

# HyCARE Hydrogen CArrier for Renewable Energy Storage

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RESEARCH DAYS

15-16 NOVEMBER



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# Project Overview

- Call year: **2018**
- Call topic: **FCH-02-5-2018: Hydrogen carriers for stationary storage of excess renewable energy**
- Project dates: **01.01.2019 - 31.07.2023**
- % stage of implementation 01/11/2023: **100 %**
- Total project budget: **1 999 230 €**
- Clean Hydrogen Partnership max. contribution: **1 999 230 €**
- Other financial contribution: **0 €**
- Partners: **UNIVERSITA DEGLI STUDI DI TORINO (Italy), ENGIE (France), GKN SINTER METALS ENGINEERING GMBH (Germany), TECNODELTA SRL (Italy), STÜHFF MASCHINEN- UND ANLAGENBAU GMBH (Germany), FONDAZIONE BRUNO KESSLER (Italy), HELMHOLTZ-ZENTRUM GEESTHACHT ZENTRUM FUR MATERIAL- UND KUSTENFORSCHUNG GMBH (Germany), CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (France), INSTITUTT FOR ENERGITEKNIKK (Norway)**



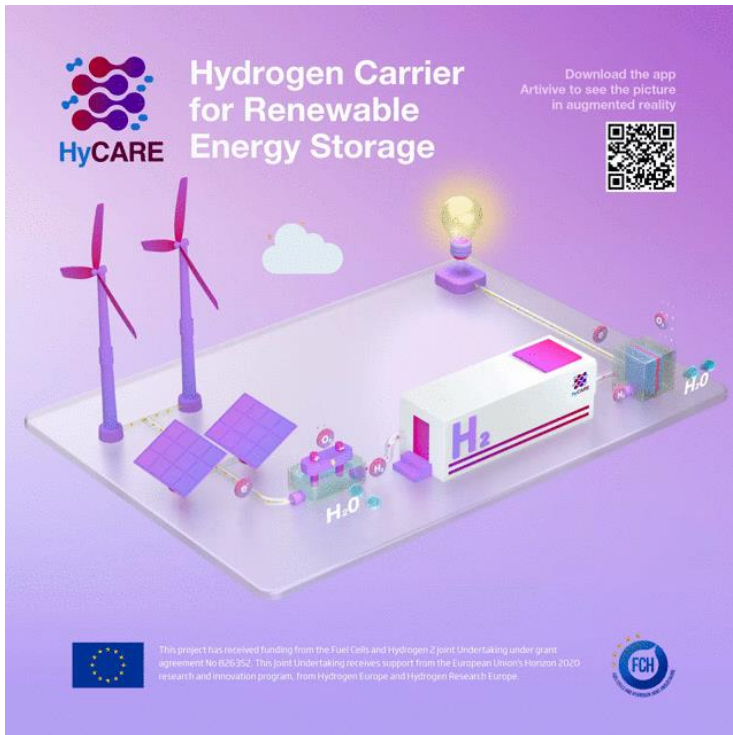
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# Project Summary



