

Embodied Carbon Quick Guide

**A Quick Reference Guide for Teams to Reduce
their Project's Embodied Carbon**

February 28th, 2020



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living-future.org/zero-carbon-certification

PRE-DESIGN

Include low carbon emissions in the site selection and development criteria:

- ❑ Build only on previously developed sites
- ❑ Restore any undeveloped portions of the site area with native vegetation

Conduct an inventory of the site resources:

- ❑ Identify buildings or in-situ materials with highest potential for reuse

Include strategies to reduce building material quantities in the Pre-Design package, including:

- ❑ Reduce floor area by optimizing the program and considering multiple uses for spaces
- ❑ Design for flexibility to eliminate future waste (e.g. open floor plates, moveable partitions)
- ❑ Specify a compact and efficient structure that reduces or eliminates redundancy

DESIGN

Conduct iterative embodied carbon assessments¹:

- ❑ Conduct an initial life cycle assessment (LCA) in Schematic Design to form a baseline of the embodied carbon of the project (see TOOLS)
- ❑ Use the LCA to identify “hot spots”; materials or assemblies with highest carbon intensities
- ❑ Set a carbon reduction target for the project
- ❑ Use the LCA to test lower carbon design or material alternatives, specifically for materials of the foundation, structure, and enclosure

Select building systems and assemblies that minimize embodied carbon:

- ❑ Specify pre-fabricated assemblies that reduce material waste and construction time
- ❑ Evaluate the use of carbon-sequestering structural systems such as mass timber
- ❑ Minimize the use of interior finish materials (e.g. polishing concrete instead of carpet, open structure without drop ceilings)
- ❑ Design for deconstruction to minimize waste generated at the end of the project life (e.g. mechanical fasteners, modular design)

Specify material characteristics² that result in low embodied carbon, including:

- ❑ Salvaged or reclaimed materials
- ❑ Locally harvested and/or manufactured
- ❑ Manufactured using renewable energy
- ❑ Contains high recycled content
- ❑ Naturally carbon-sequestering (e.g. wood, bamboo, cork, straw, hemp)
- ❑ Sustainably harvested with third-party verification (e.g. FSC certification for wood)
- ❑ High durability with long service life

Document embodied carbon design decisions in the final Basis of Design

- ❑ Summarize the methodology used to make decisions related to embodied carbon
- ❑ Record the embodied carbon of alternatives considered, and estimated avoided impacts (measured in CO₂e)

CONSTRUCTION

Request embodied carbon data during Contracting and Procurement:

- ❑ Select products with a type III Environmental Product Declaration (EPD), as defined by the International Organization for Standardization (ISO) Standard 14025, or equivalent
- ❑ Select product alternatives with lowest documented embodied carbon value

Reduce construction waste:

- ❑ Procure materials at appropriate quantities to eliminate extras and reduce packaging
- ❑ Divert the maximum quantity of construction waste from going to the landfill (i.e. recycling)

Document the as-built embodied carbon content:

- ❑ Inventory the final material and product selections, including quantities
- ❑ Conduct a final LCA to document the total embodied carbon of the project
- ❑ Consider carbon offsets to account for the remaining embodied carbon

¹ See [TOOLS](#) on the following page

² See [MATERIAL GUIDANCE](#) on the following page

MATERIAL GUIDANCE

Concrete

- Reduce cement content; use supplementary cementitious materials (SCMs)
- Specify local, recycled and strong aggregates
- Specify Portland limestone cement (PLC) instead of Portland cement
- Utilize appropriate mixes for each application; specify high-strength only where needed
- Select from the lowest energy kiln type; e.g. dry with preheater and precalciner
- Utilize CO₂ injection technology if applicable

Steel

- Procure steel produced in an electric arc furnace (EAF), avoid steel from a basic oxygen furnace (BOF)
- Avoid the use of hollow structural shapes and metal decking, utilize rebar only if needed
- Utilize salvage or reclaimed steel
- Specify high recycled content (90%+)

Wood

- Utilize reclaimed wood where possible
- Specify wood from certified sustainably managed forests (e.g. FSC certification)
- Specify fast-growing wood species
- Specify wood products manufactured using electricity and/or renewable energy

Insulation

- Minimize or avoid foam-based insulation products such as Expanded Polystyrene (EPS), Extruded Polystyrene (XPS), Polyisocyanurate (Polyiso), Structurally Insulated Panels (SIPs) and spray foam
- Use blown-in insulation in wall cavities
- Protect insulation from heat and water
- Consider natural insulation alternatives, such as wool, cork, denim or hemp

Information Source: [Carbon Smart Materials Palette](#)
See **RESOURCES** for additional guidance

TOOLS

Embodied Carbon in Construction Calculator (EC3)

<https://buildingtransparency.org>

Open-source materials comparison tool and EPD database that enables evaluation of embodied carbon data across material classes.

Tally

<https://choosetally.com>

LCA application that integrates with Autodesk® Revit® to allow comparison of design alternatives and direct reporting of environmental impacts.

Athena Impact Estimator

<https://calculatelca.com/software/impact-estimator>

LCA tool that allows users to create unique assemblies and envelope configurations, allowing flexibility for complex designs and existing buildings.

One Click LCA

<http://www.oneclicklca.com/green-building-software>

Web based LCA tool with editable baselines that permits rapid comparison of design and material alternatives. Based upon European product data.

eTool

<http://etoolglobal.com>

Free web based LCA tool that can either use predefined assemblies or allow the user to create their own. Based upon Australian product data.

RESOURCES

Zero Carbon Certification – International Living Future Institute (ILFI)

<https://living-future.org/zero-carbon-certification>

Certification system that addresses operational and embodied carbon.

Carbon Leadership Forum

<http://www.carbonleadershipforum.org>

Industry-academic collaboration of manufacturers, designers, builders and researchers focused on reducing embodied carbon in building materials.

Carbon Smart Materials Palette

<https://materialspalette.org>

Attribute-based design and material specification guidance for procuring low embodied carbon products in common material types.