



iSEnEC 2018

Integration of Sustainable Energy

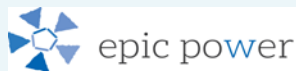
EXPO & CONFERENCE

Innovative back-up System for a 50 kW off-grid electrolyser directly linked to PV

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A blue sky with white clouds at the bottom.

WHO ARE WE?

Fundación Hidrógeno Aragón

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.





Human team

multidisciplinary research
team

Areas of work



Research &
Development



Innovation



Consultancy
and training



Business
development

On-going projects on Fuel Cells & H₂

BIG HIT



Official Website



DEMO4GRID



Official Website



QUALYGRIDS



Official Website



HYLAW



Official Website



HYTECHCYCLING



Official Website



ELY4OFF



Official Website



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.

Supported by:

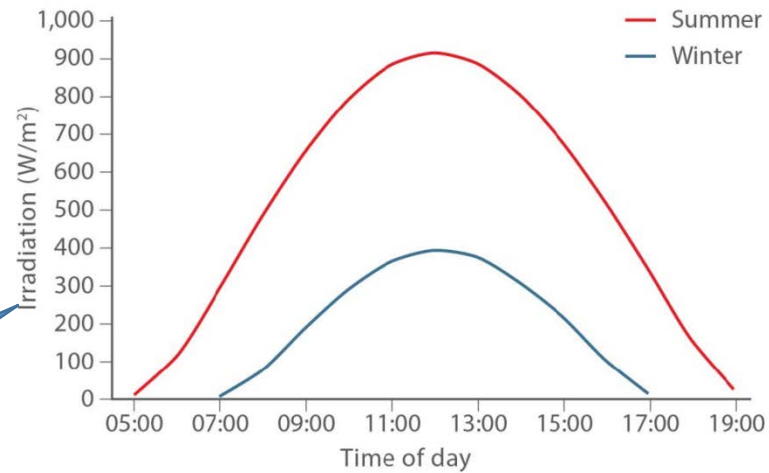


The research leading to these results has received funding from the European Union's H2020 Program for the Fuel Cells and Hydrogen Joint Technology Initiative (FCH2JU) under grant agreement n° 700359

