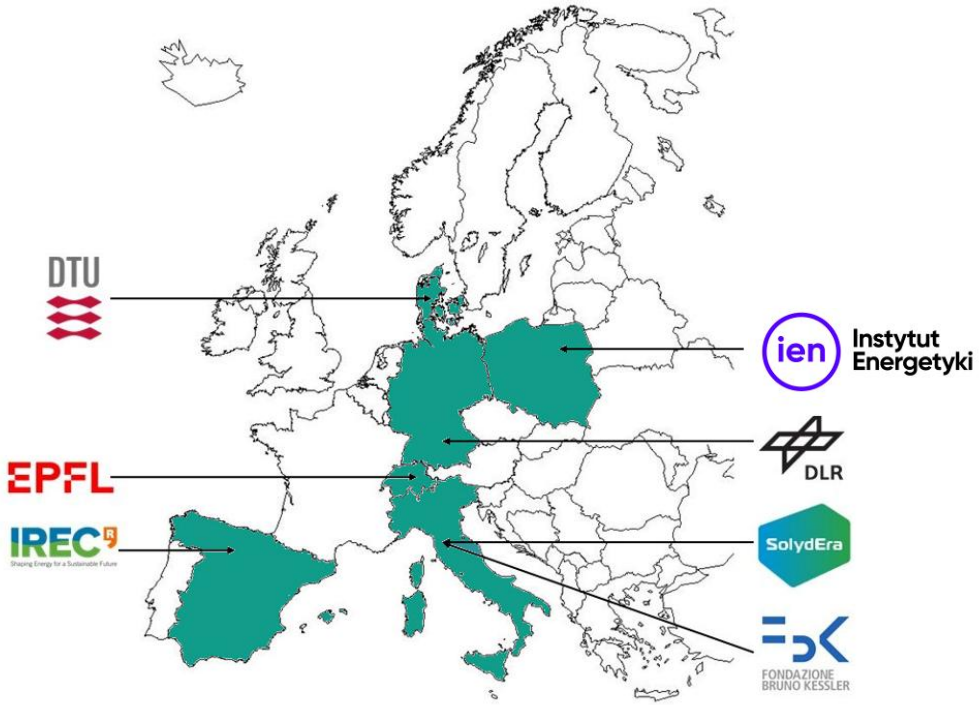
HY-SPIRE
HYDROGEN PRODUCTION BY INNOVATIVE SOLID OXIDE CELL FOR FLEXIBLE OPERATION AT INTERMEDIATE TEMPERATURE

GENERAL OVERVIEW

01.02.2024 - 31.01.2027
3 645 773 EUR (EU grant: 2 999 523 EUR)



PROJECT OBJECTIVES & EXPECTED IMPACT

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- Improvement of solid oxide electrolyzers (SOEL) by introducing **innovative low-cost and compact cell and stack concepts** that can be operated at t**emperature not higher than 700 °C.**
- Implementation of **advanced yet scalable and low-cost fabrication techniques** in order to **reduce hydrogen production cost down to 3 €/kg by 2030**.
- Introduction of **breakthrough solutions to two alternative SOEL technologies** - electrolyzers based on oxygen ion conducting electrolytes, and proton conducting ceramics.
- Importance of the project relates to **Economic and Technological impact:** increase independence on the CRM supply chains, strengthening the position of European entities as leaders of SOEL technology, lowering SOEL stack CAPEX and OPEX, as well the **Scientific impact:** Hy-SPIRE will contribute to the scientific impact of European institution of excellence in the specific sector of solid oxide electrolyzers.

