

# Building Materials

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## Impacts and Opportunities

*EESI*

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12/8/21

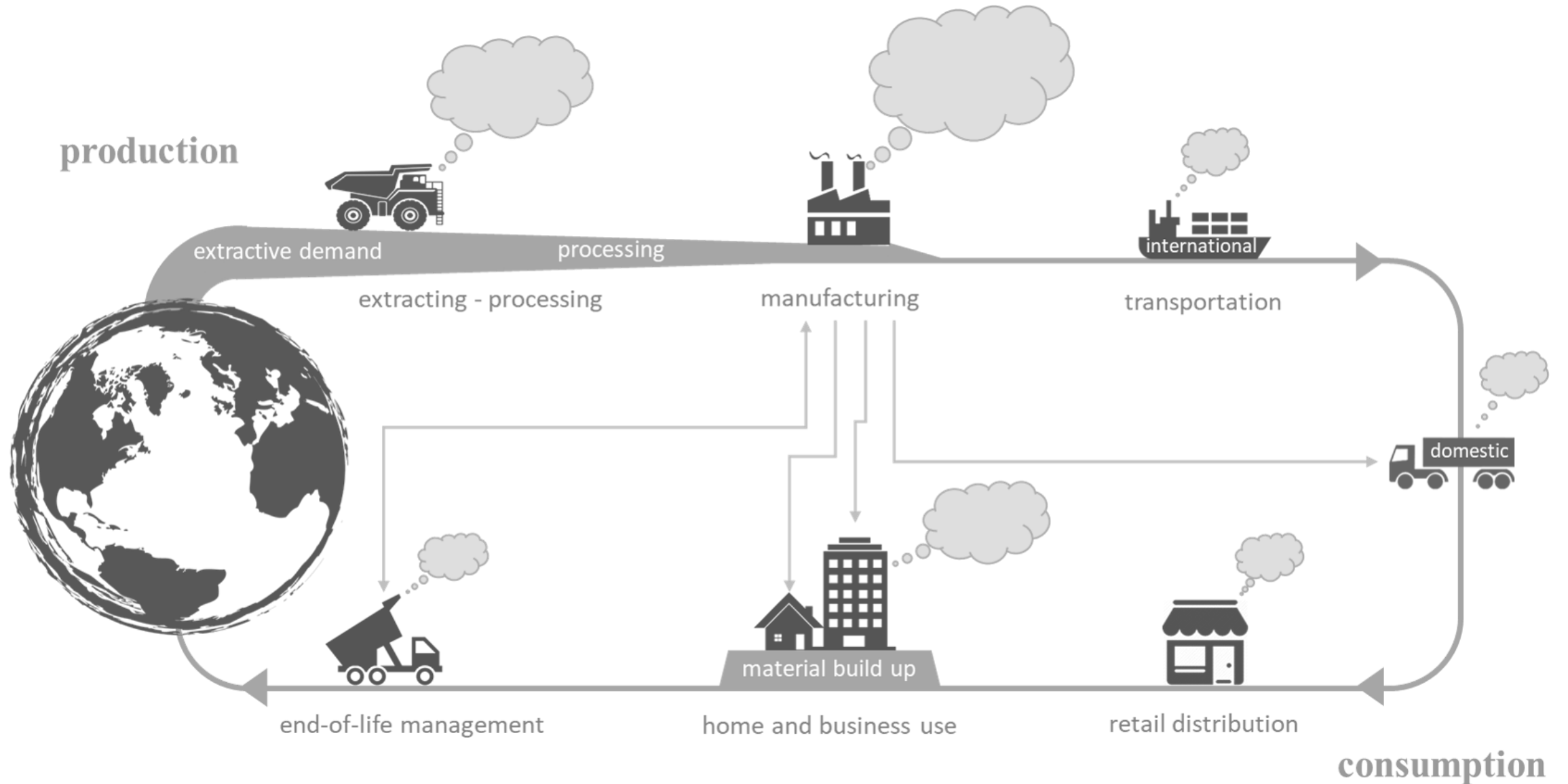
# Outline

1. Carbon impacts of building materials
2. Short term – carbon reduction opportunities
3. Long term – moving towards circular building material sector

