



The importance of silicones in our daily life

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This is Elkem

One of the world's leading providers of advanced material solutions

Who we are

- A global team of 7,300 people, with > 600 in R&D
- >30 production sites, R&D centres and offices worldwide
- Headquartered in Norway, hubs in France and China

Our commitments

- Our purpose: Advanced material solutions shaping a better and more sustainable future
- Our strategy: Dual-play growth & green leadership

What we do

- We create and deliver advanced material solutions
- We offer specialties and standards from fully integrated value chains
- Our divisions: Silicones, Silicon Products and Carbon Solutions

Our performance

- Track record of continuous improvement since 1904
- 2022: Total operating income NOK 45.9 billion
- 2023: Ecovadis "Gold" rating on sustainability
- 2022: Double A- scores from CDP for efforts on climate and forests. B score on water security



This is Elkem

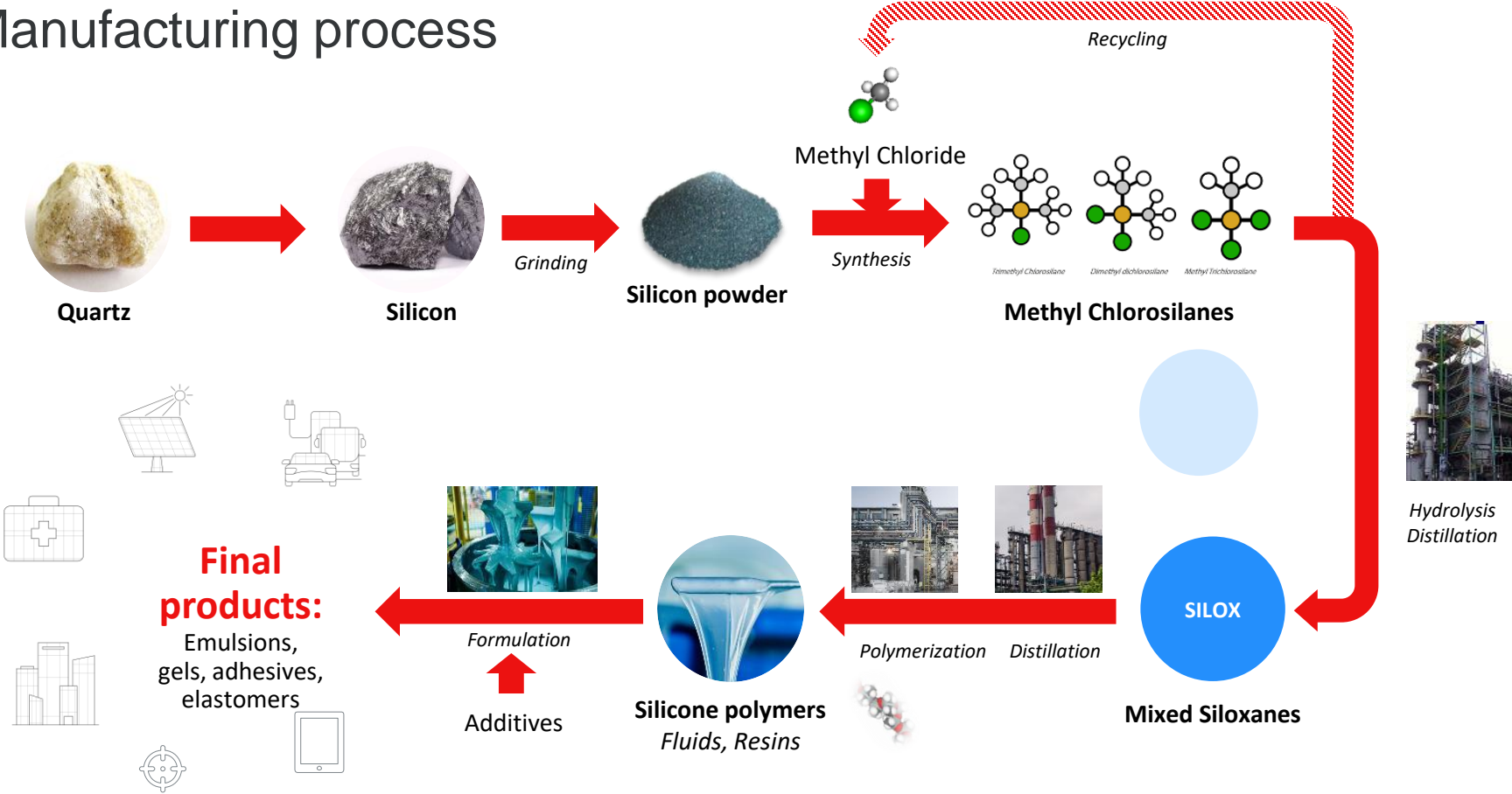
[Elkem Corporate Video 2023.mp4](#)

