

CDTI-NEDO online Joint Workshop on Hydrogen Technology

- Green Hydrogen Production & Mobility -



Renewable Hydrogen Production for Mobility.
Cost reduction challenges.

Covadonga García Gómez
Bid and Proposal Manager
H2B2 Electrolysis Technologies, SL



- ✓ Incorporated in 2016 and present in **the United States and Europe**.
- ✓ Brings two decades of **experience** in hydrogen production, processing & technology development.
- ✓ Provides Innovation, Design, Engineering, Manufacturing, Integration and O&M for modular **hydrogen production** systems using **water electrolysis**, and hydrogen filling stations.
- ✓ Focused also on Promotion, Design, Construction, O&M, and Production of hydrogen for **large plants**, with flexibility and ad hoc solutions capabilities in selling and storage of hydrogen.
- ✓ Strong **engineering and financing project** backgrounds (+20 decades accumulated experience).





H2B2 Electrolysis Technologies, SL



- ✓ **Proprietary technology** for the development of PEM electrolyzers, aiming to be one of the few across the globe to hold MW stacks.
- ✓ Not only manufacturing electrolyzers, but also providing **solutions tailored to customers' needs**.
- ✓ Obtaining **permits and licenses** for large projects and plants, as well as search for finance and **project finance**.
- ✓ Development of hydrogen **production plants** that use electrolyzers to produce several thousands kg/day.
- ✓ Plant **operation and maintenance**, and local support for its management.
- ✓ Guaranteeing the **daily hydrogen** production of its plants in terms of quality and quantity.
- ✓ **Integration** with renewable energy production plants, **optimization** of hydrogen compression and storage solutions, and **incorporation** of methanation equipment, between others.





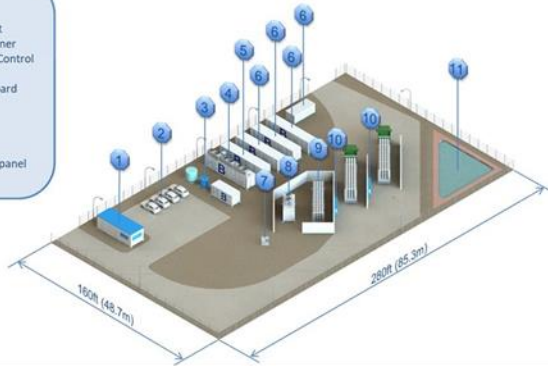
Products, services, technologies of the company



Selling hydrogen...

Hydrogen Business Unit

1. Control room
2. Parking
3. Water Treatment Plant
4. EL460N Process container
5. EL460N Electrical and Control container
6. Transformer, Switchboard and batteries
7. H2+NG injection
8. H2 compressor
9. H2 storage
10. Tube trailer dispenser panel
11. Evaporation pond



- ☐ **Integrated Project**
solution for H₂ availability

Selling equipment...

Technology Business Unit

Workshop



- ☐ H₂ solutions development
- ☐ H₂ solutions manufacturing
- ☐ (inc. services)

Factory



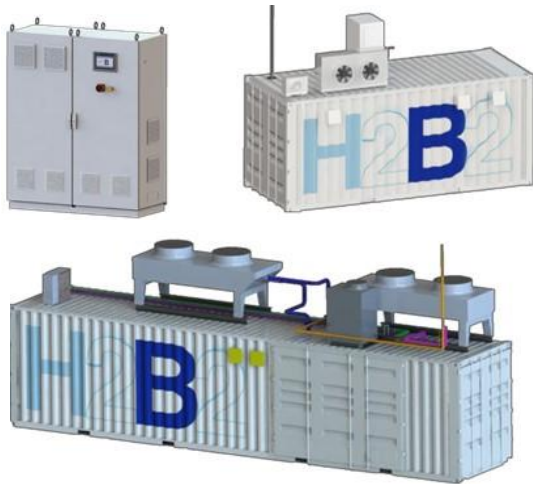
- ☐ (Serial) **Electrolyzers** manufacturing
- ☐ (inc. services)



