Facade Tectonics

Facades Carbon

A guide by the FTI Carbon Group

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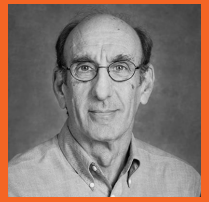
Steven Selkowitz


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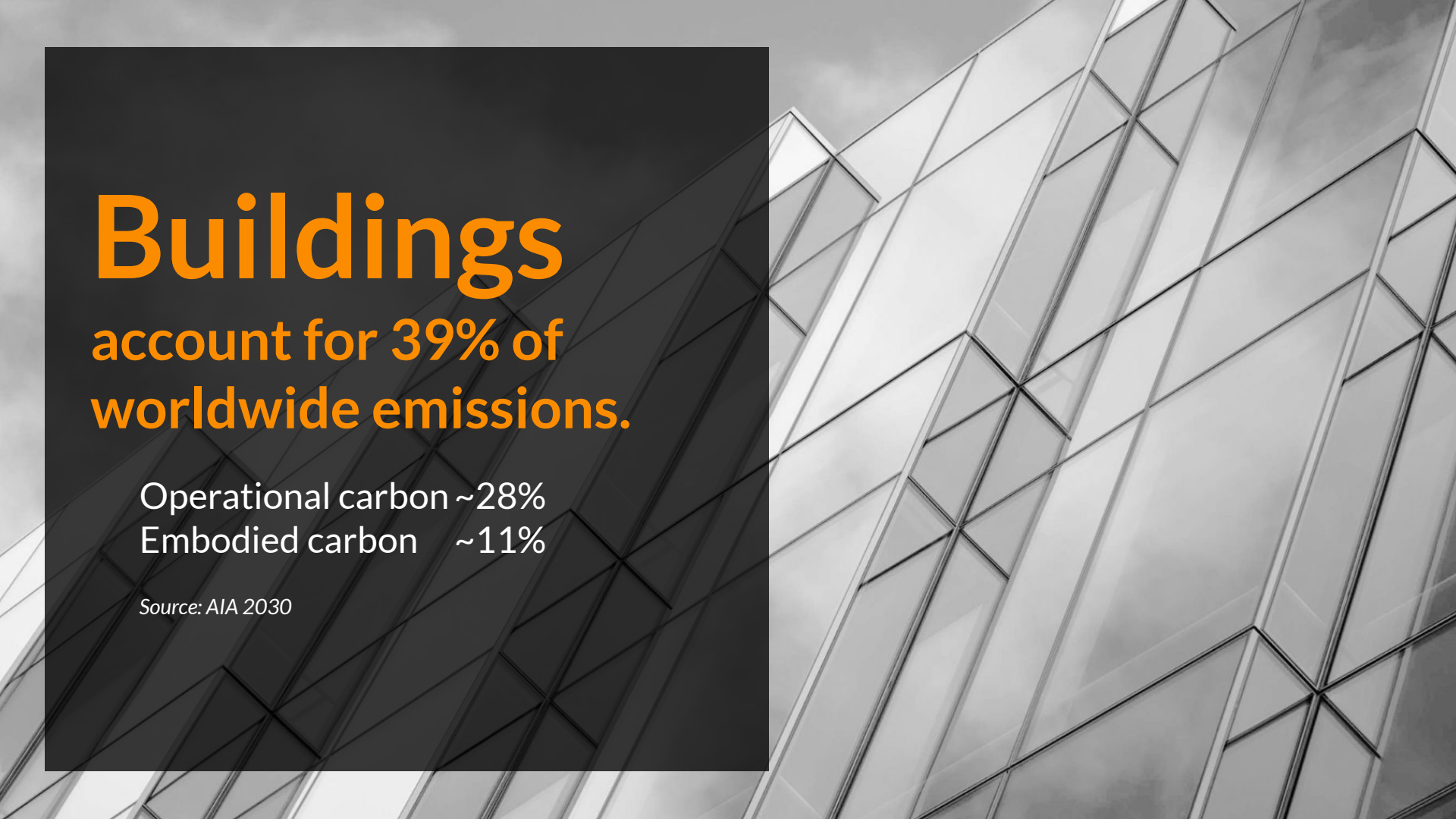


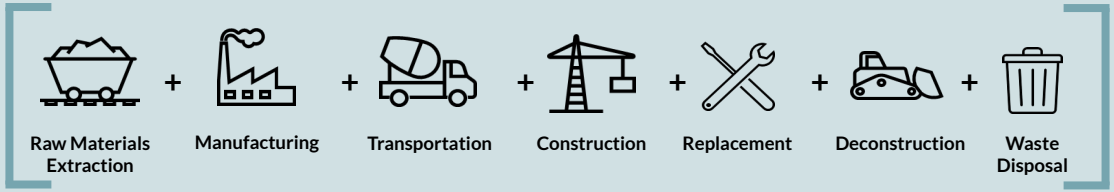
Buildings

account for 39% of worldwide emissions.

