

PROTOSTACK

TUBULAR PROTON CONDUCTING CERAMIC STACKS FOR PRESSURIZED HYDROGEN PRODUCTION



Project ID	101101504
PRR 2024	Pillar 1 – Renewable hydrogen production
Call topic	HORIZON-JTI-CLEANH2-2022-01-02: Development and validation of pressurised high temperature steam electrolysis stacks (proton conducting ceramic electrolysis)
Project total costs	EUR 2 497 013.75
Clean H ₂ JU max. contribution	EUR 2 497 013.75
Project period	1.1.2023–31.12.2025
Coordinator	SINTEF AS, Norway
Beneficiaries	Agencia Estatal Consejo Superior de Investigaciones Científicas, Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, Atena SCARL – Distretto Alta Tecnologia Energia Ambiente, CoorsTek Membrane Sciences AS, Demcon Energy Systems BV, Demcon High-Tech Systems Enschede BV, Demcon Life Sciences & Health Eindhoven BV, Shell Global Solutions International BV, Università degli Studi di Napoli Parthenope

<https://protostack.eu/>

PROJECT AND GENERAL OBJECTIVES

Protostack will create a radically new, compact and modular proton-conducting ceramic electrolyte stack design with integrated hot box for operation and delivery of hydrogen up to 30 bar. The stack will be demonstrated at 5 kW and provide a pathway for further scale-up to systems of hundreds of kW. These achievements will be an important proof of technological feasibility that will attest to the advancement of proton-conducting ceramic electrolyte technology from technology readiness level 2 to 4. To achieve its ambitious goals, the project consortium has gathered research and industry partners that are world-leading within proton ceramic technologies, with recognised expertise related to the research and development of electrolyzers, membrane reactors, materials, electrochemistry and process engineering.

NON-QUANTITATIVE OBJECTIVES

The overall consortium will engage in wide communication and dissemination activities to ensure the maximum impact of the projects' outcomes, and the industry partners have high ambitions for the business exploitation and commercialisation of the Protostack technology.

PROGRESS AND MAIN ACHIEVEMENTS

The designs of the hot box and stack concept were finalised within the first year, and production of stack components is well under way.

The first year primarily focused on validation of key cell and stack components in terms of functionality, scalable manufacturing and stability and on the production of the first short stack with the new stack design for validation of the stack concept.

The project was also co-organiser of an autumn school in Valencia with more than 100 participants – mostly graduate students.

FUTURE STEPS AND PLANS

The second year will focus on continued validation and optimisation of cell and stack components, and dedicated programmes for stack production and testing, with emphasis on durability and performance benchmarking under varying operating conditions and delivery pressure.

Construction and integration of the new hot box, along with an updated system balance of plant and safety assessment, will be a priority within the coming year.

Finally, detailed techno-economic and life-cycle analysis of the technology employed will be undertaken for specific integration scenarios and use cases.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SOA result achieved to date (by others)
Project's own objectives	Stack durability	%/khr	1.2	N/A		4
	Current density	A/cm ²	0.5	0.3		N/A
	Stack production cost	€/kg/day	1 000	N/A		N/A
	Stack efficiency	% (HHV)	75	N/A		N/A