THE NOVELTIES OF HY-SPIRE AND WORK FLOW

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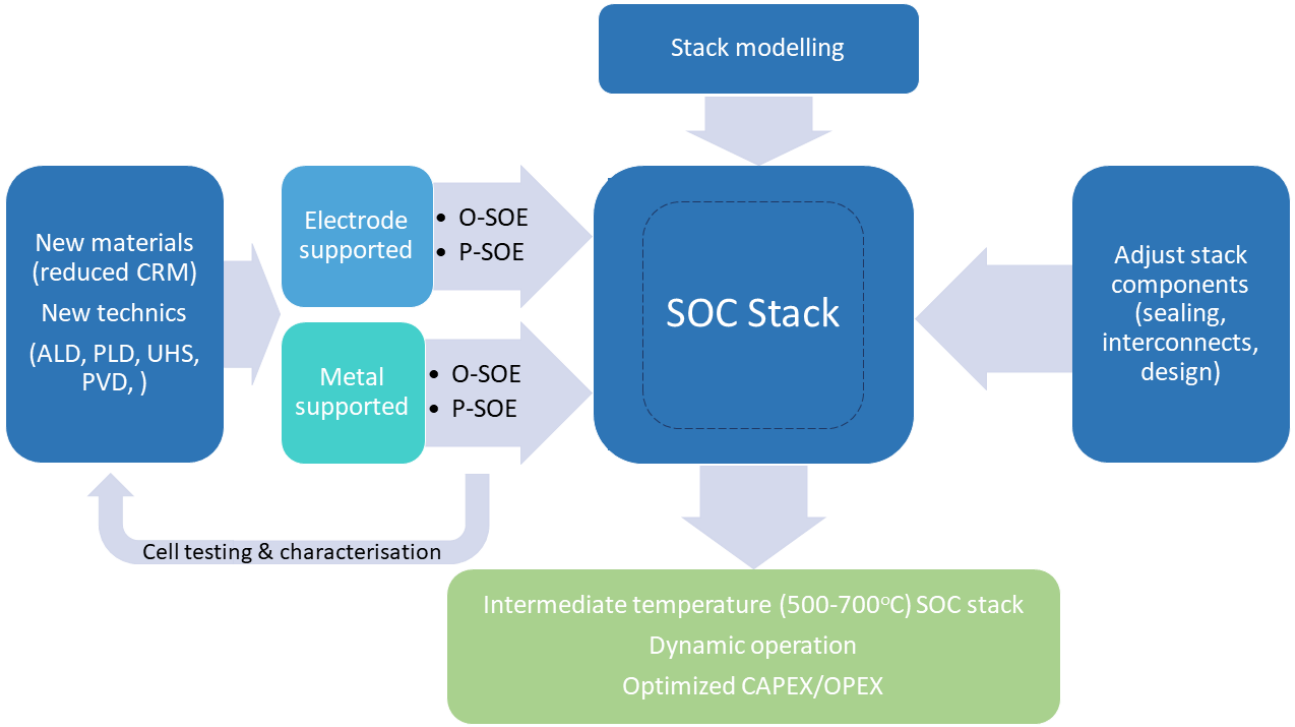
NOVELTIES AREAS

I: **Optimized microstructure, interfaces and architecture of the cell**

II: **New materials for functional layers** and the use of **alternative steel**

III: **Innovative manufacturing techniques**

IV: **Flexible operation of cells and stacks**



PROGRESS SO FAR

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Key innovations addressed in the Hy-SPIRE project:

- Ultra-thin electrolytes for O-SOE and P-SOE cells (1–2 µm): achieved through optimization of nanosuspension coating processes
- Thin (<1 µm), fully dense barrier layers: developed by optimizing barrier-layer compositions and implementing PLD technology
- Metallic substrates (AISI 441) with channel pores: improved metal-supported cell architecture to enhance thermal response and mechanical stability, including an optimized Cr-diffusion barrier
- Enhanced P-SOE electrolytes with optimized Zr:Ce ratios and/or Ba sub-stoichiometry: development of a P-SOE design with a defined preparation procedure at the 5 × 5 cm scale
- Oxygen electrodes for P-SOE stable in high-steam atmospheres: proof of concept for a new electrode composition
- New thin electron-blocking layer for P-SOE: currently under development
- Ultra-fast High-temperature Sintering (UHS) of functional layers: proof of concept demonstrated at laboratory scale for O-SOE and P-SOE electrolytes

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Webinar "Solid Oxide Cells: from materials to systems"

19 February 2025