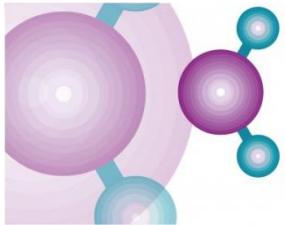


PEM Electrolyser for operation with off-grid Renewable Installations. ELY4OFF Project



12 February 2019 in Emden, Germany
HPEM₂GAS
PROJECT WORKSHOP


Pedro Casero

Project Coordinator

Innovation Area Manager (FH_a)

Emden, 12 February 2019



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.



Areas of work



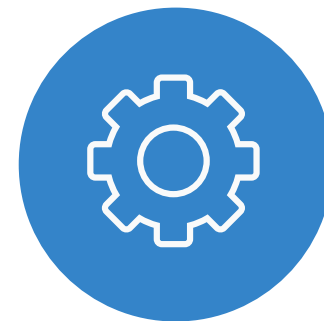
Research &
Development



Innovation



Consultancy and
training



Business
development

Background on Fuel Cell & H₂

EVERYWH2ERE



Making hydrogen affordable to sustainably operate Everywhere in European cities



BIG HIT



Building Innovative Green Hydrogen Systems in Isolated Territories



DEMO4GRID



Demonstration of 4 MW Pressurized Alkaline Electrolyser for Grid Balancing Services



QualyGridS



Standardized qualifying tests of electrolysers for grid services



HYLAW



Identification of legal rules and administrative processes applicable to Fuel Cell and Hydrogen technologies'



HYTECHCYCLING



New technologies and strategies for fuel cells and hydrogen technologies in the phase of recycling and



ELY4OFF



PEM ElectroLYsers FOR operation with OFFgrid renewable installations



ELYNTEGRATION



Grid Integrated Multi Megawatt High Pressure Alkaline Electrolysers for Energy Applications

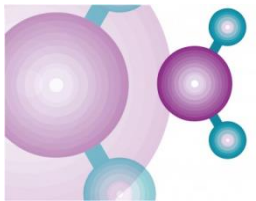


ELYGRID



Improvements to Integrate High Pressure Alkaline Electrolysers for Electricity/H2 production from Renewable





SUMMARY



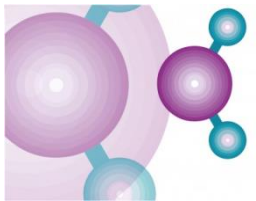
Purpose: the **development** and **demonstration** of an autonomous **off-grid** electrolysis system linked to **renewable energy sources**.

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.

Grant number	700359
Application area	H2020 Energy
Start date	01/04/2016
End date	31/03/2019
Total Budget (€)	2.315.217,50 €

