CIMA
Naturally Better Insulation

Setting the Record Straight: Facts About Low-Embodied Carbon Insulation

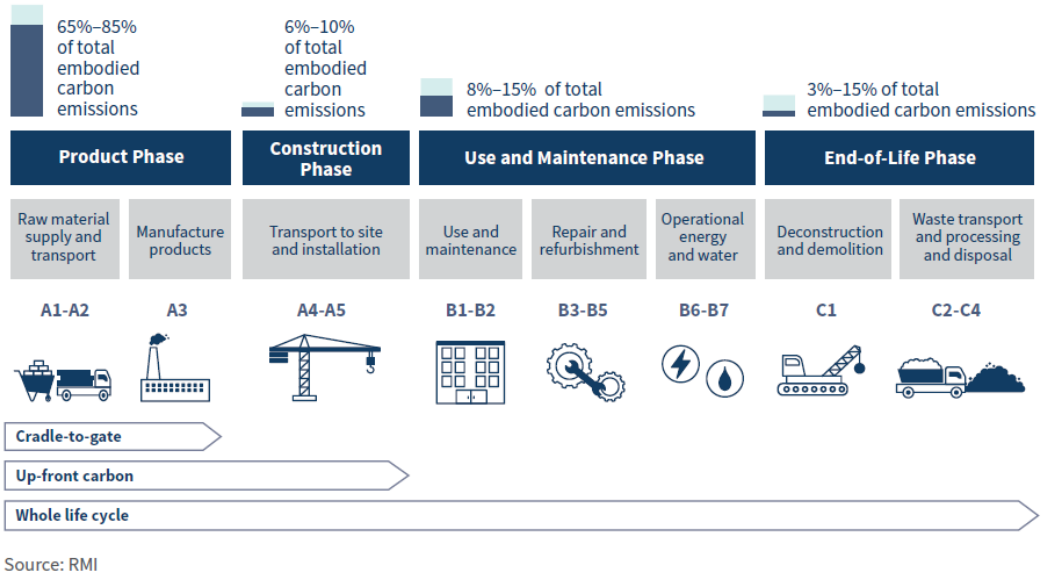
Background

Last year, the fiberglass and mineral wood industry association published a "guide [that] aims to correct misleading carbon claims made by some cellulose and wood fiber insulation manufacturers."[1] In its attempt to educate the public on embodied carbon, they included information that is, well, misleading. This document aims to truly "set the record straight" on low-embodied carbon insulation.

What is embodied carbon and operational carbon?

Embodied carbon refers to the greenhouse gas emissions associated with the supply of raw materials, transport to the factory, manufacturing, and transportation and installation of a product; this is the "upfront" carbon emissions generated before a building is used – carbon released into the atmosphere now.[2] *Operational carbon* refers to the emissions associated with the use and maintenance of a building, including heating, hot water, cooling, ventilation, and lighting systems. This is carbon that gets released over the course of a building's lifetime, whether it is 50 years or even longer.[3] Emissions of both embodied and operational carbon are represented as global warming potential (GWP) on a life cycle assessment (LCA). At the end of life, most building materials are sent to a landfill. The illustration below shows how the various LCA phases contribute to the total embodied carbon emissions of a product.[4]

Exhibit 6 **Life-Cycle Assessment Phases**



Source: RMI

[1] Setting the Record Straight: Insulation and Low Carbon Buildings. NAIMA. PUB. NO. N170 10/24.

[2] https://www.epa.gov/greenerproducts/cmore.

[3] https://oneclicklca.com/en-us/resources/articles/embodied-carbon-vs-operational-carbon.

[4] Chris Magwood and Tracy Huynh, *The Hidden Climate Impact of Residential Construction*, RMI, 2023, https://rmi.org/insight/hidden-climate-impact-of-residential-construction.

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How does insulation reduce carbon emissions?

The industry report accurately states that "all insulation products reduce energy use in all buildings." It also acknowledges closed cell spray foam products which use hydrofluorocarbons (HFCs) as a blowing agent have a very high global warming potential. This is an example where one might see operational carbon emissions among insulation materials, and even then – as the report recognized – these products are being phased out.

Thus, all things equal, insulation does not contribute to any significant operational carbon emissions but rather improves energy efficiency and can decrease the operational carbon emissions of HVAC equipment.

In the context of insulation, how do savings on operational carbon emissions impact the effects of embodied carbon emissions?

Savings on operational emissions provided by insulation should not be entirely attributed to offset the insulation's embodied carbon emissions.

