CALIFORNIA
AIR RESOURCES BOARD

Embodied Carbon in Buildings

Workshop 1
September 19th, 2024

CARB

Today's Agenda

1. Welcome / Introductory Remarks
2. Public Engagement Planning
3. Background
4. Research Presentation
5. Developing Reporting Requirements
6. Establishing the Baseline
7. Next Steps

Welcome / Introductory Remarks

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Anonymous Poll

- **Who is here?**
  - Structural Engineering
  - Trade Association
  - Material or Product Manufacturer
  - Architect / Designer
  - Builder / Contractor
  - Developer
  - Community Member
  - Government or State Entity
  - Non-Profit Organization
  - Non-Governmental Organization
  - Other

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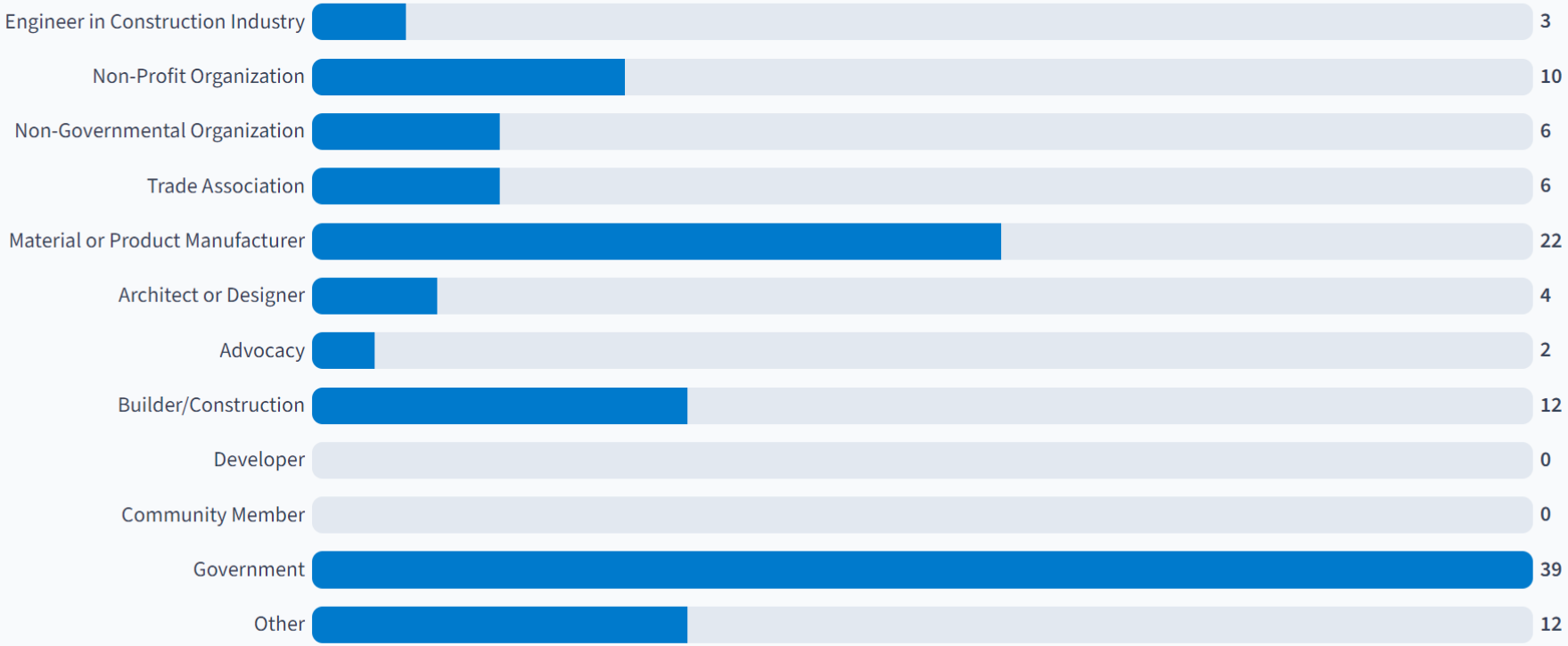
Who is here?


Engineer in Construction Industry
3
Non-Profit Organization
10
Non-Governmental Organization
6
Trade Association
6
Material or Product Manufacturer
22
Architect or Designer
4
Advocacy
2
Builder/Construction
12
Developer
0
Community Member
0
Government
39
Other
12

Public Engagement Planning

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Planning for Public Engagement

- Public workshops with comment periods
- Direct engagement with sister agencies, local government, community groups, industry, and other interested parties
- Draft regulation
- Board consideration

