HYSCALE

ECONOMIC GREEN HYDROGEN PRODUCTION AT SCALE VIA A NOVEL, CRITICAL RAW MATERIAL FREE, HIGHLY EFFICIENT AND LOW-CAPEX ADVANCED ALKALINE MEMBRANE WATER ELECTROLYSIS TECHNOLOGY

Project ID	101112055
PRR 2024	Pillar 1 – Renewable hydrogen production
Call topic	HORIZON-JTI-CLEANH2-2022-01-05: Scaling up of cells and stacks for large electrolysers
Project total costs	EUR 5 295 799.25
Clean H_2 JU max. contribution	EUR 5 295 799.25
Project period	1.6.2023–31.5.2027
Coordinator	Cutting-Edge Nanomaterials UG Haftungsbeschränkt, Germany
Beneficiaries	Bekaert NV, Commissariat à l'énergie atomique et aux énergies alternatives, Consiglio Nazionale delle Ricerche, Deutsches Zentrum für Luft- und Raumfahrt EV, Dimosia Epicheirisi Ilektrismou Anonymi Etaireia, HyGear BV, HyGear Fuel Cell Systems BV, HyGear Hydrogen Plant BV, HyGear Operations BV, HyGear Technology and Services BV, META Group SRL, Univerza v Ljubljani

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PROJECT AND GENERAL OBJECTIVES

The Hyscale project aims to upscale an advanced alkaline membrane water electrolysis technology to produce economic green hydrogen at significantly higher current densities than state-of-the-art (SOA) electrolysers. The technology is free of critical raw materials, fluorinated membranes and ionomers, meeting a significant fraction of the 2024 key performance indicators at the lab scale. Unique materials and design allow for cost-effective upscaling. The project focuses on optimising material synthesis – especially membranes, ionomers, electrodes and transport layers – in line with Europe's circular economy plan. A 100 kW stack with an active surface area of 400 cm^2 will be developed, capable of high-dynamic-range operation at 2 A/cm^2 at 1.85–2 V and 60 °C, producing hydrogen at 15 bar. The final goal is a functional electrolyser system with a capital expenditure target of EUR 400 kW, validated at technology readiness level 5 in an industrially relevant environment, accelerating technology development and promoting sustainability in Europe.

PROGRESS AND MAIN ACHIEVEMENTS

- Membrane and electrode tasks have been initiated; initial testing and distribution of samples are complete.
- A cluster meeting was held to select porous transport layer structures.
- A uniform testing protocol was established for cell testing across partners.
- Gas permeability measurement methods are being evaluated.
- PTL compatibility with electrodes is being assessed.
- Stack design has commenced, with modifications made for simplicity and cost-effectiveness.

FUTURE STEPS AND PLANS

The AionFLX™ membrane will be optimised towards gas permeation and its synthesis will be upscaled for membrane production larger than 600 cm^2. The electrode-upscaling task will be close to finalised by the end of the year. The PTL production-upscaling task to 400 cm^2 will be halfway to completion by the end of 2024; we expect results in this field.

The Hyscale materials have already been assessed in the final size of 400 cm^2 in a single cell; the next step is to prove their high levels of performance and stability. The short-stack and prototype designs will take a big step forward in 2024.

Two milestones should be reached in 2024:

- achievement of high-performance and durable Hyscale cells,
- assessment of large-area cells.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
Project's own objectives	Active surface area	cm^2	400	N/A		65.5	2021
	System size	kW	100	N/A		2.4	2021
	Stack performance	A/cm @ 2 V/cell	2	N/A		0.47	2020
Project's own objectives and SRIA (2021–2027)	Degradation	%/1 000 h	0.9	N/A		1	2021
	Use of CRM as catalysts	mg/W	0	0 125		1.7	2021
	System capital cost	€/kW	400	N/A		3 750	2021
	Electricity consumption @ nominal capacity	kW/kg	50	N/A		53.3	2021
SRIA (2021–2027)	Current density	A/cm^2	2	N/A		0.5	2020

Clean Hydrogen Partnership
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