



# Embodied carbon: The missing half of GHG emissions

## Introduction

Construction is known to be one of the largest contributors of carbon emissions globally. A staggering 40 percent of the world's carbon emissions come from buildings alone and that number jumps to 70 percent if you include infrastructure. To help combat growing environmental concerns, corporations are continually making net-zero commitments that will require reducing carbon emissions over the coming years. Yet many of those same corporations do not understand the what and the how when it comes to environmental, social, and governance (ESG) and greenhouse gas (GHG) emissions performance or reporting. This is especially true regarding carbon emissions from capital projects.



## Up to half of all carbon emissions are emitted before the building is operational

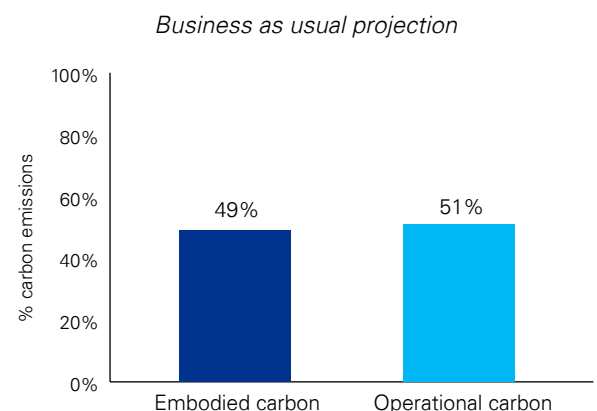
To accurately offset the carbon emissions from a building's construction, we must be clear about the exact time to start measuring. Embodied carbon is the amount of the GHG emitted during the manufacturing, transportation, installation, maintenance, and disposal of building materials; it can make up as much as 50 percent a building's lifetime emissions, depending on asset type. To date, facilities, real estate, and construction functions have ignored this half of their carbon emissions and it's not just them; current standards, guidelines, codes, and measurements mostly focus on operational carbon (from heating, air conditioning, and operating the facility) emissions. This presents a huge opportunity for many teams to further their commitments to decarbonization.

## Embodied carbon's share in building lifecycle GHG emissions is increasing

The United Nations (UN) Environment Global Status Report dated 2017 indicates that 49 percent of the total carbon emissions from global new construction between 2020 and 2050 will be embodied carbon.

As the name suggests, embodied carbon stays trapped within a structure once it is complete. As such, the opportunity to impact the embodied carbon's share of a building's emissions disappears once the facility is built. As building operations become cleaner through the use of renewables, technology use, increased systems efficiency, and electrification, embodied carbon will become responsible for an even larger percentage of emissions.

### Total carbon emissions of global new construction, 2020–2050



# California leading in efforts to limit embodied carbon

To decrease embodied carbon and further decarbonize capital projects, a new emphasis will need to be placed on choosing the right vendors and specifying the right materials.

The Buy Clean policies around construction procurement and updates to building codes requiring low-carbon materials in the US are encouraging. California has been leading with the Buy Clean California Act, which limits the maximum acceptable carbon footprint for structural steel, concrete reinforcing steel, flat glass, and mineral wool board insulation and mandates that teams provide Environmental Product Declarations (EPD) for them. EPDs have become the primary market mechanism for disclosure of product impact on the environment as they provide critical information for transparently reporting objective, comparable, and third-party verified data about a product's environmental performances from a lifecycle perspective.

A newly signed law, AB 2446, furthers the state's strategy for addressing embodied carbon by requiring the California Air Resources Board to build a framework to measure and reduce the average carbon intensity of building materials by 2025. The law requires builders and manufacturers to provide the embodied carbon amount for all nonresidential new buildings greater than 10,000 square feet (twice the size of a basketball court) and of five or more residential units by completing a whole building lifecycle assessment. The manufacturers must also submit EPDs for building materials per specifications.



## State of California proposing to amend its CalGreen code

Most recently, The California Building Standards Commission (the Commission) announced<sup>1</sup> that it will be considering a new set of embodied carbon requirements for buildings over 50,000 square feet (about half the area of a Manhattan city block). Suggested code changes and how KPMG can support impacted projects are listed below.