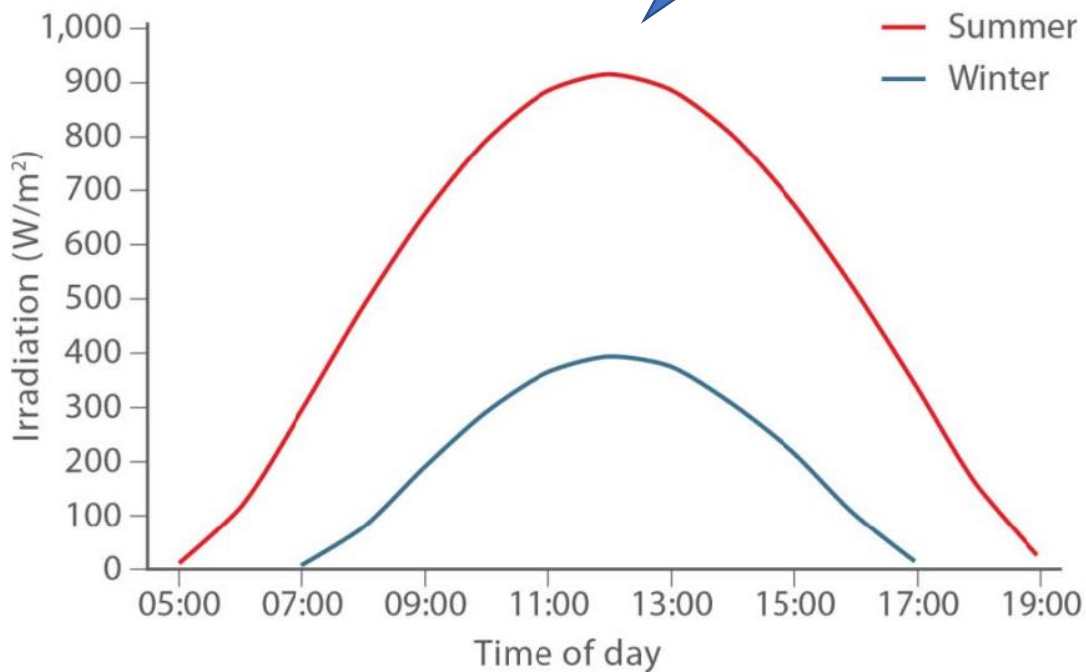




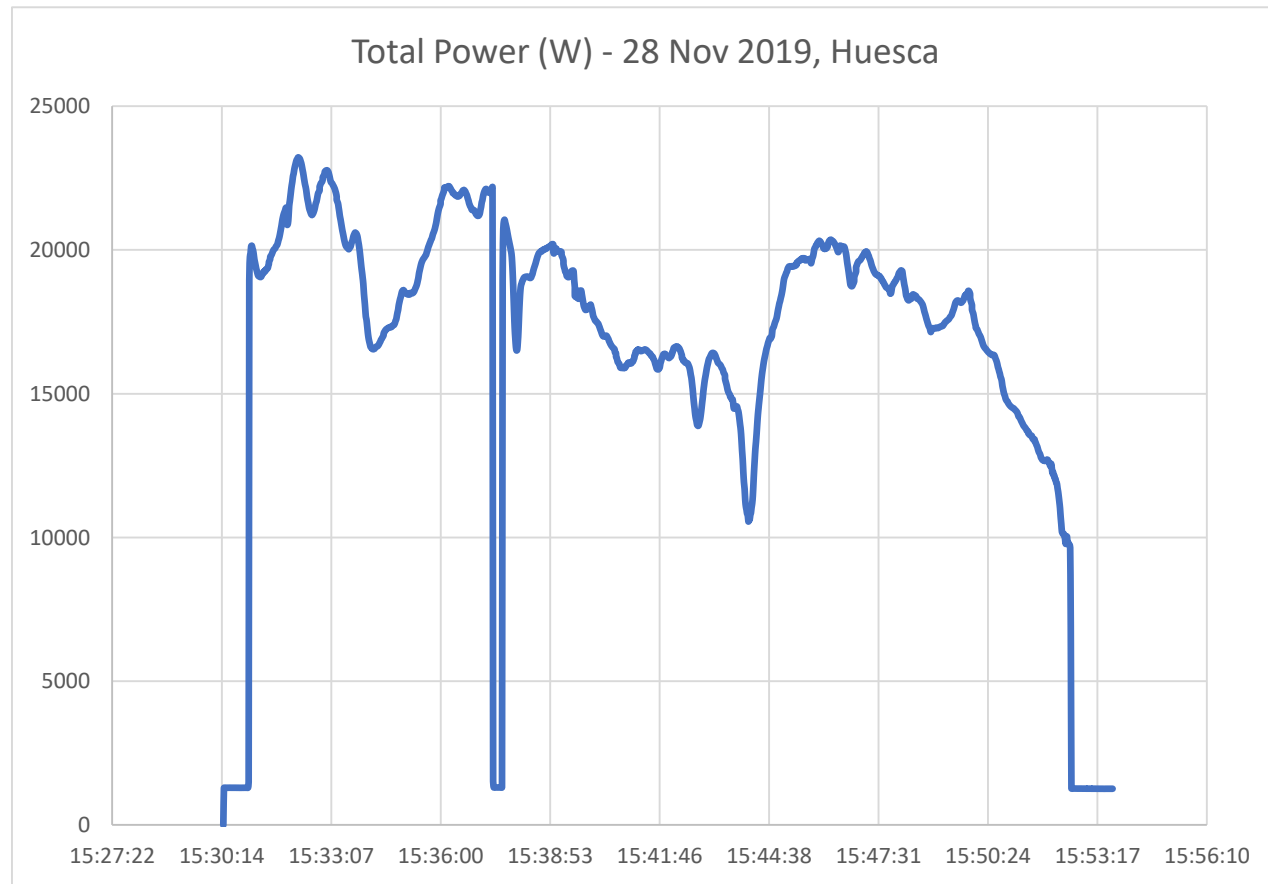
SINGLE ENERGY SUPPLY

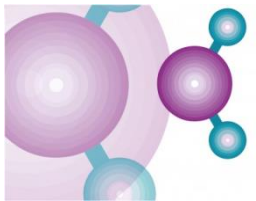


Ideal profile



Real profile





SINGLE ENERGY SUPPLY



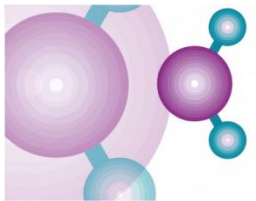
Emden, Germany
Cloudy the following days