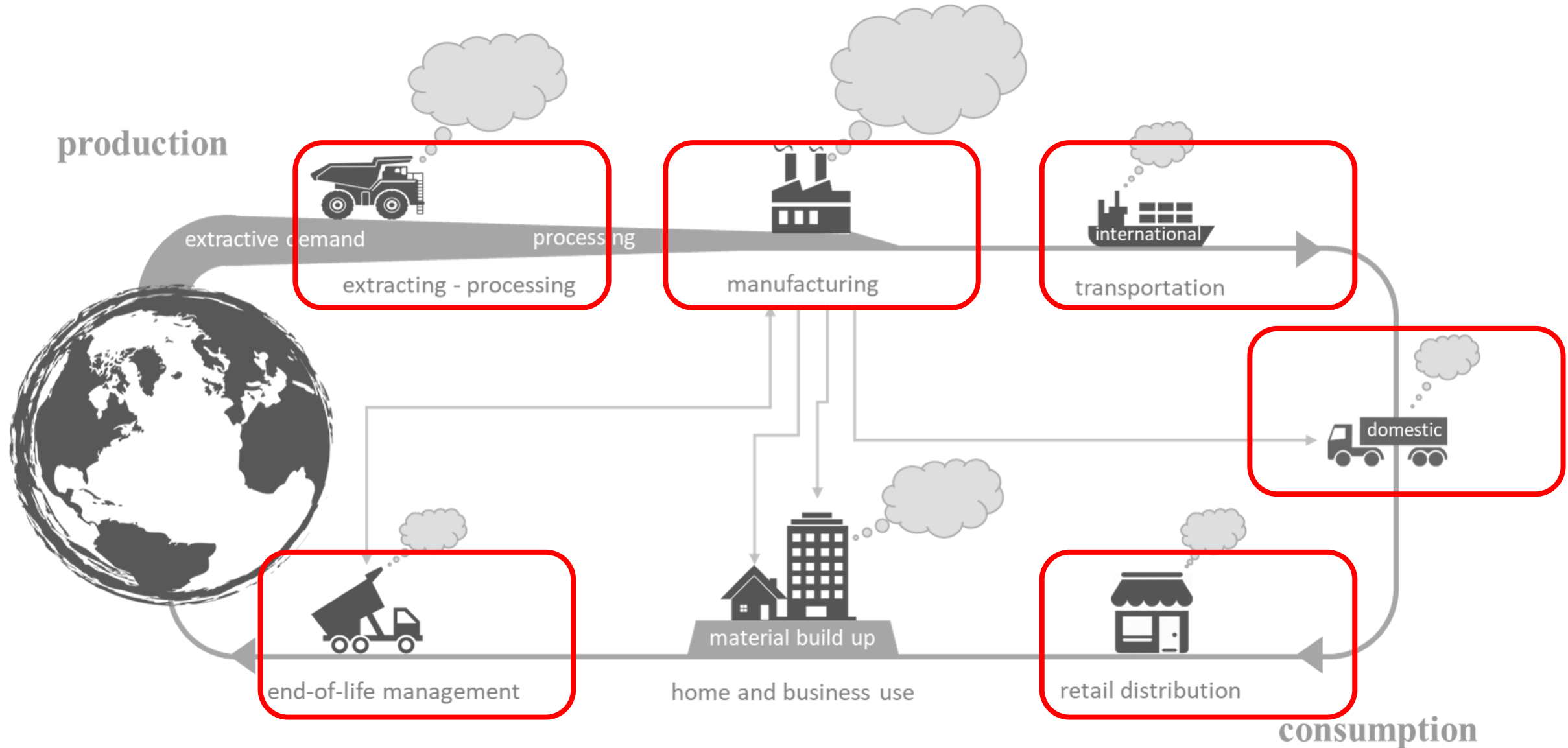


Carbon impacts of building materials

# Product lifecycle

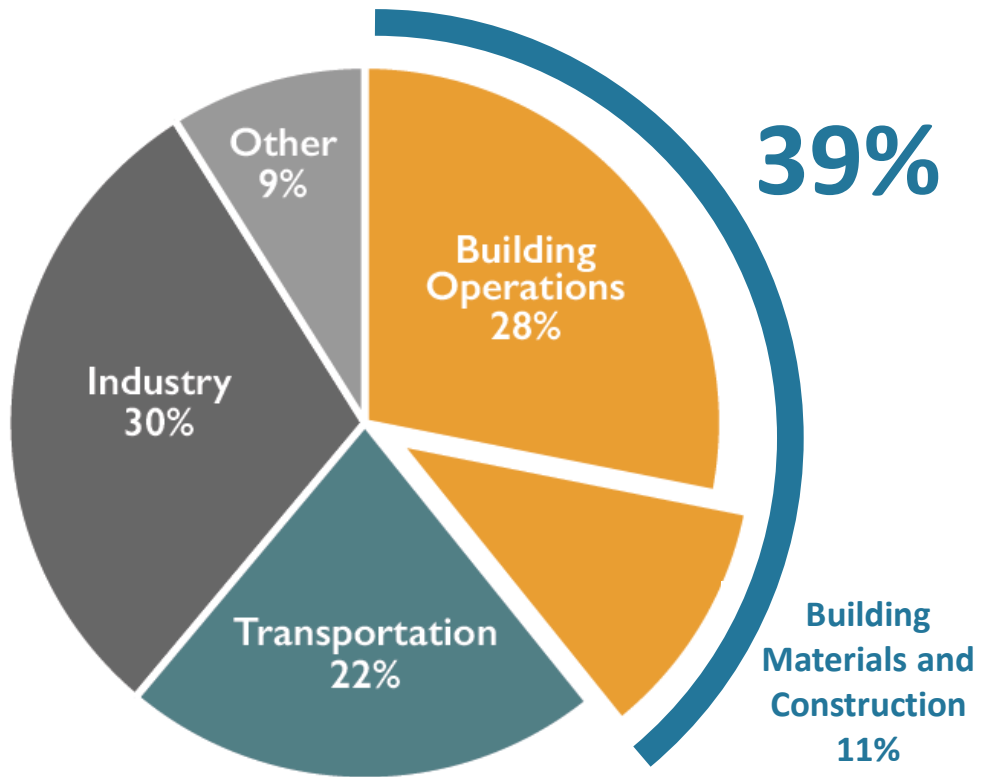


# Product lifecycle – embodied carbon focus areas

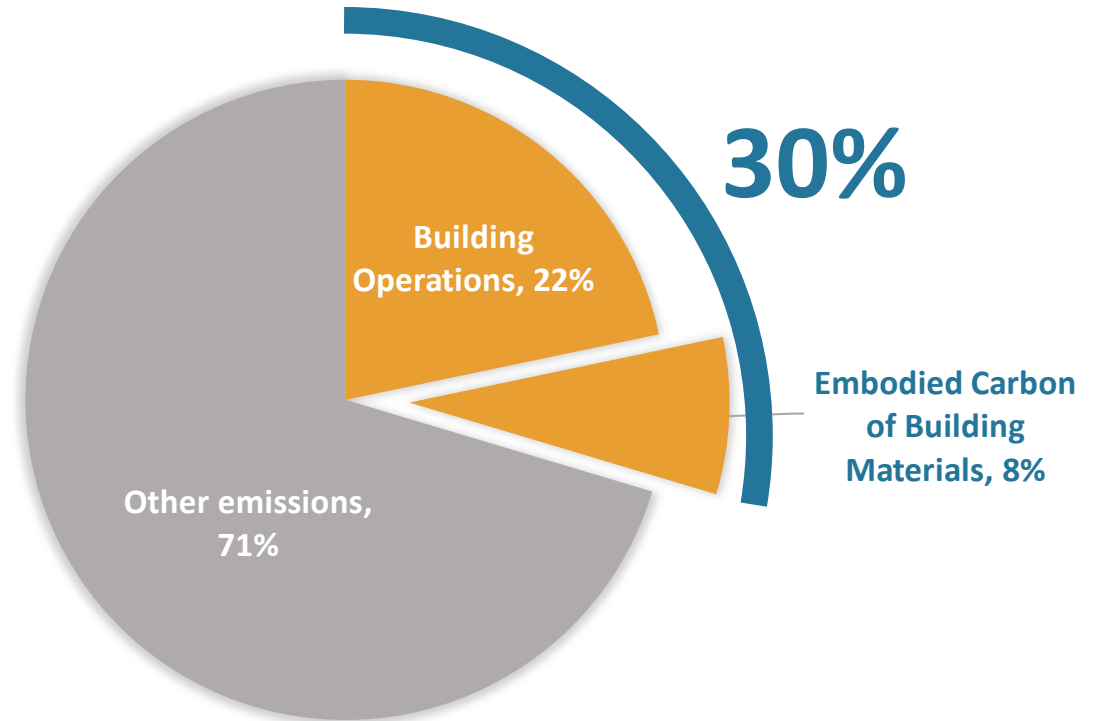


# CO2 emissions

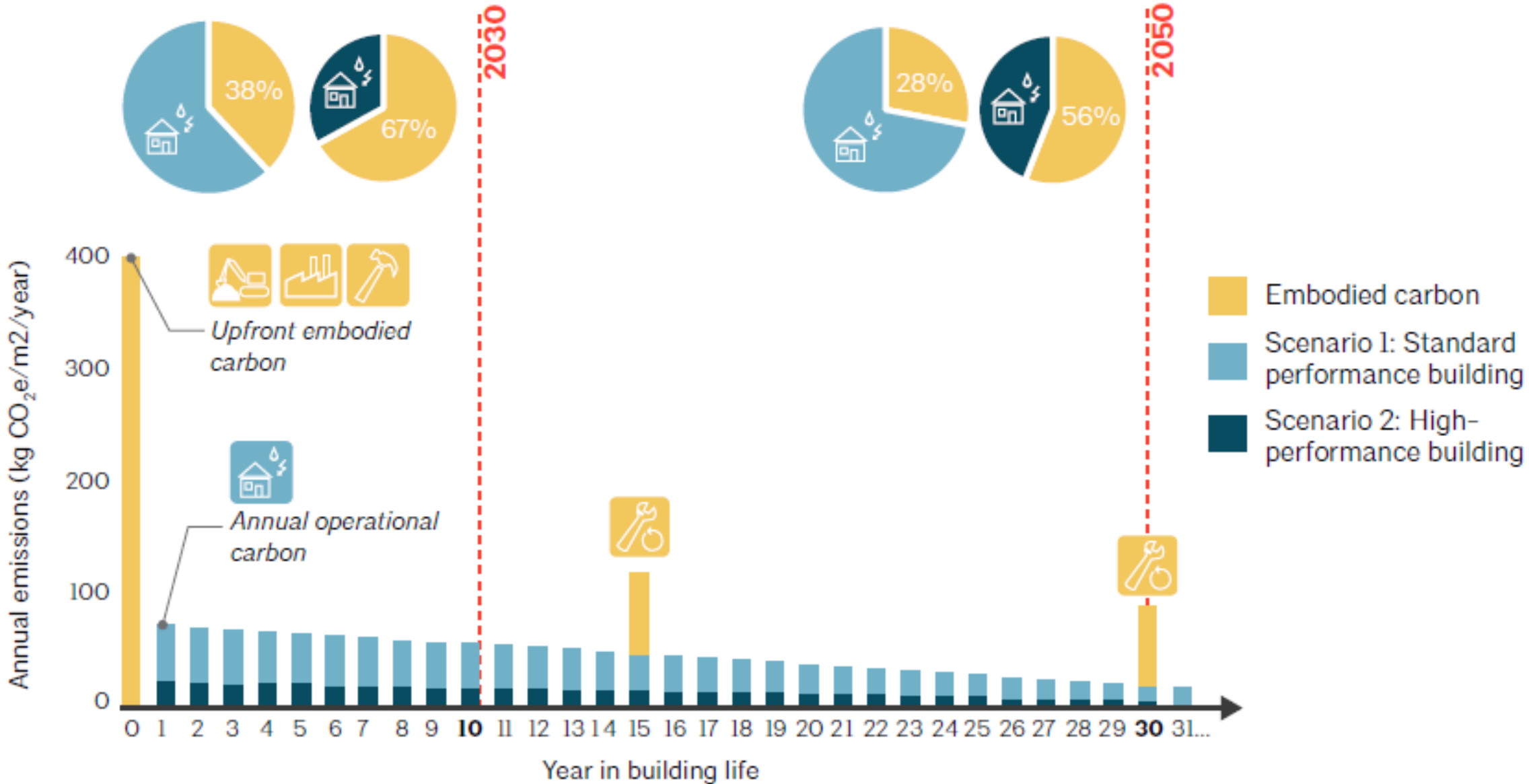
## Global



## Oregon consumption-based



# Embodied vs. Operational Carbon



Source: AIA / CLF Embodied Carbon Toolkit

