NOAH$_2$

NOVEL SOE ARCHITECTURES FOR HYDROGEN PRODUCTION

Project ID	101137600
PRR 2025	Pillar 1 - H_2 Production
Call Topic	HORIZON-JTI-CLEANH$_2$-2023-01-02
Project Total Costs	2 656 024.00
Clean H_2 JU Max. Contribution	2 655 084.00
Project Period	01-01-2024 - 31-12-2026
Coordinator Beneficiary	DANMARKS TEKNISKE UNIVERSITET, DK
Beneficiaries	LIBERTY POWDER METALS, GENVIA, SINTEF AS, HAUTE ECOLE SPECIALISEE DE SUISSE OCCIDENTALE, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, IDRYMA TECHNOLOGIAS KAI EREVNAS

https://noah2.dtu.dk/

PROJECT AND GENERAL OBJECTIVES

The overall goal of the NOAH$_2$ project is to provide a robust, cost-competitive, flexible, and durable stack concept for hydrogen production at intermediate temperatures through innovative electrode, cell, and stack designs. NOAH$_2$ will boost the electrolysis performance of solid oxide cells and stacks significantly beyond state-of-the-art through a combination of optimised structures and highly active materials, with a focus on reducing critical raw materials (CRM) and manufacturability using well-established large-scale routes for solid oxide technology. The NOAH$_2$ stack architecture relies on a metal based monolithic concept with infiltrated electrodes.

NOAH$_2$ will outline a path towards commercialisation, provide a sustainability classification with emphasis on substituting CRMs and an assessment of commercialisation potential compared to state-of-the-art SOEL, PEM, and alkaline electrolysers, and identify potential industrial players for high-volume manufacture.

Specific technical objectives for NOAH$_2$ are to:

- Reduce the costs of SOEL stacks by 50 % compared with that of state-of-the-art through (i) use of metallic instead of ceramic supporting components, (ii) integration of support layer/interconnect functionalities into a single layer, and (iii) reduction of the stack volume with at least 20 % by developing a metal based monolithic structure.
- Increase the hydrogen production rate (current density) by 20 % compared with that of the state-of-the-art, reaching 1.2 A/cm^2, through innovative electrode materials and structuring with infiltration of materials of superior electro catalytic activity at temperatures below 700 °C.
- Demonstrate commercially viable durability with degradation rates below ~0.75%/1 000 hours at the stack level.
- Reach SOEL operation in less than six hours from cold state and less than 240 seconds from hot state to enable fast dynamic operating modes, facilitated by the compact, metal based monolithic stack architecture and highly active electrodes.

NON-QUANTITATIVE OBJECTIVES

NOAH will:

- Outline a path towards commercialisation in terms of projecting costs for large scale manufacture towards MW and GW scales, reaching the 2030 targets of capital expenditure ~ 520 €/(kg/day) and operational expenditure (OPEX) ~ 45 €/(kg/day)/year.
- Provide a sustainability classification (life cycle analysis) with an emphasis on replacing critical raw materials.
- Provide an assessment of commercialisation potential compared with those of state-of-the-art SOEL, polymer electrolyte membrane, and alkaline electrolysers.
- Identify and engage with potential industrial players for high-volume manufacturing and further up-take of the project results.

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	Cell Current Density	A/cm^2	1.2		1	N/A
	Stack durability	%/1 000 h	<0.75		0.75	N/A
	Stack production costs	%	50		2 737 €/kWel - 1 210 €/kWel	2020
	Reach time to SOEL operation	hours from cold state	6		>6	N/A

Clean Hydrogen Partnership
Co-funded by the European Union