

**CENER**NATIONAL RENEWABLE
ENERGY CENTRE**HyGrIn Lab**

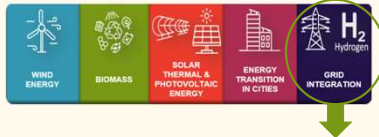
Innovation for Green Hydrogen

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Introduction

WHAT IS CENER?

The National Renewable Energy Centre of Spain (CENER) develops applied research in renewable energies and provides technological support to companies and energy institutions in the following five areas:



HyGrIn lab belongs to the **Grid Integration, Electrical Storage and Hydrogen Department**, and aims at accelerating the implementation of **hydrogen technologies**.

LIFE Programme; 2

H2020-Excellent Science; 2

H2020-Industrial
Leadership; 2

Horizon Europe; 5

H2020-Societal Challenges; 12

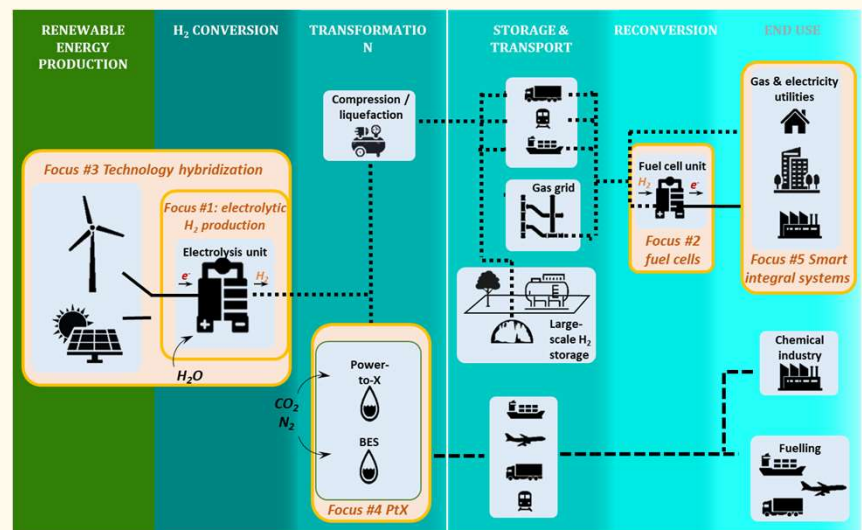
CENER has a huge experience in R&D projects at every scale (regional, national and European), with more than 70 European projects (26 in the last 5 years). **Currently it works on 17 European ongoing projects:**

H₂ and its value chain

Hydrogen can be considered as an **energy vector for achieving European Green Deal** objectives (Net-zero emissions by 2050):

- Contribute **to increase renewable energy production**
- **Enhance system flexibility**, through the storage and conversion of energy.
- Be a reliable **solution for hard-to-abate sectors**

GREEN HYDROGEN (produced from renewable energy), contributes to decarbonization goals in opposition to standard production of grey or blue H₂ from fossil fuels



HyGrIn lab

HyGrIn lab is equipped with all the necessary assets to **produce cells and stacks until reaching preindustrial scale (up to 2 kW)**. Complementary capabilities (modeling, engineering, characterization) are available to complement and foster the development of advanced cells and stacks.

The lab possesses several complementary **measuring stations for enabling multi-scale testing, from lab-scale proofs of concept (< 1 kW) to pre-commercial prototypes (2-10 kW)**, both at low and high temperatures (up to 1000°C).

Electrochemical performance analysis

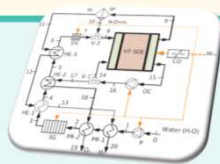
SOEC PCEL PEM AEM



The lab activities are completed with the **development of dedicated "balance of plant" for obtained cells and stacks (system design & optimization, balance of plant and interaction with RES)**.



CENER has a very versatile **microgrid**, where **different renewable energy production systems** (photovoltaic, wind power, etc) **can be combined** with conversion and electrochemical storage devices (batteries, supercapacitors, and of course, fuel cells). Furthermore, CENER has developed an **Energy Management System (EMS)** that can be adapted to any set or combination of technologies.



Materials and fabrication

SOEC PCEL

This line focuses on the **fabrication of materials and components for solid state electrolyzers (SOEC, PCEL) and fuel cells (SOFC)**. It has means for **producing solid state cells by functional printing**, and prototyping cells until preindustrial scales.



Stack design & manufacturing

SOEC PCEL

This line researches on **new configurations and components for stacks and full systems**, looking for optimizing their performance (improvement of water/H₂ distribution through new distributions, better heat control, etc)

Systems engineering

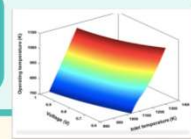
SOEC PCEL PEM AEM

Modelling hub

SOEC PCEL PEM AEM

This area specializes on:

- **Modelling of cells and stacks to imitate the response of cells and stacks within several operation scenarios**, thus minimizing experimental, temporal and economic efforts
- **Systems modelling for obtaining "plant Balance"** (energy and water requirements of electrolysis/fuel cell/storage systems, technoeconomic feasibility).



CENER OFFERS UNIQUE INSTALLATIONS FOR TESTING, DESIGNING AND SCALING ALL KIND OF TECHNOLOGIES (SOEC, PCEL, PEM, AEM, ETC)

SOEC: Solid Oxide Electrolyzer Cell

PCEL: Protonic Ceramic Electrochemical Cell

PEM: Proton Exchange Membrane

AEM: Anion Exchange Membrane