INSIDE: a high performance SPF system that advances sustainability in homes.
Bayer MaterialScience’s Spray Polyurethane Foam contribution to Bayer Corporation’s Sustainable Development Program
Sustainability is an abstract concept subject to interpretation.

Bayer MaterialScience defines sustainability as follows:

- Sustainability is an attribute of a system
- Sustainability is achieving commercial success through solid business models in a way that meets the needs of our employees, society, and protects the environment and natural resources
- Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs
At the 2005 World Summit it was noted that sustainability requires the reconciliation of environmental, social and economic demands - the “three pillars” of sustainability. This view has been expressed as an illustration using three overlapping ellipses indicating that the three pillars are not mutually exclusive and can be mutually reinforcing.

Source: Johann Dreo - Sustainable development 2006
Environmental Sustainable Development

What we know:

• Fossil fuels are a finite source of energy
• Burning fossil fuels emits greenhouse gases
• Energy efficiency in buildings conserves resources such as fossil fuels
• Buildings insulated with spray polyurethane foam will typically use 30 percent less energy for heating and cooling.*

*compared to buildings insulated with traditional fibrous insulation material. Source DOE Air sealing
Fossil fuels are a finite resource being depleted from the earth.

By conserving energy, we can slow down the depletion of fossil fuel, giving time to develop long-term solutions to meet energy needs for the future.

Insulating our homes and buildings conserves the fossil fuels needed to heat and cool them.
Buildings are responsible for more than **40 percent** of global energy use and **one-third** of global greenhouse gas (GHG) emissions in both developed and developing countries.

- **Transportation**: 28%
- **Commercial**: 18%
- **Residential**: 22%
- **Industry & manufacturing**: 32%

Source: US Energy Information Administration 2008
Since the beginning of the industrial revolution, the burning of fossil fuels has substantially increased the level of CO$_2$ in the atmosphere.

The current estimated global GHG emissions are between three or 4 times the Earth’s natural absorption rate of CO$_2$.*

*Intergovernmental Panel on Climate Change
The challenge is to conserve fossil fuels and reduce the CO$_2$-equivalent emissions in the atmosphere.

This will require changes in the way society produces, consumes, regulates and behaves.

*This challenge will require us to meet these goals without compromising future generations - the practice of sustainable development.*
How do we get there?

Studies show what can be done to reduce our need for fossil fuels and reduce GHG* emissions.

Improving the energy efficiency of buildings was found to be an economically sensible strategy for reducing GHG emissions and fossil fuel usage.

*GHG - Green House Gas


McKinsey Study

Abatement Cost Curve

This study finds there are many levers available that will, when acted upon, reduce some GHG levels.

All levers below the horizontal line make good economic sense as they indicate potential savings and minimal costs.

All insulation references are below the horizontal line and show potential savings.
Global GHG abatement cost curve
Global GHG abatement cost curve beyond 2030 BAU
Cost of abatement below EUR 60 per tCO₂e

Abatement cost
€ per tCO₂e

Note: This is an estimate of the maximum potential of all technical GHG abatement measures below EUR 60/tCO₂e, if each lever was pursued aggressively, not a forecast of what role different abatement measures and technologies will play.

Source: Global GHG Abatement Cost Curve v2.0, McKinsey & Company
Life Cycle Assessments (LCA) for some individual chemical product applications, including insulation, were calculated in the ICCA* report.

The life cycle assessment is a recognized multi-step, well-structured methodology that performs environmental impact analysis (based on ISO 14044:2006).

LCA assess energy and environmental impacts of a material in a specified application from cradle to end-of-life.

LCA results support decision-making on new projects and compare the energy and environmental impact of different products with quantitative data factoring in all the life cycle phases.

* International Council of Chemical Associations
Life Cycle Assessment

LCA performed on insulation products have demonstrated that energy savings during the use phase far outweigh energy associated with manufacturing the raw material, formulating components, transporting, installing and managing at end-of-life.

See Energy and Environmental Benefits of Insulating Commercial Buildings with Polyiso at www.bayermaterialsciencesnafta.com for an example of an LCA.
Spray foam insulation saves energy during insulation use that for outweighs energy associated with manufacturing raw materials, formulating spray foam components, transporting, installing and managing spray foam at end-of-life.

Spray foam insulation is a versatile and energy-efficient solution for various applications, including perimeter wall insulation. Safe use and handling guidelines for installers are essential to ensure proper installation and minimize environmental impacts.

**Spray Foam Insulation: Saving Energy, One Spray at a Time...**

**Spray Foam Installation:**
A spray foam insulation system involves the application of insulation at the site of the building, where the components are mixed and sprayed onto the surface. The foam expands in volume as it is sprayed onto the substrate, creating a tight, airtight seal over the walls and roof.

