HYDROSOL-beyond

THERMOCHEMICAL HYDROGEN PRODUCTION IN A SOLAR STRUCTURED REACTOR: FACING THE CHALLENGES AND BEYOND

Project ID:	826379
PRD 2023:	Panel 1 – H2 production
Call topic:	FCH-02-4-2018: Thermochemical hydrogen production from concentrated sunlight
Project total costs:	EUR 3 182 911.25
Clean H_2 JU max. contribution:	EUR 2 999 940.00
Project period:	1.1.2019–31.12.2023
Coordinator:	Ethniko Kentro Erevnas kai Technologikis Anaptyxis, Greece
Beneficiaries:	HyGear Operations BV, HyGear Hydrogen Plant BV, HyGear Technology and Services BV, EngiCer SA, Abengoa Innovacion Sociedad Anonima, HyGear Fuel Cell Systems BV, HyGear BV, Scuola universitaria professionale della Svizzera Italiana, Medioambientales y Tecnológicas (Ciemat) (Centro de Investigaciones Energéticas), Deutsches Zentrum für Luft- und Raumfahrt eV, Commissariat à l'énergie atomique et aux énergies alternatives

http://www.hydrosol-beyond.certh.gr/

PROJECT AND OBJECTIVES

HYDROSOL-beyond is a continuation of the Hydrosol-technology series of projects that focus on using concentrated solar power to produce hydrogen from the dissociation of water through redox-pair-based thermochemical cycles. The project is an ambitious scientific endeavour aiming to address the major challenges and bottlenecks identified during previous projects and to further boost the performance of solar hydrogen production technology through innovative solutions that will also increase the potential of the technology's future commercialisation.

NON-QUANTITATIVE OBJECTIVES

- Heat recovery.
- Minimisation of the parasitic losses mostly related to the high consumption of inert gas.
- Improvement of reactor design.

PROGRESS AND MAIN ACHIEVEMENTS

- Stable $NiFe_2O_4$ lattice structures have been produced.
- A small-scale hybrid ceramic/metallic heat exchanger has been constructed and tested. The results were taken into account in the development of the full-scale heat exchanger.
- The production of $NiFe_2O_4$ lattice structures for application on the tubular solar reactor at the solar platform has been scaled up.
- The scaled-up hybrid ceramic/metallic heat exchanger has been constructed and is ready for integration on the solar platform.

FUTURE STEPS AND PLANS

- The novel heat exchanger will be integrated in the existing solar platform. A small-scale apparatus has been manufactured and is being evaluated at the laboratory. The results will be taken into account in the development of the full-scale heat exchanger and its integration in the solar plant.
- The solar platform will be operated in H_2 production mode at the Plataforma Solar de Almería in Spain to run thermal tests on solar reactors.
- Operation of the solar reactor at the solar simulator facility at Forschungszentrum Jülich was achieved, with production of 8.8 gH_2/cycle. The desired temperatures for the operation were achieved using less power than expected (150 kW from solar simulator lamps).

QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year of SoA target
AWP 2018	Demonstration of the process at realistic scale and in realistic working conditions, using an existing solar demonstration facility (> 200 kW range)	kW/reactor	250	150		250	2018
	Durability	cycles	1 000	150		602	
	Heat recovery rates of high-temperature heat in excess of 60 %	%	60	46		N/A	

Clean Hydrogen Partnership
Co-funded by the European Union