Spray Polyurethane Foam Life Cycle Assessment Summary

For Residential Insulation and Commercial Roofing

Spray Polyurethane Foam Saves Energy and Reduces Environmental Impact

Life cycle assessment shows SPF insulation significantly reduces energy and environmental impact when evaluated over the entire life cycle.

The Spray Polyurethane Foam Alliance (SPFA) completed a Life Cycle Assessment (LCA) of open and closed-cell spray polyurethane foam (SPF) insulation in buildings to quantify cradle-to-end of life energy and environmental impacts across the entire life cycle. The LCA was conducted to assure builders, designers, and consumers that the products are indeed part of a responsible and effective energy and environmental construction solution.

SPFA conducted two studies to complete this LCA effectively: one focused on embodied energy and the environmental impact of manufacturing SPF products, and the second focused on the energy use phase of SPF products. The first study was performed in accordance with ISO 14040/44. The second study followed recognized whole building energy modeling methods to estimate the use-phase impact of SPF in residential and commercial buildings and was also independently validated. Together, these results create a picture of the overall energy and environmental impact of SPF products.

Founded in 1987 originally as the Polyurethane Foam Contractors Division, the Spray Polyurethane Foam Alliance (SPFA) is the voice as well as the educational and technical resource for the spray polyurethane foam industry.

As part of the LCA, SPFA evaluated the impact of three SPF products (low- and medium-density wall foams and medium-density roof foam) in residential and commercial buildings. A formal independent critical review was conducted in accordance with the ISO 14040 series of LCA standards, plus further technical input and review included broad participation of SPFA members and industry representatives

A complete 48-page report containing *details of the SPF Life Cycle Assessment can be obtained from the Spray Polyurethane Foam Alliance website at www.sprayfoam.org.*

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The Life Cycle Approach: An Essential and Holistic Product Evaluation

What is Spray Polyurethane Foam (SPF)?

Spray Polyurethane Foam (SPF) insulation is rigid, lightweight, flexible, wind resistant, and effective in extreme temperatures and weather conditions. When applied, SPF adheres immediately and expands from 20 to 120 times of its liquid volume.

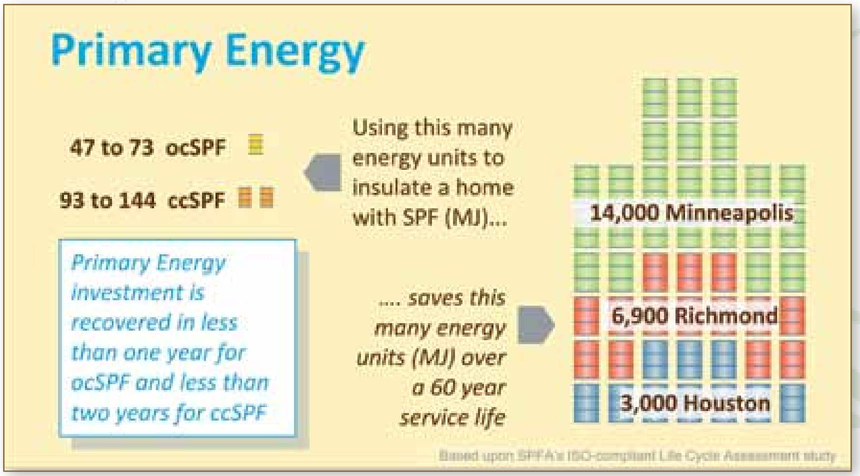
SPF insulations offer more consistent insulation performance (R-value) and other advantages over alternative insulation systems, due to SPF's ability to provide an integral air barrier, and in the case of close-cell spray foam, water vapor resistance. SPF products also offer good acoustic performance.

