NEPTUNE

NEXT GENERATION PEM ELECTROLYSER UNDER NEW EXTREMES

Project ID:	779540
PRD 2023:	Panel 1 – H2 production
Call topic:	FCH-02-1-2017: Game changer water electrolysers
Project total costs:	EUR 1 927 335.43
Clean H_2 JU max. contribution:	EUR 1 926 221.25
Project period:	2.1.2018–30.4.2022
Coordinator:	ITM Power (Trading) Limited, United Kingdom
Beneficiaries:	Consiglio Nazionale delle Ricerche, Engie, IRD Fuel Cells A/S, Pretexo, Solvay Specialty Polymers Italy SpA

https://cordis.europa.eu/project/id/779540

PROJECT AND OBJECTIVES

NEPTUNE addresses challenges associated with reducing capital costs and increasing production rates and output pressures of water electrolysis, which will be required to achieve large-scale application of polymer electrolyte membrane electrolysers. The project is developing a set of breakthrough solutions at the material, stack and system levels to increase hydrogen pressure to 100 bar and current density to 4 A/cm^2 for the base load, while keeping nominal energy consumption at < 50 kWh/kg of H_2. The novel solutions will be validated by demonstrating a robust and rapid-response electrolyser.

NON-QUANTITATIVE OBJECTIVES

The objective was to extend the protocols for testing electrolysis systems under the new operating conditions (high temperature and pressure).

PROGRESS AND MAIN ACHIEVEMENTS

- Under the project, a new simplified balance of plant for polymer electrolyte membrane electrolysis was designed and built to extend operating conditions.
- The membrane electrode assembly degradation rate achieved at 80 °C was 4.4 µV/h/cell at 4 A/cm^2 in a test lasting more than 2 000 hours (single-cell level).
- At 90 °C, cell voltages of 1.74 V at 4 A/cm^2 and 1.98 V at 8 A/cm^2 were achieved, with noble metal loading of 0.34 mg/cm^2 (anode) and 0.1 mg/cm^2 (cathode).

FUTURE STEPS AND PLANS

The project has been completed.

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
Project's own objectives	Anode catalyst loading per W	mg/W	0.05	0.0459	✓	0.23	2018
	Cathode catalyst loading per W	mg/W	0.0071	0.0135	⚙	0.035	
	Efficiency degradation per 1 000 hours for LT electrolyser	%/1 000 h	0.29	0.23	✓	0.2	

Clean Hydrogen Partnership
Co-funded by the European Union