Overview

This Presentation
1. Climate Action Plans (CAPs)
2. Integrating Embodied Carbon into CAPs
3. Greenhouse Gas Inventories and Baselines
4. Case Studies
5. Development Process and Stakeholders

Policy Introductory Series
1. Introduction to the Embodied Carbon Policy Landscape
2. Climate Action Plans
3. Procurement Policy
4. Building Codes
5. City Zoning and Incentive Programs
6. Reuse and Deconstruction

Thanks to the CLF Regional Hub Policy Leads for feedback and review, and to our partners in the Carbon-Free Buildings Program at RMI for collaborating on development of the case study content in this presentation in summer 2021.
Matching Policy Opportunities with Embodied Carbon Reduction Strategies

**Optimize Project**
- Build less, reuse more
- Design to reduce embodied carbon and increase material/structural efficiency

**Optimize System**
- Choose low-carbon systems and assemblies
- Use alternate, low-carbon materials

**Optimize Procurement**
- Select the lowest carbon version of the selected product
- Clean manufacturing (efficiency, fuel switching)

**TOOLS**
- Early Design Calculators, Rules of Thumb
- Whole Building Life Cycle Assessment (WBLCA)
- Environmental Product Declaration (EPDs) / EC3 Tool

**POLICY MEASURES**
- Reuse & Deconstruction
- Zoning and City Incentive Programs
- Building Codes and Regulations
- Procurement (Buy Clean)
- Climate Action Plans

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Intro to Climate Action Plans
What is a Climate Action Plan (CAP)?

CAPs are **roadmaps** that outline specific activities that an agency will undertake to reduce GHG emissions.
What is a Climate Action Plan (CAP)?

CAPs are roadmaps that outline specific activities that an agency will undertake to reduce GHG emissions.

Why include embodied carbon in CAPs?

- Create alignment around regionally relevant goals and strategies
- Encourage complementary policy development
- Encourage regional collaboration
- Highlight municipal ‘lead by example’ policies and opportunities

Summary of the ‘How We Build and Renovate’ Section of the City of Vancouver Climate Emergency Action Plan
North American Climate Action Plan (CAP) Precedents with Embodied Carbon

CAPs with embodied carbon
- Edmonton (AB)
- Toronto (ON)
- Vancouver Climate Emergency Action Plan (B.C.)
- King County 2020 Strategic Climate Action Plan (WA)
- Portland (OR)
- Bend (OR)
- Eugene Community Climate Action Plan (OR)
- Bay Area, CA
  - San Francisco Climate Action Plan
  - Oakland 2030 Equitable Climate Action Plan
  - Albany 2019 Climate Action and Adaptation Plan
  - City of Dublin 2020 Climate Action Plan
- L.A. Green New Deal Sustainable City pLAn (CA)
- Phoenix Climate Action Plan (AZ)
- City of Austin Climate Equity Action Plan (TX)

C40 Clean Construction - Planned Actions
- Los Angeles, CA (USA)
- Mexico City (Mexico)
- San Francisco
Integrating Embodied Carbon into CAPs
How is embodied carbon integrated into CAPS?

Every climate action plan is different, but embodied carbon typically falls into the following areas:

1. Buildings
2. Waste and Material Recovery
3. Local Production / Industry
4. Consumption Emissions

Setting goals related to buildings and materials or consumption can help ensure that transportation construction materials are included (concrete, asphalt, etc.)

<table>
<thead>
<tr>
<th>City</th>
<th>Area E.C. Strategies are Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin</td>
<td>● Sustainable Buildings</td>
</tr>
<tr>
<td>Eugene</td>
<td>● Consumption Emissions</td>
</tr>
<tr>
<td>King County</td>
<td>● Green Building</td>
</tr>
<tr>
<td></td>
<td>● Consumption &amp; Materials</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>● Industrial Emissions &amp; Air Quality Monitoring</td>
</tr>
<tr>
<td></td>
<td>● Lead by Example (Municipal Buildings)</td>
</tr>
<tr>
<td>Phoenix</td>
<td>● Stationary Energy Sector Goals (Net-Zero Buildings)</td>
</tr>
<tr>
<td>San Francisco</td>
<td>● Responsible Production and Consumption</td>
</tr>
<tr>
<td>Vancouver B.C.</td>
<td>● How We Build and Renovate</td>
</tr>
</tbody>
</table>
**Strategies included in Climate Action Plans**

Strategies identified by Climate Action Plans that incorporate embodied carbon goals and targets.

