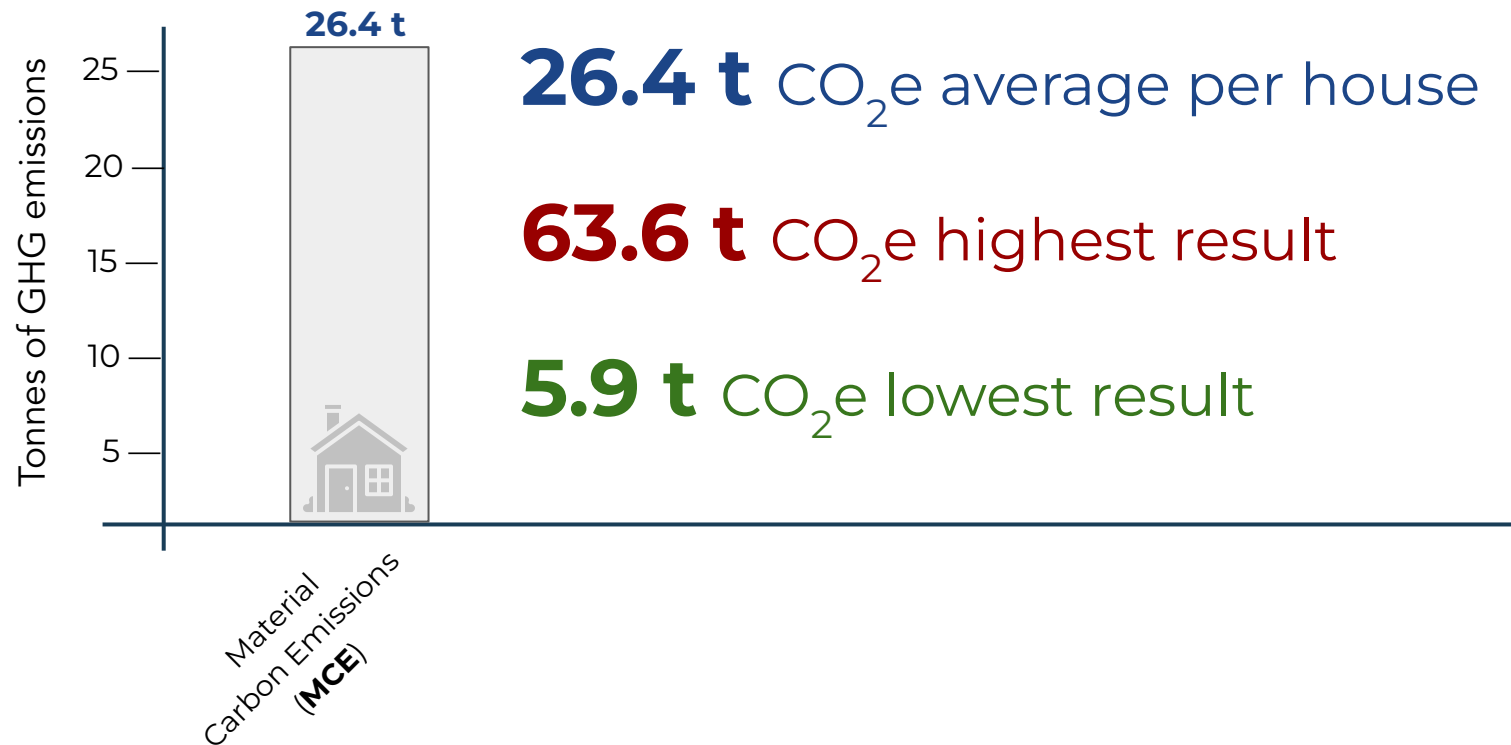
Moving Beyond *just* Energy Efficiency



- 34 homes studied, of a total 72 homes built in the year (47% sample size)
- 18 single detached
- 5 single detached with secondary suite
- 5 laneway homes
- 4 duplexes
- 2 row houses

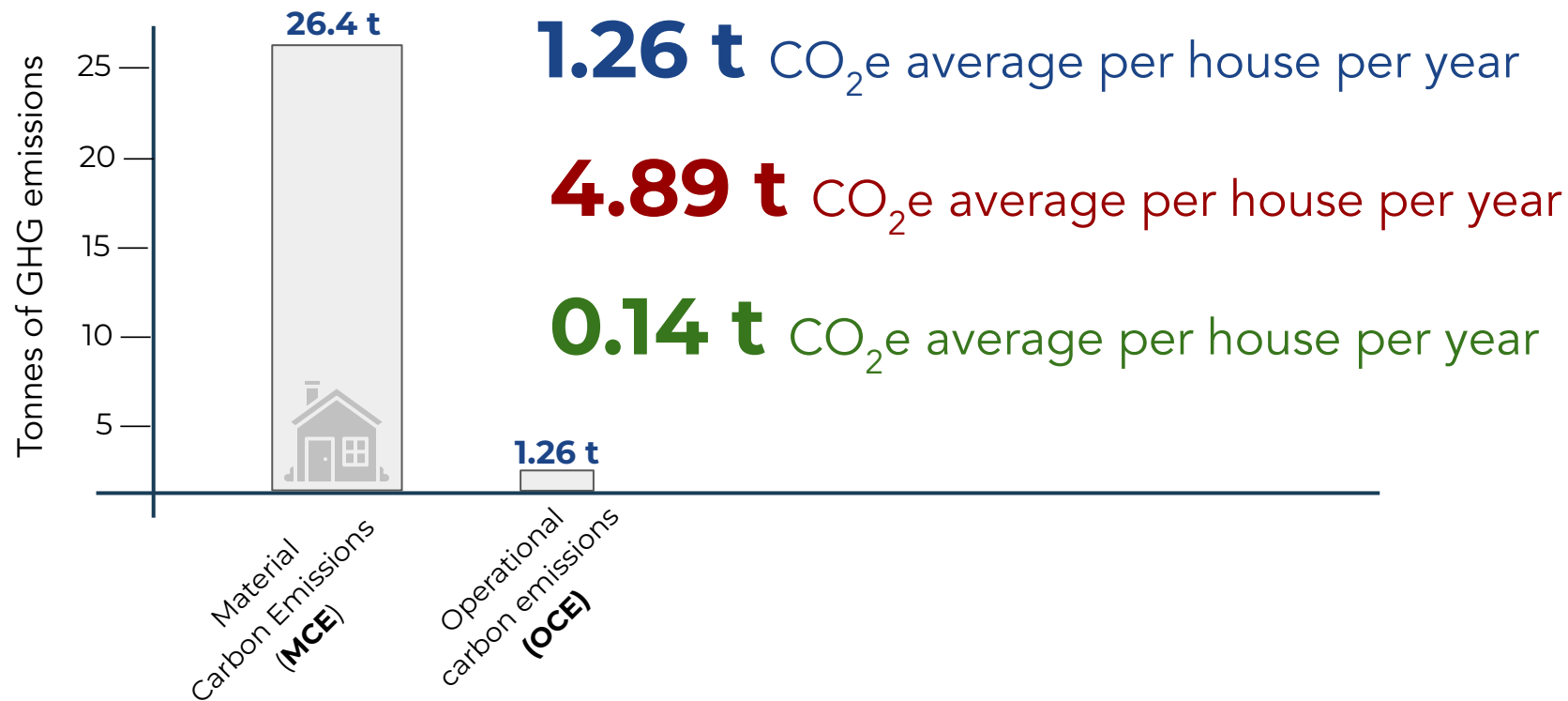
“What did we find in Nelson and Castlegar?...”