# Strategies to reduce embodied carbon

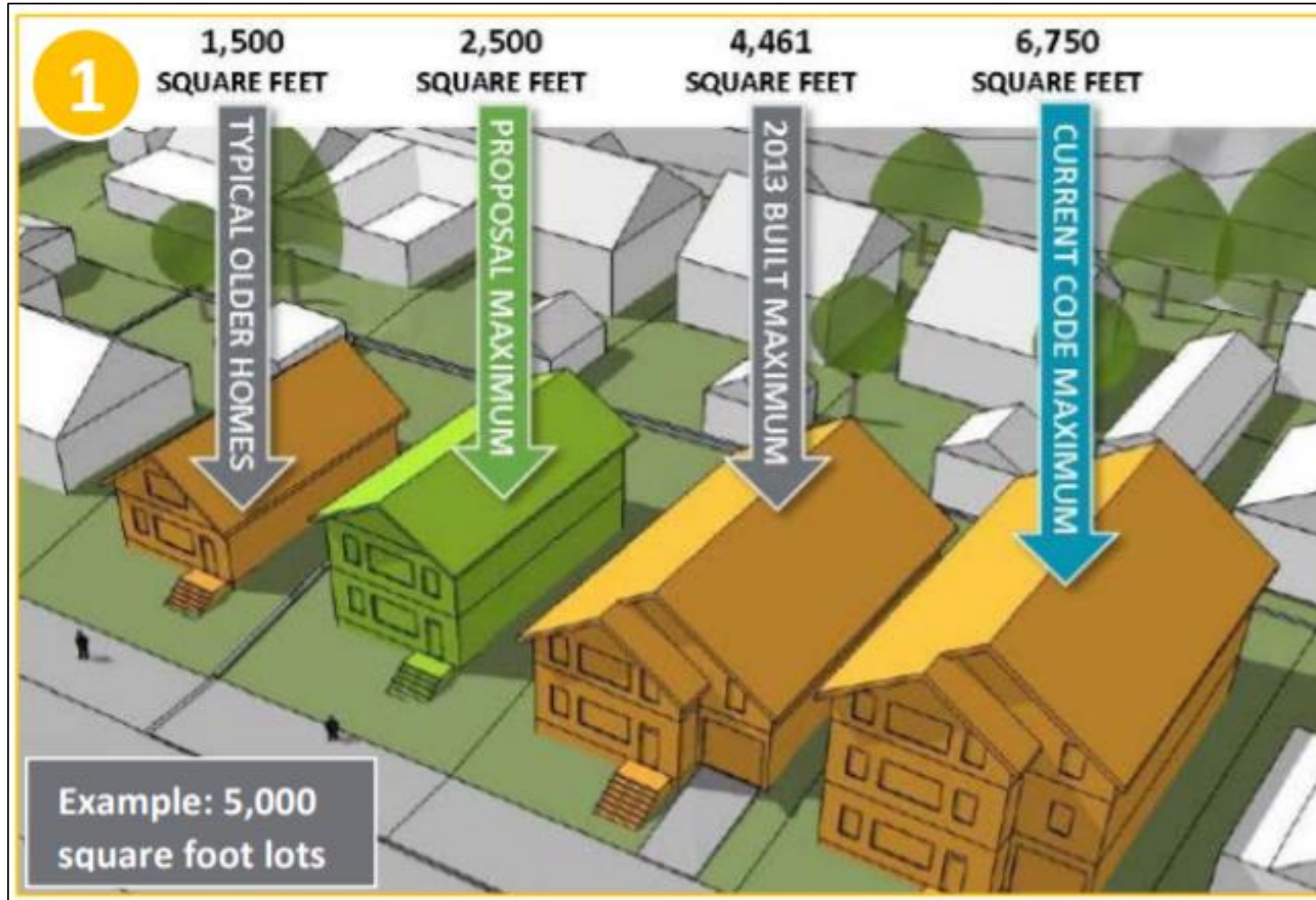
- Build less
- Reuse existing buildings
- Build smaller
  - occupancy matters
- Reuse materials
- Optimize building
  - whole building LCA
- Optimize materials
  - EPDs
  - other certifications
- Minimize waste
- Recover waste





Reduction strategies – short term

# City of Portland - Zoning Code



# Vancouver, BC – whole building LCA requirement

## Policy

- Requires reporting of embodied emissions for all rezoned buildings
- Equivalent annual embodied emissions values must be reported alongside operational emissions in kgCO<sub>2</sub>e/m<sup>2</sup>/year
- Data collected by city to understand scale of embodied emissions



# City of Portland – Deconstruction requirement



# Environmental Product Declarations (EPDs) for public purchasing

**BUY**   
**CLEAN**



## Other State Efforts:

- Oregon
- New York
- Washington
- Minnesota

## Federal Efforts:

- Buy clean Procurement Requirements

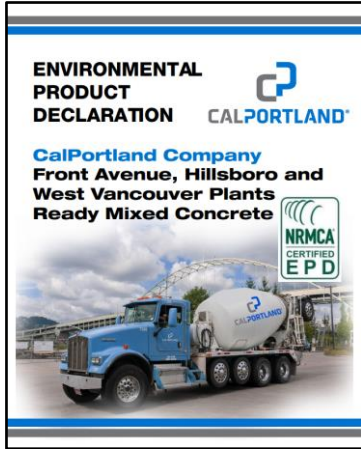
# What is an Environmental Product Declarations (EPD)?

