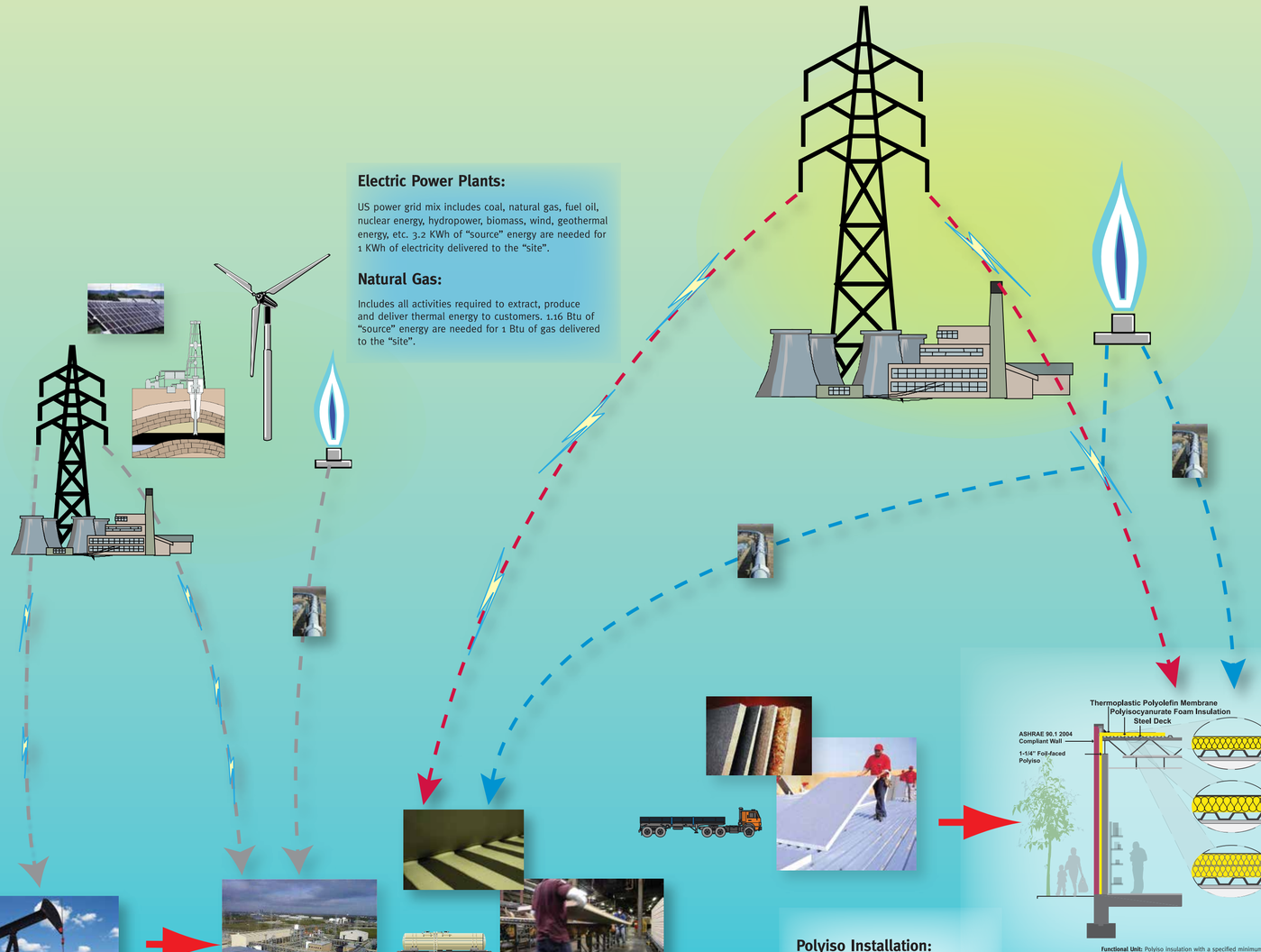
Polyiso: The Product for Building Sustainability

Increased levels of polyisocyanurate (polyiso) insulation save energy and prevent Global Warming Potential (GWP) emissions during polyiso use that far outweigh energy and GWP emissions associated with making, transporting, installing and managing polyiso at end-of-life.

Presented by: Jerry Phelan and George Pavlovich
Covestro LLC • 1 Covestro Circle • Pittsburgh, PA 15205



Electric Power Plants:

US power grid mix includes coal, natural gas, fuel oil, nuclear energy, hydropower, biomass, wind, geothermal energy, etc. 3.2 KWh of "source" energy are needed for 1 KWh of electricity delivered to the "site".

