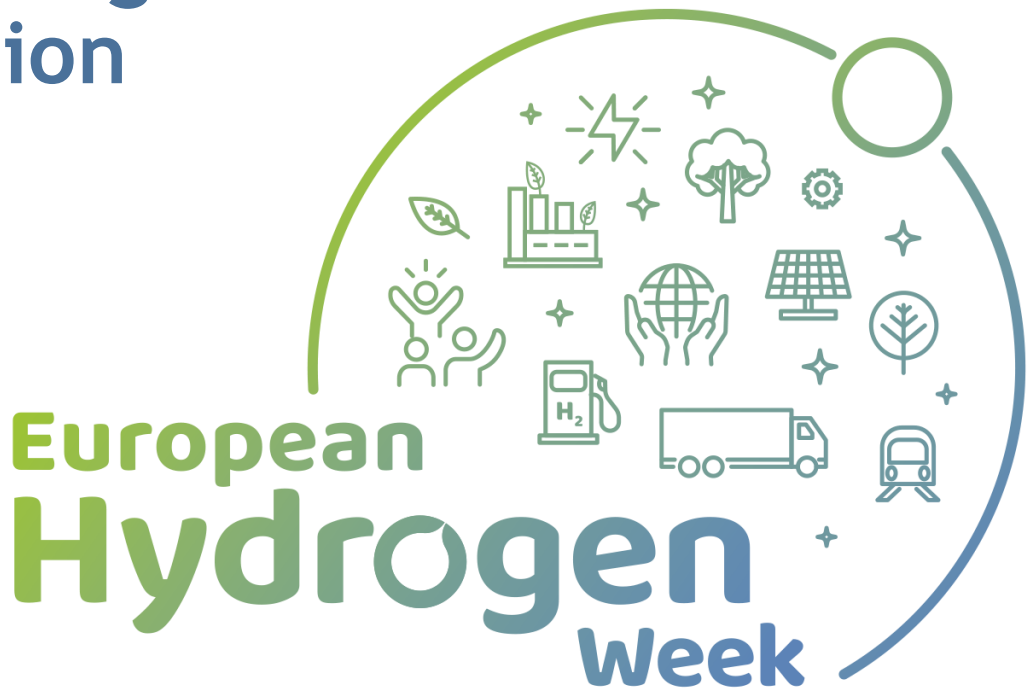
Hydrogen Storage & Distribution



Project Officers

D. Tsimis
C. Pavel
N. Lymperopoulos
A. Garcia-Hombrados

PRD parallel session on H_2 storage & distribution

2nd Dec. 16:00 - 17:20

H2 Distribution and Storage/Carriers

#PRD2021
#CleanHydrogen

European Hydrogen Week

Hydrogen Storage & Distribution activities

Enabling the creation of a logistical infrastructure of hydrogen through research on:

- Bulk Underground storage
- Aboveground hydrogen storage
- Hydrogen injection & separation from gas grid
- Hydrogen Carriers for the distribution of hydrogen

#PRD2021
#CleanHydrogen

FCH

European Commission

Bulk Underground Storage

To enable seasonal storage, as a backup and buffer, enhancing security of supply in the medium term.

4 projects

11.1 M€ funding

HyUnder COMPLETED

- Investments for caverns >500,000 m³ in brown field sites: 40-60 €/m3
- Small additional cost of 0.5 €/kg H_2

hystories Hydrogen Storage in European Subsurface

- More focused on depleted reservoirs and aquifiers
- Developing database of sites
- Cost assessment for development of each of the competing geological storage options

hypster Hydrogen Storage

- Cyclic testing of hydrogen storage in a salt cavern
- 2-3 tonnes of H_2 to be stored (1st phase)
- Etrez storage site fed by 1MW electrolyser

HEAVENN

Salt cavern 40-80 bar

HyUSPRe Hydrogen Underground Storage in Porous Reservoirs

- Technical feasibility & risk assessment for H_2 storage in porous reservoirs.
- Geochemical, microbiological, flow and transport processes in the presence of hydrogen
- Business cases identification

#PRD2021
#CleanHydrogen

FCH

European Commission

European Hydrogen Week

Aboveground Storage

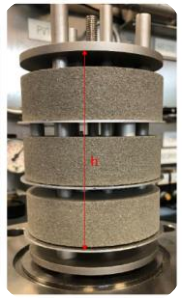
Primary focus here has been the development of metal hydride solutions