Operational carbon ~28%
Embodied carbon ~11%

Source: AIA 2030

EMBODIED CARBON (MAKING BUILDINGS)



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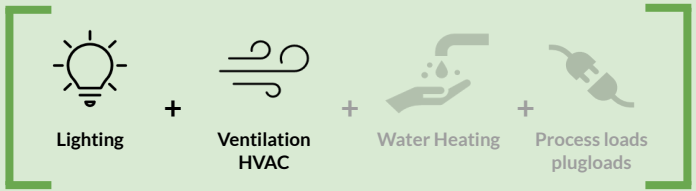
OPERATIONAL CARBON (USING BUILDINGS)



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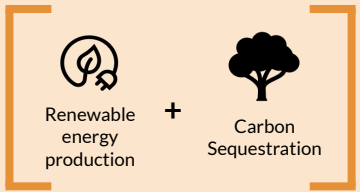
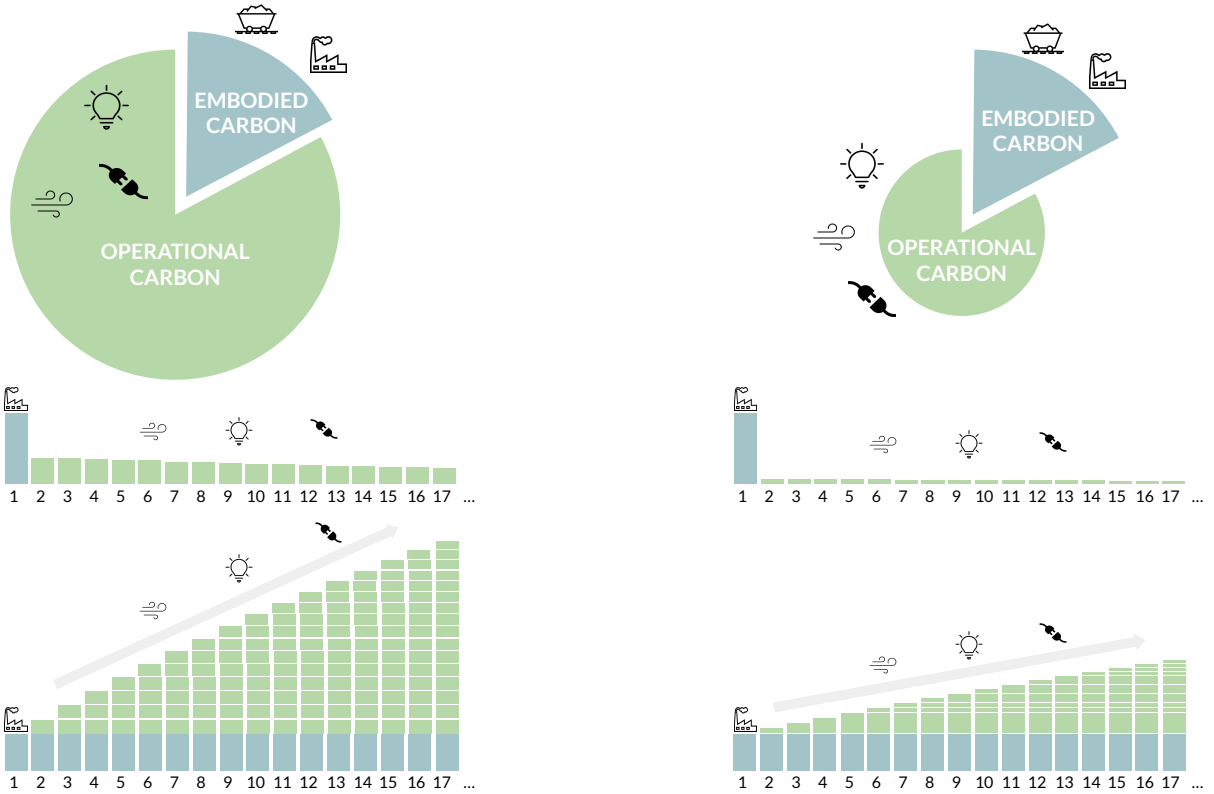
CARBON OFFSETS