Results from **MCE** study of **35** local homes:



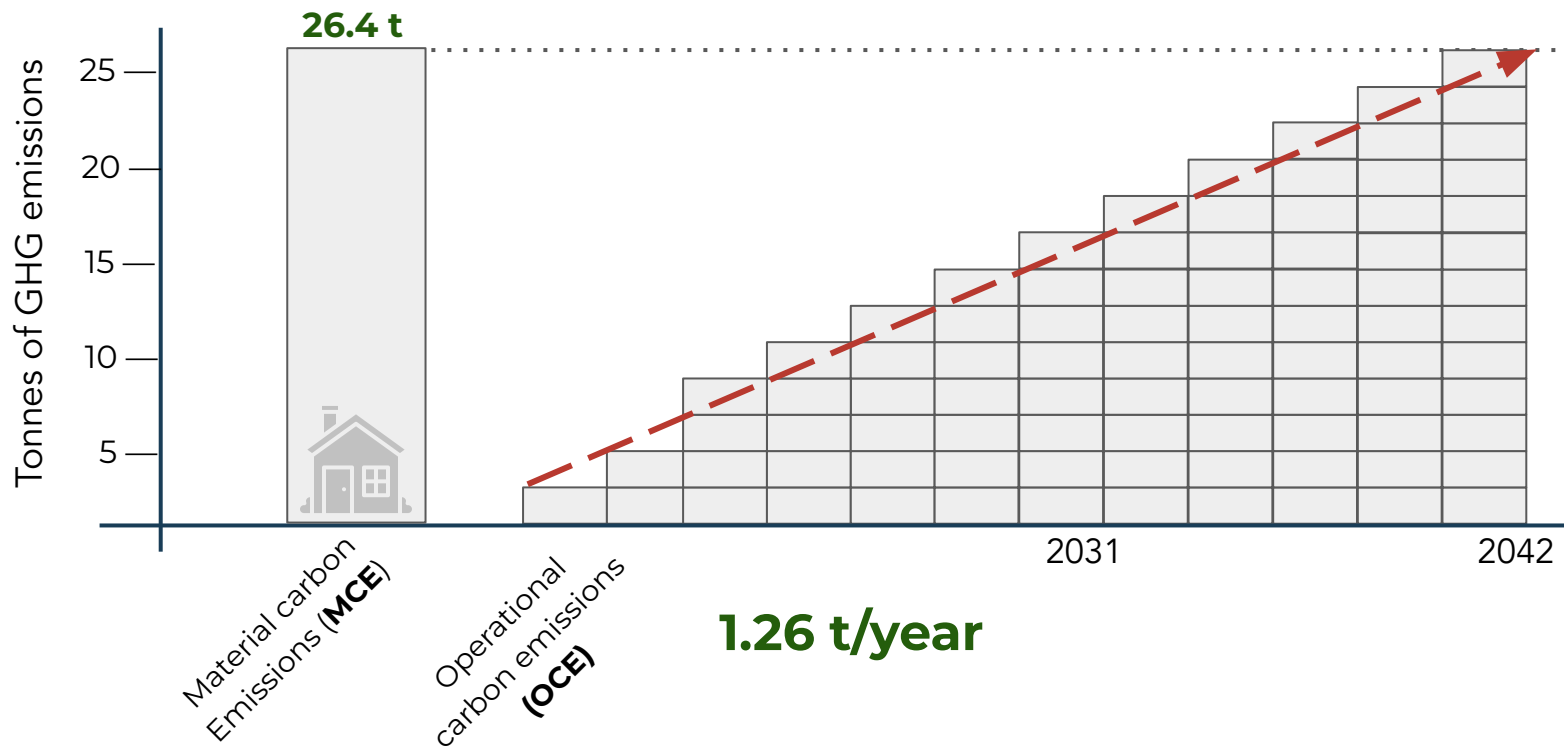
“What did we find in Nelson and Castlegar?...”

Results from **OCE** study of 35 local homes:



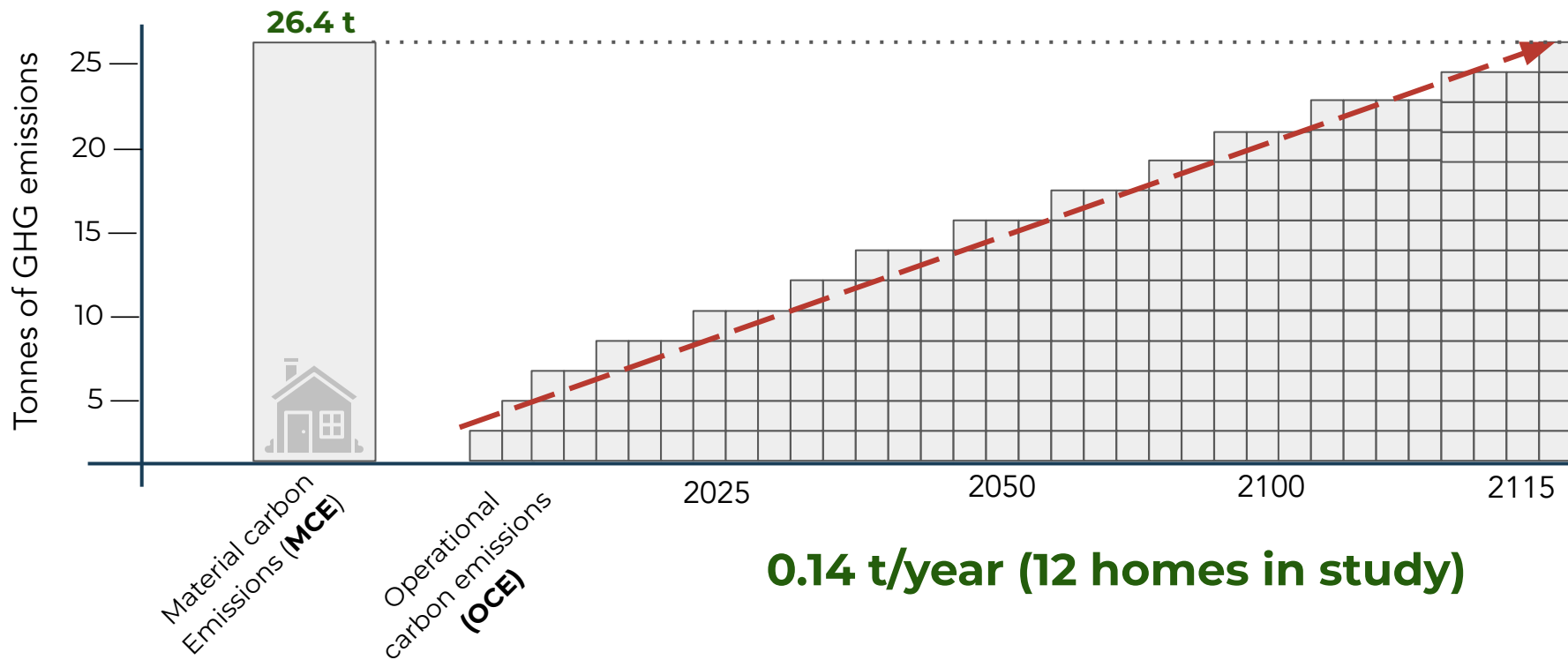
“What did we find in Nelson and Castlegar?...”

