The Role of Foam Plastic Insulation for Mitigating and Adapting to Climate Change

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Applied Building Technology Group (ABTG) is committed to using sound science and generally accepted engineering practice to develop research supporting the reliable design and installation of foam sheathing. ABTG's educational program work with respect to foam sheathing is supported by the Foam Sheathing Committee (FSC) of the American Chemistry Council.

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Foam sheathing research reports, code compliance documents, educational programs and best practices can be found at www.continuousinsulation.org.

Foam Plastic Applications for Better Building

Topics

1. Overview of building materials and their contributions to global and United States (US) Greenhouse Gas (GHG) emissions

2. Contribution of insulation embodied carbon to global and US GHG emissions

3. Advancements in foam plastic insulation to lower their Global Warming Potential (GWP) and maintain critical performance characteristics

4. Operational emissions savings (carbon payback and carbon savings ratio) of building insulation in light of building electrification, a changing power grid, and the importance of building envelope efficiency

5. Multi-functional applications of foam plastic insulation to optimize building system design, performance, resiliency, resource efficiency, affordability, and total carbon reductions in the building construction and its operation

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Global and U.S. Annual Greenhouse Gas Emissions

Source[a]	Gross GHG Emissions (GtCOe)[b]	% of Total Global GHG Emissions	% of Total US GHG Emissions	% of Total US Bldg & Const Mat'l Emissions
Global Total (~80% FFC)[c]	59	100%		
US Total (~73% FFC)[c]	6.0	10.1%	100%	

a. Sources of data include IIPC (2022), EPA (2022), NASEM (2021), USCA (2021a), and DOE (2022) as documented by ABTG (2023).
b. 1 GtCO2e = 1 billion metric tons of CO2e = 1 trillion kg of CO2e emissions (equivalent to CO2 emissions from the combustion of about 110 billion gallons of gasoline); data in table is based on gross emissions, excluding carbon sinks.
c. % FFC = percentage of GHG emissions from fossil fuel combustion.

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U.S. Greenhouse Gas Emissions by Economic Sector

Annual GHG Emissions by US Economic Sectors (EPA, 2022)				
Source[a]	Gross GHG Emissions (GtCOe)[b]	% of Total Global GHG Emissions	% of Total US GHG Emissions	% of Total US Bldg & Const Mat'l Emissions
Transportation	1.63	2.8%	27%	
Electric Power	1.48	2.5%	25%	
Industry[b]	1.43	2.4%	24%	
Buildings	0.79	1.3%	13%	
Agriculture	0.64	1.1%	11%	

a. Sources of data include IIPC (2022), EPA (2022), NASEM (2021), USCA (2021a), and DOE (2022) as documented by ABTG (2023).
b. About 25% of industry emissions (1.43 GtCO2e) are associated with emissions that are attributed downstream to building and construction materials as embodied emissions (0.36 GtCO2e).

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GHG Emissions by U.S. Construction Material Type

Annual GHG Emission by US Building & Construction Material Types (Embodied Emissions – Subset of Industry Emissions Reported Above)[c]				
Source[a]	Gross GHG Emissions (GtCOe)[b]	% of Total Global GHG Emissions	% of Total US GHG Emissions	% of Total US Bldg & Const Mat'l Emissions
Concrete	0.100	0.17%	1.7%	28%
Gypsum Board & Panels	0.080	0.14%	1.3%	22%
Steel (structural)	0.052	0.09%	0.9%	13%
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Building Insulations (all types)	0.006	0.01%	0.10%	1.7%
Flat Glass for Glazing	0.005	0.008%	0.08%	1.4%
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All Others (unquantified)	0.12	0.2%	2.0%	34%
Total - all bldg.& const. mat'ls: Total - bldg. mat'ls only:	0.36 0.24	0.61% 0.41%	6% 4%	100% 68%

