

Embodied Carbon Reduction Roadmap



At Hines, we strive to challenge the status quo and take leadership on carbon reduction.

The impact of climate change is growing across the globe. Sharp deviation from the status quo is required to combat it and avoid lasting effects to world populations and ecosystems.

Buildings make up 38% of global energy-related Greenhouse Gas (GHG) emissions, with building materials and construction processes being major contributors.

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Understanding Carbon

The term “carbon” typically refers to carbon dioxide and other greenhouse gases associated with climate change. The impact of these gases is commonly measured through Global Warming Potential (GWP), reported in kilograms of CO₂ equivalent.

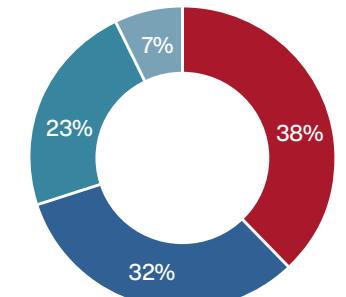
Carbon emissions are categorized into Embodied and Operational

- » Embodied carbon includes emissions from product creation, construction, remodeling, and deconstruction. Product creation is typically the largest contributor
- » Operational carbon includes energy and water emissions from daily building operations

Many factors influence the proportion of embodied versus operational carbon—such as building type, life span, and local energy grid—but embodied carbon is a major contributor.

Embodied carbon is reported through Environmental Product

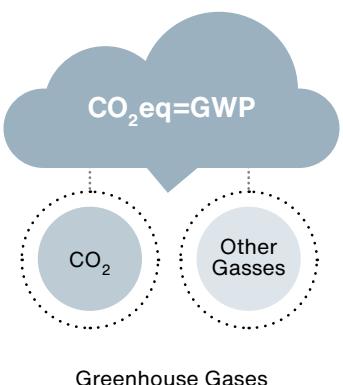
GLOBAL CO₂ ENERGY-RELATED EMISSIONS BY SECTOR



■ Buildings ■ Transportation
■ Industry ■ Other

Source: United Nations Environment Programme 2020 Global Status Report for Buildings and Construction

CARBON



Declarations (EPDs) in terms of GWP for a building product. Today, availability of EPDs varies widely across the U.S. and for different building products, but information is rapidly expanding.

GWP DATA AVAILABILITY

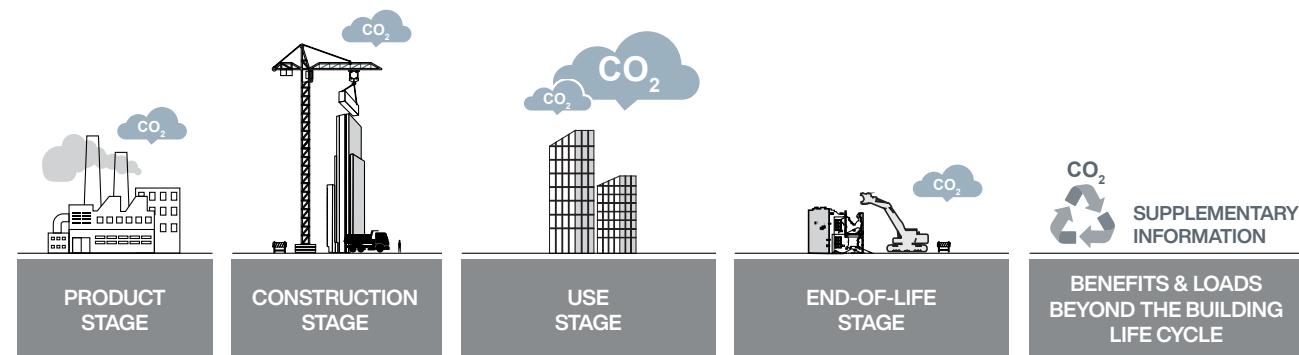
MOST DATA AVAILABLE	LIMITED DATA AVAILABLE	DATA NOT YET AVAILABLE
Concrete Steel Timber	Carpet Ceiling Tiles Cladding Drywall Insulation Metal Studs	BMUs Elevators MEP Systems

Measuring Carbon

A building's carbon impact can be organized into its life-cycle stages, and measured through a Whole-Building Life-Cycle Assessment (WBLCA).

