

City of Cambridge Embodied Carbon Educational Toolkit



CAMBRIDGE
CDD#344
COMMUNITY DEVELOPMENT DEPARTMENT
344 Broadway

August 2023

For Owners, Developers, & Design Teams

SECTION 1: Introduction to Embodied Carbon

What is Embodied Carbon?

Resource: [AIA-CLF Embodied Carbon Toolkit for Architects, Part 1](#)

- Definitions of embodied carbon, operational carbon and total carbon
- Buildings and their impact on climate change
- The time urgency of upfront carbon emissions
- The connections to climate justice, public health and equity
- Supply chain transparency

Embodied Carbon and Scope 3 Emissions

Resource: [CLF Embodied Carbon Toolkit for Building Owners, Primer 2](#)



CLF creates an array of free resources and toolkits to support action to reduce embodied carbon.

For Design Teams (Architects, Engineers, & Consultants)

SECTION 2: Measuring Embodied Carbon

Resource: [AIA-CLF Embodied Carbon Toolkit for Architects, Part 2](#)

- Intro to life cycle assessment (LCA) and life cycle stages
- Definition of and metric for global warming potential
- Four key steps of an LCA with guidance specific to performing a whole building life cycle assessment (WBLCA)
- Environmental Product Declarations (EPD's)
- Overview of tools for measuring embodied carbon

SECTION 3: Strategies for Reducing Embodied Carbon

Resource: [AIA-CLF Embodied Carbon Toolkit for Architects, Part 3](#)

Strategies for Reducing Embodied Carbon in Buildings:

- Design Strategies
- Material and system selection strategies
- Specification and procurement strategies
- Process strategies

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Embodied Carbon Reporting Template

Instructions for Completion

The City of Cambridge Embodied Carbon Reporting Template includes several sections to be completed by the project team. The template is in a Word document format, included as part of the Green Building Requirements Net Zero Narrative.

Section 1: Applicability

Section 2: Project Information Inputs

- Current Project Design Phase (% Complete SD/DD/CD/CA)
- # Stories Above Grade
- # Stories Below Grade

Section 3: Narratives

- Required Narratives
- Optional Narratives if Applicable

Section 4: Life Cycle Analysis (LCA) Inputs

This section requires the inputs necessary to perform a life cycle analysis and includes options to choose from for each of the following:

- Phase of project design during which LCA was performed
- LCA tool/software used
- Source of material quantities used in the LCA
- Life cycle stages that are included in the LCA tool used
- Physical scope of materials and systems included in the LCA

- Reference study period (expected life of the building)
- Source of material carbon data
- Carbon sequestration/biogenic carbon data used (for wood)

Section 5: Life Cycle Analysis (LCA) Results

- This section requires the results from the life cycle analysis performed including:
 - Global Warming Potential (GWP)/Embodied Carbon of the total project
 - GWP/Embodied Carbon of the structural and enclosure components separately
 - GWP/Embodied Carbon by Division/Material Category
 - GWP/Embodied Carbon per unit of floor area



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Rating Systems that Address Embodied Carbon

US Green Building Council/GBCI LEED v4/v4.1

Visit the [website](#).

Credit: Building Life-Cycle Impact Reduction

Demonstrate reduced environmental effects during initial project decision-making by reusing existing building resources or demonstrating a reduction in materials use through life-cycle assessment (LCA).

Credit: Environmental Product Declarations (EPDs)

To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products from manufacturers who have verified improved environmental life-cycle impacts.

Credit: Sourcing of Raw Materials

To encourage the use of products and materials for which life cycle information is available and that have environmentally, economically, and socially preferable life cycle impacts. To reward project teams for selecting products verified to have been extracted or sourced in a responsible manner.

Pilot LEED Credit MRpc132- Procurement of Low Carbon Construction Materials

To reduce the embodied carbon of materials used in construction.

Visit the [website](#).

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Rating Systems that Address Embodied Carbon

International Living Future Institute (ILFI), Living Building Challenge (LBC 4.0)

Visit the [website](#).

Core Imperative 07 Energy + Carbon Reduction (C4)

The intent of this Imperative is to treat energy as a precious resource and minimize energy related carbon emissions that contribute to climate change.

All projects must achieve a reduction in total net annual energy consumption (after accounting for on-site renewable power), as compared to a typical existing building with comparable climate, size, use and occupancy, and combustion must be limited.

All projects must meter energy used by the project.

New or Existing Building projects must demonstrate a 20% reduction in the embodied carbon of primary materials compared to an equivalent baseline.¹⁸ Existing Buildings may count in-situ materials against the required twenty percent.

All projects must select interior materials with lower than industry average carbon footprint for product categories for which embodied carbon data is readily available.

All projects must be designed to be “zero ready” through strategies such as designating area(s) and pre-installing wiring and connections for both electric vehicle charging and future installation of renewable energy systems.

Imperative 08 Net Positive Carbon

The intent of this Imperative is to foster the development and use of carbon-free renewable energy resources while avoiding the negative impacts of fossil fuel use, primarily the emissions that contribute to global climate change.

All projects must supply 105% of their project’s energy needs through on-site renewable energy on a net annual basis, without the use of combustion.

All projects must account for the total embodied carbon emissions (tCO₂e) from construction (including the energy consumed during construction), through the utilization of carbon-sequestering materials and/or through a one-time carbon offset purchase through an ILFI-approved carbon offset provider.

International Living Future Institute (ILFI), Zero Carbon Certification

Visit the [website](#).

100% of the operational energy use associated with the project must be offset by new on- or off-site renewable energy.

100% of the embodied carbon emissions impacts associated with the construction and materials of the project must be disclosed and offset.

New projects must get 10% reduction in the embodied carbon of the primary materials of the foundation, structure, and enclosure compared to an equivalent baseline.

The total embodied carbon of the project building may not exceed 500kg CO₂e/m².

100% of the embodied carbon emissions of the construction and materials of the project must be disclosed and offset by on-site carbon-sequestering materials or by a one-time purchase of carbon offsets from an ILFI-approved source.

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International WELL Building Institute, WELL V2.0

Visit the [website](#).

Feature: Innovation I06 Carbon Disclosure and Reduction

Part 1: Carbon Inventory

Assessment of carbon emissions across entire organization

Part 2: Carbon Reduction Goal

Setting goals that meet Science Based Target Initiative criteria

Part 3: Carbon Reduction

Carbon emissions demonstrate the goal has been met

Part 4: Carbon Neutral

Certified carbon neutral by a scheme that follows PAS 2060 or has achieved Part 1 of this feature and has purchased approved carbon credits and/or offsets to offset all emissions.

Institute for Sustainable Infrastructure, Envision v3

Visit the [website](#).

Climate and Resilience (CR) Credit 1.1: Reduce Net Embodied Carbon

To reduce the impacts of material extraction, refinement/manufacture, and transport over the project life.

The project team identifies primary materials to be used on the project during construction and operation. The team determines which materials are the primary contributors to net embodied carbon (collectively >80%).

(B) Embodied carbon is calculated, or acquired by a validated source, for the primary materials identified.

(C) The project team demonstrates a percentage reduction in total embodied carbon of materials over the life of the project compared to the baseline.