<table>
<thead>
<tr>
<th>Buildings</th>
<th>Material Recovery &amp; Reuse</th>
<th>Low Carbon Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal buildings</td>
<td>Support local reuse markets</td>
<td>Municipal procurement</td>
</tr>
<tr>
<td>Base codes, Building Incentives &amp; Regulations</td>
<td>Deconstruction reqs</td>
<td>Support local low-carbon material producers</td>
</tr>
<tr>
<td>Voluntary codes/reporting</td>
<td>Waste separation/diversion reqs</td>
<td>Grants for new technologies</td>
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**Strategies included in Climate Action Plans**

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<td>Voluntary codes/reporting</td>
<td>Waste separation/diversion reqs</td>
<td>Grants for new technologies</td>
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</tbody>
</table>

- **Education**
- **Incentive programs**
- **Policy alignment**
**Targets included in Climate Action Plans**

Targets are a key component of any climate action plan strategy. Embodied carbon is no exception.

Embodied carbon targets recommended by NGOs:
- **C40 Clean Construction Declaration**
- Targets (Buildings and infrastructure)
  - 30% by 2025
  - 50% by 2030

- **Architecture 2030**
  - Embodied Carbon Targets
    - 45% or better in 2025
    - 65% or better in 2030
    - **Zero** global warming potential (GWP) by 2040

(In the future, may also be able to reference CDP and Scope 3 Science Based Targets)

<table>
<thead>
<tr>
<th>CAP</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Austin</strong></td>
<td>40% reduction by 2030 from a 2020 baseline</td>
</tr>
<tr>
<td><strong>Los Angeles</strong></td>
<td>50% by 2030 (from 2020 baseline, but not confirmed)</td>
</tr>
<tr>
<td><strong>Phoenix</strong></td>
<td>Design and construct all new buildings within the city to LBC, Net-Positive Design, or equivalent design standards by 2050</td>
</tr>
<tr>
<td><strong>San Francisco</strong></td>
<td>Achieve total carbon balance</td>
</tr>
<tr>
<td></td>
<td>10% per project from 2021-2025 (municipal)</td>
</tr>
<tr>
<td><strong>Vancouver B.C.</strong></td>
<td>40% reduction by 2030 from a 2018 baseline</td>
</tr>
<tr>
<td><strong>Eugene</strong></td>
<td>Overall target not included</td>
</tr>
<tr>
<td><strong>King County</strong></td>
<td>Overall target not included</td>
</tr>
</tbody>
</table>
Greenhouse Gas Inventories and Baselines
GHG Emissions Inventories: Production vs. Consumption based

**PRODUCTION-BASED INVENTORY**
Quantifies emissions produced within a regional boundary
(power plants, factories, cars, cattle, forestry, etc.)

Methodology fairly standardized - guidelines include [IPCC](https://www.ipcc.ch) (national), [US EPA](https://www.epa.gov) (state), and [CDP-ICLEI](https://www.cdpICLEI.org) (city)

**CONSUMPTION-BASED INVENTORY**
Quantify emissions consumed within a regional boundary
(electricity, food, construction goods, etc.)

Methodology not yet standardized; state approach published by US EPA
Why does it matter?

PRODUCTION-BASED INVENTORY
- Excludes upstream and downstream life cycle stages
- Can unintentionally incentivize emissions outsourcing

CONSUMPTION-BASED INVENTORY
- Includes most life cycle stages
- Incentivizes development of policies informed by upstream and downstream emissions impacts
Case Study Washington and Oregon

**EXAMPLE (Production-based):**

- **Transportation** 44.9%
- **Electricity** 16.3%
- **Residential, Commercial, Industrial heating** 23.4%
- **Other** 15.4%

**2018 Washington Greenhouse Gases**

Sources of Washington State GHG, 2018
Source: WA Department of Ecology

**EXAMPLE (Consumption-based):**

Consumption-based GHG Emissions Inventory for Oregon
Source: Oregon Department of Environmental Quality
Case Study Oregon GHG Inventory

GHG Emissions for Oregon
Source: Oregon Department of Environmental Quality
The Greenhouse Gas Protocol Corporate Accounting and Reporting Standard splits GHG emissions into three scopes:

- **Scope 1 emissions** are from a company’s operations that are under a facility’s direct control, e.g., on-site fuel combustion;
- **Scope 2 emissions** are from usage of electricity, steam, heat and/or cooling purchased from third parties; and
- **Scope 3 emissions** are upstream and downstream value chain emissions, including upstream supply chain emissions from purchased products, transport emissions, and business travel and downstream emissions from transport of products, usage of sold products and product disposal.
Case Studies
**Austin Climate Equity Plan 2020-21**

