

# **BUILDINGENERGY BOSTON**

---

## **Scaling Embodied Carbon Through Building Codes**

**Ariel Brenner, New Buildings Institute  
Andy Buccino, Stephens and Company**

*Curated by Tammy Ngo*

---

**Northeast Sustainable Energy Association (NESEA) | March 21, 2025**

# Session Outline

*Provide an overview of existing and planned strategies to introduce and enhance embodied carbon provisions in codes, standards, and programs:*

- Existing policy and codes landscape
- Ongoing efforts with commercial model codes and standards
- The residential embodied carbon policy ecosystem

# Introductions

# New Buildings Institute & Embodied Carbon

- Embodied Carbon Building Code and Residential Code Overlays
- Participant in ASHRAE 189.1 (IgCC) Working Group 9 on Materials and Resources and RESNET 1550
- GSA Procurement Specification
- State and jurisdictional building codes, reach codes, and associated research and reports
- Proponent of various code proposal
- Implementation & training



When it comes to building decarbonization, many professionals are familiar with operational carbon, which refers to the greenhouse gases (GHG) emitted from energy use (electricity and fossil fuels) for building operations. As California State building codes (Title 24) increase building energy efficiency, the relative proportion of a building's embodied carbon will increase compared to operational carbon. Professionals are quickly becoming familiar with embodied carbon as the state legislature has passed bills like Bay Area Clean California that require limited embodied carbon in building products on state-funded projects.

#### What is Embodied Carbon?

Embodied carbon refers to the GHG emissions from the non-renewable energy associated with the material extraction, manufacturing, transportation, installation, maintenance, and disposal of building materials. Unlike operational carbon values to measure a building's products lifecycle, also called cradle-to-grave (see Figure 1).

**Why Focus on Embodied Carbon?**  
Worldwide, 39% of all emissions come from buildings, with 11% from building materials and construction.

(Embodied carbon) according to the International Energy Agency. Embodied carbon emissions are expected to increase due to a growing global demand for construction to accommodate population growth and the need to replace aging infrastructure. The 2018 United Nations Intergovernmental Panel on Climate Change report states that we must reduce emissions by 45% by 2030 to have a chance of limiting warming to under 1.5°C. In addition, California goal is to reduce economy-wide emissions by 40% by 2030 from 1990 levels, and 80% by 2050. With these strict timelines to mitigate the impacts of climate change, it becomes imperative to address embodied carbon.



#### What are refrigerants?

A refrigerant is a liquid or a gas with a very low boiling point. Refrigerants are used to transfer heat. For conventional air conditioning (A/C), the refrigerant absorbs heat from the air inside a building and rejects it to the outdoors. The reverse is true for heat pumps in heating mode.

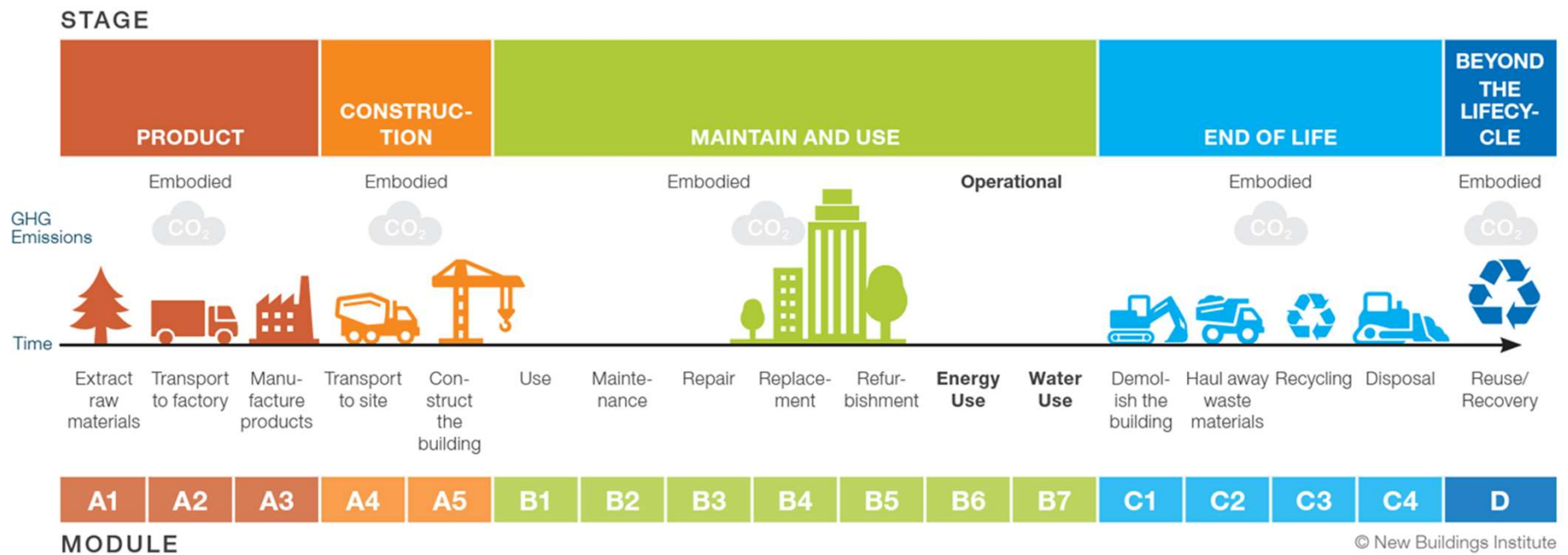
#### Why are refrigerants of concern?

Many refrigerants have high global warming potential (GWP), so it is crucial that leaks from equipment be repaired promptly and refrigerants are collected during maintenance and when equipment is retired. Fluorinated gas (F-gas) refrigerants are responsible for 2% of total global greenhouse gas (GHG) emissions. Older refrigerants contain high ozone-depleting potential (ODP) and high global warming potential (GWP) molecules. Modern refrigerants used in these pumps from 2019-2020 have greater than that of carbon dioxide (CO<sub>2</sub>) over a 100-year period. Refrigerants used in refrigeration systems have a GWP that is 1,000 times greater than CO<sub>2</sub>. Not all refrigerants are equal, though. There are tens of thousands of refrigerants and blends registered from Oct. 15, 2010. According to the International Energy Agency, global refrigerant demand is expected to grow by 2050 because of increased adoption of high-efficiency heat pumps and the increased demand for cooling, especially as global temperatures rise. If unregulated, the expansion of refrigerant use would lead to refrigerants making up a greater percentage of total GHG emissions.



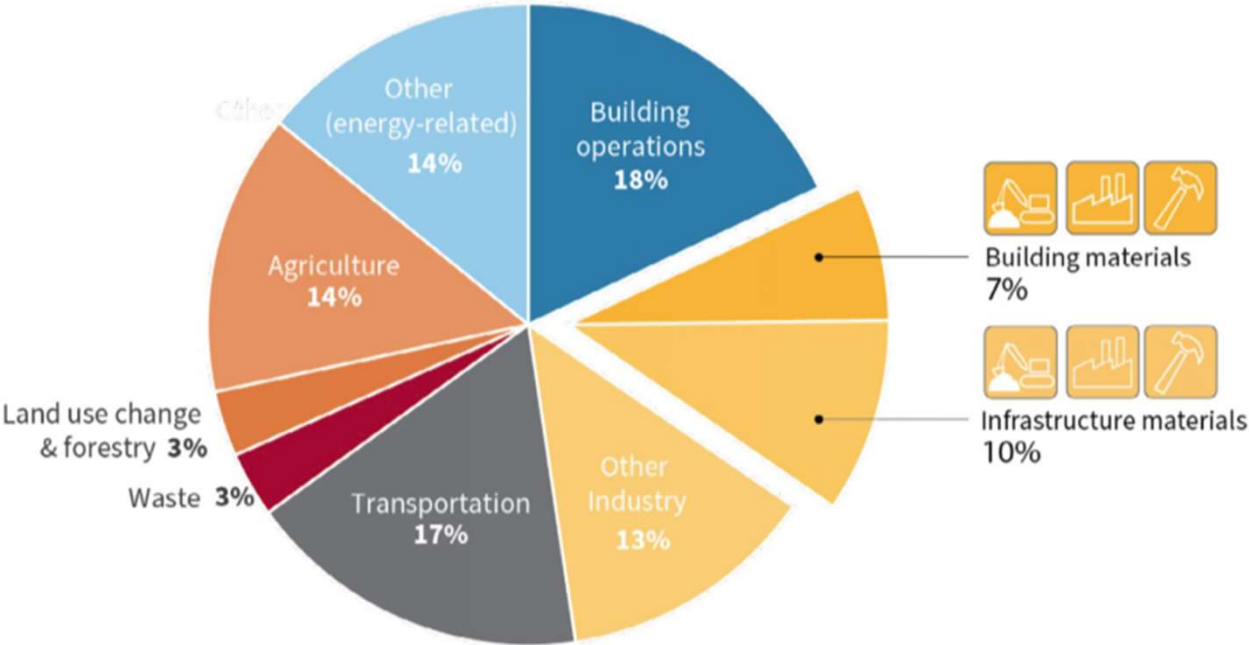
# Embodied Carbon: An Overview

# Embodied Carbon: An Overview



# Embodied carbon from buildings makes up 7% of worldwide GHG emissions

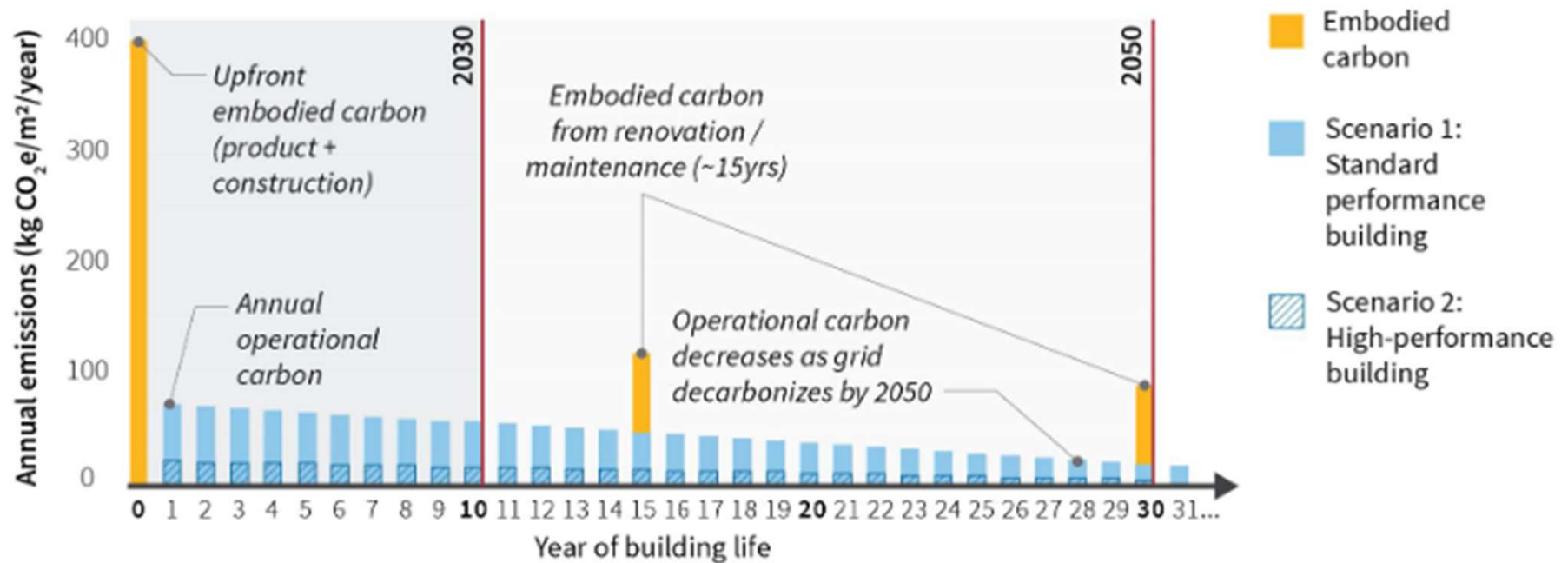
Global Greenhouse Gas Emissions Breakdown by Sector (2019)



