American Chemistry Council

SILICONES

Facilitate Improvements in Energy Efficiency

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WHAT ARE SILICONES?

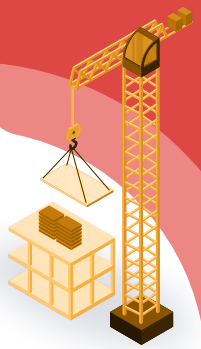
Silicones are among the world's most important and adaptable materials, used in thousands of products and applications. The backbone of silicon and oxygen atoms is the foundation of silicone chemistry and allows for the formation of siloxanes. Siloxanes are raw materials based on silicon, oxygen, hydrogen and carbon and are the critical building blocks used to make silicone polymers. Silicones can be made to resist moisture, chemicals, heat, cold, and ultraviolet radiation. Silicones display a host of unique properties that can lubricate, seal, bond, release, defoam, spread, and encapsulate. Because of these and other properties, silicone polymers are utilized in thousands of products in applications such as construction, consumer products, electronics, energy, healthcare, and transportation.

The use of silicones enables improvements in energy efficiency by reducing primary energy demand and facilitating the transition to renewable energy.

AUTOMOTIVE

Silicone rubber, elastomers, sealants, lubricants, and plastic additives are used extensively in automotive components, and help contribute to energy efficiency.

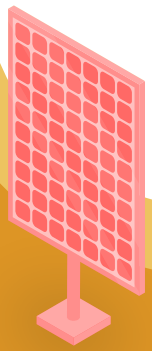
CONSTRUCTION



Silicones used in construction applications contribute to greater energy efficiency and can significantly reduce the carbon footprint of buildings over time. Specifically, silicones improve building energy efficiency, reducing operating costs and energy demand.

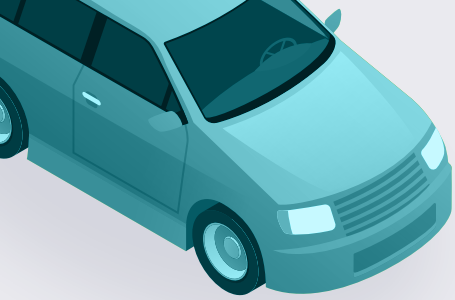
SOLAR ENERGY

Silicones are used as a frame sealant, junction box adhesive, junction box potting agent, and an encapsulant for microinverters in the fabrication of photovoltaic (PV) systems.



WIND ENERGY

Silicone bonding agents and lubricants used in the manufacturing of wind turbines increases the durability and weather resistance of the rotor blades. By improving durability and strength, silicones facilitate larger wind turbines with greater energy potential.

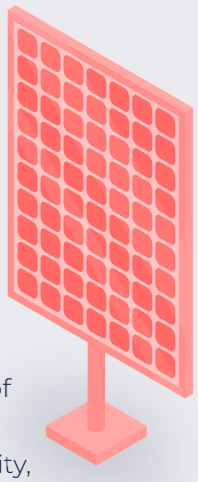


AUTOMOTIVE

- The use of silicones helps reduce weight for passenger vehicles. Lower vehicle weight results in increased fuel efficiency and lower emissions of various pollutants, primarily CO_2. Overall, the reduction of primary energy demand (fuel) due to the use of silicones for an average passenger car is about 5%.
- Silicones are also used in the production of "green" tires. Green tires have less rolling resistance due to the addition of silicones and precipitated silica. The use of silicones in green tires helps to reduce the rolling resistance and fuel consumption resulting in less CO_2 emissions. Rolling resistance can account for up to 30% of a vehicle's fuel consumption and a quarter of its CO_2 emissions.

By using silicone materials for sealing and bonding in batteries and energy storage, the electric insulation can be considerably increased compared to alternatives. Silicone solutions for battery packs and modules in electric vehicles tends to increase the energy density. As a result, a higher energy efficiency can be achieved as the primary energy demand decreases for the application. Silicone materials used in batteries for electric vehicles help support the renewable energy transition.

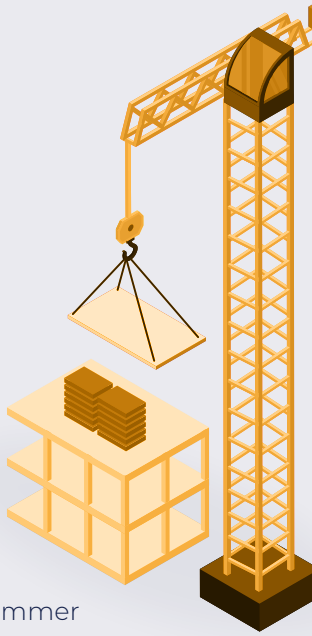
SOLAR ENERGY



- In solar panels, the mechanical and chemical properties in silicones' encapsulants help achieve a long-lasting use and avoid premature end of life.
- Silicones are used to frame solar panel cells and give electrical protection so that they can generate and deliver electricity over a number of years with minimal maintenance

By converting solar energy into electricity, photovoltaics is one of the key technologies that offer a sustainable solution to meet this demand. By using silicone materials in PV systems, the production of renewable electricity is supported.

CONSTRUCTION



- Silicone sealants help make buildings energy efficient by helping to prevent humidity and hot or cold air from coming through joints and cracks. Applying silicone resin emulsion paints to an unprotected building façade can reduce heat loss by up to 40%.
- Material savings in the production phase and energy efficiency in the use phase are among the most important objectives in sustainable building design. New high performance silicone adhesive solutions allow slimmer connections and profile sections, which can result in significant material savings and reduces energy use and CO_2 emissions.

By using silicone materials as sealants, adhesives, and coatings, the increased water resilience of the building materials can decrease degradation and erosion, lengthening the operational lifetime of the material.

WIND ENERGY

- A wind turbine with silicone lubrication produces about 8% more energy than a wind turbine with synthetic oil. Silicone lubricants can reduce friction in wind turbine components (gearboxes, hydraulic circuits and brakes) improving energy efficiency and reducing wear and tear in components.
- Silicones are also used as adhesives to bond the rotor blades protections. The average blades manufactured between 1980 and 1990 were 17 metres across and generated 75 kilowatts of energy. In 2019, the average rotor diameter size was around 129 metres with one rotor 132 metres in diameter and a rated power 3,465KW. This requires higher performing components, including stronger bonds on the blades themselves.

By improving durability and strength alongside low weight, silicones have facilitated larger wind turbines with greater energy potential.