PEM Electrolyser for operation with off-grid Renewable Installations.
ELY4OFF Project

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WHO ARE WE?
It is a **private, non-profit** organization, created to promote the use of hydrogen as an energy vector.

Promoted by the Government of Aragon, it was **founded in 2003** with the support of the administration, industry and the main society actors from different sectors of activity.

**70 members** of key importance for the Aragonese economy
Installations

• **Main building**: 1200 m², with offices, labs and warehouse.

• **Integrated in** the Ither project, which is a **demonstration project** with a renewable energy infrastructure based on a wind farm 635 kW and a 100 kW photovoltaic system with different technologies linked to a hydrogen production facility compression (up to 350 bar) and dispensing hydrogen.
Areas of work

Research & Development → Innovation → Consultancy and training → Business development
Background on Fuel Cell & H₂
**Purpose:** the development and demonstration of an autonomous off-grid electrolysis system linked to renewable energy sources.

The **PEMWE** (Polymer Electrolyte Membrane Water Electrolyser) **industrial prototype** (50 kW) will be directly linked to track the solar photovoltaic power source producing over 1.5 tonnes of hydrogen per year and ensuring cold start and rapid response to changes.

The **demonstration period** in a relevant environment (TRL 6) will last 8 months and will take place in Huesca, Spain.

<table>
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<tr>
<th>Grant number</th>
<th>700359</th>
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<tr>
<td>Application area</td>
<td>H2020 Energy</td>
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<tr>
<td>Start date</td>
<td>01/04/2016</td>
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<td>End date</td>
<td>31/03/2019</td>
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<td>Total Budget (€)</td>
<td>2.315.217,50 €</td>
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SINGLE ENERGY SUPPLY

Ideal profile

Real profile

Total Power (W) - 28 Nov 2019, Huesca
Emden, Germany
Cloudy the following days

Rainfall: 0%
Humidity: 85%
Wind: 14 km/h

6 °C | 43 °F
SINGLE ENERGY SUPPLY
SINGLE ENERGY SUPPLY

62.5 kWp in 13 strings
450 - 800 V
4.8 kWp per string
Eurener Modules 320 W
DEMOSPOT (Huesca)

- Electrolyser
- Back-up system
- 62.4 kWp
DEMO SITE (Huesca)

H2 Storage 7 kg at 20 bar

H2 Storage 23 kg at 350 bar
✓ To **adapt** the voltage produced by the PV field to the required voltage of the stack (with MPPT)

✓ Capable of following RES **variability** quickly

✓ **Novel** electronic structure

✓ Efficiencies > **92%** in all conditions

✓ **13 units** (4.8 kW)
PV field output: 450 – 800 V

Stack requirements: 110 – 160 V
DCDC CONVERTERS

- EPIC DC/DC
- Itm (plc & electrical)
- INYCOM control
Promising results, but an MEA could not be developed in time -> a commercial MEA was tested.

Optimization of BoP consumption (variable pump, thermal insulation, ...)

Non-typical FAT: no rectifier at factory -> on site after DCDC integration

Final tests done 5-8 Feb 19 were successful: good dynamic response

Many control modifications due to off-grid
HYBRID STORAGE SYSTEM (I)

From 13 DC/DC converters

Sunny Island SI5048 3 x 5 kW

DC/DC 25kW

TAME POWER

Tripower 2 x 15kW

DC/DC 5kW

TAME POWER

4.5 kW FC (Hydrogenics)

Baterias 48V 1990 Ah (c120)

To stack

To BoP & control
HYBRID STORAGE SYSTEM (2)

From 11 DC/DC converters

To stack

Sunny Island SI5048 3 x 5 kW

Tripower 2 x 15 kW

Sunny boy 5 kW

DC/DC 5 kW

TAME POWER

4.5 kW FC (Hydrogenics)

To BoP & control

Baterias 48V 1990 Ah (c120)
HYBRID STORAGE SYSTEM
The PEMWE’s BOP **essential consumptions** are covered (PLC, anti-freezing system) as well as the PLCs in the microgrid. **24/7**

The PEMWE’s BOP **non essential consumptions** are covered, as well as those covered in the Idle status.

The PEMWE’s stack is **generating hydrogen**, being the BOP consumptions also covered.
✓ Integration of the components and commissioning is taking more time than expected -> current delay of 6 months.

✓ Successful tests last week -> demo period to start in March 19 (permits obtained, official documentation in elaboration)

✓ Project ends in March -> an extension has been requested

✓ Other on-going activities: LCA, cost analysis, recommendations to overcome regulatory barriers, exploitation plan, ...

✓ Business cases assessed (CEA): re-electrification, grid injection, mobility
High System Efficiency

through improved PEMWE and direct DC/DC

Reliable

Hybrid Storage System with enhanced autonomy
This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No (700359). This Joint Undertaking receives support from the European Union’s Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research.

Many tanks for your attention,

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