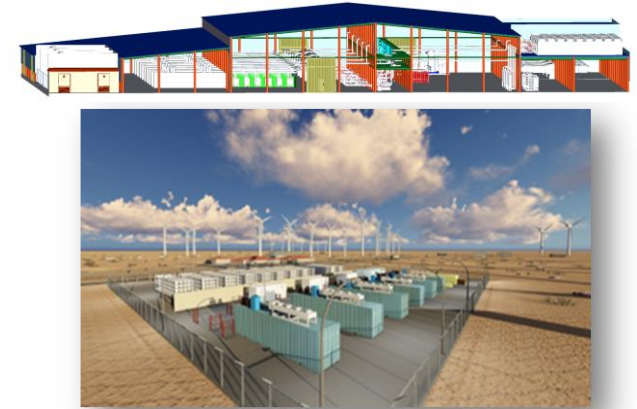
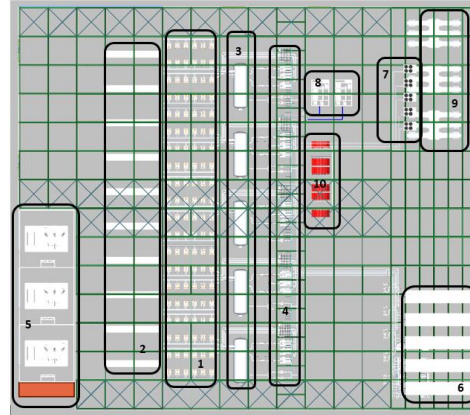
Products, services, technologies of the company