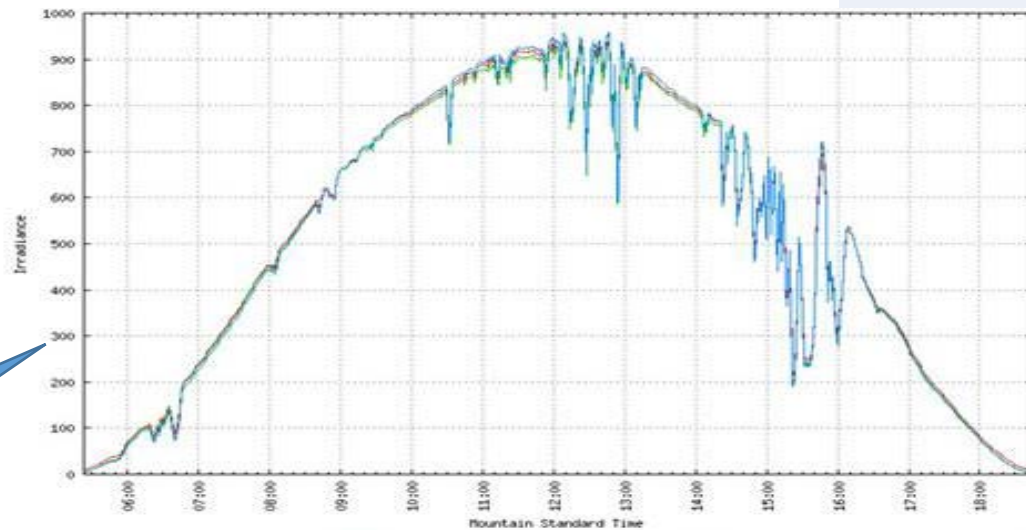
Grand total: 2.315.217,50 €

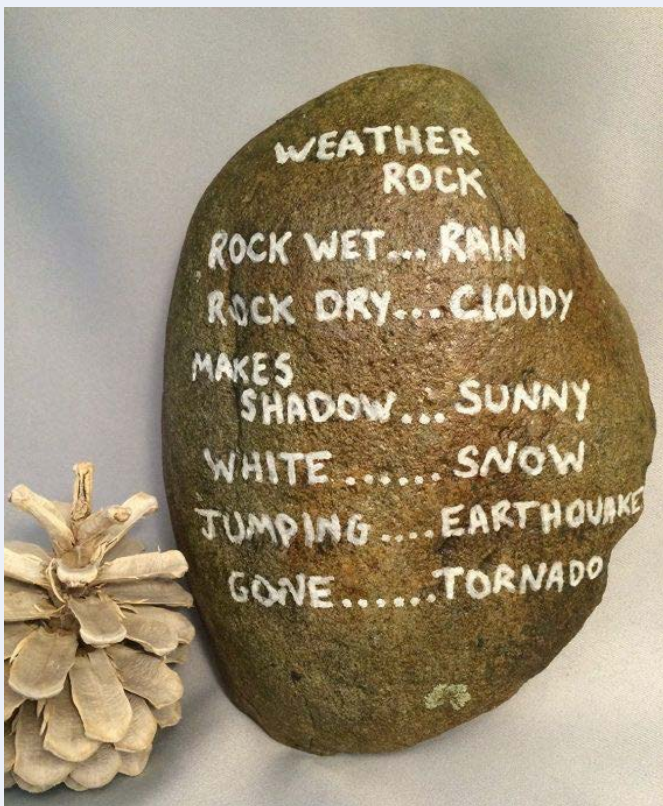


ideal



real





Huesca

martes

Tormentas dispersas



21 °C | °F

