BUILDINGENERGY BOSTON

RESNET Standard 1550:
Embodied Carbon Comes of Age

Chris Magwood, RMI

Curated by Aidan Mayer

Northeast Sustainable Energy Association (NESEA) | March 20, 2025

BUILDINGENERGY BOSTON

Learning Objectives:

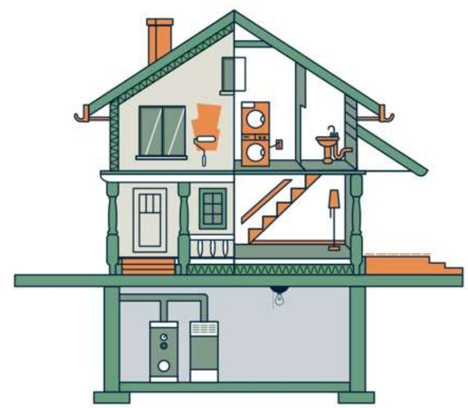
- Explore the contents of the new RESNET Standard 1550
- Describe the life cycle phases and product categories that are included/excluded from standard, the rationale for these decisions and the limitations and advantages inherent these decisions
- Formulate a strategy for the potential inclusion of 1550 in your own decarbonization efforts and workflow
- Discuss any issues and concerns with 1550 and ways to get involved in the ongoing development of the standard and training/certification efforts that support it

RMI
ENERGY. TRANSFORMED.

RESNET® Standard 1550: Embodied carbon comes of age

NESEA Building Energy Boston
March 20, 2025

Draft PDS-01
Standard RESNET C1550



Standard for
Calculating and Reporting
the Embodied Carbon of Buildings
with Dwelling and Sleeping Units

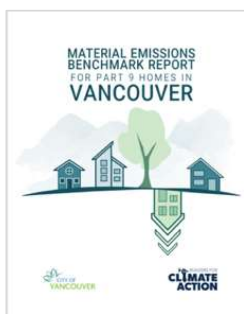

NESEA Building Energy Boston 2019 Keynote with introductions
Reelife Productions
BUILDINGENERGY
BOSTON
NESEA

Thank you NESEA for:

BUILDERS FOR CLIMATE ACTION

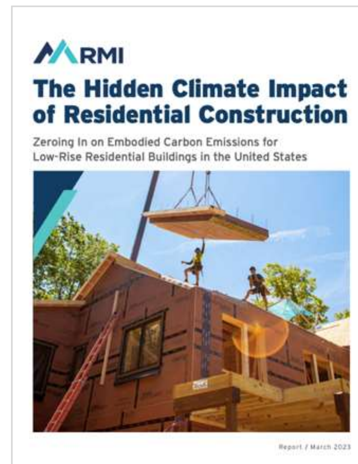
BEAM

BUILDING EMISSIONS ACCOUNTING FOR MATERIALS



HomebuildersCAN

CARBON ACTION NETWORK



RESNET

RESIDENTIAL ENERGY SERVICES NETWORK

Leading the Path to Net Zero Energy Homes

Standard 1550 Embodied Carbon Task Group

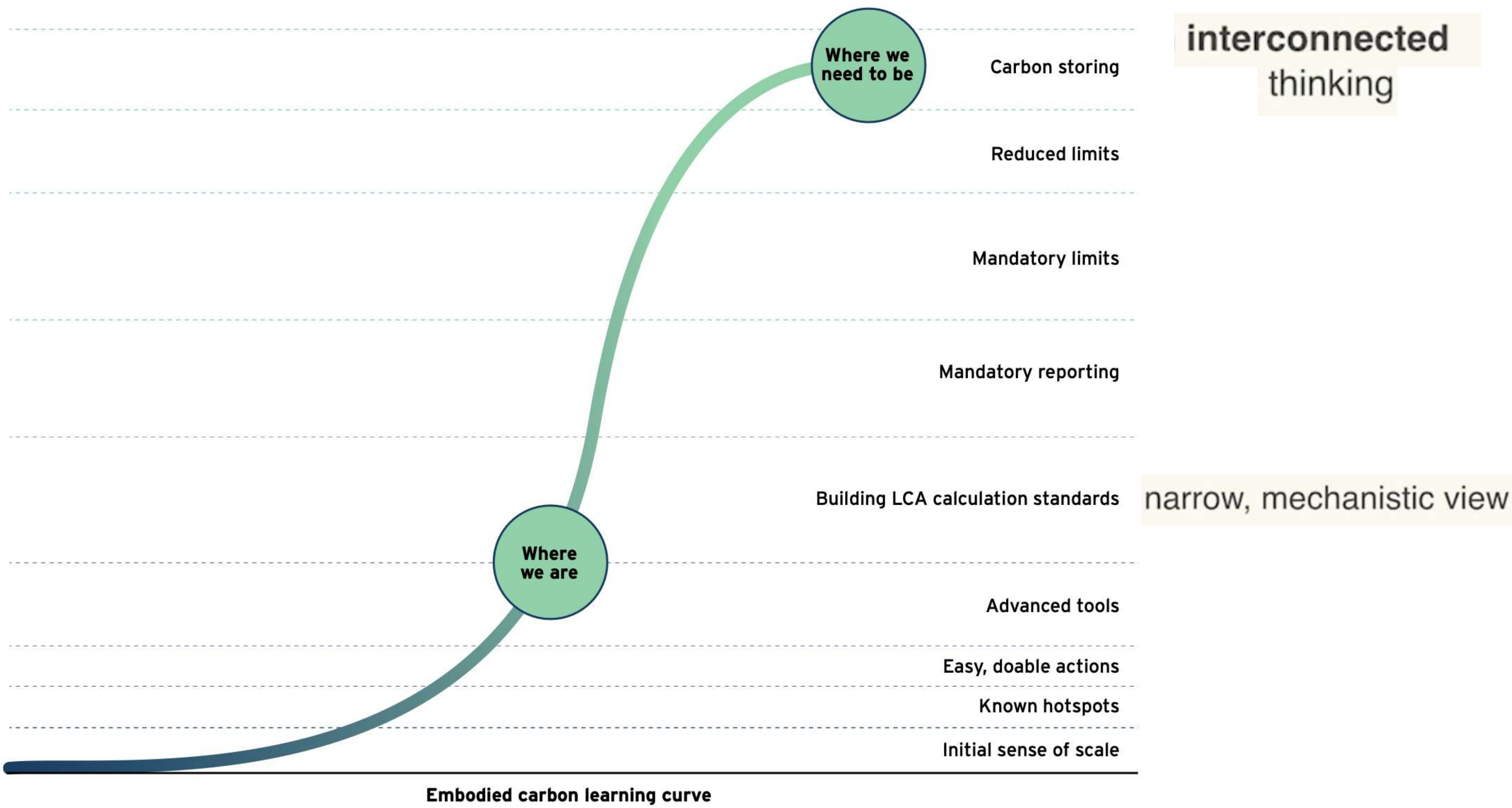
Our simple message:

Making carbon-storing buildings is the most impactful action the building community can undertake to address climate change.