21 years of OCE to equal MCE!

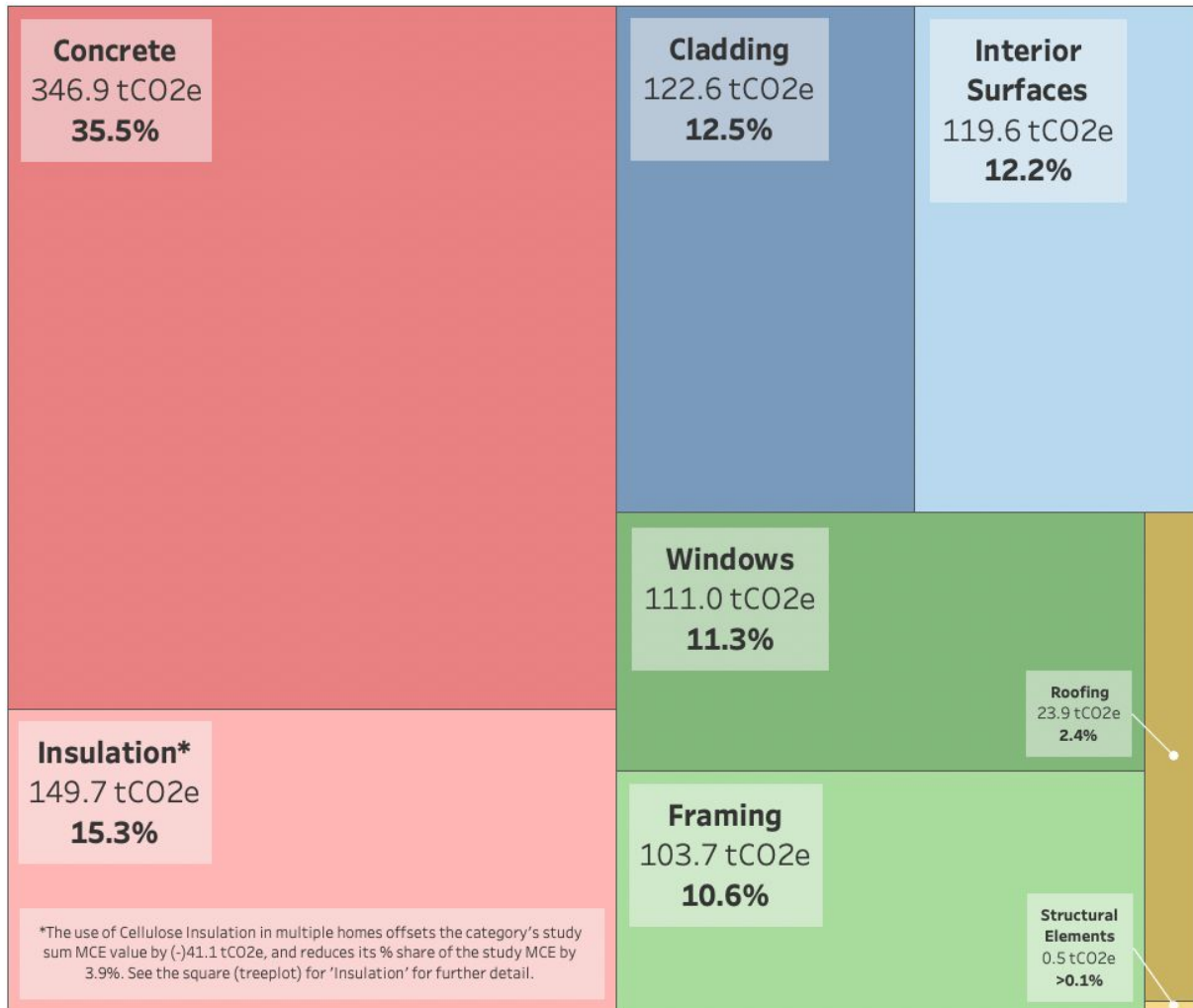


“What did we find in Nelson and Castlegar?...”

94 years before today's OCE matches MCE!



Average of all materials from all homes



“How much of a difference can we make?...”

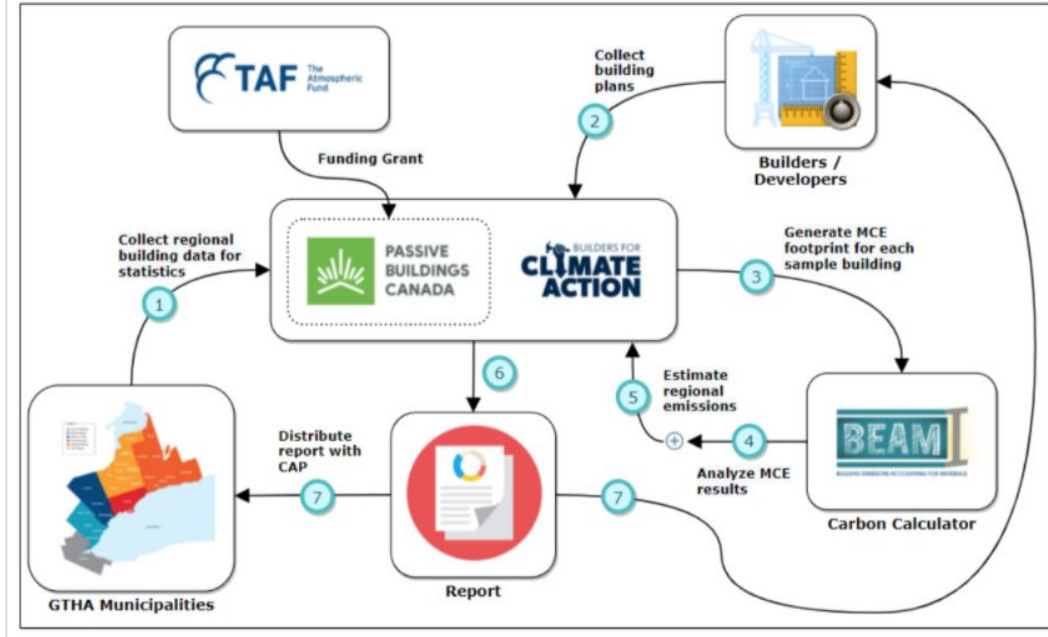
Highest MCI house

<i>Change to Best Conventional Materials:</i>	
Average concrete →	High SCM concrete
EPS ICF →	Wood chip ICF
Mineral wool cavity insulation →	Cellulose
XPS continuous insulation →	Wood fiberboard
Hardwood floors →	½ Linoleum flooring
Mineral wool roof insulation →	Cellulose
309.1 →	151.3 kg CO ₂ e/m ²