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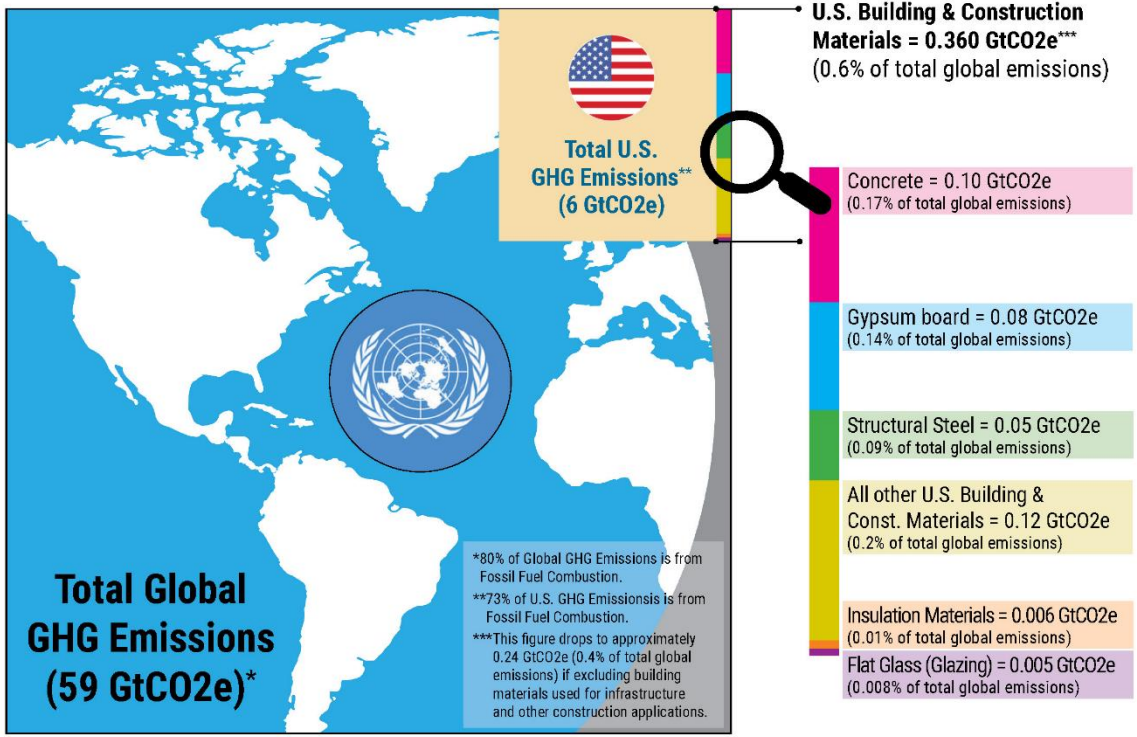

Total Global, Total U.S. & Total U.S. Construction Material Emissions (Annual Basis)