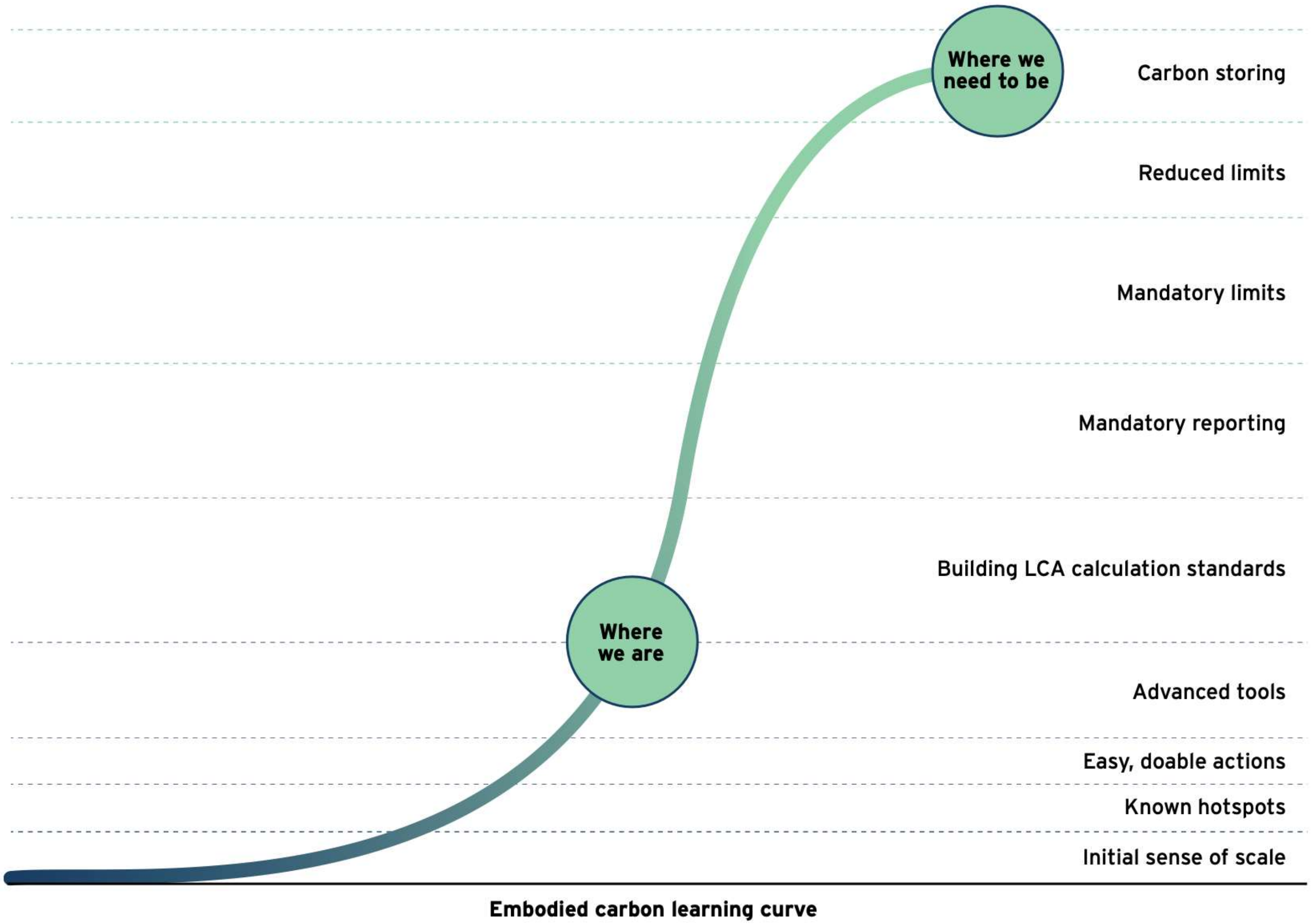
Our "life cycle" message:

Truly addressing climate change requires us to **change our thinking**, and move beyond a narrow, mechanistic view of issues to an **interconnected style** of thinking.

We must accelerate our position on this curve to meet climate thresholds



We must accelerate our position on this curve to meet climate thresholds



interconnected thinking

RESNET Leading the Path to Net Zero Energy Homes

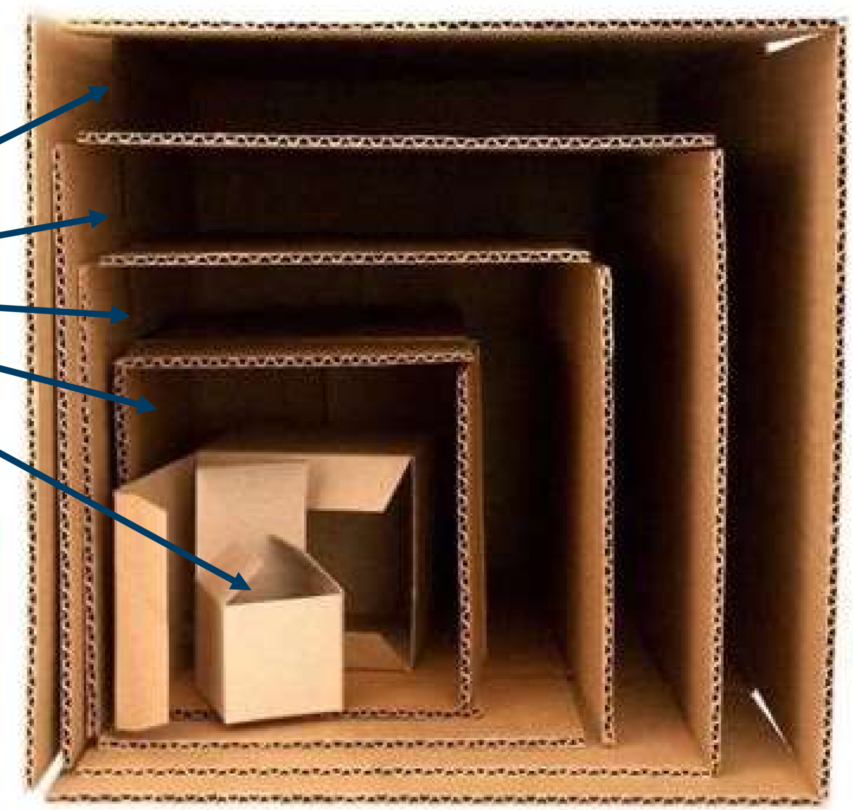
Standard 1550 Embodied Carbon Task Group