Background

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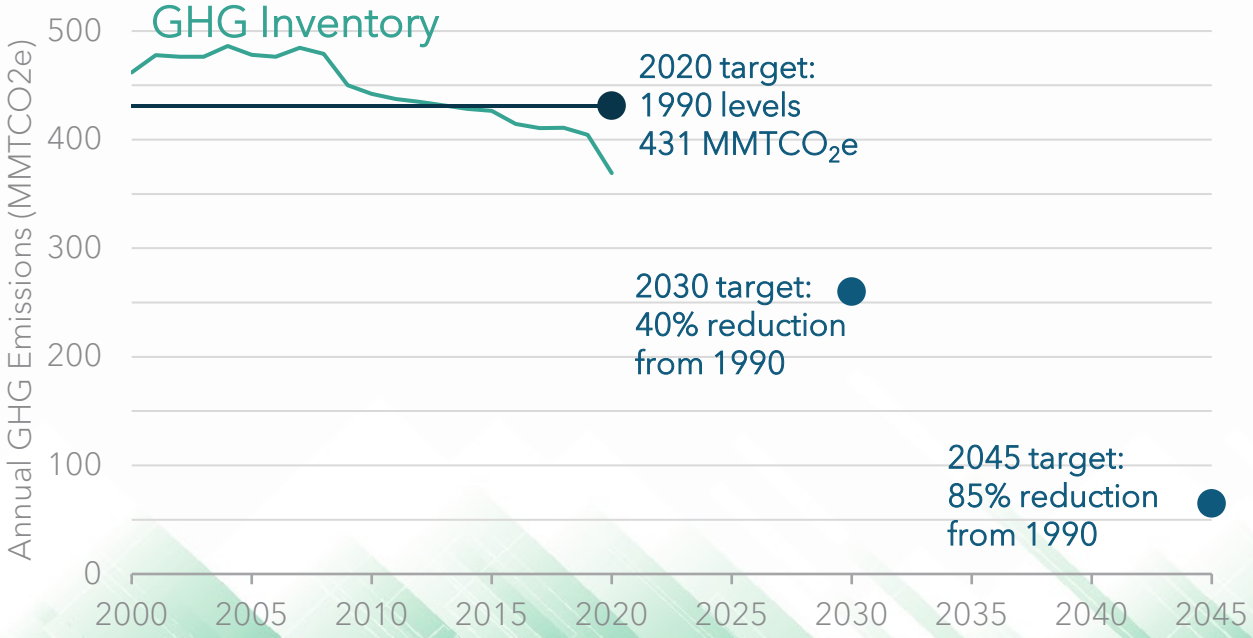
California's Fight against Climate Change

Met the 2020 Greenhouse Gas (GHG) Emissions Target Early



ACHIEVING
CARBON
NEUTRALITY
BY **2045**

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California's Climate Policy Portfolio

Mix of Regulations, Incentives, and Carbon Pricing

- **Economy-wide carbon price funding further GHG reductions:** Cap-and-Trade
- **Reduce carbon-intensity of transportation fuels:** Low Carbon Fuel Standard
- **Renewable energy requirements for utilities:** Renewables Portfolio Standard
- **Zero-emission new vehicle sale targets:** Advanced Clean Cars, Advanced Clean Trucks
- **Building energy efficiency and electrification:** Energy Code and Green Building Standards
- **Reduce short-lived climate pollutants:** Oil and Gas, HFC, and Landfill Methane Regulations
- Develop **State Strategies** for natural and working lands, cement decarbonization, carbon-capture and sequestration, and low-carbon hydrogen development
- Leverage **funding and investments** provided through the Cap-and-Trade funded Greenhouse Gas Reduction Fund, state General Fund, federal Bipartisan Infrastructure Bill, and Inflation Reduction Act

AB 32 Statutory Requirements

- Provide direct GHG emissions reductions and air quality benefits
- Minimize emissions "leakage" – increase to non-CA GHG emissions
  - Ensure high-road jobs remain
- Facilitate sub-national and national collaboration
  - Develop exportable programs for partners to adopt
- Support cost-effective and flexible compliance

AB 2446 and AB 43
Statutory Requirements and Dates

By December 31, 2026

Adopt a framework for measuring carbon intensity of building materials

By December 31, 2028

Develop a comprehensive strategy to reduce GHG emissions

By December 31, 2035

Achieve a 40% net reduction in GHG emissions of building materials by 2035

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Statute: California HSC Section 38561.3 and 38561.6

Related Policies and Statutes

Buy Clean California Act (2017)

- Requires submittal of Environmental Product Declaration (EPD) data for eligible materials/products - Established GWP limits for four materials

CALGreen Embodied Carbon Requirements (2024)

- Whole-building life cycle assessment requirements for large non-residential and school buildings starting July 2024 – requires a 10% reduction in GWP or meet alternative compliance paths

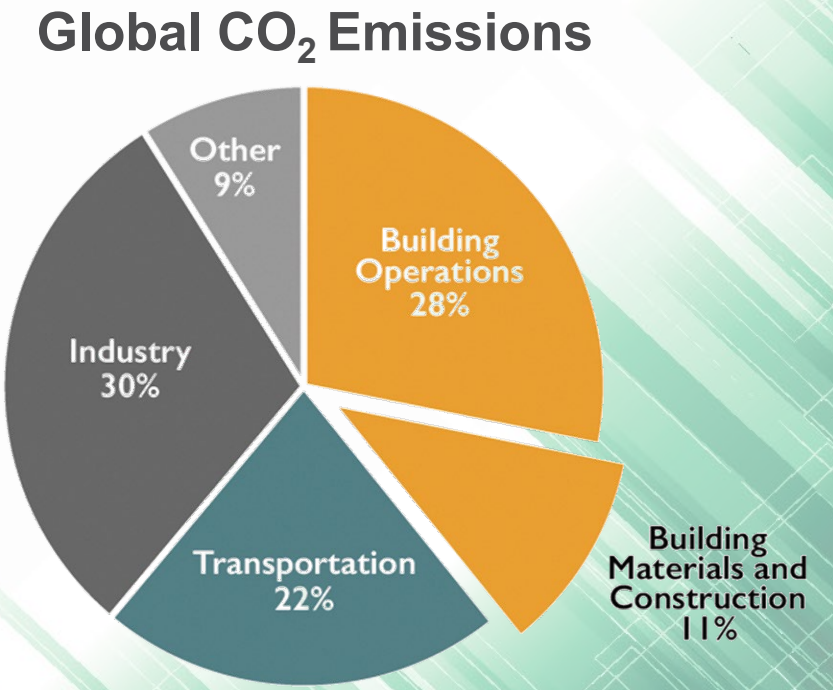
SB 596

- Directs CARB to develop a strategy to achieve net-zero emissions for cement used within the state by 2045

