The Drive Toward Reducing Carbon in Concrete Construction

Dodge Construction Network

Speakers

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Dodge Construction Network

Allison Palmer

Senior Manager, Strategic Business

CarbonCure Technologies

AGENDA

- ❑ **Why Address Embodied Carbon?**
- ❑ The Importance of Concrete in Reducing Embodied Carbon
- ❑ Where We Are Now
- ❑ Drivers for Increasing Reductions
- ❑ Challenges
- ❑ Advancements in Concrete

21% Building Sector share of total GHG emissions:

- 57% indirect emissions from offsite generation of electricity and heat
- 24% direct emissions produced onsite
- 18% embodied emissions

Need further gains: in most regions, efficiency improvements: have been matched by growth in floor area per capita.

"Well-designed and effectively implemented mitigation actions in the building sector have significant potential for achieving the UN Sustainable Development Goals."

Start treating carbon accounting the same way you treat your financial accounting. You need to know [your entire] footprint and what you can do about it.

Cristina Gamboa, CEO, World Green Building Council

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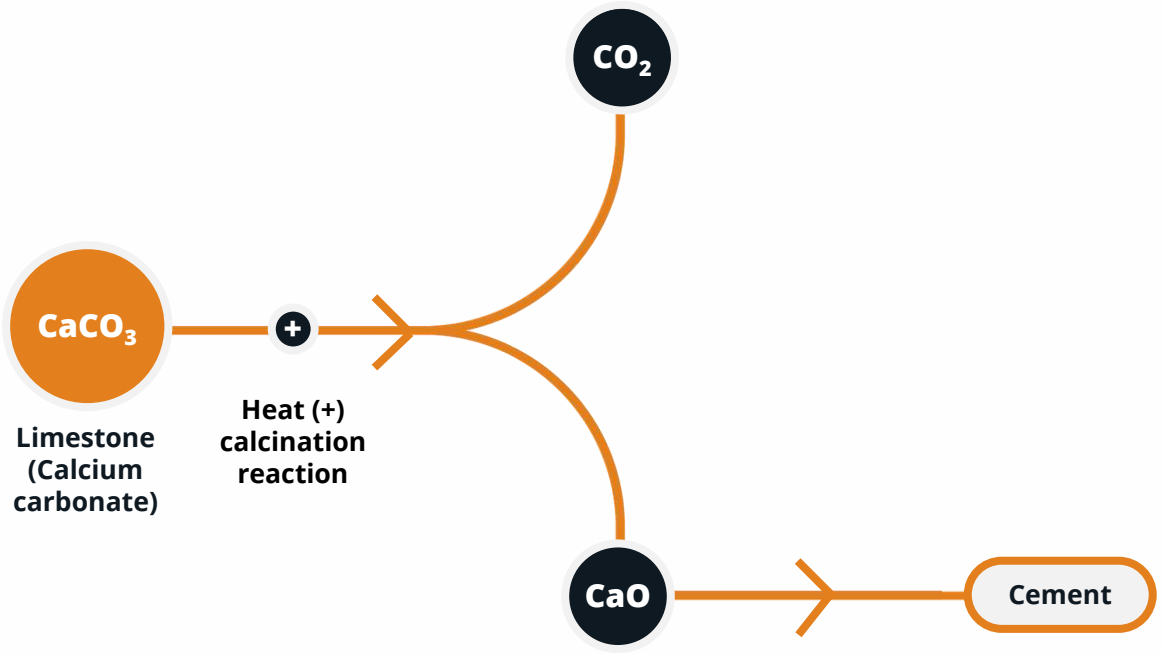
Did you know?

Cement makes up only 12% of the weight of concrete.

But is responsible for **95%** of concrete's carbon footprint.

CARBON CURE™

Cement Manufacturing Process



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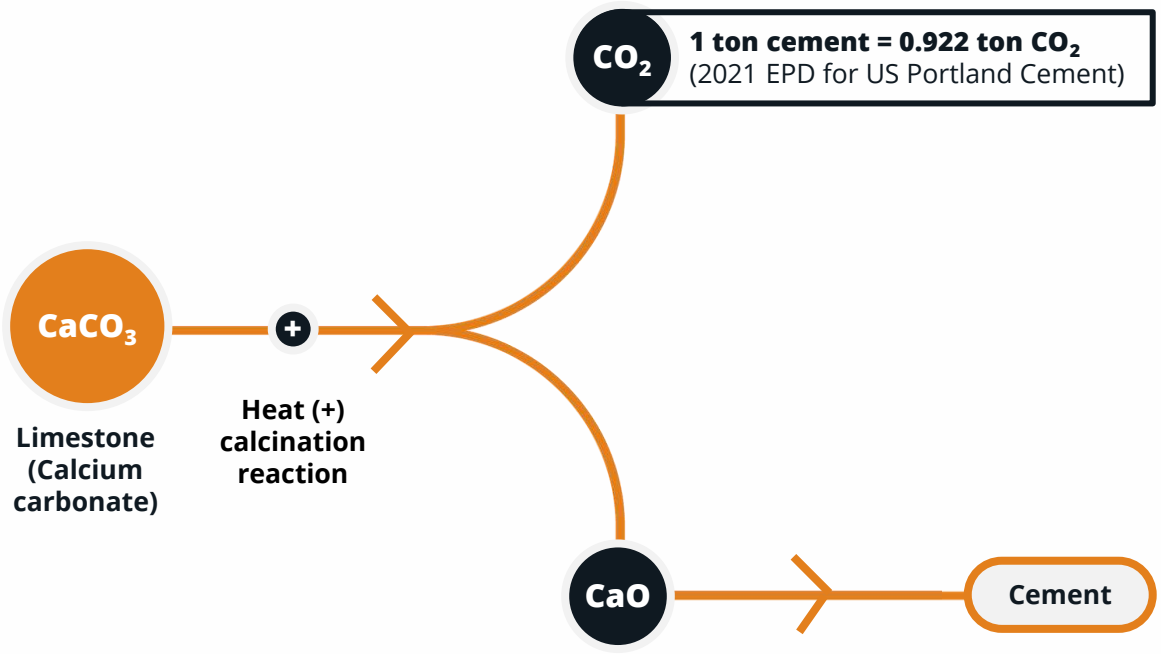

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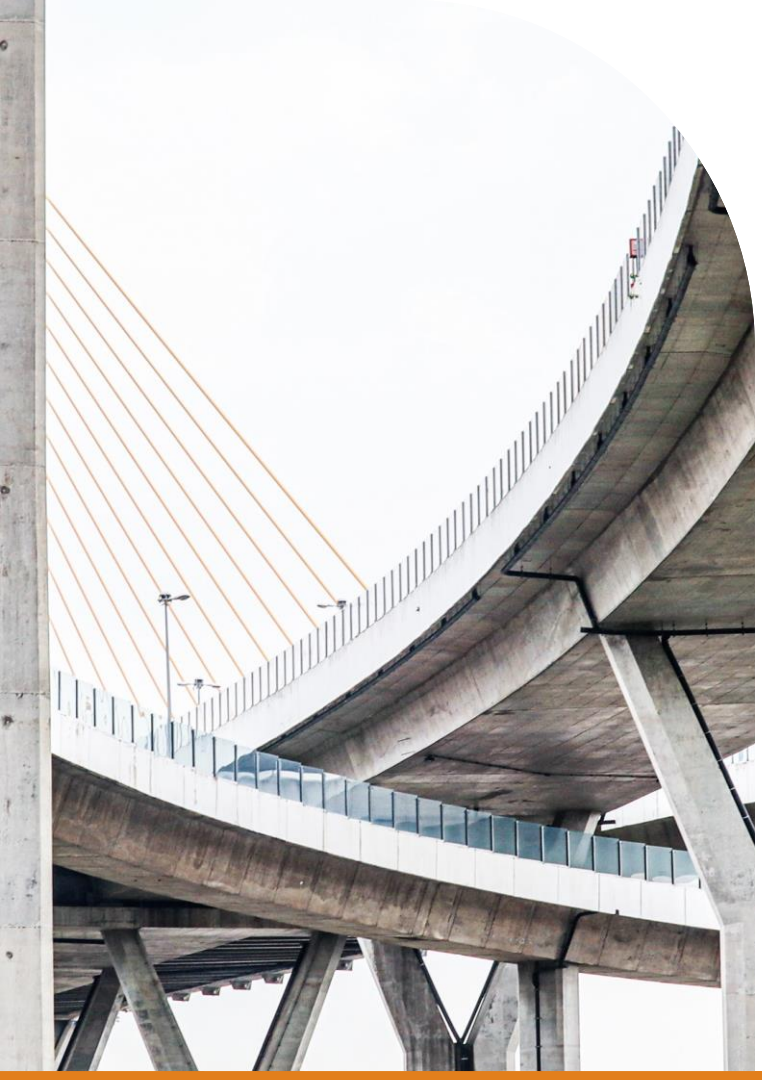

Concrete is the most abundant human-made material in the world.