Why do we need a standard?

Life cycle stages

Project boundary

Building products

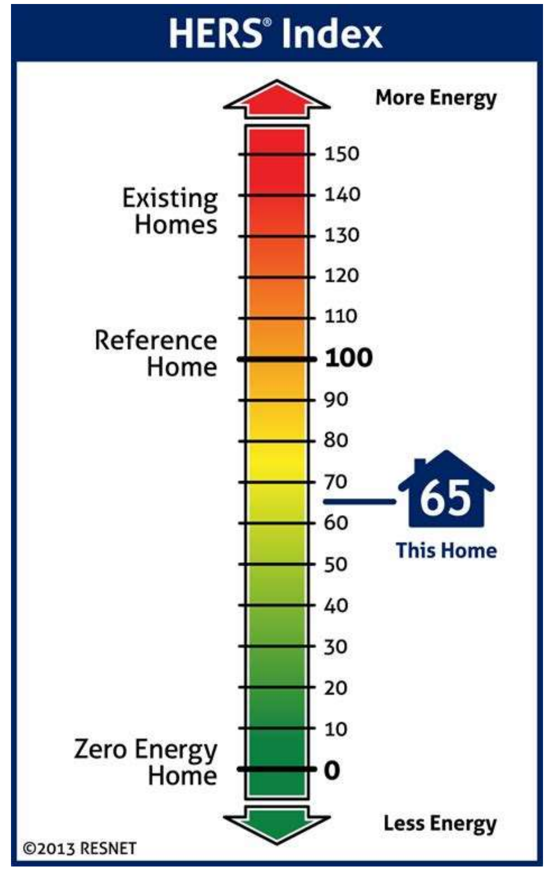


thisiswhyimbroke.com

Results are only comparable if we're using the same box.

Why a RESNET standard?

RESNET® HERS INDEX



Why a RESNET standard?

RESNET® HERS INDEX

RESNET HERS H2O®

HERS® CARBON INDEX

Why a RESNET standard?

RESNET® HERS INDEX

RESNET HERS H2O®

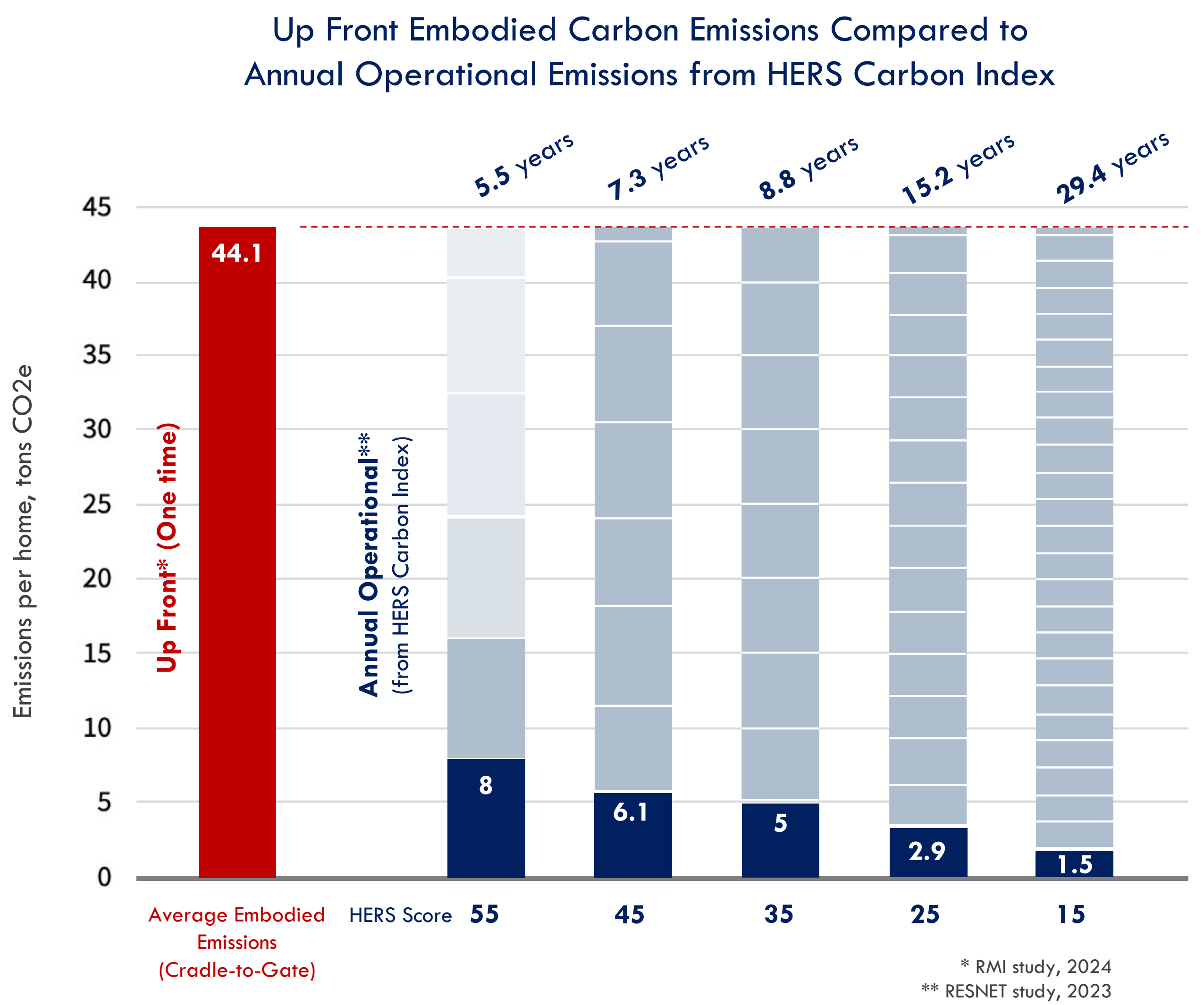
HERS® CARBON INDEX

LEVERAGE EXISTING MODELING DATA

EMBODIED CARBON

Why a RESNET standard?