Natural Gas:

Includes all activities required to extract, produce and deliver thermal energy to customers. 1.16 Btu of "source" energy are needed for 1 Btu of gas delivered to the "site".

Raw Material Extraction and Refining:

Involves extraction of crude oil and natural gas, mining of coal, cultivation of crops, refining of crude oil into benzene, pentane, diesel, propane, etc.

Raw Material Manufacture:

Includes processing of raw materials for making chemicals such as diphenylmethane diisocyanate (MDI), polyester polyol, pentane blowing agent, and additives such as flame retardants and catalysts/surfactants.

Recycled materials are used for manufacturing facer and some chemicals such as polyester polyol.

Polyiso Manufacturing:

Major chemical raw materials (MDI, polyester polyol) are mixed with additives and blowing agents. The chemical mix reacts as it is sprayed onto the facers, which bond to each side of the foam on a moving belt laminator, forming foam insulation boards.

Polyiso Installation:

Polyiso product is wrapped in plastic and shipped from the polyiso manufacturing plant to the building site. Polyiso insulation is lifted by cranes for attachment to the roof deck.

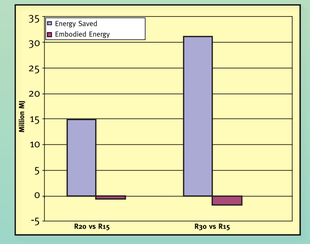
Functional Unit: Polyiso insulation with a specified minimum thermal resistance for a one-story 125,000 ft² retail building roof over a 30-year insulation life.

Polyiso Use:

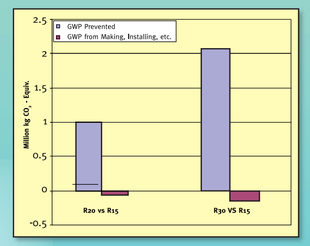
Rigorous Whole Building Energy Analysis based on the US DOE EnergyPlus simulation program was applied to estimate energy savings and GWP emissions prevented during the use phase. Integrated whole building simulation is essential for modeling realistic energy consumption. ASHRAE 90.1 Appendix G procedures were followed to provide credible data on energy consumption comparisons.

Energy savings from increasing insulation from R-15.3 to R-20.4 amount to 15 million MJ, with embodied energy being only 5% compared to the energy saved. Energy savings from increasing insulation from R-15.3 to R-30.6 total 31 million MJ, while the embodied energy for additional insulation is only 7% compared to the energy saved.

Global Warming Potential (GWP) emissions prevented in the use phase by increasing insulation from R-15.3 to R-20.4 are nearly 1 million kg CO_2-equivalent, while GWP emissions generated from all other life cycle phases are about 4% compared to GWP emissions prevented. GWP emissions prevented in the use phase by increasing insulation from R-15.3 to R-30.6 total 2.1 million kg CO_2-equivalent, while the GWP emissions contributed from all other phases are only 6% compared to GWP emissions prevented.

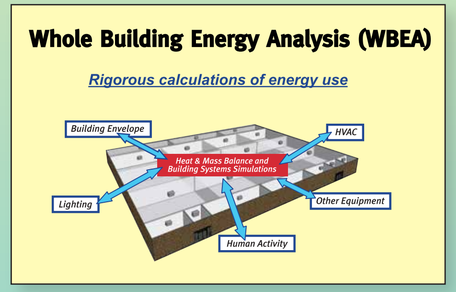


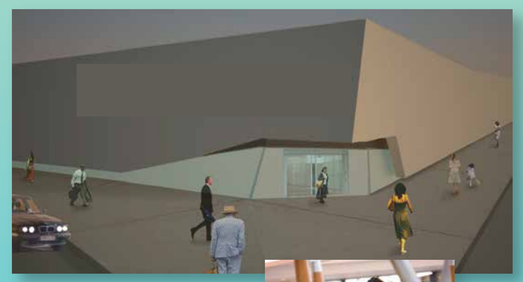
Energy Savings in Use vs Embodied Energy in Polyiso



GWP Prevented in Use vs GWP from All Other Life Cycle Phases

Example for building in Chicago, IL





End-of-life (EOL):

Involves transportation to and disposal of insulation in a local solid waste landfill.

Embodied Energy & GWP:

Based on current polyiso manufacturing and use for commercial roofing in North America, life cycle inventory methods from ISO 14040 were used to estimate "cradle to end-of-life" energy and GWP emissions.

up to 365 days = 1 year

10,950 days = 30 years

30 days = 1 month