As a result, cement production creates **~7%** of the world's CO_2 emissions and is one of the **largest contributors** to embodied carbon in the built environment.

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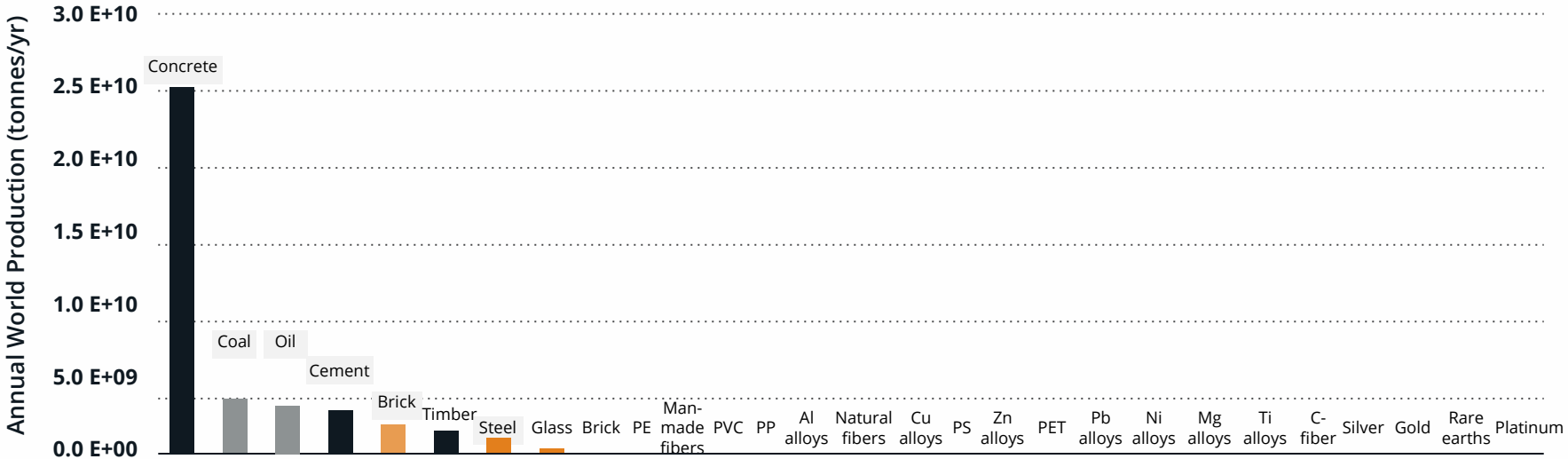
Concrete Made At Unparalleled Scale



Source: *"27 Materials on Which Industrialized Society Depends"*
Adapted from Ashby (2013) Materials and the environment, eco-informed material choice. ISBN 978-0-12-385971-6

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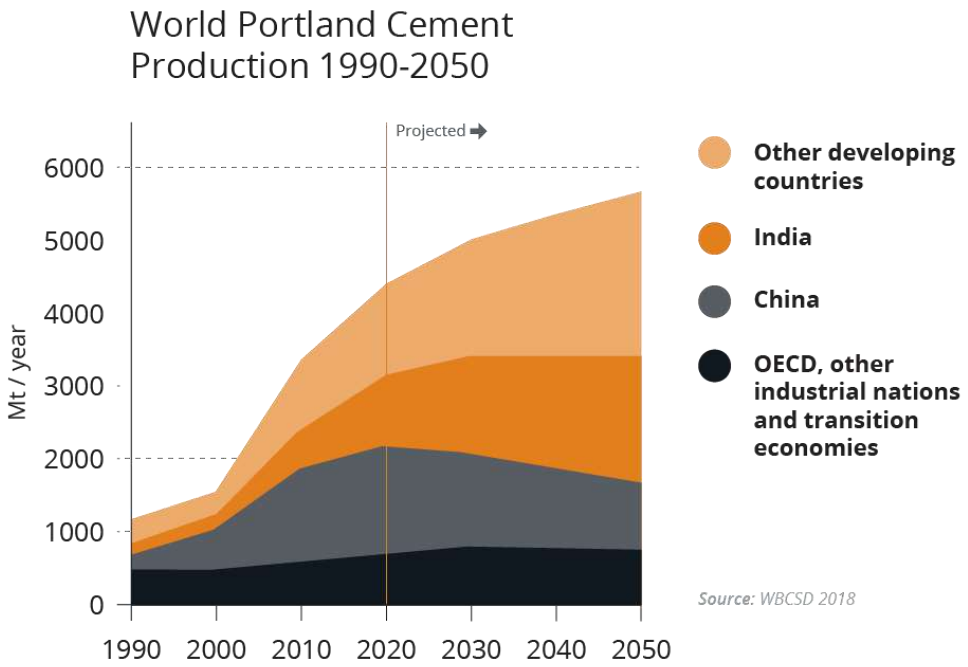
Cement Demand Projection

Cement demand expected to grow 12 to 23% by 2050.

-IEA, Cement Sustainability Initiative



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Online Study Conducted Spring 2022

Requirements to participate:

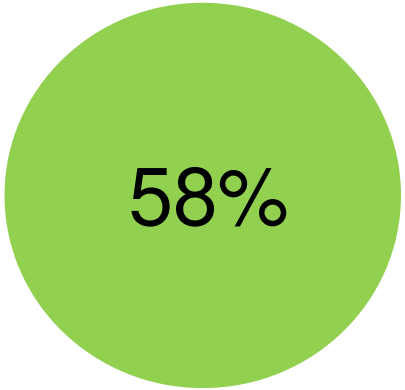
Had to be involved with or have influence over the specification or purchase of concrete for projects.

