Decoding Carbon

Net Zero

died Carbon

GHG

Net Pos

Green Buildin

Embodied Carbo

Net Positive

Vet Positive

Greenhouse Gass

Embodied Carbon & Carbon

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Why Do We Care About Carbon?

Buildings and Construction's Share of Global Energy-Related CO₂ Emissions, 2020



"Buildings construction industry" is the portion (estimated) of overall industry devoted to manufacturing building construction materials such as steel, c and glass. Indirect emissions are emissions from power generation for electricity and commercial heat.

Source: IEA 2021. Adapted from "Tracking Clean Energy Progress"

Building Life Cycle





Operational Carbon

Annual Energy Use X (kWh) Building Lifetime X (yrs) *Output Emissions Rate (lb CO2_e/ MWh)* Total Lifetime = Operational Emissions

- Energy modeling provides estimate for annual energy use
- Building lifetime is estimated lifetime
- Output emissions rate can be found using EPA eGRID Data Explorer (set to "all fuels", "state", and most current year for most accurate numbers)



Life-Cycle Assessment Phases



Embodied Carbon – Up-front Emissions

- Reduce high emissions materials where possible
 - Concrete reduce volume, look for mixes with SL/FA to reduce cement or explore new low emission alternatives
 - Steel reduce volume, explore recycled content rebar
 - *Fossil fuel-based insulation* explore low or no emission insulation products
- Make **small changes** in areas that don't create cost premium
- Use recycled materials wherever possible



Embodied Carbon – Up-front Emissions

- Use Environmental Product Declarations (EPDs) to identify high emissions materials in buildings & to calculate emissions profile
- Use Whole Building Life Cycle Analysis (WBLCA) tools to compare materials and look for alternative options

ENVIRONMENTAL INDICATORS AND INTERPRETATION

his EPD contains environmental information about the specified products, in the form of quantitative indicator alues for a number of parameters, which encompass calculated environmental impact potentials, resource and nergy use, and waste generation.

invironmental indicator results for the A1 - A3 modules on an aggregated basis and the A4 module are shown ne following tables for the declared unit of 1m² of fibre cement panel.

Modules A1 - A3		Unit	Hardie [®] Panel	Hardie® Plank	Hardie [®] VL Plar
Climate change - GWP100	GWP	kg CO2-eq	8.94E+00	7.34E+00	1.20E+01
Ozone layer depletion - ODP steady state	ODP	kg CFC11-eq	5.13E-07	4.51E-07	7.39E-07
Acidification potential - average Europe	АР	kg SO ₂ -eq	2.75E-02	2.51E-02	3.54E-02
Eutrophication - generic	EP	kg PO₄ [⇒] ∙eq	4.05E-03	3.44E-03	6.02E-03
Photochemical oxidant creation potential	POCP	kg ethene-eq	1.51E-03	1.46E-03	2.04E-03
Depletion of abiotic resources - elements, ultimate reserves	ADPE	kg Sb-eq	2.95E-05	2.76E-05	4.33E-05
Depletion of abiotic resources - fossil fuels	ADPFF	MJ	8.92E+01	8.26E+01	1.32E+02
Modules A4		Unit	Hardie® Panel	Hardie [®] Plank	Hardie® VL Plar
Climate change - GWP100	GWP	kg CO2-eq	1.45E+00	1.38E+00	1.72E+00
Ozone layer depletion - ODP steady state	ODP	kg CFC11-eq	2.47E-07	2.32E-07	2.92E-07
Acidification potential - average Europe	AP	kg SO2-eq	1.98E-02	1.92E-02	2.36E-02
Eutrophication - generic	EP	kg PO(³ -eq	1.97E-03	1.84E-03	2.33E-03
Photochemical oxidant creation potential	POCP	kg ethene-eq	6.60E-04	6.50E-04	7.90E-04
Depletion of abiotic resources - elements, ultimate reserves	ADPE	kg Sb-eq	5.27E-06	5.22E-06	6.32E-06
Depletion of abiotic resources - fossil fuels	ADPFF	MJ	2.12E+01	2.01E+01	2.51E+01



Embodied Carbon – End of Life Emissions

- Prioritize recyclable building materials & design for deconstruction
- Design for **flexibility** and potential for reconfiguration within buildings
- Design age-in-place and accessible spaces to extend use of home
- Select resilient and long-lasting materials







Considering Material & Design Changes



Typical Building



High Performance Building



New Frontier Building



Implementing Carbon Reductions



Questions?



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POWERHOUSE

https://powerhouse-designs.com/embodied-carbon-consulting

Powerhouse Designs offers carbon related consulting and calculation services.