PROCEED: advancing protonic electrolysis for renewable hydrogen production

PROCEED (Proton Conductive Electrolysis with Enhanced Durability) is a four-year Horizon Europe project that aims to accelerate the development and industrial adoption of Proton Conducting Ceramic Electrolyser technology.

Proton Conducting Ceramic Electrolysers offer a promising solution for producing high-purity hydrogen at intermediate operating temperatures. Nevertheless, challenges related to material degradation, manufacturing, system complexity and long-term operation still limit the wider industrial use of this technology.

PROCEED brings together universities, research organisations and industrial partners to address these challenges. The consortium will develop innovative metal-supported cells, advanced materials and protective coatings, as well as a compact and integrated balance of plant.

During the project, the partners will design and validate two innovative short-stack configurations and develop a 20 kW industrial prototype. Experimental testing and numerical modelling will support the development of a system that combines high performance with improved durability and manufacturability.

PROCEED will also assess the economic and environmental sustainability of the proposed technology. A techno-economic analysis, lifecycle assessment and industrialisation roadmap will help prepare the project results for future scale-up and market deployment.

Through this work, PROCEED aims to contribute to a more diverse European hydrogen technology landscape and support the development of efficient and sustainable renewable hydrogen production.

Meet the project coordinator: Politecnico di Milano

PROCEED is coordinated by Politecnico di Milano, Italy's largest technical university and an internationally recognised institution in engineering, architecture and design.

The university conducts research in areas including sustainable energy systems, hydrogen technologies, advanced materials, artificial intelligence, mobility, aerospace and the circular economy. Its close cooperation with companies, public institutions and research organisations helps transform scientific results into practical solutions.

Within PROCEED, Politecnico di Milano coordinates the consortium and supports the scientific and technical development of the project. Its researchers contribute to the preparation and optimisation of ceramic suspensions, the experimental testing of metal-supported cells, system modelling and the integration of the final electrolysis prototype.

The project is coordinated by Alessandro Donazzi, Associate Professor at the Department of Energy of Politecnico di Milano. Together with the consortium partners, the coordination team will ensure that the project's technical activities, expected results and long-term objectives remain closely aligned throughout its four-year duration.

Find out more about Politecnico di Milano:
https://www.polimi.it/en/

PROCEED kick-off meeting

The PROCEED consortium met in Milan on 11 and 12 May 2026 for the project's kick-off meeting, marking the official start of the four-year collaboration.

Hosted by Politecnico di Milano, the meeting brought together representatives from the project's partners.

Over two days, the pconsortiume discussed the project's scientific, technical and management activities. The meeting provided an opportunity to review the work plan, coordinate the first tasks and establish a plan for upcoming activities.

Discussions covered the development of materials and metal-supported cells, manufacturing processes, degradation analysis, modelling, stack design, system integration and prototype testing. The partners also addressed sustainability, industrialisation, communication and the future exploitation of the project results.

"PROCEED represents an important step toward achieving Europe's climate and hydrogen ambitions by advancing innovative electrolysis technologies that can support a more sustainable and robust energy system," said Alessandro Donazzi, Project Coordinator and Associate Professor at the Department of Energy of Politecnico di Milano.

First steps toward high-quality proton-conducting electrolytes

During the first months of the project, Politecnico di Milano and Tecnalia worked to advance the materials and manufacturing processes required for the project's first metal-supported cells.

To build a solid operational foundation, commercial powders were sourced and thoroughly characterized for all primary cell components: BZCY for the proton-conducting electrolyte, a BLC-BZCY composite for the oxygen electrode, and a Ni-BZCY composite for the hydrogen electrode.

Special emphasis was placed on the BZCY electrolyte suspension, a critical component that must deliver high proton conductivity while remaining completely gas-tight. Through a systematic parametric study evaluating the impact of pH, dispersant concentration, and ultrasonication duration, the team identified an optimal formulation consisting of 20% BZCY powder and 1.5% dispersant, processed with one minute of ultrasonication.

Using this optimized suspension, initial electrolyte layers were deposited via Suspension High-Velocity Oxy-Fuel spraying. In parallel, the partners are exploring Suspension Plasma Spray to evaluate its capability for producing thin ceramic coatings with finely controlled microstructures.

Current efforts focus on achieving fully dense and uniform electrolyte layers. Combining tailored ceramic suspensions with scalable thermal-spray techniques establishes a commercially viable manufacturing route for high-performance proton ceramic electrolysis cells