Precipitaciones: 90%

Humedad: 79%

Viento: 16 km/h

Temperatura

Precipitaciones

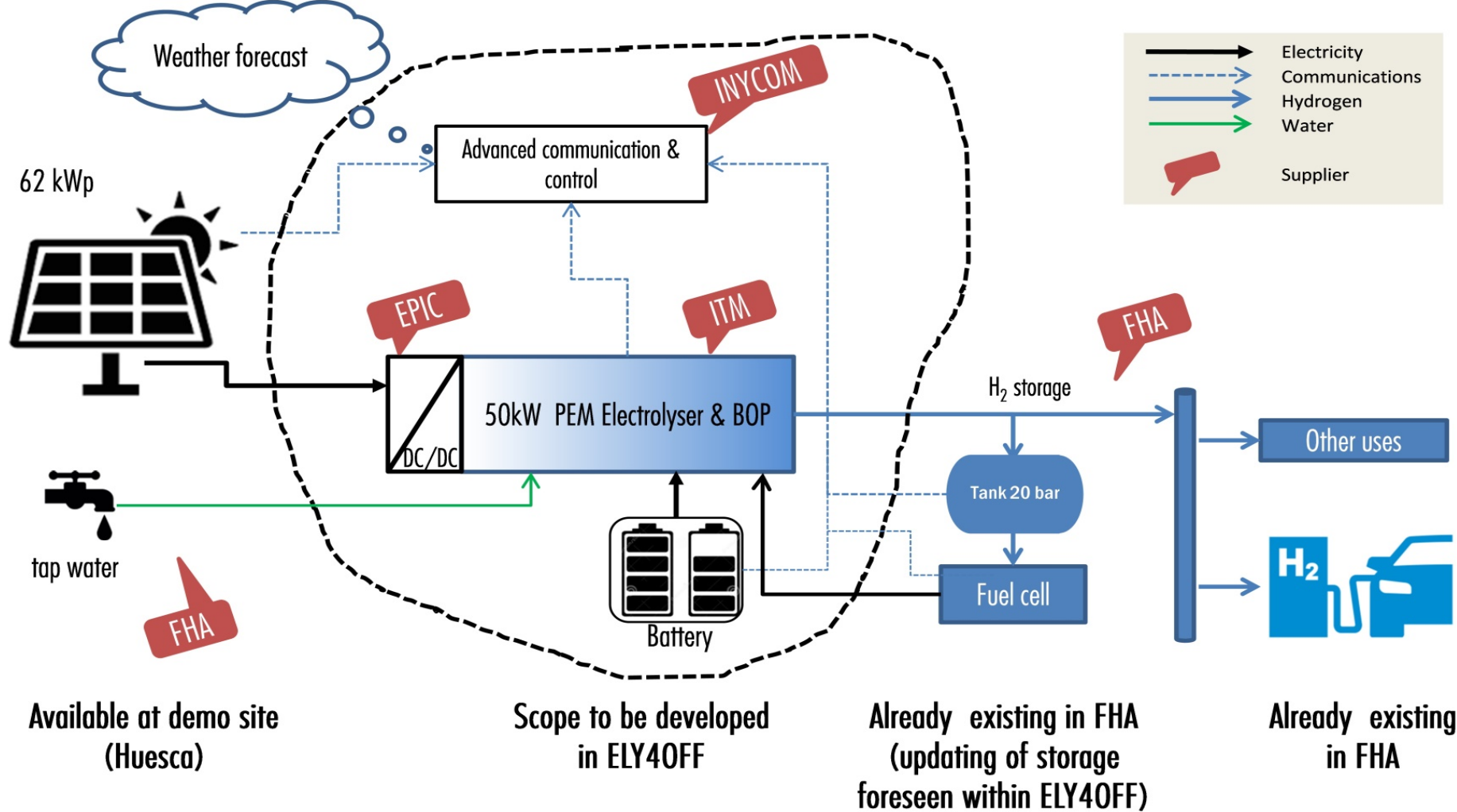
Viento

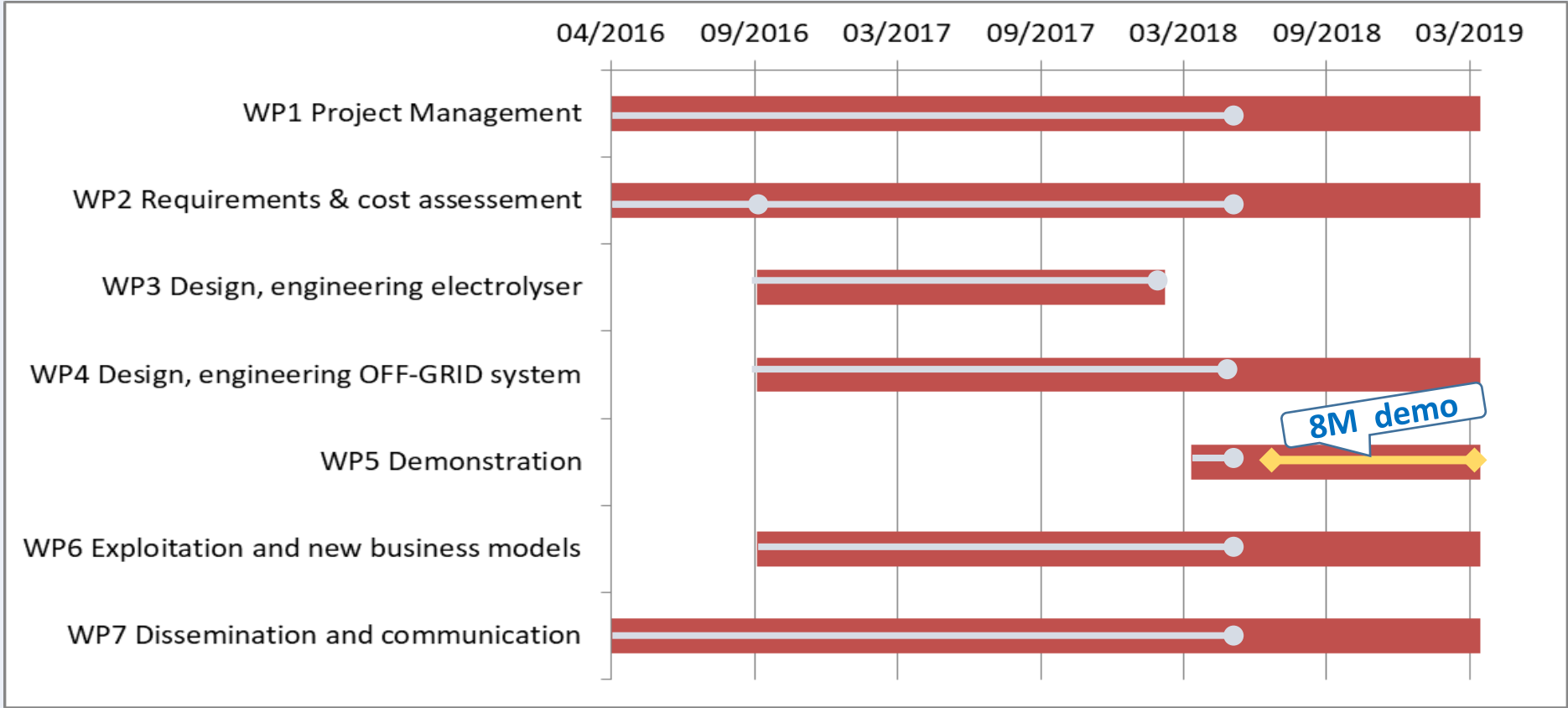