Source: Carbon Leadership Forum, based on data from World Resources Institute (WRI) and International Energy Agency (IEA)



# Upfront vs. Later-Life Embodied Emissions



Source: Carbon Leadership Forum

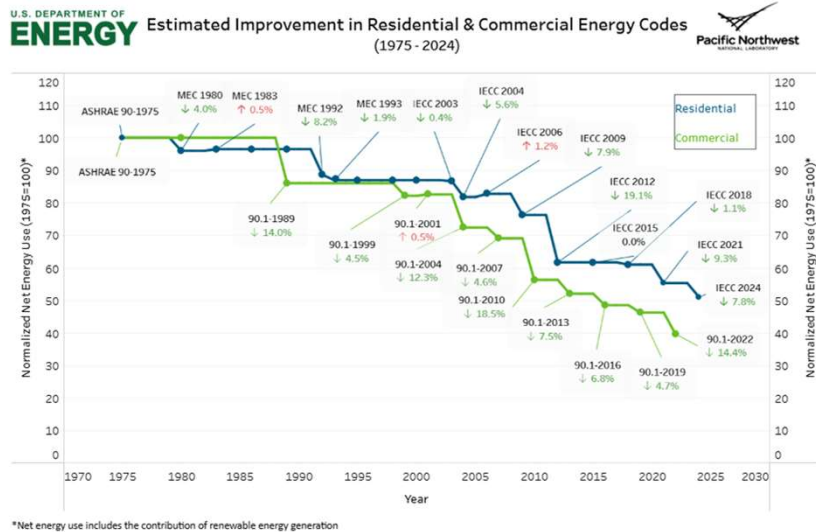


Source: Carbon Leadership Forum

- Type of program
- Regulatory
  - Incentive
  - Public Pilot/Study
  - Planned (Action Plan/EO)
  - Agency Program
  - Government funded tool
  - Education/Training
  - (No Value Provided)
  - Passed/Active

# Embodied Carbon Code Approaches

# Why Codes?



Source: U.S. Department of Energy and Pacific Northwest National Laboratory

- Building energy codes have been a powerful tool for addressing climate change <sup>1</sup>
- Building codes are intended to preserve public health, safety, and welfare, and have been proven to save lives and money <sup>2</sup>
- Building codes impact early decision-making on design and construction practices, which can lead to low-cost and high-impact strategies for embodied carbon

<sup>1</sup> U.S. Department of Energy

<sup>2</sup> U.S. Federal Emergency Management Agency

# Typical Embodied Carbon Code Approaches

Product-level

GWP Reporting

GWP Limits

Building-level

GWP Reporting

GWP Limits

Incentivizing Building Reuse

Reporting

Thresholds

# Typical Embodied Carbon Code Approaches

Product-level

GWP Reporting

GWP Limits

Building-level

GWP Reporting

GWP Limits

Incentivizing Building Reuse

Reporting

Thresholds

# Product-Level Strategies

## Product-level

### GWP Reporting

**Environmental product declarations (EPDs)**  
communicate environmental impact of a construction product across its life cycle

### GWP Limits

**Sample provision:** Meet GWP limit that is X% industry-wide EPD

| Jurisdiction                                  | Policy   |
|---|--|
| <b>California</b>                             | Compliance pathway: 175% of industry average GWP for structural steel, rebar, flat glass, light and heavy duty mineral wool insulation, and ready mix concrete |
| <b>Canada</b>                                 | Standard on Embodied Carbon in Construction: 10% below regional industry average for concrete  |
| <b>Marin County, CA</b>                       | Nation's first low-carbon concrete code; low-carbon concrete codes adopted by 4 other CA jurisdictions   |
| <b>Denver, CO</b>                             | Green Code: GWP limits for concrete and steel  |
| <b>Boulder, CO</b>                            | Energy code: Optional credit for GWP reduction for insulation, concrete, masonry, steel, wood, glazing, gypsum, and others                                     |
| <b>Vermont</b>                                | Energy Code: Optional credit for GWP reporting of insulation   |
| <b>Buy Clean Policies (not building code)</b> | <b>WA; OR; NY; NJ; MD; MN; CO; CA; US GSA</b>  |

# High-Impact Strategies by Material

| Material                         | EC Reduction Strategy  |
|----------------------------------|--|
| <b>Concrete / Cement</b>         | <ul style="list-style-type: none"> <li>• Blended cements</li> <li>• Supplementary cementitious materials (SCMs)</li> <li>• Water-reducing admixtures to reduce cement content</li> <li>• Power with low-carbon energy</li> </ul>                 |
| <b>Steel</b>                     | <ul style="list-style-type: none"> <li>• Scrap content in electric arc furnace, powered with low-carbon energy</li> </ul>  |
| <b>Aluminum</b>                  | <ul style="list-style-type: none"> <li>• &gt;90% recycled content</li> <li>• Power with low-carbon energy</li> </ul>   |
| <b>Wood</b>                      | <ul style="list-style-type: none"> <li>• Source locally</li> <li>• Source from sustainably managed forests</li> <li>• Low-carbon transport methods</li> <li>• Timber with bio-based adhesives</li> <li>• Power with low-carbon energy</li> </ul> |
| <b>Glass</b>                     | <ul style="list-style-type: none"> <li>• Recycled cullet</li> <li>• Furnaces that utilize Oxy Fuel technology</li> <li>• Design burners and nozzles to decrease energy use</li> </ul>  |
| <b>Board and Foam Insulation</b> | <ul style="list-style-type: none"> <li>• Bio-based alternatives</li> <li>• Lower-GWP blowing agents</li> <li>• Mineral wool: increase renewable energy at furnace</li> </ul>   |



# Typical Embodied Carbon Code Approaches

Product-level

Building-level

Incentivizing Building Reuse

GWP Reporting

GWP Limits

GWP Reporting

GWP Limits

Reporting

Thresholds

# Building-Level Strategies

## Building-level

### GWP Reporting

**Whole building life cycle analysis (WBLCA)** evaluates the impact of a building throughout its life cycle (stages A-C)

### GWP Limits

**Sample provisions:**  
 -Total carbon budget at building level: carbon per square foot; can be set by building type  
 -Percentage reduction compared to a modeled baseline

| Jurisdiction             | Policy   |
|--------------------------|--|
| <b>Vancouver, Canada</b> | Building Bylaws: 800 CO <sub>2</sub> e/m <sup>2</sup> or 10% reduction compared to baseline; limit decreases over time |
| <b>Toronto, Canada</b>   | Green Standard: 350 CO <sub>2</sub> e/m <sup>2</sup> ; voluntary 250 CO <sub>2</sub> e/m <sup>2</sup>                  |
| <b>California</b>        | 10% reduction compared to baseline   |
| <b>Minnesota</b>         | Sustainable Building Guidelines: 10% compared to reference building  |

# High-Impact Building-Level Strategies

Build less

Reuse more

Build lighter  
and smarter

Procure/  
substitute  
lower-carbon  
products

Use high-  
quality  
materials

# Typical Embodied Carbon Code Approaches

Product-level

GWP Reporting

GWP Limits

Building-level

GWP Reporting

GWP Limits

Incentivizing Building Reuse

Reporting

Thresholds

# Building Reuse

- Realizes substantial embodied carbon reductions
- Avoids emissions associated with demolition and new construction
- Building codes do not have the authority to mandate building reuse
- Code strategies can encourage adaptive reuse or make it easier for applicants seeking to reuse (i.e., administrative flexibility, incentives through compliance pathways)

| Jurisdiction | Policy  |
|--------------|---|
| California   | Compliance pathway: 45% reuse of structure and enclosure                        |
| ASHRAE 189.1 | Consideration of new compliance pathway in chapter 9 on Materials and Resources |