HERS raters can provide guidance for affordable decarbonization decisions



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RESNET draft Standard 1550

Purpose & Scope:

1. Purpose

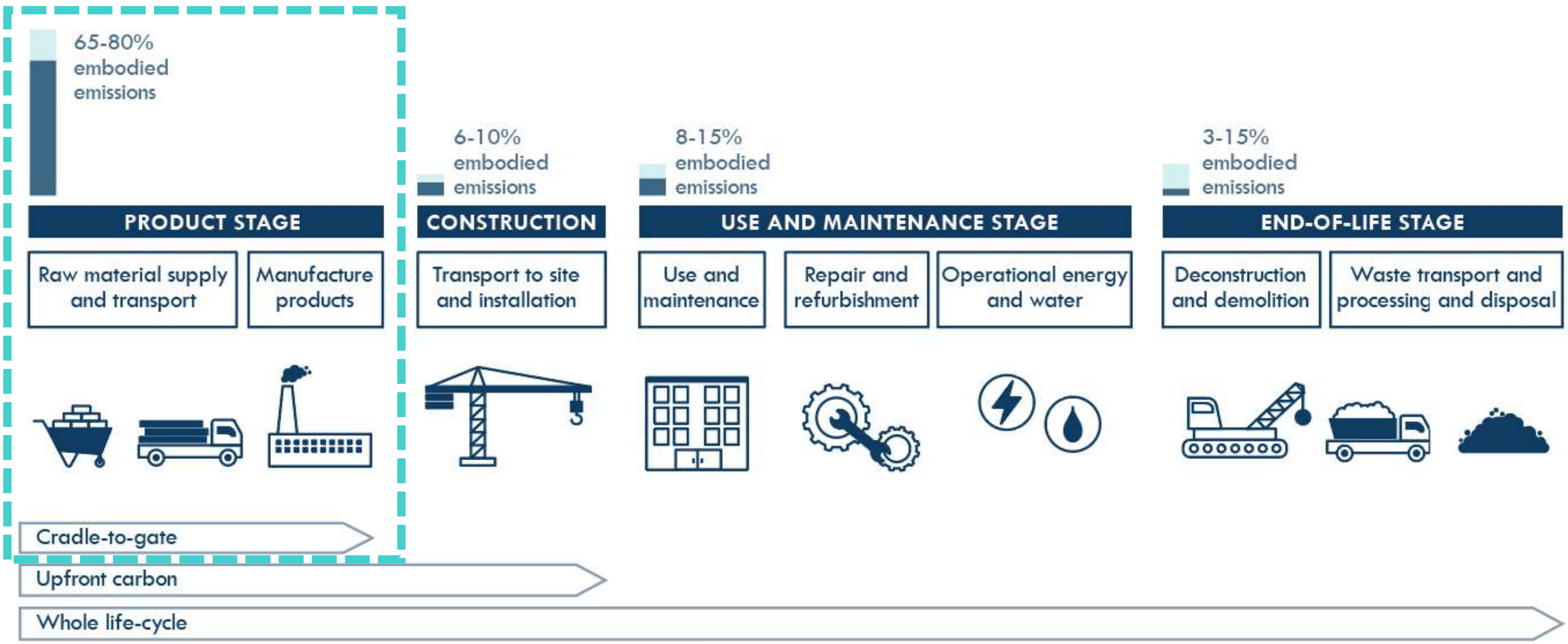
The provisions of this document establish a methodology for quantifying and reporting embodied greenhouse gas emissions associated with building products using data commonly gathered by energy raters and according to the system boundary and data sources defined in Section 5.

2. Scope

This standard is applicable to buildings with Dwelling Units and Sleeping Units in Residential or Commercial Buildings, excepting hotels and motels .

This standard does not set benchmarks or establish levels of building performance.
This standard shall not be used to circumvent any safety, health, or environmental requirements.

Life cycle stages A1-A3



Basic embodied carbon math

Material quantity × Emission factor = **Product emissions**

kg CO_2e

per life cycle phase

Material quantity: From HERS models
- Area-based takeoffs

Emission factor: From EPDs or other approved data source

Basic embodied carbon math

Material quantity × Emission factor = **Product emissions**

kg CO2e

per life cycle phase

Material quantity

From HERS models

- Area-based takeoffs

TABLE 10.1.1

provides takeoff calculations

Emission factor

From EPDs or other approved data source

TABLE 5.3.2

provides data hierarchy

Estimating material carbon emissions

Emission data sources

EPD – Product Impacts

Declared Unit: 1 m^3

Construction Material

Amount per Unit	
Global Warming Potential	450 $kgCO_2e$
Emitted	475 $kgCO_2e$
Sequestered	-25 $kgCO_2e$
Ozone Depletion	0.00 kgCFC11e
Acidification Potential	3.01 $kgSO_2e$
Eutrophication Potential	0.15 kgNe
Smog Formation	0.63 kgO_3e
Primary Energy Demand	3020 MJ
Non-renewable	3045 MJ
Renewable	25 MJ

An **Environmental Product Declaration** (EPD) "quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function."

The EPD methodology follows ISO series 14040 & 14025 requirements.

Reports in kg CO2e.

Building product categories

Taking a "drip-line in" approach

Table 5.4.1 lists inclusions

Table 10.4.1 lists exclusions

- Site work
- Driveways/hardscape
- Balconies/porches/decks
- Formwork
- Appliances
- Cabinetry/millwork
- Gutters/soffit/fascia
- Fasteners/connectors
- Controls/valves
- Light fixtures

Two types of assessment

Following HERS modeling method

Projected Assessment

Projected Assessments are generated prior to construction wherein the actual installed conditions, equipment, and systems are not yet completed or installed.