The Need to Decarbonize Buildings

Buildings contribute significantly to statewide and global emissions

- Decarbonization is part of California's climate and air quality strategies
- Urgent need to increase use of low-carbon, low-cost building materials in location efficient building designs



Retrieved from: newbuildings.org

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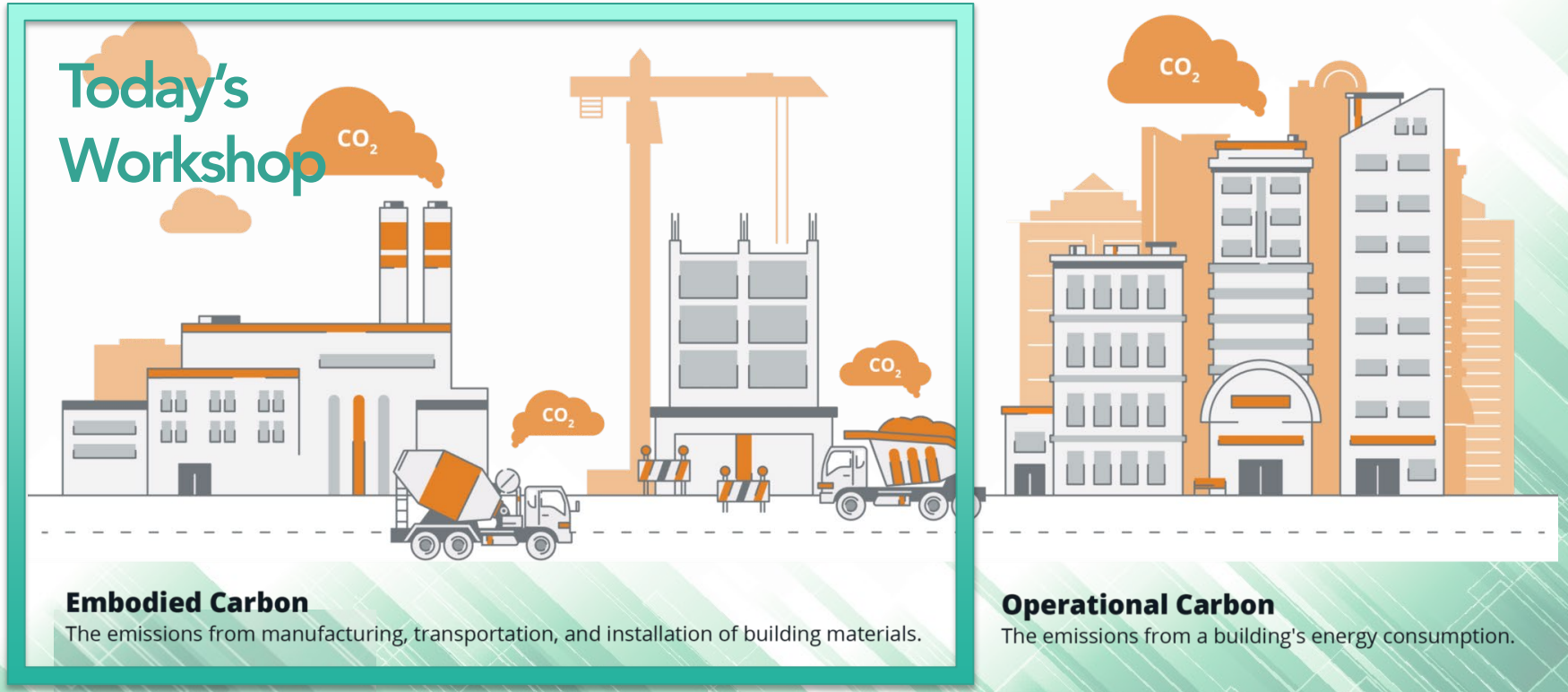
Building Decarbonization

