Clean Hydrogen Partnership

Hydrogen Production

Solid oxide electrolyser technology proves its power

Producing hydrogen in sufficient volumes and for a variety of applications is a vital part of efforts to decarbonise Europe's energy, transport and industry sectors. Projects funded by the Clean Hydrogen Partnership are demonstrating the flexibility and scalability of solid oxide cell technology to make this clean energy carrier.

Towards low-CO_2 steelmaking

Steel manufacturing is a sector where it is traditionally difficult to reduce greenhouse gas emissions. To demonstrate how hydrogen can help decarbonise such hard-to-abate sectors, the GrInHy2.0 project installed a solid oxide electrolyser (SOEC) in the Salzgitter AG steelworks in Salzgitter, Germany. Waste heat from steelmaking is used to make steam which, with 'green electricity, powers a 720 kW electrolyser that produces hydrogen, which is used in steel annealing. The availability of high temperature steam reduces electricity use – one of the major cost factors in hydrogen production.

The GrInHy2.0 electrolyser produces 170 normal cubic metres (Nm^3) of hydrogen per hour and uses up to 20 % less electricity than low-temperature electrolysers.

Meanwhile, the SWITCH and REFLEX projects are demonstrating how reversible solid oxide technology can operate in electrolysis mode to produce hydrogen, or in fuel cell mode to generate electricity.

Turning up the heat on electricity consumption

The GrInHy2.0 consortium is laying the foundation for further market deployment of SOECs and gaining an in-depth understanding of their performance in fuel cell stacks. The project results will be disseminated among those decision makers who are likely to commission similar facilities.

SWITCH will be demonstrated at a hydrogen refuelling station in the Netherlands, and REFLEX will soon be providing heat and power to a technology park headquarters in France. Both projects are developing the know-how for SOEC applications such as heating homes or powering a grid.

TOWARDS GREATER EFFICIENCY

The application of SOEs in different contexts needs to be further demonstrated and must be accompanied by improvements in materials used in the fuel cells, to ensure better performance, greater durability and lower cost.

GENERATING MULTIPLE BENEFITS

These projects seek to demonstrate, at scale and in different settings, the greater electrical efficiency and versatility of SOC technology compared with proton-exchange membrane and alkaline electrolysis. SOC is capable of co-generating electricity, hydrogen and heat when operating in fuel cell mode using natural gas or biogas. **The goal?** GrInHy2.0, SWITCH and REFLEX are helping to attract further investments to ensure improvements to components and systems and reduce capital expenditure. **Key results?** GrInHy 2.0 is a leader in high-temperature electrolyser technology and is setting new standards for SOEC use. REFLEX has developed an innovative prototype stack and improved the efficiency of its electronics and software. REFLEX demonstrated the power-to-power round-trip efficiency of the technology and its flexibility, taking it from Technology Readiness Level 3 to 6.

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GrInHy2.0 project
Reflex project
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KEY ACHIEVEMENTS

170 NM³ OF 'GREEN' HYDROGEN
produced per hour by the GrInHy 2.0 electrolyser

84 % ELECTRICAL EFFICIENCY
of the high temperature GrInHy 2.0 electrolyser, compared with around 60 % for alkaline or PEM versions

EUR 4 500
per kg of 'green' hydrogen per day Capex target achieved by GrInHy 2.0

100KG/DAY
hydrogen production expected by the SWITCH system

IMPACTS

MEGAWATT SCALE
demonstration of high-efficiency hydrogen production by GrInHy2.0

HIGHEST EFFICIENCY
on the market achieved by the SOEC technology used in GrInHy2.0

GUARANTEED AND COST-OPTIMISED
production of hydrogen by the combination of electrolysis (SOE) and fuel cell (SOFC) modes in the SWITCH system – depending on the price of electricity and natural gas

SUSTAINABLE AND SECURE
supply of hydrogen thanks to the SWITCH system

MORE COMPETITIVE REVERSIBLE SOC MARKET
expected by the REFLEX project through lower capital- and operating expenditure of reversible SOC technology

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