# First in the Nation: Embodied Carbon in CALGreen

## Product Path

**Products:** Structural steel, rebar, flat glass, light and heavy duty mineral wool insulation, and ready mix concrete

**Exception:** Concrete mixes can use a weighted average for all mixes

## Lifecycle Analysis

**Scope:** 60-year cradle-to-grave WB LCA (ISO 14044), excluding operating energy. Show GWP analysis.

**Components:** Primary and secondary structural members, glazing, insulation, exterior finishes.

## Building Reuse

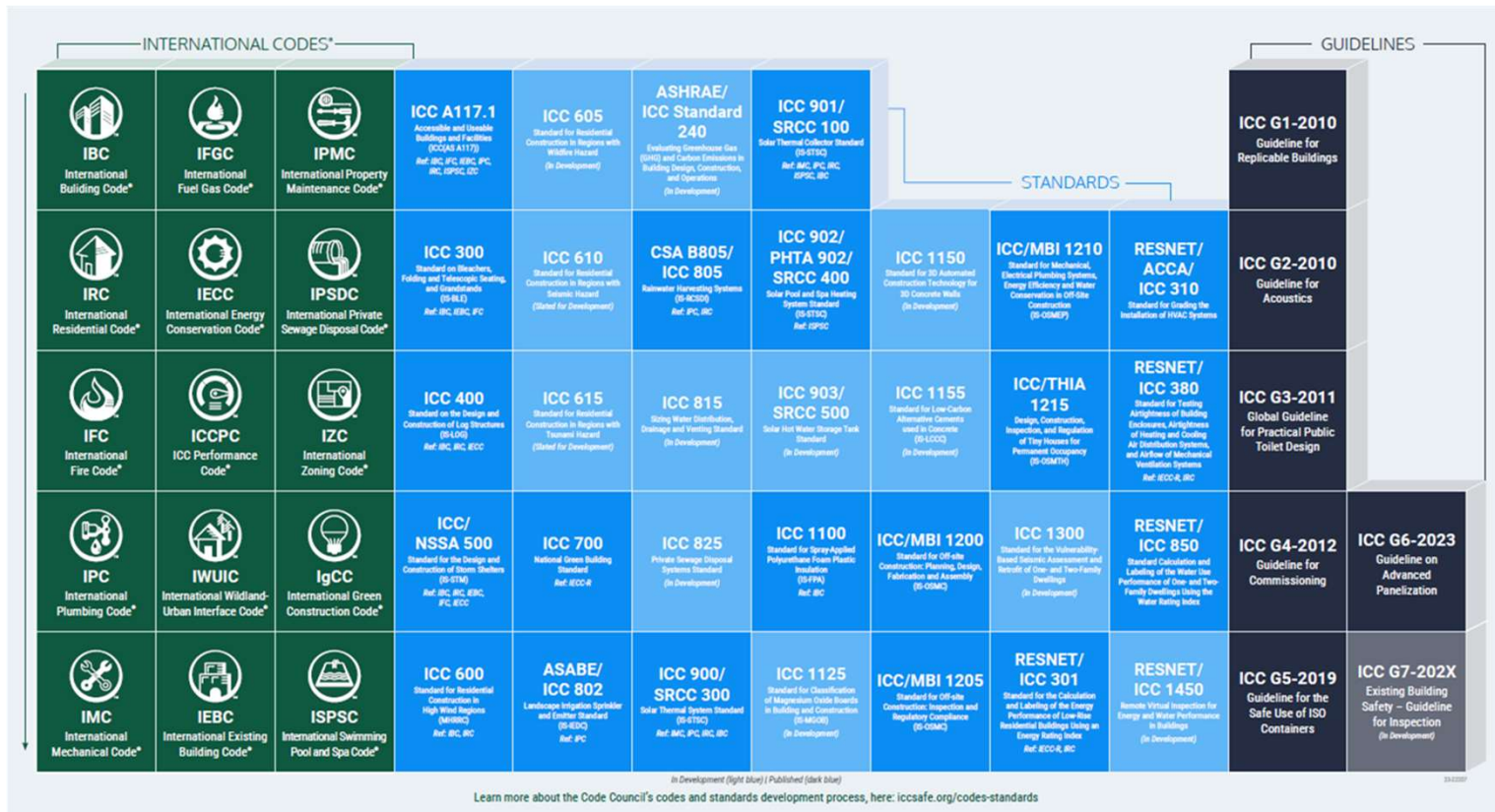
**Components:** Existing primary structural elements, enclosure, window assemblies, and insulation.

**Exceptions:** Additions 2x+ the area of existing building; windows, insulation, portions structurally unsound or hazardous, and hazardous materials that are remediated as part of the project

|                  | Product Path              | Lifecycle Analysis Path     | Building Reuse Path  |
|------------------|---------------------------|-----------------------------|--|
| <b>Mandatory</b> | 175% of IW-EPD GWP Limits | 10% reduction from baseline | 45% of the structure and enclosure to be reused  |
| <b>Tier 1</b>    | 150% of IW-EPD GWP Limits | 15% reduction from baseline | 75% of the structure and enclosure to be reused  |
| <b>Tier 2</b>    | IW-EPD GWP Limits         | 20% reduction from baseline | 75% of the structure and enclosure to be reused AND 30% of interior non-structural elements to be reused |

# Model Codes Landscape

# Model Codes: The Existing Landscape



Source:  
International  
Code Council



# Model Codes: The Existing Landscape

| INTERNATIONAL CODES*                          |  |   |   |  |   |   |   |  |   | GUIDELINES  |  |
|---|--|---|---|--|---|---|---|--|---|---|--|
| <b>IBC</b><br>International Building Code*    | <b>IFGC</b><br>International Fuel Gas Code*                  | <b>IPMC</b><br>International Property Maintenance Code*     | <b>ICC A117.1</b><br>Accessible and Usable Buildings and Facilities (ICC A117)<br>Ref: IBC, IFC, IRC, IFC, IBC, IFGC, ICC         | <b>ICC 605</b><br>Standard for Residential Construction in Regions with Wildfire Hazard<br>(In Development)          | <b>ASHRAE/ ICC Standard 240</b><br>Evaluating Low-Carbon Gas (LPG) and Carbon Footprints in Building Design, Construction, and Operations<br>(In Development) | <b>ICC 901/ SRCC 100</b><br>Solar Thermal Collector Standard<br>(ICC 901)<br>Ref: IBC, IFC, IRC, IFGC, ICC                              |   |  |   | <b>ICC G1-2010</b><br>Guideline for Replicable Buildings                  |  |
| <b>IRC</b><br>International Residential Code* | <b>IECC</b><br>International Energy Conservation Code*       | <b>IPSDC</b><br>International Private Sewage Disposal Code* | <b>ICC 300</b><br>Standard on Branches, Fittings and Tees, and Connections<br>(ICC 300)<br>Ref: IBC, IFC, IFC                     | <b>ICC 610</b><br>Standard for Residential Construction in Regions with Seismic Hazard<br>(Standard for Development) | <b>CSA B805/ ICC 805</b><br>Rainwater Harvesting Systems<br>(ICC 805)<br>Ref: IFC, IBC  | <b>ICC 902/ PHTA 902/ SRCC 400</b><br>Solar Pool and Spa Heating System Standard<br>(ICC 902)<br>Ref: IFGC                              | <b>ICC 1150</b><br>Standard for 3D Reinforced Concrete Technology for 3D Concrete Walls<br>(In Development)         | <b>ICC/MBI 1210</b><br>Standard for Mechanical, Electrical Plumbing Systems, Energy Efficiency and Water Conservation in Off-Site Construction<br>(ICC 1210)                     | <b>RESNET/ ACCA/ ICC 310</b><br>Standard for Guiding the Installation of HVAC Systems   | <b>ICC G2-2010</b><br>Guideline for Acoustics                             |  |
| <b>IFC</b><br>International Fire Code*        | <b>ICCPCC</b><br>ICC Performance Code*                       | <b>IZC</b><br>International Zoning Code*                    | <b>ICC 400</b><br>Standard on the Design and Construction of Log Structures<br>(ICC 400)<br>Ref: IBC, IFC, IECC                   | <b>ICC 615</b><br>Standard for Residential Construction in Regions with Tornado Hazard<br>(Standard for Development) | <b>ICC 815</b><br>Siting Water Distribution, Drainage and Wastewater Standard<br>(In Development)   | <b>ICC 903/ SRCC 500</b><br>Solar Hot Water Storage Tank Standard<br>(In Development)   | <b>ICC 1155</b><br>Standard for Low-Carbon Alternative Concrete used in Concrete<br>(In Development)                | <b>ICC/THIA 1215</b><br>Design, Construction, Inspection, and Regulation of Top Houses for Permanent Occupancy<br>(ICC 1215)   | <b>RESNET/ ICC 380</b><br>Standard for Testing Arrangements of Building Enclosures, Airflows of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems<br>Ref: IECC-4, IBC | <b>ICC G3-2011</b><br>Global Guideline for Practical Public Toilet Design |  |
| <b>IPC</b><br>International Plumbing Code*    | <b>IWUIC</b><br>International Wildland Urban Interface Code* | <b>IgCC</b><br>International Green Construction Code*       | <b>ICC/ NSSA 500</b><br>Standard for the Design and Construction of Storm Shelters<br>(ICC 500)<br>Ref: IBC, IFC, IECC, IFC, IECC | <b>ICC 700</b><br>National Green Building Standard<br>Ref: IECC-2  | <b>ICC 825</b><br>Private Sewage Disposal Systems Standard<br>(In Development)  | <b>ICC 1100</b><br>Standard for Spray-Applied Polyurethane Foam Plastic Insulation<br>(ICC 1100)<br>Ref: IBC                            | <b>ICC/MBI 1200</b><br>Standard for Off-Site Construction: Planning, Design, Fabrication and Assembly<br>(ICC 1200) | <b>ICC 1300</b><br>Standard for the Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings<br>(In Development)                                     | <b>RESNET/ ICC 850</b><br>Standard Calculation and Labeling of the Water Use Performance of One- and Two-Family Dwellings Using the Water Rating Index  | <b>ICC G4-2012</b><br>Guideline for Commissioning                         | <b>ICC G6-2023</b><br>Guideline on Advanced Panelization   |
| <b>IMC</b><br>International Mechanical Code*  | <b>IEBC</b><br>International Existing Building Code*         | <b>ISPSC</b><br>International Swimming Pool and Spa Code*   | <b>ICC 600</b><br>Standard for Residential Construction in High Wind Regions (ICC 600)<br>Ref: IBC, IFC                           | <b>ASABE/ ICC 802</b><br>Landscape Irrigation Sprinkler Standard<br>Ref: IFC   | <b>ICC 900/ SRCC 300</b><br>Solar Thermal System Standard<br>(ICC 900)<br>Ref: IBC, IFC, IFC, IBC   | <b>ICC 1125</b><br>Standard for Classification of Magnesium Oxide Boards in Building and Construction<br>(ICC 1125)<br>(In Development) | <b>ICC/MBI 1205</b><br>Standard for Off-Site Construction: Inspection and Regulatory Compliance<br>(ICC 1205)       | <b>RESNET/ ICC 301</b><br>Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings Using an Energy Rating Index<br>Ref: IECC-4, IBC | <b>RESNET/ ICC 1450</b><br>Resilient Virtual Inspection for Energy and Water Performance in Buildings<br>(In Development)   | <b>ICC G5-2019</b><br>Guideline for the Safe Use of ISO Containers        | <b>ICC G7-202X</b><br>Existing Building Safety – Guideline for Inspection for Inspection<br>(In Development) |

In Development (light blue) | Published (dark blue)

