HUNTSMAN
BUILDING SOLUTIONS

ENVIRONMENTAL PRODUCT DECLARATION

White Paper

Introduction to Global Warming Potential (GWP)

When emitted into the atmosphere, Greenhouse gases (GHG) absorb energy and trap heat in the atmosphere, effectively warming it. As such, they act like a blanket insulating the Earth and contribute to global warming[1]. Each Greenhouse gas has a distinctive heat-trapping potential (e.g. its ability to absorb energy) and atmospheric lifetime (e.g. how long it stays in the atmosphere).

Hence the Global Warming Potential (GWP) metric was developed to compare the global warming impacts of those different GHGs. Precisely, GWP is the measure of how much energy the emissions of 1 ton of a gas will absorb over a given period, relative to the emissions of 1 ton of carbon dioxide (CO2)[2].

GWP is measured using the Carbon Dioxide Equivalent (CO2-eq.) metric, which represents the number of metric tons of CO2 emissions with the same global warming potential as one metric ton of a given greenhouse gas. In other words, the CO2-eq. value converts the amounts of Greenhouse gases to the equivalent amount of CO2 with the same Global Warming Potential over the chosen time horizon. The higher the GWP, the more a gas warms the planet compared to CO2 over that period, which is usually 100 years.

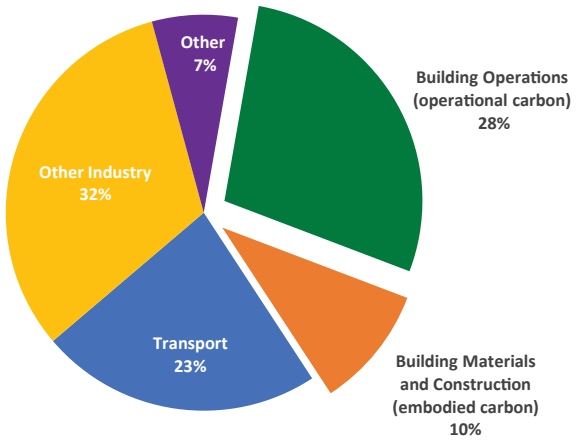
Worldwide Issue - Global Warming

There are two main types of carbon (GHG) emissions in buildings that contribute to Global Warming:

- Embodied carbon of buildings: the Greenhouse gases (GHG) emitted from the manufacturing, transport, use phase and disposal of building materials across their whole life-cycle.

- Operational carbon of buildings: the GHG emitted from the energy use for operating, heating and cooling of buildings.

Global CO_2 Emissions by Sector



Data sources: UN Environment Global Status Report 2020; IEA Energy Technology Perspectives 2020; IEA World Energy Balances 2020

Embodied carbon emissions from building materials and construction represent 10% of global carbon emissions, and building operations account for 28%[3][4][5] Together, the building construction and operations sectors are responsible for nearly 40% of the global annual GHG emissions. (see ''Global CO2 Emissions by Sector'' chart above).

[1] United States Environmental Protection Agency. (2020, September 9). *Understanding Global Warming Potentials.* US EPA. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials
[2] idem
[3] United Nations Environment Programme. (2020). *2020 Global Status Report for Buildings and Construction - Towards a zero-emissions, efficient and resilient buildings and construction sector.* Nairobi
[4] U.S. Energy Information Administration. (2020, October). Energy Technology Perspectives 2020
[5] U.S. Energy Information Administration. (2020, October). World Energy Balances 2020

According to the latest U.N. Environment Programme's Emissions Gap report[6], in order to achieve the Paris Agreement's goal to limit global temperature increase to 2 degrees Celsius above pre-industrial levels (preferably to 1.5), the world needs to achieve drastic cuts in global GHG emissions. We need to reduce carbon emissions by more than 50% by 2030 and strive to reach carbon neutrality by 2050. As such, the building construction and operation sector will play a major role in achieving this vision since it accounted for 38% of the world's CO2 emissions in 2018.

