Future Energy

# 24/7 ZEN Project

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# IREC Research Centre

**CERCA Research Centre,** with a TECNIO accrediation.
IREC has a dual approach:

## Market orientation

Market Orientation focusing on **technology development**, **new products** and new **technical solutions** for energy sector companies active in the same fields as IREC's established lines of action.

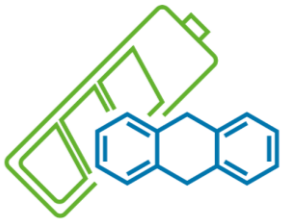
## Long-term research

Long-term research into different aspects of the established lines of action. It will not be initially aimed at the market, but at **generating knowledge** amongst groups in the Institute itself, with a **long-term commercial projection** in mind.

ORGANIZATION

# IREC Research Centre

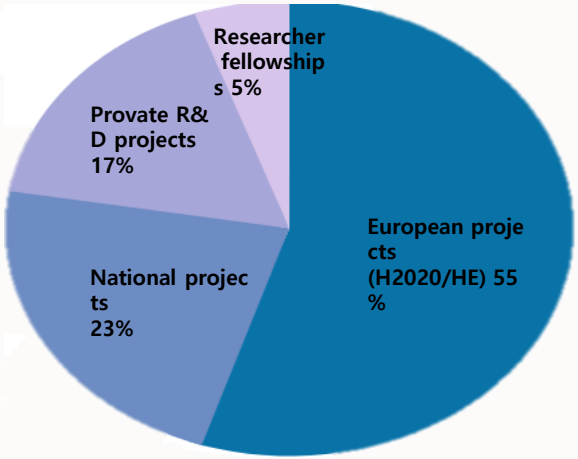
Energy & Environment



Energy Storage

Smart Energy Management





# THE PROJECT

2023 KOREA EUREKA Day

## TITLE

**24/7 ZEN** - REVERSIBLE SOEC/SOFC SYSTEM FOR A ZERO EMISSIONS NETWORK ENERGY SYSTEM

## CALL / TOPIC

HORIZON-JTI-CLEANH2-2022-1 / Reversible SOC system development, operation and energy system (grid) integration

## PLAN & CONSORTIUM

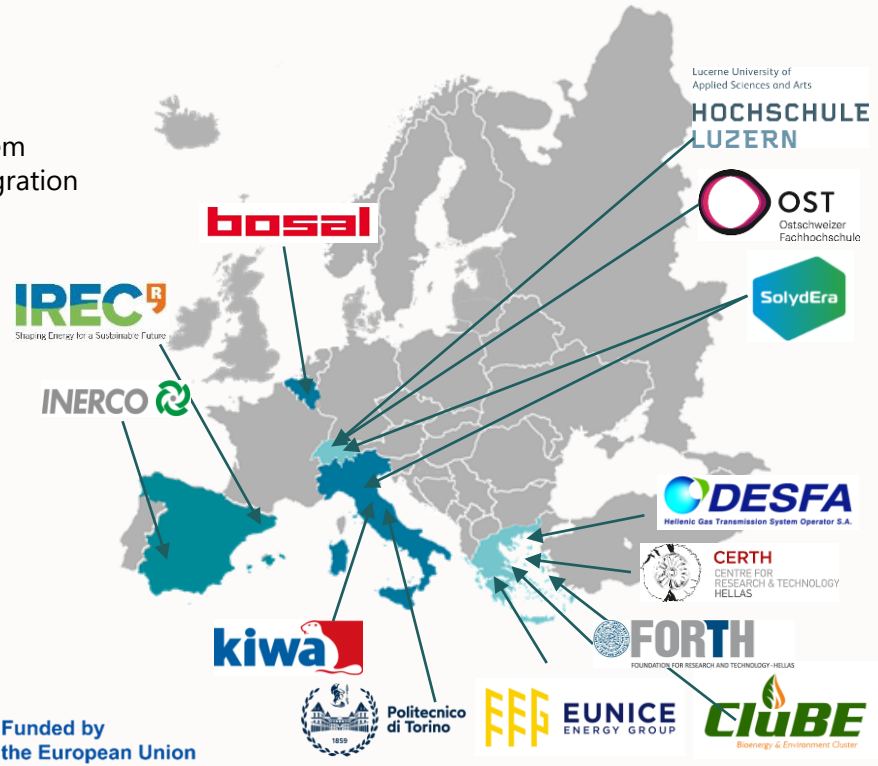
- 36 month of duration / 7 WPs
- 12 EU partners (4 countries)
- 3 Swiss partners