**Target:**
- By 2030, reduce the embodied carbon footprint of building materials used in local construction by 40% from a 2020 baseline.
## Austin Climate Equity Plan 2020-21

<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Municipal buildings</strong></td>
<td>Create design and construction specifications and purchasing agreements for city-owned projects.</td>
</tr>
<tr>
<td><strong>Incentives</strong></td>
<td>Integrate lower-carbon building materials and deconstruction practices into City incentive programs, such as expedited permitting and Green Building program. Transition voluntary practices into requirements over time.</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>Create a performance framework and educational programming for industry professionals and the general public.</td>
</tr>
<tr>
<td><strong>Support local producers</strong></td>
<td>Encourage growth of local businesses, prioritize partnerships within local materials markets to decarbonize high-impact materials, specifically: glass, steel, aluminum, concrete, drywall, insulation, and carpet.</td>
</tr>
</tbody>
</table>
Target:

- Achieve total carbon balance across the buildings and infrastructure sectors.
- By 2030, buildings constructed will have a 40% reduction in embodied carbon.
<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy Instruments</td>
<td>Develop a suite of incentives, policies, and/or guidelines for adaptive reuse of existing buildings, as well as the design and procurement of low carbon structural materials for new construction.</td>
</tr>
<tr>
<td>Materials</td>
<td>Amend existing policies to require deconstruction of buildings and increase the source separation of specific materials.</td>
</tr>
<tr>
<td>Incentives</td>
<td>Policy framework to expand and cultivate regional building material reuse markets that support workforce development, small business enterprises, and entrepreneurial innovation.</td>
</tr>
<tr>
<td>Education</td>
<td>Advance best practices for “Design for Disassembly” and “Buildings As Material Banks” by creating implementation resources in partnership with global cities, and pilot at least one municipal project to maximize the value of carbon already invested in buildings.</td>
</tr>
</tbody>
</table>
Target:

- Overall target not included.

**King County 2020 Climate Action Plan** (Seattle Area)
<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base construction codes</td>
<td>Introduce building code requirements that lower embodied carbon in certain building materials.</td>
</tr>
<tr>
<td>Municipal buildings</td>
<td>Specify low-embodied carbon building materials in King County capital projects, starting with concrete and expanding to other materials.</td>
</tr>
<tr>
<td>Support local producers</td>
<td>Dedicate resources to increase the reuse of wood products in construction and support a reusable wood market.</td>
</tr>
<tr>
<td>Incentives</td>
<td>Provide financial and technical support to bridge the gap between code-minimum buildings and high-performance buildings with lower embodied carbon emissions.</td>
</tr>
</tbody>
</table>
Development Process for CAPs

**Who:**
- Municipalities of cities/counties, institutions, organizations
  - Engagement of a variety of stakeholders (residents, businesses, elected officials, design and construction communities, etc.)

**How:**
- Iterative Process
  - Set preliminary goals/targets
  - Evaluate measures/strategies
  - Calculate financial impact (sometimes)
- Public comment process
- Revise goals based on feedback
Takeaways

**CAPs are roadmaps that outline specific activities that an agency will undertake to reduce GHG emissions**

Embodied Carbon:

- GHG Inventories: Production vs. Consumption based
- Create alignment around regionally relevant goals and strategies
- Encourage complementary policy development
- Encourage regional collaboration
- Highlight municipal ‘lead by example’ policies and opportunities
Thank You!
Oakland 2030 Equitable Climate Action Plan

Target:

- Estimate reduction in GHG impact from embodied carbon standards.
### Oakland 2030 Equitable Climate Action Plan

<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base codes and regulations</td>
<td>Reduce lifecycle emissions: Adopt a concrete code for new construction that limits embodied carbon emissions. Performance standards for existing buildings.</td>
</tr>
<tr>
<td>Education</td>
<td>Support the Reuse, Repair, Recovery, and Refurbishment Economy.</td>
</tr>
<tr>
<td>Education</td>
<td>Expand Community Repair Resources.</td>
</tr>
<tr>
<td>Materials + Waste</td>
<td>Establish a deconstruction requirement.</td>
</tr>
<tr>
<td>City Procurement</td>
<td>Track annual embodied GHG emissions related to City expenditures for construction, building maintenance, travel, and food. Establish maximum GHG performance thresholds.</td>
</tr>
</tbody>
</table>
Oakland 2030 Equitable Climate Action Plan

Buildings

- **B-4: Reduce lifecycle emissions**
  
  “By 2023, adopt a concrete code for new construction that limits embodied carbon emissions. In subsequent building code updates, implement improved embodied carbon performance standards including additional materials and material-efficient building practices, with exemptions for cost barriers as needed to prevent these changes from directly increasing housing or rent costs.”