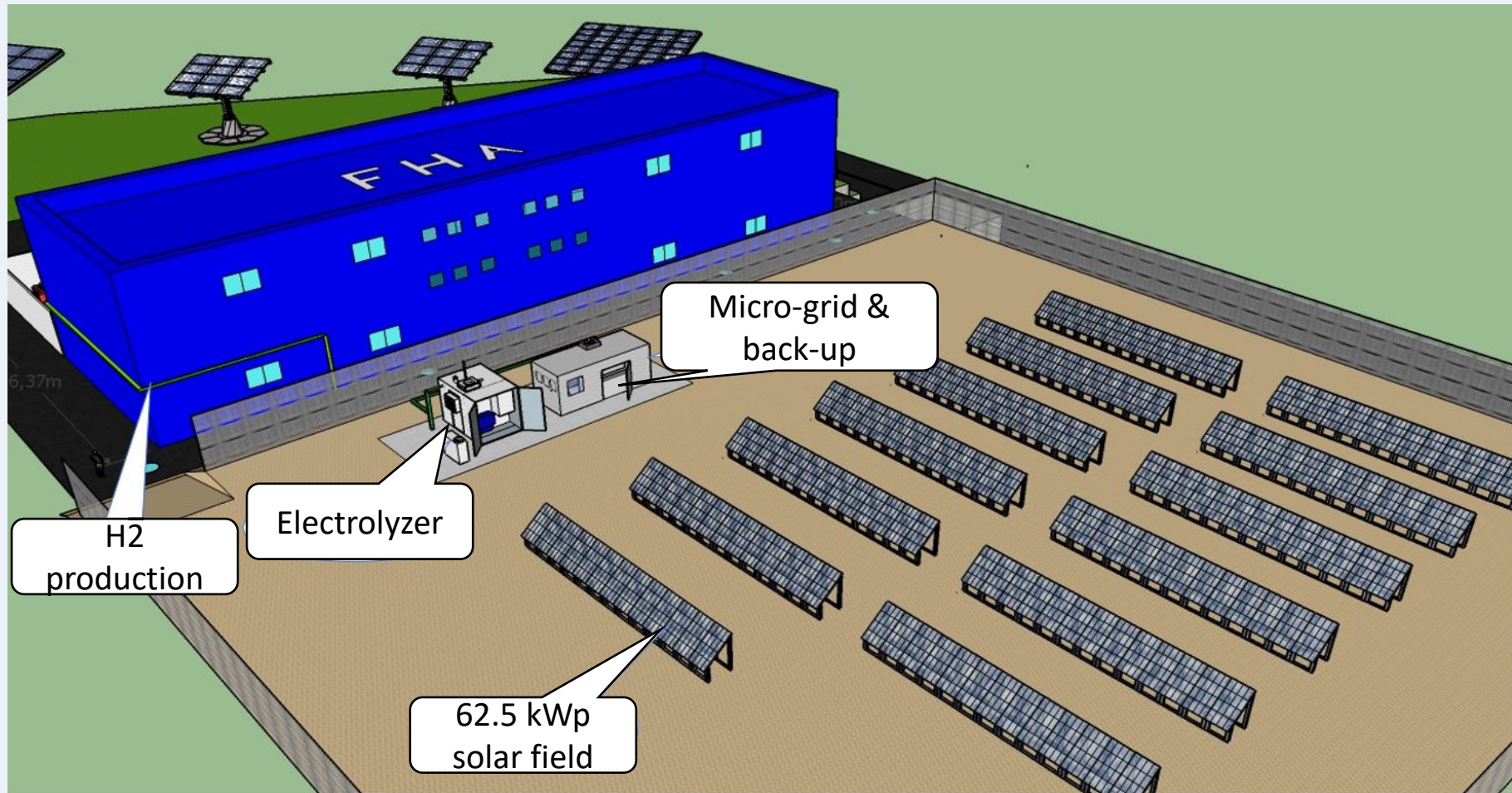


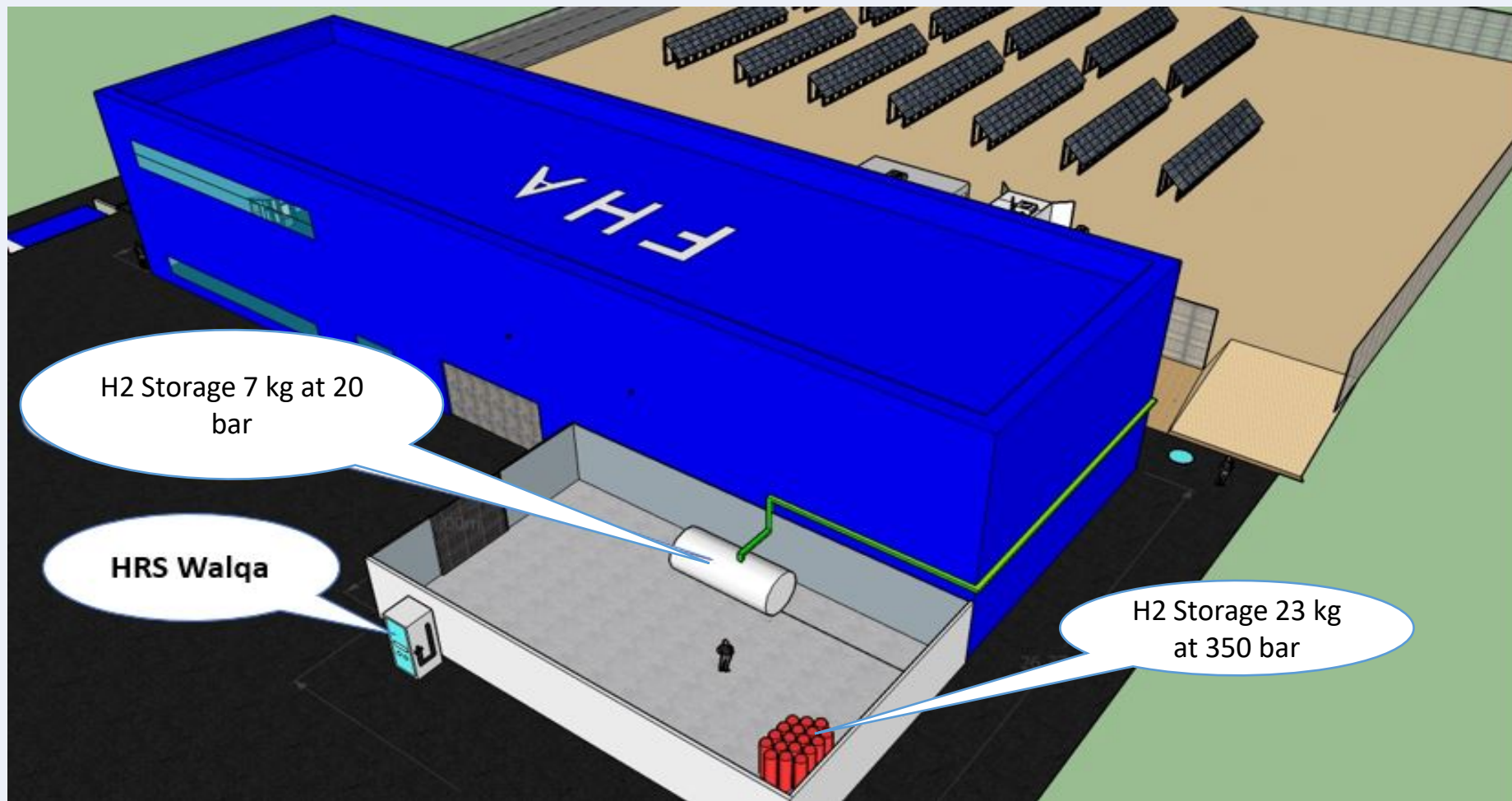
**Efficient and reliable production of hydrogen
in off-grid installations. ELY4OFF Project**