H2B2

Electrolyzers



Hydrogen Solutions



Hydrogen Refueling Stations



Products, services, technologies of the company

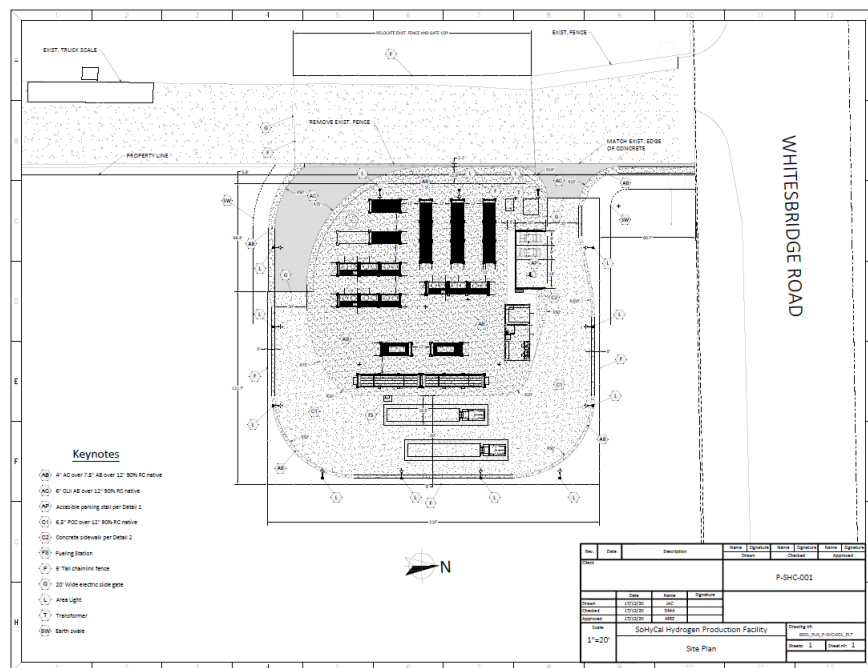
CPV4H2



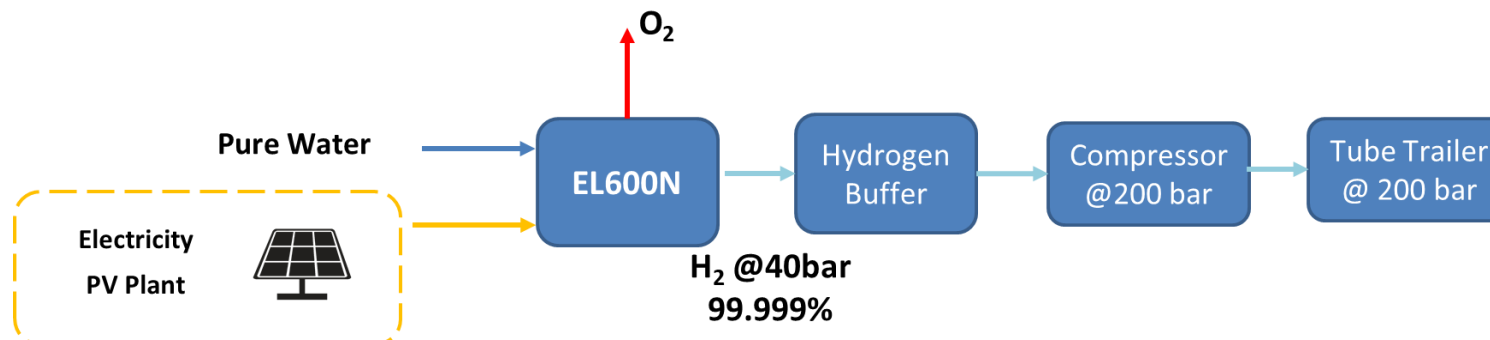
- ✓ CPV4H2: Hydrogen production pilot system from solar energy with high conversion efficiency through photovoltaic concentration
 - Design, manufacture and analysis of a small-scale proof of concept.
 - Scale up to industrial pilot demonstrator, tested under real conditions at Isfoc installations in Puertollano (Ciudad Real, Spain).
 - Direct integration with renewable energy for hydrogen production through photovoltaic concentration.
 - Technological development both in hydrogen electrolysis as well as energy conversion



- Project partially funded by CDTI (ITC20181066), developed by Isfoc, BSQ Solar and H2B2.



- ✓ H2B2 was awarded by California Energy Commission (CEC) a grant of US\$3.96 million to the project "Solar PV Hydrogen production plant in Central California", **SoHyCal**. Grant agreement (ARV-21-029) signed last September.
- ✓ Construction, financing and operation of a 100% renewable hydrogen production plant with PEM technology, with a nameplate capacity of up to **1,000 kg/day**, using renewable energy from a PV plant.
- ✓ H₂ production intended for the California sustainable mobility market.



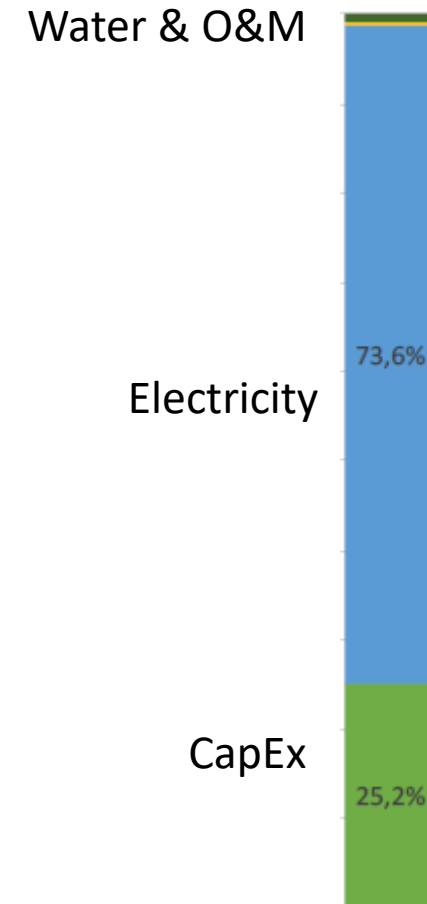


Main challenges and solutions

H2B2



- ✓ Costs of produced hydrogen can have following weights considering CapEx and OpEx costs.
- ✓ This graph corresponds to costs distribution considering hydrogen produced from Renewable Energy, being 50% the utilization rate of the electrolyzer.
- ✓ To reduce US\$/kg H₂, we have to work on:
 - Minimizing CapEx
 - Reducing electricity impact
 - Maximizing efficiency of the electrolyzer (to reduce electricity consumption)
 - Reducing electricity price (renewable energy is key)