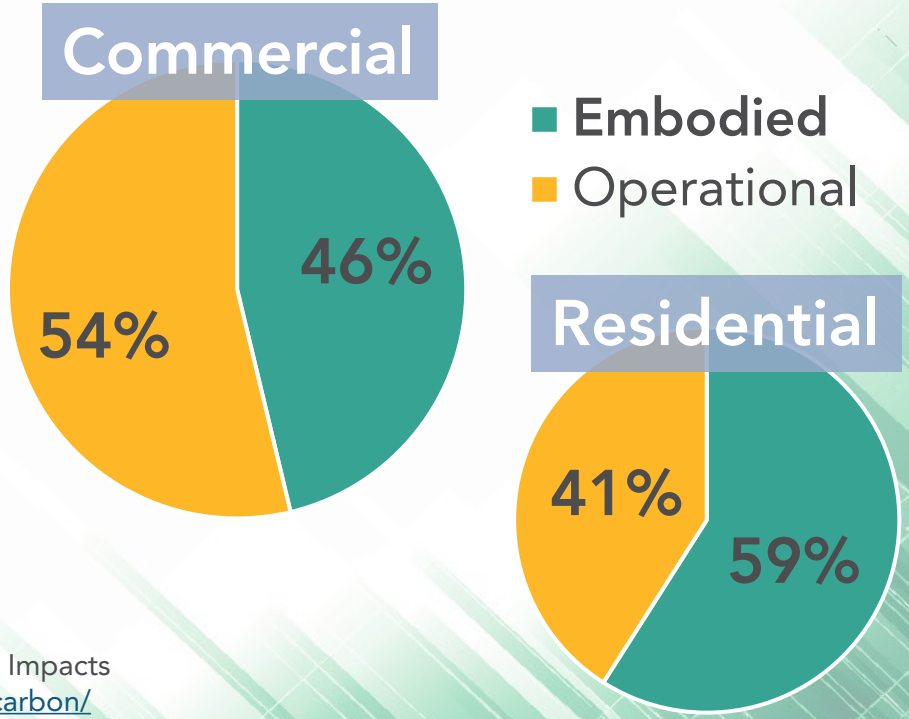
Embodied + Operational



Retrieved from: https://www.carboncure.com

Embodied Carbon is Critical

- As operational emissions go down, embodied carbon (EC) becomes increasingly important
- Over half of the carbon footprint of new buildings in California are attributable to embodied carbon



Adapted from: Analysis of Embodied and Operational Carbon Impacts of 30 Building; https://carbonleadershipforum.org/california-carbon/

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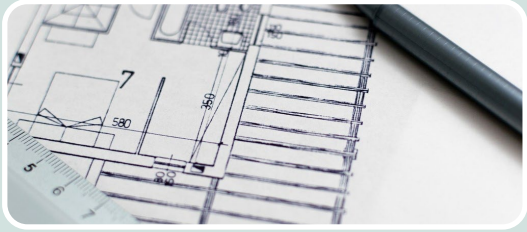
What Key Factors Influence Carbon Emissions Related to Buildings

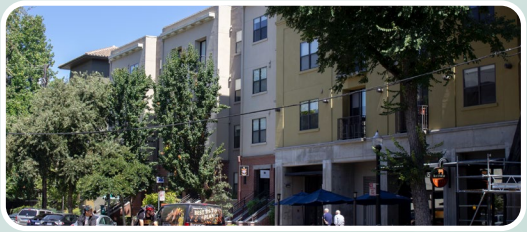
Materials:

Energy and non-energy related emissions from extraction, refining, and manufacturing building materials



Design:

Building design influences the types and quantity of building materials used, as well as operational energy requirements



Location:

Building site impacts operational energy needs, material availability, travel behavior, land-use, and construction processes

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Research Presentation

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Research Presentation

Professor Eric Masanet

Mellichamp Chair in Sustainability Science for Emerging Technologies

University of California Santa Barabara

Principle Investigator - *A Review of Embodied Carbon Data, Embodied Carbon Emissions, and Emissions Reduction Technologies and Policies for California Building Construction Materials*

https://ww2.arb.ca.gov/review-embodied-carbon-data-embodied-carbon-emissions-and-emissions-reduction-technologies-and

Developing Reporting Requirements

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AB 2446 and AB 43
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Other Regulatory Greenhouse Gas Related Reporting

- US EPA Greenhouse Gas Reporting Program (emissions from many large facilities nationally)
- CARB Mandatory GHG Reporting (emissions and product data for facilities in CA)
- *Under Development:* SB 253/261 (scope 1, scope 2, and scope 3 emissions for large companies)

Statutory Requirements

- **HSC §38561.3 (c)(1)** A requirement for the submission by an entity undertaking the construction of a project […] of **a life-cycle assessment.**
- **HSC §38561.3 (c)(2)** A requirement for the submission by the manufacturer of a building material of an **Environmental Product Declaration (EPD)** or similarly robust material life-cycle assessment approaches […]
- **HSC §38561.3 (d)** […]**a fee** to reimburse the state board for any administrative costs incurred in administering the reporting mechanism […]
- **HSC §38561.3 (e)** […] the state board shall evaluate the **cost impact and feasibility of implementation of the strategy** […] for the purpose of developing recommendations
- **HSC §38561.3 (i)** (5) Manufacturers of building materials shall be required to **report data to the state board to ensure that their products comply with applicable reduction targets**

Existing Data Gaps

- Comprehensive facility-specific Environmental Product Declarations (EPDs)
- Quantities of material/products used for new construction
- Product and material chain-of-custody
- Cost information for many manufactured products
- GHG mitigation interventions available to manufacturers and project developers