[elkem corporate video.mp4](#)

[Elkem corporate video 2022 - YouTube](#)

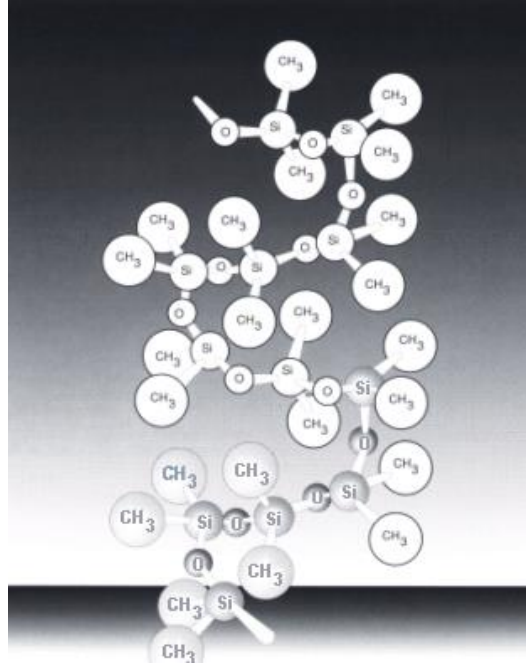
[We are Elkem - Advanced materials shaping a more sustainable future - YouTube](#)

Manufacturing process



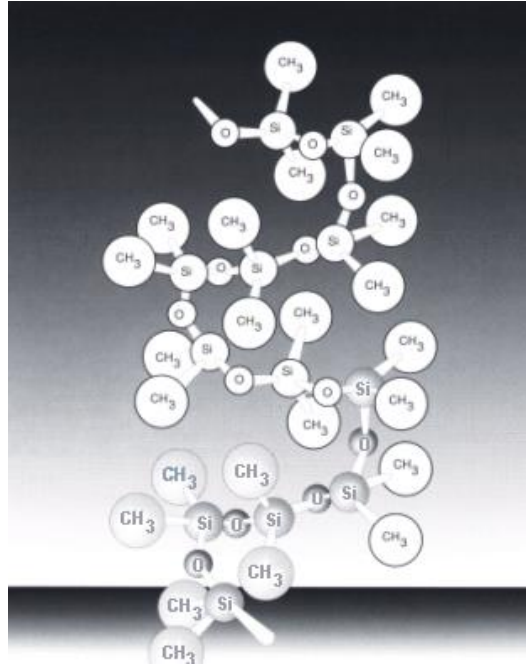
Silicones: Unique chemistry ...

- Inorganic & Organic Hybrid Structure
- Si-O Bond Energy > C-C
- Si-O Rotation Energy < C-C
- Si-O Bond Length > C-C
- Broad Si-O-Si Valence Angle
- CH₃ low inter- & intra- molecular interactions
- Low surface tension
- Low Glass Transition temperature



... providing unique properties

- Flexibility & Spreadability
- Water repellency
- Heat Resistance
- Oxidation & UV Resistance
- Chemical Resistance
- Fire Resistance
- Viscosity stability vs T°C
- Physiologically inert
- Dielectric properties
- Resistance to shear stress
- Compressibility
- Lubricity
- Soft touch



Unique chemistry vital applications

Silicones bring unparalleled properties and performances to materials, which are essential in multiple industries.