<i>Change to Best Possible Materials:</i>	
EPS sub slab insulation →	Foam glass gravel
Average concrete →	High SCM concrete
EPS ICF →	Treated wood foundation
Mineral wool cavity insulation →	Straw bale
Hardwood floors →	Linoleum & cork flooring
Mineral wool roof insulation →	Cellulose
309.1 →	55 kg CO ₂ e/m ²

EMBARC Study

EMBARC Study at a Glance



- 503 as-built homes from the GTHA
- Mix of single detached, semi-detached, and townhouses to match distribution in the region
- Largest study of its kind in the world
- Does not consider OCE

EMBARC Study: Preliminary Results

BEST



Total Net Carbon EMISSIONS

116
kgCO₂e/m²

AVERAGE



Total Net Carbon EMISSIONS

189
kgCO₂e/m²

WORST



Total Net Carbon EMISSIONS

561
kgCO₂e/m²

EMBARC Study: Material Substitutions

Highest MCI house

<i>Change to Best Available Materials:</i>	
Average concrete →	High SCM concrete
Brick cladding →	Engineered wood
Mineral wool cavity insulation →	Cellulose
XPS continuous insulation →	Wood fiberboard
Carpet & Hardwood floors →	½ Linoleum & ½ best available carpet
Mineral wool roof insulation →	Cellulose
262 kg CO ₂ e/m ² →	66 kg CO ₂ e/m ²

<i>Change to Best Possible Materials:</i>	
Average concrete →	Best Canadian concrete
Brick cladding →	Engineered wood
Mineral wool cavity insulation →	Straw bale
Framing & drywall interior walls →	Compressed straw board walls
Hardwood floors →	Linoleum & cork flooring
Mineral wool roof insulation →	Cellulose
262 kg CO ₂ e/m ² →	-47 kg CO ₂ e/m ²

Comparing MCI for heated floor area in three studies

NRCan (Tier 3 avg)

HCM: **513** kg CO₂e/m²

MCM: **150** kg CO₂e/m²

BAM: **2** kg CO₂e/m²

BPM: **-50** kg CO₂e/m²

Nelson

Highest: **309** kg CO₂e/m²

Average: **150** kg CO₂e/m²

Lowest: **72** kg CO₂e/m²

*Best: **2** kg CO₂e/m²

EMBARC

Highest: **561** kg CO₂e/m²

Average: **189** kg CO₂e/m²

Lowest: **116** kg CO₂e/m²

Trent University Forensic Crime Scene Building: Achieving Zero Carbon



Step 1: Enter Project Information

Project:	Forensics Training Facility
Client:	Trent University
Address:	
City:	Peterborough
Province:	Ontario
Postal code:	

Building Type:	Institutional - Post-secondary
Storeys:	1.1
Year Built:	2020
Heated Floor Area (above grade):	423.6 m ²
Heated Floor Area (below grade):	0.0 m ²
Evaluation date:	February 10, 2021



Step 2: Enter Project Dimensions

For darker blue shaded cells, provide inputs. Lighter blue cell inputs are optional.

COMPONENT	AREA/ VOLUME	UNIT	CALCULATION INCLUDES THESE COMPONENTS			DESCRIPTION OF REQUIRED UNITS
FOOTINGS, PADS & PIERS	10.1	m ³	Linear Dimension 100.6	X	Footing Thickness 0.152	Total cubic meters of all footings, piers and posts
				X	Footing Width 0.660	
FOUNDATION WALL AREA	140.3	m ²	Foundation wall, exterior continuous insulation, interior framing, interior insulation, interior wall finish			Total wall area (excluding windows and doors)
FOUNDATION SLAB/FLOOR AREA	355.9	m ²	Slab, sub-slab insulation, Basement flooring (adds to total habitable area)			Square meters
EXTERIOR WALL AREA	682.7	m ²	Framing, insulation, exterior continuous insulation, structural sheathing, cladding			Total wall area (include gable area, exclude window & door openings)
WINDOW AREA	26.6	m ²	Windows			Square Meters (full dimensions of glazing units)
INTERIOR WALL AREA	297.0	m ²	Wall framing and cladding			Calculate area of one side of all interior walls (exclude interior doors and other openings)
TOTAL FRAMED FLOOR AREA	387.8	m ²	Floor joists/framing, sub floor, flooring (adds to total habitable area)			Square Meters (exclude stairs and other openings)
TOTAL CEILING/ATTIC INSULATION AREA (all levels)	395.3	m ²	Ceiling finish area, Attic insulation area			Square Meters
ROOFING SURFACE AREA	415.6	m ²	Roof framing, roof decking/strapping, roofing			Square Meters, (total surface area, not projected)
STRUCTURAL ELEMENTS	0.0	m ³	All large timber posts and beams			Cubic meters of all heavy framing members