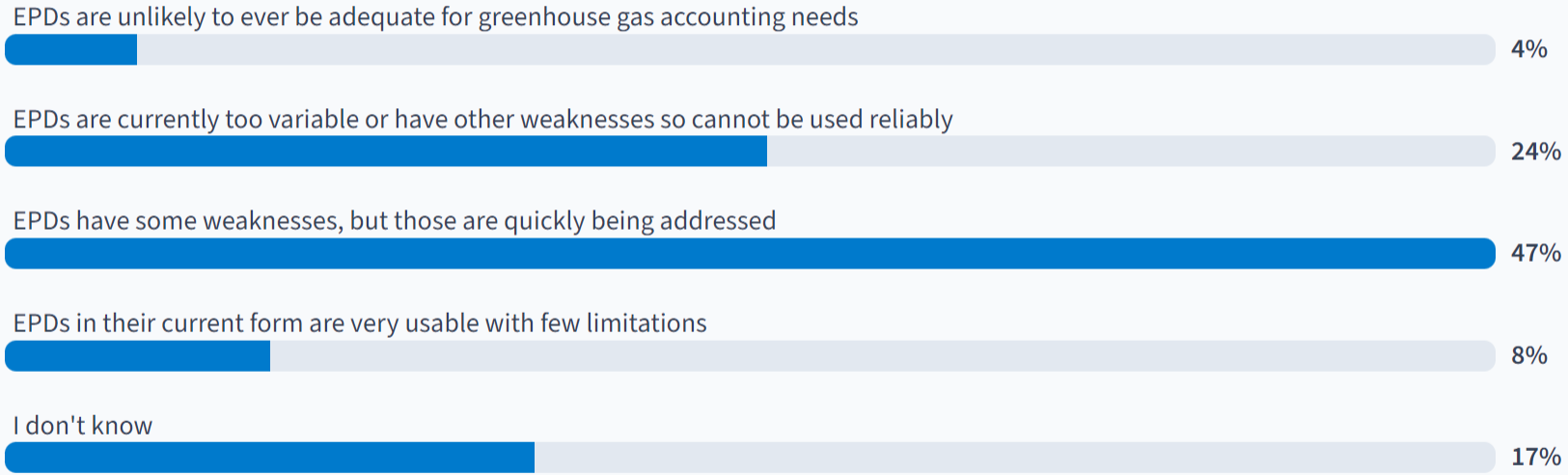
Anonymous Poll

- What is your familiarity with the EPD generation process?
  - I had not heard of EPDs before this workshop
  - I have heard of EPDs but have never worked with them
  - I have used EPDs before
  - I have helped generate or create EPDs

- How good are EPDs for determining embodied carbon emissions?
  - EPDs are unlikely to ever be adequate for greenhouse gas accounting needs
  - EPDs are currently too variable or have other weaknesses so cannot be used reliably
  - EPDs have some weaknesses, but those are quickly being addressed
  - EPDs in their current form are very usable with few limitations
  - I don't know

What is your familiarity with the EPD generation process?

How good are EPDs for determining embodied carbon emissions?



Request for Feedback

- What major barriers do you face in generating EPDs?
- What suggestions do you have for overcoming limitations to EPD generation and collection?
- Are there other data or resources the you would recommend which could accomplish the same objectives as EPDs?
- Are there regulatory data reporting requirements that could be leveraged?

Who Reports?

Manufacturers of Building Materials

- Production Quantity, Cost Data, EPDs and Background Data
- HSC §38561.3 (c)(2), HSC §38561.3(i)

Developers and Builders

- Building Life Cycle Assessments, Quantity of Materials
- HSC §38561.3 (c)(1)

Request for Feedback

- Who else should report?
- What else should be reported?
- What local, state, or federal reporting could be leveraged?

Request for Feedback

Help inform CARB's reporting tools and templates

- Are there standardized ways that firms already collect, share, or report relevant data?
- How can CARB best design data-reporting systems to leverage data collection already being done?
- What sorts of data are most difficult to track and report?

Request for Feedback

Statute requires the evaluation of the cost impact and feasibility of implementation of the strategy

- What approaches should CARB use to collect cost data from manufacturers and builders?
- What methodologies should CARB consider for evaluating cost impacts?

CARB will be exploring feasibility considerations in future workshops

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Establishing Baseline

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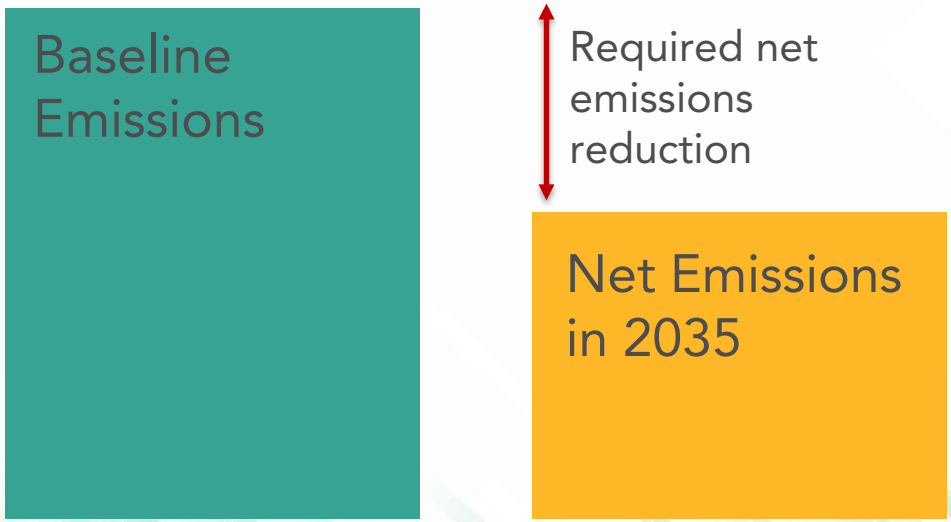
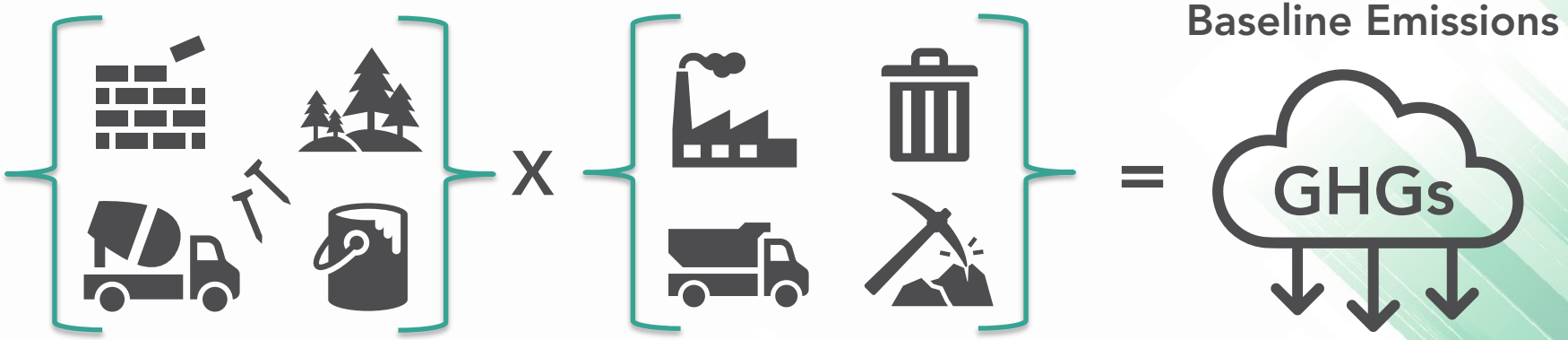
An emissions baseline is necessary to assess 40% net reductions in GHG emissions