Addressing upfront carbon is therefore crucial to fighting the climate crisis as energy demand and consumption, as well as the resulting building-related carbon emissions, are projected to continue to rise as the world's building stock is expected to double by 2060[7]. That's why coordinated action across all industry sectors is crucial to moving towards high-performance and low-carbon buildings, such as near-zero energy buildings. Addressing upfront carbon by changing the way buildings are designed, built, used and decommissioned will be a priority over the coming decades. HBS is committed to manufacturing insulation solutions that outperform other insulations in reduced embodied and building operational carbon emissions, as proven by both industry and HBS specific Environmental Product Declarations (EPD) and Life Cycle Assessments (LCA).

HBS EMBODIED CARBON REDUCTION (EPD)

What are Environmental Product Declarations (EPDs)?

Increasing demand among architects and designers for product specifications with transparent LCA-based environmental impact reports with the goal of slowing down global warming and climate change. An Environmental Product Declaration (EPD) is an independently made, third-party verified document that communicates transparent, objective and comparable information about the life-cycle environmental impact of products. The EPD is based on a product's life-cycle assessment (LCA), which is a standardized analysis of its environmental emissions and resource use across its life-cycle. The EPD and LCA are both done in accordance with strict ISO standards which ensure completeness and impartiality of information when assessing products' environmental impact. The LCA evaluates a product's impact in 6 Environmental Impact Categories, one of which is Global Warming Potential.

Why are EPDs such an important consideration when evaluating the best sustainable options available for insulation products?

Heatlok HFO/Heatlok Soya HP: 1st SPF product line with a product-specific, Type III EPD which is third party made and verified by UL in accordance with ISO 14044, ISO 14040, ISO 14025, ISO 21930 and EN 15804. The EPD and LCA are both done in accordance with strict ISO standards which ensure that the studies and reports used to assess a product's environmental impact are complete, impartial and independently verified. It also makes sure the declared life-cycle assessment results are standardized and comparable to other products. This impartiality, transparency and standardization brought about by EPDs are the key to making an informed sustainable choice when specifying products. In addition, specifying products with a third-party verified EPD contributes towards LEED v4 credits and other green building rating systems. Indeed, LEED encourages using products and materials for which life-cycle information is available and that have environmentally, economically and socially preferable life-cycle impacts disclosed in an Environmental Product Declaration[8].

[6] United Nations Environment Programme. (2020). *Emissions Gap Report 2020*. Nairobi
[7] International Energy Agency. (2017). *Energy Technology Perspectives 2017*
[8] U.S. Green Building Council. (2021). *Building product disclosure and optimization - environmental product declarations | U.S. Green Building Council.* https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-healthca-22