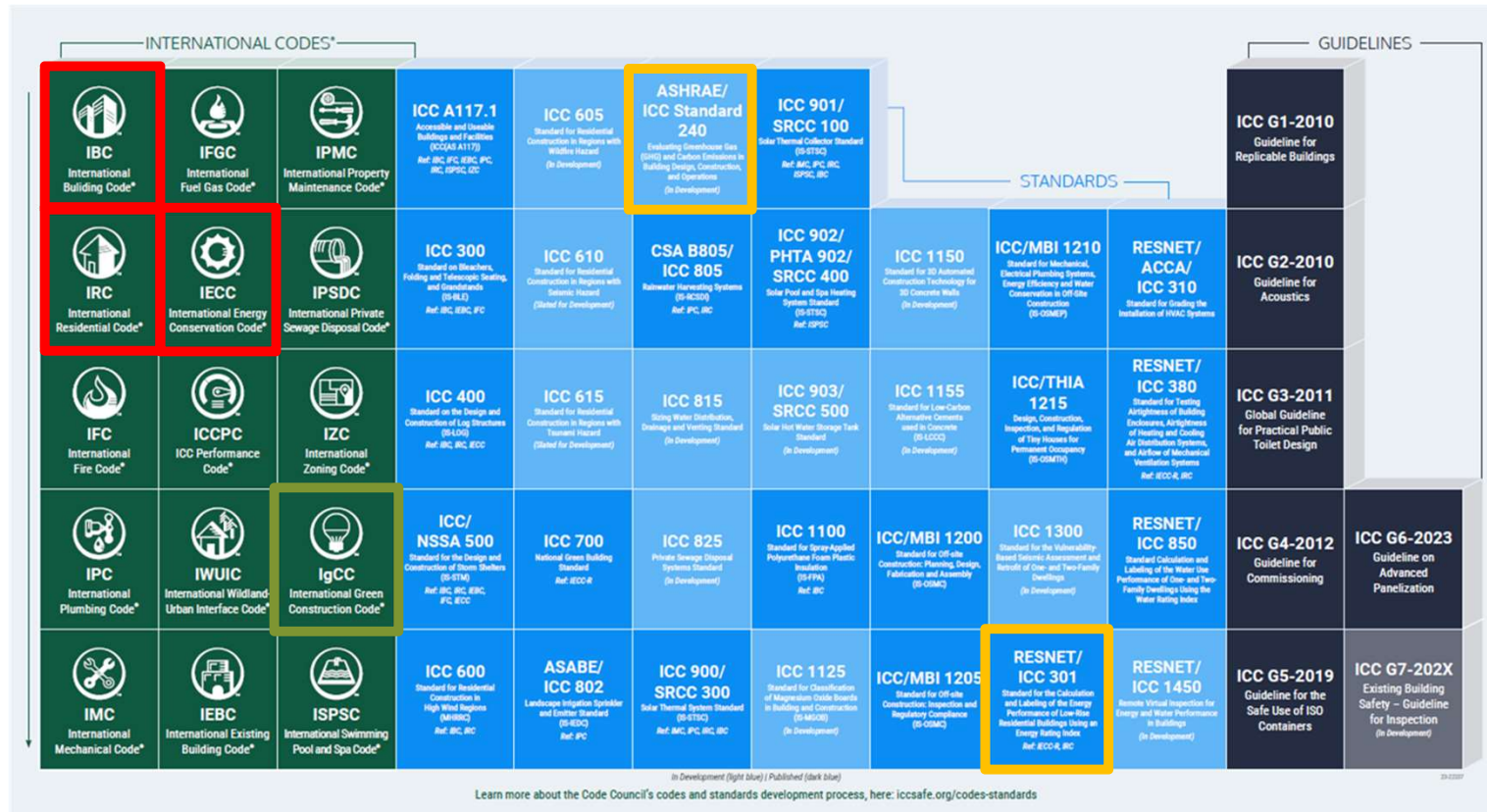
Learn more about the Code Council's codes and standards development process, here: [iccsafe.org/codes-standards](https://www.iccsafe.org/codes-standards)

Existing EC provision; updates pending

EC provision under development

Source:  
International Code Council

# Model Codes: The Existing Landscape



- Existing EC provision; updates pending
- EC provision under development
- Potential focus of future efforts

Source:  
International Code Council

# Why a RESNET standard?



LEVERAGE EXISTING  
MODELING DATA



# RESNET Sets Yearly Target of 1,000,000 Homes by 2028

## Raters Registered 436,798 Homes in 2024

<https://www.resnet.us/>

Trends in HERS® Rated Homes, 2024

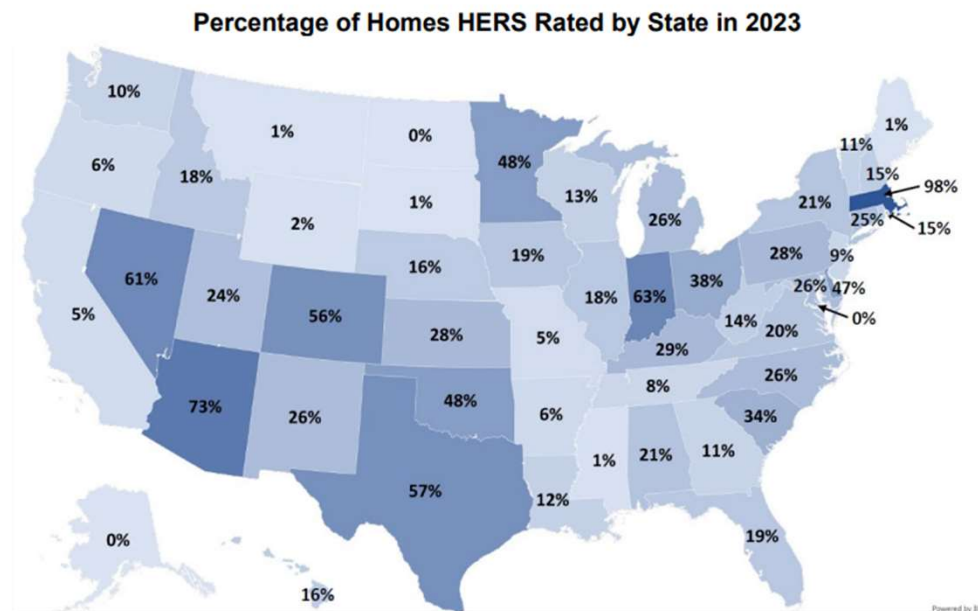


Figure 1. Percent of New Homes HERS Rated by State, 2023

[https://www.resnet.us/wp-content/uploads/RESNET\\_2024\\_HERSTrendsDataReport\\_FINAL.pdf](https://www.resnet.us/wp-content/uploads/RESNET_2024_HERSTrendsDataReport_FINAL.pdf)

# RESNET 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. ”

RMI – Energy. Transformed.



Dr. David Goldstein

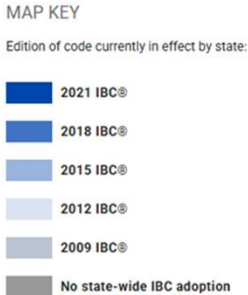
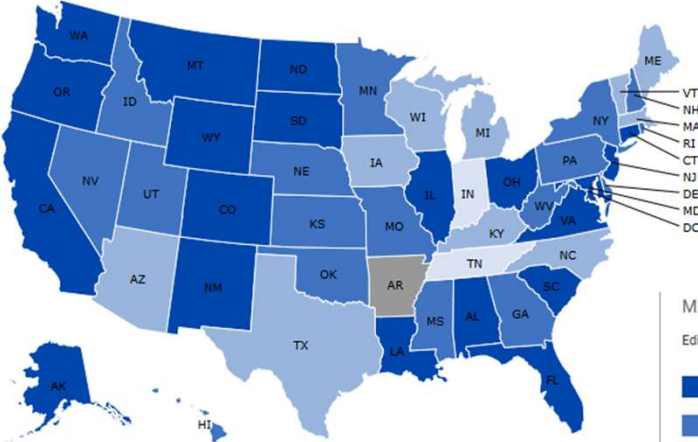
## RESNET/ICC 1580-202x

- Provide a **consistent methodology** for using long run marginal emission rates by **Cambium generation** and emission assessment (GEA) region in the **calculation of CO2e emissions**.
- Requirements on **how to estimate CO2e emissions** from measured data on electricity and fuel consumption of a **facility or organization**.
- For the purposes of complying with standards on **disclosure of emissions** and of reducing emissions year after year using an Energy Management System.

# Model Codes Adoption

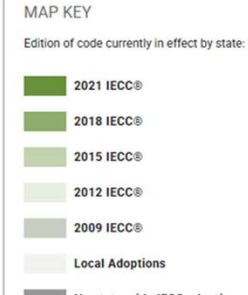
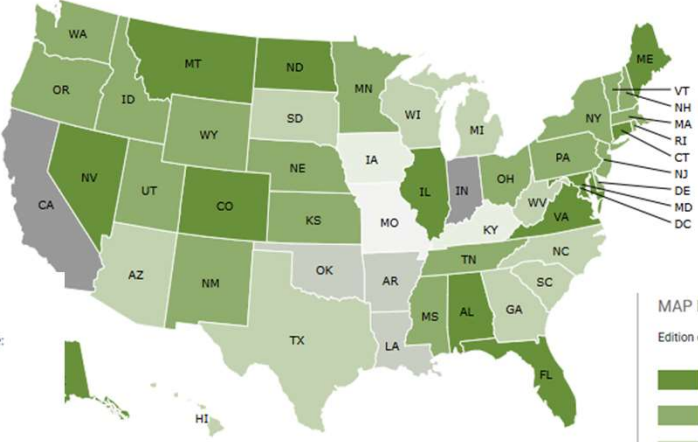
## INTERNATIONAL BUILDING CODE® (IBC®)

ADOPTION MAP



## INTERNATIONAL ENERGY CONSERVATION CODE® (IECC®)

ADOPTION MAP



Source: International Code Council

# NBI's IBC Effort



# Model Codes Adoption

**New appendix**  
for adoption by interested jurisdictions

## Product-level

Submit product-specific EPDs for covered products (concrete, steel, wood, glass, insulation) that indicate a % reduction in GWP compared to industry-average values

## Building-level

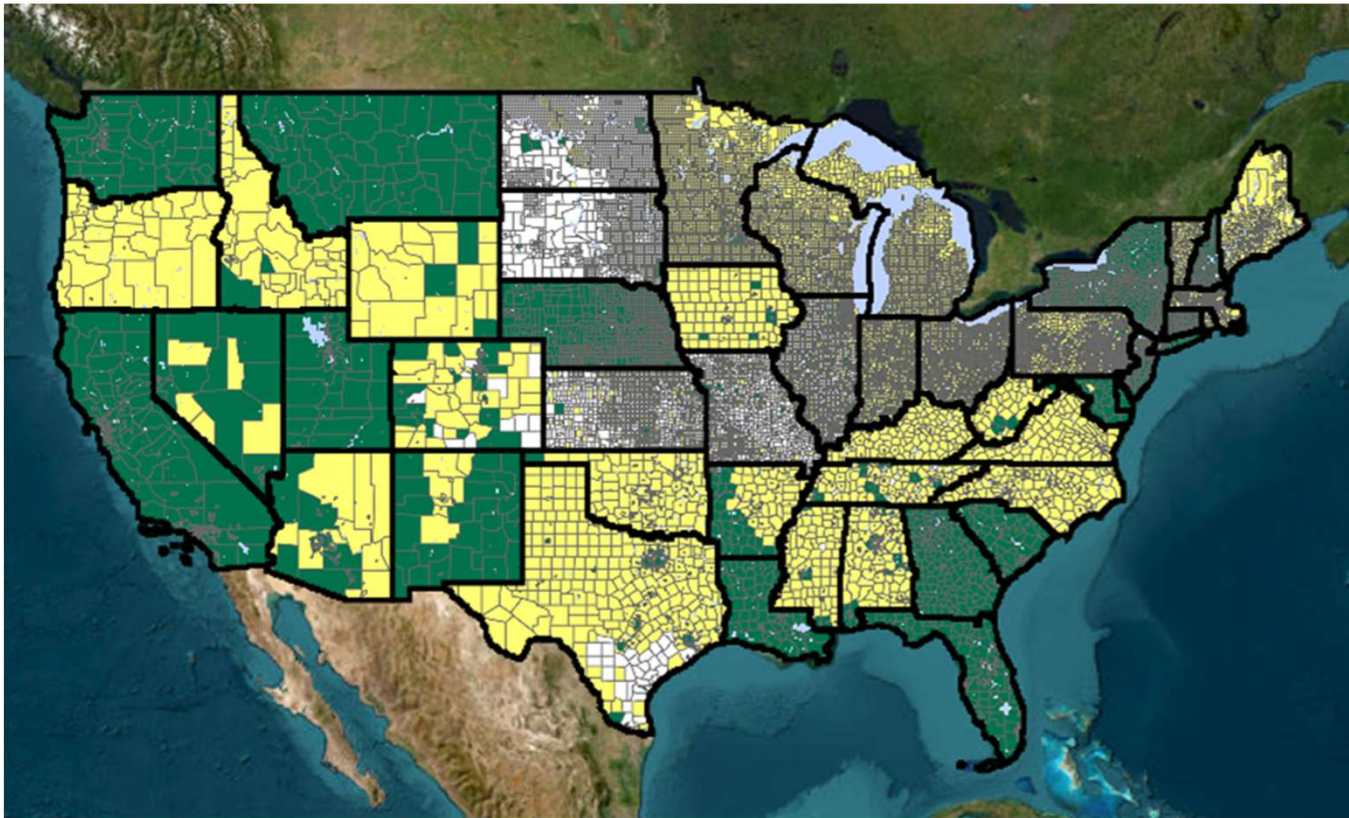
Submit a WBLCA for the building's structure and enclosure that indicates a % reduction in GWP compared to a baseline or compared to 500 kgCO<sub>2</sub>e/m<sup>2</sup>