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

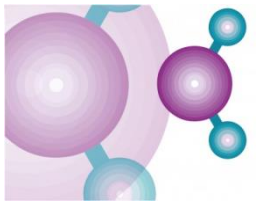
Temperatura Precipitaciones Viento



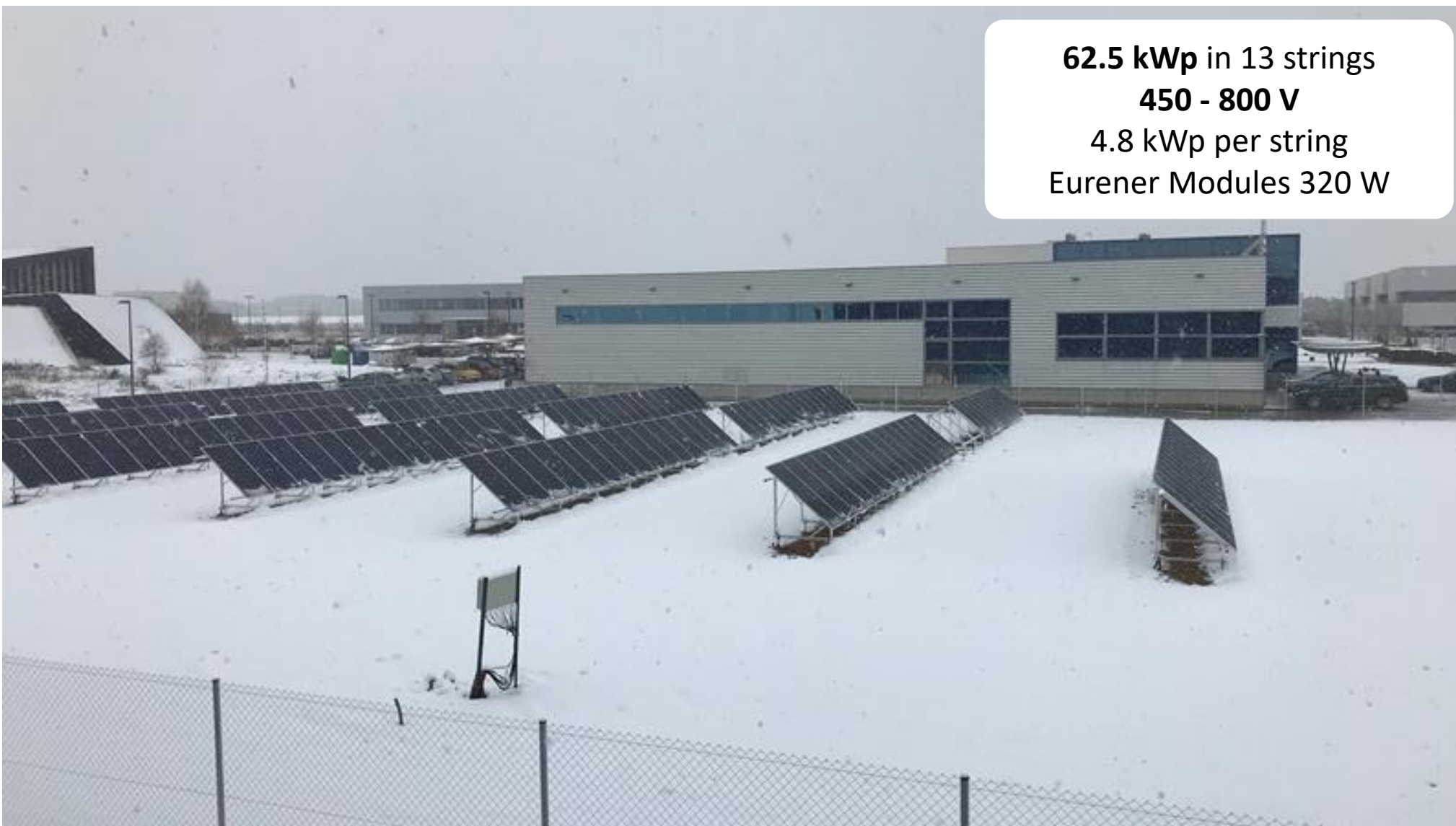


SINGLE ENERGY SUPPLY

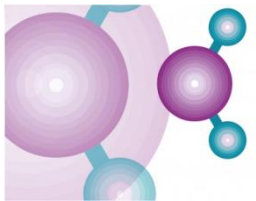




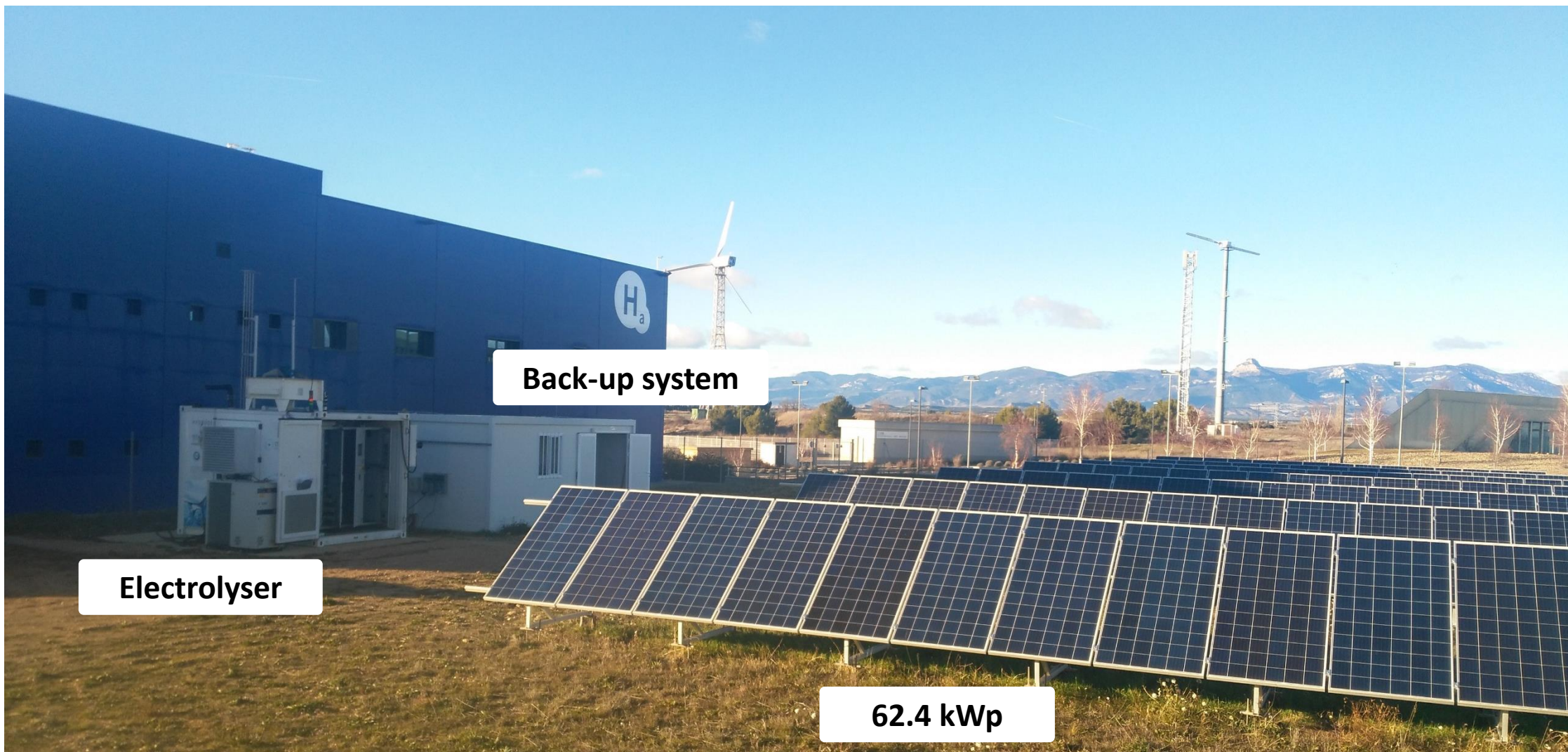
SINGLE ENERGY SUPPLY



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



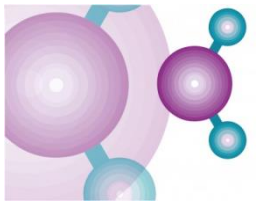
DEMO SITE (Huesca)



