PROMETEO

HYDROGEN PRODUCTION BY MEANS OF SOLAR HEAT AND POWER IN HIGH TEMPERATURE SOLID OXIDE ELECTROLYSERS

Project ID:	101007194
PRD 2023:	Panel 1 – H2 production
Call topic:	FCH-02-2-2020: Highly efficient hydrogen production using solid oxide electrolysis integrated with renewable heat and power
Project total costs:	EUR 2 765 206.25
Clean H_2 JU max. contribution:	EUR 2 499 531.25
Project period:	1.1.2021–30.6.2021
Coordinator:	Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, Italy
Beneficiaries:	Capital Energy Services SLU, École Polytechnique Fédérale de Lausanne, Fondazione Bruno Kessler, Fundación Imdea Energia, NextChem SpA, SNAM SpA, SolydEra SA, Stamicarbon BV

https://prometeo-project.eu

PROJECT AND OBJECTIVES

Prometeo aims to produce hydrogen from renewable heat and power sources using solid oxide electrolysis (SOE) in areas with low electricity prices associated with photovoltaics or wind. A 25 kWe SOE prototype (approximately 15 kg/day of H_2 production) will be developed and validated in the relevant environment, combined with intermittent sources: non-programmable renewable electricity and high-temperature solar heat with thermal energy storage. Partial-load operation, transients and hot standby periods will be studied.

NON-QUANTITATIVE OBJECTIVES

Demonstrate the capability to transfer the technology from component developers to system integrators and end users.

PROGRESS AND MAIN ACHIEVEMENTS

- The project defined end users' cases.
- Preliminary process flow diagrams were created.
- A thermal energy storage system was identified and was experimentally validated in the laboratory.
- Process modelling tools were developed.

FUTURE STEPS AND PLANS

- Experimental determination of the performance map for the SOE stack and the balance of plant in the laboratory is in progress – it was expected to be complete by January 2023.
- Process flow diagrams for the 25 kWe pilot plant under different operation modes are being finalised. They were expected to be complete by March 2023.
- The integrated pilot plant (25 kWe) will be designed and built. The basic design is in progress. The pilot plant is expected to be shipped to the project site in the first half of 2024.
- Based on finalised process flow diagrams for the pilot plant (25 kWe), analysis of case studies at multi-MW scale will be performed. This was expected to start by April 2023.

QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Demonstrate ≥ 98 % availability of the electrolyser: hours in which the SOE has been kept at ≥ 650 °C (i.e. ready to start) v total hours	%	98	
	Demonstrate the production of hydrogen by operation of > 1 000 hours: hours of experimental validation runs of the prototype	hours	1 000	
	Demonstrate, using SOE with renewable heat integration, electrical efficiency of ≥ 85 % based on lower heating value (LHV) and specific energy consumption of < 39 kWh/kg H_2 in a relevant market-representative environment: power-to-hydrogen energy conversion efficiency of the heat-integrated SOE system (LHV basis)	%	85	
	Obtain solar-to-hydrogen energy conversion efficiency from global solar radiation to H_2 energy (LHV basis): ≥ 10 %	%	10	

Clean Hydrogen Partnership
Co-funded by the European Union