Confirmed Assessment

Confirmed Assessments are conducted, generated, and verified after completion of construction.

Verification

Following HERS verification method

Verification (for Confirmed Assessments)

A ***Certified Rater*** **shall complete all the tasks** and gather all the required verification documents specified in Table 10.3.1.

If inspection of the *assessed home* and/or verification documents results in variations from the *construction documents* used for calculations, **all variations must be documented, and all required changes made to the dimensions and/or product selection** used for the *embodied carbon* assessment.

Verification

Following HERS verification method

Verification procedure

- Measure & verify dimensions
- Determine & record product brands
- Record with photos, receipts or other documents

Software

Following HERS software verification method

Software representatives

- Active participants in working groups
- Monitoring progress of standard
- Lag time expected between standard release and software availability

Software workflow

BUILDING EMISSIONS ACCOUNTING FOR MATERIALS

ekotrope

Software connectivity

- Prototype of connectivity between Ekotrope and BEAM for study in MA

MASSACHUSETTS CLEAN ENERGY CENTER

NEHERS

NORTHEAST HOME ENERGY RATING SYSTEM ALLIANCE

BUILDERS FOR CLIMATE ACTION

ASSESSING THE UPFRONT CARBON OF BUILDING MATERIALS IN HOMES

https://www.masscec.com/resources/assessing-upfront-carbon-building-materials-homes

EMBODIED CARBON REDUCTION HIERARCHY

use less stuff

use better versions of the same stuff

use better stuff

~~move and build stuff in cleaner ways~~

~~make stuff circular~~

use less stuff.

REUSE

Reuse an entire building and/or components of a deconstructed building. Limit the scope of renovations to what is needed. Prioritize salvaged materials over new production.

RIGHT-SIZE

Optimize building size by using space more intensively and minimizing excess space. Design with better scheduling or dual-use spaces to decrease the building size.

DEMATERIALIZE

Expose structure instead of applying finishes. Optimize structural system to minimize excess underutilized material. Consider reducing overdesign by evaluating conservative load assumptions.

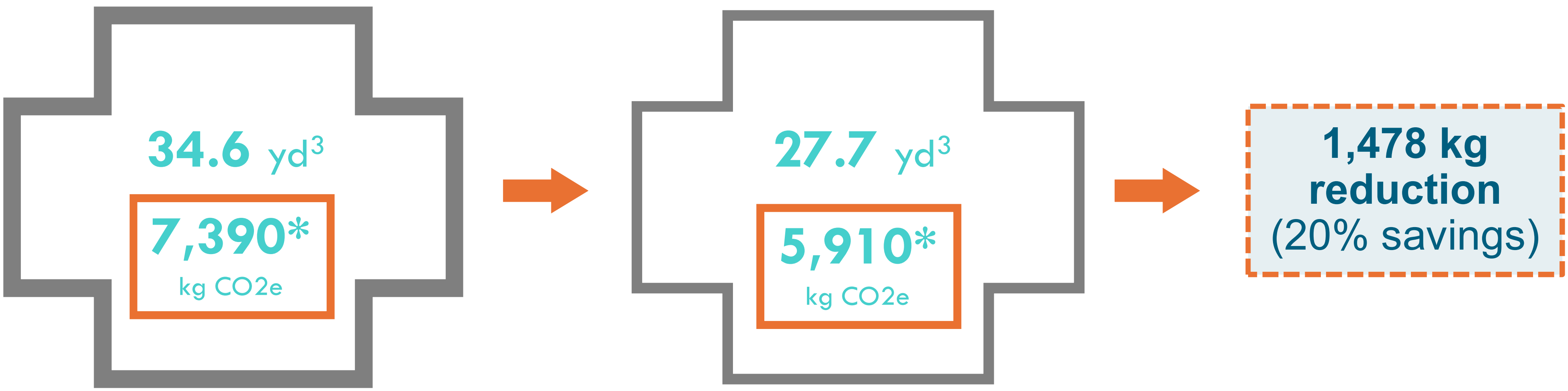
use less stuff.

FOUNDATION 1

- **1120 ft²**
- **10-inch wide**

FOUNDATION 2

- **1120 ft²**
- **8-inch wide**



*Results for NRMCA average mix as calculated in BEAM

use less stuff.

FOUNDATION 1
- 1120 ft^2
- 10-inch wide

FOUNDATION 2
- 1010 ft^2
- 10-inch wide

*Results for NRMCA average mix as calculated in BEAM

use less stuff.

FOUNDATION 1

- **1120 ft^2**
- **10-inch wide**

34.6 yd^3

7,390* kg CO2e

FOUNDATION 2

- **1010 ft^2**
- **8-inch wide**

24.9 yd^3

5,320* kg CO2e

2,070 kg reduction
(30% savings)

*Results for NRMCA average mix as calculated in BEAM

use better versions of the same stuff.

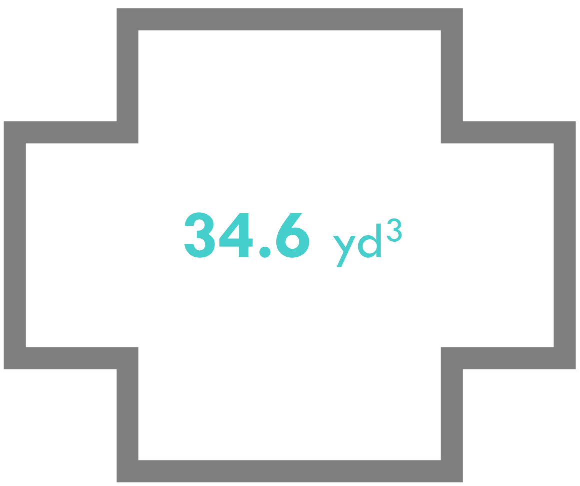
PRODUCT/MATERIAL SUBSTITUTIONS

Make substitutions for highest impact materials informed by a whole-building integrated approach (Building LCA) or by low-material GWP limits when you cannot do an LCA.

use better versions of the same stuff.

FOUNDATION 1

- **1120 ft^2**
- **10-inch wide**



7,390*
kg CO2e
NRMCA average mix

4,725*
kg CO2e
NRMCA best low-carbon mix

2,665 kg reduction
(36% additional savings)

*Results for NRMCA mixes as calculated in BEAM

use better versions of the same stuff.

