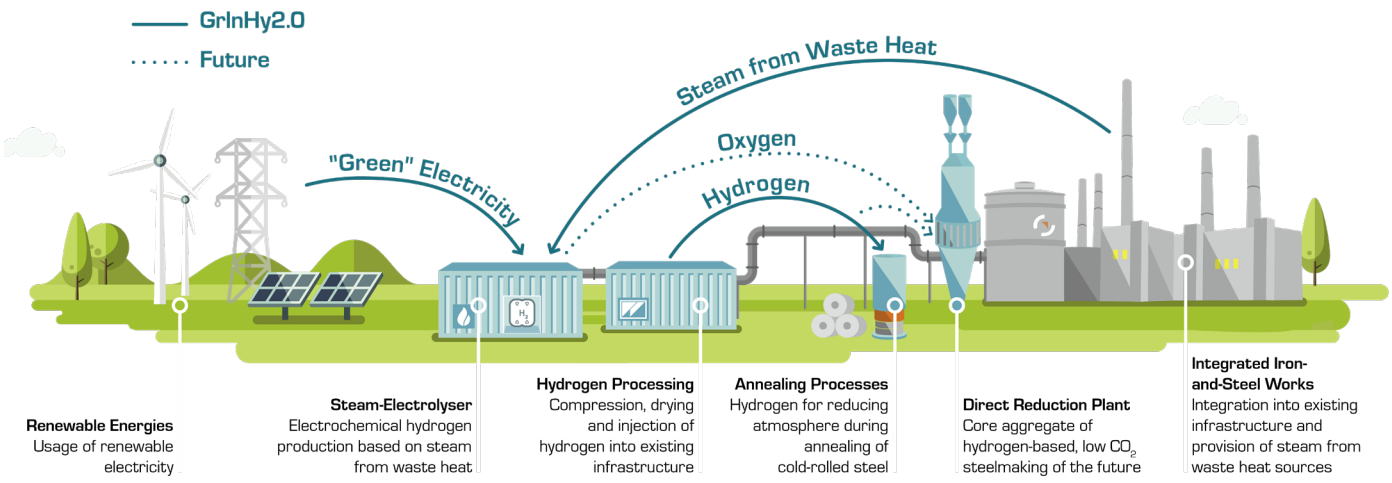
CLEAN HYDROGEN PARTNERSHIP FUNDING PROJECT

GrInHy2.0 - GREEN INDUSTRIAL HYDROGEN

GrInHy2.0
Green Industrial Hydrogen



PROJECT OVERVIEW

Within the EU-funded GrInHy2.0 project, a demonstration plant will showcase the hydrogen production via steam electrolysis utilising waste heat from the iron-and-steel factory of Salzgitter Flachstahl GmbH. The project partners are constructing and integrating the world's most powerful high-temperature electrolyser based on solid oxide electrolysis cells for the energy-efficient production of green hydrogen, supplied by Sunfire GmbH.

With the first implementation of a high-temperature electrolyser of the megawatt-class in an industrial environment, GrInHy2.0's prototype will produce 200 Nm^3/h of hydrogen at nominal power input of 720 kW_{AC}. The hydrogen will be used for annealing processes as a substitute for hydrogen produced from natural gas. In a broader perspective, the project will also deliver answers on how to avoid CO_2 emissions in the European steel industry by switching to a hydrogen-based primary steelmaking and what is needed to achieve this.

MISSION

+ Integration of a steam electrolyser into an existing industrial energy and media supply infrastructure
+ Meeting the quality standards of the steel industry for hydrogen supply
+ Utilisation of waste heat from high-temperature industrial processes
+ Assessment of the techno-economic feasibility based on the steel industry as well as other industrial sectors
+ Setting new standards in long-term stack validation of the solid oxide electrolysis cell technology

OBJECTIVES

Technical

+ Electrical electrolyser efficiency up to 84 $\%_{el,LHV}$ (< 40 $kWh_{el,AC}/kg$)
+ Electrolyser scale-up to 720 $kW_{el,AC}$ producing 200 Nm^3/h (18 kg_{H2}/h)
+ More than 13,000 operating hours at system level with a proven availability of > 95 %
+ Lifetime: more than 20,000 operating hours at stack level
+ Demonstrate hot start from minimum to maximum power in < 5 minutes