Main challenges and solutions H2B2



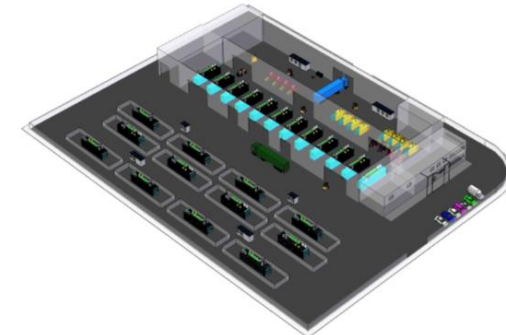
To improve CapEx....

- ✓ Sustaining this hydrogen market requires the competitiveness of products and solutions:

- Manufacturing capabilities development
- Value chain development

- ✓ Reducing costs and delivery times

- Electrolyzers manufacturing
- Engineering and development solutions
- Renewable hydrogen production





Main challenges and solutions

H2B2



To reduce electricity impact....

- ✓ This hydrogen market also requires maintaining a high level of technological development: **R&D**
 - Stack: scale, technology, **efficiency**, operation conditions...
 - Balance of Plant: **efficiency**, integration, components development, operation range
 - Energy management: hydrogen systems and plants
- ✓ With indicators such as the reduction of the investment cost or the increase in energy efficiency, although also associated with
 - Maximize **equipment life**
 - Take advantage of the degree of flexibility and dynamism that technology offers - **Curtailement**
 - Allow its integration into digitized and intelligent management systems
- ✓ And following the usual trends in the industry:



Scalability

Standardization

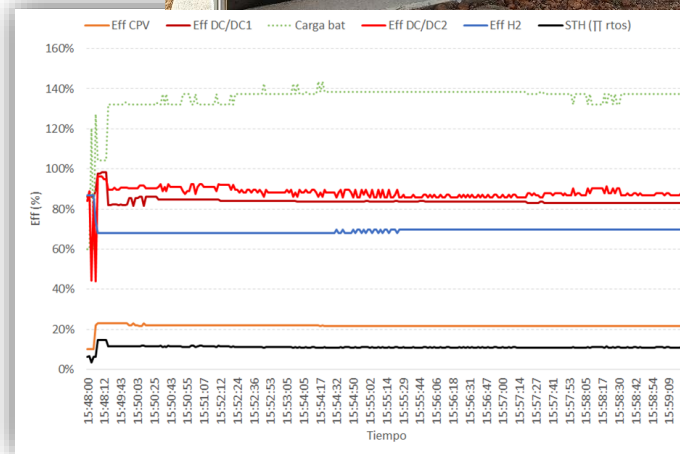
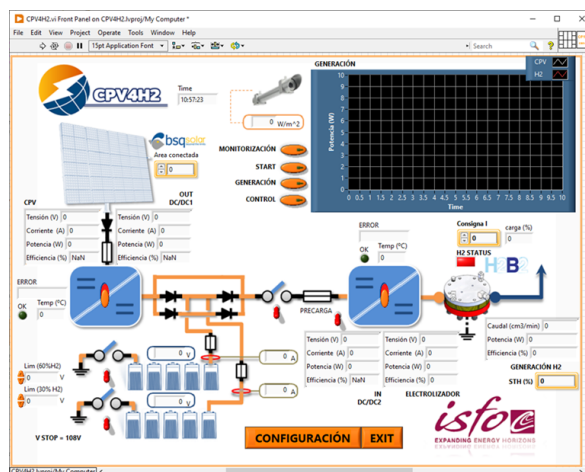
Automation



