

Mechanical insulation: 3-time winner in industrial energy management

The U.S. needs to build more power plants, poles and wires to meet rising electricity demand, but projects and supply chains are backlogged in every direction. One of the quickest ways to add more electrons to the system is by reducing the demand for electrons in the first place. The cheapest form of energy is the energy you don't use.

Mechanical insulation rarely gets headlines, but it delivers some of the most reliable, measurable and cost-effective climate benefits in the built environment. While new technologies promise future breakthroughs, mechanical insulation is already cutting energy waste, lowering operating costs and reducing carbon emissions every hour of every day. Its value comes from three simple advantages: it slashes energy bills, it has extremely low embodied carbon while preventing carbon from entering atmosphere and it avoids CO₂ at a cost unmatched by almost any modern climate technology.

A direct hit on energy bills

Mechanical systems, with their steam

lines, hot water piping, process equipment, chillers and tanks lose enormous amounts of energy when left bare or poorly insulated. A single uninsulated foot of 4-inch pipe operating at 350°F can waste more than 1,400 BTU per hour, every hour of the year. Add just two inches of fiberglass insulation and that loss drops to about 71 BTU per hour, a drop of by more than 90%. The result is immediate, permanent savings. Facilities see lower fuel consumption, reduced peak loads and more stable process temperatures. Unlike many efficiency upgrades, insulation has no learning curve, no software updates and no maintenance burden. It simply works.

Low embodied carbon, high climate impact

Mechanical insulation materials have some of the lowest embodied carbon of any building product. Many insulating materials have Environmental Product Declarations (EPDs) that quantify a product's environmental impacts across its life cycle. An EPD requires detailed information, not only regard-

ing a product's ingredients, but knowledge about the manufacturer's operations, its supply chain and how the products are being used by customers. EPDs across these material types consistently show the same pattern: a small carbon "footprint" to manufacture, paired with an outsized carbon "handprint" from the energy savings the insulation delivers over its service life. As an example, a foot of pipe insulation may generate just a few pounds of CO₂ to manufacture while saving over a ton of CO₂ annually once installed. Mechanical insulation can pay back its embodied carbon in a matter of days. Few climate solutions offer such a fast, reliable return. When a product's handprint overwhelms its footprint, the climate wins. Mechanical insulation does that every single day.

The cheapest CO₂ reduction money can buy

In a world chasing hightech carbon solutions, mechanical insulation remains one of the most cost-effective tools available.

Consider that insulating a single foot of pipe operating at 350°F (example above) can avoid more than one ton of CO₂ per year. The installed cost is under \$50 per foot. That means insulation delivers CO₂ reductions at \$50 per ton, a fraction of the cost of emerging technologies such as direct air capture, which often exceed \$1,000 per ton.

Mechanical insulation is typically used at higher operating temperatures, which translates to higher savings when insulation is applied to bare pipe surfaces. In an era focused on innovation, it's worth remembering that one of the most powerful tools is already in our hands; mechanical insulation saves energy, has positive handprint over footprint, reduces emissions cheaper than most technologies and pays for itself quickly. In a world chasing breakthroughs, insulation is the rare solution that delivers one every single day.

For more information, visit insulationappraisers.com, insulationinspectors.com or insulation.org.

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