Socio-Political

+ Create viable technology by demonstration in a complex industrial environment
+ Assess CO_2 avoidance potential of a hydrogen-based European steel industry
+ Provide significant share of green hydrogen to the iron-and-steel works
+ Evaluate situation on purchasing renewable electricity and green H_2 certification

Economical

+ Reduction of electrolyser investment costs to < 4,500 €/(kgH_2/d)
+ Production of more than 100 tons of green hydrogen at under 7 €/kgH_2
+ Create a viable market by demonstrating the steam electrolysis technology based on techno-economic studies for further market deployment



Left: Electrolyser installation at the Salzgitter Flachstahl steel plant (© Salzgitter AG); Middle: Sunfire-HyLink SOEC electrolyser (© Sunfire GmbH); Right: Drone shot of the GrInHy2.0 installation at the Salzgitter Flachstahl steel plant (© Salzgitter AG)

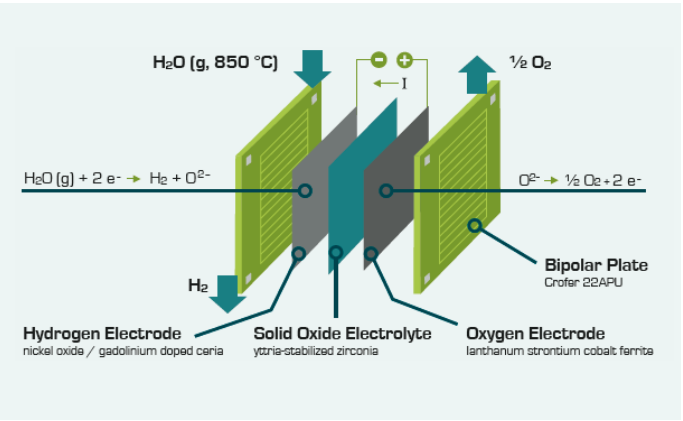
SOEC TECHNOLOGY

Steam electrolysers utilize steam from waste and renewable energy to split and separate water molecules into H_2 and O_2 in solid oxide electrolysis cells (SOEC). At operating temperatures of 850 °C the ceramic electrolyte becomes conductive for oxygen ions. By applying a voltage of 1.3 V to the cell, water can be split and the oxygen ions are transferred through the electrolyte to the opposite side of the cell, while H_2 remains at the steam feed side.

The hydrogen is produced highly energy-efficient at atmospheric pressure saturated with water vapor. Therefore, a hydrogen processing unit completes the set-up. It dries and compresses the product to enable its injection into the onsite hydrogen pipeline. The hydrogen at around 10 bar(g) is then used for Salzgitter Flachstahl's steel annealing processes to provide a reductive process atmosphere while increasing the heat transmission and, thus, the energy efficiency at the same time.

Steam Electrolyser Unit HyLink 200:

Parameter	Value
Nominal Power AC	720 $kW_{el\ AC}$
H_2 Production Rate	200 Nm^3/h
Part Load Ability	15...100 %
Ramp-up Time	5 min



PROJECT PARTNERS

Salzgitter Mannesmann Forschung GmbH | Salzgitter Flachstahl GmbH | Sunfire GmbH | Paul Wurth S.A. (SMS Group) | Tenova S.p.A. | CEA - Commissariat à l'Énergie atomique et aux énergies alternatives

For further information and news please visit

www.green-industrial-hydrogen.com

CONTACT DETAILS:

E-mail: info@green-industrial-hydrogen.com

Salzgitter Mannesmann Forschung GmbH
Efficiency of Resources and R&D-Coordination
Eisenhüttenstraße 99
38239 Salzgitter, Germany

Clean Hydrogen Partnership

Co-funded by the European Union

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 826350. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation programme, Hydrogen Europe and Hydrogen Europe Research.