### Potential new CalGreen codes

The State of California is considering baseline carbon emission must be calculated, minimum 10 percent carbon reduction demonstrated

If the Commission acts as announced, KPMG can support the quantification, verification, and tracking of project carbon baselines, EPDs, emission sources, and mitigation strategies that promote project success and demonstrate compliance

#### Option 1 – Reuse of an Existing Building larger than 50, 000 SF:

Reuse a minimum of 45 percent of an existing building's primary structural elements

#### Option 2 – New Building larger than 50,000 SF:

Demonstrate 10 percent reduction in Global Warming Potential (GWP) compared to the baseline building design through Whole Building Lifecycle Assessment excluding operational energy

#### Option 3 – New Building larger than 50,000 SF:

Obtain EPDs for five high-impact materials that are individually or on average lower than a specified threshold of GWP



### How KPMG can support

KPMG will partner with your real estate engineering and construction teams to evaluate which portions of the existing building can be reused and show the most potential for carbon emissions reduction without sacrificing cost, schedule, and quality.

KPMG will help quantify your projects baseline design emissions and GWP reduction, analyze project budget to incorporate a whole life cycle approach, detail cost and schedule impacts of GWP reduction pathways, and calculate return on investment of proposed strategies.

KPMG will work with your procurement and supply chain teams to identify qualifying high-impact materials with current EPDs or assess EPD-holding replacements when necessary. In cases where a key vendor or relationship is identified we can support the development of a compliant EPD.

<sup>1</sup> State of California Department of General Services website, Building Standard Commission Rulemaking section, 2023.

# Carbon literacy in construction

If made official, it will build on California’s Buy Clean Policy established in 2017 by requiring embodied carbon declarations for construction within the state.<sup>2</sup> This may put significant pressure on a construction industry that is already strained by supply chain issues and inflation to quickly adapt to including embodied carbon in their projects. Material producers may need to track and disclose, general contractors may need to calculate and manage, and owners may need to monitor and report the amount of embodied carbon in their projects. Regulators may need new technology and tools to verify the material and project disclosures they will receive from projects in the pipeline, including performing EPD verifications. Project teams may need to add embodied carbon optimization knowledge to their skill sets, develop a structured mechanism to calculate, decrease, track, and monitor embodied carbon emissions, create Project Carbon Management Offices, and incorporate whole lifecycle analysis into project planning and execution.

Soon, all construction professionals may need to consider total project carbon emissions in project planning together with cost, schedule, and quality. Companies may need scenario analysis to determine the most optimal project delivery timelines, budgets, and carbon emissions. These scenarios may need to be evaluated for their commercial impacts such as delayed building occupancy costs versus higher carbon offset purchases for the company, that may impact ESG performance scores.

Outside of code requirements, embodied carbon calculations are the only way to track up to half of the resulting carbon emissions of construction projects that have gone largely unaccounted thus far while being touted as a global best practice.

These changes will require construction professionals to approach construction management with an increased focus on total project carbon management and develop carbon literacy. A new metric, total project carbon, which is the sum of embodied and operational carbon for the lifecycle of the project, will need to be tracked.

## Total project carbon: A new metric in town



To address the increasing environmental concerns from investors and the public, corporations have been making ESG commitments to reduce carbon emissions. Yet, those same companies are struggling with the tracking and reporting of carbon emissions from their capital projects.

Public and private institutions are seeking resources that can help them decarbonize, operationalize ESG, and create accountability and transparency to avoid green-washing.

Total project carbon calculation will shed light to half of the construction industry GHGs that have been ignored until now to do just that.



Traditionally, corporations have focused on addressing operational carbon emissions and completely ignored the embodied carbon.

Currently, standards pertaining to the carbon emissions of active projects vary globally and embodied carbon standards are seldom used at best. However, that is starting to change; requirements to capture embodied carbon are beginning to emerge and tools are being developed to address the need.