Environmental Product Declarations (EPD) GWP Comparisons

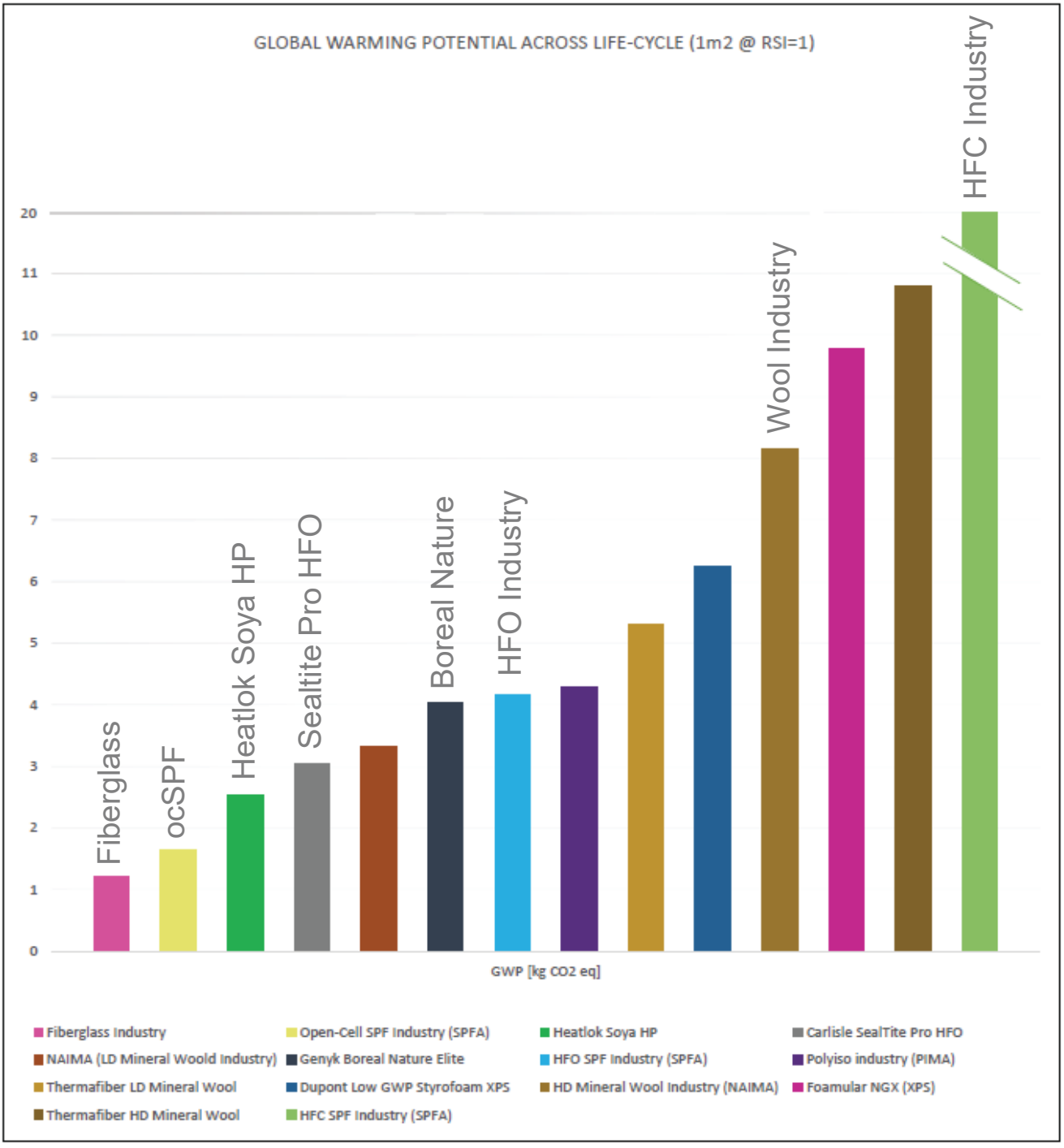
What EPD Comparisons Tell Us:

Innovation in SPF = new generation of products with significantly reduced embodied carbon compared to other insulations

EPDs assume a 75-year lifespan. In reality, replacing fiberglass only once doubles its embodied carbon and makes it equivalent to Heatlok Soya HP. Spray foam's slightly higher embodied carbon than fiberglass is offset through product durability, assembly comparisons, and/or energy efficiency (GWP Payback Period).

Embodied Carbon Take-aways:

- HFO vs HFC Industry: **80%** reduction
- Heatlok Soya HP vs HFO Industry: **39%** reduction
- Heatlok Soya HP vs Mineral Wool Industry: **70%** reduction
- Heatlok Soya HP vs Carlisle Sealtite Pro HFO: **17%** reduction
- Heatlok Soya HP vs Genyk Boreal Nature: **37%** reduction



Data sources: Products' respective EPDs.

Assembly Comparisons

Heatlok HP, being multi-functional with its thermal insulation, air and vapour barrier properties, replaces several products by a single one. As such, it effectively decarbonizes the building envelope.

By replacing fiberglass with outbound mineral wool or boardstock insulation and their required membranes in traditional assemblies with Heatlok Soya HP at an equivalent R-value, assembly's embodied carbon will provide a 45% GWP reduction.