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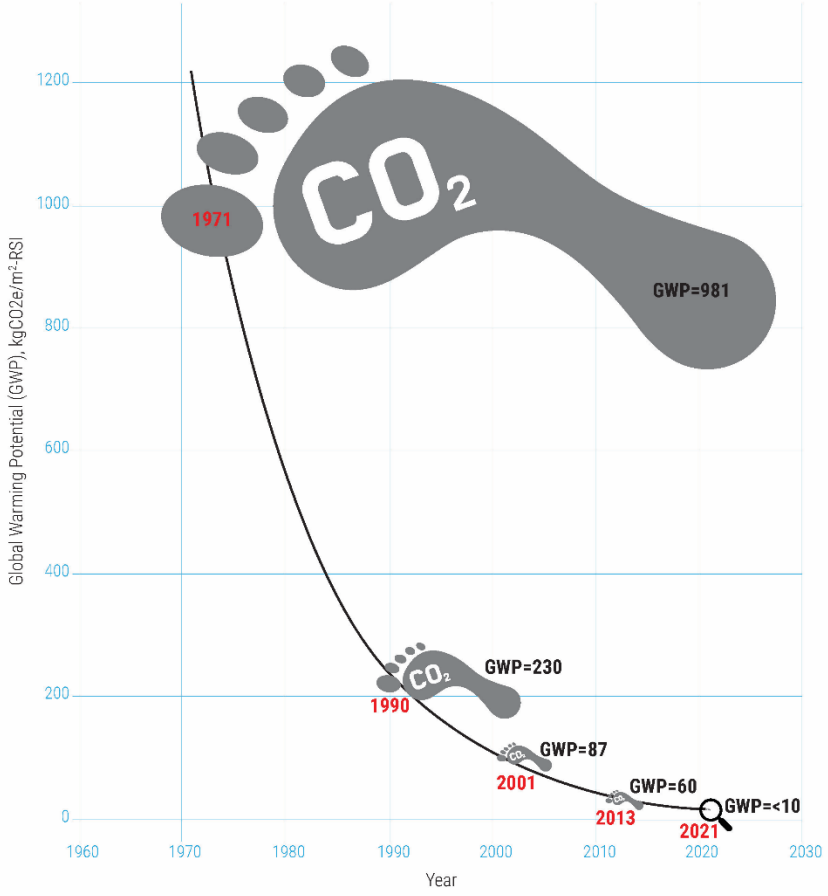
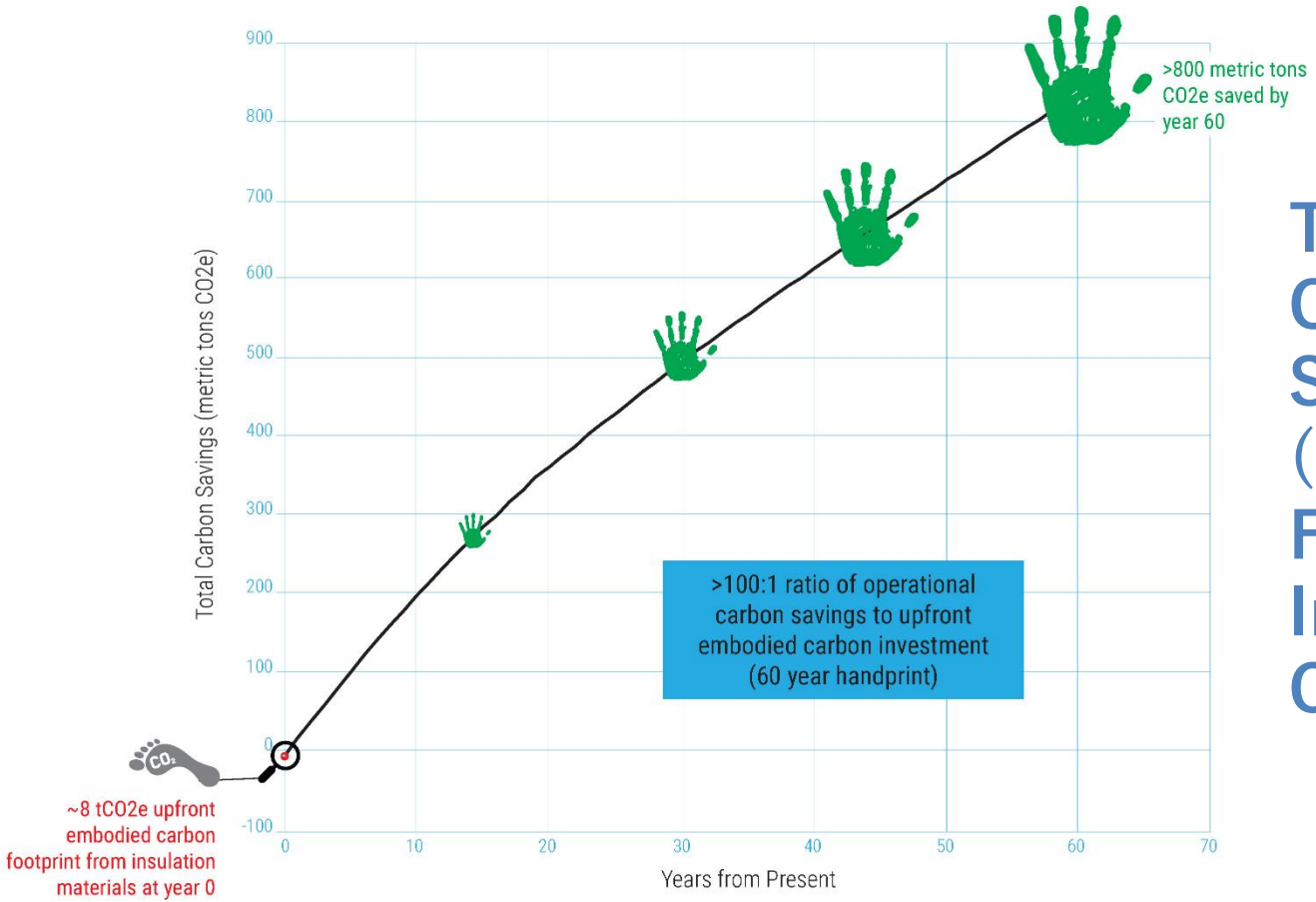