- Disclosure label that reports the environmental impacts of products
- Typically include impacts of raw material extraction, transportation, and manufacturing
- Third party certified against ISO standards

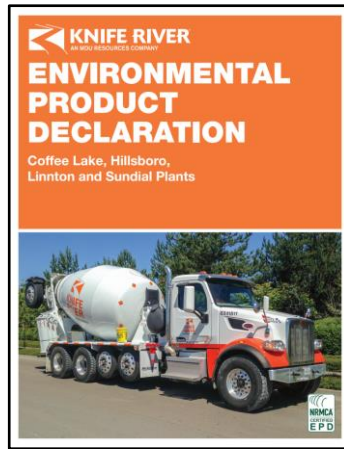
<b>ENVIRONMENTAL IMPACTS</b>	
<b>Declared Product:</b> Mix 45SS420A • Bend Plant Exterior SOG Compressive strength: 4000 PSI at 28 days	
<b>Declared Unit:</b> 1 m <sup>3</sup> of concrete	
<b>Global Warming Potential (kg CO<sub>2</sub>-eq)</b>	<b>387</b>
<b>Ozone Depletion Potential (kg CFC-11-eq)</b>	<b>9.8E-6</b>
<b>Acidification Potential (kg SO<sub>2</sub>-eq)</b>	<b>2.42</b>
<b>Eutrophication Potential (kg N-eq)</b>	<b>0.47</b>
<b>Photochemical Ozone Creation Potential (kg O<sub>3</sub>-eq)</b>	<b>58.0</b>
<b>Abiotic Depletion, non-fossil (kg Sb-eq)</b>	<b>1.2E-6</b>
<b>Abiotic Depletion, fossil (MJ)</b>	<b>1,229</b>
<b>Total Waste Disposed (kg)</b>	<b>2.76</b>
<b>Consumption of Freshwater (m<sup>3</sup>)</b>	<b>2.89</b>
<b>Product Components:</b> natural aggregate (ASTM C33), Portland cement (ASTM C150), batch water (ASTM C1602), slag cement (ASTM C989), admixture (ASTM C260)	

Additional detail and impacts are reported on page three of this EPD

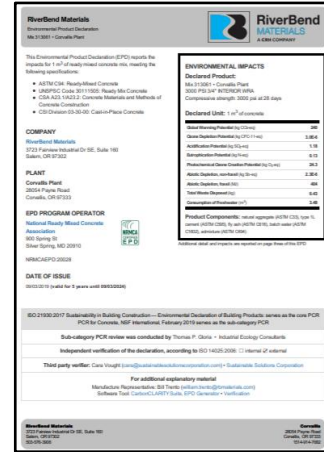
# Oregon Concrete EPDs



CalPortland



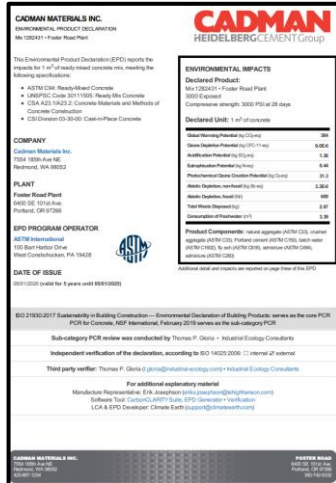
Knife River



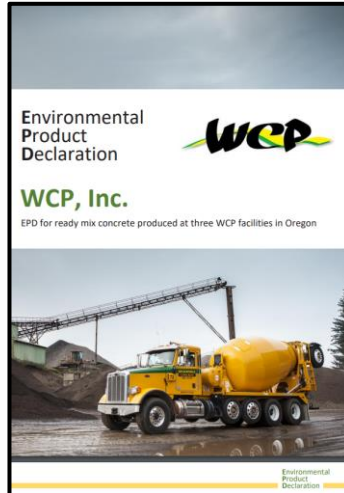
RiverBend



Hooker Creek



Cadman



Wilsonville

## Program stats:

- 10 companies
- 21 central batch plants
- 4 mobile mix plants
- Over 1500 EPDs produced

