# SUSTAINCELL

## SUSTAINCELL: DURABLE AND SUSTAINABLE COMPONENT SUPPLY CHAIN FOR HIGH PERFORMANCE FUEL CELLS AND ELECTROLYSERS

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| **Project ID** | 101101479 |
| **PRR 2025** | Pillar 8 - Strategic Research Challenge |
| **Call Topic** | HORIZON-JTI-CLEANH$_2$-2022-07-01 |
| **Project Total Costs** | 9 993 652.00 |
| **Clean H$_2$ JU Max. Contribution** | 9 993 652.00 |
| **Project Period** | 01-01-2023 - 31-12-2028 |
| **Coordinator Beneficiary** | SINTEF AS, NO |
| **Beneficiaries** | UNIVERSITE DE MONTPELLIER, TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, HAUTE ECOLE SPECIALISEE DE SUISSE OCCIDENTALE, FUNDACION TECNALIA RESEARCH and INNOVATION, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, FORSCHUNGSZENTRUM JULICH GMBH, DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV, DANMARKS TEKNISKE UNIVERSITET, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS |

https://sustaincell.eu/

### PROJECT AND GENERAL OBJECTIVES

SUSTAINCELL aims to support European industry in developing next-generation electrolyser and fuel cell technologies by developing a sustainable European supply chain of materials, components and cells. This will be based on scientific breakthrough innovations, eco-design guidelines and environmentally-friendly manufacturing routes.

SUSTAINCELL focuses on developing new critical-raw-material (CRM)-lean and/or CRM-free materials and architectures, aiming to maximise functionalities and durability while decreasing CRM content per unit cell. The new flexible and scalable processing routes will exhibit higher productivity, reduced utilities consumption and reduced greenhouse gas emissions. The project will also develop enhanced recovery and treatment processes for optimising recovery and reuse of platinum group metals / CRMs and ionomers extracted from end-of-life stacks and production processes.

### NON-QUANTITATIVE OBJECTIVES

- Harvesting and expanding European knowledge and know-how on the identification, substitution, recovery and recycling strategies and value chains, of critical raw materials.
- Ensuring the replacement and/or reduction of critical raw materials per unit cell using eco-friendly processing methods.
- Increasing the yield of ionomer and critical raw materials recovered from used cells and membrane electrode assemblies and from scrap and waste, by recycling.
- Contributing to the development of EU harmonised protocols.
- Validating new solutions in terms of gain in performance and durability at single cell level.
- Demonstrating the sustainability of at least three innovative solutions for each technology.
- Maximising the impact, uptake and acceptance of SUSTAINCELL results by developing strategies for dissemination to, communication with and exploitation by academia, industries, policy makers, non-governmental organisations and the public.
- Establishing a suitable toolbox for efficient risk management and knowledge sharing between partners.

### PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

Materials and processes for critical raw material reduction in high temperature electrolysers:

- Thinned Ni-3YSZ electrodes with 50% less NiO using $MgAl_2O_4$ and $Al_2O_3$ additives showing increased mechanical strength.
- Ni-free, REE-lean perovskite electrodes (LST and LSCM) showing comparable performance to Ni-based cermets.
- LSF-based electrodes with YSZ backbones showing improved polarisation resistance (ca 50%).
- PBSCF nanofiber electrodes for PCCELs showing reduced Co/REE use and improved porosity and performance (ca 93–97%).
- Exploration of photonic annealing for rapid electrode sintering.

CRM Reduction in LT Electrolysers:

- Novel AEMs and CEMs developed showing stable performance and good conductivity (up to 0.07 S/cm).
- pPIM ionomers showing higher oxygen diffusion and PEMFC performance versus Nafion.
- Ni@C-N HOR catalysts and Ni-MOF based HER catalysts showing optimised activity and stability.

Innovation & Testing:

- A robotic catalyst discovery platform was built at DTU using ML-guided synthesis and testing.
- Round-robin testing protocols were harmonised among partners for AEMEL cells.




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- Photonic annealing, flame spray pyrolysis, and dip-coating enabled scalable electrode production.

Recycling & Sustainability:

- Testing of critical raw materials separation from end-of-life high temperature cells through physical disintegration methods (ball milling, hydrogen decrepitation).
- Life cycle analysis and techno-economic assessments identified environmental hotspots and critical raw material use across even electrolysis/FC technologies.
- A benchmark report mapped critical raw materials usage, with outreach to industry and RTD groups.

## FUTURE STEPS AND PLANS

- Amplify interaction with external stakeholders and dissemination activities through setting up the advisory board of the project.
- Organise joint seminars and workshops with European and international projects addressing similar research topics and/or focusing on the development of SUSTAIN-CELL technologies.
- Pursue research activities and validate performance of new materials and components at cell level.

## PROJECT TARGETS

| Target source | Parameter | Unit | Target | Target achieved? |
|---|---|---|---|---|
| **Project's own objectives** | CAPEX | €/kW | @ 100 MW [AEL 400 €/kW, AEMEL 300 €/kW, PEMEL 500 €/kW, SOEL 520 €/kW], @ 500 kWe, PEMFC 900 €/kW] | |
| | PEMFC electrical efficiency, non-recoverable CRM loading, degradation rate | % | ~56% (% LHV $H_2$), 0.01 mg/Wel, 0.2%/1 000 h | |



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