Embodied Carbon Footprint of XPS

1970-Present



Typical Net Carbon Savings (Handprint) of Foam Plastic Insulation Over 60 years

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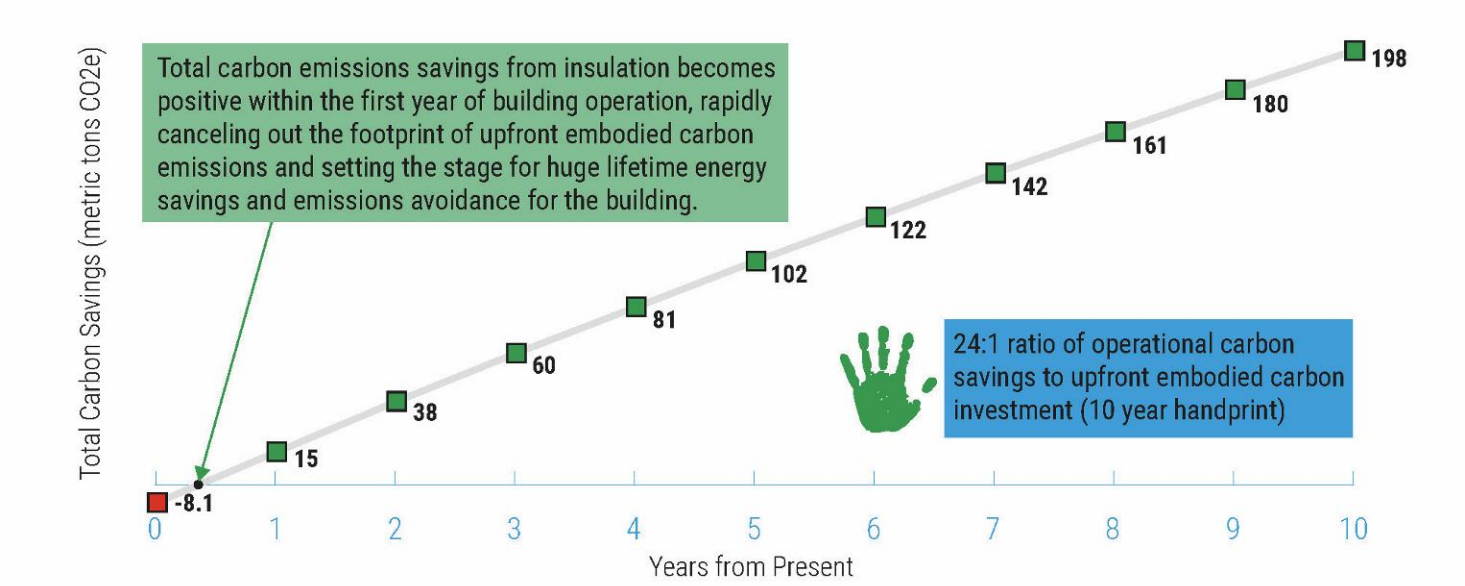
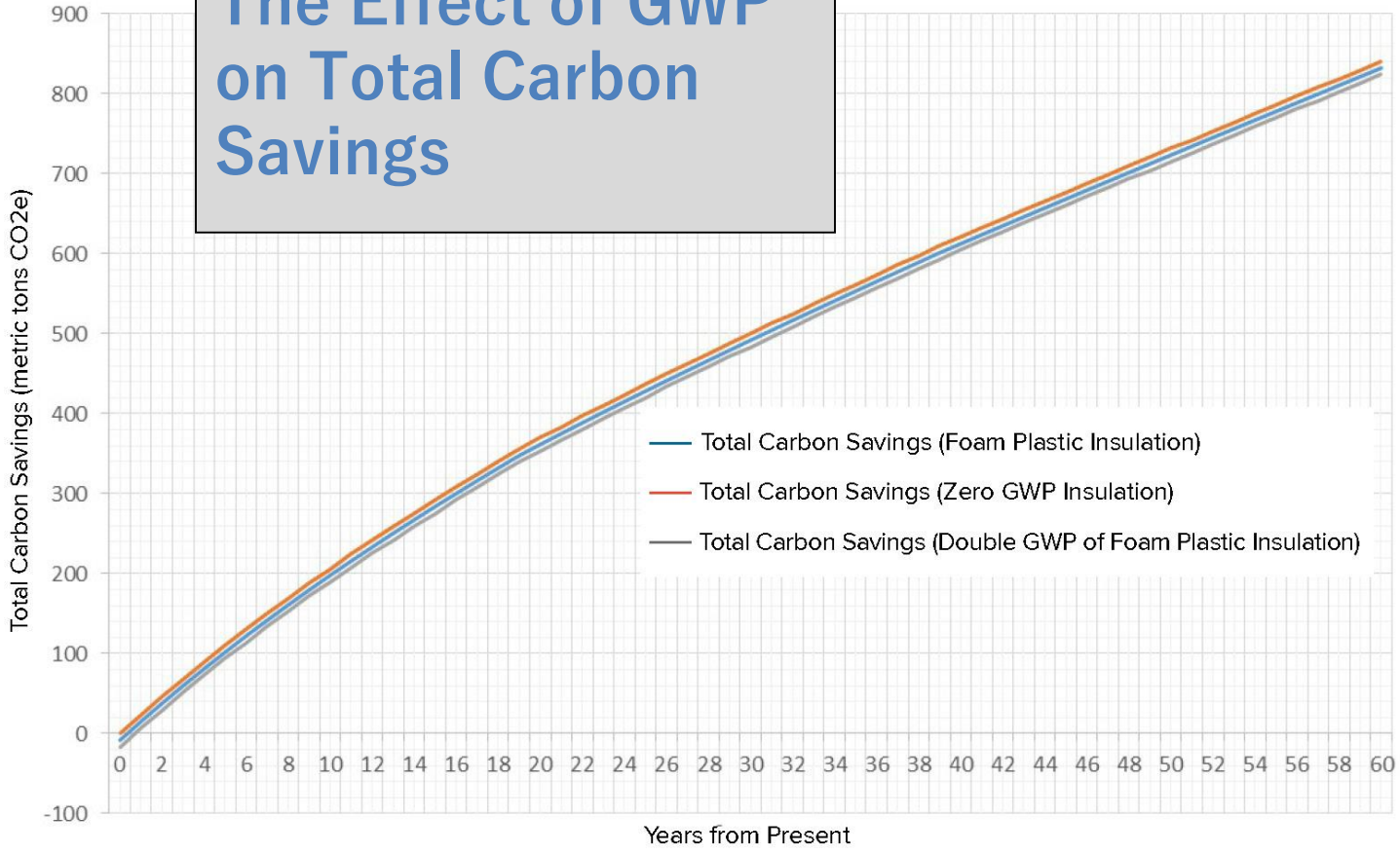
Typical Carbon Emissions Break-Even Point & Carbon Savings Ratio