45 Architects

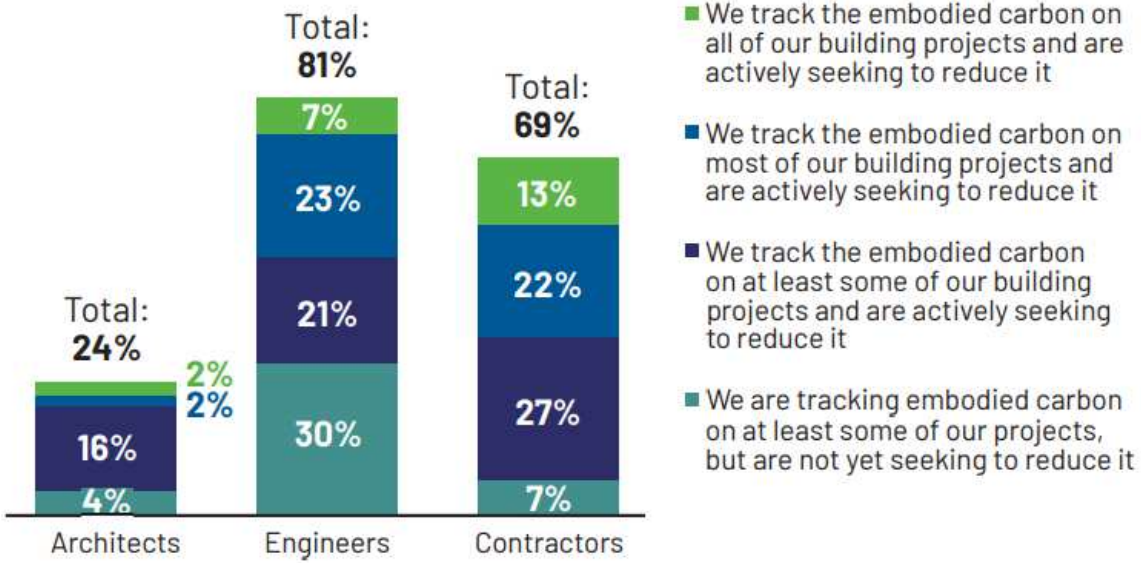
43 Structural Engineers

45 Contractors

Current Approach to Tracking and Reducing Embodied Carbon

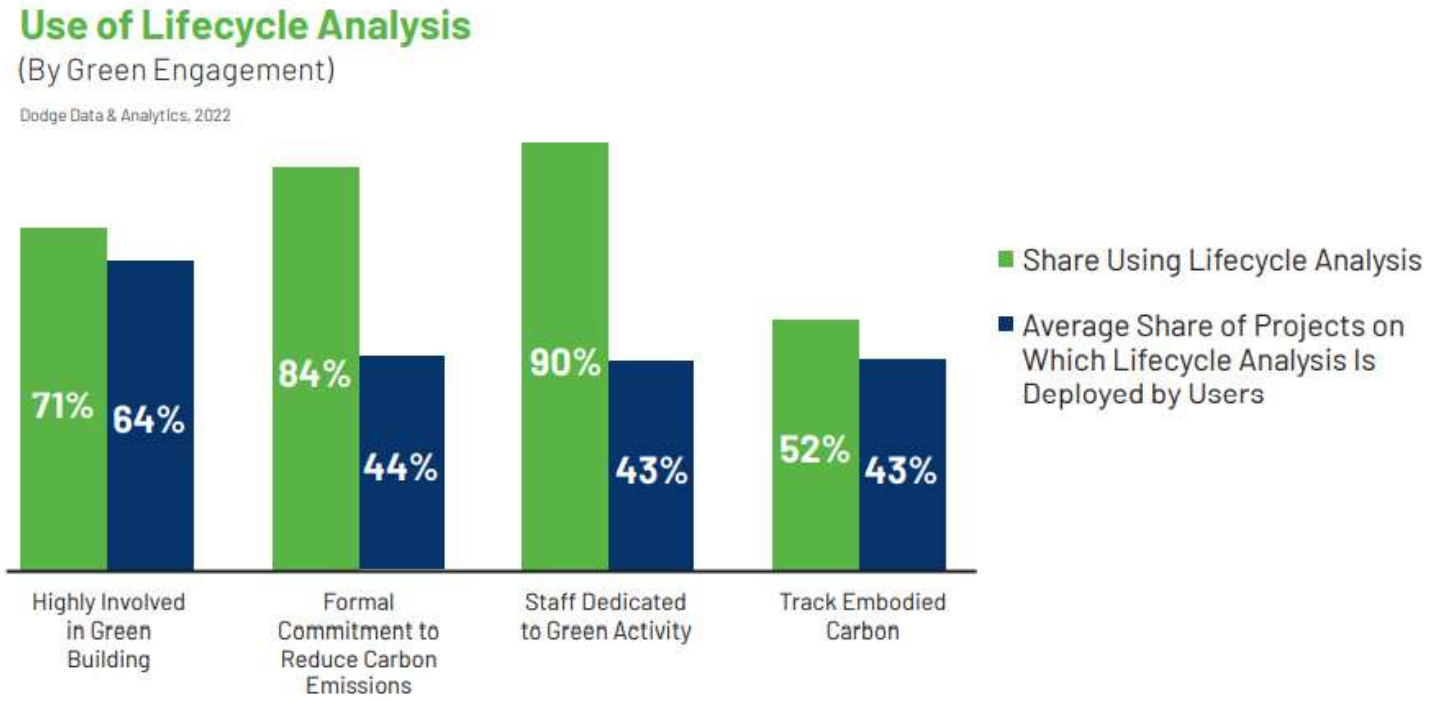


Share of Respondents Who Track Embodied Carbon on at Least Some of Their Projects



Means of Measuring Embodied Carbon

Lifecycle Analysis



Environmental Product Declarations

EPDs use consistent measurements for easy & objective comparison of products in same category

Environmental Facts Functional unit = 1 yd^3 of concrete	**Impact**
Primary Energy Demand (BTU)	$9.3x10^5$
Global Warming Potential (lb CO_2 eq)	360
Acidification Potential (lb H+ eq)	40
Eutrophication Potential (lb N eq)	0.4
Ozone Depletion Potential (lb CFC-11 eq)	$1.98x10^{-5}$
Smog Potential (lb O_3 eq)	21

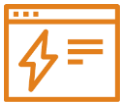
CARBON CURE

Prove how your concrete is different

CarbonCure Express EPD

Easy as 1,2,3

- CarbonCure does all the heavy lifting
- No headaches
- CarbonCure provides the guidance and expertise to create the LCA and EPD
- Low time investment



Straightforward Cost

- Less upfront costs
- Fixed fee per plant
- Unlimited EPDs per plant

High-Quality

- Product-specific EPDs
- Digital integration allows for fast and accurate EPDs using real data

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How CarbonCure Express EPD is Different

1. **Tell Us About Your Mixes:** We need to know about the raw materials that go into your mixes.

2. **Tell Us About Your Plant:** Help us learn more about your suppliers and ancillary materials.

And that's it!
We take care of the rest.

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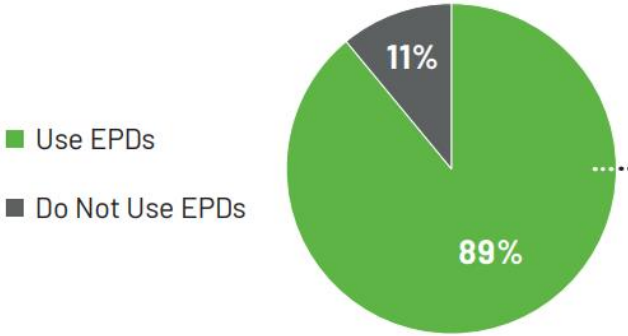
Use of EPDs

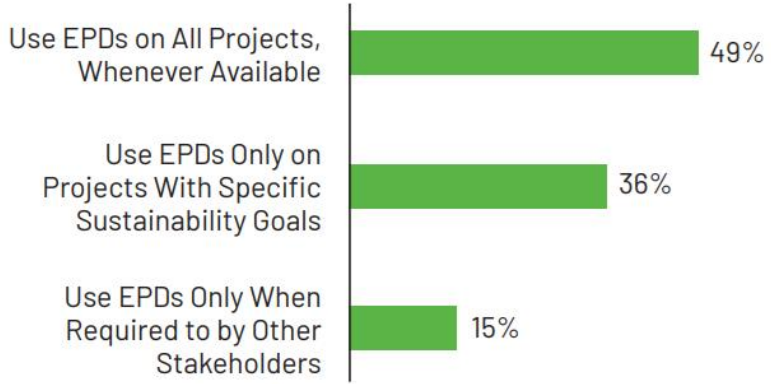
Use Environmental Product Declarations (All Respondents)

Dodge Data & Analytics, 2022

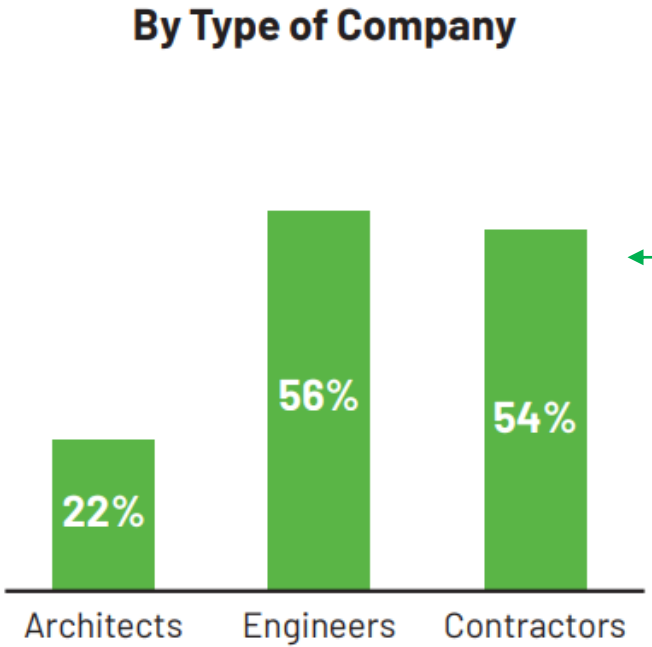


Frequency of Use of EPDs (According to Those Using Them)