Material Consumption + Waste

- **MCW-4: Support the Reuse, Repair, Recovery, and Refurbishment Economy**
  
  “By 2025, create a community reuse and repair program to increase waste diversion, reduce material consumption, and create green jobs”

- **MCW-5: Expand Community Repair Resources**
  
  “Expand the City’s existing tool lending library services to at least 5 other Oakland Public Library branches, recreation facilities, community centers, or other community sites by 2030”

- **MCW-6: Establish a deconstruction requirement**
  
  “Establish a deconstruction requirement to reduce demolition waste from construction and renovation and facilitate material reuse”
Vancouver Climate Emergency Action Plan

Target:

- By 2030, the embodied emissions from new buildings will be reduced by 40% compared to a 2018 baseline.
Lower carbon construction

By 2030, we will ensure 40% less embodied emissions from new buildings and construction projects compared to 2018. Vancouver’s Embodied Carbon Strategy sets a vision for a healthy, equitable, circular, and carbon-positive construction economy.

We aim to take responsibility for carbon pollution created while extracting, manufacturing, assembling, replacing and disposing of building materials, such as concrete, metals, insulation. This means:

- Using materials more efficiently
- Reusing existing buildings and materials
- Building more from sustainably sourced wood and mass timber
- Using lower-carbon blends of concrete
- Powering construction sites with renewable energy instead of diesel fuel
- Using low-carbon insulation instead of spray foam, and
- Putting less parking in buildings

To ensure we meet our target, we’ll:

- Set embodied carbon pollution limits for new buildings
- Make it easier and less expensive to use lower carbon materials in new buildings
- Support people using low-carbon materials in new buildings
- Align low carbon planning and strategies
Vancouver Climate Emergency Action Plan

200k tonnes CO₂e/year (embodied)

No new policies

2020
175k
150k
125k
100k
75k
50k
25k
0k

2030 TARGET FOR EMBODIED CARBON

2022

2026

CEAP BM5 (range)

2030

EMBODIED CARBON OF NEW CONSTRUCTION IN VANCOUVER

Modelled, all materials
## Vancouver Climate Emergency Action Plan

<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base codes and regulations</td>
<td>Require new buildings to use low carbon materials. Whole building life cycle assessment that demonstrates embodied carbon reductions required for all new construction.</td>
</tr>
<tr>
<td>Incentives</td>
<td>Remove barriers to build with mass timber and expand existing incentive programs, such as Near Zero Program, to include embodied carbon.</td>
</tr>
<tr>
<td>Education</td>
<td>Fund tools and training, support events and knowledge-sharing networks, advocate with other organizations and governments.</td>
</tr>
<tr>
<td>Policy alignment</td>
<td>Connect and remove barriers to reducing embodied carbon in planning, zoning, transportation, and zero waste efforts.</td>
</tr>
</tbody>
</table>
Phoenix Climate Action Plan 2021

Target:

- Net positive new construction by 2050 in terms of both energy use and the embodied energy in building materials.
## Phoenix Climate Action Plan 2021

<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
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</thead>
<tbody>
<tr>
<td>Voluntary codes</td>
<td>Include standards to reduce embodied carbon emissions through a “whole project” approach. Streamline permitting process for green/sustainable construction.</td>
</tr>
<tr>
<td>Reporting</td>
<td>Use EC3 calculator to test on a sample of building stock to determine which methods of construction can be targeted to lower GHG impact.</td>
</tr>
<tr>
<td>Municipal buildings</td>
<td>Design all municipal buildings to meet Living Building Challenge, Net Positive Design, or equivalent by 2050.</td>
</tr>
<tr>
<td>Incentives</td>
<td>Improve existing Adaptive Reuse Program that encourages adaptive reuse of buildings through financial incentives.</td>
</tr>
</tbody>
</table>
Los Angeles Green New Deal Sustainable City Plan 2019