But the fiberglass and mineral wool industry report said insulation is unique in the fact that its embodied carbon is overtaken by savings it provides on operational carbon emissions.

This is not entirely wrong. But the notion of operational carbon making up for the embodied carbon is like saying you saved money because you bought something on sale. You didn't "save" anything, you just didn't pay as much.

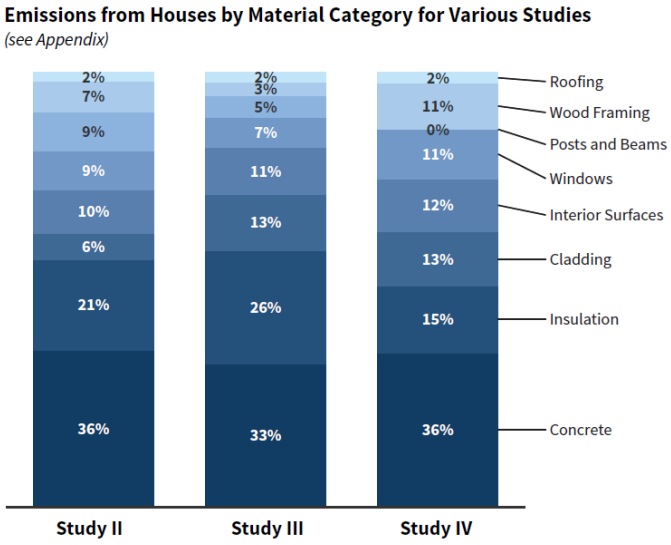
Some products are better than others. Why not pick the product with the lowest embodied carbon, which in turn also has the shortest carbon payback?

It seems like embodied carbon doesn't really matter based on the U.S. Department of Energy report that showed a pie chart with the highest embodied carbon emissions sources.

Correct…yet if you look more closely, the biggest slice of the pie charts showing the top five materials says, "All others." What percentage of this is insulation? Furthermore, the DOE report says, "It is important to understand that similar homes may produce very different results when calculating their associated carbon emissions…Different materials and their quantities can influence the results, and the EPD documents from different manufacturers can include vastly different emissions data for the same material or product type."[5] If we want to see where insulation more accurately ranks, several of the same authors contributed to an RMI report which examines material categories in general, rather than looking at the embodied carbon emissions of specific materials.[6] You can easily see that insulation has the second highest embodied carbon emissions after concrete.

[5] "Carbon Emissions in a Typical New Production Home: A Case Study." IBACOS, February 2023, https://www.nrel.gov/docs/fy23osti/84227.pdf.

[6] *The Hidden Climate Impact of Residential Construction*, ibid.



Source: Builders for Climate Action

What about the comment that cellulose and wood fiber cannot be carbon negative because biogenic carbon stored in the materials is emitted back into the atmosphere at the end of life?

The fiberglass and mineral wool industry report was correct in saying that insulation made from carbon-storing materials like newspaper, cardboard, or wood waste temporarily stores carbon – though "temporary" means 75 years according to the service life of insulation materials. But to claim "cellulose and wood fiber insulation products are not carbon negative" is wrong: the upfront carbon benefit of using biogenic materials is higher than the end-of-life emissions.

Some CIMA manufacturers have environmental product declarations (EPDs) which show a negative overall life cycle GWP figure as part of their LCA – this is because carbon storage is greater than carbon emissions throughout the product's life cycle. Keep in mind that an EPD is a third-party verified document that, in most cases, contains emission rates determined by a third-party consultant. And just a note on the carbon payback table in the industry report: the ICF study from which it came from referenced an R-value of 0, however building codes impose a minimal level of thermal performance. Thus, the study methodology is flawed.

Does CIMA misrepresent end-of-life GWP within its industry-average EPD?

Cellulose manufacturers divert waste that would have otherwise gone to a landfill, effectively delaying the inevitable by several decades (or longer). Other forms of insulation create waste: fiberglass was previously sand, and spray foam was previously oil or natural gas. These materials have less recycled content and are practically impossible to reuse or recycle at the conclusion of a building's life.

Our industry-average EPD clearly indicates that cellulose insulation is landfilled at the end of life. That said, evolving end uses for biogenic materials are on the rise. This includes recycling, reuse, and conversion to biochar to being burned as biofuel, and other potential uses under development which influence the overall climate impact of biogenic carbon. We hope that all building products see a reduction in end-of-life emissions through more effective deconstruction and recycling initiatives.