Dodge Data & Analytics, 2022

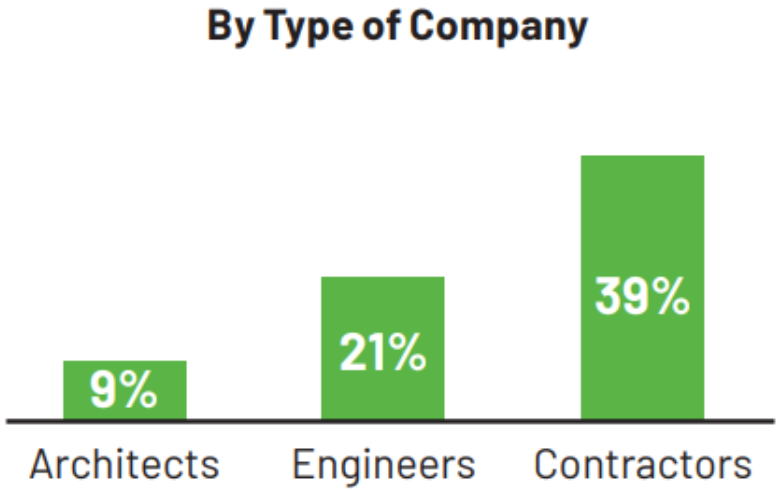


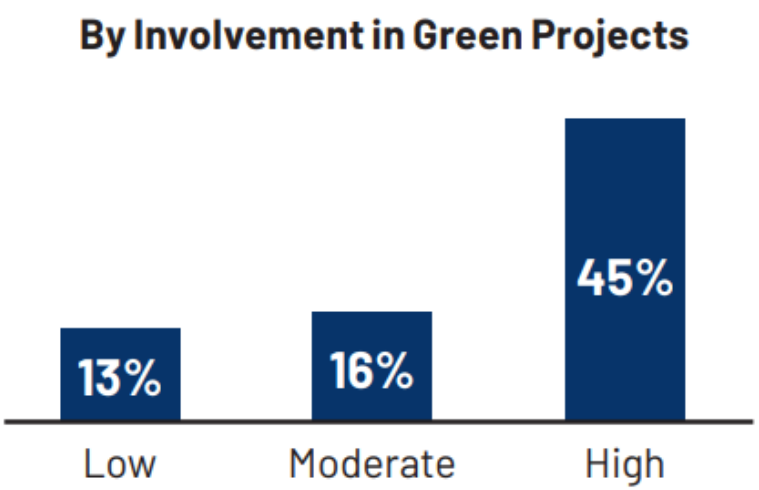
Use of EPDs


By Type of Company
22%
56%
54%
Architects
Engineers
Contractors

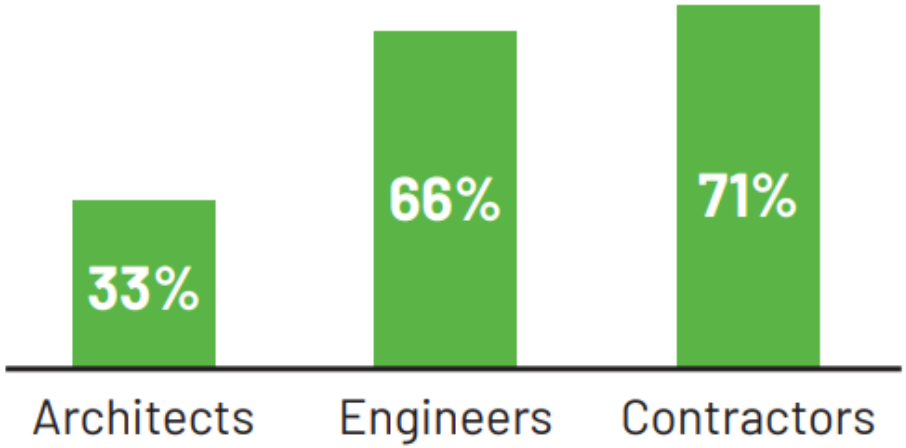

Frequency of Use of EPDs
(According to Those Using Them)
Dodge Data & Analytics, 2022
Use EPDs on All Projects, Whenever Available
49%

Frequency That Practitioners Request EPDs on All Projects





Increased Use of EPDs in the Last Year



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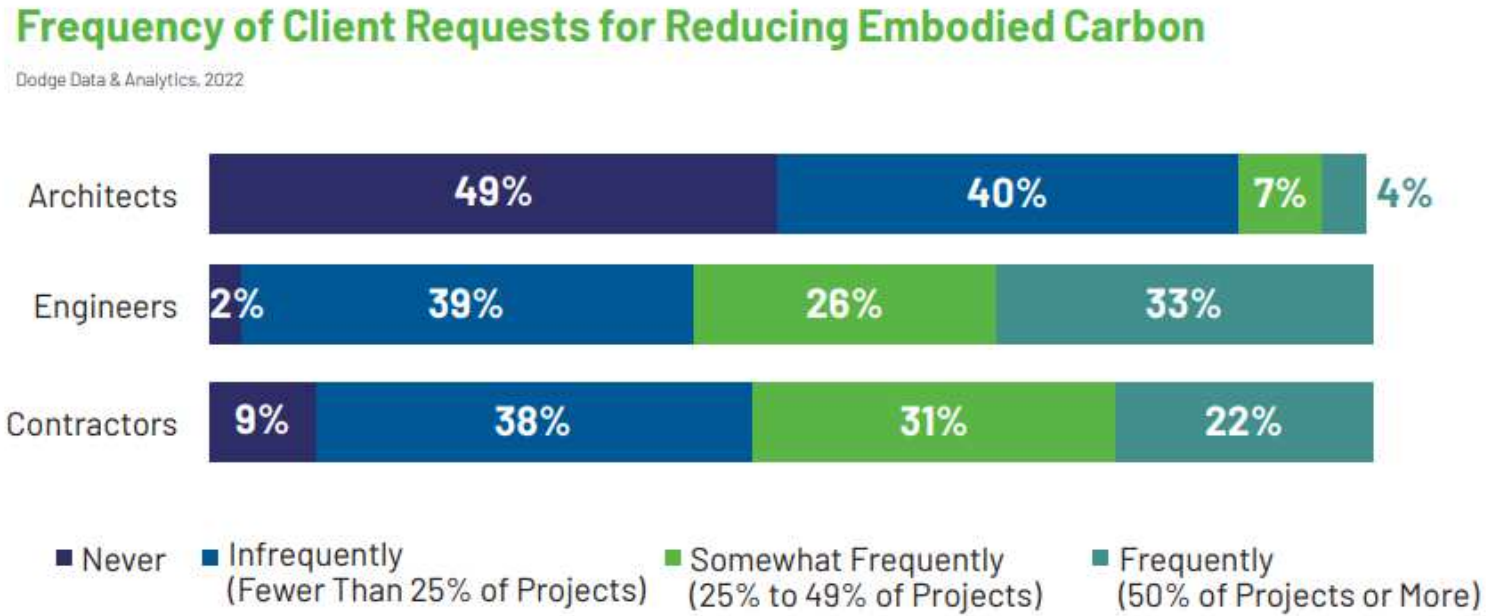
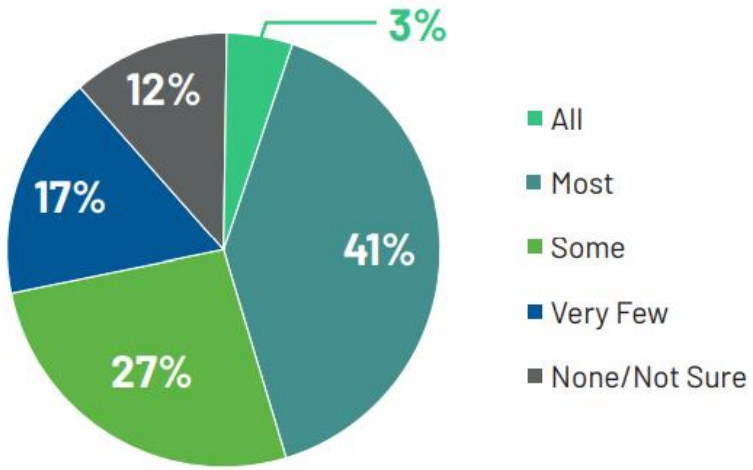
Owners Driving Increased Engagement