DRYWALL

- 4,000 ft^2
- 1/2-inch wide

GWP of 5 brands*

- 970 kg CO2e
- 825 kg CO2e
- 510 kg CO2e
- 350 kg CO2e
- 340 kg CO2e

65% difference

*Results calculated in BEAM

use better stuff.

EXTERIOR CLADDING

- **2,000 ft^2**

GWP average of 12 cladding types*

Brick:	8,780 kg CO2e
Acrylic stucco:	6,970 kg CO2e
Natural stone:	3,975 kg CO2e
Steel panel:	2,290 kg CO2e
Veneer brick:	1,940 kg CO2e
Stucco:	1,860 kg CO2e
Vinyl:	875 kg CO2e
Fiber cement:	720 kg CO2e
Engineered wood:	600 kg CO2e
Natural wood:	220 kg CO2e

98% difference

*Results calculated in BEAM

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use your judgement.

MEP default values*:

1. Default is only option
2. Default can be replaced by product EPD
3. Defaults can be compared

Electrical			**Subtotal :**	**1186 Kg CO2e**
Load Center and Meter	Number of dwelling unit :	1	unit	220
Electrical distribution wiring, receptacles, switches, boxes	CFA :	2926	ft2	966
Plumbing			**Subtotal :**	**3230 Kg CO2e**
Domestic Hot Water				
DHW tank heater, gas	each	0	unit	0
DHW tank heater, electric	each	0	unit	0
DHW tank heater, heat pump hybrid electric	each	0	unit	0
DHW tankless heater, gas	each	2	unit	520
Kitchen / Bathroom Plumbing				
Kitchen sink, DWV primary stack, water sevice piping	per dewling unit :	1	unit	280
Bathroom DWV and potable distribution piping	Number of bathroom :	5	unit	700
Pipe insulation	Insulated piping if box checked :	☑		1.6
Toilet	Number of toilets :	5	unit	650
Lav Sink	Number of Sinks :	7	unit	406
Bathtub	Number of Bathtubs :	2	unit	540
Shower	Number of showers :	3	unit	132
Mechanical			**Subtotal :**	**8307 Kg CO2e**
Heating and Cooling Equipment				
Natural Gas Furnace	Equip capacity :	0	kBtu capactiy	0
Ducted Heat Pump + Compressor	Equip capacity :	2.8	tons	2153
Mini-Split Heads + Compressor	Equip capacity :	4.5	tons	3240
Central A/C Compressor	Equip capacity :	0	tons	0
Electric Aux Heater	Equip capacity :	0	kBtu capactiy	0
Electric Baseboard	Equip capacity :	0	kBtu capactiy	0
Gas boiler	Equip capacity :	0	kBtu capactiy	0
Air-to-water heat pump	Equip capacity :	0	tons	0
Ground source heat pump equipment	Equip capacity :	0	tons	0
Ground source heat pump ground loop borehole	Li. feet of borehole :	0	linear foot	0

*Results from beta BEAM-Ekotrope connection

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Case Study: Zero House

Embodied Carbon

Cradle-to-gate, kg CO_2e/m^2

*Average based on report from 2022.

Carbon Storage

- Straw insulation (half of first floor walls)
- Recycled juice-box structural sheathing
- Cellulose insulation (roof, walls & floors)
- Wood fiberboard continuous insulation

14 tons of CO2 stored

"

Simple, low-cost offsite panelization makes it easier to create carbon-storing, healthy and efficient housing.

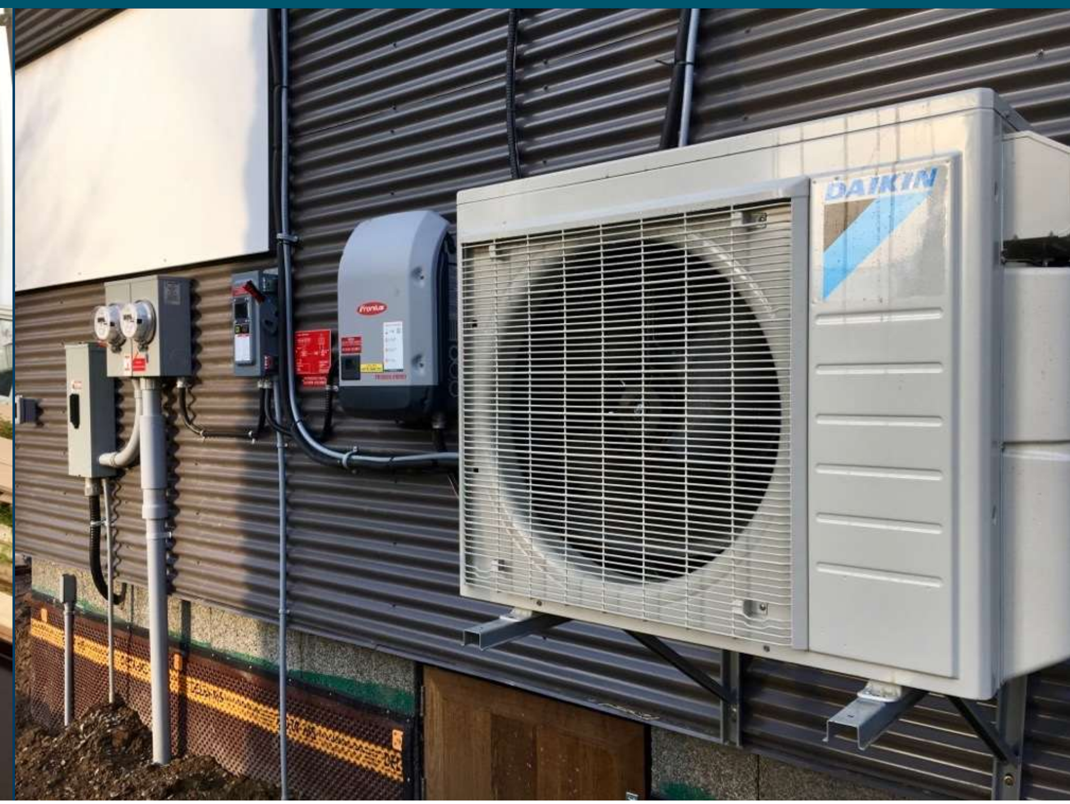
Chris Magwood, Former Executive Director, Endeavour Centre

Operational Carbon | Zero House was designed to exceed Canada's Tier 5, net zero ready codes. The fully electric building is very airtight (1.0 ACH/50), highly insulated and incorporates passive solar strategies. 3.5 kW of roof-integrated solar covers ~70% of annual electrical loads.

