REDHY

REDOX-MEDIATED ECONOMIC, CRITICAL RAW MATERIAL FREE, LOW CAPEX AND HIGHLY EFFICIENT GREEN HYDROGEN PRODUCTION TECHNOLOGY

Project ID	101137893
PRR 2024	Pillar 1 – Renewable hydrogen production
Call topic	HORIZON-JTI-CLEANH2-2023-01-01: Innovative electrolysis cells for hydrogen production
Project total costs	EUR 2 998 988.75
Clean H_2 JU max. contribution	EUR 2 990 238.75
Project period	1.1.2024– 31.12.2027
Coordinator	Deutsches Zentrum für Luft- und Raumfahrt EV, Germany
Beneficiaries	Centre national de la recherche scientifique, Consiglio Nazionale delle Ricerche, Cutting-Edge Nanomaterials UG Haftungsbeschränkt, Industrie De Nora SpA, Uniresearch BV, Universitat Politècnica de València

https://cordis.europa.eu/project/id/101137893

PROJECT AND GENERAL OBJECTIVES

The REDHY project aims to surpass the drawbacks of state-of-the-art electrolysers and become a pivotal technology in the hydrogen economy. The REDHY approach is highly adaptable, enduring, environmentally friendly, intrinsically secure and cost-efficient, enabling the production of economically viable green hydrogen at considerably higher current densities than SOA electrolysers. REDHY is entirely free of critical raw materials (CRMs) and does not require fluorinated membranes or ionomers, while maintaining the potential to fulfil a substantial portion of the 2024 key performance indicators. A five-cell stack with an active surface area exceeding 100 cm^2 and a nominal power of 1.5 kW will be developed, capable of managing a vast dynamic range of operational capacities with economically viable and stable stack components. These endeavours will guarantee lasting and efficient performance at an elevated current density (1.5 A/cm^2 at E_{cell} 1.8 V/cell) at low temperature (60 °C) and suitable hydrogen output pressure (15 bar). The project's ultimate objective is to create a prototype, validate it in a laboratory setting for 1 200 hours at a maximum degradation of 0.1 %/1 000 h and achieve technology readiness level 4.

NON-QUANTITATIVE OBJECTIVES

- Develop highly efficient and durable materials that are free of CRMs and fluorine for the REDHY technology to a large-area short stack (five cells) with an active surface area of > 100 cm^2 per cell and a nominal power of > 1.5 kW with adequate manufacturing quality.
- Validate the stack's efficiency and robustness when the electrical grid is fed by a large proportion of renewable energy sources or the system is directly interfaced with renewable energy sources.
- Demonstrate optimisation strategies for the porous electrodes to enhance their mass transport characteristics and enhance energy efficiency.
- Demonstrate a reduced energy consumption of 48 kWh/kg H_2 or less by implementing highly reversible, stable redox mediators with enhanced kinetics.
- Demonstrate a drastic reduction in interface resistance across all cell components, leading to energy efficiencies of > 82 %.
- Demonstrate the decoupling of oxygen and hydrogen production and enable the REDHY system to operate at a minimum 5 % of partial-load operation (nominal load 1.5 A/cm^2) without exceeding 0.4 % H_2 concentration in O_2.
- Demonstrate that the REDHY technology is capable of performing efficient and direct seawater electrolysis.
- Integrate the short stack into a prototype full system.
- Demonstrate the operation of the REDHY electrolyser at 1.5 A/cm^2 with electricity consumption of 48 kWh/kg over at least 1 200 hours of operation with a degradation of 0.1 %/1 000 h.

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	Partial load	%	5		N/A	N/A
	H_2 concentration in O_2	%	0.4		N/A	N/A
SRIA (2021–2027)	Current density	A/cm^2	1.5		0.6	2020
	Degradation	%/1 000 h	0.1	⚙	0.19	2020
	CAPEX	€/kW	400		900	2020
	Use of CRMs as catalysts	mg/W	0		2.5	2020
	Electricity consumption at nominal capacity	kWh/kg	48		55	2020

Clean Hydrogen Partnership
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