Electric mobility

Lightweight
Battery thermal management
Electrical & fire safety



Semiconductors

Thermal management
Electronic assembly
Circuit protection



Low-carbon energies

Long-term reliability (weather, UV)
Nonflammable materials
High temperature operations



Healthcare

Biocompatible materials for
temporary or permanent
implants and prosthesis



Aerospace & defense

Properties retention at
temperatures beyond the limits
of organic chemistry

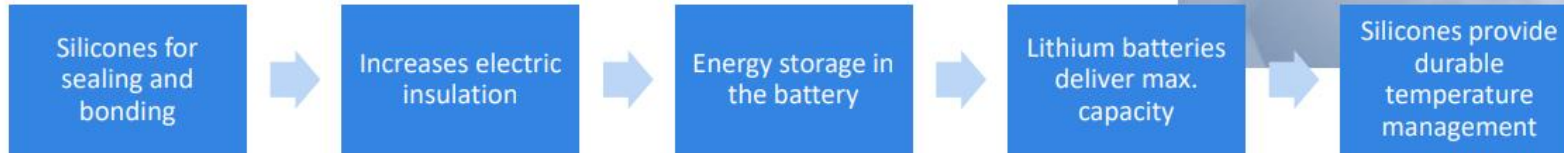
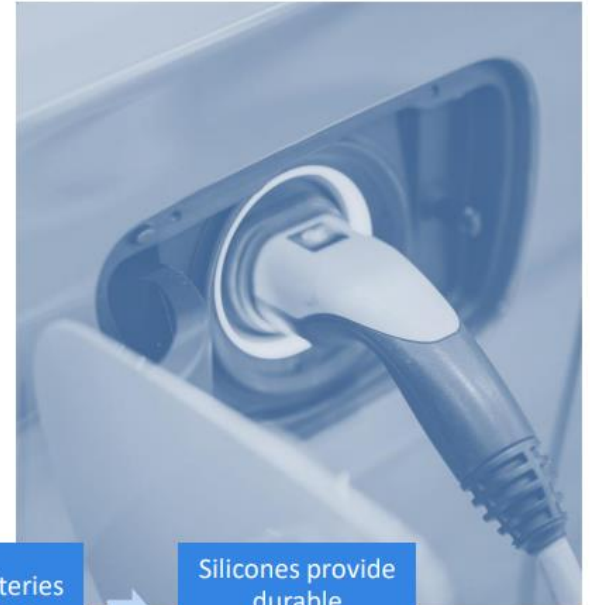


Construction

Long-lasting, weather-proof
adhesives and sealants for energy
efficient glass façades

Example: Batteries for e-mobility

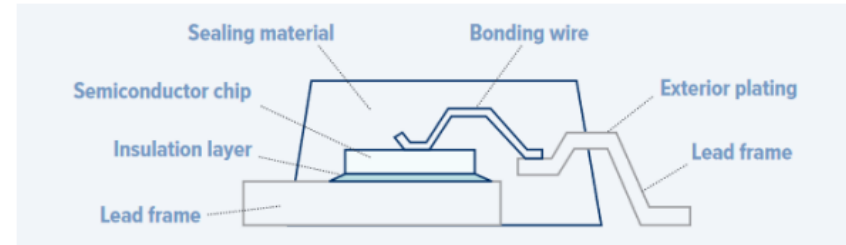
- Using silicone materials for sealing and bonding battery components considerably increases electric insulation and safety compared to alternatives.
- Silicone solutions for battery packs and modules in electric vehicles enable energy density to be safely increased, helps prevent electric surges or battery fires, and shields batteries from moisture and temperature fluctuations.
- Lithium batteries are delivering their maximum efficiency in a temperature range of 15°C to 35°C. Thermally conductive silicone solutions enable improved battery temperature control, and thus contribute optimizing the charge/discharge cycles.
- The strongly increasing global demand for electric vehicles leads to a steep increase in demand for batteries and its components.