## Incentivizing Building Reuse




Submit proof of reuse of at least 45% of existing building's structure and enclosure

# Why the IBC?

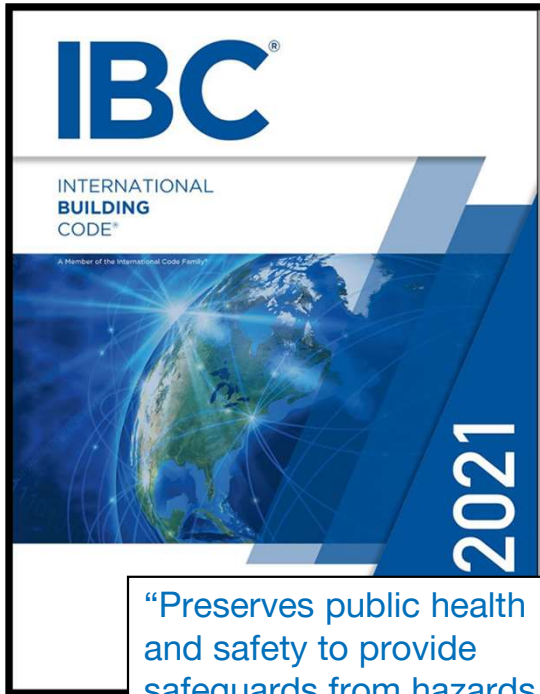
Source: FEMA  
Building Codes  
Adoption  
Tracker



## Combined Hazard Building Codes

-  No Building Code Data
-  Old or Weakened IBC/IRC, or No Code Adopted
-  2018 or later IBC & IRC

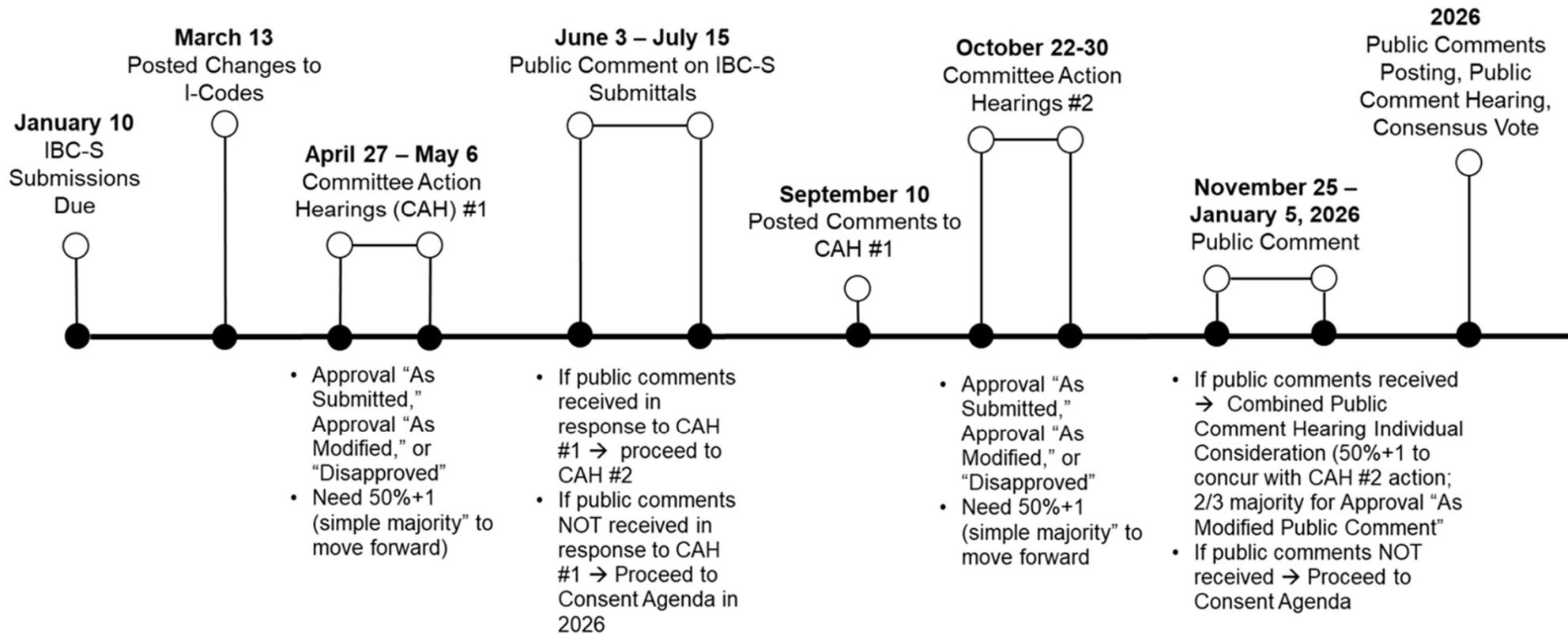
# Why the IBC?: Scope Compatibility



“Preserves public health and safety to provide safeguards from hazards associated with the built environment.”

|                          | Building Code                 | Residential Code | Mechanical Code                        | Plumbing Code                     | Electrical Code                         | Green Code                    | Energy Code |
|--------------------------|-------------------------------|------------------|--|-----------------------------------|---|-------------------------------|-------------|
| <b>Primary Systems</b>   |                               |                  |  |                                   |   |                               |             |
|                          | <b>Structure and envelope</b> | All              | Air supply, distribution, conditioning | Water supply, disposal, hot water | Electrical service, wiring, and systems | Site, Materials, Energy, IAQ, |             |
| <b>Materials Covered</b> |                               |                  |  |                                   |   |                               |             |
| Concrete                 | X                             | X                | X                                      | X                                 |   | X                             |             |
| Steel                    | X                             | X                | X                                      | X                                 |   |                               |             |
| Glass                    | X                             | X                |  |                                   |   |                               |             |
| Aluminum                 | X                             |                  | X                                      |                                   |   |                               |             |
| Wood                     | X                             | X                |  |                                   |   |                               |             |
| Copper                   |                               |                  | X                                      | X                                 | X                                       |                               |             |
| Plastic                  | X                             | X                | X                                      | X                                 |   |                               |             |
| Insulation               | X                             | X                | X                                      |                                   |   |                               |             |
| Refrigerants             |                               |                  | X                                      |                                   |   | X                             |             |

# 2025 IBC Timeline and Milestones



# **Interplay with Washington State Efforts**



*Washington  
State uses the  
IBC as its base.*



*Successes and  
lessons learned  
from Washington  
inform the IBC  
submission  
strategy*

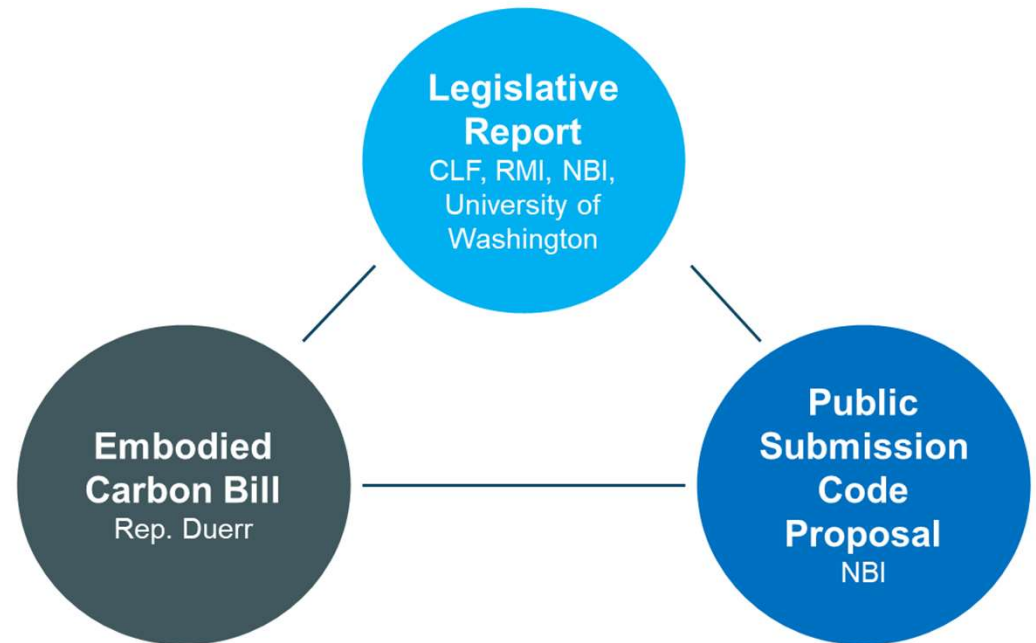
# Complementary Embodied Carbon Efforts in Washington State

**2024:**

## Washington Buy Clean Buy Fair Act

- Requires state projects to submit EPDs for major construction materials
- Directs the development of statewide database and clear guidelines for reporting

**Recent and Ongoing:**



# Context and Takeaways from Past and Ongoing Proposals

## Past Proposals:

- **Prescriptive only:** GWPs for concrete and steel, EPDs for some wood products

## Current Proposals:

- **3 pathway options:** prescriptive (material-level caps), performance (whole building LCA), or building reuse

## Takeaways:

- A successful code proposal will have a clear methodology for determining compliance.
- Sensitivity to ensuring no materials were treated preferentially.
- Most consensus around incorporating as new appendix. Other sections discussed include chapter 1, chapter 4, and a new chapter.
- General support from industry for the 3 pathway options.
- What constitutes the right GWP value for the state requires conversation with industry.