Owners Driving Increased Engagement

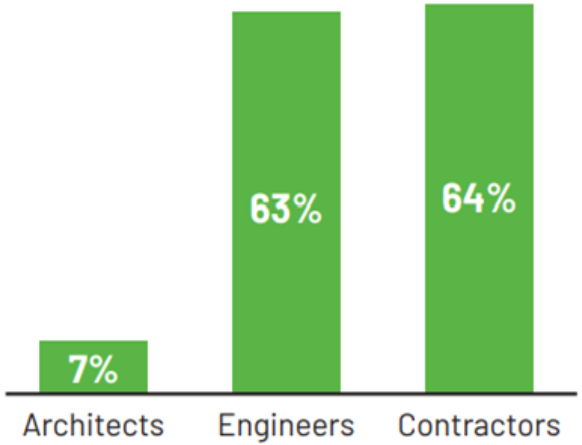
Frequency of Clients Asking for EPDs

Dodge Data & Analytics, 2022



Most/All Clients Ask for EPDs

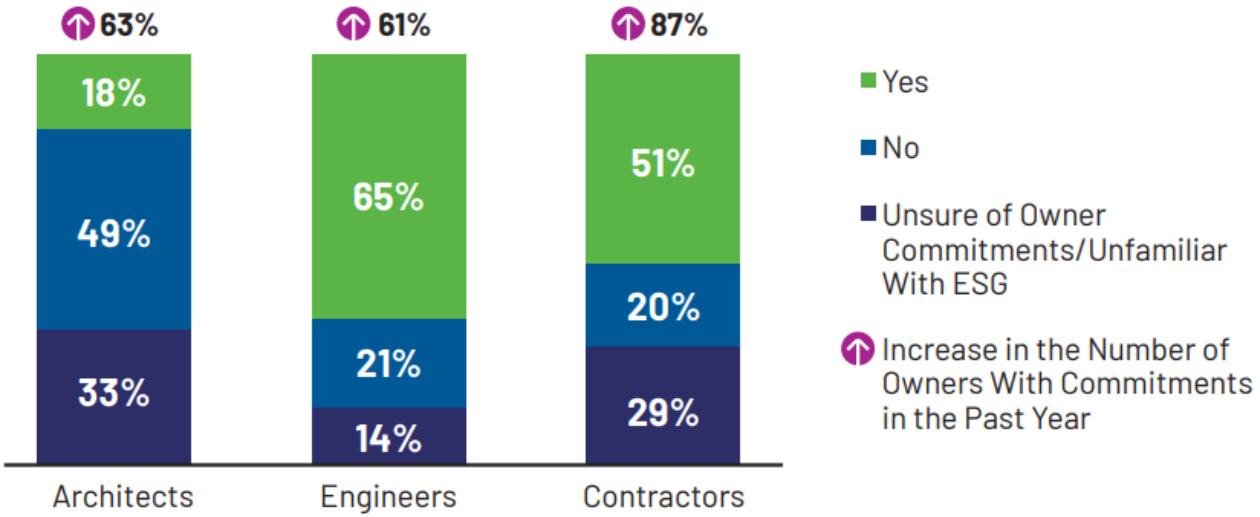
Dodge Data & Analytics, 2022



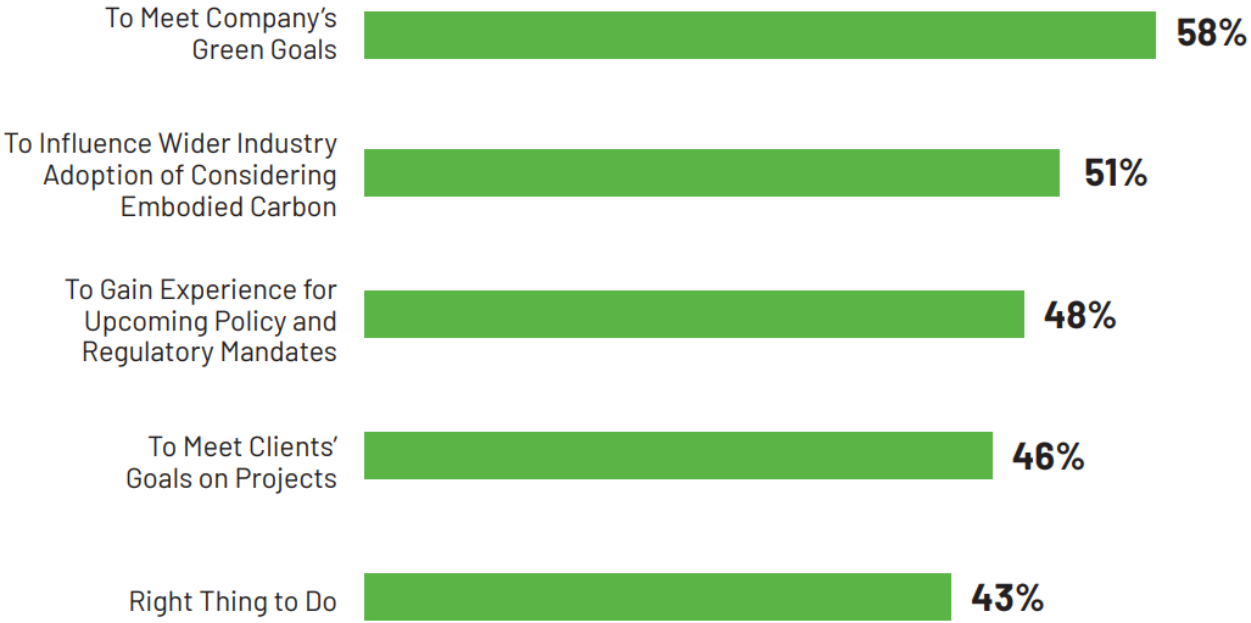
Owners Driving Increased Engagement

Involved in Projects With Owners/Investors With Specific ESG Commitments

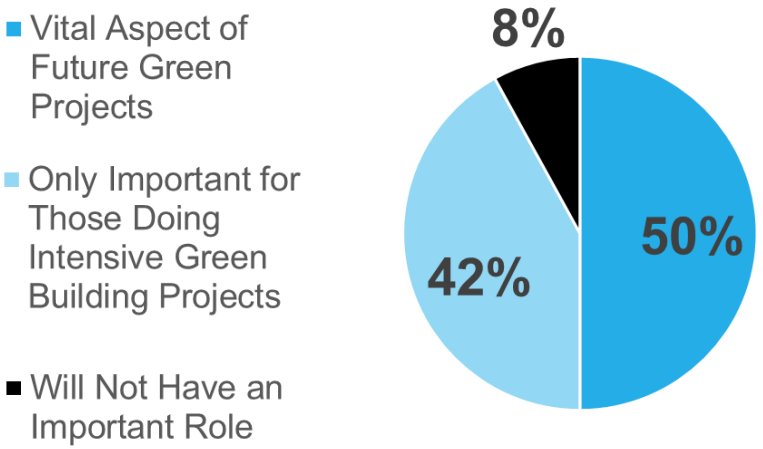
Dodge Data & Analytics, 2022

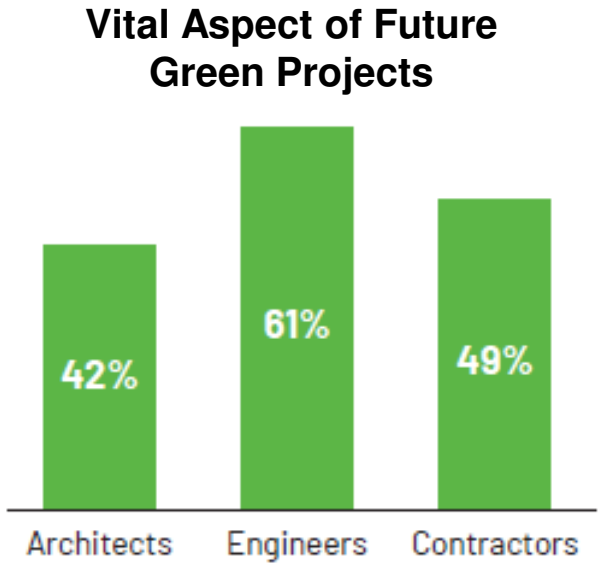


Reasons That Practitioners Currently Take Embodied Into Consideration at Project Start



