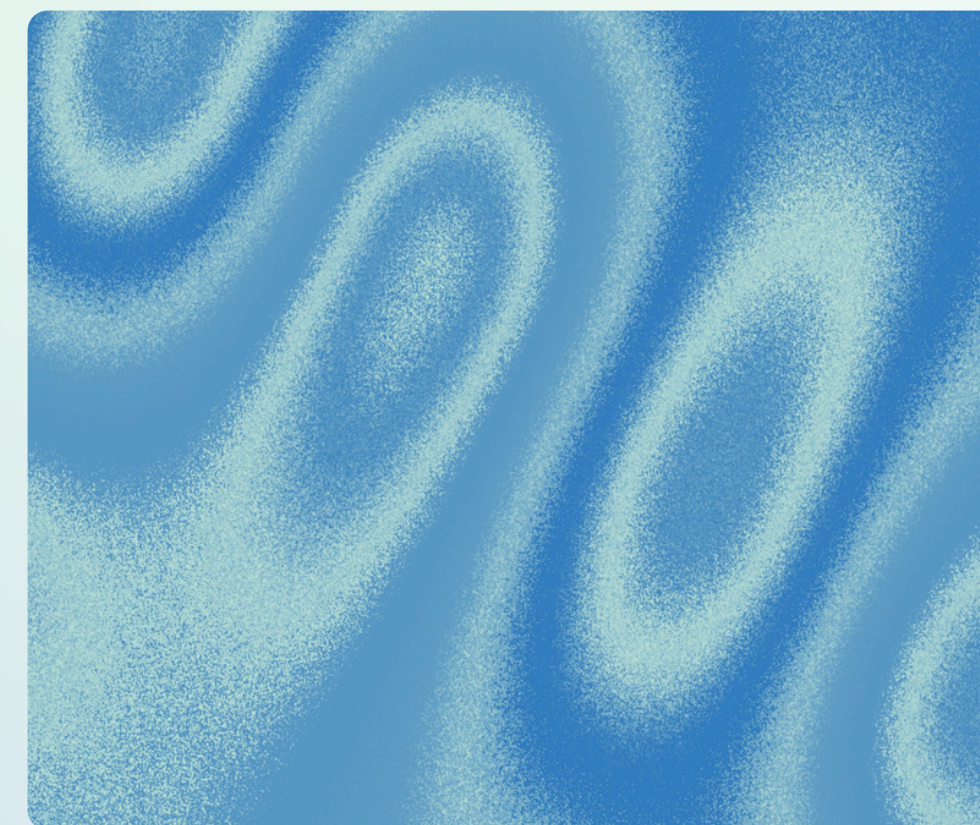




Understanding Solid Oxide Electrolysis (SOEC): The Basics

Solid Oxide Electrolysis Cells (SOECs) are advanced devices that use ceramic materials and high temperatures (typically 600–750°C) to split steam (H_2O) into hydrogen and oxygen. The ceramic electrolyte conducts oxygen ions through the cell while electricity drives the electrochemical reaction. **Because part of the energy comes from heat in the steam, SOECs can produce hydrogen more efficiently than conventional low-temperature electrolyzers.**