Main challenges and solutions CPV4H2



- ✓ Direct integration with CPV
 - System efficiency
 - Autonomous and isolated system
 - Control strategies
 - DC/DC development





Main challenges and solutions SoHyCal

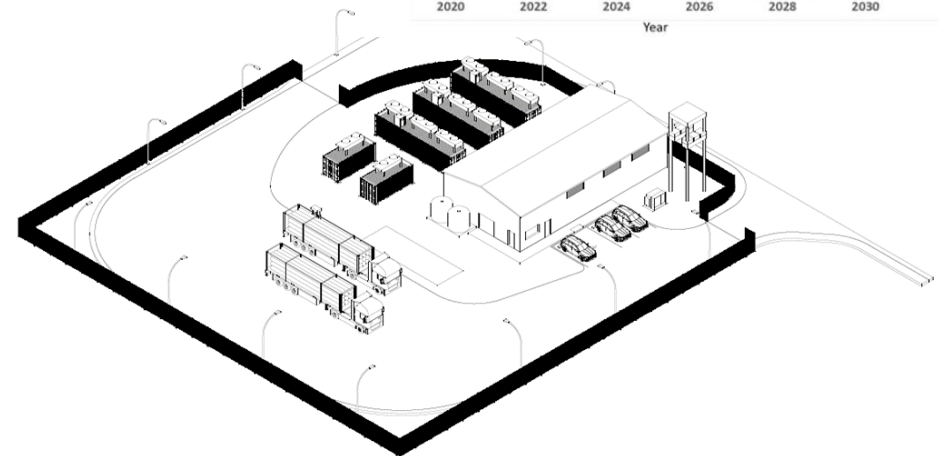
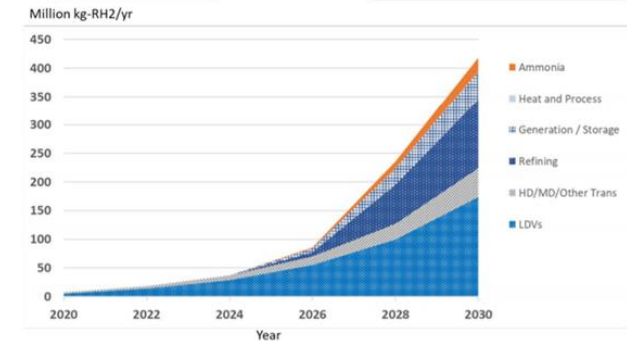
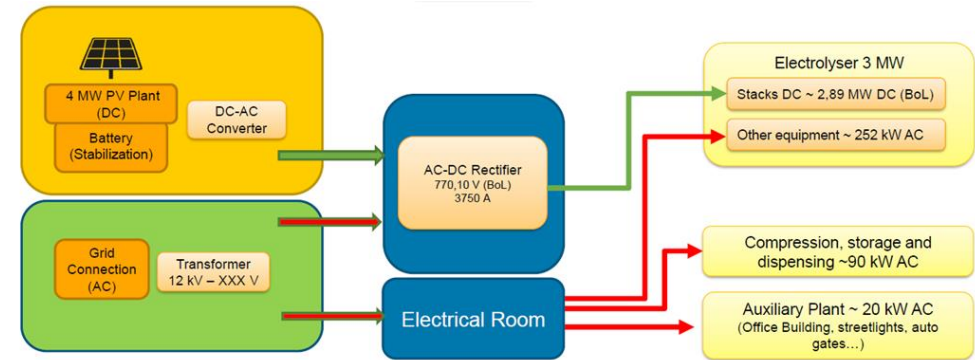