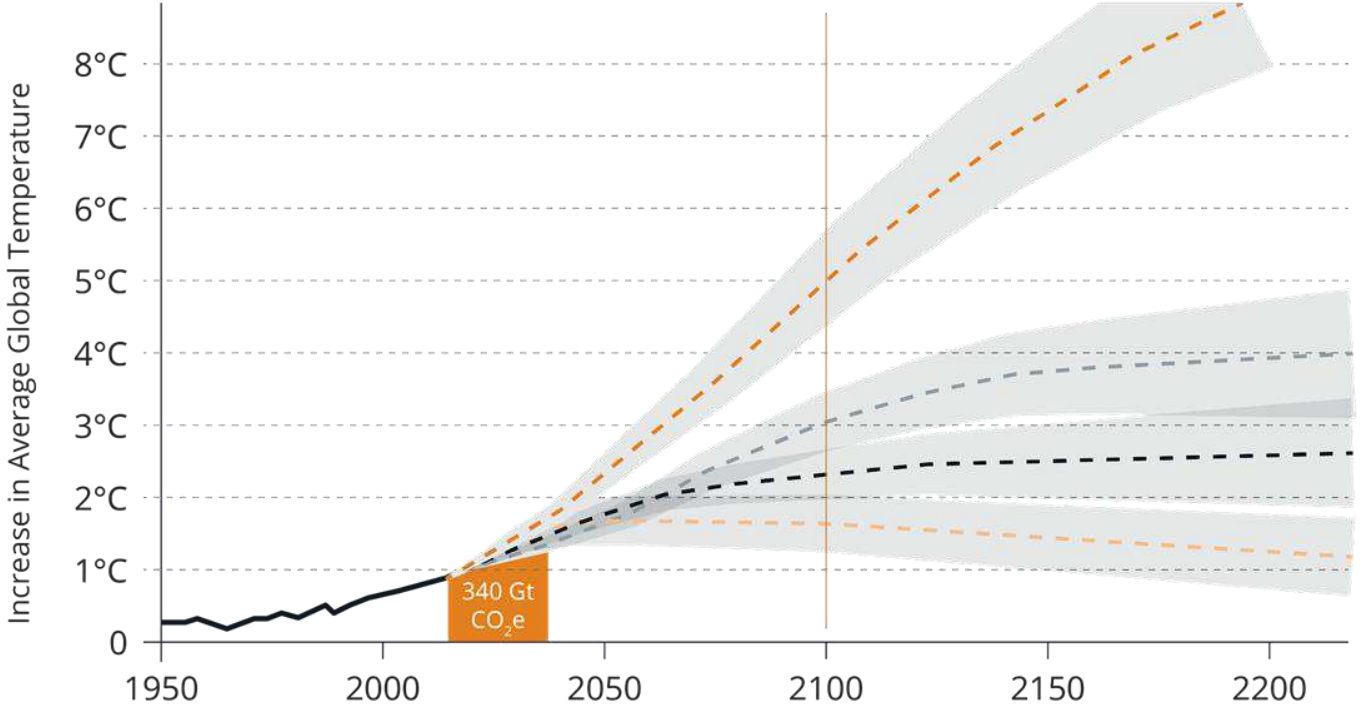
Importance of Integrating Reduction of Embodied Carbon Into Green Building Projects in the Next Five Years





Global CO_2 Challenge

Global temperature projections for various scenarios



RCP8.5
Business-as-usual
2.2 trillion tons carbon

RCP6.0
emissions peak 2080
1.6 trillion tons carbon

RCP4.5
emissions peak 2040-50
1.3 trillion tons carbon

RCP2.6 (1.5°C)
0.53 trillion tons carbon
zero CO_2 emissions ~2050

Source: Reproduced with permission from Architecture 2030; Adapted from IPCC Fifth Assessment Report, 2013. Representative Concentration Pathways (RCP), temperature projections for SRES scenarios and the RCPs.

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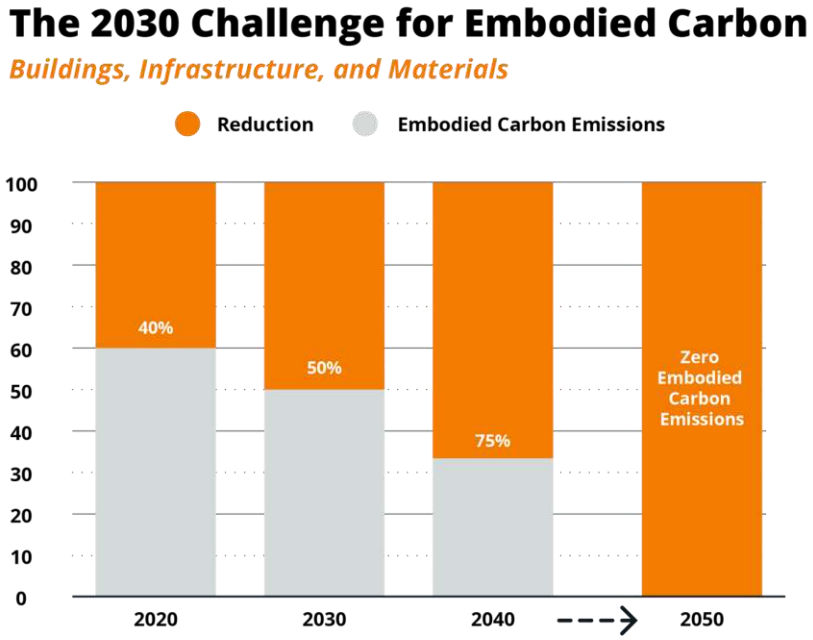
The Embodied Carbon Challenge

A multi-disciplinary challenge to achieve net zero embodied carbon by 2050



Mission alignment with:

Carbon Leadership Forum

SEI ASCE

architecture 2030

C40 CITIES

WORLD GREEN BUILDING COUNCIL

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Top Reasons That Embodied Carbon Is NOT Taken Into Consideration at Project Start

Architects

- Not a priority for most clients (71%)
- Concerns about increased cost (49%)
- Lack of knowledge of how to measure (44%)

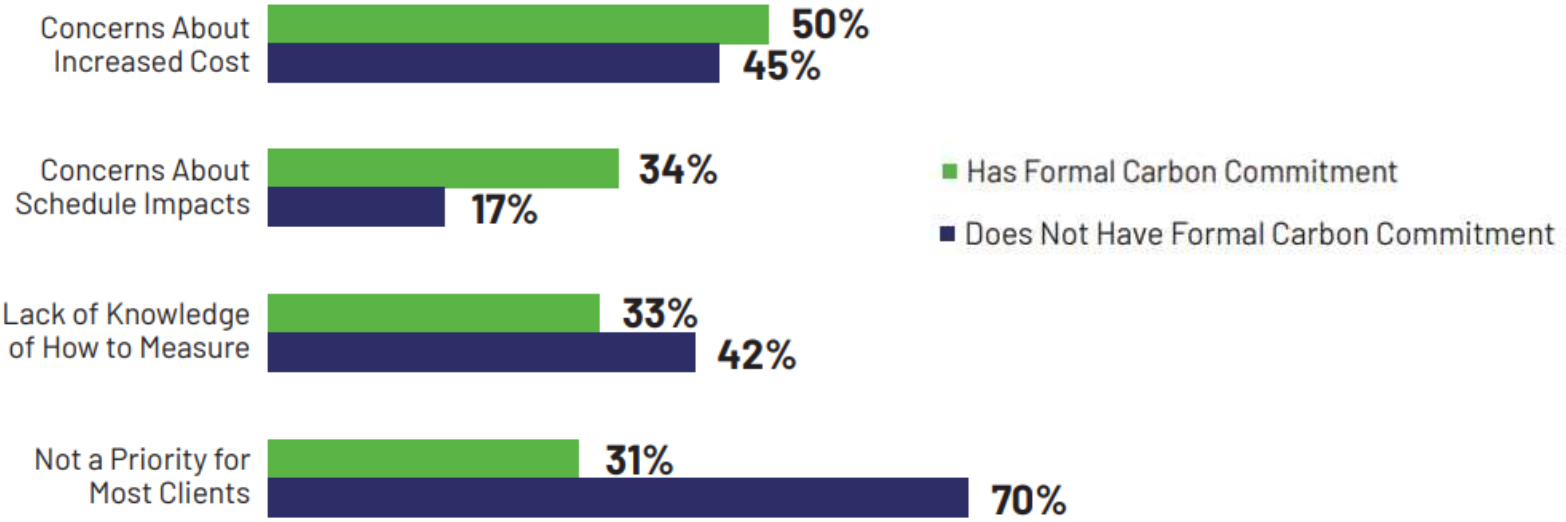
Engineers

- Not a priority for most clients (37%)
- Concerns about increased cost (37%)
- Concerns about schedule impacts (33%)