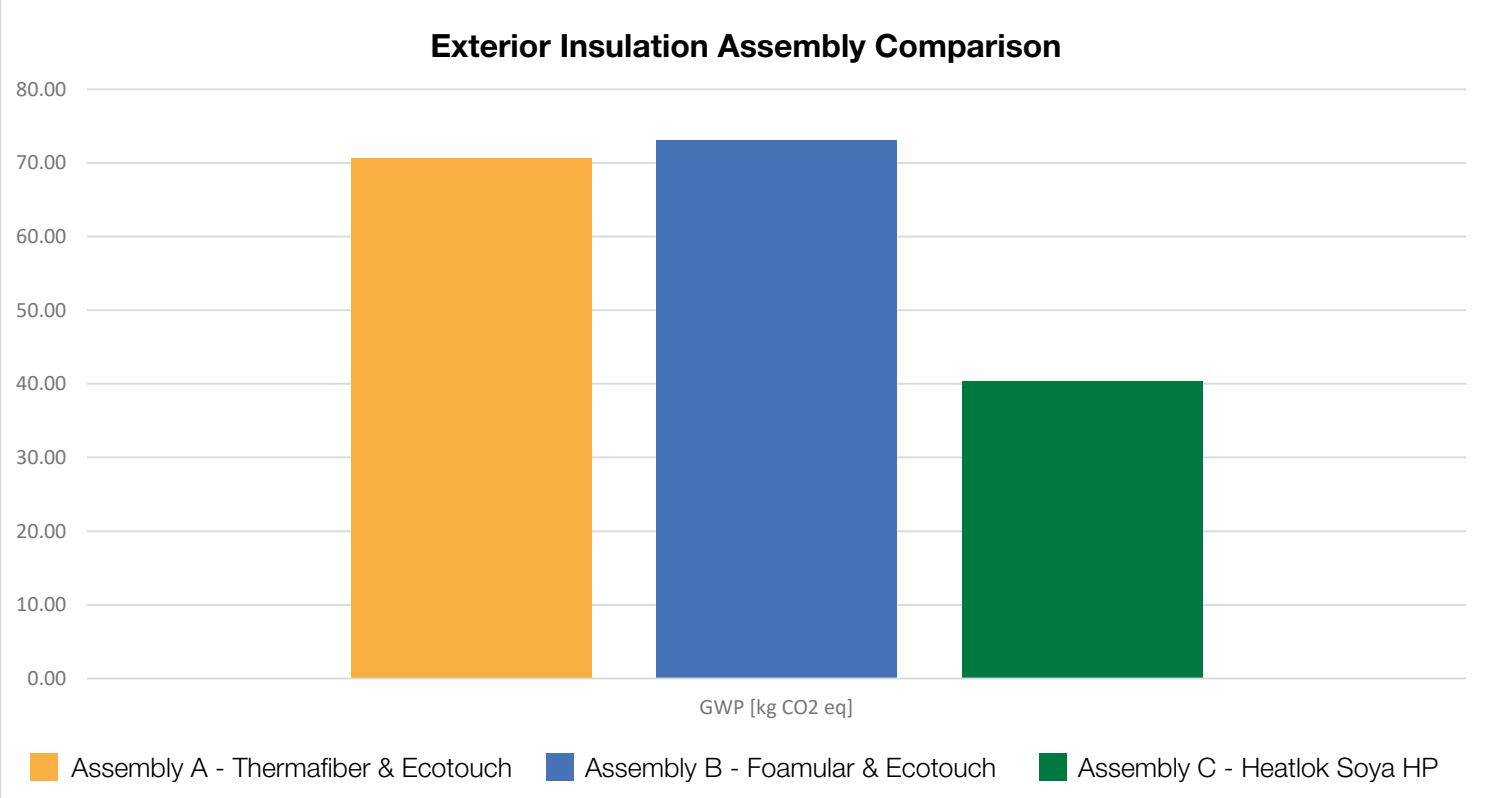


Chart source: © 2021 Huntsman Building Solutions. All rights reserved.
Data sources: Products' respective EPDs.