Example: electronic assembly / semiconductors

- Silicones are used in the **assembly of electronics and semiconductors**, to ensure the safety and reliability of high computing rate electronic devices, by providing
 - **Thermal management:** prevents overheating
 - **Durability:** protects from water, air and shocks
 - **Reliability:** protection from electromagnetic interferences
- *Siloxane D4 is used in the **manufacturing process of semiconductors**, as a precursor for nanometric dielectric layer deposition in advanced semiconductor technology manufacturing. This layer offers a unique combination of thermomechanical and dielectric properties allowing the several billion of transistors of an individual chip to function. The basic functionality requires the use of D4.**

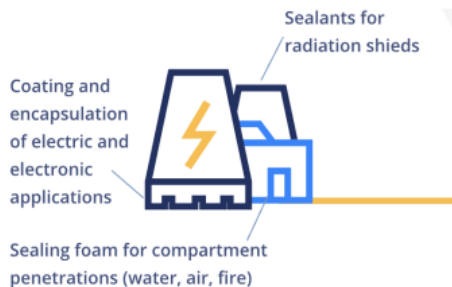
* Source: SIA Comments On the D4 Manufacturer Request for Risk Evaluation, July 31, 2020



Example: low-carbon energy applications

Nuclear:

Silicones are essential for sealing and manufacturing safe radiation shields. They protect electrical circuits in all environments, ensuring heat and fire resistance.



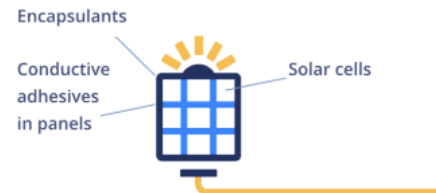
Wind:

Silicone lubricants help minimise the friction in turbine components. The advanced adhesives based on silicones are used to bind the giant rotor blades, generating more power.



Solar:

Silicones are used as conductive adhesives and encapsulants in the manufacture of solar panels. Their resistance to UV radiation and temperature changes reduces repair costs, and their superior transparency improves panel efficiency.