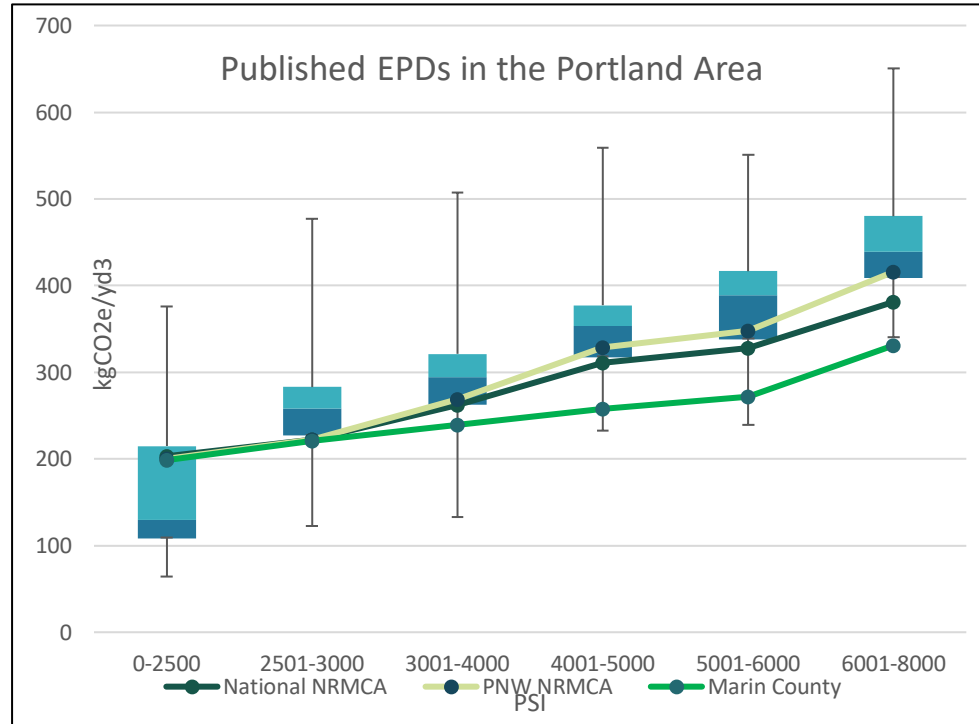
# City of Portland Concrete Procurement Policy



- Jan 1, 2020
  - EPDs required on all City projects
- Jan 1, 2022
  - City publishes GWP threshold
- ~ June 1, 2022
  - All EPDs must be below threshold



# Concrete – policy + pilots



## 2020 Low Carbon Concrete Sidewalk Pilot

This case study provides information on the City of Portland's first round of low-carbon concrete pilot projects, featuring sidewalk ramps within the City's Bureau of Transportation.