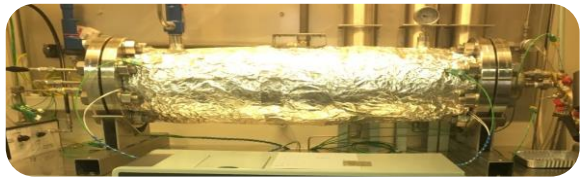
4 projects

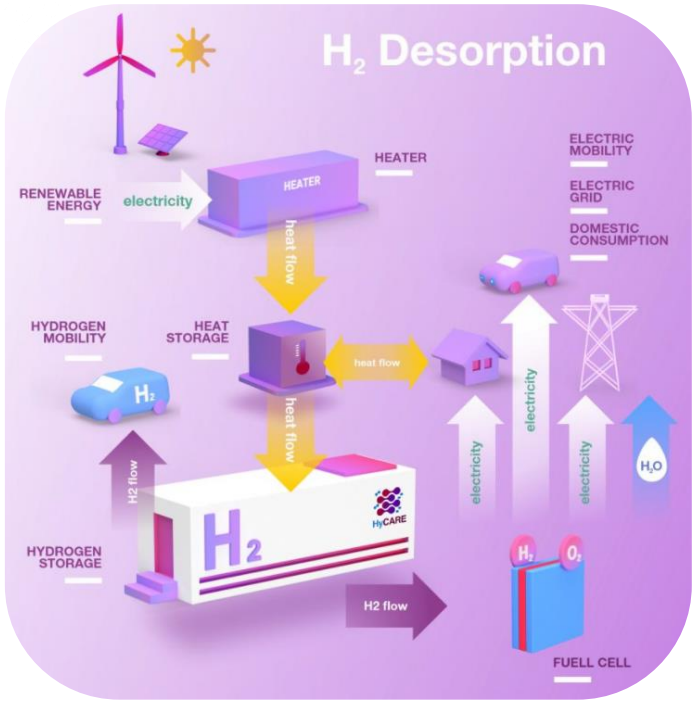
7.4 M€ funding

HyCARE

- System Capable of storing 50kg H_2
- **70%** round-trip efficiency
- Low pressure storage <50bar
- TiFe-based intermetallic alloys
- Coupled to phase change materials that store heat for the release of H_2







#PRD2021
#CleanHydrogen

FCH

European Commission

Hydrogen in the gas grid

Facilitating the formation of the backbone of a pan-European grid where the existing gas grid could be partially re-purposed

HIGGS
Hydrogen in Gas Grids

- Focuses on high pressure natural gas grid
- Development of a R&D platform for testing mixtures (20%, 100% H_2)
- Innovations needed to make the existing HPN compatible with H_2 /CH_4 admixtures

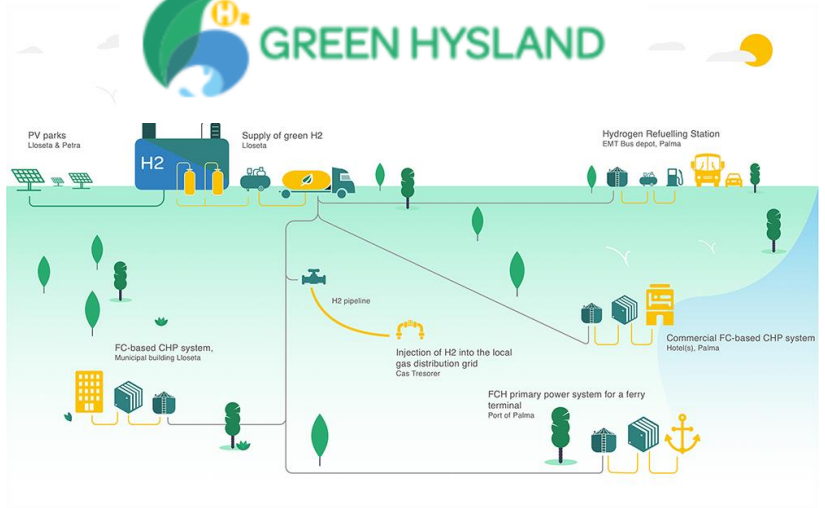
Demos

HEAVENN

HPEM2GAS

180kW PEM electrolyser and hydrogen injected into the natural gas grid

GREEN HYSLAND



Injection of H2 into the local gas distribution grid (2%), Mallorca

#PRD2021
#CleanHydrogen

FCH

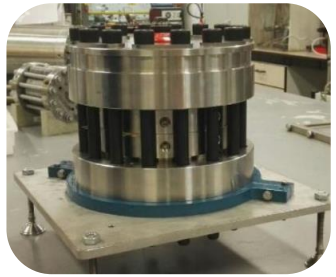
European Commission

European Hydrogen Week

Efficient separation / purification of H_2

Electrochemical separation / purification technologies showing first results

HyGrid


Focus on "low H_2 content" (e.g. 2-10 %)