Security: against leakage currents and flashovers



Durability: longer service life

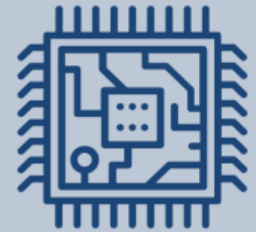
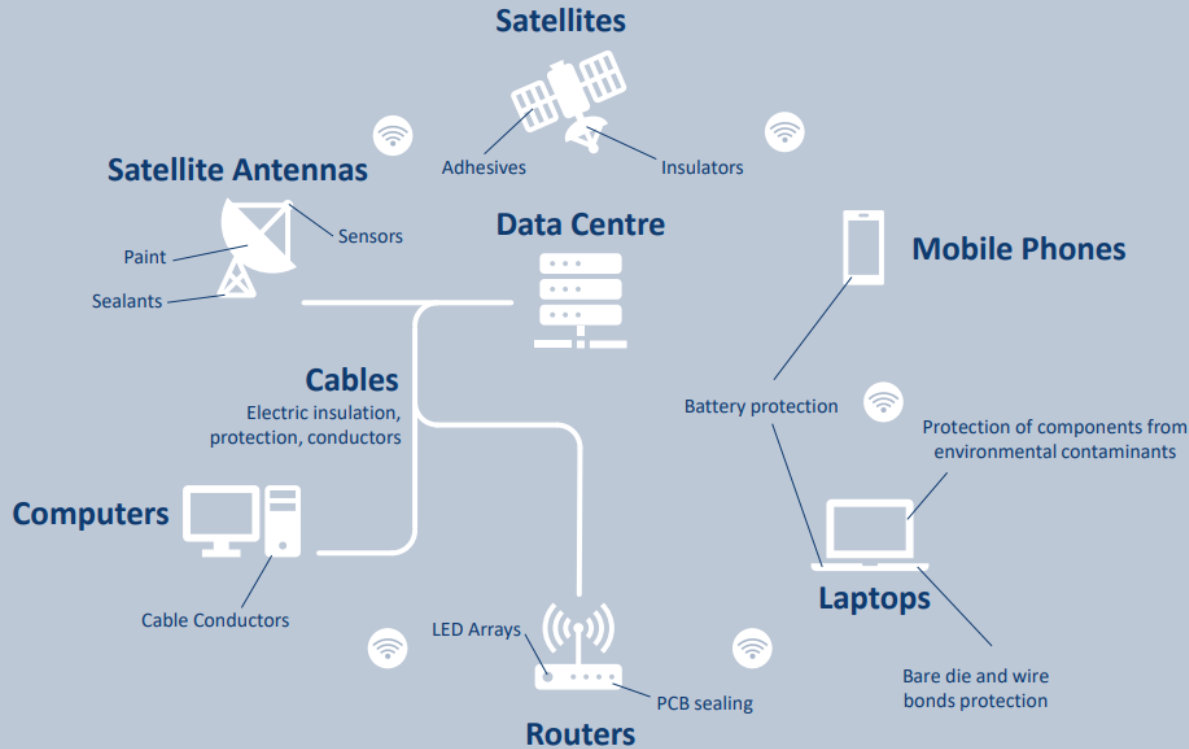


