The Principles of Low-Carbon Design

The building design process is complicated and varies from project to project. Code requirements, energy efficiency requirements, and owner programs and preferences will conflict with the specific decisions and recommendations needed when adopting a lower-carbon design process.

As the architect, you'll need to decide when one criteria will supersede another. You'll also have to wade through product descriptions and other sources of information that present product data and environmental impact statements from a variety of contexts and with a variety of motivations.

They may not be intentionally misleading, but the context for their assertions may target economies, cultures, or climate zones that differ from yours.

Incorporating a set of guiding principles into your design process may reinforce your intuition and keep a perspective on the specifics of your project.

The book **Carbon: A Field Guide For Building Designers** (Kuittinen, Organschi, and Ruff) presents twelve principles of low-carbon design. They have been summarized in this fact sheet to support your effort to coordinate your own strategy to integrate low-carbon design into your projects.

1 - SIMPLIFY

Simplification lowers the complexity and number of parts in a building assembly. It reduces the amount of material needed to be manufactured, transported, maintained, and potentially discarded. It also reduces the effort, energy, and time needed to construct the building.

Targets for simplification include:

- The technical intensiveness of enclosure, structure, and systems.
- The number and interrelationship of different materials.
- The number of joints and parts required in cladding or finishing systems

2 - REDUCE WEIGHT

Basic weight reduction can yield significant efficiencies in material and energy consumption, lowering emissions and decreasing foundation materials.

3 - MINIMIZE DISTURBANCE

Reuse existing buildings. Reuse existing biological materials (biomass). Build less, and build more densely.

4 - OPTIMIZE ECOSYSTEM SERVICES

Minimize disturbance of existing ecosystems and make the most of what they can provide (shading, windbreak, carbon storage, water retention, stormwater absorption)

5 - REUSE

Reuse materials and resources to reduce material and energy consumption. Reusing an existing building has at least 44% less impact on the environment than new construction.

6 - DESIGN FOR DURABILITY AND THEN REVERSIBILITY

Durability relates to extending the lifespan of materials. It makes the most of the energy needed to manufacture and deliver building materials. Durability includes lasting cultural meaning and value, flexibility, and material resistance to wear.

- Reversibility includes making the means of assembly for any of these systems more legible.
- Locate joints in places that are legible and accessible.
- Use exposed fasteners so maintenance and deconstruction are obvious to future users.
- Avoid sequential assemblies that require the removal of more parts than necessary to fix one piece.
- Leave working room for hands and tools so adjacent materials and components don't have to be destroyed and replaced.

The effect of reversibility increases the chance that the building can be maintained without demolition or disassembled for reuse.

7 - KEEP TRACK OF TIME AND DISTANCE

How long a material takes to come from natural resources and the energy needed to make and deliver it impact carbon emissions. Lifespan and life cycle also impact emissions

8 - SHARE

Share spaces, make them flexible and multi-functional so we can build less.

9 - STORE CARBON

Build with bio-based materials as much as possible. Reduce the net up-front GHG emissions caused by your building by using materials that have absorbed carbon dioxide from the atmosphere during their lifespan. Using bio-based materials keeps the absorbed carbon dioxide from being released back to the environment for another lifetime because the plant materials are prevented from their natural decomposition.

10 - DECOUPLE

Realize that architectural beauty doesn't have to be derived from excessive material and energy consumption. Simple and plain can be beautiful too.

11 - USE WBLCA TO OPTIMIZE DESIGN

WBLCA (formal or streamlined) can be a tool to meaningfully assess tradeoffs in embodied carbon and operational carbon for envelope designs. This gives the owner information to make decisions about how much insulation to use compared with how high performing the HVAC system needs to be so that the return on investment is maximized, and so that material quantities are as efficient as possible.

12 - SET TARGETS

An RMI study reports that reducing upfront emissions can reduce 24-46% of benchmarked carbon with only an increase in construction cost by 1%.