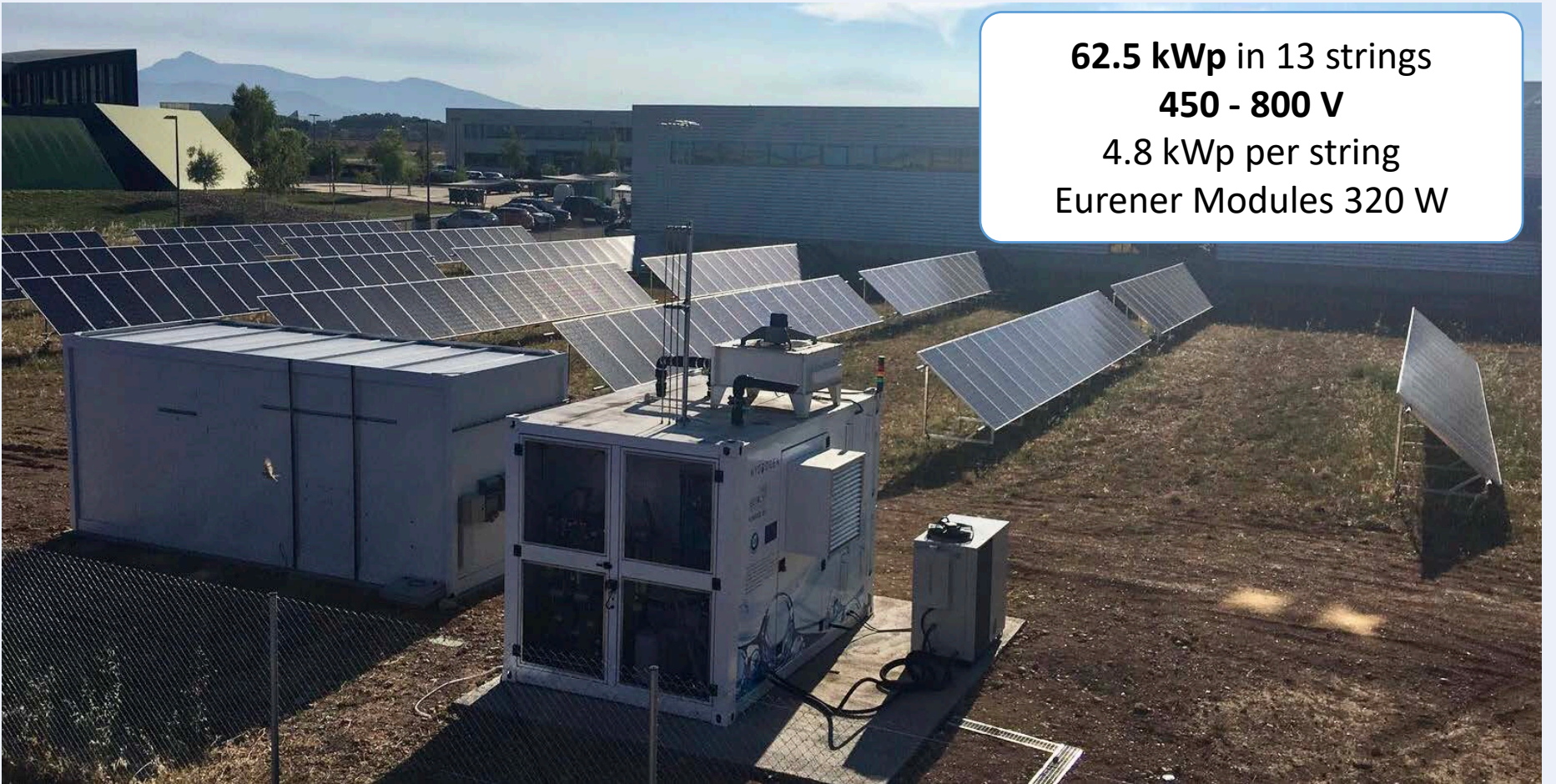
H2 Storage 7 kg at 20
bar

HRS Walqa

H2 Storage 23 kg
at 350 bar

- ✓ An in-depth **assessment of the best options** available **for the DC/DC conversion** linking the PV plant with the stack has been conducted. 13 prototype modules has been built.
- ✓ A large-scale **reduction** of kWh required for **frost protection** has been achieved in the BoP
- ✓ Several **energy storage architectures** have been assessed → finally the backup system will allow **5 days without solar source**.
- ✓ One specific business case related to "**electrification of isolated areas**" has been evaluated through time-step simulations.
- ✓ **Exploitation strategy** has been defined
- ✓ **Assembly started**, soon commissioning