Airtight building (1.0 ACH50)

Fully electric building

Roof-integrated solar panels

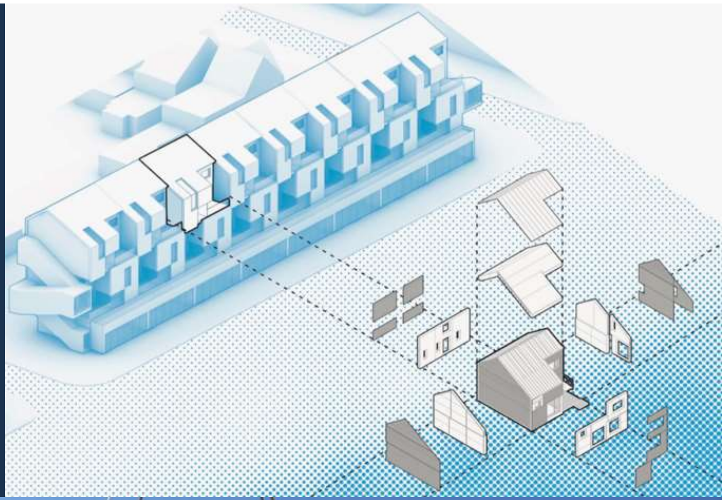


Lessons Learned

1. Design for disassembly works! The building was built and dismantled three times with all materials reused and no waste.

2. Offsite panelization can be straightforward and doesn't require a "factory".

3. It is possible to combine efficiency, carbon storage and occupant health.

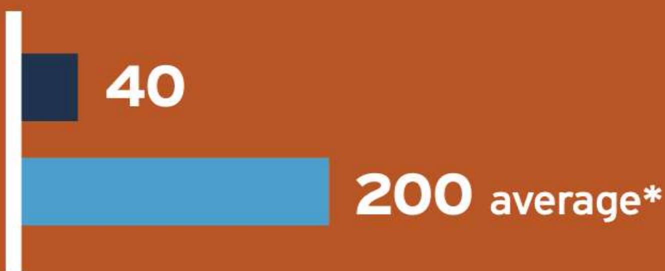


RMI | HomebuildersCAN

Case Study: Solstice Northeast

Embodied Carbon

Cradle-to-gate, kg CO2e/m²



*Average based on report from 2022.

Carbon Storage

- Dense pack cellulose insulation
- Engineered wood siding
- Certified FSC lumber

90 tons of CO2 stored


Photo by Footprint Development

“

Solstice Northeast is Minnesota's first low embodied carbon, passive house (Phius) certified apartment building. Achieving passive house performance with a ~60% reduction in embodied carbon emissions was no small feat, but it also wasn't expensive! Fully 1/3rd of that EC reduction was cost neutral.

Cody Fischer, President, Footprint Development

Operational Carbon | The Solstice Northeast apartment building was designed as fully electrified, and certified to Phius Core which considerably reduced operating energy consumption. The building was designed with no mechanical equipment located on roof. To maximize space for a rooftop solar array, a special roof anchor system was designed in coordination with the location of roof ventilation points.