Reliability: better performance



Efficiency: lower maintenance costs

HOW SILICONES ENABLE INTERNET DATA FLOW

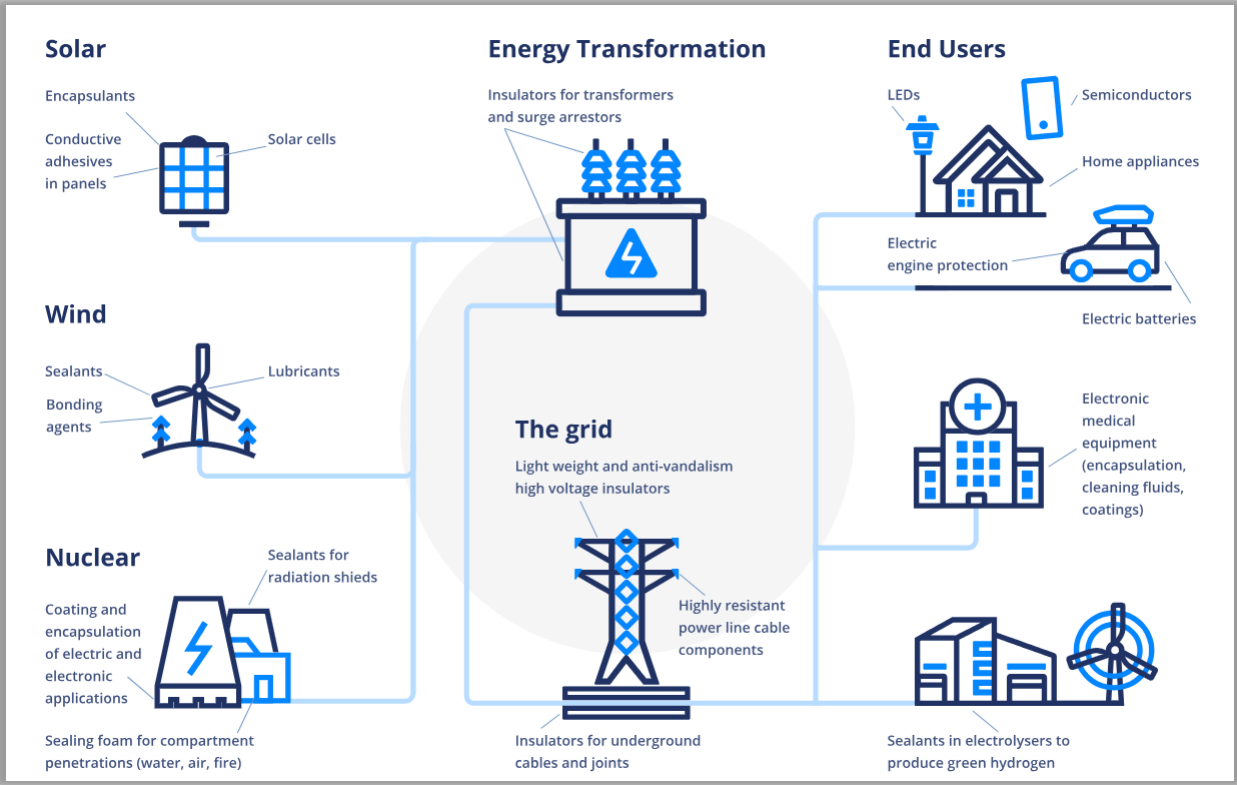


Semiconductors

Microprocessor bonds
PCB coatings
PCB seal and bond substrates

Silicones enable low-carbon electricity & durable solutions

By using products made with silicones, you save 9 times more greenhouse gases than what was emitted during the manufacture of these silicone materials*



**(Global Silicones Council. 2020. Socio-economic evaluation of the global silicones industry.)*

Industrial Assembly

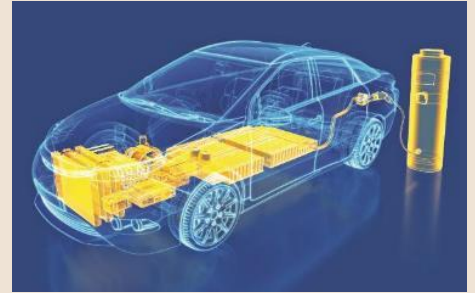
Our silicone innovations enable heat resistance & protect on-board electronics & parts

Main benefits

- ✓ Potting & encapsulation of sensitive electronics with silicone gels and elastomers (RTV2)
- ✓ Bonding and gasketing applications
- ✓ Silicones for battery modules
- ✓ Adhesion on multiple substrates
- ✓ Heat and humidity resistance
- ✓ UV, chemical and thermal resistance -60°C up to +300°C



Electronics



Automotive



Aeronautic & defense



Domestic Appliance

Life Science

Our silicone innovations are specifically designed to serve healthcare applications

Main benefits

- ✓ Biocompatible
- ✓ Chemically inert
- ✓ Better comfort than organic adhesives
- ✓ Hypoallergenic
- ✓ High performance physical properties
- ✓ Stable across a wide range of environmental conditions
- ✓ Form a permeable matrix structure for drug delivery system
- ✓ Excellent tensile & elongation properties



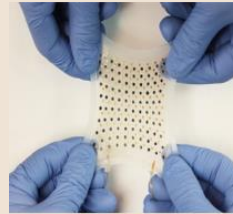
Skin adhesive



Advanced Surgery



Breast implant



Diagnostics
& monitoring



Orthotics &
prosthetics



Dental



Additive
manufacturing

Rubber

Our silicone innovations enable the transition to more sustainable transportation

Main benefits

- ✓ Resist to high and low temperatures : silicones are stable from -60°C to $+250^{\circ}\text{C}$
- ✓ Flexible : easy to install in limited space
- ✓ Higher heat and fire resistance compared to standard organic polymers
- ✓ Low smoke emissions in the event of combustion
- ✓ Non-corrosive and non-toxic combustion gasses
- ✓ Help to reduce vehicle weight and CO2 emissions



Railway



eV cable



Engine parts



Insulators

Construction

Our silicone innovations improve energy efficiency & long-lasting sealing solutions