REVIEW SELECTED MATERIALS

211,156

217,493

6,337

SECTION	CATEGORY	MATERIAL	QTY	UNIT	%	NET CARBON FOOTPRINT [kg CO ₂ e]	CARBON EMISSIONS [kg CO ₂ e]	CARBON STORAGE [kg CO ₂ e]
Footings & Slabs	REBAR - FOOTINGS	Rebar / Concrete Reinforcing Steel Institute / / 15M	363.9	m	100%	559	559	0
Footings & Slabs	CRUSHED STONE BASE	Aggregate / / / Avg construction aggregate (gravel & sand)	355.9	m2	100%	62	62	0
Footings & Slabs	SLAB FLOOR(S)	Concrete - Standard mix, Canadian average / Canadian Ready-Mixed	355.9	m2	100%	17,378	17,378	0
Footings & Slabs	SLAB - REBAR	Welded wire mesh / Serfas / / 6" x 6" x 6/6g	355.9	m2	100%	584	584	0
Footings & Slabs	SUB-SLAB INSULATION	EPS foam board - AVERAGE	355.9	m2	100%	7,700	7,700	0
Foundation Walls	CONCRETE WALLS	Concrete - Standard mix, Canadian average / Canadian Ready-Mixed	140.3	m2	100%	11,417	11,417	0
Foundation Walls	CONTINUOUS INSULATION	EPS foam board - Foundation Insulation - AVERAGE	140.3	m2	100%	1,210	1,210	0
Foundation Walls	USER-DEFINED OPTIONS	Cement board 1/2" / 2' x exterior perimeter	140.3	m2	35%	481	481	0
Ext. Walls	STEEL FRAME CONSTRUCTION	Steel studs - Load bearing / MarinoWARE / Structural stud and track /	682.7	m2	100%	16,213	16,213	0
Ext. Walls	CAVITY INSULATION	Spray polyurethane foam - Closed Cell (HFC) / SPFA / / R 6.6/inch	682.7	m2	100%	58,545	58,545	0
Ext. Walls	CONTINUOUS INSULATION (EXT. or INT.)	XPS foam board (Typical) - Exterior Walls - AVERAGE	682.7	m2	100%	33,705	33,705	0
Ext. Walls	MASONRY WALLS - 8" - HOLLOW, NO CONCRETE	Concrete Masonry Units - Exterior Walls - AVERAGE	682.7	m2	100%	15,437	15,437	0
Cladding	EXTERIOR CLADDING	Metal Panels - Steel / Canadian Sheet Steel Building Institute / 24 gau	682.7	m2	100%	10,215	10,215	0
Cladding	INTERIOR CLADDING for EXTERIOR WALLS	Drywall 1/2" Typical - Interior Cladding for Exterior Walls - AVERAGE	682.7	m2	100%	1,112	1,112	0
Windows	TRIPLE PANE WINDOWS - GENERIC	Window - triple pane / Fiberglass frame / / USA & CAN	26.6	m2	100%	3,378	3,378	0
Int. Walls	STEEL FRAME CONSTRUCTION	Steel studs - Non-loadbearing / MarinoWARE / Viper Stud Viper 20 / 36	297.0	m2	51%	719	719	0
Int. Walls	INTERIOR WALL CLADDING	Drywall 1/2" Typical - Interior Walls - AVERAGE	297.0	m2	100%	484	484	0
Int. Walls	USER-DEFINED OPTIONS	Mineral wool batt - 2x4 Interior Walls - AVERAGE	297.0	m2	51%	919	919	0
Int. Walls	USER-DEFINED OPTIONS	Mineral wool batt - 2x6 Interior Walls - AVERAGE	297.0	m2	49%	1,390	1,390	0
Int. Walls	USER-DEFINED OPTIONS	Steel studs - Load bearing / MarinoWARE / Structural stud and track /	297.0	m2	49%	3,456	3,456	0
Floors	WOOD FLOOR FRAMING	Wood joist / American Wood Council & Canadian Wood Council / / T.	387.8	m2	8%	-50	77	127
Floors	SUB FLOORING	Plywood / American Wood Council & Canadian Wood Council / / 5/8"	387.8	m2	8%	13	111	98
Floors	FINISHED FLOORING	Ceramic tile flooring - AVERAGE	387.8	m2	13%	895	895	0
Ceilings	CLADDING	Drywall 1/2" - Ceilings - AVERAGE	395.3	m2	100%	963	963	0
Roof	WOOD FRAME CONSTRUCTION	Wood roof truss - prefabricated / Quebec Wood Export Bureau / Comm	415.6	m2	93%	-2,573	1,598	4,171
Roof	ROOF DECKING	Plywood / American Wood Council & Canadian Wood Council / / 3/4"	415.6	m2	100%	202	1,736	1,535
Roof	ROOFING MEMBRANE	SBS Modified Bitumen Roofing / ARMA / Includes: CertainTeed, Firest	415.6	m2	100%	2,785	2,785	0
Roof	ROOFING	Metal Panels - Steel / Canadian Sheet Steel Building Institute / 24 gau	415.6	m2	124%	7,698	7,698	0
Roof	ROOF INSULATION	Mineral wool batt - Roof Insulation - AVERAGE	415.6	m2	7%	1,510	1,510	0
Roof	ROOF INSULATION	Mineral wool loose fill / NAIMA / R 3/inch	415.6	m2	93%	11,787	11,787	0
Roof	USER-DEFINED OPTIONS	Wood framing & siding - SPF / American Wood Council & Canadian W	415.6	m2	7%	-271	135	406

EXTERIOR WALLS - STRUCTURE & INSULATION

INSTRUCTIONS:

CATEGORY	MATERIAL	QUANTITY	%	SELECT	NET kgCO ₂ e EMISSIONS	SELECTED MATERIAL kgCO ₂ e CONTENT	kgCO ₂ e EMISSIONS	kgCO ₂ STORAGE
CAVITY INSULATION		R-VALUE: 20						
FIBERGLASS BATT								
	Fiberglass batt - Exterior Walls - AVERAGE	682.7 m2	100%		1,614		1,614	0
	Fiberglass batt / Owens Corning / EcoTouch Pink batt and roll / R 3.6/inch	682.7 m2	100%		1,116		1,116	0
	Fiberglass batt / CertainTeed / Sustainable Insulation / R 3.6/inch	682.7 m2	100%		2,260		2,260	0
	Fiberglass batt / Knauf / EcoBatt / R 3.6/inch	682.7 m2	100%		1,467		1,467	0
FIBERGLASS BLOWN-IN								
	Fiberglass loose fill - Exterior Walls - AVERAGE	682.7 m2	100%		2,407		2,407	0
	Fiberglass loose fill / Owens Corning / AttiCat, ProCat, ProPink / R 2.8/inch	682.7 m2	100%		2,364		2,364	0
	Fiberglass loose fill / CertainTeed / InsulSafe, Optima, TruComfort / R 2.6/inch	682.7 m2	100%		3,102		3,102	0
	Fiberglass loose fill / Knauf / Jet Stream ULTRA / R 2.2/inch	682.7 m2	100%		1,755		1,755	0
MINERAL WOOL BATT								
	Mineral wool batt - Exterior Walls - AVERAGE	682.7 m2	29%	1	1,854	1,854	1,854	0
	Mineral wool batt / Owens Corning / Thermafiber UltraBatt / R 4.3/inch	682.7 m2	100%		9,619		9,619	0
	Mineral wool batt / Rockwool / Safe'n'Sound, ComfortBatt / R 3.8/inch	682.7 m2	100%		3,150		3,150	0
CELLULOSE INSULATION								
	Cellulose - Exterior Walls - AVERAGE	682.7 m2	100%		-5,512		1,432	6,943
	Cellulose - dense pack / / R 3.7/inch / Includes AFT, Applegate, Can-Cell, Cell-Pak, Cleanfiber, Climatizer, Fiberlite, Igloo, ICC, Mason City, Nu-Wool, Soprema, Thermo-Kool	682.7 m2	100%		-5,938		2,342	8,281
	Cellulose - batt / CMS / R 3.6/inch / EcoCell	682.7 m2	100%		-4,895		1,171	6,066
	Cellulose - spray applied / R 3.75/inch / International Cellulose Corp. / K-13, ThermoCon	682.7 m2	100%		-5,701		782	6,483
WOOD FIBER BATT								
	Wood fiber batt - Exterior Walls - AVERAGE	682.7 m2	100%		-5,343		1,142	6,485
	Wood fiber batt / Pavatex / Pavaflex / R 3.8/inch	682.7 m2	100%		-7,554		149	7,703
	Wood fiber batt / GUTEX / ThermoFlex / R 4/inch	682.7 m2	100%		-4,939		1,695	6,634
	Wood fiber batt / Steico / SteicoFlex / R 3.8/inch	682.7 m2	100%		-5,456		1,546	7,003
	Wood fiber - dense pack / GUTEX / ThermoFiber / R 3.8/inch	682.7 m2	100%		-3,424		1,175	4,600
OTHER NATURAL FIBER INSULATION								
	Wool batt / Havelock Wool / / R 3.6/inch	682.7 m2	100%		3,112		7,190	4,078
	Wool loose fill / Havelock Wool / / R 4.4/inch	682.7 m2	100%		4,588		7,190	2,602
	Hemp fiber batt / Generic / / R 3.3/inch	682.7 m2	146%	1	-3,306	-3,306	3,507	6,813
	Straw Bale / / Wheat & rye straw / R 3.3/inch	682.7 m2	100%		-17,394		824	18,218
SPRAY FOAM, CLOSED CELL								
	Spray polyurethane foam - Closed Cell (HFC) / SPFA / / R 6.6/inch	682.7 m2	100%		31,646		31,646	0
	Spray polyurethane foam - Closed Cell (HFO) / SPFA / / R 6.6/inch	682.7 m2	100%		10,004		10,004	0