The Effect of GWP on Total Carbon Savings



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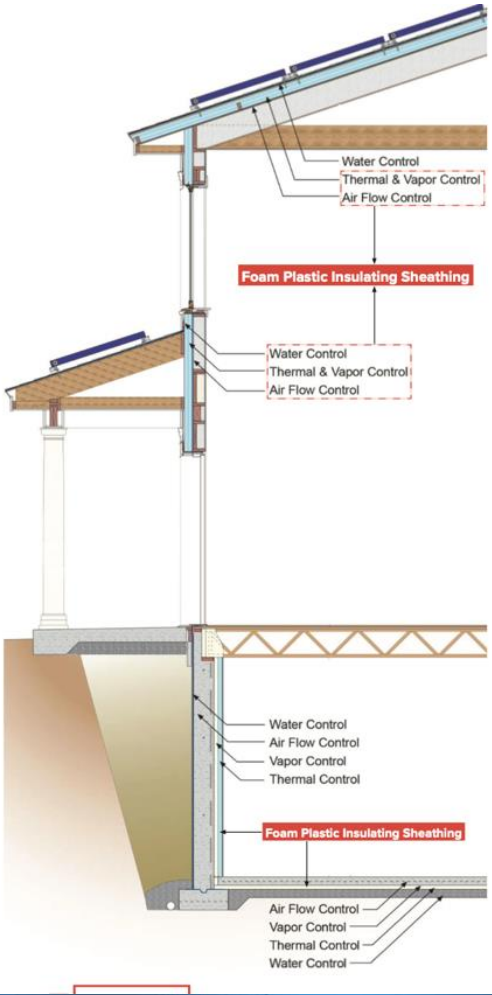

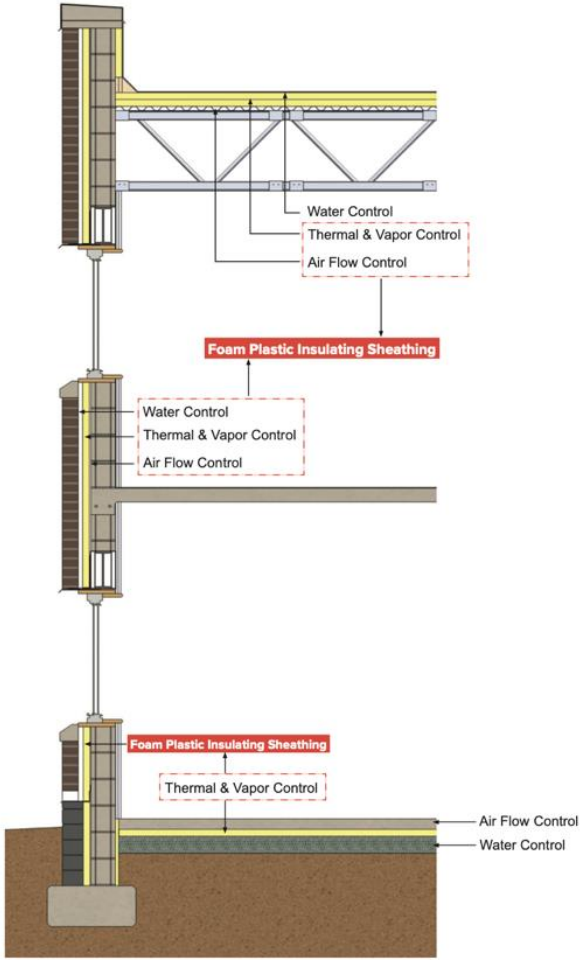

Optimizing Design and Performance

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Summary

- Foam plastic insulation embodied carbon has been greatly reduced
- Foam plastic insulation is a key contributor to carbon reductions, resiliency, energy efficiency, etc.
- Its multifunctional benefits have carbon savings not recognized by many current carbon accounting practices
- Foam plastic insulation is readily available and in use today
- To improve carbon accounting and policy WBLCA should be used
- **Building envelope efficiency should remain our first priority**

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