# Implementation

## **SECTION Q104**

### **DOCUMENTATION OF REDUCTION OF EMBODIED GHG EMISSIONS**

#### **Q104.1 Registered design professional.**

*A registered design professional shall prepare the construction documents and provide signature verifying compliance with the requirements of this appendix.*

#### **Q104.2 Amended construction documents for embodied GHG emissions.**

*Covered products shall be installed in accordance with the approved construction documents. Prior to the issuance of the certificate of occupancy, the registered design professional that submits documentation per Sections Q103.3, Q103.4, or Q103.5 shall ensure that as-built product selection matches the approved construction documents. If as-built products differ from those submitted on the approved construction documents, the registered design professional shall update the embodied GHG emissions calculations based on the updated procured products and attest that they are accurate to the best of the registered design professional's knowledge.*

# Massachusetts EC Landscape

**SENATE . . . . . No. 2967**

---

**The Commonwealth of Massachusetts**

\_\_\_\_\_  
**In the One Hundred and Ninety-Third General Court**  
**(2023-2024)**  
\_\_\_\_\_

An Act promoting a clean energy grid, advancing equity and protecting ratepayers.

19           “Environmental product declaration” or “EPD”, an independently verified and registered  
20       declaration that provides a life cycle assessment of a product’s global warming potential and  
21       facilitates a comparison of environmental impacts between products fulfilling the same function;  
22       provided, however, that such declaration shall be a Type III or higher as defined by the  
23       International Organization for Standardization (ISO), 14025:2006, or substantially similar life  
24       cycle assessment and comparative methodologies that have uniform standards in data collection  
25       and scientific integrity, and any pertinent product category rule developed in conformance with  
26       ISO 14025:2006.

# Massachusetts Carbon Matrix

Synergy across the State

## Government Leadership

From the Governor's office to the Building Officials

## DOER

Actionable Policy across Residential, Commercial & industrial

## Utilities

3-year plans in tight alignment with state policy -

## MASS Save

Performance Based Incentives

## Workforce Development

Weatherization, Energy Consultants, Builder Training

## Architects / Engineers / Designers

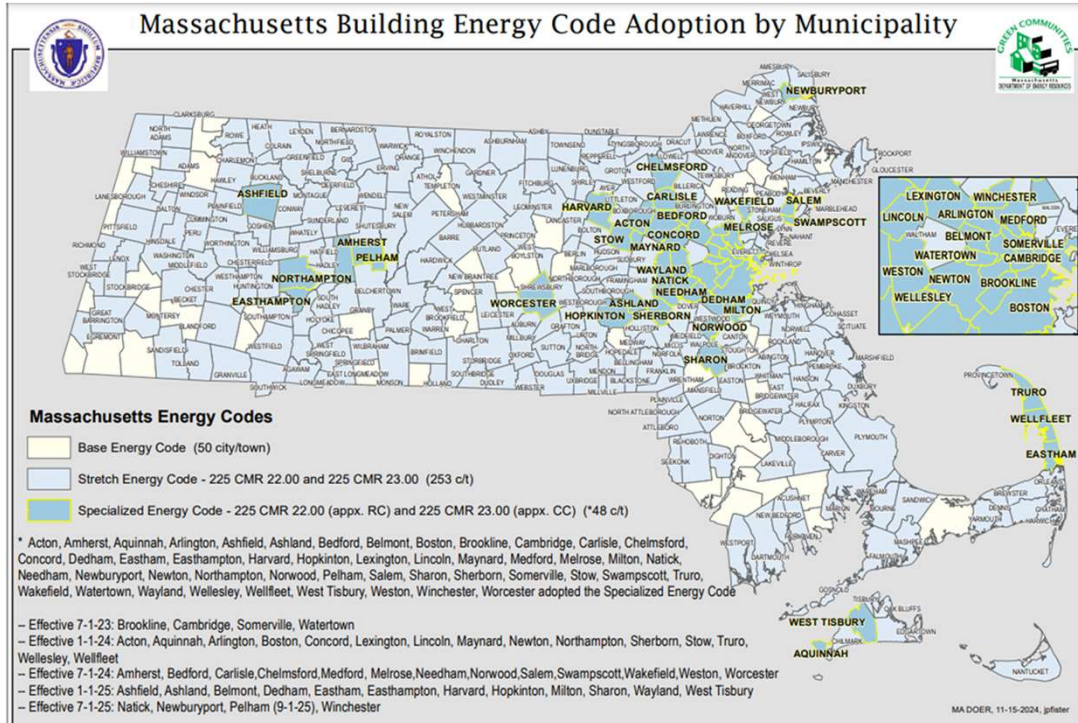
## HERS Raters

## MASS Clean Energy Center

Innovation through investment



# Massachusetts: The Test Kitchen

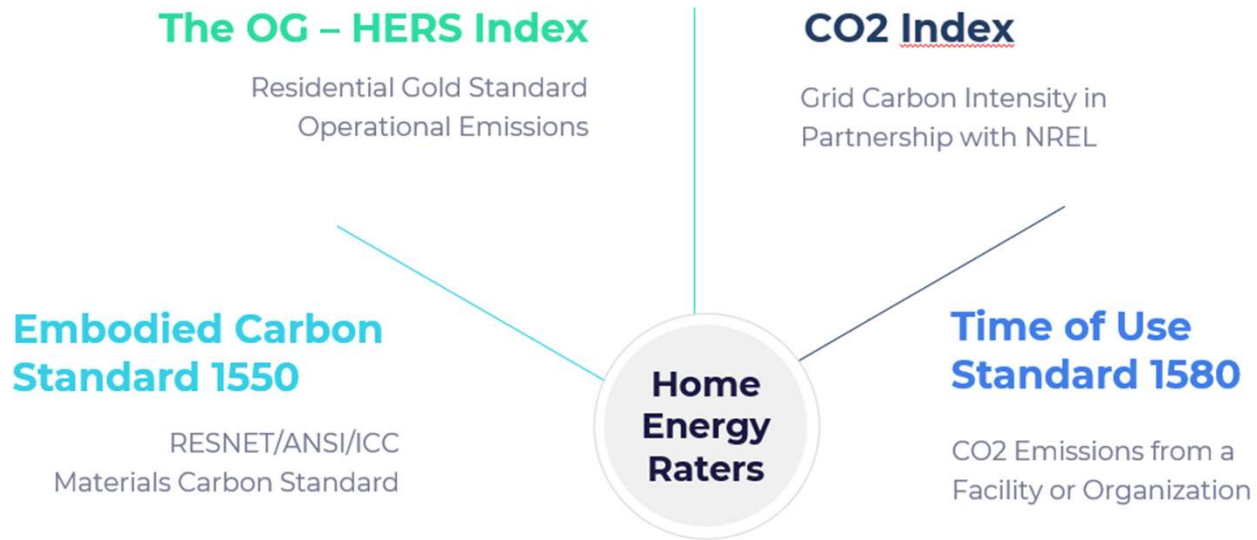


<https://www.mass.gov/doc/building-energy-code-adoption-by-municipality/download>

[https://www.instagram.com/officialmassierraclub/p/DCXT6jayBO-/?img\\_index=1](https://www.instagram.com/officialmassierraclub/p/DCXT6jayBO-/?img_index=1)

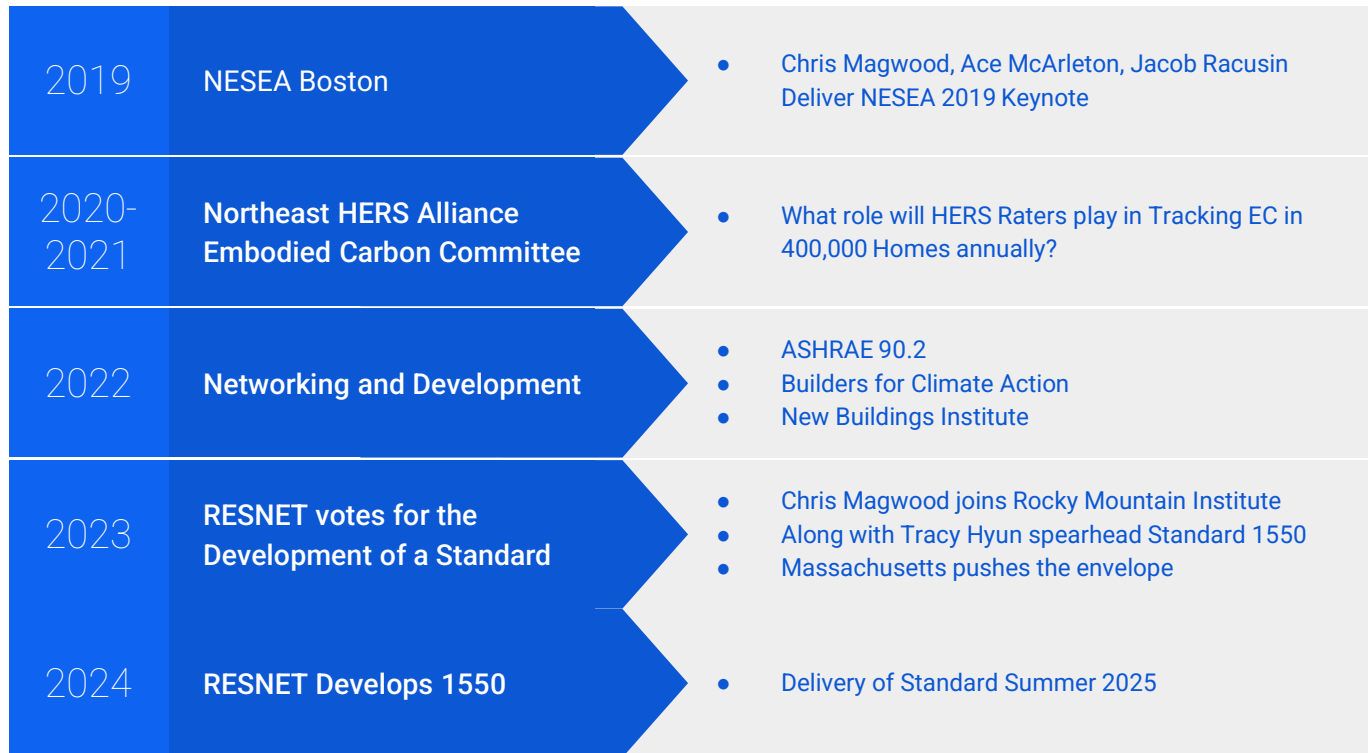
# The RESNET Ecosystem

The Trifecta + 1



## What does the next decade hold for the Rating Industry?

# Residential Embodied Carbon Developments: A Timeline



# MA DOER - Residential Stretch Code Effective 2/14/2025

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

| Clean Energy Application   | Maximum HERS Index score <sup>a,b</sup>         |   |   |                          |   |
|--|---|---|---|--------------------------|---|
|  | <del>New construction until June 30, 2024</del> | New construction permits after July 1, 2024 | New Construction with R406.5.2 embodied carbon credit | Accessory Dwelling Units | Major alterations, additions, or change of use <sup>c</sup> |
| <i>Mixed-Fuel Building</i>   | <del>52</del>                                   | 42  | 45  | 52                       | <del>52</del> 65  |
| Solar Electric Generation  | <del>55</del>                                   | 42  | 45  | 55                       | <del>55</del> 70  |
| <i>All-Electric Building</i>   | <del>55</del>                                   | 45  | 48  | 55                       | <del>55</del> 70  |
| Solar Electric & <del>All-Electric Building</del> <i>All-Electric Building</i> | <del>58</del>                                   | 45  | 48  | 58                       | <del>58</del> 75  |

<sup>a</sup> Maximum HERS rating prior to onsite renewable electric generation in accordance with Section R406.5



# Embodied Carbon Credit

## R406.5.2 Add Subsection R406.5.2

### 1. Insulation embodied carbon credit:

- Up to 3 HERS points off for low carbon insulation
- Leverages a state of VT GWP chart of materials

### 2. Low GWP concrete mix credit:

- Up to 3 HERS points off for GWP reduction from regional baseline

<https://www.mass.gov/doc/fall-2024-stretch-specialized-code-residential-redlines-full/download>

---

# MA DOER - Commercial Stretch Code Effective 2/14/2025

For prescriptive projects, embodied carbon is now an option to earn 8 credits in Section C406, with C406.14 for concrete and Section C406.15 for insulation.