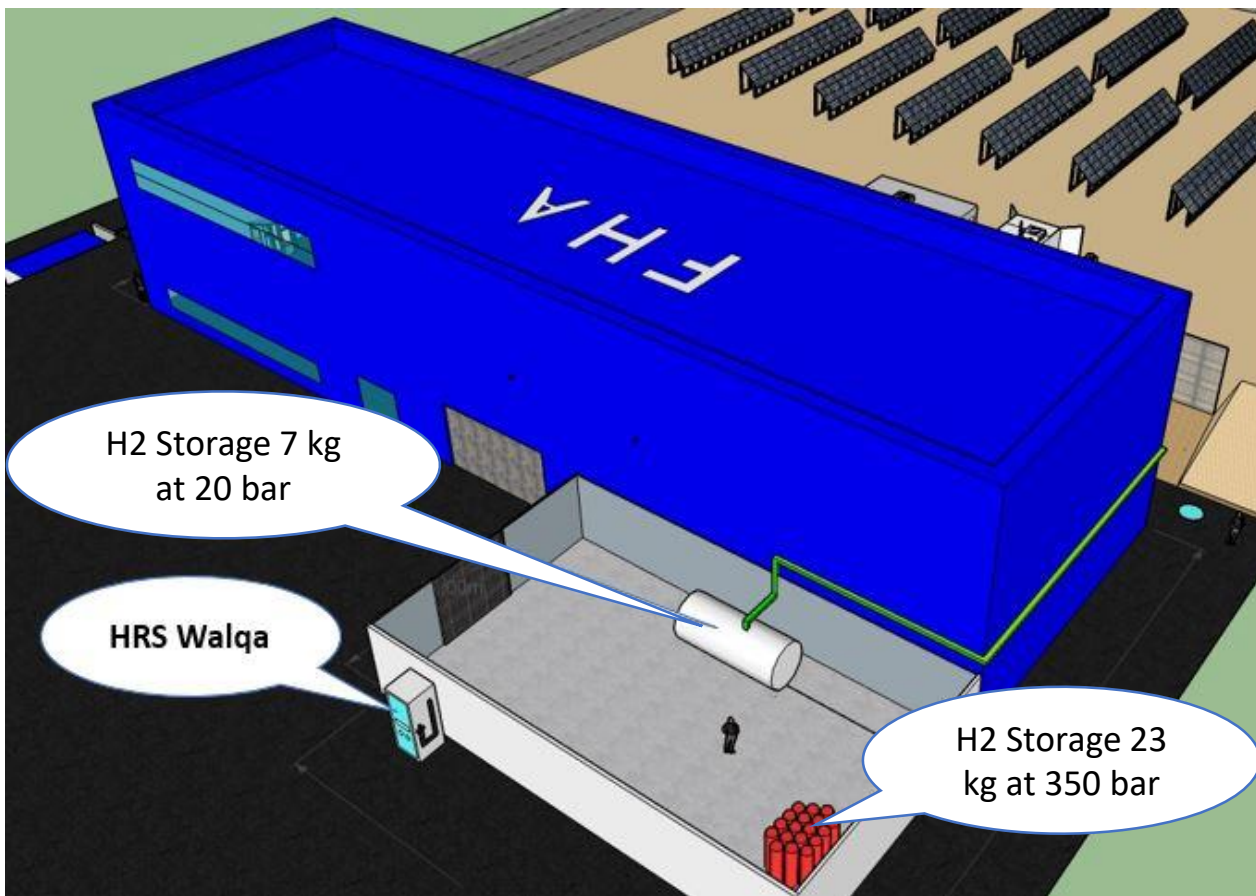
Back-up system

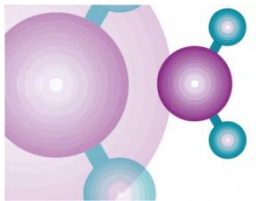
Electrolyser

62.4 kWp



DEMO SITE (Huesca)

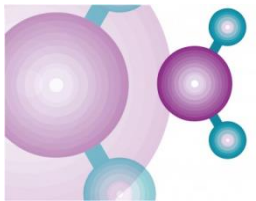




epic power

- ✓ 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)