Targets:
< 5 kWh/kg H_2
< 1.5 €/kg H_2
@30bar

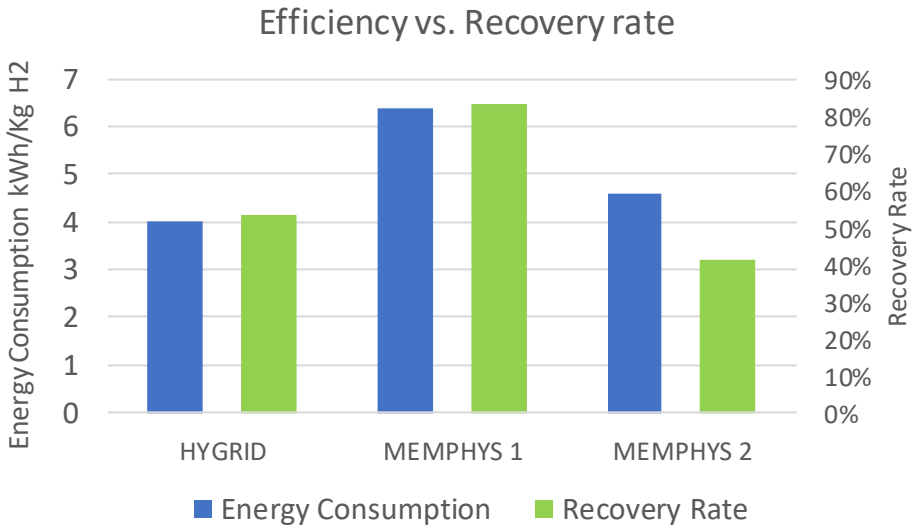
Cost of purified H_2 < 1.5 €/kg

5-25 kg H_2/day, H_2 delivery @ 200 bar

MEMPHYS

Focus on a high concentration (> 50 %) H_2

Targets: < 3 kWh/kg H_2 @ 200bar



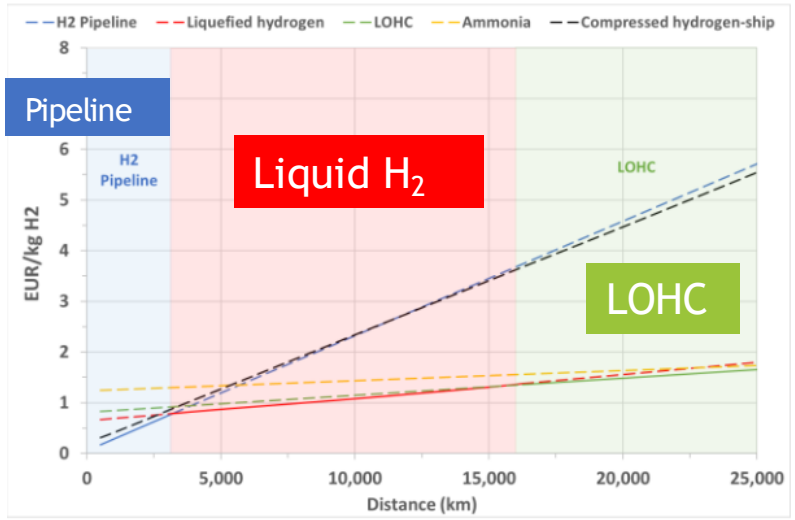
#PRD2021
#CleanHydrogen

FCH

European Commission

Hydrogen Carriers

One of the most promising solutions for the distribution of hydrogen across very long distances



*

24kg H_2/day storage

24kg H_2/day release

- Up to 5x higher transport capacity per 40-tonne truck compared to 200 bar tube trailers
- Testing for the supply of stationary fuel cell for 6 months

- Novel catalyst testing, system validation and demonstration in demo unit (>10 kW, >200h);
- Targets reduction of the system cost to 3€/kg for large scale applications.

*https://ec.europa.eu/jrc/sites/default/files/jrc124206_assessment_of_hydrogen_delivery_options.pdf

#PRD2021
#CleanHydrogen

European Hydrogen Week

Conclusions

Enabling the creation of a logistical infrastructure of hydrogen through research on:

- Underground storage gaining a prominent role in the partnership. Surge of interest from industry and academia in the last years. First demonstrations starting now.
- Aboveground storage work has mostly focused on metal hydrides, aiming at improving gravimetric density and round-trip efficiency.
- Small scale demonstrations already taking place for H_2 injection in the gas grid. Research on-going to identify risks and mitigation techniques.
- Separation/purification technologies showing first results. Still work to be done to improve energy efficiency at high recovery rates and to scale-up the technology.
- First proof-of-concepts being tested on LOHCs. On-going research to improve performance and costs.