

Hosted by:



Australian Hydrogen Research Conference, AHRC2023

8<sup>th</sup> -10<sup>th</sup> February 2023, Canberra, Australia

## Green hydrogen production by means of solar heat and power in high temperature solid oxide electrolyzers

Alberto Giaconia<sup>a</sup>, Massimiliano Della Pietra<sup>a</sup>, Pablo Moreno<sup>b</sup>, Matteo Testi<sup>c</sup>, Stefan Diethelm<sup>d</sup>, Manuel Romero Alvarez<sup>e</sup>, Matteo Robino<sup>f</sup>, Jan van Herle<sup>g</sup>, Barbara Morico<sup>h</sup>, Joey Dobrée<sup>i</sup>

<sup>a</sup>ENEA

<sup>b</sup>Capital Energy SL

<sup>c</sup>Fondazione Bruno Kessler

<sup>d</sup>SOLIDpower SA

<sup>e</sup>IMDEA Energy

<sup>f</sup>Snam SpA

<sup>g</sup>Ecole Polytechnique Federale de Lausanne

<sup>h</sup>NextChem Srl

<sup>i</sup>Stamicarbon BV

---

### Abstract

Green hydrogen can be generated from water and electricity from renewable energy sources (solar, wind). However, the efficient and continuous dispatch of green hydrogen for industrial processes is challenged by the intermittent supply of renewable electricity. This issue can be mitigated by developing innovative electrolyzers characterized by improved efficiency, reliability and flexibility, in combination with optimized schemes for the BoP.

In this context, the European project PROMETEO (Hydrogen PROduction by MEans of solar heat and power in high TEMperature Solid Oxide Electrolyzers) proposes an innovative system based on Solid Oxide Electrolysis (SOE) making a highly efficient use of heat and power generated from solar energy. Concentrating Solar technologies with Thermal Energy Storage (TES) are used to drive hydrogen production when solar resource is not directly available and/or when power is less expensive.

A fully-integrated optimized prototype (15 kg/day hydrogen production, 25 kWe SOE) where the SOE is combined with the TES and ancillary components will be constructed and validated. The design of the prototype considers multiple criteria: end-users' needs, sustainability, regulatory, safety scale-up and engineering concerns. Particular attention is paid to partial load operation, transients and hot stand-by periods.

A suitable TES, consisting of one tank filled with a molten salt, has been considered to generate the feed steam for the SOE at controlled temperature and rate when the power is available.

Industrial end-users lead to techno-economic and sustainability studies to apply the technology in on-grid and off-grid scenarios and for different applications: utility for grid balancing, power-to-gas, and hydrogen as feedstock for the fertilizer/chemical industry.

The project PROMETEO started in January 2021 and receives funding from the Clean Hydrogen Joint Undertaking (CH JU) under grant agreement No. 101007194. The JU receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe Research.