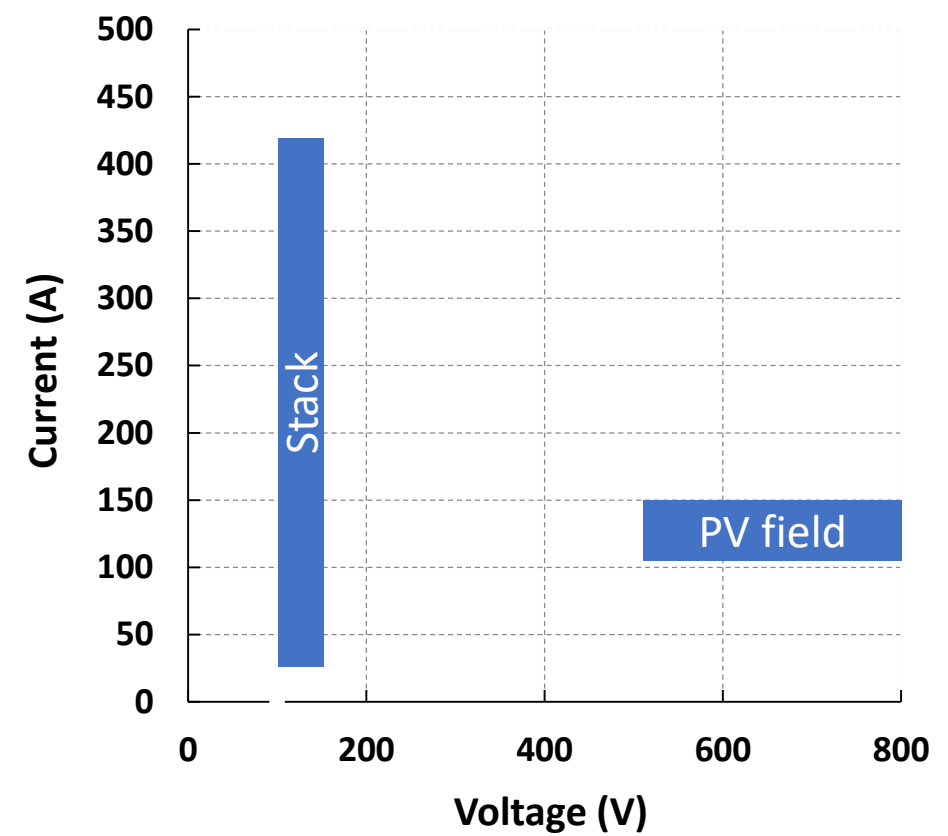
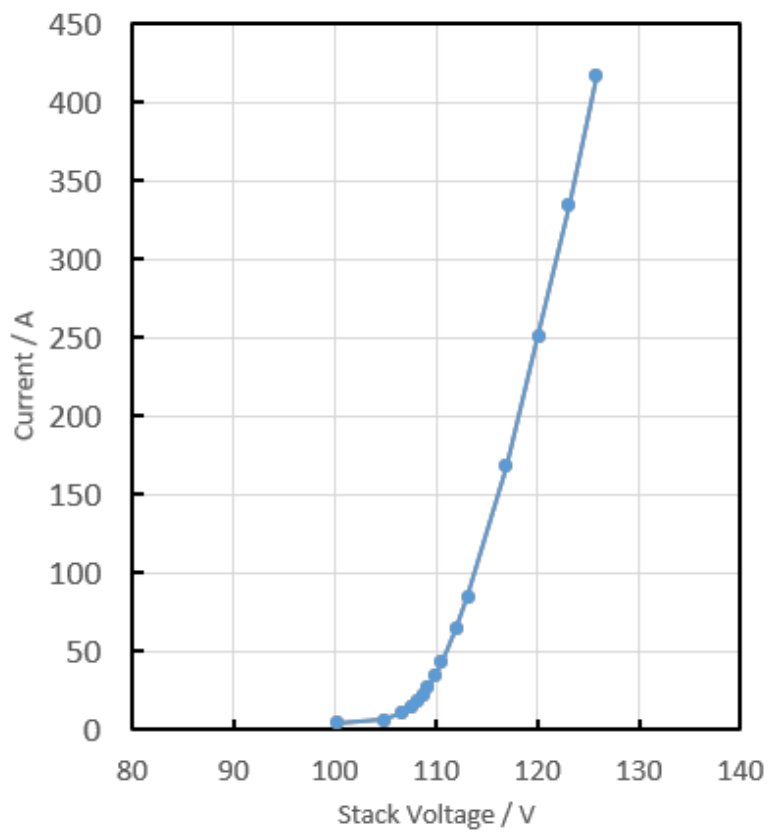
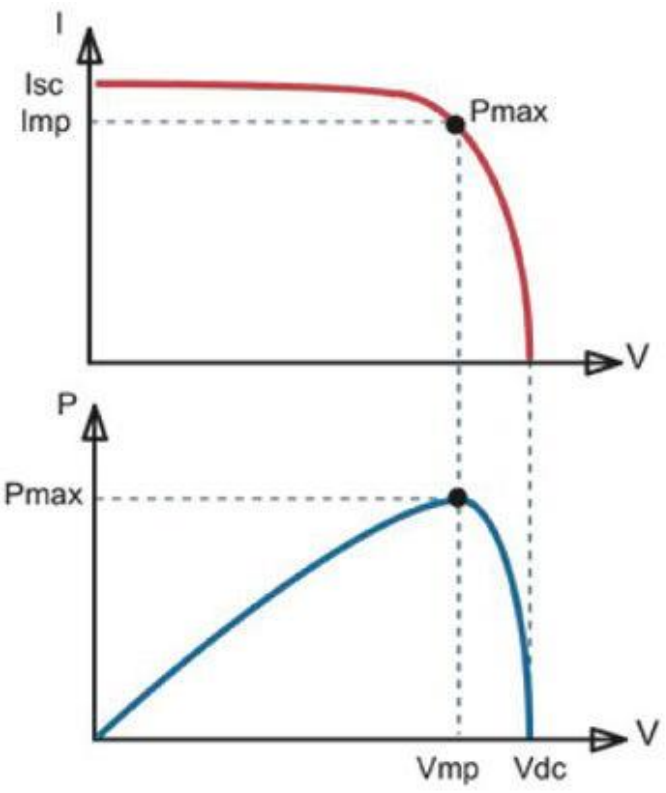