Main benefits

- ✓ Ease of extrusion from the cartridge
- ✓ Speed of curing
- ✓ Elasticity to accommodate joint movement
- ✓ Protection against mold for sanitary sealants
- ✓ Adhesion on construction materials (concrete, aluminum, glass, plastics)
- ✓ Durability



Structural glazing



Facade sealant



Sanitary applications



Aquarium

Advanced Molding

Our silicone customized solutions guarantee absolute fidelity for end-user features reducing waste during the mold-making process

Main benefits

- ✓ Excellent print performance
- ✓ Outstanding solvent resistance even in diluted state
- ✓ Superior thermal stability
- ✓ Easy processing
- ✓ High oil dilution possibilities
- ✓ Low tension surface
- ✓ Aging resistance



Architectural molding



Prototyping



Composite molding



Pad printing

Self Adhesive Industry

Our silicones solutions offer unique release & adhesion performance for everyday consumer goods

Main benefits

- ✓ Control release
- ✓ Adhesion onto paper or film
- ✓ Harmless (Food contact compliant and/or skin contact compliant)
- ✓ Water repellency at short contact time
- ✓ Ease at coating in very thin film, fluid
- ✓ Low surface tension
- ✓ Good wetting of various surfaces



Food packaging &
Bakery



Phone construction &
Screen protection



Hygiene



Label

Textile Coating

*Our silicone solutions are versatile
& efficient coatings
contributing to durability & safety in
transportation and protective
fabrics*

Main benefits

- ✓ Thermal insulation
- ✓ Controlled permeability
- ✓ Durability & aging resistance
- ✓ Excellent stability at low and high temperatures
- ✓ Outstanding flame resistance
- ✓ Easy cleaning
- ✓ Environment-friendly - solventless



Airbags



Artificial leather



Protective coating



Lace coating

Textile & Leather

Our silicone solutions improve the quality, performance and comfort of clothing and accessories

Main benefits

- ✓ Pliable, bacteria- and heat-resistant
- ✓ Glossy or smooth feel
- ✓ Low skin irritability
- ✓ Softness
- ✓ Resistance to yellowing
- ✓ Water resistance and durability



Textile finishing



Leather treatment



Waterproof clothing

Performance Ingredients

Our innovating solutions offer cutting edge products to ease industrial processes

Main benefits

- ✓ Efficiency in wide temperature & pH range
- ✓ Chemically inert
- ✓ Compatibility with various media
- ✓ Regulation compliancy
- ✓ Outstanding slip & release properties
- ✓ Long-lasting Water repellency
- ✓ UV and heat resistance
- ✓ Very low COV content



Foam control

(crop care, pulp & paper, oil & gas, water treatment, plastic recycling)



Tire release



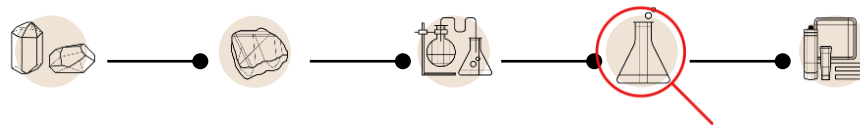
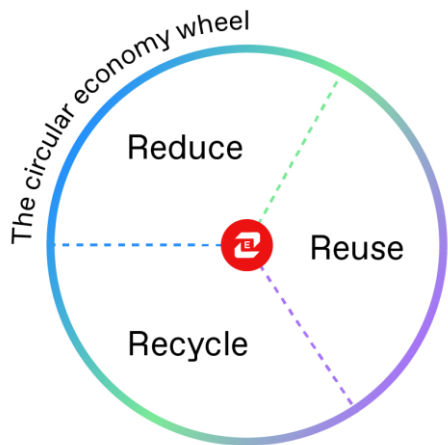
Building protection