## OFFICERS

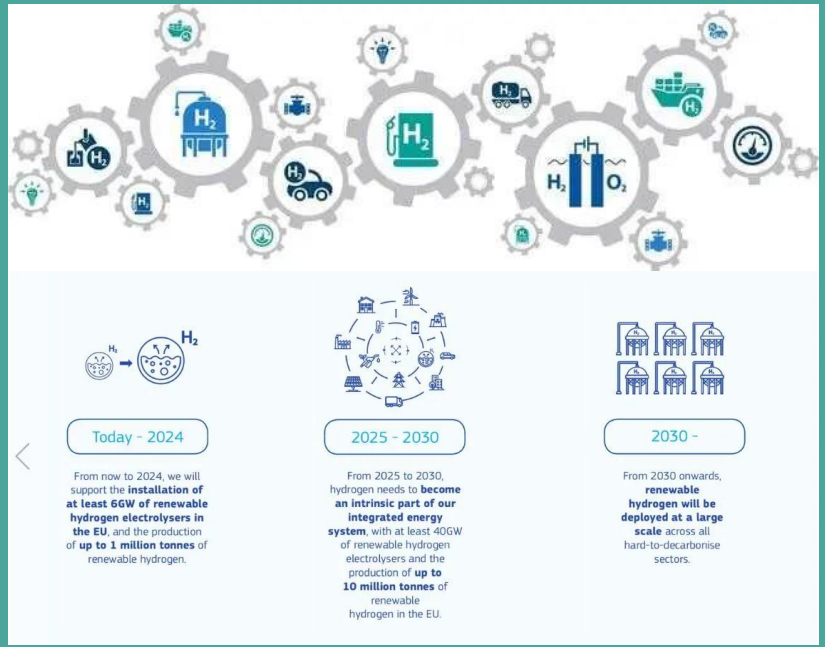
- Eleni Kontonasiou
- Antonio Requena (Financial)

## REFERENCE & FUNDING

- #101101418
- 5,498,886 € (EU)
- 2.268.706 € (Swiss)




Funded by the European Union




# Project ambition

The need for 24/7 ZEN solution

- Eu takes *$H_2$ as key energy vector for the decarbonisation*.
- Renewable energy-based scenario *requires efficient stor age technologies.*
- *rSOC* technology is presented as one of the *most promis ing solutions for PtG* processes.
- *SOC need to be enhanced*:

- System operation
- Cost-competitiveness
- Designs of scaled demo scenarios
- Connection to the grids
- Proof of the techno-economic viability.

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***Technology Challenge 1 (TRL 2-3):***
*Cell performance and durability and overall system cost-competitiveness.*

- ***Thin film deposition techniques***
- ***Infiltration and exsolution approaches***
- ***Rapid thermal processing (RTA) processes***
- ***Electrocatalysts synthesis***
- ***New & improved interconnect coating (EDP)***

***KPIs***
*1.5 A/cm² SOC*
*Deg. rate ≤0.4%/kh*

***Technology Challenge 2 (TRL 3→5):*** *Conceptual system design and reduced system costs.*

- ***The Large Stack Module (LSM) tested as rSOC + BOP***
- ***Scale up of primary hot BoP***
- ***Heat exchangers on compact module (TRL6)***
- ***Reformer & Evaporator integration***

***KPIs***
*A RT efficiency of 45%*
*Stack cost reduction 3500€/kW*

***Technology Challenge 3 (TRL 3→5):*** *Storage for sustainable grid balancing*

- ***Demo testing of integration on real enviroment***
- ***Optimised control of transients for Energy management***

***KPIs***
*Mobile – Plug & Play*
*Replicable Solution*
*<30min transition*

Funded by the European Union

# Project ambition

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- ***rSOC*** technology is presented as one of the ***most promising solutions for PtG*** processes.
- ***SOC need to be enhanced***:
  - System operation
  - Cost-competitiveness
  - Designs of scaled demo scenarios
  - Connection to the grids
  - Prove of the techno-viability.

