The Issues

The construction and operation of buildings in the U.S. accounts for 40% of all U.S. GHG emissions. Any approach to combating global climate change must include a robust and **COMPREHENSIVE** plan for reducing the carbon footprint of the built environment.

So how to 'green' the built environment? Where are the possible energy savings, and how can we make the most impact?

Initial Embodied Energy

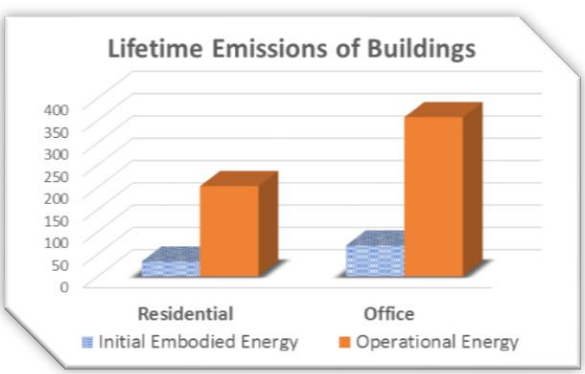
One viewpoint on how to reduce the carbon footprint of the built environment, is to minimize the Initial Embodied Energy of a building.

The Initial Embodied Energy is the cumulative energy consumed in the sourcing and manufacture of the building materials transported to the construction site, and incorporated into the building itself.

The Initial Embodied Energy of a building typically constitutes approximately 10% of its lifetime emissions. While a small fraction of lifetime emissions, reducing the Initial Embodied Energy can yield some savings. The carbon footprint of building materials is one of the factors involved in the design process.

Lifetime Emissions

The emissions profile of a building is in fact dominated by the Operating Energy – the energy and emissions required to heat, cool and supply electricity over its service life. Operating Energy typically accounts for about 90% of the lifetime emissions of a building.



Because the Initial Embodied Energy of a building represents a small part of its lifetime energy footprint, slight differences in the Initial Embodied Energy of various building materials are not the key component for any comprehensive approach for reducing the carbon footprint of the built environment.

A complex array of factors interacts to determine the lifetime carbon footprint of buildings, and its constituent component. Over the lifetime of a building, the key factors shaping the carbon footprint are: Design, Location, Construction Practices, Climate Related Impacts, Energy Source, Operational and Maintenance Decisions, and End-of-Life Disposal Practices.

Design is the Key Factor

Reducing the carbon footprint of a building requires a more comprehensive design approach than materials substitution. Since the emissions associated with replacement and repair can equal or exceed the initial embodied energy of the materials, the longevity and durability of materials is a big part of the equation.

Because the vast majority of lifetime emissions are incurred during the building's operational phase, we can make much more of an impact on the carbon footprint of the built environment through improved best practices, and innovations in construction and design.

The design of a building, which can include both active and passive features to reduce operating energy, is the crucial factor.

Operating Efficiency

Better Energy Efficiency is the most cost-effective strategy, with the best return on investment. Greening the built environment means maximizing operating efficiency.

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Passive and active design features that capitalize on low-carbon energy sources such as solar and geothermal energy, are the way of the future.

Enhancing the operating efficiency of a building often involves a small increase in Initial Embodied Energy. This is because more energy intensive, or additional materials may be required for better quality design and construction. Examples can include greater insulation on external walls, installation of solar photovoltaic cells, and 'intelligent' energy monitoring systems.

Hybrid Buildings

All building materials have a role to play in our efforts to Build Better Buildings, and to reduce the carbon footprint of the built environment.

While it's popular to talk about "Wood Buildings" or "Concrete Buildings", in truth our cities and towns are not built with entirely wood, concrete or steel buildings. Buildings are constructed with a mix of materials. A single building can comprise of over 60 different basic materials, and over 2000 different components. The reason for this is that different materials have unique properties that make them most suitable for different functions.

There are an enormous number of building components and materials that contribute to the Initial Embodied Energy of a building. Some are more flexible, but less durable. Others more expensive, but have greater thermal mass.

Materials Selection

The materials selection process requires a detailed consideration of technical, aesthetic, economic and environmental factors. As a result, the design process frequently involves a complex series of trade-offs, that can make the decision process a challenge.

There is a balance to be struck between the varying properties of each material, and project specific requirements. Just as the least expensive material is rarely used, neither is the most carbon friendly material selected. There simply are far too many other factors to consider.

Reducing the carbon footprint of a building requires long-term planning, and good carbon literacy. We need to invest in the right areas in order to make a difference.

Materials Criteria Checklist

Criteria	Performance		
	High	Med	Low
Durability		✓	
Thermal Mass	✓		
Cost		✓	
Embodied Carbon			✓
Moisture Resistance			✓
Accoustics	✓		
Fire Performance			✓
Adaptability		✓	
Maintenance	✓		

Building for Resilience

Over the coming decades, climate change will bring greater fluctuation and weather-related extremes, from rainfall patterns, to floods, fires and freezing. These conditions will challenge the construction and resilience of our homes and commercial establishments. Our buildings and fixed infrastructure must be resistant to climate related damage, and capable of quick recovery.

Durability and Longevity are essential design considerations. Highly efficient, and low-cost buildings will still incur severe environmental and GHG emissions if they need to be rebuilt every 25 years.

A longer service life reduces the demand for new raw materials, reduces transportation and manufacturing emissions, and reduces the stress on our waste disposal systems. Better to build it once, and build it to last.

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