Delivering your potential

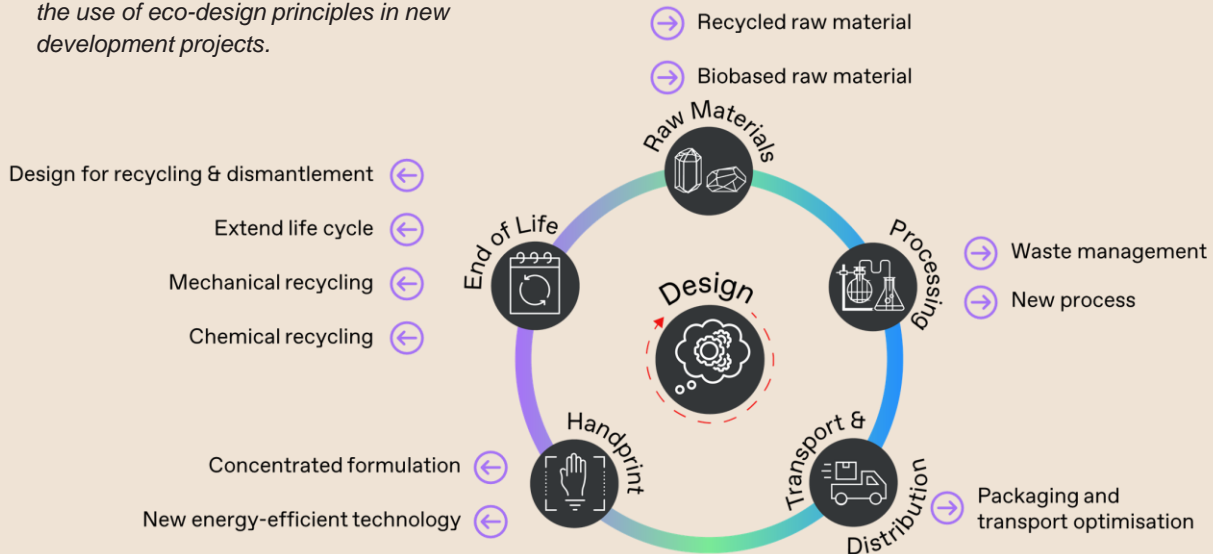
Enabling circular economies

At Elkem, the objective is to increase circularity. Through close partnerships with customers and research Elkem's goal is to standardise a 3R approach, based on reuse, reduce, and recycle.



Systematizing the use of eco-design

Our R&I team is focused on systematizing the use of eco-design principles in new development projects.





Silicones reduce greenhouse gas emissions during use phase

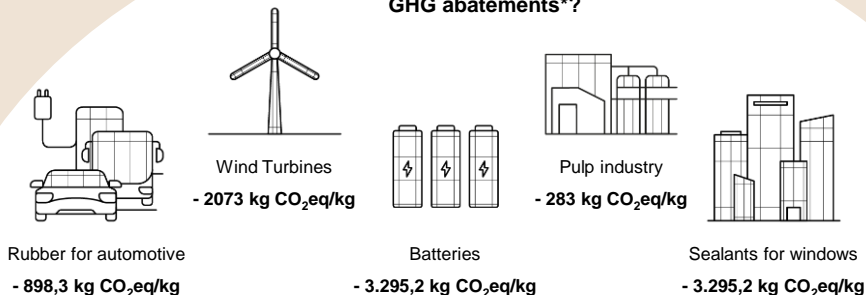
Limit the production and consumption of other materials by:

- Extending the lifespan of end-products
- Contributing to a more efficient use of materials
- Delivering specific function with less material and/or less carbon
- Demonstrating better resistance to environmental hazards

Reduce fossil fuels consumption:

- At our customers', their production processes are more efficient (better productivity, less waste)
- During the use phase of the finished products :
 - Fuel savings due to lighter and more efficient transportation
 - Savings in heating and electricity consumption (insulation, sealing)

Where does the use of silicones lead to the biggest GHG abatements**?



For every ton of CO₂ emitted during silicones manufacturing and end-of-life, the use of silicones allows for savings 9 times greater**.