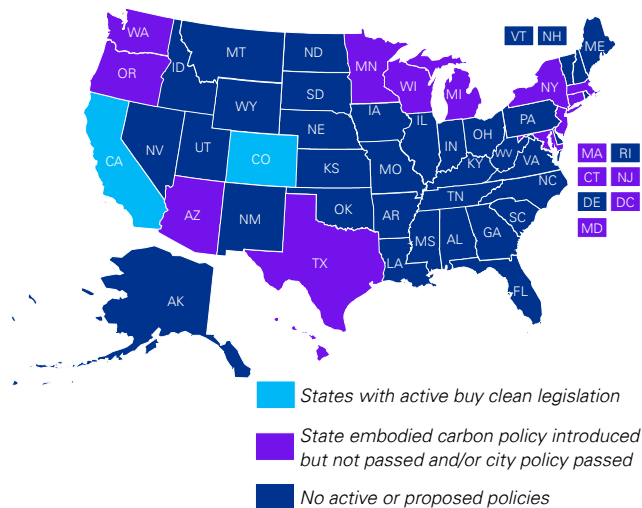
Project teams will need to learn how to incorporate the new embodied carbon standards developed in addition to sustainable building requirements.



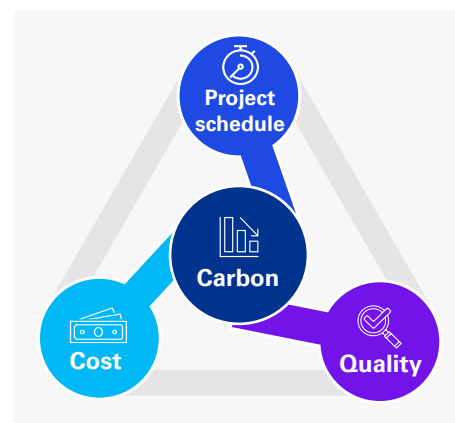
This major shift in the industry will require project teams to think about not only an asset’s functional lifetime, but also its creation and disposal phases as well.

In the future, construction professionals will need to monitor, disclose, and balance embodied carbon emissions alongside operational carbon, culminating in a new metric, total project carbon.

For capital programs to truly demonstrate their decarbonization efforts, total project carbon must be evaluated in the same breath as the more traditional program key performance indicators like project cost, schedule, and quality.



Source: Carbon leadership forum



<sup>2</sup> State of California Department of General Services website, Procurement Division Buy Clean California Act section, 2023.

# Benefits and opportunities

Reducing total carbon emissions through the lifecycle of a building can provide a competitive advantage as it serves to achieve net-zero goals. It makes it possible for stakeholders to potentially finance the project through green funds that may decrease capital costs, while reducing your buildings' impact on the climate and global warming.

Projects that incorporate total project carbon as a metric have a better chance of reaching embodied carbon reduction goals while evaluating the effects on project cost and schedule. Optimizing embodied carbon can create efficiencies by increasing construction productivity, minimizing waste, and using lean construction processes overall. The result is a healthy and sustainable facility with reasonable capital costs, a strong net operating income through low energy demand, and associated utility costs.

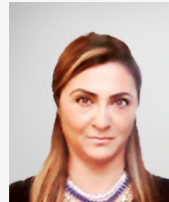
In short, for real estate owners, operators, and builders, decarbonization presents both a challenge and an opportunity. By pursuing total project decarbonization in construction and operations, project stakeholders not only demonstrate their commitment to sustainability, but also position themselves for long-term success with increased return on their investment.

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# Why KPMG

## Capital projects expertise

KPMG advises client globally to improve performance of capital projects by pairing the construction experience of its professionals with industry-leading technology and methodologies

## Decarbonization experience

KPMG has over 1,000 dedicated climate GHG accounting, decarbonization professionals and subject matter professionals across real estate, embodied carbon, and green finance

## Data, analytics, technology

KPMG offers proprietary ESG data and analytics tools as well as tools and resources from alliances (e.g., Microsoft Cloud of Sustainability, Appian ESG solutions)

## We "walk the walk on ESG"

The KPMG Impact Plan includes a roadmap to be net zero by 2030 along with increasing inclusion and diversity, and driving sustainable growth for stakeholders

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