**Insulation Use Phase:**
Energy savings are readily estimated using building energy simulation models. As illustrated in the graph above, the embodied energy, i.e., energy used to make, transport, install and dispose of the insulation at end-of-life is minimal compared to the cumulative energy savings over the life of the insulation. In addition to providing significant energy and cost savings, spray foam insulation has many other advantages, including les air and moisture infiltration, reduced HVAC system capacity requirements, added strength to the structure and integrity of the building envelope, sustained performance from insulation that does not sag over time, attenuation of outside noise, and durability that lasts for decades.

**Embodied Energy & SWP:**
Life cycle inventory methods based on ISO 14040 can be used to estimate "cradle to end-of-life" energy and from manufacturing, transporting, installing and managing spray foam at end-of-life.

**Spray Foam Formulation:**
Spray foam formulations are complex and involve mixing various components such as polyurethane and surfactants. The components are mixed and sprayed onto the substrate, and the foam expands in volume as it is sprayed onto the substrate, creating a tight, airtight seal over the walls and roof.

**Raw Material Extraction and Refining:**
In the diagram, the process of extracting raw materials is shown, followed by their refinement. This step includes the extraction of raw materials, such as petrochemicals, and their conversion into a usable form.

**Raw Material Manufacture:**
The manufacture of raw materials involves processing these materials into the desired form. This step includes the conversion of raw materials into spray foam components.

**Embedded Energy & SWP:**
The diagram highlights the energy and environmental impacts associated with each phase of the spray foam insulation process, from raw material extraction to installation and management at end-of-life.
LCA calculations show that the highest values obtained with an increase of insulation can contribute substantially to energy efficiency improvement.*

- Insulation contributes to fossil fuel conservation and GHG reduction.

*ICCA - Innovations for Greenhouse Gas Reductions July 2009
Bayer MaterialScience’s Contribution

Bayer MaterialScience contributes to environmental sustainability by delivering innovative spray foam products that reduce the energy needs of homes and buildings.

Bayer MaterialScience has reduced its own carbon footprint by focusing on and making our own processes more efficient.

Bayer North America reduced its direct GHG emissions from the baseline (an average of 1998 to 2001) through 2008 by 660,000 equivalent metric tons of carbon. (Verified by a third party - Chicago Climate Exchange).
Social sustainable development is Bayer’s commitment to help our employees, customers, and neighbors to meet their changing personal and professional needs. Some of the ways Bayer does this are as follows:

- Providing guidance in Safety and Health
- Sharing Best Practices within the industry
- Community Outreach Program
EPA recognized Bayer MaterialScience for its leadership in product stewardship for spray foam in a teleconference following Bayer’s award-winning presentation at the American Chemistry Council’s Center for Polyurethane Industry Polyurethanes 2010 Technical Conference on time limits for safe re-occupancy.

Bayer MaterialScience collaborated with the Spray Polyurethane Foam Alliance (SPFA) and the Center for the Polyurethane Industry (CPI) to launch product stewardship programs and participated on several workgroups.
Direct Involvement with Trade Organizations:

- **PIMA** - Polyisocyanurate Insulation Manufacturers Association
- **ACC** - American Chemical Council
- **CPI** - Center for the Polyurethane Industry
- **ABAA** - Air Barrier Association of America
- **AIA** - The American Institute of Architects
Community Outreach

Girls Hope House in New Orleans, LA
• Application of spray polyurethane foam in a home destroyed by Hurricane Katrina provided a significant savings in the annual energy bill.

Hurricane Katrina Revitalization, Long Beach, MS
• Combination of Spray Polyurethane Foam and steel frame construction completed the mission of creating new building structures able to withstand storms like Hurricane Katrina in the future.

Garfield Manor Detroit, MI, part of Sugar Hill District Urban Renewal
• Spray Polyurethane Foam, along with other energy efficient strategies such as solar power, geothermal walls, white roof, and rainwater harvesting were used in this sustainable redevelopment.

Habitat for Humanity – Cresco, PA
• Application of spray polyurethane foam in a Habitat for Humanity home, providing a 30-50 percent reduction in the monthly utility bills.
Bayer MaterialScience is a large, global, healthy, and viable business with a solid financial future. Bayer MaterialScience will have the opportunity to be an economic contributor to its community.
Economic Sustainable Development

- Bayer - The Inventor Company
- Focused development on new products
- Research and Development is a driving force
- Innovations are essential for future growth
Bayer Corporation employs approximately 108,000 Full Time employees worldwide.

Bayer MaterialScience LLC employs 14,300 in North America.

Bayer MaterialScience Spray Foam employs 57 full time employees, with 11 temporary employees in two locations in the United States.

As an employer, fair compensation, pension, and health-care plans improve the social security of Full time employees at our sites and strengthen the local purchasing power.
Sustainable Development is a path forward that allows humanity to meet current environmental, human, health, economic, and societal needs without compromising the progress and success of future generations.

Sustainable Development policy is a reflection of Bayer MaterialScience’s deep dedication to creating products and service that benefit society while meeting Bayer Corporation’s social, economic and environmental responsibilities.

Bayer is committed to Sustainable Development and to being a socially and ethically responsible citizen.
Go to www.spf.bayermaterialscience.com to learn more about the competitive advantages of spray polyurethane foam.

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