- **C406.14 for concrete:**
  - **Your average Concrete Mix is lower than the regional average or not**
- **C406.15 for insulation**
  - **The building shell is either negative carbon (carbon storing) or not**



The Massachusetts 2025-2027  
Energy Efficiency and Decarbonization Plan

***Enhancement #6: Include an embodied carbon reduction component***

Embodied carbon is a term for GHG emissions released during upstream stages of a product's life cycle. Those stages typically include extraction, production, transport, and manufacturing. As new buildings become more energy efficient, embodied carbon will represent a growing share of total building emissions. According to Architecture 2030, embodied carbon is on track to represent most carbon emissions from new buildings and infrastructure between now and 2030.<sup>122</sup>

**1. Collaborate with the Massachusetts Clean Energy Center to increase workforce diversity, doubling annual funding to \$24 million per year**

# Massachusetts Carbon Matrix

Synergy across the State

## Government Leadership

From the Governor's office to the Building Officials

## DOER

Actionable Policy across Residential, Commercial & industrial

## Utilities

3-year plans in tight alignment with state policy -

## MASS Save

Performance Based Incentives

## Workforce Development

Weatherization, Energy Consultants, Builder Training

## Architects / Engineers / Designers

## HERS Raters

## MASS Clean Energy Center

Innovation through investment



# How to Get Low Emissions Concrete

- 1. Find Ready-Mix partner **EXPERIENCED** in:
  - Environmental Product Declarations (EPDs)
  - Supplying better than NRMCA Eastern benchmark



MA Ready-Mix Concrete Plants with EPD Capability via MassCEC grant

- 1. Set performance based specification **EARLY** and engage ready-mix partner **EARLY**



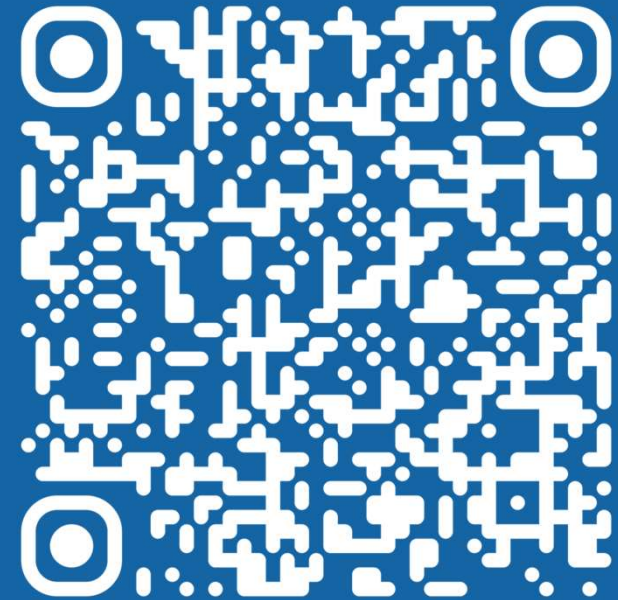


# EMBODIED CARBON REDUCTION CHALLENGE

LEARN 7 STRATEGIES



SEE 16 CASE STUDIES



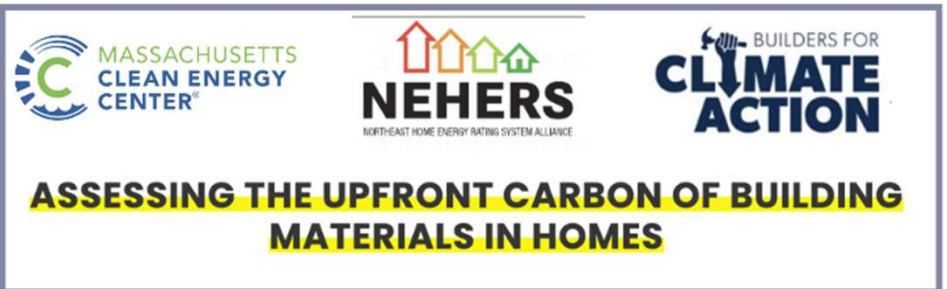
# 100-Homes Study

# Software workflow



## Software connectivity


- Prototype of connectivity between HERS and embodied carbon software in MA



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



# On the Precipice of Carbon Reporting at Scale



| Carbon Index                          | HERS® Index | About these ratings:   | Home:   |
|---------------------------------------|-------------|--|---|
| <b>59</b>                             | <b>52</b>   | Both ratings are relative performance scores. A lower Carbon Rating Index means fewer carbon emissions for a home. The lower the HERS Rating, the more energy efficient the home. For more info: <a href="http://www.resnet.us/about/resnet-carbon-rating-index">www.resnet.us/about/resnet-carbon-rating-index</a> <a href="http://www.hers.com">www.hers.com</a> | 151 S<br>Nantux<br>Builde<br>Steve  |
| CO <sub>2</sub> e Emissions [tons/yr] |             | Annual Cost  | <b>Annual Savings*</b><br><b>8.0 Tons CO<sub>2</sub>e</b><br><b>\$7,327</b><br><small>*Relative to an average U.S. home</small> |
| Heating                               | 2.5         | \$2,227  |   |
| Cooling                               | 0.0         | \$14   |   |
| Hot Water                             | 0.8         | \$505  |   |
| Lights/Appliances                     | 2.9         | \$2,627  |   |
| Service Charges                       |             | \$122  |   |
| Generation (e.g. Solar)               | 0.0         | \$0  |   |
| <b>Total:</b>                         | <b>6.2</b>  | <b>\$5,495</b>   |   |

5.62 kgCO<sub>2</sub>e/yr



|                     |                                  |
|---------------------|----------------------------------|
| Footings & Slabs    | 18,558 kg CO <sub>2</sub> e      |
| Foundation Walls    | 24,513 kg CO <sub>2</sub> e      |
| Structural Elements | 1,896 kg CO <sub>2</sub> e       |
| Exterior Walls      | 3,579 kg CO <sub>2</sub> e       |
| Party Walls         | 0 kg CO <sub>2</sub> e           |
| Cladding            | 1,427 kg CO <sub>2</sub> e       |
| Windows             | 6,113 kg CO <sub>2</sub> e       |
| Interior Walls      | 3,913 kg CO <sub>2</sub> e       |
| Floors              | 7,827 kg CO <sub>2</sub> e       |
| Ceilings            | 1,956 kg CO <sub>2</sub> e       |
| Roof                | 4,784 kg CO <sub>2</sub> e       |
| Garage              | 0 kg CO <sub>2</sub> e           |
| <b>NET TOTAL</b>    | <b>74,566 kg CO<sub>2</sub>e</b> |