A/B » C = 45% GWP ↓

ENERGY EFFICIENCY

Energy consumption and the resulting carbon emissions represent a significant cost of building operations. Therefore, it's important to aim to reduce the demand for energy while increasing energy efficiency to reduce GHG emissions. As previously stated, Heatlok Soya HP grants reductions not only in materials' embodied carbon, but also in building operational carbon emissions. Indeed, with its inherently seamless and higher thermal insulation, vapor and air barrier properties which perfectly seal all cavities, gaps and joints, Heatlok Soya HP contributes to reducing heat, air and moisture movement/transfer through the envelope. This increases energy savings and reduces HVAC loads, which results in lower building operational carbon emissions. That means using spray foam in place of other products could reduce annual home heating and cooling-related carbon emissions by 30% according to the American Chemistry Council[9].

[9] American Chemistry Council. (2018). *POLYURETHANES CONTRIBUTE TO SUSTAINABILITY.*

SPFA's Use Phase Report

In 2021, the Spray Polyurethane Foam Alliance (SPFA) released their Use Phase report: an energy modeling analysis comparing embodied carbon, energy efficiency and environmental impact of SPF and fiberglass insulation.

SPFA vs Fiberglass

Spray foam is air impermeable, fully adhered to the substrate, will not sag or suffer convective loss over time and has an inherently higher thermal insulation value than fiberglass. Creating tighter and more energy efficient building envelopes with SPF insulation allows reduced HVAC loads, energy savings and reduced operational carbon emissions. So, despite SPF's higher embodied carbon compared to fiberglass, the study shows that simply replacing fiberglass with SPF brings energy savings equivalent to **5,638 kWh/year** and operational carbon emission reductions of **1,556 kg CO2e/year**. At this rate, SPF offsets/cancels its higher initial embodied carbon compared to fiberglass in **only 8 years**. This is SPF's Carbon/Environmental Payback Period. Then, after 8 years, during the remainder of its service life, SPF will prevent the release of **104,000 kg of CO2e** (carbon equivalent) that would be released in the atmosphere using less performing insulation such as fiberglass → **net positive environmental impact of SPF over fiberglass**[10][11]. Moreover, the yearly energy savings directly translate to annual energy cost savings for homeowners and building operators.

Heatlok Soya HP vs Fiberglass

As demonstrated in its product-specific EPD, Heatlok Soya HP has lower embodied carbon than the spray foam industry average, which shortens its Carbon/Environmental Payback Period. Indeed, Heatlok Soya HP will offset/cancel its higher initial embodied carbon compared to fiberglass in **only 4 years**. Then, after 4 years, during the remainder of its service life, Heatlok Soya HP will prevent the release of **110,000 kg of CO2e** (carbon equivalent) that would be released in the atmosphere using fiberglass insulation → **net positive environmental impact of Heatlok Soya HP over fiberglass**. Moreover, the yearly energy savings directly translate to annual energy cost savings for homeowners. One ton of carbon emitted from the production of our spray polyurethane insulation results in 11 and 14 tons of carbon avoided. SPF insulation offers the best Return on Invested Carbon in the market.

In summary, spray foam and Heatlok Soya HP grant more energy and carbon savings in a shorter period compared to fiberglass insulation. They will offset their embodied carbon compared to fiberglass in only a few years, then decarbonize the building envelope for the entirety of its lifespan. This is how Heatlok Soya HP helps move towards the goal of reaching zero carbon energy. It is the product of choice for environmentally conscious people looking to choose the most sustainable products and reduce their carbon footprint.

EPD	Embodied Carbon (1m2)	Yearly Carbon Emission Reductions through energy savings	GWP Payback Period	Lifetime Carbon Savings	Return on Invested Carbon
HFO Industry	4.16 kg	1556 kg CO2/year	**7-8 years**	**>104 tCO2**	**8x**
Heatlok Soya HP	2.53 kg	1556 kg CO2/year	**3-4 years**	**>110 tCO2**	**11x**
Open-cell SPF	1.65 kg	1556 kg CO2/year	**2-3 years**	**>112 tCO2**	**14x**

 Data source: SPFA ''Counting Carbon" Energy Study. GWP Payback Period will be longer in regions with predominantly clean energy sources (e.g. hydroelectricity).

LEED & Other Sustainability Benefits

Our spray foam products contribute towards LEED credits with their recycled content. Every year, HBS recycles 250 million PET bottles, which are diverted from landfills and converted into the most effective energy-saving spray foam solution on the market. Our products also grant LEED points with their Greenguard Gold certification for indoor air quality and their reduction of construction waste. LEED also gives points to projects and buildings that optimize energy performance and provide optimal thermal comfort.