Achievements by now

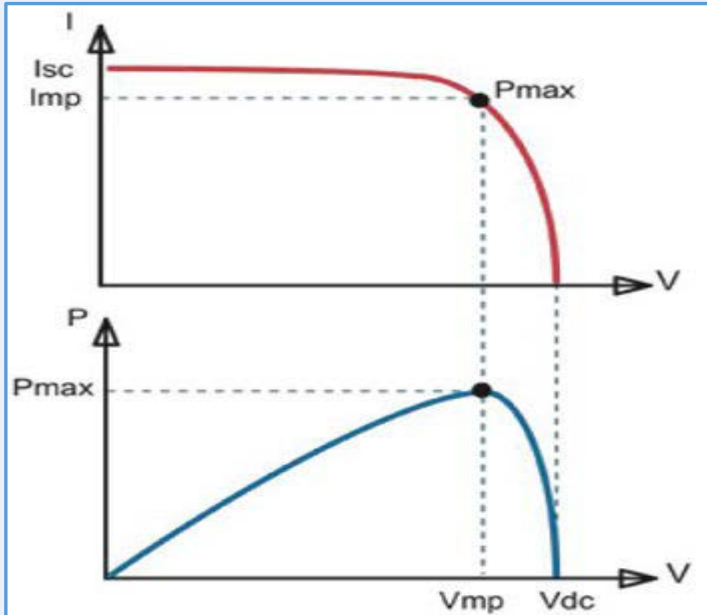


62.5 kWp in 13 strings
450 - 800 V
4.8 kWp per string
Eurener Modules 320 W

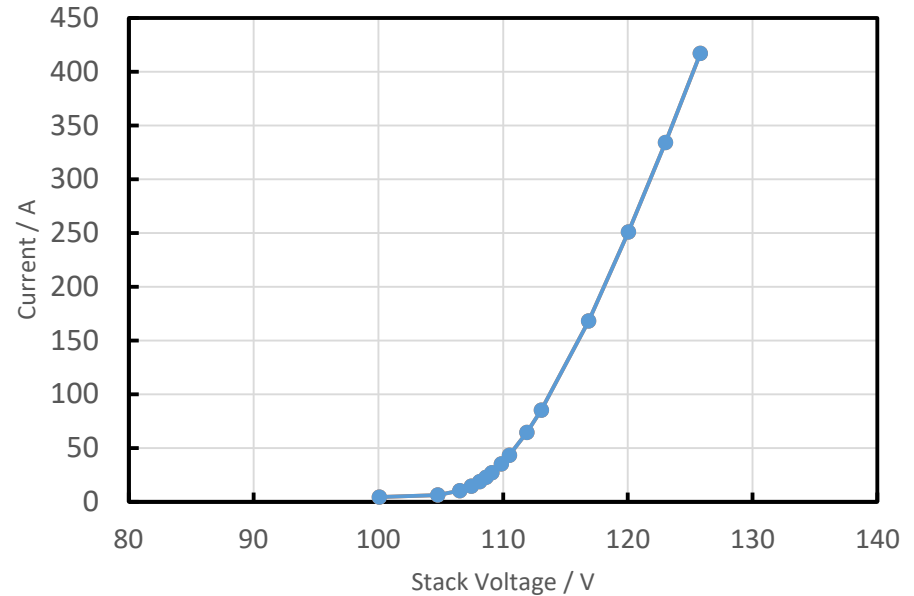
Challenge 1.