✓ Hydrogen production costs

- Plant design
- Electricity costs
- Operation modes
- Autonomous operation

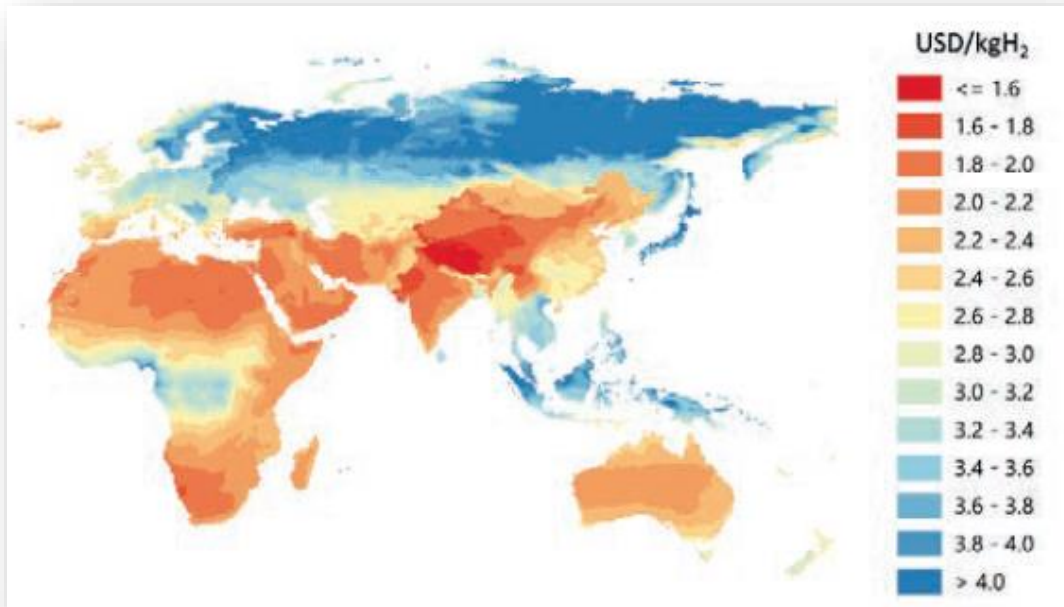
✓ System reliability

- Plant design
- Control system
- Equipment lifetime
- Appropriate maintenance



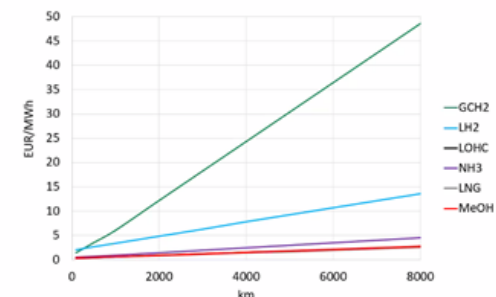


Ideas for a Japan – Spain collaboration



- ✓ Apart from renewable hydrogen that can be produced in Spain and shipped to Japan, H2B2's technology can be used worldwide, so both electrolyzers and Hydrogen Refuelling Stations

- ✓ Spain could produce green hydrogen at a competitive price (<2 USD / kg) before 2030
- ✓ To do this, demonstration projects that hybridize RES with electrolysis are essential.
- ✓ Not only electricity costs are crucial in this challenge, but also efficiency of the system.





Ideas for a Japan – Spain collaboration

H₂ production costs



- ✓ CDTI-NEDO
- ✓ EPC contractor
 - Engineering-Construction corporations, capable of investing, engineering, construction of projects – hydrogen production plants]
 - H2B2 as technology provider, supporting on engineering skills [engineering, equipment]
- ✓ Investment organization:
 - Investment on projects
 - H2B2 as technology provider, supporting on project promotion [project promotion, engineering, equipment, operation of the asset]

CDTI-NEDO online Joint Workshop on Hydrogen Technology

- Green Hydrogen Production & Mobility -



**Renewable Hydrogen Production for Mobility.
Cost reduction challenges.**

Covadonga García Gómez
Bid and Proposal Manager
H2B2 Electrolysis Technologies, SL
covadonga.garcia@h2b2.es