A simplified method, the **Product Stage Focus Method**, prioritizes the product creation stage, which typically accounts for the largest portion of impact and often presents the most cost-effective route to lower embodied carbon. This involves collecting building component quantities and the GWP of these components. The primary structural materials should be considered at a minimum, with envelope, finishes, and other materials considered when possible.

BUILDING LIFE-CYCLE



CALCULATING EMBODIED CARBON

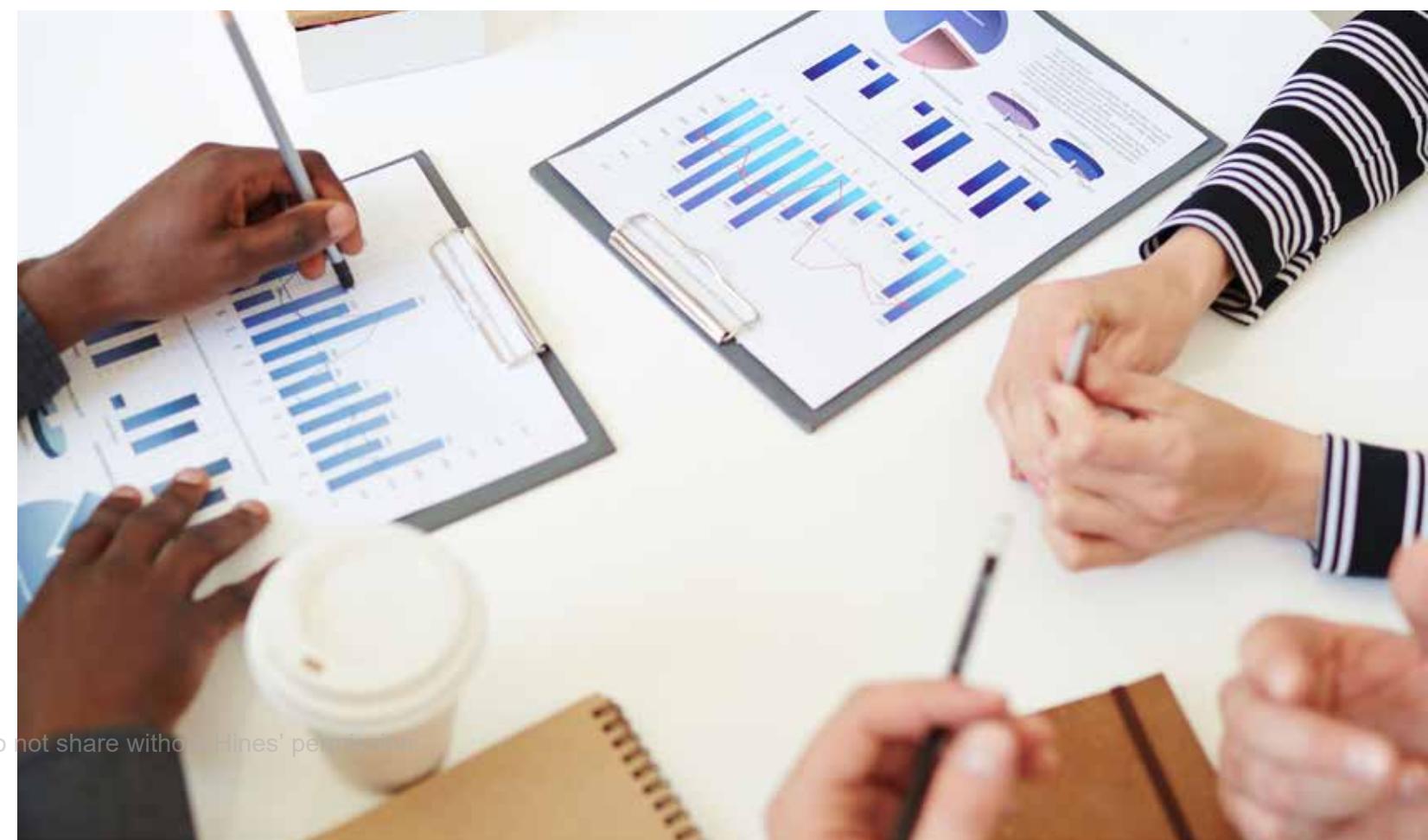
Material Quantity	X	Global Warming Potential	=	Embodied Carbon
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Determination of building component quantities should occur at Schematic Design and each subsequent design milestone. The design team should perform these quantity take-offs, reconciling with the General Contractor when on-boarded to ensure their accuracy.