Use emission values in BEAM to select new materials based on carbon emissions

REVIEW SELECTED MATERIALS

5,713

120,914

115,201

SECTION	CATEGORY	MATERIAL	QTY	UNIT	%	NET CARBON FOOTPRINT [kg CO ₂ e]	CARBON EMISSIONS [kg CO ₂ e]	CARBON STORAGE [kg CO ₂ e]
Footings & Slabs	SUB-SLAB INSULATION	Foam glass aggregate / Misapor / Glavel / R 1.7/inch, 10-80 mm	355.9	m2	100%	2,250	2,250	0
Foundation Walls	CONTINUOUS INSULATION	Wood fiber board / GUTEX / Multi-Therm / R 3.6/inch, 40, 60, 80, 100, 120, 140, 160,	140.3	m2	100%	345	3,264	3,609
Foundation Walls	INSULATED CONCRETE FORMS (ICF)	WOOD CHIP CEMENT ICF 14" R-28 with MINERAL WOOL INSERTS (5 in. @ R4.2	140.3	m2	107%	6,506	17,974	11,468
Foundation Walls	INSULATED CONCRETE FORMS (ICF)	Concrete - 35-50% slag mix, Canadian average / Canadian Ready-Mixed Concrete.	140.3	m2	107%	3,225	3,225	0
Foundation Walls	USER-DEFINED OPTIONS	Cement board 1/2" / 2" x exterior perimeter	140.3	m2	35%	481	481	0
Ext. Walls	WOOD FRAME CONSTRUCTION	Wood framing & siding - SPF / American Wood Council & Canadian Wood Coun	682.7	m2	146%	4,396	2,191	6,587
Ext. Walls	CAVITY INSULATION	Mineral wool batt - Exterior Walls - AVERAGE	682.7	m2	29%	1,854	1,854	0
Ext. Walls	CAVITY INSULATION	Hemp fiber batt / NaturFibre / Hemp Wool / R 3.7/inch	682.7	m2	146%	23,078	24,479	47,557
Ext. Walls	USER-DEFINED OPTIONS	Hempcrete Block / Just BioFibre / SSR Block / R2.0/inch	682.7	m2	41%	1,119	15,235	16,354
Cladding	EXTERIOR CLADDING	Wood Siding - 3/4" - AVERAGE	682.7	m2	35%	482	291	773
Cladding	EXTERIOR CLADDING	Steel Panel Siding - Exterior Wall Cladding - AVERAGE	682.7	m2	65%	6,310	6,310	0
Cladding	STRAPPING for RAIN SCREEN	Wood framing & siding - SPF / American Wood Council & Canadian Wood Coun	682.7	m2	100%	240	120	360
Cladding	INTERIOR CLADDING for EXTERIOR WALL	Drywall 1/2" / CertainTeed / AirRenew / 1/2" (12.7 mm)	682.7	m2	100%	1,014	1,014	0
Cladding	USER-DEFINED OPTIONS	Vertical Strapping - 1x4 @ 17" o/c - Wood framing & siding - SPF	682.7	m2	100%	339	169	508
Windows	TRIPLE PANE WINDOWS - GENERIC	Window - triple pane / Fiberglass frame / / USA & CAN	26.6	m2	100%	3,378	3,378	0
Int. Walls	WOOD FRAME CONSTRUCTION	Wood framing & siding - SPF / American Wood Council & Canadian Wood Coun	297.0	m2	51%	426	212	639
Int. Walls	WOOD FRAME CONSTRUCTION	Wood framing & siding - SPF / American Wood Council & Canadian Wood Coun	297.0	m2	49%	644	321	964
Int. Walls	INTERIOR WALL CLADDING	Drywall 1/2" / CertainTeed / AirRenew / 1/2" (12.7 mm)	297.0	m2	100%	441	441	0
Int. Walls	USER-DEFINED OPTIONS	Hemp fiber batt / NaturFibre / Hemp Wool / R 3.7/inch	297.0	m2	28%	1,241	1,317	2,558
Int. Walls	USER-DEFINED OPTIONS	Hemp fiber batt / NaturFibre / Hemp Wool / R 3.7/inch	297.0	m2	49%	3,445	3,654	7,099
Int. Walls	USER-DEFINED OPTIONS	Mineral wool batt - Exterior Walls - AVERAGE	297.0	m2	23%	414	414	0
Floors	WOOD FLOOR FRAMING	Wood Joist / American Wood Council & Canadian Wood Council / / TJI 230/360	387.8	m2	8%	50	77	127
Floors	SUB FLOORING	Plywood / American Wood Council & Canadian Wood Council / / 5/8"	387.8	m2	8%	13	111	98
Floors	FINISHED FLOORING	Linoleum flooring - AVERAGE	387.8	m2	13%	23	181	159
Ceilings	CLADDING	Drywall 1/2" / CertainTeed / AirRenew / 1/2" (12.7 mm)	395.3	m2	100%	587	587	0
Ceilings	USER-DEFINED OPTIONS	Strapping - 1x4 @ 16" o/c - Wood framing & siding - SPF	682.7	m2	100%	361	180	540
Roof	WOOD FRAME CONSTRUCTION	Wood roof truss - prefabricated / Quebec Wood Export Bureau / Common (Dout	415.6	m2	93%	2,573	1,598	4,171
Roof	ROOF DECKING	Plywood / American Wood Council & Canadian Wood Council / / 3/4"	415.6	m2	100%	202	1,736	1,535
Roof	ROOFING MEMBRANE	SBS Modified Bitumen Roofing / ARMA / Includes: CertainTeed, Firestone, GAF,	415.6	m2	100%	2,785	2,785	0
Roof	ROOFING	Metal Panels - Steel / Canadian Sheet Steel Building Institute / 24 gauge	415.6	m2	124%	7,698	7,698	0
Roof	ROOF INSULATION	Cellulose - loose fill / / R 3.7/inch / Includes: AFT, Applegate, Can-Cell, Cell-Pak, C	415.6	m2	93%	2,841	3,670	6,511
Roof	FLAT ROOF - FRAMING	Wood framing & siding - SPF / American Wood Council & Canadian Wood Coun	415.6	m2	7%	271	135	406
Roof	FLAT ROOF - INSULATION	Mineral wool batt - Roof Insulation - AVERAGE	415.6	m2	7%	673	673	0
Roof	FLAT ROOF - INSULATION	Hemp fiber batt / NaturFibre / Hemp Wool / R 3.7/inch	415.6	m2	7%	1,542	1,636	3,178