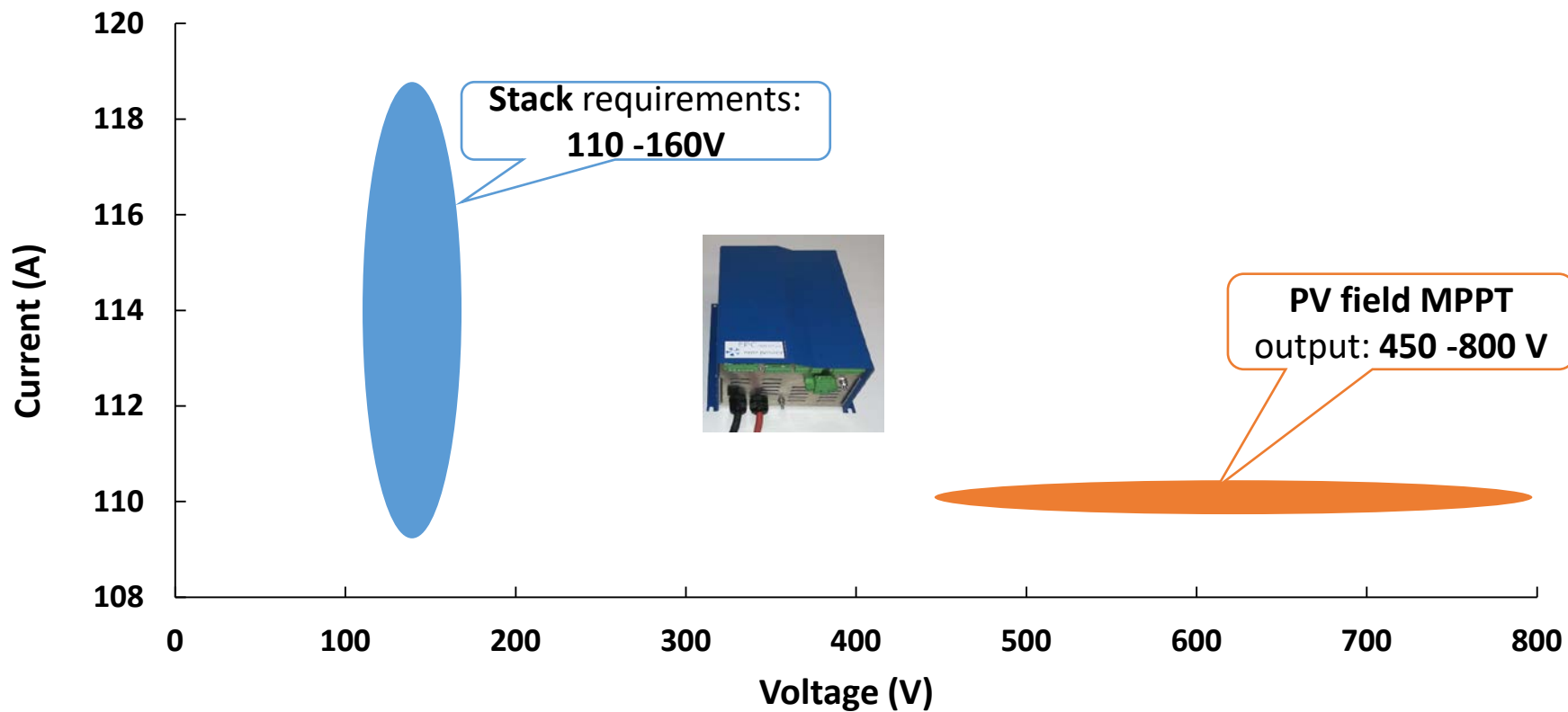
Direct DC/DC conversion

PV field output: 450 – 800 V

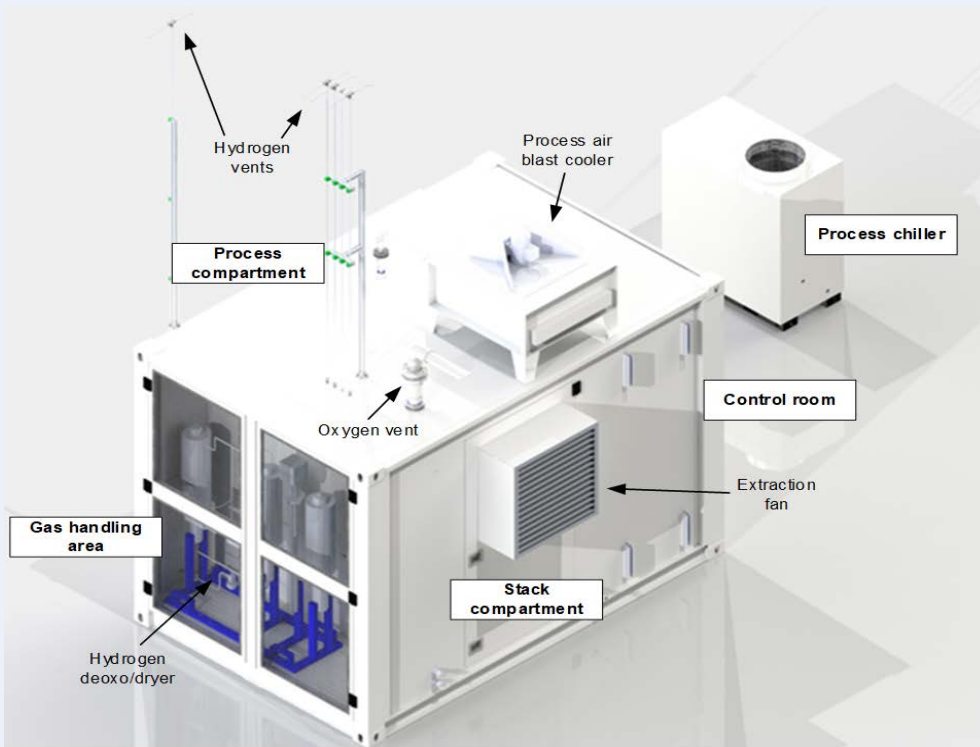


Stack requirements: 110 – 160 V

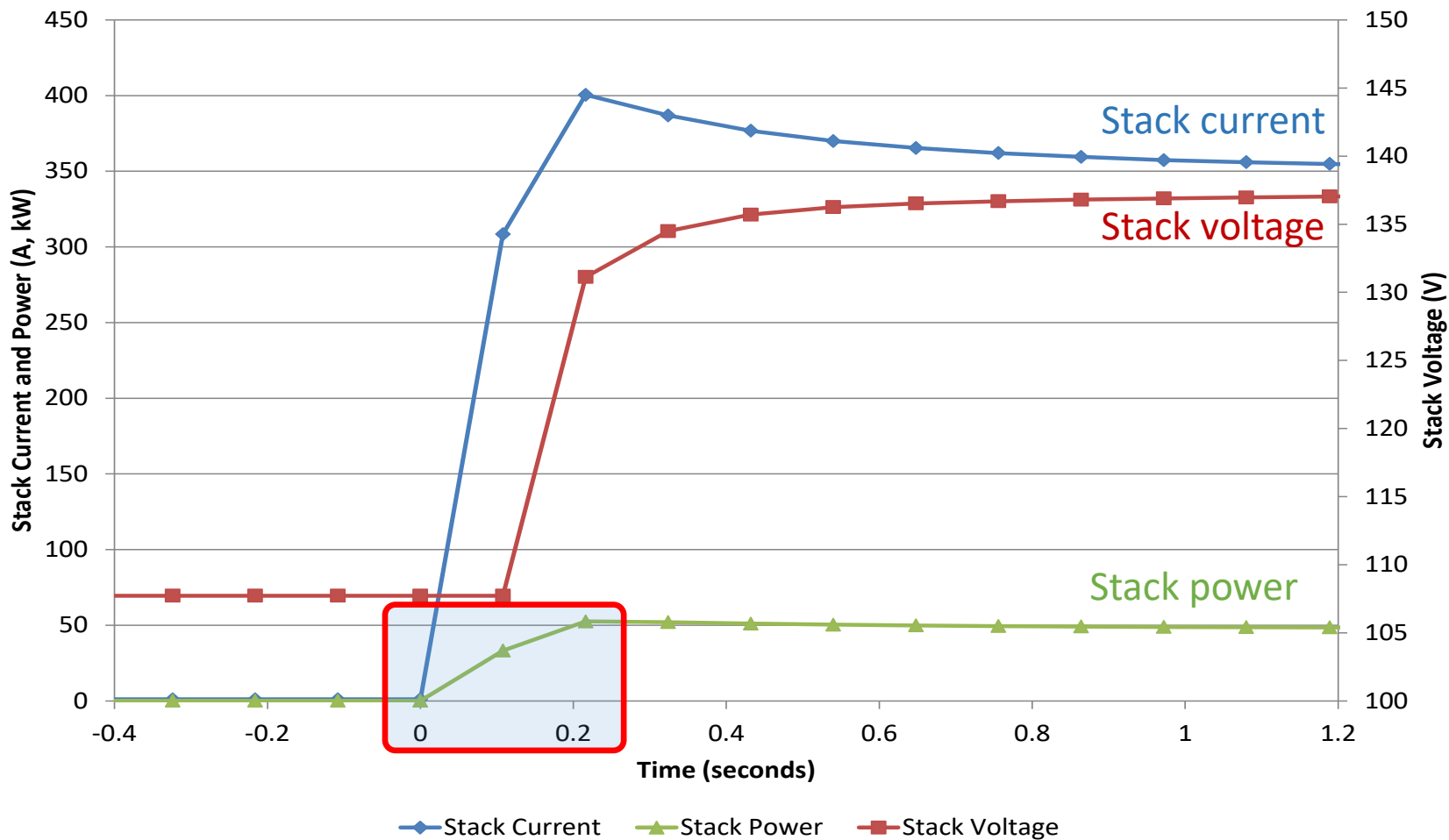




Challenge 2. Electrolyzer



Parameter	HGas
Number of Stacks	1
Min H2 Prod (kg/24hrs)	3
Max H2 Prod (kg/24hrs)	28
Water Consump. (l/kg H ₂)	15
Operating Pressure (bar)	20
System Efficiency at Maximum Load (kWh/kg)	62
Cold Start (sec)	300
Warm Start (sec)	30
Modulation (sec)	2
Hydrogen Purity	99.999% - ISO 14687-2:2012
Electrolyser Packaging	13' ISO Container
Temperature Range (°C) ²	-15 to + 40
Water Quality	Drinking Water
Certification	CE



Challenge 3.

Innovative back-up system