[10] Sustainable Solutions Corporation. (2021, February). *SPF Residential Energy Modeling Analysis.* Spray Polyurethane Foam Alliance
[11] Spray Polyurethane Foam Alliance. (2021). *Counting Carbon: Demand a Better Insulation in Your Next Home.*

As such, the Heatlok product line grants LEED points through its reduction in energy demand as well as the resulting operational carbon emissions of a building. Moreover, the Heatlok product line is formulated with the new-generation Solstice® Liquid Blowing Agent technology. This new hydrofluoroolefin (HFO) blowing agent is the most environmentally conscious blowing agent produced, with a zero ozone depletion potential (ODP) and a very low global warming potential (GWP) of 1, which is 99.9% lower than HFCs previously used in the industry. The Heatlok products therefore contribute towards Greenhouse gas and Global Warming Potential reductions. Heatlok Soya HP's Environmental Product Declaration (EPD) also grants LEED points.

Reuse Potential and Longer Building Lifespans

Spray foam insulation will never have to be repaired or removed. It can therefore be salvaged and reused when a building assumes a new function. As such, it contributes to LEED V4.1's objective of promoting building materials reuse (See LEED v4.1 Building Life-Cycle Impact Reduction Credit). In parallel to its own reuse potential, Heatlok HFO/Heatlok Soya HP increases the reuse potential of other components in the envelope. The product's continuous air and vapor barrier properties, which effectively reduce air and moisture movement, keep the envelope's materials and components in good condition for longer, and therefore increase buildings' life expectancy. Buildings in better condition and with longer lifespans diminish the need for new construction and promote building reuse and sustainable development. This is important considering the fact that new construction is a main driver of global warming, pollution and resource depletion.

Reducing the Use of Non-Renewable Resources

Reducing building energy demands with spray foam also reduces the use and need for non-renewable resources such as fossil fuels (oil, coal, natural gas, etc.). So the social, financial and environmental benefits of the product are numerous: Heatlok Soya HP contributes to sustainable development by reducing energy demands, which reduces energy costs, operational carbon emissions as well as resource use.

Reducing Buildings' Carbon Footprint = ↓Material embodied Carbon + ↓Operational Carbon of Buildings

Conclusion

In conclusion, global warming and climate change are critical and imminent issues that cannot be ignored. The construction and building operations sectors are some of the main producers of GHG emissions and drivers of global warming. So it's more important than ever to optimize the energy performance of our buildings by using high performance insulating products such as Heatlok Soya HP. Countries are making a collective effort to reduce embodied and operational carbon emissions in the construction and building industries to reach the global warming reduction goals outlined in the Paris Agreement. As such, designers and decision-makers need to choose the most sustainable products with the lowest carbon footprint. For this purpose, Environmental Product Declarations are standardized, third-party verified sustainability reports which disclose a product's embodied carbon and Global Warming Potential based on a full Life-Cycle Analysis.

HBS' Heatlok Soya HP product line is the first spray polyurethane foam insulation with a product-specific EPD. Heatlok Soya HP's EPD demonstrates a major reduction in GWP compared to other insulation types. In addition to the reduced embodied carbon in the product, Heatlok Soya HP reduces a building's energy demands which subsequently reduces its energy costs, operational carbon emissions and need for non-renewable resources such as fossil fuels. That's why Heatlok Soya HP is the product of choice for a more environmentally sustainable future (and present!) in which the construction and building sectors' carbon footprint and contribution to global warming are reduced to a minimum.

Heatlok Soya HP's EPD demonstrates emissions reductions in all 6 Environmental Impact Categories outlined in the LCA when compared to other insulation types. However, for clarity, only the GWP category was presented in this report. Complete LCA information and comparisons in the other Environmental Impact Categories are available on demand or in our EPD. HBS' Sustainable Building Science team is available to assist you in your sustainable designs and product choices, in your LEED certification process, and to answer any questions you may have.

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