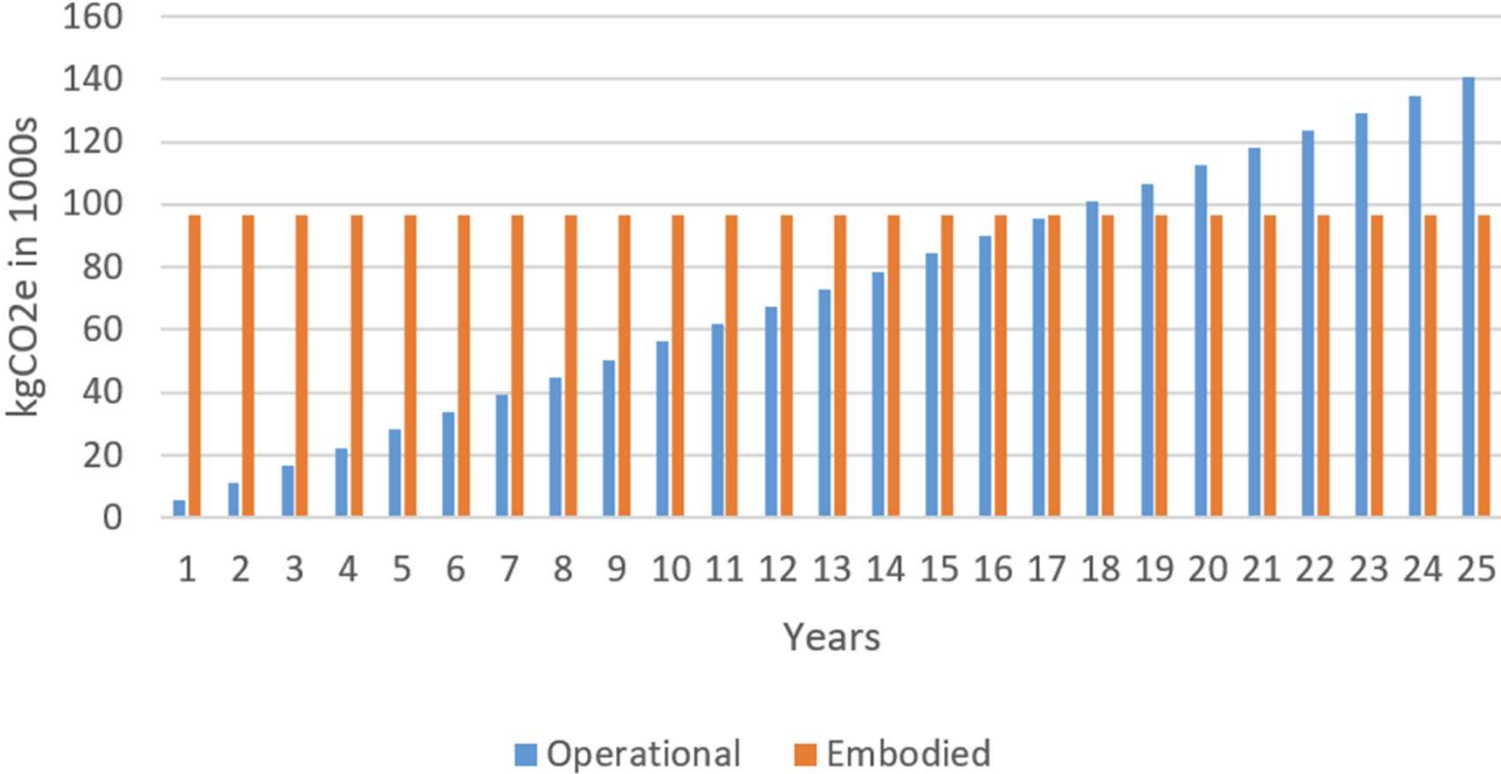
74,566 kgCO<sub>2</sub>e

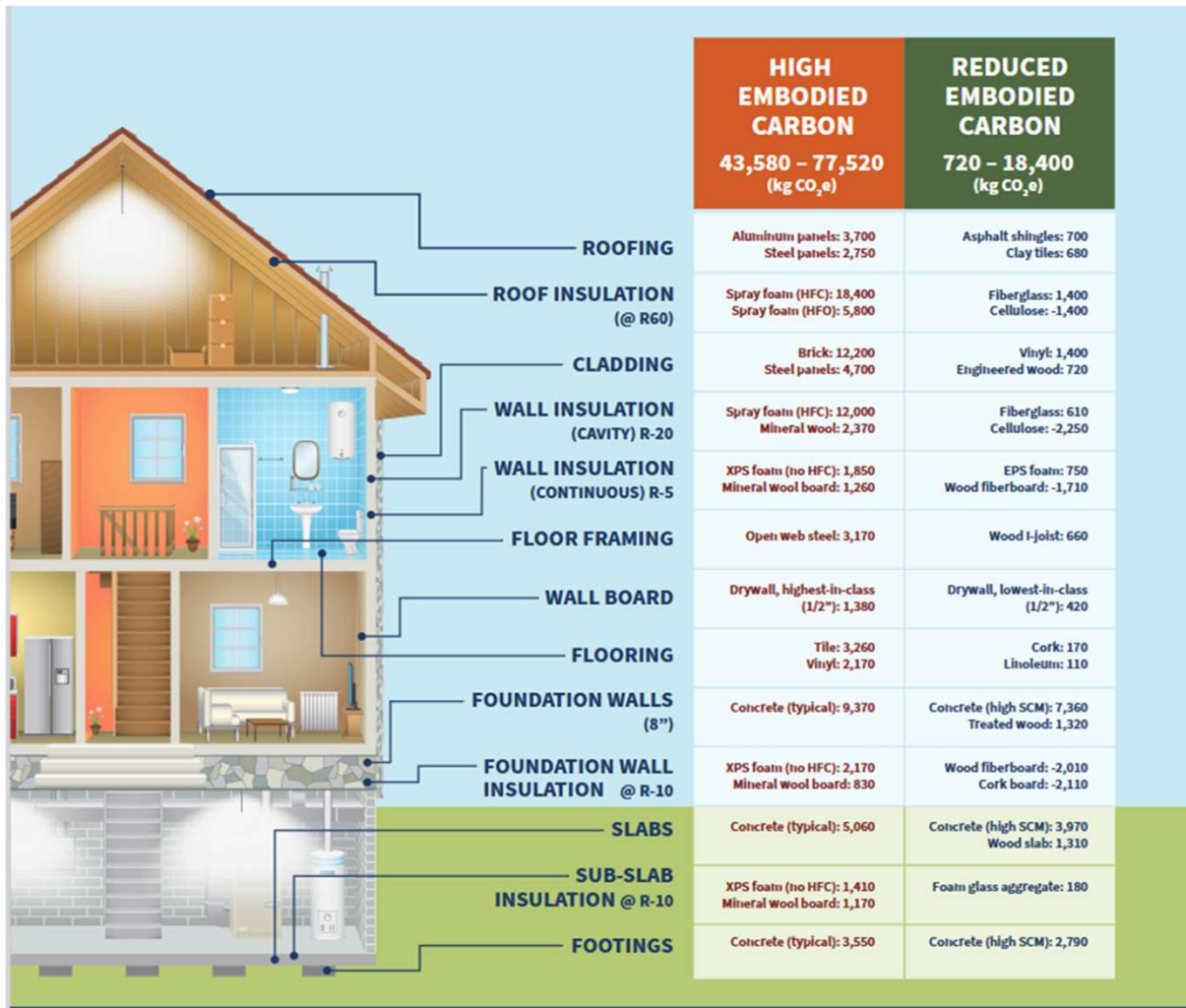
## Ekotrope-BEAM INTEGRATION WORKSHEET (BETA) STEP 4.1 - MEP :

|            |        |
|------------|--------|
| Electrical | 2,123  |
| Plumbing   | 4,070  |
| HVAC       | 16,048 |

22,241 kgCO<sub>2</sub>e

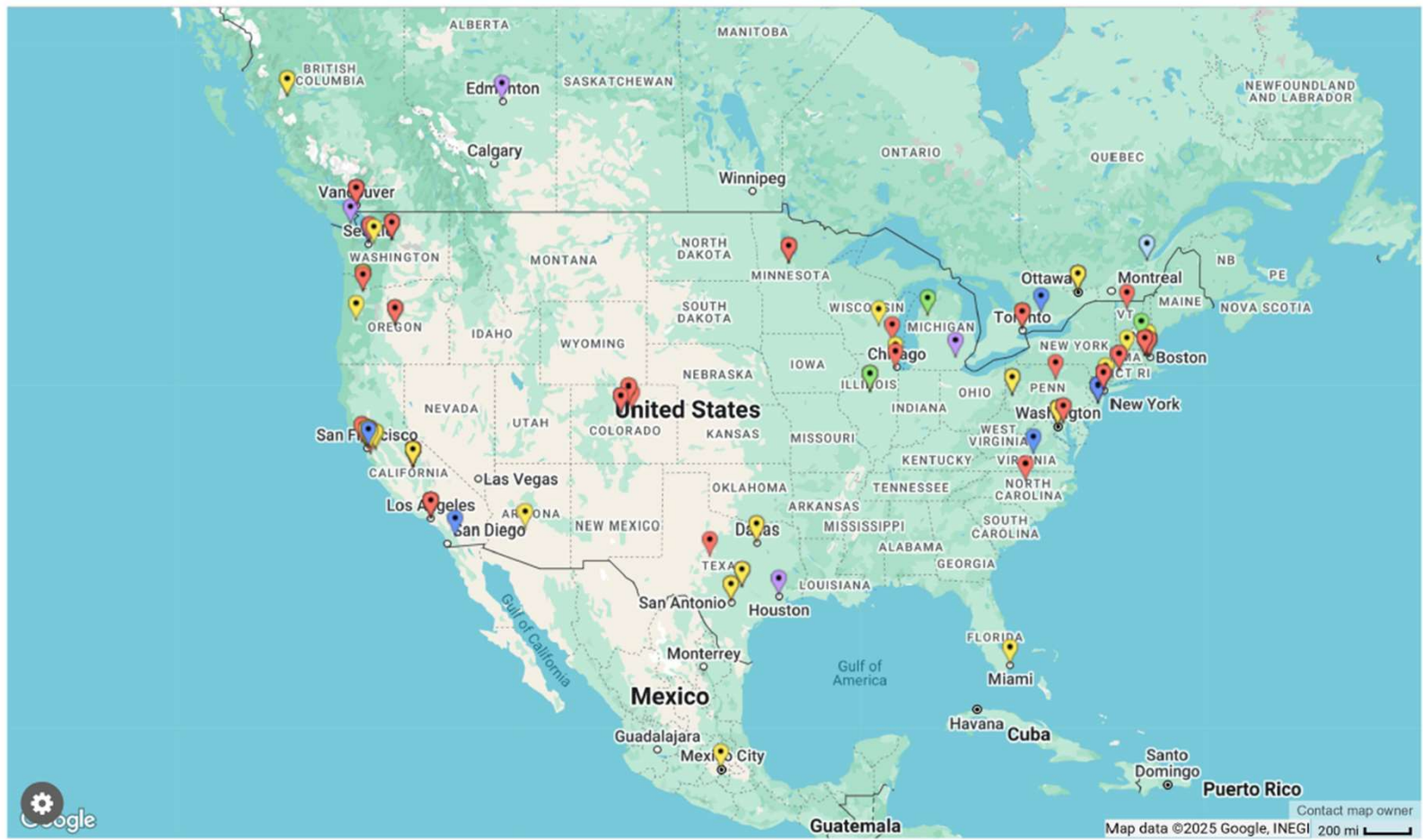
# Emissions over 25 Years



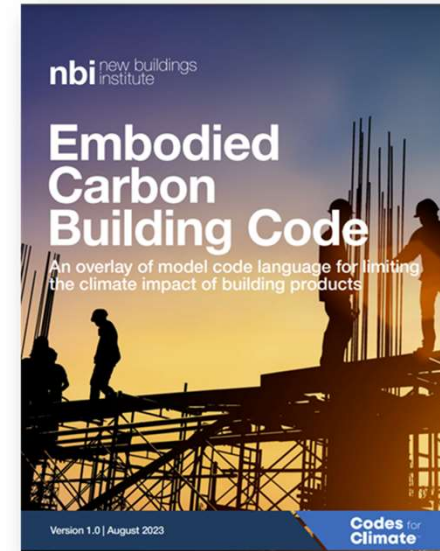
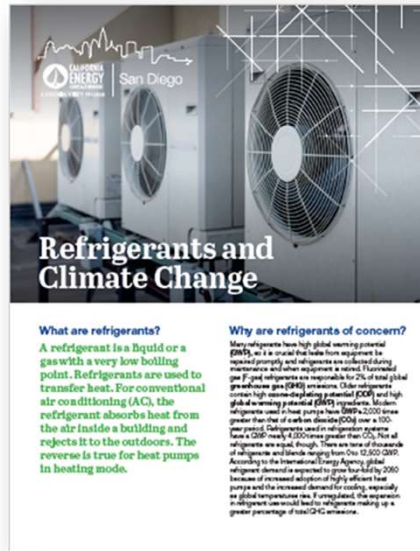


Source:  
HomebuildersCAN

# What's Next?



# For More Information:



For information or to get involved in code efforts:  
[ariel@newbuildings.org](mailto:ariel@newbuildings.org)

For a copy of the 100 Homes Study:  
[andyb@stephensandcoinc.com](mailto:andyb@stephensandcoinc.com)

# Questions and Discussion

**For information or to get involved in code efforts:**

[ariel@newbuildings.org](mailto:ariel@newbuildings.org)

**For a copy of the 100 Homes Study:**

[andyb@stephensandcoinc.com](mailto:andyb@stephensandcoinc.com)

# Thank You!