24/7 ZEN

# OBJECTIVES

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**A 24/7 energy supply demo covering the entire value chain**, from the materials engineering for **optimised cells and stack**, to the rSOC system and the ways to **control it upon integration into real-world electricity and gas grids**.

Scientific

A **plant with 33 kW of power source (FC) and 100 kW of power sink (EL)** that can be scaled and replicated to multi-MW scale installations. 24_7 ZEN will identify **optimal integration of rSOC for different scenarios** and address scenarios to deploy it as a **techno-economically viable** RE storage system.

Technical

**Demonstrate a 33/100 kW power balancing plant**, taking **gas and electricity from the grid** for the system operation, and **injecting the H2 and electricity produced back** to the respective grids

Industrial

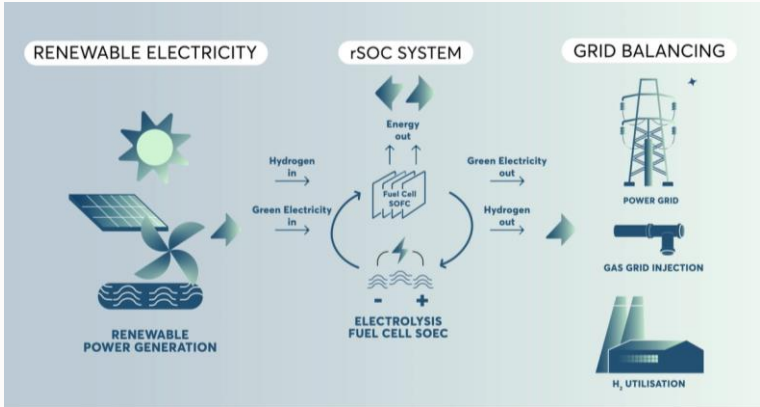
Acquire both **experimental data and conceptual understanding** on how rSOC systems can absorb excess electric RE as well as assessing the **limits of economically viable business models** to use rSOC systems.