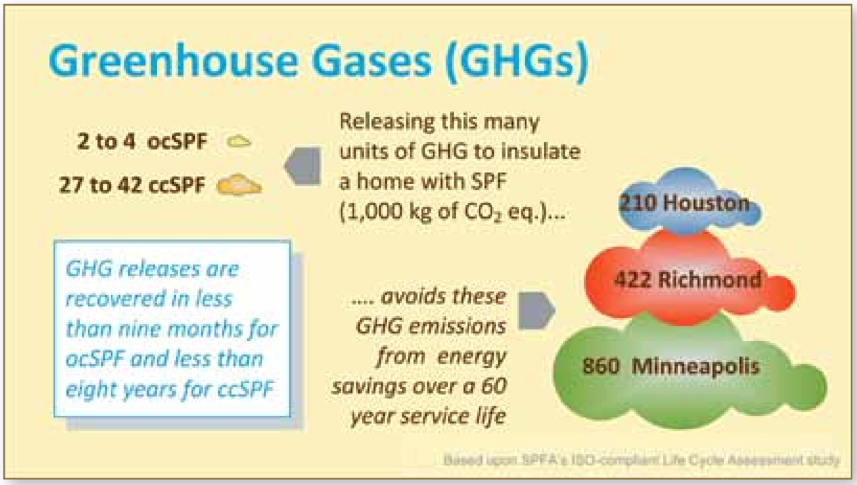
When SPF is created, a blowing agent is combined with liquid polyurethane raw materials, which creates a foamed material composed of small bubbles or cells. The two components join under pressure as they are sprayed on to building assemblies. As the mixture cures, the cells burst (ocSPF) or remain intact (ccSPF).

The life cycle approach to evaluating the energy and environmental impacts of products is critical in understanding these impacts and for developing environmental improvement strategies. For SPF insulation, the use phase energy savings and avoided environmental impacts result from a high R-value and reduced air infiltration. These positive impacts significantly offset the impacts associated with manufacturing SPF, which are quantified using a holistic life cycle assessment. Considering only single attributes (such as recycled or renewable material content), or only the impacts from the manufacturing phase of a product creates a limited and technically flawed perspective on the environmental impact of SPF.

SPF's Complete Life Cycle Results: Significant Energy Savings and Reduced Environmental Impacts

The LCA results show that spray foam products save significantly more energy and prevent more environmental impacts during the life of the insulation in a building compared to the relatively minor energy and environmental impacts associated with making the insulation.





What is the difference between open and closed cell SPF?

Closed-cell spray polyurethane foam (ccSPF) *is also known as medium-density spray foam. The material weighs about 2 pounds per cubic foot with an R-value of 6.0 to 6.8 per inch. It can be used as cavity insulation or continuous exterior insulation for walls, floors and ceilings. SPF used on exterior sides of low-slope roofing has a density of about 3 pounds per cubic foot and provides similar R-values as medium density SPF.*

Open-cell spray polyurethane foam (ocSPF) *is also known as low-density spray foam. The material weighs about ½-pound per cubic foot with an R-value of 3.6-4.5 per inch and can be used for interior, above-grade insulation and acoustic applications.*

For all environmental categories studied, embodied environmental impacts from manufacturing are minimal when compared to environmental impacts avoided during insulation use over a 60-year period.

The table below shows the ratio of energy and GHG avoided to the embodied amounts used to make the SPF insulation. It also shows the years of use (payback) required to recover the embodied impacts. The table includes LCA results for all three SPF types used for residential insulation and low-slope roofs in commercial buildings.

Application	SPF Type	Ratio & Payback	Houston		Richmond		Minneapolis	
			Energy	GHG	Energy	GHG	Energy	GHG
Residential Insulation	Low Density Open-Cell	Avoided/Embodied	64	92	128	164	194	248
		Payback (Yr)	0.9	0.7	0.5	0.4	0.3	0.2
	Medium Density Closed-Cell	Avoided/Embodied	32	7.6	64	13.6	98	21
		Payback (Yr)	1.9	7.9	0.9	4.4	0.6	2.9
Commercial Roofing	Roofing R4 --> R20	Avoided/Embodied	55	15	56	15	66	17
		Payback (Yr)	1.1	4	1.1	4.1	0.9	3.6
	Roofing R12 --> R20	Avoided/Embodied	30	8.2	28	7.5	29	7.3
		Payback (Yr)	2	7.3	2.1	8.0	2.1	8.3

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