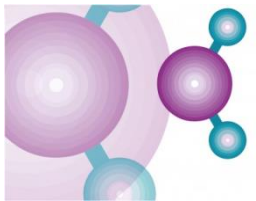


DCDC CONVERTERS

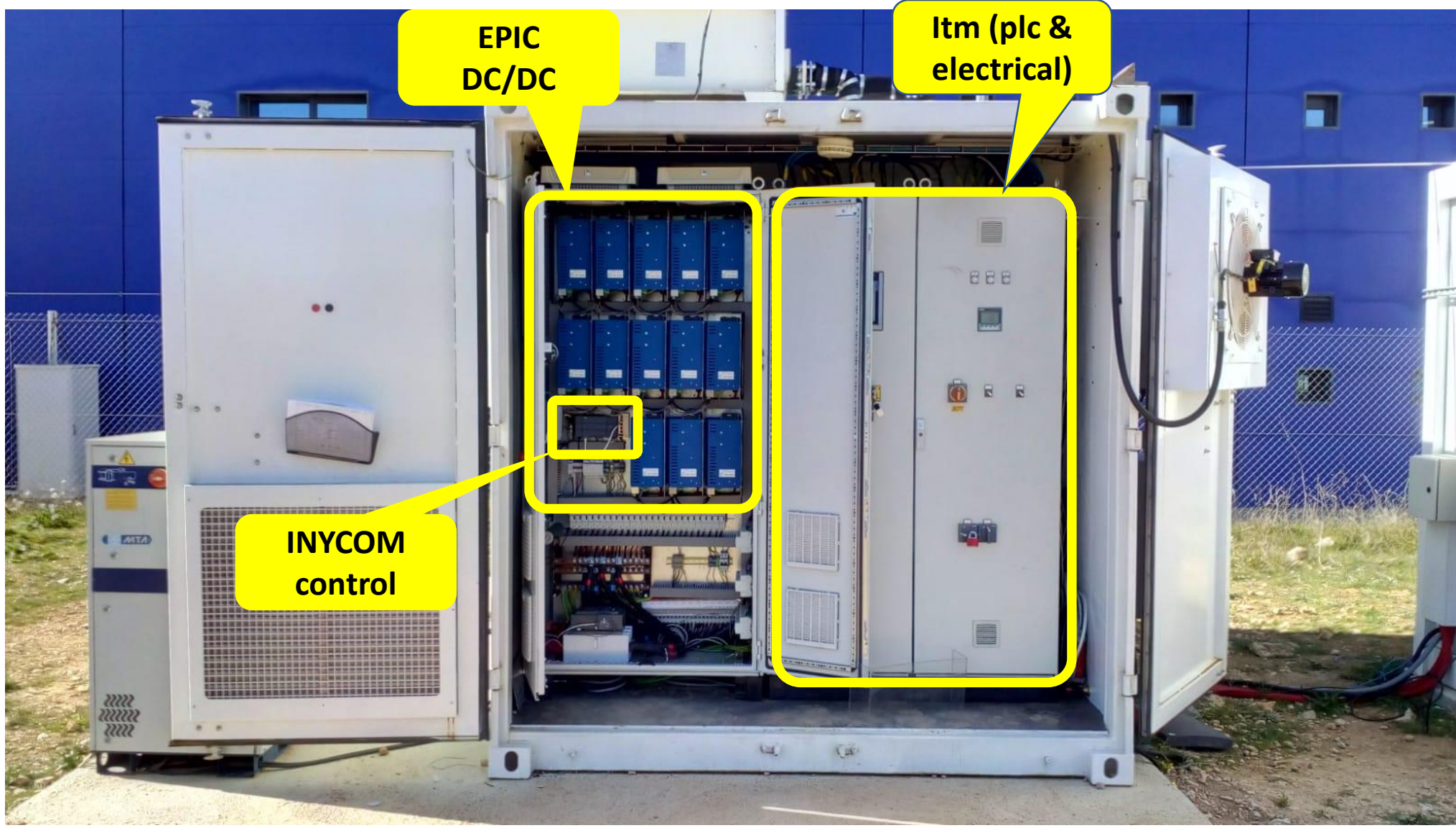
PV field output: 450 – 800 V

Stack requirements: 110 – 160 V





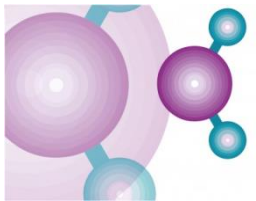
DCDC CONVERTERS



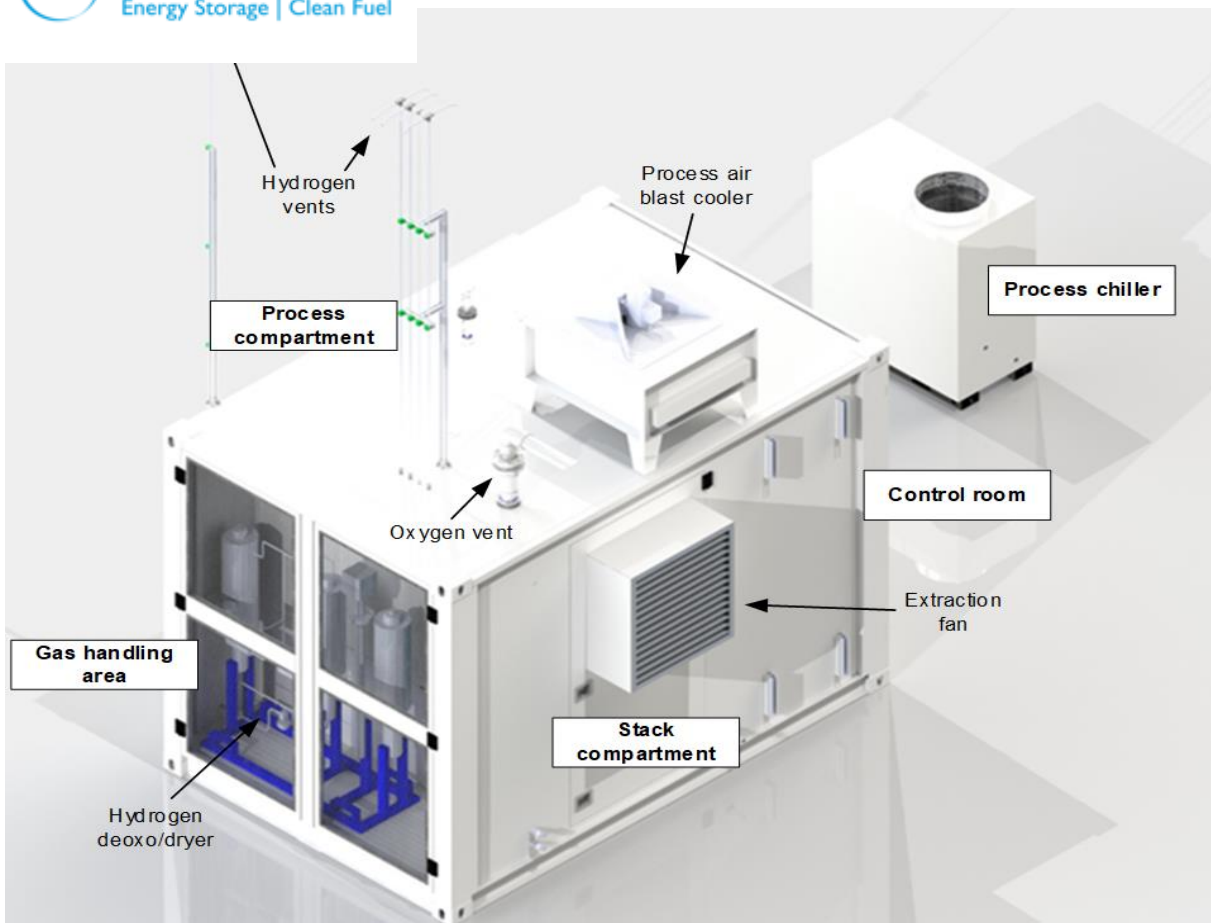
**EPIC
DC/DC**

**Itm (plc &
electrical)**

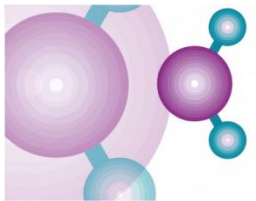
**INYCOM
control**



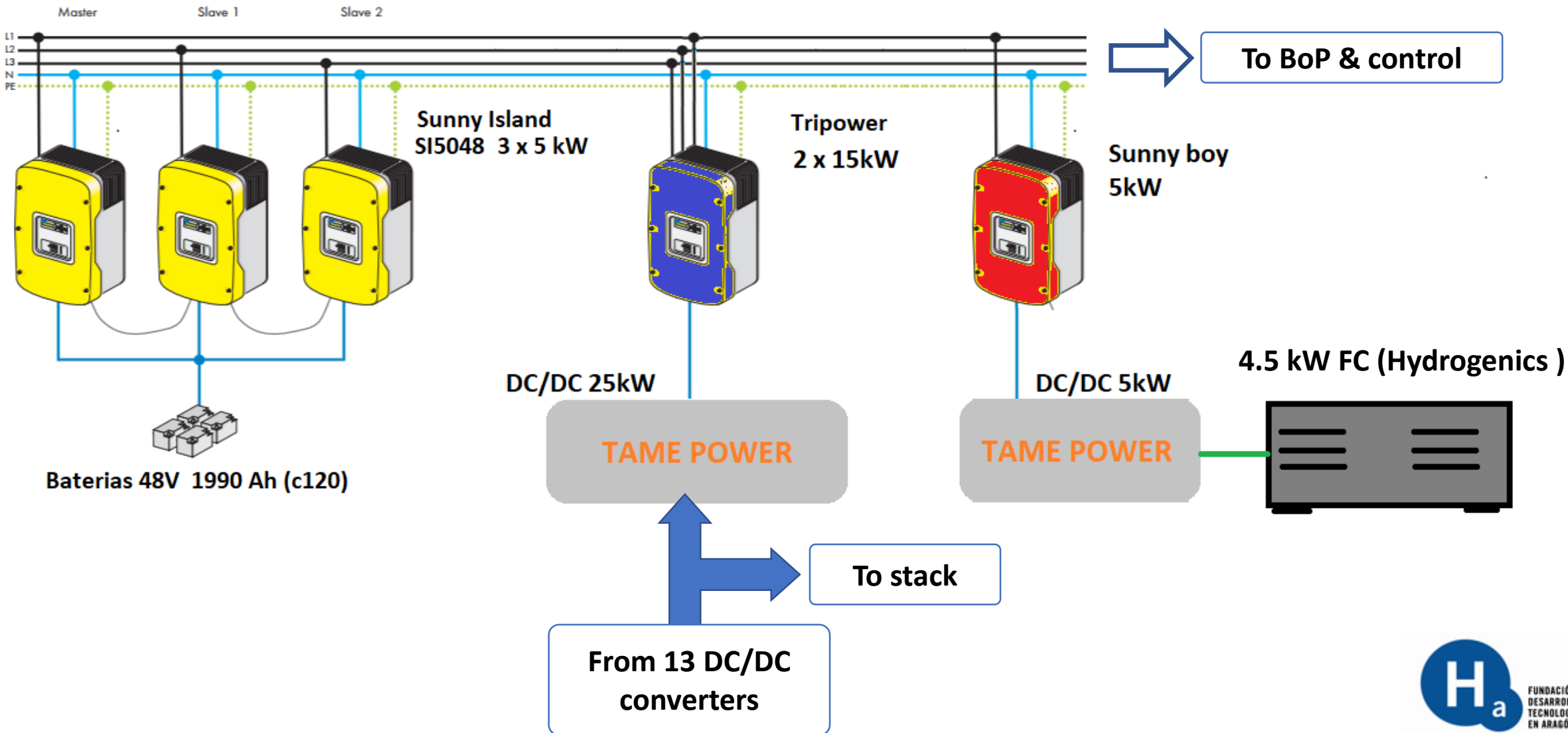
HGAS PEM ELECTROLYSER

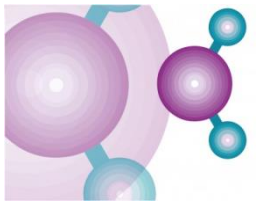


- ✓ Promising results, but an MEA could not be developed in time -> a **commercial MEA** was tested
- ✓ Optimization of **BoP consumption** (variable pump, thermal insulation, ...)
- ✓ Non-typical **FAT**: no rectifier at factory -> on site after DCDC integration
- ✓ Final tests done 5-8 Feb 19 were successful: **good dynamic response**
- ✓ Many **control modifications** due to off-grid