For illustrative purposes only

Illustrative GHG Emissions Baseline for Building Materials



Total amount of building materials used in California (e.g. units)

Life-cycle GHG emissions of materials (e.g. kg-CO_2e per unit)

Total emissions from which to assess a 40% net reduction

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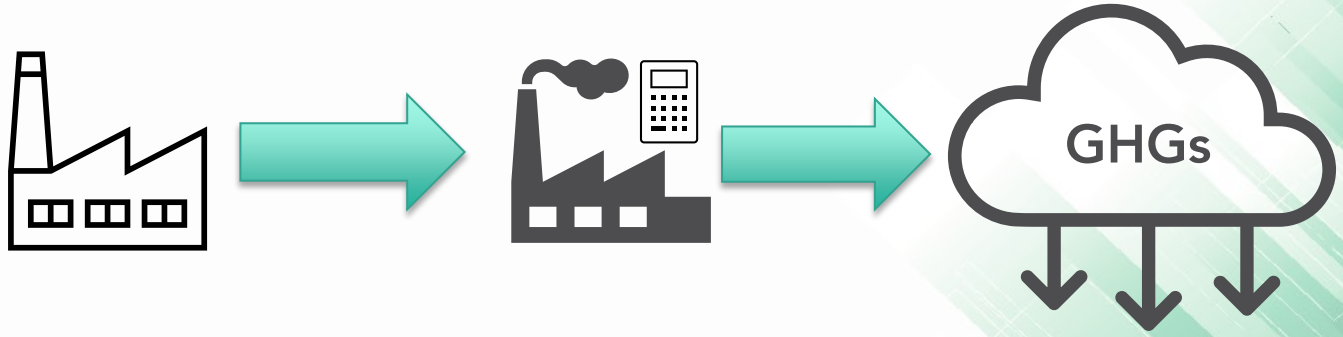
Concepts for Baseline Development

- Staff are considering potential methods for developing a GHG emissions baseline
  - A “top-down” approach
  - A “bottom-up” approach

Top-down Approach for Establishing Baseline Emissions

Top-down Approach



Industry and Sector Output

(e.g. Total $ of Product Sold)

Emissions Attribution for Relevant Output

(e.g. gCO_2e/$-product-produced)

Baseline Emissions

(tons CO_2e)

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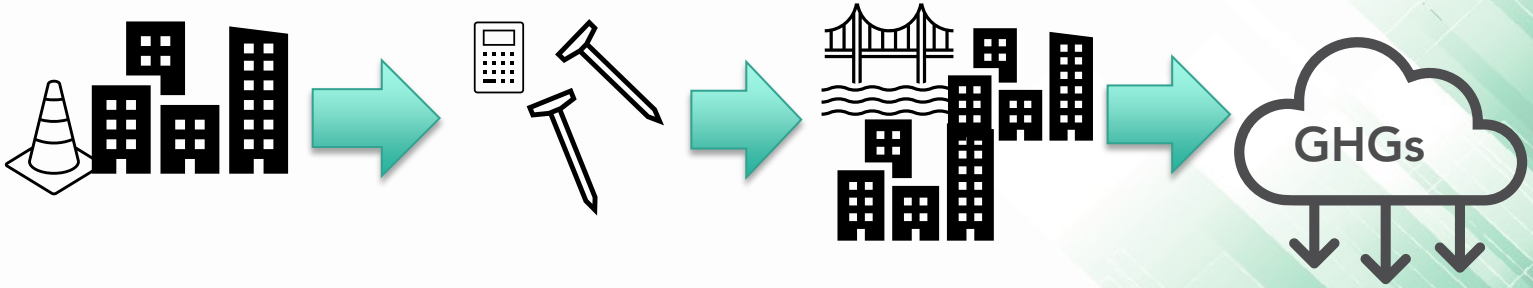
Bottom-up Approach for Establishing Baseline Emissions

Bottom-up Approach



Survey of Buildings and Construction

(Sample buildings of different types)

Material Quantity Estimation and Emissions Attribution

(quantity of material used in each specific building)