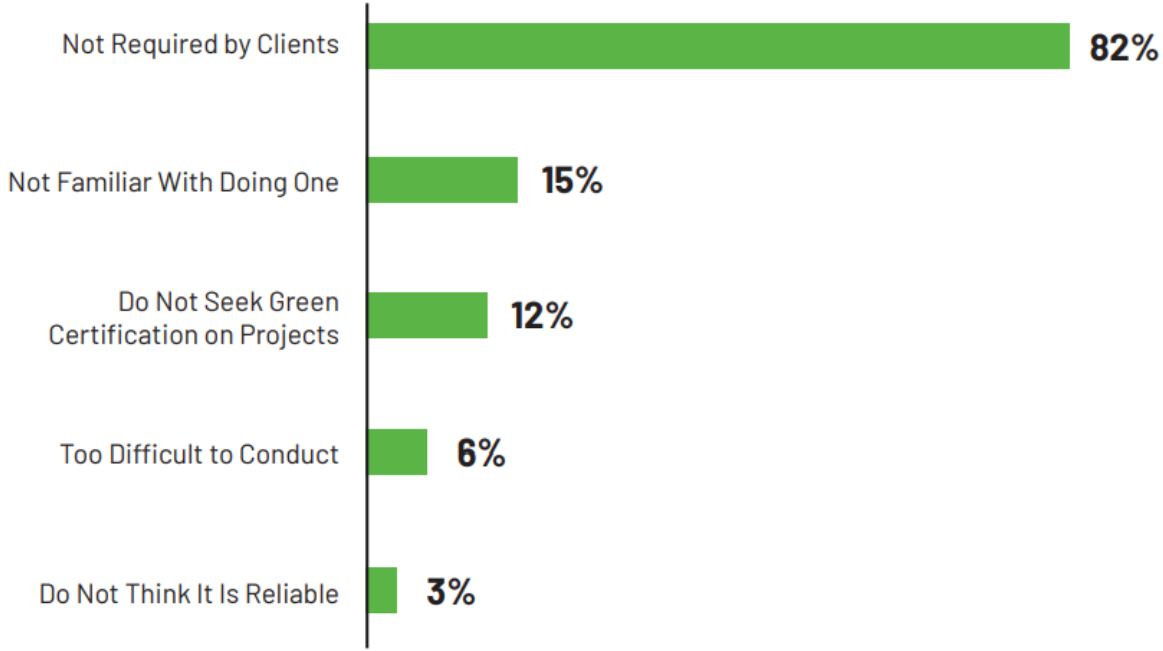
Contractors

- Concerns about increased cost (58%)
- Lack of knowledge of how to measure (33%)
- Not a priority for most clients (31%)

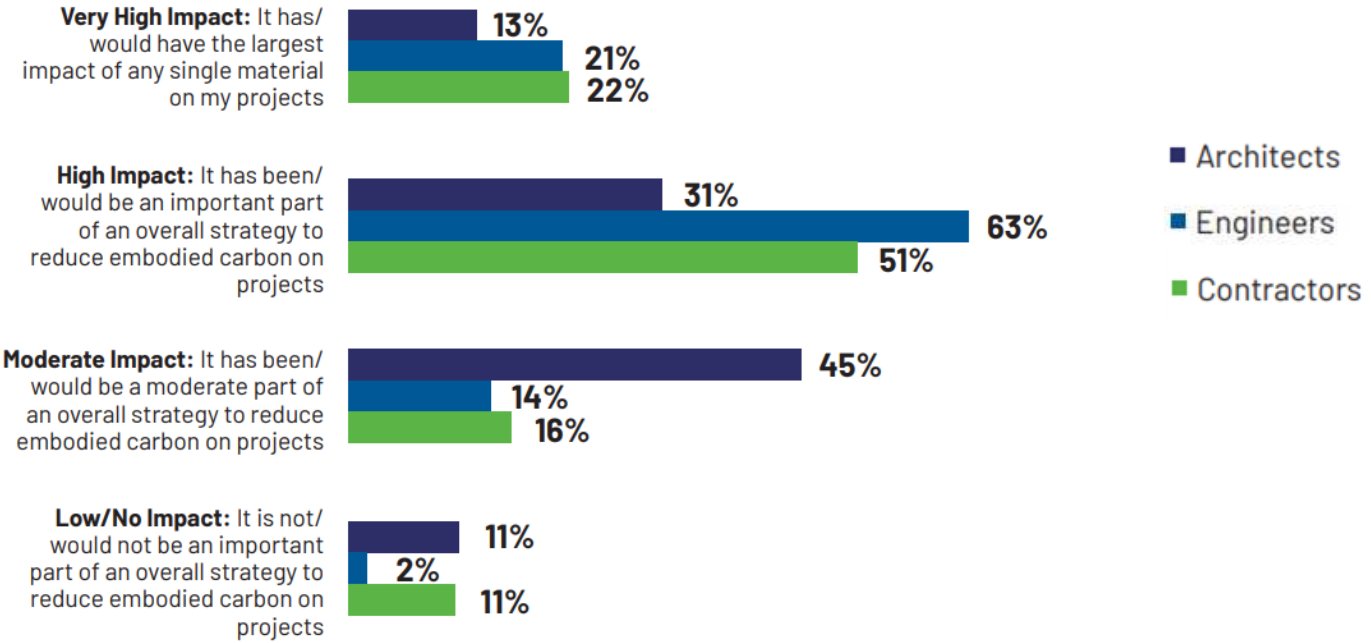
Top Reasons That Embodied Carbon Is NOT Taken Into Consideration at Project Start



Reasons That Practitioners Currently Do NOT Conduct a Lifecycle Analysis on Their Projects



Importance of Reducing Embodied Carbon of Concrete to Overall Embodied Carbon Reduction on Projects



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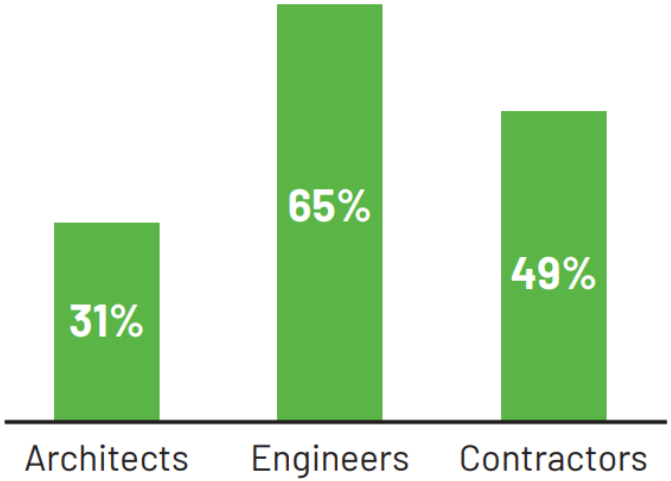
Aware of Concrete Products or Companies That Can Reduce the Level of Embodied Carbon



CarbonCure's Solution for Embodied Carbon

- CarbonCure's CO_2 mineralization technologies offer a proven solution for reducing embodied carbon ***today***
- The tech beneficially repurposes CO_2 to produce the same high quality concrete but with a lower carbon footprint.

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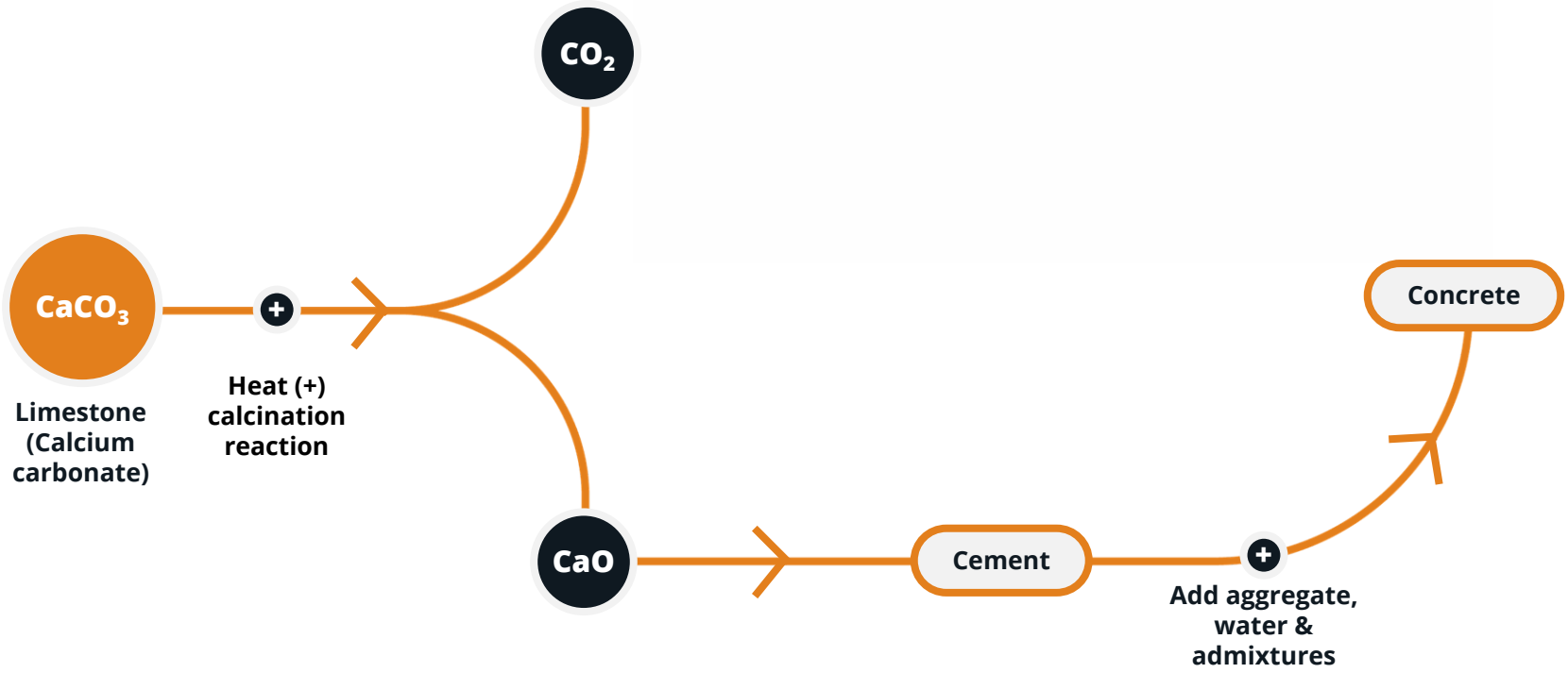
Concrete Manufacturing Process



