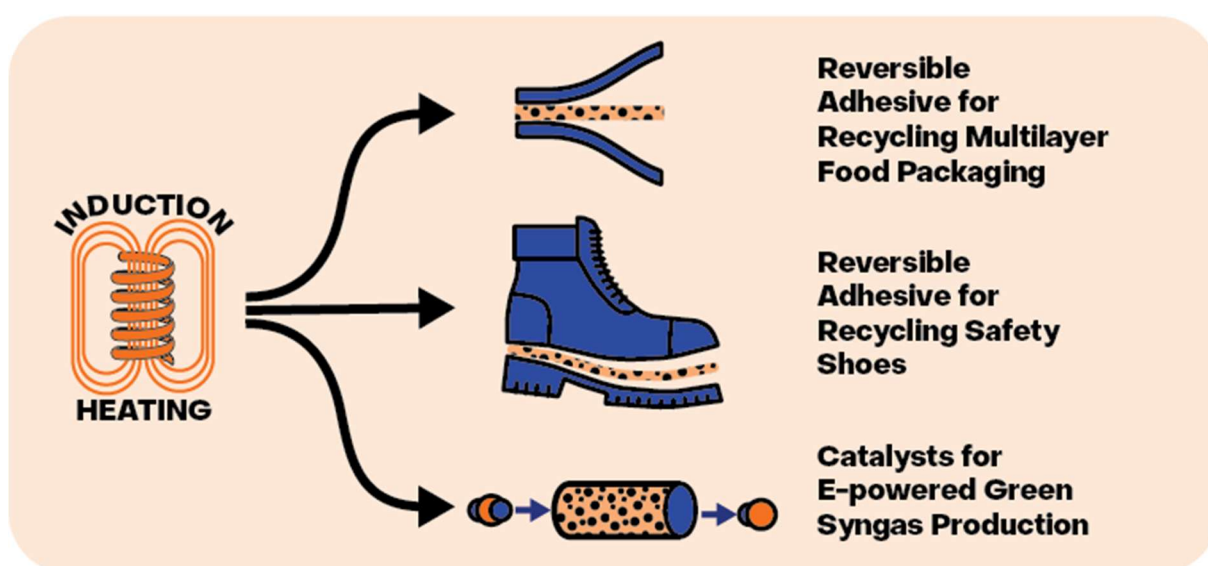


CircuTherm

Industrial processes are responsible for a large share of energy use, CO₂ emissions, and raw material consumption. A major reason is the reliance on conventional heating technologies, which are inefficient, slow to respond, and difficult to electrify. They often heat large unused volumes and limit innovation in recycling and sustainable production. CircuTherm is a project that addresses these challenges by developing a fundamentally different thermal processing approach based on inductive heating.

CircuTherm focuses on highly efficient, localized heating, where up to 90% of electrical energy is converted directly into heat at the exact location where it is needed. This is made possible through the integration of magnetic iron oxide nanoparticles, advanced inductive heating equipment, and a flexible platform for site-specific heat generation. The result is a fast, controllable, and fully electrifiable process that reduces energy losses, lowers CO₂ emissions, and enables new circular processing routes that are not feasible with traditional heating methods.

Demonstration cases



The CircuTherm technology is developed and validated in three industrial demonstration cases, where inductive heating and magnetic nanoparticles play a central role:

- **Reversible adhesives for multilayer plastic packaging.** Inductive heating is used to activate magnetic nanoparticles embedded in adhesive layers. This allows controlled debonding of multilayer packaging without damaging the individual layers, enabling high-quality separation and improved recycling of plastics.
- **Reversible adhesives in safety shoes.** In footwear production, the technology enables selective heating of adhesive joints so that shoe components can be detached at end of life. This makes it possible to separate and recycle different materials, supporting circular product design.
- **Inductively heated catalysts for CO₂ conversion.** Magnetic nanoparticles are integrated into catalytic materials, allowing direct inductive heating of the catalyst inside a reactor. This enables efficient and electrically driven operation of energy-intensive reactions such as the reverse water gas shift (rWGS), improving process efficiency and reducing reliance on fossil-based heating.

Towards industrial impact

CircuTherm will demonstrate these applications at pilot scale and assess their environmental and economic performance using life cycle assessment (LCA) and techno-economic analysis. By combining energy efficiency, electrification, and circular design, CircuTherm supports the transition toward low-carbon, future-proof industrial processes across multiple sectors.