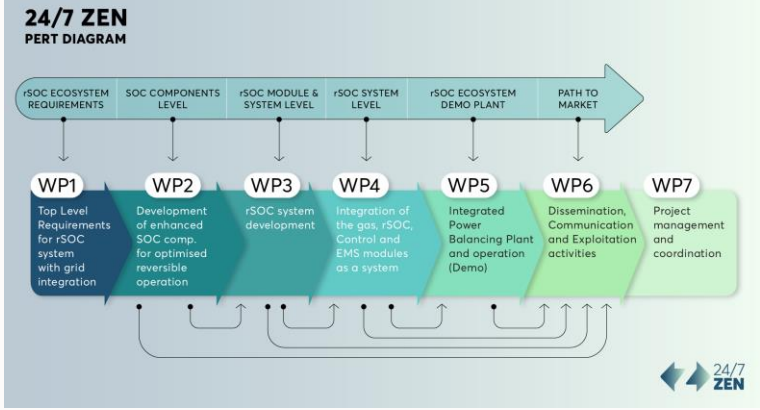
Comercial

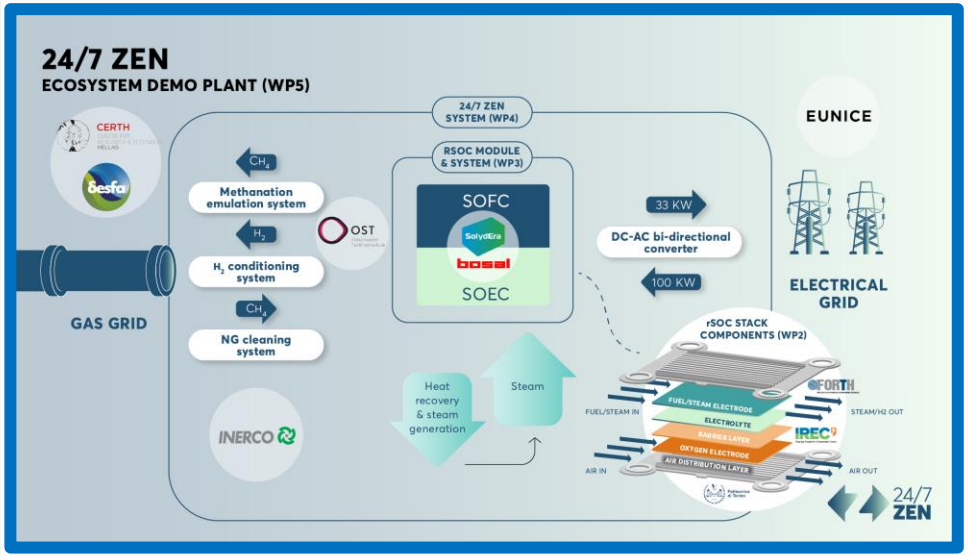
Funded by the European Union

Clean Hydrogen Partnership

# METHODOLOGY



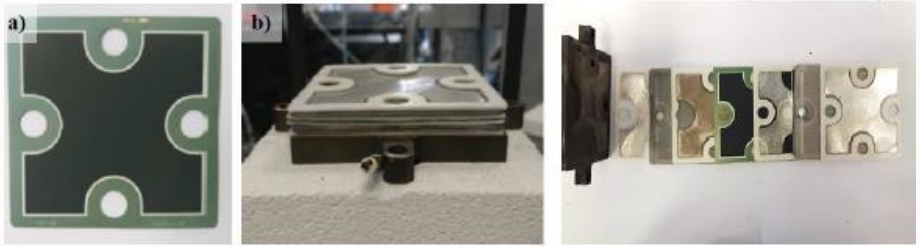



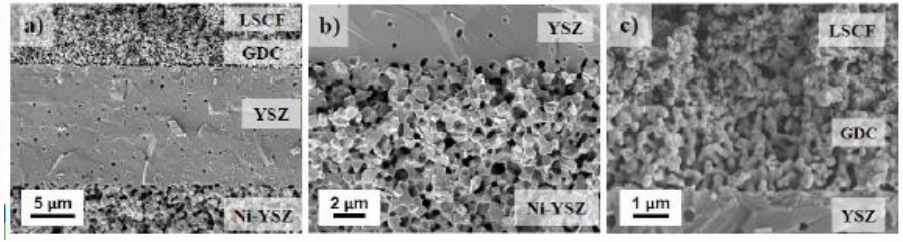
# CONVENTIONAL /REVERSIBLE

## Conventional SOC:

**Large area** own cells + interconnects = SRU and SHORT STACKS

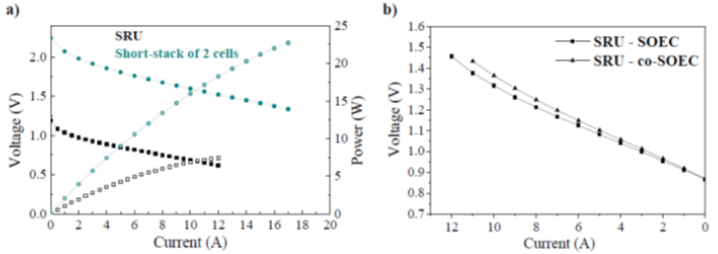



**Reliable industrial fabrication** (FAE&AMES)

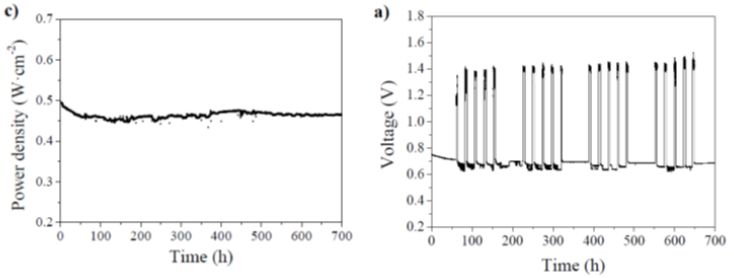



## Reversible mode:

Able to operate in **fuel cell and electrolysis modes**

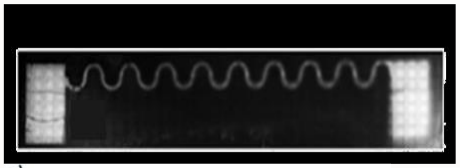


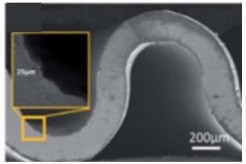

Technology **stable in the 100 h range and reversible**

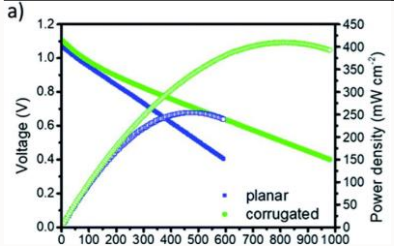


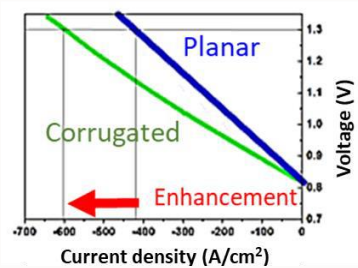