Project Scaling

(number of buildings of each type built in state)

Baseline Emissions

(tons CO_2e)

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Potential Strengths and Weaknesses

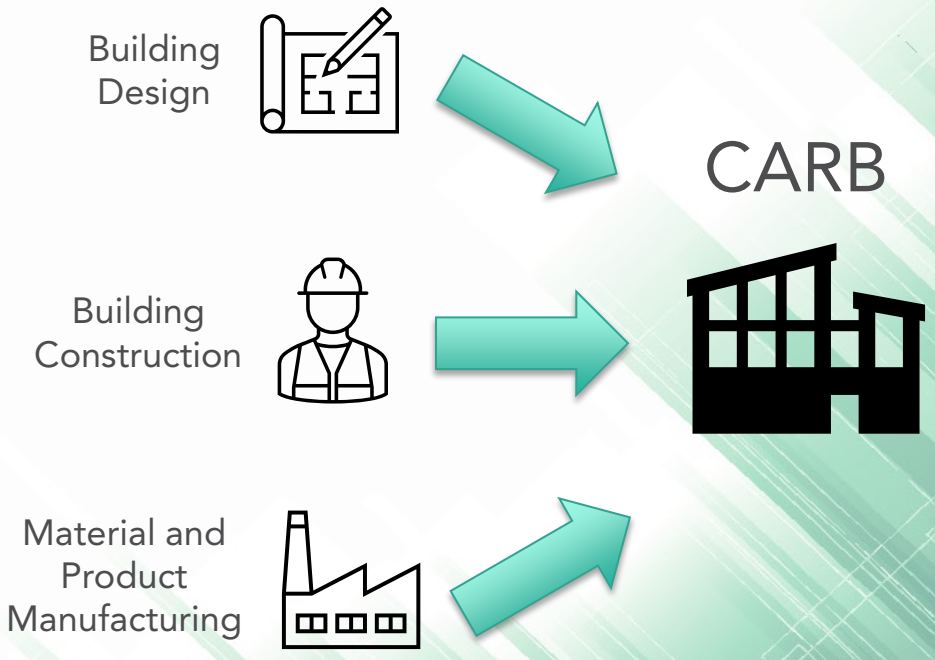
	Top-down	Bottom-up
+	- Data are more widely available - Estimates will capture most of the relevant emissions	- Good detail ('high resolution') for specific projects - Allows for targeted analysis for individual entities
−	- Limited specificity for individual actors	- Difficult to generalize results to an aggregate population - "data greedy" (difficult and expensive to collect)

Request for Feedback

- How might CARB address data limitations for bottom-up and top-down approaches to assess GHG emissions?
- Is one baseline-development approach preferable?
- What additional factors for baseline development should CARB consider?
- Is there existing information we could rely on for baseline setting?
- What is the appropriate level of data for this program to track progress towards the target (e.g. facility level, product specific, industry average)?

CARB is Seeking Early Engagement

Partnering with CARB for early data sharing and engagement will allow interested parties to inform system design, reducing hurdles and costs for reporting.



Core Requests for Information from Interested Parties

- Input on approaches to data reporting
- Are you interested in working early with CARB to help define key aspects of reporting tool development?
- Input to help inform the methodology used for baseline development
- Input data robustness necessary for implementation of this policy

Public Comments via Zoom

Online Attendees

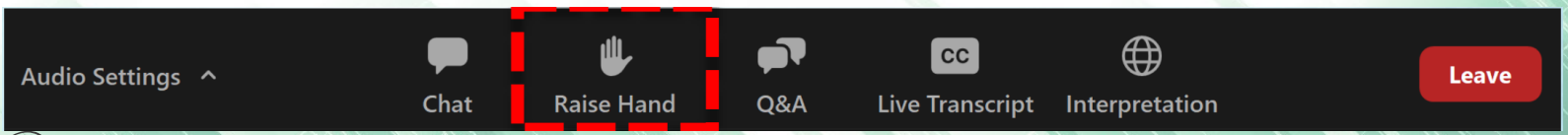
- Use the "**Raise Hand**" feature in the Zoom toolbar.
- When staff call your name, please "**Unmute**" yourself by clicking the red button and proceed to introduce yourself.