Phius Core certification

All-electric

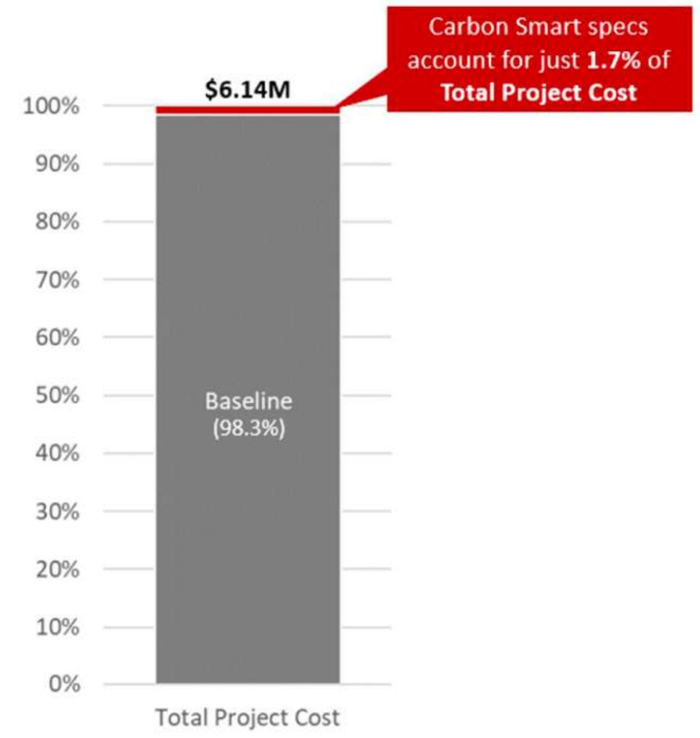
Rooftop solar array

Lessons Learned

1. Major embodied carbon reductions can be achieved for no or low cost.

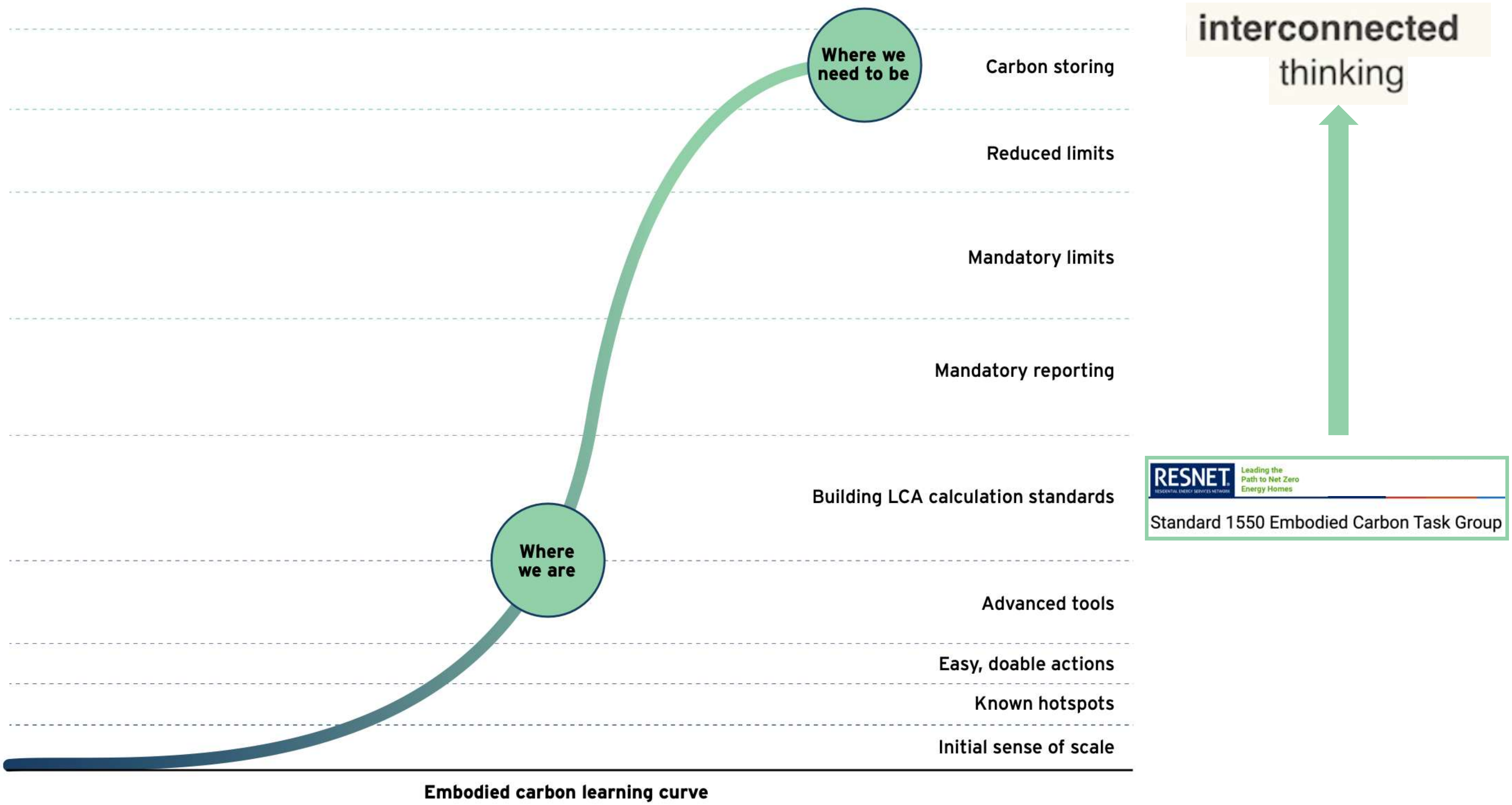
2. Market rate passive house and low embodied carbon apartment buildings can be achieved without subsidy, using readily available materials and familiar trade techniques.

3. For "missing middle" scale housing, reducing the embodied carbon of the structural system had the highest impact.

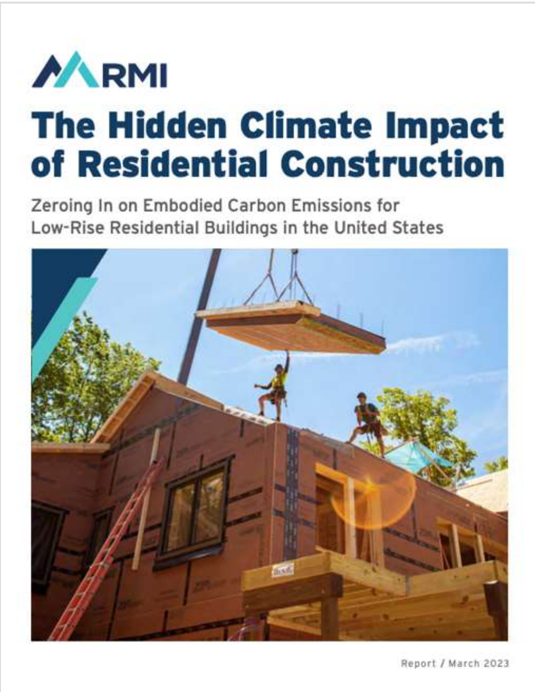


Baseline	Solstice Northeast	Carbon Reduction
Fiberglass batt insulation	Dense pack cellulose insulation	-20.6 tCO2e
Fiber cement siding and full-depth brick	Engineered wood siding and thin brick	-14.4 tCO2e
Standard carpet and LVP	Interface™ carpet and LVP	-9.2 tCO2e
Standard gypsum wall board	USG EcoSmart™ Panels	-9.1 tCO2e

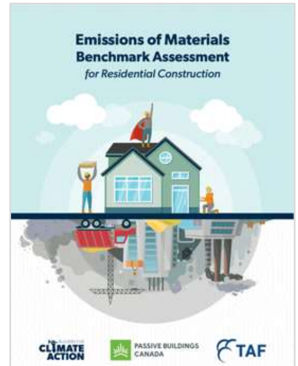
We must accelerate our position on this curve to meet climate thresholds

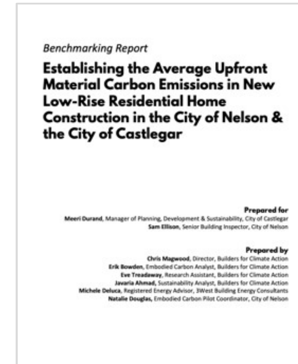


Resources

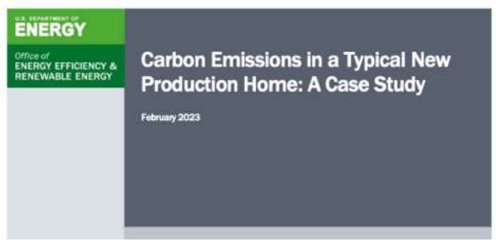


https://rmi.org/insight/hidden-climate-impact-of-residential-construction/





https://www.buildersforclimateaction.org/our-work.html



https://www.nrel.gov/docs/fy23osti/84227.pdf

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