Target:
- Reduce industrial emissions by 38% by 2035; and 82% by 2050
<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
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<tbody>
<tr>
<td>Municipal buildings</td>
<td>Ensure all new municipally owned buildings and major renovations will be all-electric, effective immediately.</td>
</tr>
<tr>
<td>Reporting</td>
<td>Implement GHG performance standards for material procurement for purchasing by City Departments.</td>
</tr>
<tr>
<td>Reporting</td>
<td>Identify embedded carbon emissions in the City’s supply chain through Departmental participation in the Carbon Disclosure Project supply chain reporting program.</td>
</tr>
<tr>
<td>Procurement</td>
<td>Update the City’s Environmentally Preferred Products Purchasing Program to include additional construction materials and a GHG performance standard, such as the Buy Clean California Act.</td>
</tr>
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</table>
Los Angeles C40 Clean Construction Declaration Commitment

3 commitments + 8 supporting actions. Commitments include:

- Reduce embodied emissions by at least 50% for all new buildings and major retrofits by 2030, striving for at least 30% by 2025
- Reduce embodied emissions by at least 50% of all infrastructure projects by 2030, striving for at least 30% by 2025
- Procure and, when possible, use only zero emission construction machinery from 2025 and require zero emission construction sites city-wide by 2030

Commitments include:

- Reduce embodied emissions by at least 50% for all new buildings and major retrofits by 2030, striving for at least 30% by 2025
- Reduce embodied emissions by at least 50% of all infrastructure projects by 2030, striving for at least 30% by 2025
- Procure and, when possible, use only zero emission construction machinery from 2025 and require zero emission construction sites city-wide by 2030
Target:

- No overall embodied carbon target but has strategies to facilitate a Carbon-Free Economy
### Albany, CA Climate Action & Adaptation Plan 2019

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<tr>
<th>Category</th>
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<tbody>
<tr>
<td>Partnerships</td>
<td>Partner with regional entities (architects, designers, and contractors) to encourage carbon-smart building materials. To enable and promote carbon-sequestering building materials in new construction and renovations. Ultimately lead to requirements for the disclosure and/or limit the embodied carbon emissions of buildings through whole-building or material specific policies.</td>
</tr>
<tr>
<td>Municipal buildings</td>
<td>Adopt CALGreen voluntary green building tiers.</td>
</tr>
</tbody>
</table>
Facilitate a Carbon-Free Economy

Strategy 3.2.5

"Partner with regional entities to encourage carbon-smart building materials. This includes educating architects, designers, and contractors. This action would enable and promote carbon-sequestering building materials in new construction and renovations. Ultimately, this action could lead to requirements for the disclosure and/or limit the embodied carbon emissions of buildings through whole-building or material specific policies"
Dublin, CA Climate Action Plan 2030 and Beyond

Target:

- Adopt an ordinance mandating low carbon concrete for all new development projects by 2023
## Dublin, CA Climate Action Plan 2030 and Beyond

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<tr>
<th>Category</th>
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<tr>
<td>Education</td>
<td>Conduct outreach to the development community regarding low carbon concrete using the Bay Area Low Carbon Concrete Codes Project.</td>
</tr>
<tr>
<td>Regulation</td>
<td>Present a low carbon concrete ordinance to City Council based on the Marin County model ordinance with specifications for residential and non-residential development applications.</td>
</tr>
<tr>
<td>Education</td>
<td>Educate City staff, and the development community on the new reach code requirements.</td>
</tr>
<tr>
<td>Education</td>
<td>Keep current on new model ordinances that identify other building materials to target for additional embodied carbon reductions.</td>
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Dublin, CA Climate Action Plan 2030 and Beyond

Section 6.4: Strategy 4: Materials and Waste Management

Measure MM-2: Reduce the Embodied GHG Emissions Associated with Building Materials

- The City of Dublin will require the use of low carbon concrete in new construction projects to reduce lifecycle GHG emissions and the embodied carbon associated with construction projects.
- **Target:** Adopt an ordinance mandating low carbon concrete for all new development projects by 2023
- **Actions:**
  1. Conduct outreach to the development community regarding low carbon concrete using the Bay Area Low Carbon Concrete Codes Project.
  2. Present a low carbon concrete ordinance to City Council based on the Marin County model ordinance with specifications for residential and non-residential development applications.
  3. Educate City staff, and the development community on the new reach code requirements.
  4. Keep current on new model ordinances that identify other building materials to target for additional embodied carbon reductions.
King County 2020 Climate Action Plan

- **Strategy 4.2.2 Parter with King County cities on C&D recovery and reuse.** King County will work with and support city partners and partnering agencies to implement codes, policies, and incentives resulting in the maximum recovery and reuse of structural and nonstructural components of existing structures. King County’s goal is for at least eight cities to have taken one of these steps by 2025.