Phone Attendees

- Dial *9 to raise or lower your hand
- Dial *6 to mute or unmute

Technical Difficulties

- If you have technical difficulties, please email: embodiedcarbon@arb.ca.gov



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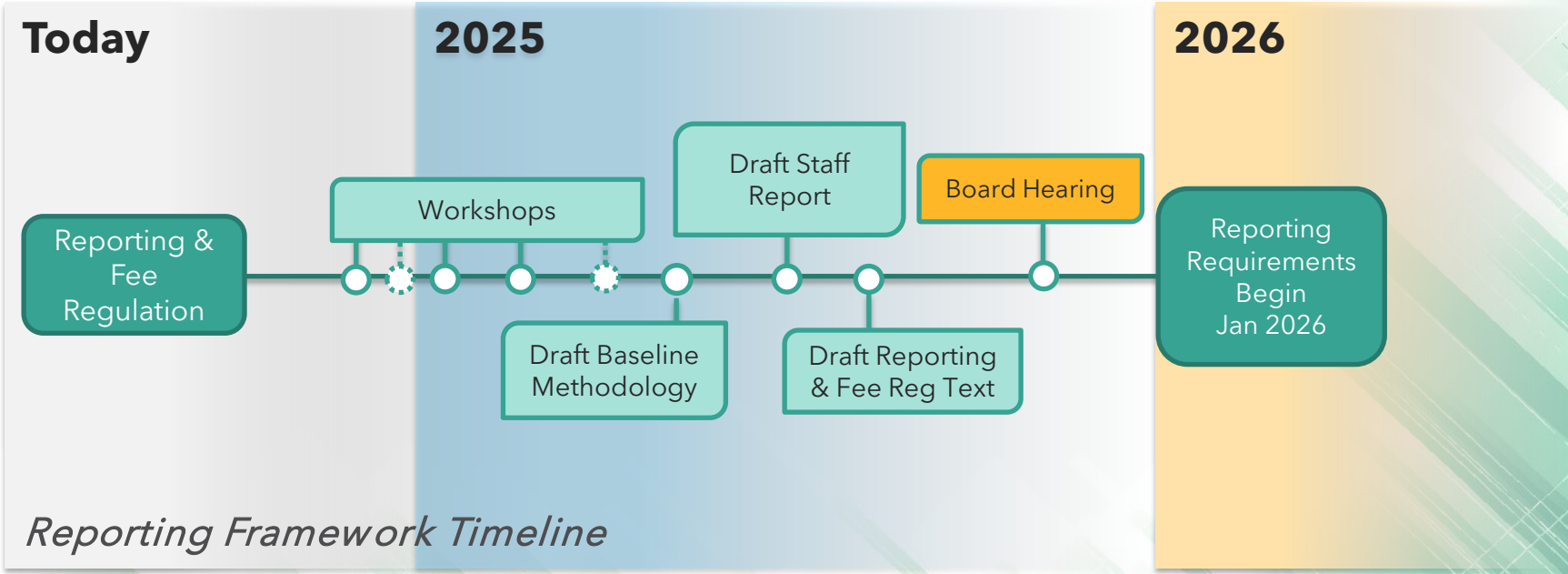
Near Term Timeline and Key Milestones



Reporting Framework Timeline

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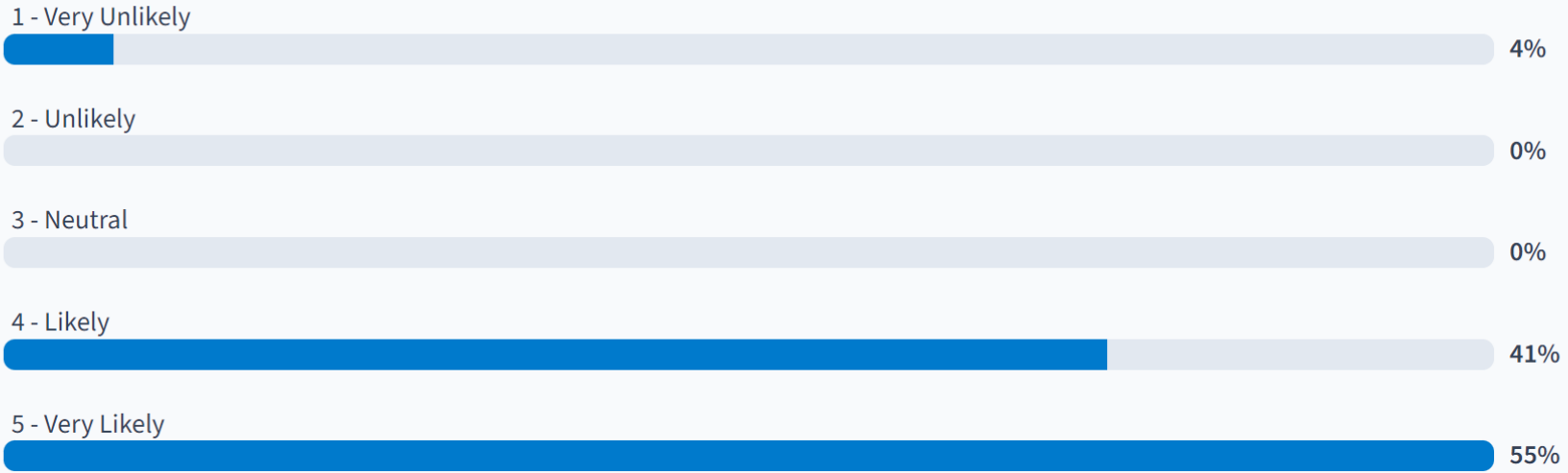
Anonymous Poll

- What is your likelihood of attending future workshops for this program?
- Are you subscribed to the embodied carbon email list?

What is your likelihood of attending future workshops for this program?



Are you subscribed to the embodied carbon email list?

Next Steps

- Submit public comments in writing before **October 11th** to https://ww2.arb.ca.gov/public-comments/comments-workshop-building-embodied-carbon-september-19

- Subscribe to the Embodied Carbon Listserv for updates on future workshops

Definitions for Reference

- **Life-Cycle Assessment (LCA)**: Compilation and evaluation of the inputs, outputs, and the potential environmental impacts of a product system throughout its life cycle (e.g., from cradle-to-grave).
- **Environmental Product Declaration (EPD)**: A document that communicates the life-cycle assessment of a product based on defined rules.
- **Embodied Carbon:** The carbon dioxide equivalent emissions associated with a product as determined using life-cycle assessment.
- **Carbon Intensity:** The carbon dioxide equivalent emissions associated with a product based on a comparable functional unit (e.g., kg CO_2e per board feet).