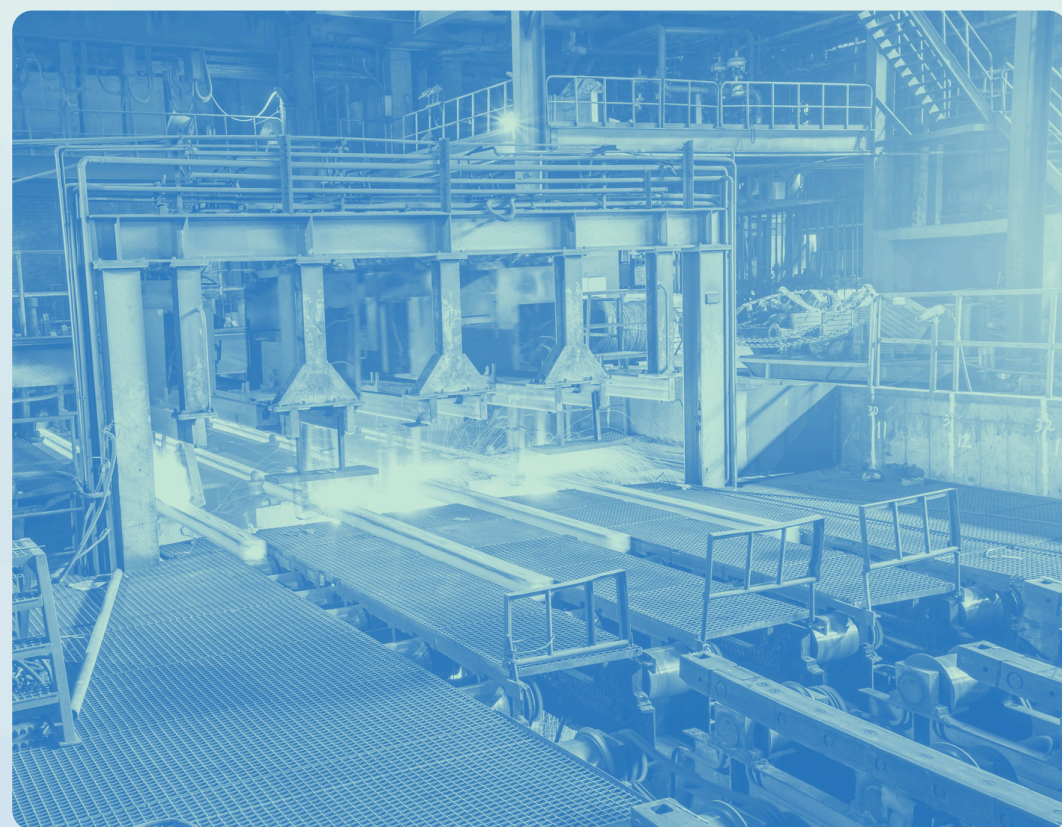
Why SOEC is Important: The Big Picture

SOEC is one of the most electrically efficient methods available for producing green hydrogen. Unlike conventional electrolyzers that rely almost entirely on electricity, SOECs use both electricity and heat. By supplying part of the required energy as steam at high temperature, the electrical energy demand is significantly reduced. **Elcogen reports electrolysis efficiencies reaching approximately 80–90% and hydrogen production energy consumption below 3 kWh/Nm³, making SOEC technology particularly attractive where industrial heat is available.**





SOEC in Our Daily Lives: Practical Impact



SOEC technology is especially valuable for energy-intensive industries that already generate large amounts of waste heat or steam. Steel plants, chemical manufacturing facilities, refineries, and synthetic e-fuel producers can use this available heat to improve hydrogen production efficiency and lower operating costs. The resulting green hydrogen can replace fossil fuels in industrial processes, while co-electrolysis can produce syngas for synthetic fuels and chemicals. **This helps reduce carbon emissions from sectors that are otherwise difficult to decarbonise.**



The Crucial Difference: Why innovation is needed?

Although SOEC technology offers exceptional efficiency, the high operating temperatures create significant materials challenges. Ceramic layers must withstand thermal cycling, mechanical stress, chemical reactions, and long operating lifetimes without degrading. **To achieve commercial-scale deployment, the industry needs ceramic materials that combine high ionic conductivity with excellent durability and manufacturability.**

Advanced printable ceramic materials are particularly important because they enable precise layer structures, improved performance, and more robust cell designs capable of long-term operation under demanding conditions.





ELCOGEN's Role: Addressing SOEC Challenges



Elcogen develops advanced solid oxide cell technology focused on improving efficiency, durability, and manufacturability. Its cells use engineered ceramic layer structures and proprietary materials to achieve high electrochemical performance at relatively low operating temperatures of 600–750°C. Looking toward future manufacturing approaches, advanced printable ceramic materials such as scandia-stabilized zirconia (ScSZ) and scandia-ceria-stabilized zirconia (scCeSZ) offer higher ionic conductivity than conventional zirconia-based electrolytes and are well suited for additive manufacturing. **Combined with 3D-printing techniques, these materials can enable optimised cell geometries, increased active surface area, improved mechanical robustness, and next-generation SOEC designs with enhanced performance and lifetime.** Elcogen's expertise in ceramic solid oxide technology positions it to benefit from and contribute to these advanced manufacturing developments.