- **Strategy 5.2.2 Support the transition to a reusable wood market.** The County will dedicate resources to catalyze the movement of wood markets away from combustion and toward higher value uses that are more sustainable for both the environment and people of King County.

- **Strategies GHG 3.3.1/GHG 4.2.1/GHG 4.3.1 [related to Green Building Codes]** Proposed requirements may include ... construction and demolition (C&D material management), materials with low embodied carbon and toxicity...

- **Strategy GHG 4.14 Manage King County capital portfolios to maximize GHG emissions reductions in operational and embodied emissions.** They will use the following strategies... Use the Embodied Carbon in Construction Calculator (EC3) tool to identify low embodied emissions materials that meet construction specifications, and to inform decisions in materials selections in accordance with King County’s Sustainable Purchasing Guide.

- **Strategy GHG 5.8.1 Specifying low-embodied carbon building materials in King County capital projects.** The mining, manufacturing and transportation of building materials result in significant GHG emissions. To reduce these “embodied” emissions, King County will develop requirements and specifications for the use of low emission alternatives for concrete, asphalt, wood, and steel by County project managers and designers in bid solicitations.

By 2022, the County shall create standard specifications for concrete and begin requesting environmental product declarations (EPDs) for this material in construction bids. By 2023, it will require the use of EPDs for concrete and, by 2024, require a maximum global warming potential (GWP) for concrete products, which it will enforce for all construction projects starting in 2025. The Embodied Carbon in Construction Calculator (EC3) tool will be used to help choose the lowest embodied carbon materials per project that meets the specification. Based on lessons learned, the County will expand these specifications to other high embodied emissions materials including asphalt, wood, and steel.
Eugene, OR Climate Action Plan 2.0

Target:

- Overall target not included.
### Eugene, OR Climate Action Plan 2.0

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentives</td>
<td>Use less building materials during construction.</td>
</tr>
<tr>
<td></td>
<td>Single family home decrease from 2,300 to 1,600 sq ft.</td>
</tr>
<tr>
<td>Incentives</td>
<td>30% low-carbon materials used in 50% of community concrete consumption to incentivize or require use of low-carbon concrete.</td>
</tr>
<tr>
<td>Improve construction and demolition waste</td>
<td>Add new infrastructure and sorting equipment to allow for material recovery.</td>
</tr>
<tr>
<td>recovery</td>
<td></td>
</tr>
</tbody>
</table>


City of San Francisco

Responsible Production and Consumption (RPC) 1: Achieve total carbon balance across the buildings and infrastructure sectors.

Supporting actions

1. Between 2021-2025, phase-in policies to reduce embodied carbon more than 10% per project by addressing at least three product categories or building assembly types.

2. By 2023, develop a suite of incentives, policies, and/or guidelines for adaptive reuse of existing buildings, as well as the design and procurement of low carbon structural materials for new construction.

3. By 2025, establish a maximum allowance for embodied carbon of buildings, to be adjusted in regular intervals.

4. By 2025, amend existing policies to require deconstruction of buildings and increase the source separation of specific materials.

5. By 2025, engage with designers, landlords, and lessees to develop guidelines for tenant improvement and space turnover projects that reduce excess material purchases and support reuse distribution channels.

6. By 2025, create a policy framework to expand and cultivate regional building material reuse markets that support workforce development, small business enterprises, and entrepreneurial innovation.

7. By 2030, advance best practices for “Design for Disassembly” and “Buildings As Material Banks” by creating implementation resources in partnership with global cities, and pilot at least one municipal project to maximize the value of carbon already invested in buildings.
Strategies included in Climate Action Plans

Strategies identified by climate action plans that incorporate embodied carbon goals and targets:

- Municipal ‘Lead by Example’ requirements
  - Green / Net-Zero Building Design
  - Low-carbon material procurement

- Support local materials markets
  - Material reuse markets
  - Low-carbon material producers

- Education
  - Tools and training
  - Support events and knowledge sharing
  - Focus: local industry, workforce development around deconstruction

- Incentives
  - Financial (density bonus, tax incentive, etc.)
  - Schedule (expedited permitting)
  - Encourage adaptive reuse, deconstruction

- Base codes and building regulations *(may start as voluntary)*
  - Maximum carbon emissions limits for buildings
  - Reporting requirements
  - Low carbon fuels on construction sites
  - Reduce parking requirements

- Waste recovery requirements
  - Deconstruction
  - Construction waste separation and diversion requirements

- Policy alignment