Trent University Forensic Building Material Carbon Emissions (MCE)

Part of building	Base Case kg CO2e	As-Built kg CO2e	As-Built, including timber storage kg CO2e
Footings & Slabs	29,516	13,503	13,503
Foundation walls	13,108	9,866	1,128
Exterior walls	123,900	-6,967	-18,043
Exterior cladding	11,327	6,263	2,861
Windows & doors	3,378	3,378	3,378
Interior walls	6,968	-4,900	-3,580
Floors	858	-15	-679
Ceilings	963	227	227
Roof system	21,138	4,130	-5,624
NET TOTAL	211,156	25,484	-6,829
MCE Reduction		88%	103%
Net Carbon Intensity, kg CO2e/m2	498	60	-16.1



BUILDING EMISSIONS ACCOUNTING FOR MATERIALS

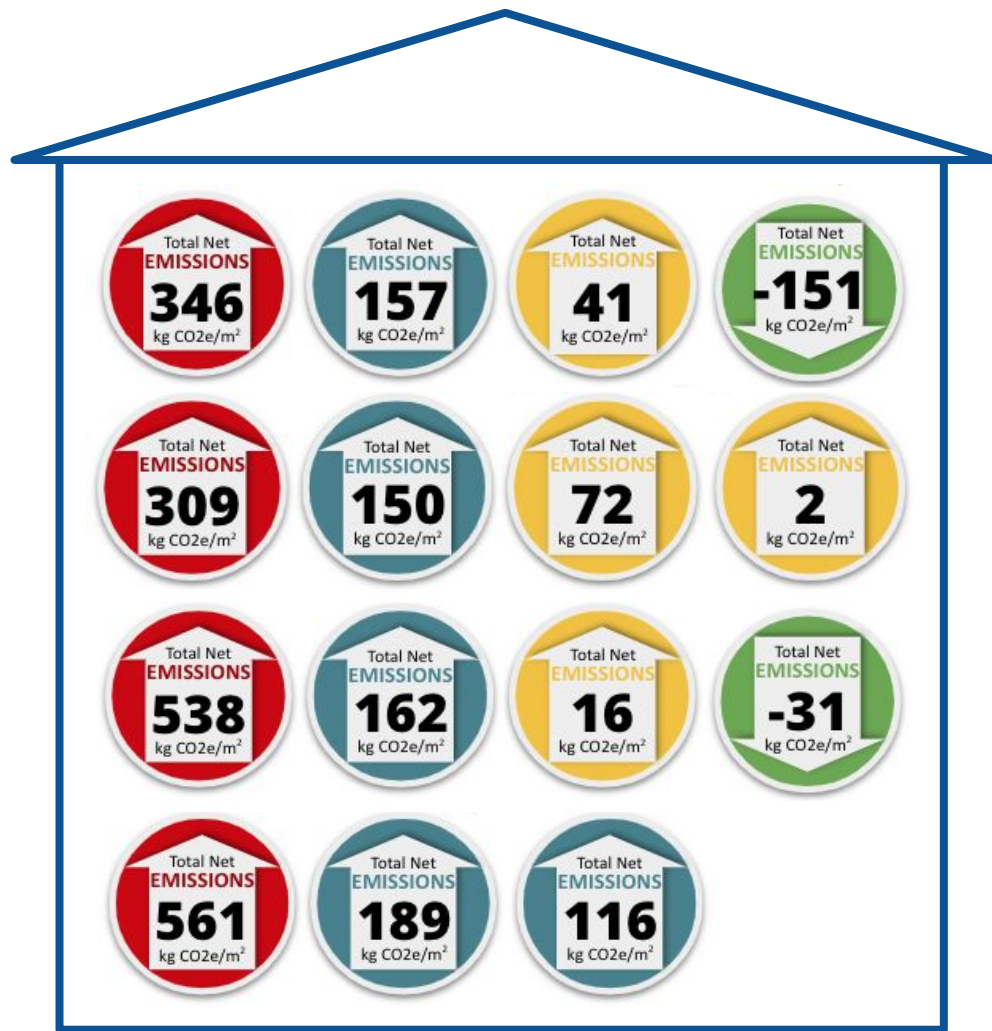
Results from BEAM material carbon estimator

ILFI Zero Carbon certification (First building to achieve carbon storage in materials)



Questions?

www.buildersforclimateaction.org



NRCan's Material Carbon Emissions Estimator (MCE²) Tool

- No cost tool to help builders understand the first carbon impacts of their homes
- Informs product selections

Created in Partnership with Chris Magwood and Builders for Climate Action



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Net-Zero Emissions by 2050



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What does this calculator do?

Material Embodied Carbon

EXTRACTION + TRANSPORTATION + MANUFACTURING
Stages A1-A3 of Life Cycle Assessment



"Cradle to Gate" Emissions
Typically represents **70-80%** of life cycle emissions.