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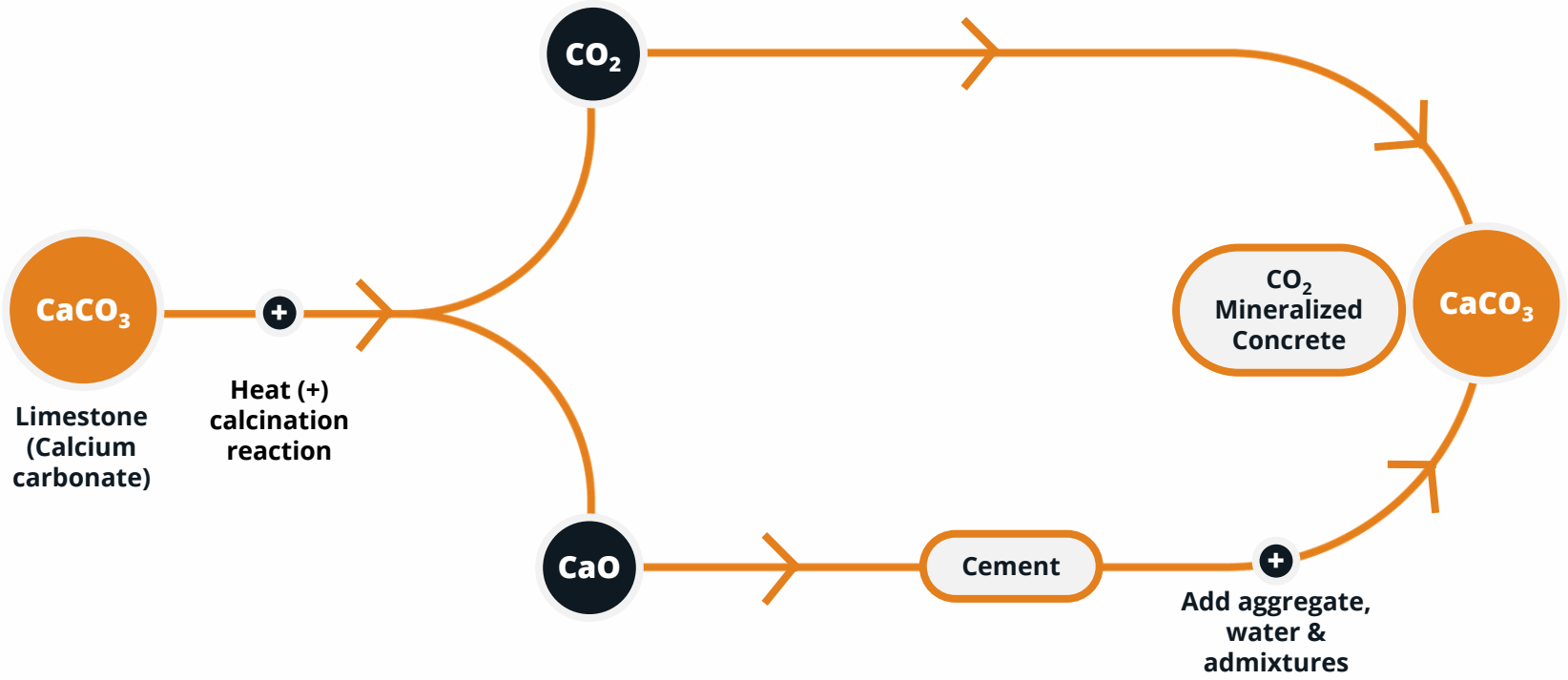
Converting CO_2 to a Mineral



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CO_2 Injection

New Emphasis on Embodied Carbon

Green buildings certification systems now address embodied carbon

LEED BD+C:
New Construction | v4.1 - LEED v4.1

Building Life-Cycle Impact Reduction

Possible 5 points

2 points
Demonstrated impact reduction of at least **5%** in global warming potential (GWP) and 2 other impact categories

3 points
Demonstrated impact reduction of at least **10%** in global warming potential and 2 other impact categories

4 points
Demonstrated impact reduction of **20%** in global warming potential, at least **10%** in 2 other impact categories, and building reuse and/or use of salvaged materials

Materials & Resources
Focuses on minimizing embodied environmental impacts to support a life cycle approach that improves performance

Option 4:
Whole Building Life Cycle Assessment (1-4 points)
Conduct a life cycle assessment and show a 10% impact reduction in embodied CO_2 emissions + 2 other impact categories shown on an environmental product declaration

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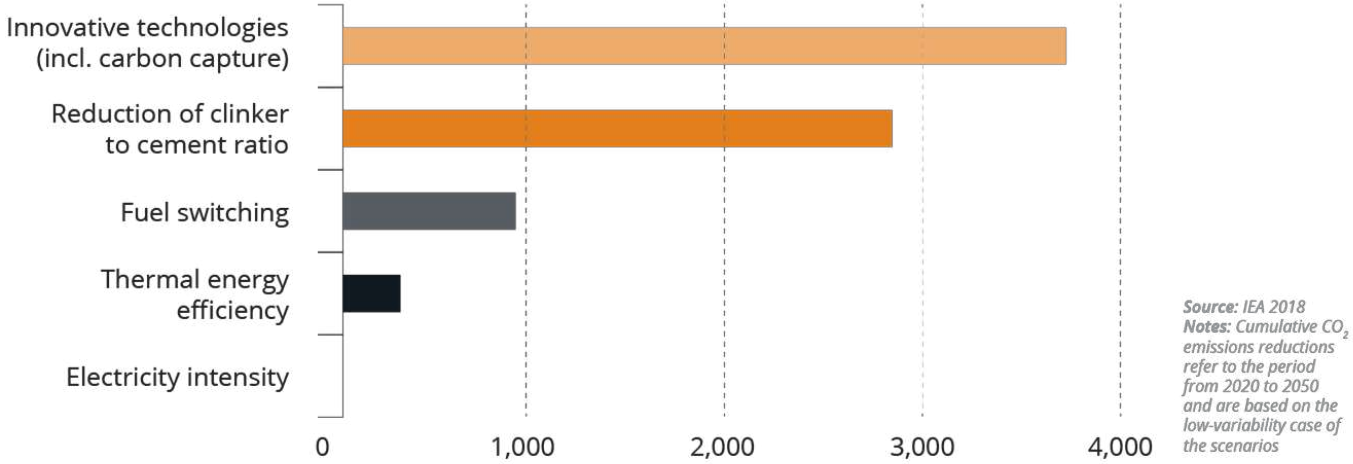
IEA Technology Roadmap

Pathway for reducing emissions in the cement and concrete sector



Source: IEA 2018
Notes: Cumulative CO_2 emissions reductions refer to the period from 2020 to 2050 and are based on the low-variability case of the scenarios

- 48% of emissions reductions must come from carbon capture and utilization strategies
- 37% of reductions must come from reduced clinker to cement ratios

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Key Takeaways & Questions

Thank you