Facades Carbon

A guide by the FTI Carbon Group
FTI Carbon Group

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Buildings account for 39% of worldwide emissions.

Operational carbon ~28%
Embodied carbon ~11%

Source: AIA 2030
EMBODIED CARBON (MAKING BUILDINGS)

- Raw Materials Extraction
- Manufacturing
- Transportation
- Construction
- Replacement
- Deconstruction
- Waste Disposal

OPERATIONAL CARBON (USING BUILDINGS)

- Lighting
- Ventilation
- HVAC
- Water Heating
- Process loads
- plugloads

CARBON OFFSETS

- Renewable energy production
- Carbon Sequestration

TOTAL NET CARBON
CLF predicts our 2050 emissions will be 49% embodied and 51% operational.
What actions can we all take?

1. Do not build
2. Reuse existing
3. Build sufficiently
4. Build to last
5. Design for disassembly
6. Future-proofing
7. Low-carbon design based on LCA
8. Low-carbon material
Build smaller and optimize the design to reduce material use. Then use low-carbon materials. Recycling requires energy but keeps materials in use. Upcycle/recycle preferred to downcycle.

Embodied Carbon: Order of Priorities

Material & Resource Management Considerations

Prevent

Is new construction really needed, or build nothing? Focus on longevity for building and its systems

Reuse

Salvage any parts at the end of its lifecycle (Design for Disassembly, Circularity)

Reduce

Build smaller and optimize the design to reduce material use. Then use low-carbon materials.

Recycle

Recycling requires energy but keeps materials in use. Upcycle/recycle preferred to downcycle.

Energy Recovery

Combustion but helps divert from landfill or reliance on fossil fuels.

Disposal

As a last resort!
Operational Carbon: Order of Priorities

Energy Efficiency

Passive Strategies
- Passive envelope + eliminate HVAC / lighting (daylighting, ventilation, solar, thermal, orientation)

Load Reduction
- Reduce demand on HVAC / lighting further (active façade)

Efficiency
- HVAC equipment w/ higher COP, EER, SEER

Recovery
- Energy heat/enthalpy recovery; co/tri-generation

Renewable
- E.g., solar, wind, hydro

Offsets
- Use sparingly and beware of double counting, longevity
What actions can Owners/Developers take?
Owners/Developers: Façades

- **Re-use** existing building stock if possible & reuse system components
- **Upgrade** old façades (reduce loads, improve comfort, resilience)
- **Design for reuse** (Design for Disassembly, re-use, recycling, upgradability)
- **Require Whole-Life Carbon Assessments** in Specifications
  - Time value of carbon, future weather data, electrical grid changes
  - Budget for whole-life carbon based on benchmarks (e.g., ILFI, Toronto, London, CLF).
- **Long building lifetime** (payback, life span, system durability, precedents)
- **Holistic bidding** (cost, carbon, lead time, and performance)
- **Avoid relying on on-site renewables**
- **Avoid carbon offsets**
- **Sustainability assessment of construction strategies** before engaging a GC
  - Encourage input from trade-partners (especially envelope) early on for cost, construction and procurement lead times and methods, and carbon implications.
What actions can Architects/Engineers take?
Specify project-specific LCA
- Sensitivity analysis
- Time value of carbon, future weather data, and future electrical grid mix
- Balance MEP systems and better building envelopes.

Operational carbon:
- Massing + orientation optimized for heat gain, daylighting, natural/artificial shading
- Thermal breaks, warm-edge spacers, vacuum-insulated glazing (VIG), solar-control glass (better U & SHGC), optimize Window-to-Wall Ratio (WWR)
- Simulate with no MEP to identify internal temperatures during the year

Embodied carbon:
- Ask for EPDs, or embodied carbon assessments from fabricators, or demonstration of the supplier’s commitment to carbon reduction on every project through a sustainability action plan (“Supply follows demand”).
- Low Carbon Materials (see next page)
Architects/Engineers: Façades
(continued)

**Aluminum** – Driven by carbon in smelting and recycled content
- Low-carbon primary energy + high recycled content (encouraging post-consumer content).
- Consider the trade-off between longevity and recyclability in the choice of finishes.
- Low carbon aluminum would be aluminum that has an embodied carbon lower than the Aluminum Extruders’ Council’s industry-wide average.
- Ask for an EPD or a certificate providing embodied carbon of the prime/billet aluminum and proof of recycled content.

**Steel** – Driven by mill source and recycled content
- Specify EAF steel and low carbon primary energy (e.g., low carbon electricity) in manufacturing, and steel with high recycled content.
- Consider alternative profile shapes to achieve lower carbon and design for ability to reuse steel at building end of life.
- Provide an EPD or a certificate providing embodied carbon of the mill-sourced steel and proof of recycled content.
- Review most current benchmarks (CLF, EC3, etc.) and applicable legislation to determine what low-carbon is.
Architects/Engineers: Façades
(continued)

Glass – Driven by IGU design due to emissions from base float glass production
• Optimize glass thickness and make up (double vs triple) through whole building LCA
• Use glazing adapters to reduce use of new aluminum dies for different IGU thicknesses.
• Choose IGU design, manufacturer and installer to manage IGU service life. Glazed façade lifetime/replacement schedule is determined by the IGU seal durability.
• Ask for a supplier specific EPD for the flat glass (when IGU not available), with alternative path for fabricators to demonstrate their commitment to carbon reduction.

All materials –
• Balance the transportation impacts with the embodied carbon of the materials.
• Plan around longer lead times for low-carbon sources or any new products with enhanced circularity.
• Weigh the impact on circularity of glass and metal design choices (e.g., risk of future contamination of float glass recycling, aluminum finishes).
What actions can Manufacturers/Contractors take?
Manufacturers, installers, sub-contractors: Façades

- Sustainability program focused on reducing carbon, waste, environmental impact
- Product-specific EPDs (not industry average ones) and/or understand the carbon footprint of their products/services as appropriate
- Track and reduce scope 1 and 2 emissions + output generated
- Look for opportunities to reduce the carbon intensity of your primary energy (e.g. on-site renewables, renewable energy credits, transition from fossil fuels to clean electric).
- Increase recycled content of products without trading off lifetime or operational performance
- Implement infrastructure for take-back programs which result in recycling/re-use. Engage with demolition contractors to prevent direct to landfill path.
- Invest in testing to provide better understanding of material/product durability and service-life
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Thank you!

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