+



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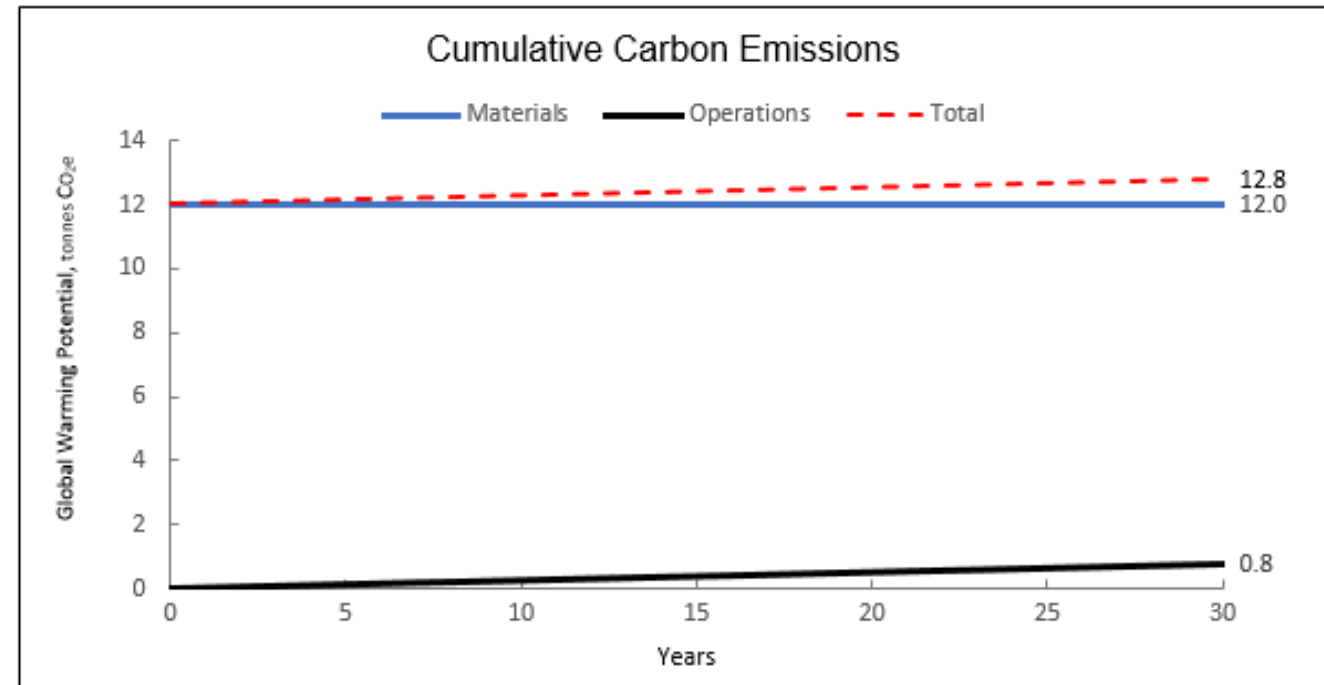
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What do results look like?

- Depending on location and fuel source, embodied emissions can dwarf operational emissions.
- Material selection matters!

PROJECT EMISSIONS TIMELINE



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What do results look like?

TOP 10 MOST IMPACTFUL MATERIALS

Rank	kg CO ₂ e	Section	Material
1	4,702	Windows	Window - triple pane / Wood frame
2	1,814	Footings & Slabs	Concrete - 31-35 MPa, 35-50% Sk
3	1,519	Cladding	Steel Panel Siding - AVERAGE
4	1,496	Roof	Metal Panels - Steel / Canadian Sh
5	1,255	Footings & Slabs	EPS foam board - AVERAGE
6	1,173	Footings & Slabs	Concrete - 31-35 MPa, 35-50% Sk
7	486	Roof	EPS foam board with graphite / BA
8	426	Roof	PVC Roofing Membrane / CIFA / In
9	418	Floors	Hardwood flooring - AVERAGE
10	385	Roof	OSB sheathing / American Wood (



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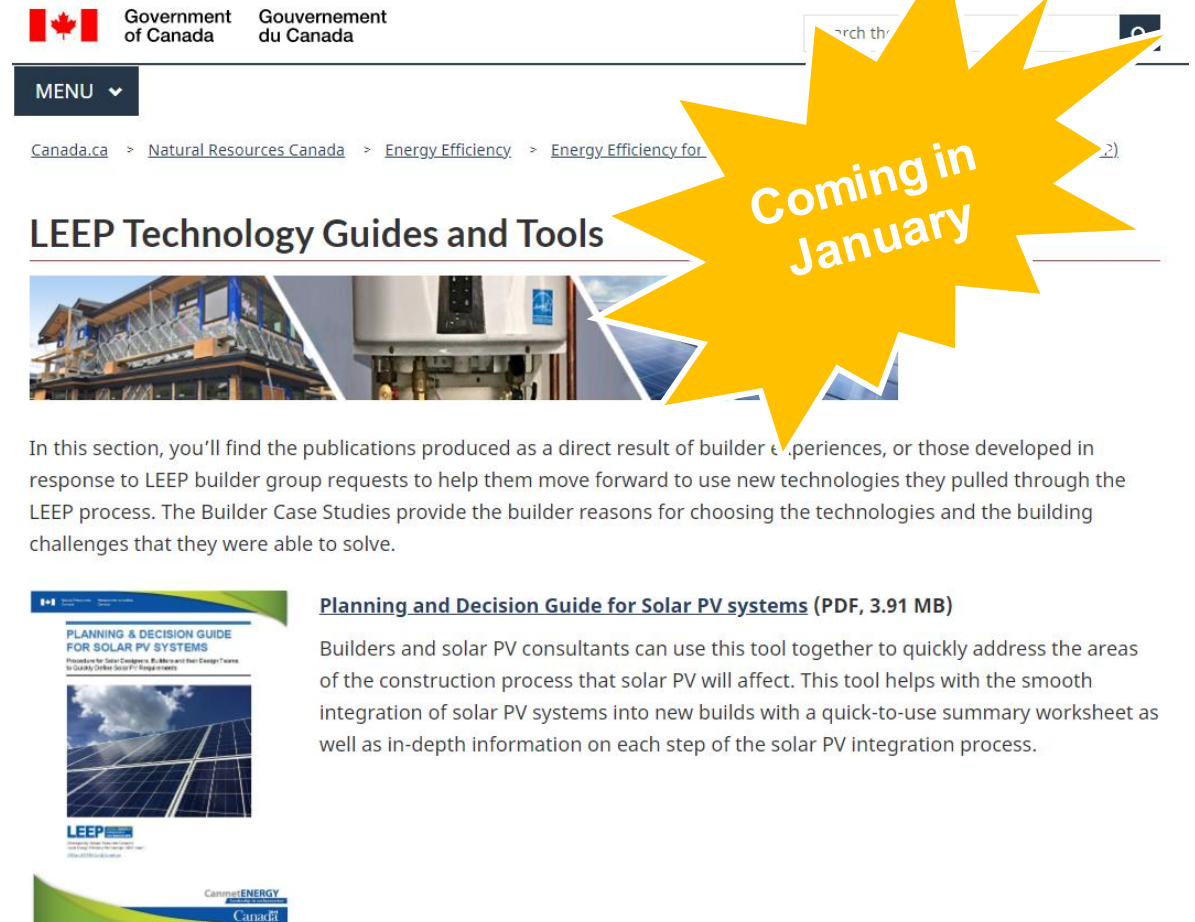
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NRCan's Material Carbon Emissions Estimator (MCE²)

NRCan will be posting the MCE² on the LEEP website January.

<https://www.nrcan.gc.ca/energy-efficiency/homes/local-energy-efficiency-partnerships-leep/leep-technology-guides/17346>

Created in Partnership with Chris Magwood and Builders for Climate Action



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LEEP Technology Guides and Tools

In this section, you'll find the publications produced as a direct result of builder experiences, or those developed in response to LEEP builder group requests to help them move forward to use new technologies they pulled through the LEEP process. The Builder Case Studies provide the builder reasons for choosing the technologies and the building challenges that they were able to solve.

Planning and Decision Guide for Solar PV systems (PDF, 3.91 MB)

Builders and solar PV consultants can use this tool together to quickly address the areas of the construction process that solar PV will affect. This tool helps with the smooth integration of solar PV systems into new builds with a quick-to-use summary worksheet as well as in-depth information on each step of the solar PV integration process.



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