The GWP of building components should be taken from their EPDs. An EPD may report the average GWP of multiple suppliers, called industry-average, or be specific to one supplier or product, called product-specific. Product-specific EPDs, also known as Type III, are the most accurate and therefore most desirable.

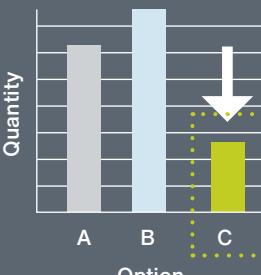
During design phases, industry-average EPD and GWP values should be used for project-to-project consistency and comparison. When a supplier is selected in construction, product-specific Type III EPDs should be used.

The **As-Designed Embodied Carbon** and **As-Built Embodied Carbon** summaries should be reported to Hines Conceptual Construction Group and recorded in the Hines Embodied Carbon Database.



Carbon Reduction Strategies

Reducing the embodied carbon in our buildings can be done in several ways when incorporated into the decision-making process starting in design and extending through procurement and construction. The strategies to reduce embodied carbon can largely be summarized as follows:

USE LESS MATERIAL	
Consider effect on total amount of material used in design decisions.	<p>Example considerations:</p> <ul style="list-style-type: none"> » Building shape » Floor-to-floor height » Column spacing » Architectural finishes vs exposed structure » Basement vs podium parking » System selection 
SPECIFY LOWER CARBON PRODUCTS	
Specify and select materials considering their embodied carbon.	<p>Example considerations:</p> <ul style="list-style-type: none"> » Concrete strength and steel grade » Envelope system components » Architectural finishes » Renewable products where possible 
BUY LOWER CARBON PRODUCTS	
Compete prospective suppliers to drive down embodied carbon and cost.	<p>Example considerations:</p> <ul style="list-style-type: none"> » Include embodied carbon in bid selection criteria » Require submission of EPDs » Review supplier-specific embodied carbon factors, such as manufacturing source (domestic vs international) » Encourage supplier collaboration in embodied carbon reduction efforts 

Carbon Reduction Responsibilities

The process outlined in the Hines Embodied Carbon Reduction Guide involves contributions from the Hines Team, Design Team, and Contractor in order to achieve as much reduction as possible.

Hines	DESIGN TEAM	GENERAL CONTRACTOR
<ul style="list-style-type: none"> ● Select <u>Design Team</u> with embodied carbon reduction experience, particularly the architect and structural engineer ● Distribute project-specific <u>Owner Project Requirements (OPR)</u> template, including embodied carbon reduction strategies, for consideration and discussion with design team ● Assist design team to <u>Identify Baseline</u> at Schematic Design using the <u>GWP Baselines Values Appendix</u> as a point of comparison through the design and construction process ● Select <u>General Contractor</u> and material bidders willing to assist in embodied carbon reduction 	<ul style="list-style-type: none"> ● Select <u>Materials and Systems, Optimize Layout</u> and <u>Set Design Criteria</u> with consideration of embodied carbon reduction and input from Hines ● Use material quantities and embodied carbon estimates to <u>Identify Baseline</u> ● Summarize material quantities and embodied carbon estimates at project milestones to monitor throughout design phases ● Implement <u>Material-Specific Reduction Strategies</u> to lower embodied carbon throughout design phases ● Include submission of Bill of Materials and Type III EPDs in project <u>Specifications</u> ● Provide <u>As-Designed Embodied Carbon Summary</u> at completion of design using industry-average EPDs for comparison in Hines Embodied Carbon Database 	<ul style="list-style-type: none"> ● Implement <u>Construction Stage Reduction</u> strategies in transportation and construction activities ● Lead in <u>Material Bidder Selection</u>, including soliciting Base Bids and Alternate Voluntary Bids, for greater embodied carbon reduction and advise Hines on cost and schedule impacts ● Reconcile material quantities and embodied carbon estimates with design team ● Provide <u>As-Built Embodied Carbon Summary</u> with final Bill of Materials and Type III EPDs at project completion for the Hines Embodied Carbon Database