PEACE

PRESSURIZED EFFICIENT ALKALINE ELECTROLYSER

Project ID	101101343
PRR 2024	Pillar 1 – Renewable hydrogen production
Call topic	HORIZON-JTI-CLEANH2-2022-01-03: Development of low temperature water electrolysers for highly pressurised hydrogen production
Project total costs	EUR 2 504 965.00
Clean H_2 JU max. contribution	EUR 2 504 964.75
Project period	1.6.2023–31.5.2026
Coordinator	Deutsches Zentrum für Luft- und Raumfahrt EV, Germany
Beneficiaries	Brandenburgische Technische Universität Cottbus-Senftenberg, Danmarks Tekniske Universitet, GRANT Garant s.r.o, Hydrogen Chemical Company BV, Materials Mates Italia SRL, Technische Universiteit Eindhoven

http://www.h2peace.eu/

PROJECT AND GENERAL OBJECTIVES

The PEACE research and innovation project kicked off in June 2023. A collaboration of seven European research organisations and universities, with large and small companies on board, under the coordination of Deutsches Zentrum für Luft- und Raumfahrt, aims to develop a high-pressure alkaline electrolysis (AEL) technology to substantially reduce hydrogen production costs, thus enhancing the competitiveness of the hydrogen economy.

A new concept of hydrogen production with two-stage pressurisation will be developed and demonstrated on an AEL system of more than 50 kW that is capable of operating at pressure exceeding 50 bar. The integration of advanced components, an innovative design and optimised operation strategies will be explored through modelling and experimental testing, ultimately aiming to demonstrate a system with impressive efficiency characteristics.

The PEACE-produced hydrogen will already be compressed, representing a significant advantage for its subsequent use in downstream processes operating with compressed hydrogen – reducing by a considerable percentage the capital expenditure and operational expenditure on the electrolysis system for the chemical sector.

PEACE places a strong emphasis on sustainability and circularity aspects – a life-cycle assessment of the PEACE technology will be conducted to quantify its environmental impact. Its adverse environmental impact is presumed to be low.

NON-QUANTITATIVE OBJECTIVES

The main goal of PEACE is to reduce the levelised cost of hydrogen for green H_2 production. To achieve that, the project aims to achieve:

- high-efficiency stack development by incorporating advanced and qualified components that are free of precious metals;
- implementation of an innovative two-stage pressurisation concept to decrease the compression costs for downstream integration;
- balance-of-plant and auxiliary optimisation and qualification with a focus on high-pressure operation;
- technology demonstration by constructing and operating a newly developed, pressurised and high-efficiency stack of > 50 kW;
- effective integration of the PEACE technology with downstream chemical plants to directly use the PEACE-produced hydrogen;
- reduction of the capital cost of the system by increasing stack efficiency, reducing compression need and optimising the balance of plant.

PROGRESS AND MAIN ACHIEVEMENTS

- The qualification of non-precious components has started.
- The simulation scenarios have been established for the upstream and downstream integration and operation optimisation, considering a combination of the solar and wind power supplied, and also two possible downstream processes: ammonia production or methanol production.
- A solid data management plan based on the findability, accessibility, interoperability and reusability data policy has been implemented.
- A project communication strategy targeting multiple audiences is under way, focusing on the PEACE website and the PEACE LinkedIn and X profiles.

FUTURE STEPS AND PLANS

- Qualification of various cell and stack components will take place.
- The PEACE AEL stack demonstrator with the best-performing components will be assembled.
- Demonstrator enrichment with the dual-stage pressurisation concept will take place.
- When the demonstrator is in operation, PEACE will undertake evaluation of function, performance and characteristics simulations.
- Assessment of the environmental and other impacts of the PEACE technology will take place.

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- The PEACE AEL will be integrated with a chemical plant directly utilising the PEACE-produced hydrogen.
- The sustainability and circularity aspects of the project will be analysed in more detail. The data for the modelling will be based on communications with work programme 2, while the modelling carried out in work programme 4 will be used to understand the interaction between the AEL technology and the surrounding system (e.g. electricity, heat, and fuel requirements and production).

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
Project's own objectives	Maximum current density	A/cm^2	1.45		0.6	2020
	Pressurisation energy consumption	kWh/kg H_2	0.46		0.5	N/A
	Overall system efficiency	%	68–72		66.7	2020
	Nominal current density	A/cm^2	1		N/A	N/A
	Minimal load	% of nominal load	14		N/A	N/A
	Voltage efficiency (LHV)	%	62–75		55–62	N/A
	Minimum pressurisation level	bar	50		N/A	N/A
	Cell voltage	V	1.65–2.00		1.9–2.3	N/A
	Use of critical materials	mg/W	0		0.6	2020
	Specific energy use	kWh/kg	49		50–59	N/A
	Minimum stack size	kW	50		N/A	N/A
	LCOH	€/kg	3		5	N/A
Project's own objectives and SRIA (2021–2027)	Degradation rate	%/kh	0.11		0.12	2020
	Electrical consumption @ nominal capacity	kWh/kg	48		50	2020

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