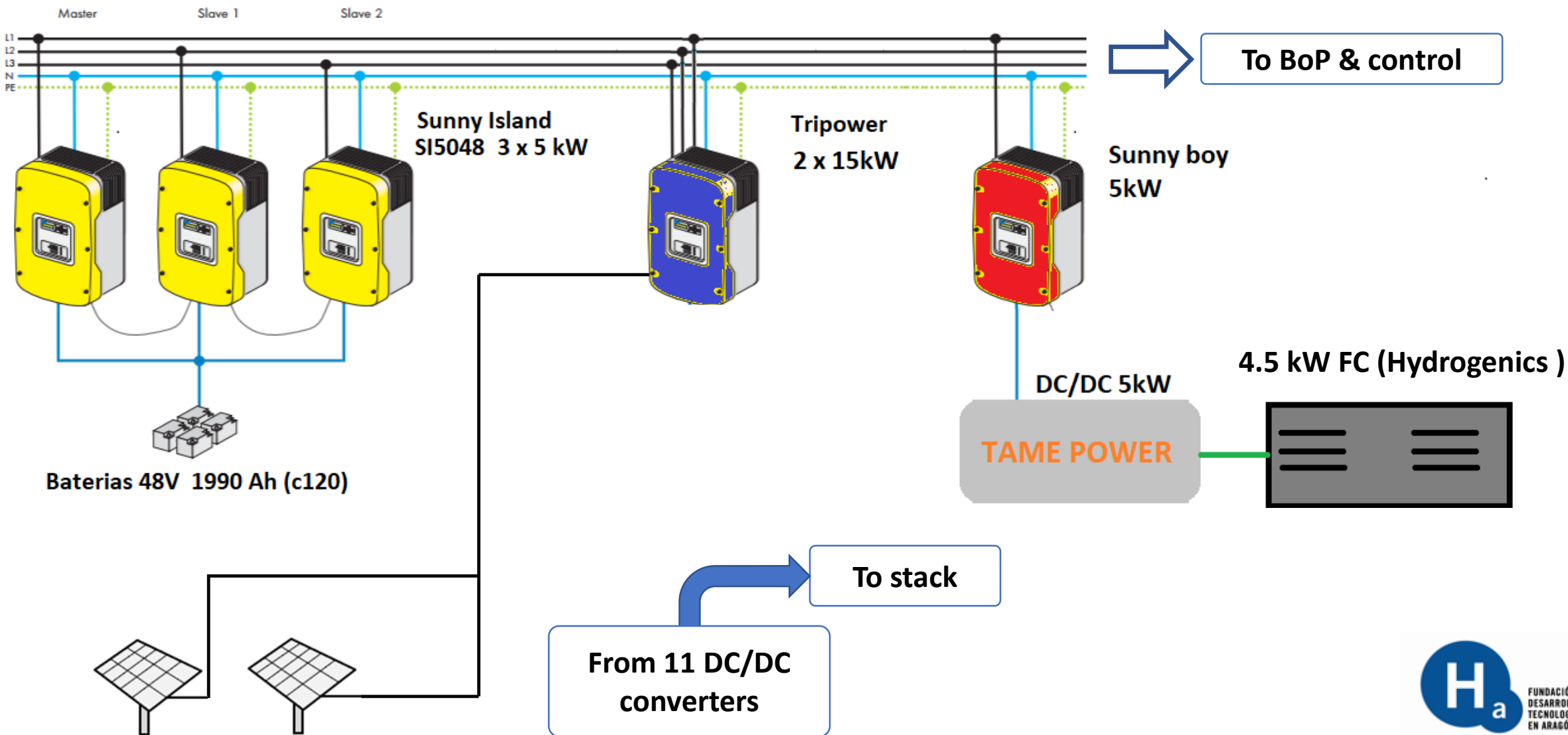


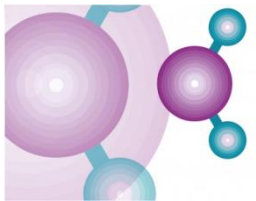
HYBRID STORAGE SYSTEM (I)





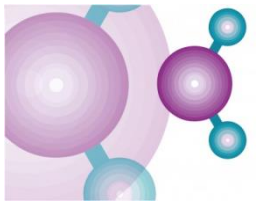
HYBRID STORAGE SYSTEM (2)





HYBRID STORAGE SYSTEM





Idle

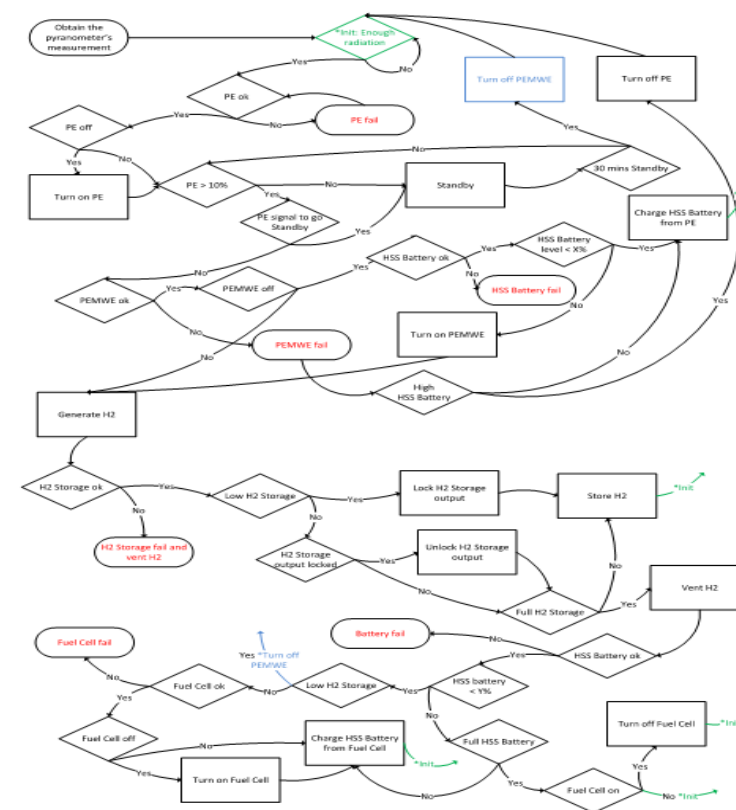
The PEMWE's BOP essential consumptions are covered (PLC, anti-freezing system) as well as the PLCs in the microgrid. **24/7**

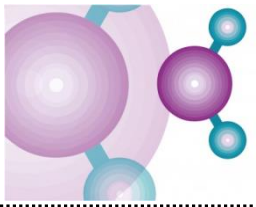
Standby

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

Generation

The PEMWE's stack is generating hydrogen, being the BOP consumptions also covered.

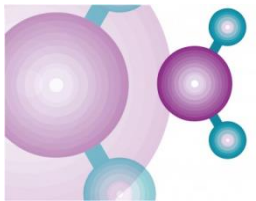




CURRENT STATUS

- ✓ 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



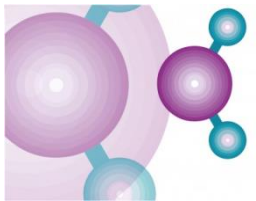


High System Efficiency

through improved
PEMWE and direct
DC/DC

Reliable

Hybrid Storage System
with enhanced
autonomy



12 February 2019 in Emden, Germany
HPEM₂GAS
PROJECT WORKSHOP



European
Commission |



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,

Pedro Casero

Project Coordinator

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