# 3D PRINTING /CATALYSIS

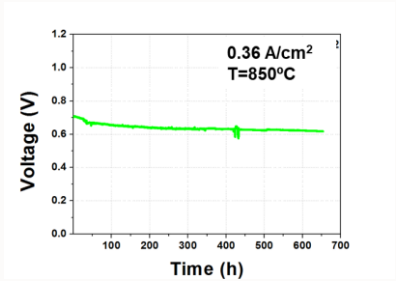
## 3D printing: enhanced by design

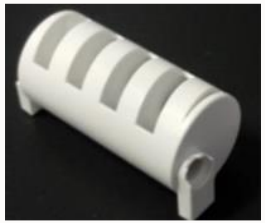




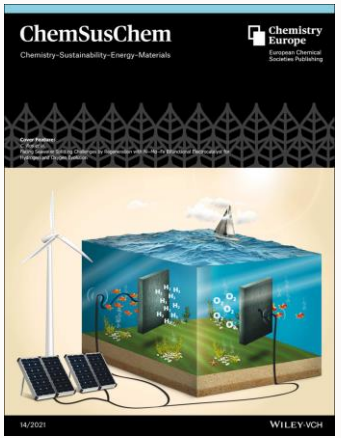



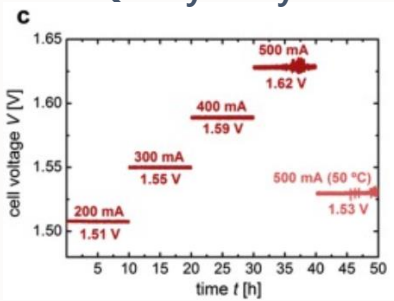
## Catalysis

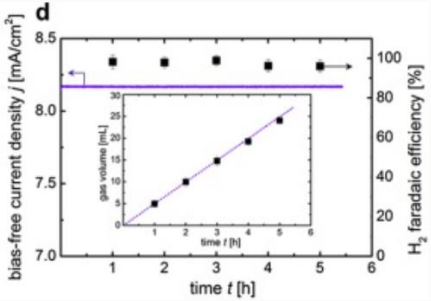
**Photocatalysis (PC)**
**Electrocatalysis (EC)**
**Photoelectrocatalysis (PEC)**

Capabilities:

- **Catalyst development**
- **Photo-active materials**
- **development**
- **Cell design, modelling and**
- **scale-up**
- **Seawater electrolyzers**
- **H2 Quality analysis**



# PROFILES

- Ceramic powder suppliers
- Cells, seals and current collector manufacturers.
- Companies interested in:
  - SOFC for Aviation and Naval applications.
  - Customized fuel cells (size, power, others).

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# Thank you!