prometeo
GREEN HYDROGEN FROM SUNSHINE

Hydrogen PROduction by MEans of solar heat and power in high TEmperature Solid Oxide Electrolysers

Introduction to PROMETEO

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Clean Hydrogen Partnership

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No **101007194**. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research

Co-funded by the European Union

Solar hydrogen production: High-T electrolysis (SOE)

- Develop a flexible and optimized system to convert solar energy to hydrogen based on high temperature Solid Oxide Electrolysis (SOE) coupled with an innovative Thermal Energy Storage (TES)
- Develop a fully-integrated system at the prototype level (25 kWe electrolyser with at least 15 kg/day hydrogen production capacity) combined with RES
- Validate the technology in a relevant environment (TRL 5) for at least 1,000 hours under representative conditions
- The system prototype will be modular, with the potential to be replicated on the MWe industrial scale
- Techno-economic and sustainability analysis at the 1-100 MW range considering end-users' cases

https://prometeo-project.eu/prototype

Main achievements & Progress so far

PROMETEO is “product oriented” project…
→ so we started from end-users’ requirements

Energy industry

- curtailment mgt
- grid services
- seasonal storage
- on-grid & off-grid

capital energy
alkeymia

SPAIN

Large renewable energy projects promotion platform focused on off/on shore wind energy, biodiesel, PV and

Chemical industry

- 24/7 operation
- +5/-10 % flow rate
- H_2 purity control

STAMICARBON

THE NETHERLANDS

Large company, leader in the development of fertilizer technology and in the supply of services related to urea

Gas industry

- power-to-gas appl.
- H_2/NG blends
- control H_2 properties

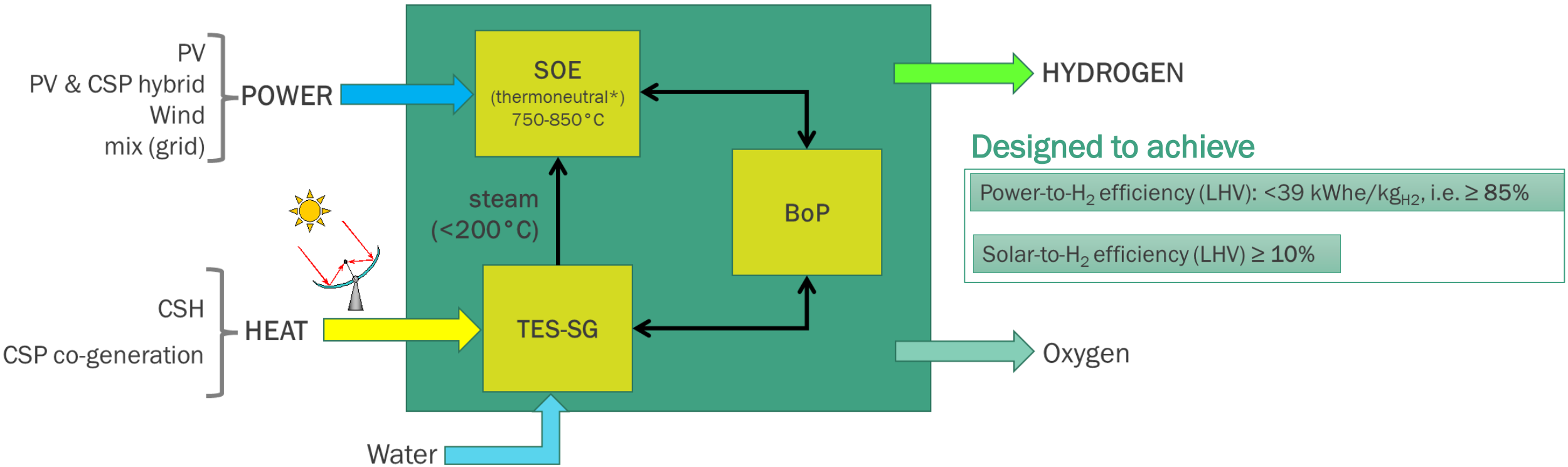
snam

ITALY

Large energy infrastructure company, operating the largest natural gas transmission network and

Main achievements & Progress so far

System architecture & basic components



Designed to achieve

- Power-to-H_2 efficiency (LHV): <39 kWhe/kg_{H2}, i.e. ≥ 85%
- Solar-to-H_2 efficiency (LHV) ≥ 10%

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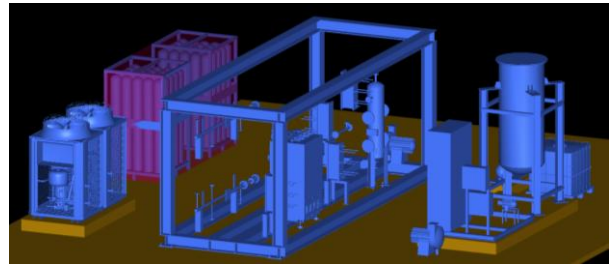

Prometeo project's timeline

ATENA
FUTURE TECHNOLOGY

1 Solid Oxide Electrolyser stack

Starting point: Solid Oxide Electrolyser (SOE), i.e. an advanced electrolysis system with high efficiency, fed with steam and operating at high temperatures (>750°C). The SOE was supplied by the partner SolydEra S.p.A. and is the basic component of the prototype.

2 Analysis of end-users' cases

The potential adopters of PROMETEO's prototype steer the R&D activities to find appropriate and effective solutions to end-users' applications:

- chemical storage of renewable electricity by Capital Energy
- green hydrogen in chemical industries, such as ammonia and fertilisers production, by Stamicarbon
- injection of green hydrogen into the gas grid, by Snam

3 Flow-sheeting & modelling

Prometeo analyses the most appropriate manner to integrate the SOE stack with the Balance of Plant (BoP) and Renewable Heat & Power Supply Systems to meet end-users' needs.

4 Lab validation of components

The key components of the prototype are

- the SOE stack,
- the heat storage system (TES) with the steam generator,
- and the BoP units.

Components are individually tested and validated in the laboratories before their integration in the prototype.

5 Design

A fully-integrated pilot unit is designed. This system will include a 15 kW SOE and will produce 15 kg/day of hydrogen H_2.

6 Construction

The pilot unit is assembled, delivered to demo site in Spain and connected with renewable heat & power sources.

7 Fully integrated prototype

The pilot unit is tested for at least 1,000 hours to validate its performances under representative conditions.

8 Assessment

The final configuration of the system and test results are used to assess effective achievement of end-users' needs of modular scale-up systems for commercial exploitation.

Discover the prototype:
prometeo-project.eu

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Thank you for your attention

ENEA ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

alkeymia

ATENA FUTURE TECHNOLOGY

capital energy

EPFL

FONDAZIONE BRUNO KESSLER

institute IMDEA energy

snam

SolydEra

STAMICARBON

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