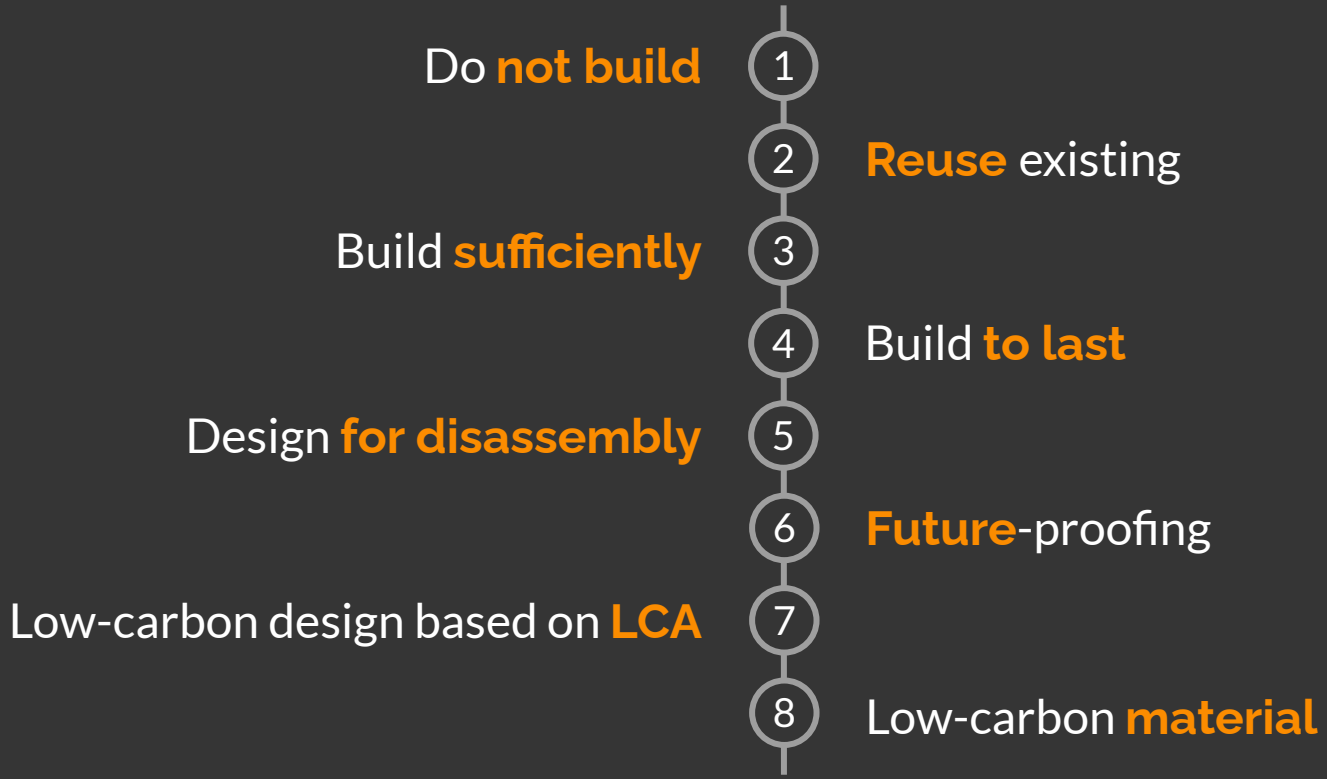
= TOTAL NET CARBON

INCREASE BUILDING'S PERFORMANCE → INCREASE EMBODIED CARBON IMPACT



CLF PREDICTS OUR 2050 EMISSIONS WILL BE 49% EMBODIED AND 51% OPERATIONAL

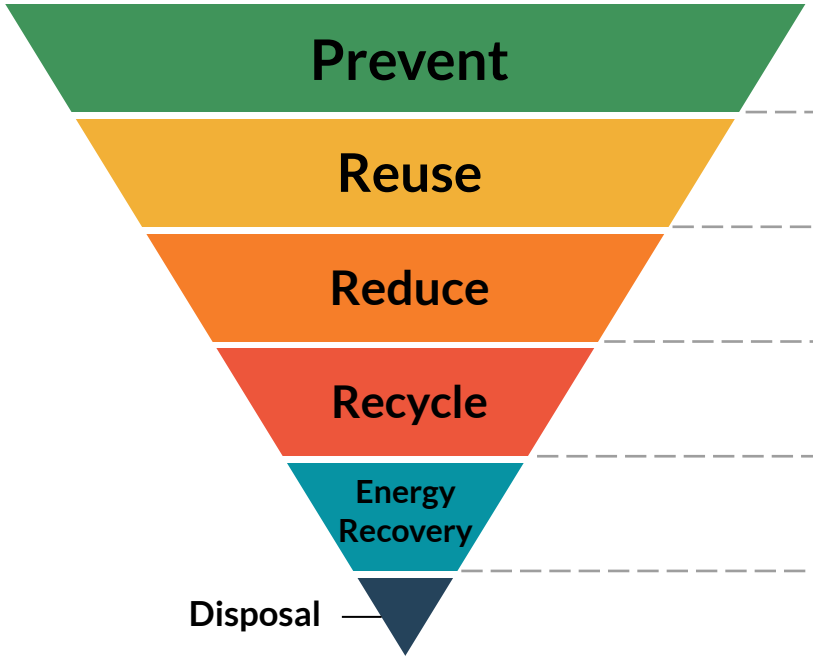
What actions can we all take?



Lacaton & Vassal

Embodied Carbon: Order of Priorities

Material & Resource Management Considerations



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

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

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

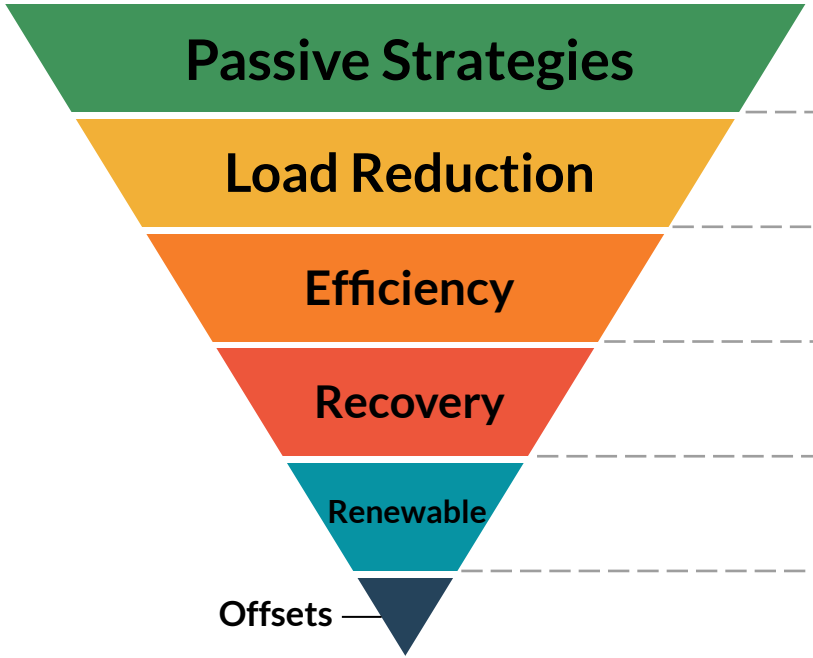
Recycling **requires energy** but **keeps materials in use**.
Upcycle/recycle preferred to downcycle.

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

As a **last resort!**

Operational Carbon: Order of Priorities

Energy Efficiency



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

Reduce demand on HVAC / lighting further (active façade)

HVAC equipment w/ higher COP, EER, SEER

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

E.g., solar, wind, hydro

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?

Architects/Engineers: Façades

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

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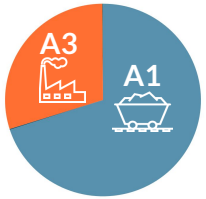
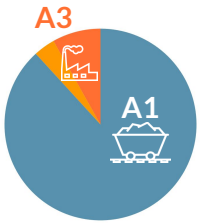


Adapted from AEC EPD (painted extrusions) 2022

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



Adapted from AISC EPD (fabricated hot rolled profiles) 2021

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

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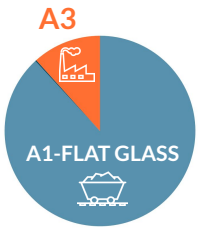

IGU EPD (typical, US) 2023

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

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**

Q&A

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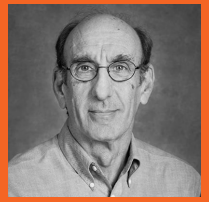
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