Essential consumers are: PCS (main and ITM's) & safety devices (< 1 kW), and frost protection (< 1 kW). **24/7**

Batteries storage (Pb-A) and **Fuel Cell** (4.5 kW) backs-up the system.

Priority is batteries (intra-day) and then Fuel Cell

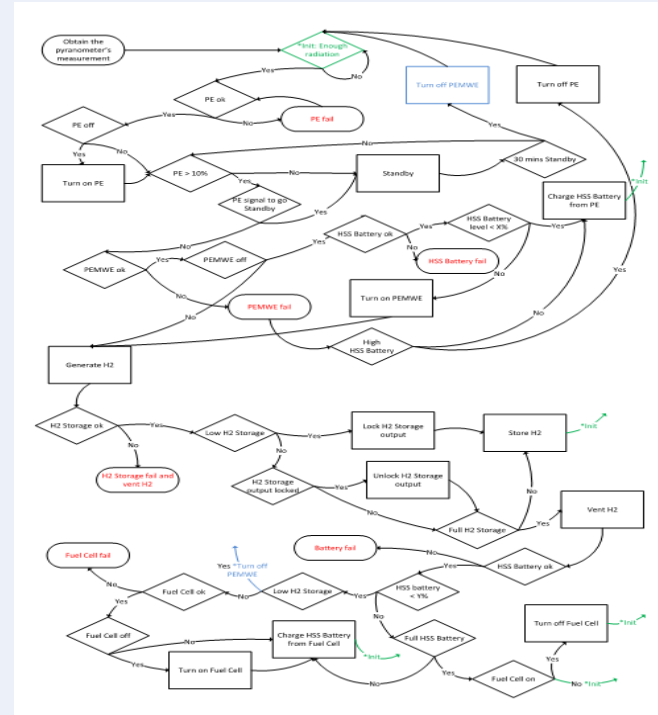
Simulations done using ODYSSEY (CEA)



Challenge 4.

Overarching control 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.



Main messages

High System Efficiency

through improved PEMWE and direct DC/DC



Reliable

Hybrid Storage System with enhanced autonomy





Many tanks for your attention,

Pedro Casero

ELY4OFF Project Coordinator

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