October 2020



# Additional City of Portland Pilot Projects



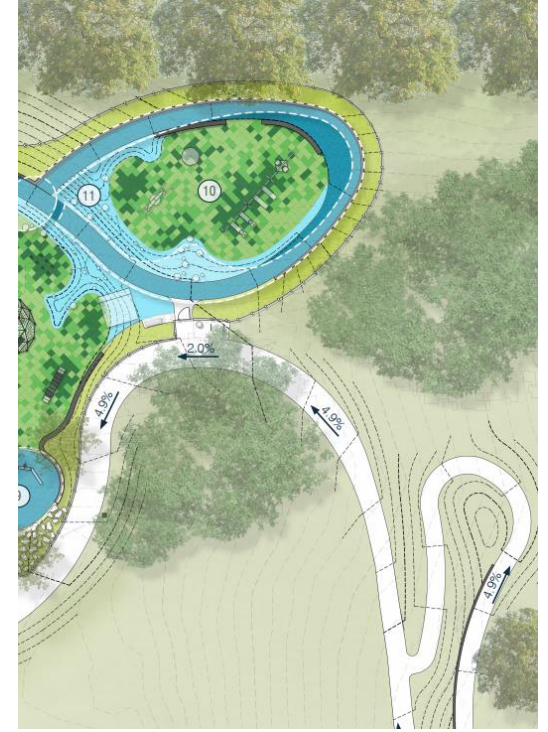
Traffic signal  
pole footing



Driveways



Pavement and  
ADA ramps



Stormwater +  
Playground

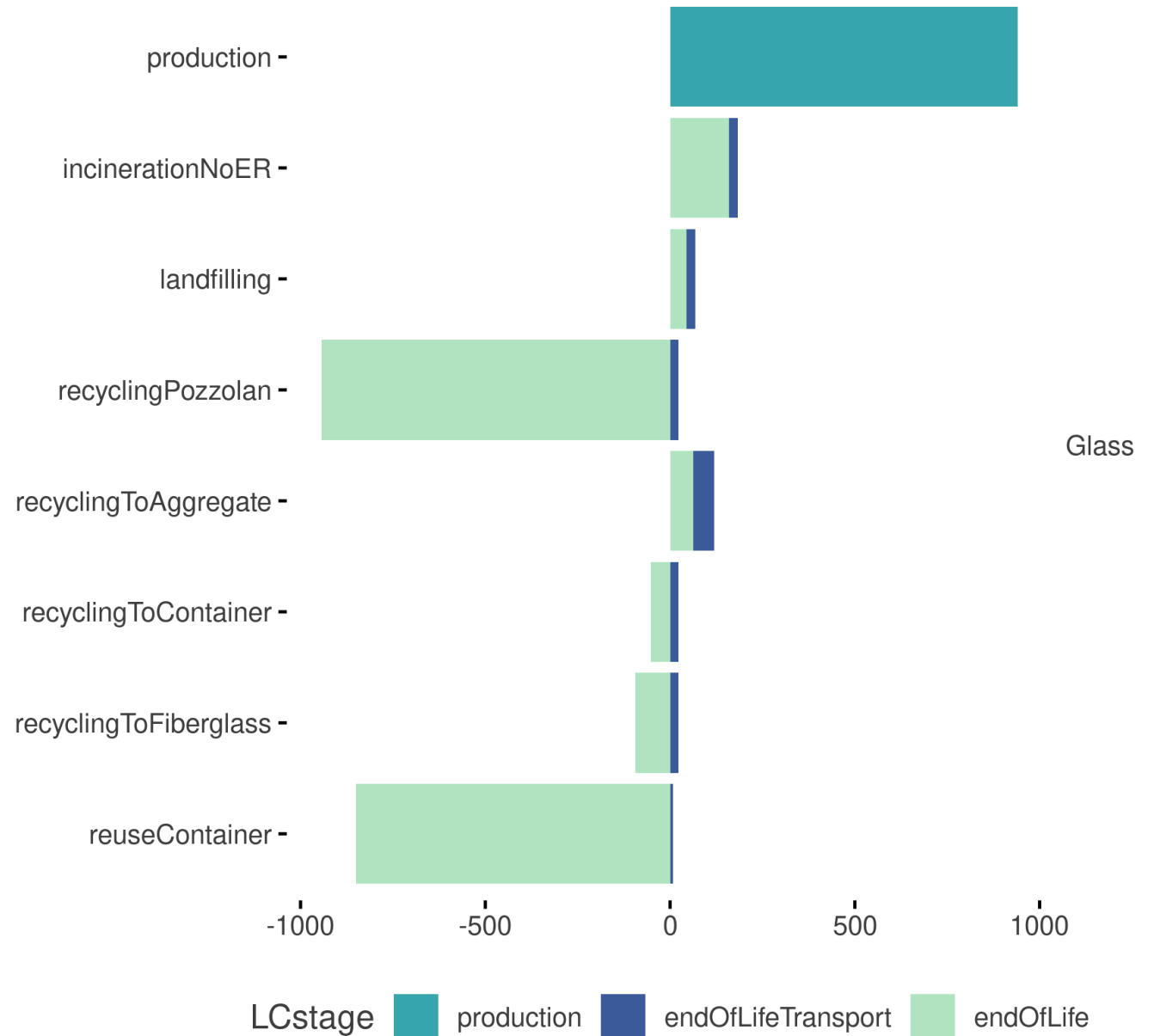
# Marin County, California - Building Code

**Table 19.07.050** Cement and Embodied Carbon Limit Pathways

	<b>Cement limits</b> for use with any compliance method 19.07.050.2 through 19.07.050.5	<b>Embodied Carbon limits</b> for use with any compliance method 19.07.050.2 through 19.07.050.5
Minimum specified compressive strength $f_c$ , psi (1)	Maximum ordinary Portland cement content, lbs/yd <sup>3</sup> (2)	Maximum embodied carbon kg CO <sub>2e</sub> /m <sup>3</sup> , per EPD
up to 2500	362	260
3000	410	289
4000	456	313
5000	503	338
6000	531	356
7000	594	394
7001 and higher	657	433
up to 3000 light weight	512	578
4000 light weight	571	626
5000 light weight	629	675
<b>Notes</b>		
(1) For concrete strengths between the stated values, use linear interpolation to determine cement and/or embodied carbon limits.		
(2) Portland cement of any type per ASTM C150.		

Long term – moving towards circular building material sector

# GWP 20 impacts per ton of waste (kg CO2 eq.)



# materials management

*conserving resources · protecting the environment · living well*

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