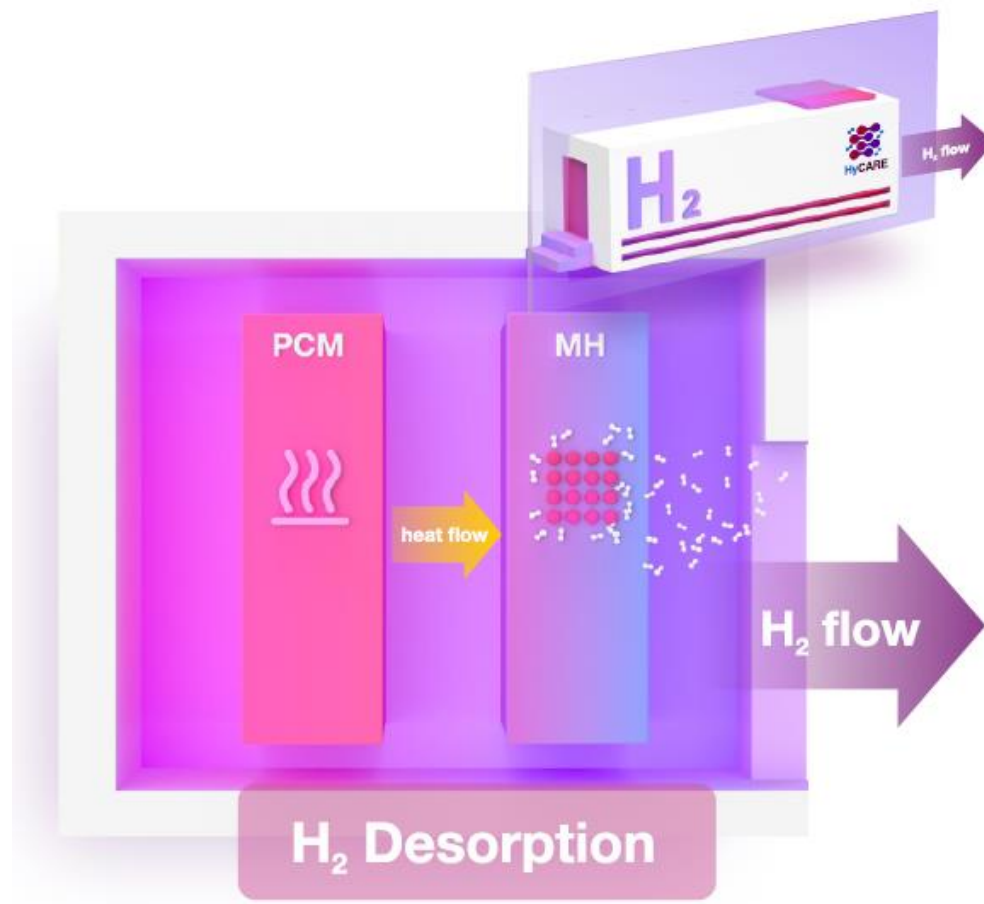
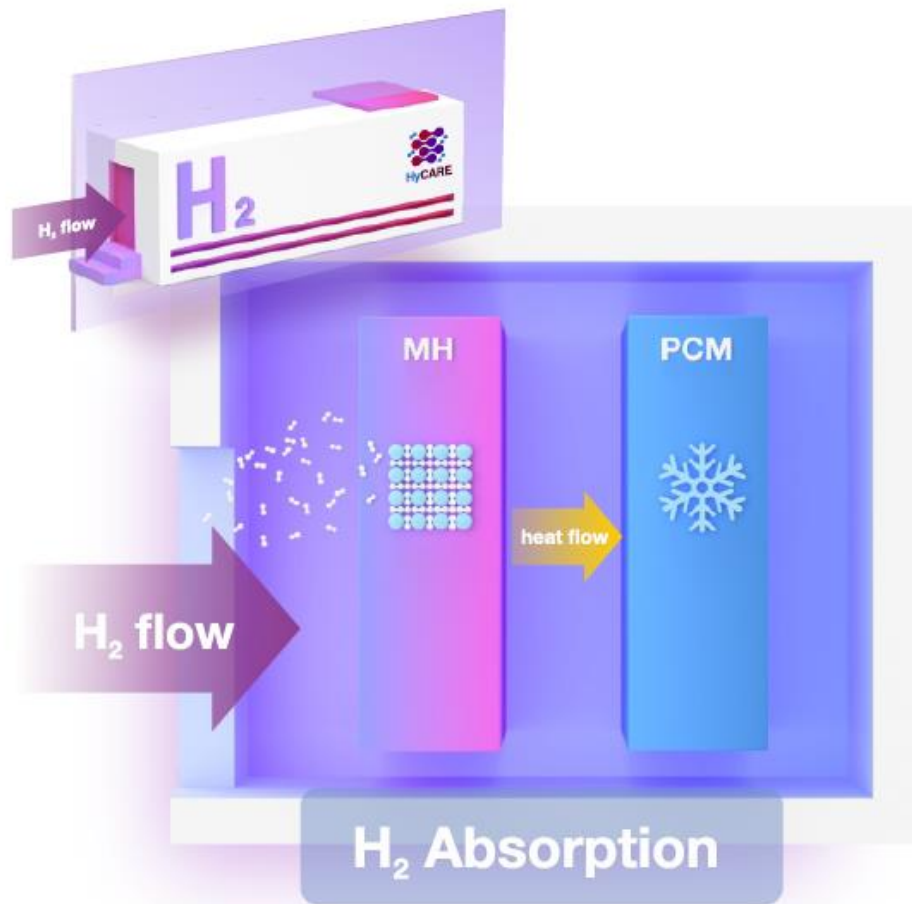
- **High quantity of stored hydrogen**  $\geq 50$  kg
- **Low pressure**  $< 50$  bar and **low temperature**  $< 100^{\circ}\text{C}$
- **Low footprint**, comparable to liquid hydrogen storage
- **Innovative design**
- **Hydrogen storage** coupled with **thermal energy storage**
- Improved **energy efficiency**
- **Integration** with an **electrolyser** (EL) and a **fuel cell** (FC)
- Demonstration in **real application**
- Improved **safety**
- **Techno-economical evaluation** of the innovative solution
- Analysis of the environmental impact via **Life Cycle Analysis** (LCA)
- Exploitation of **possible industrial applications**
- **Dissemination** of results at various levels
- **Engagement** of local people and institution in the demonstration site





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# Project Concept



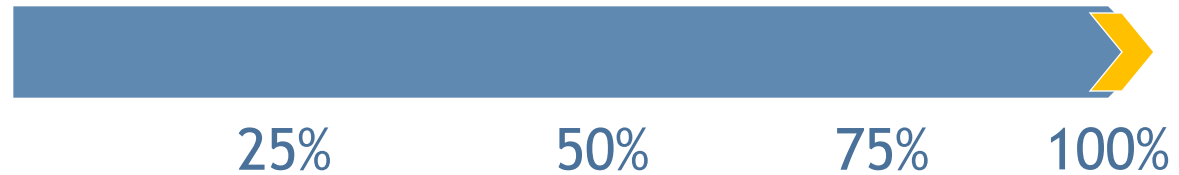
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# Project Progress/Actions

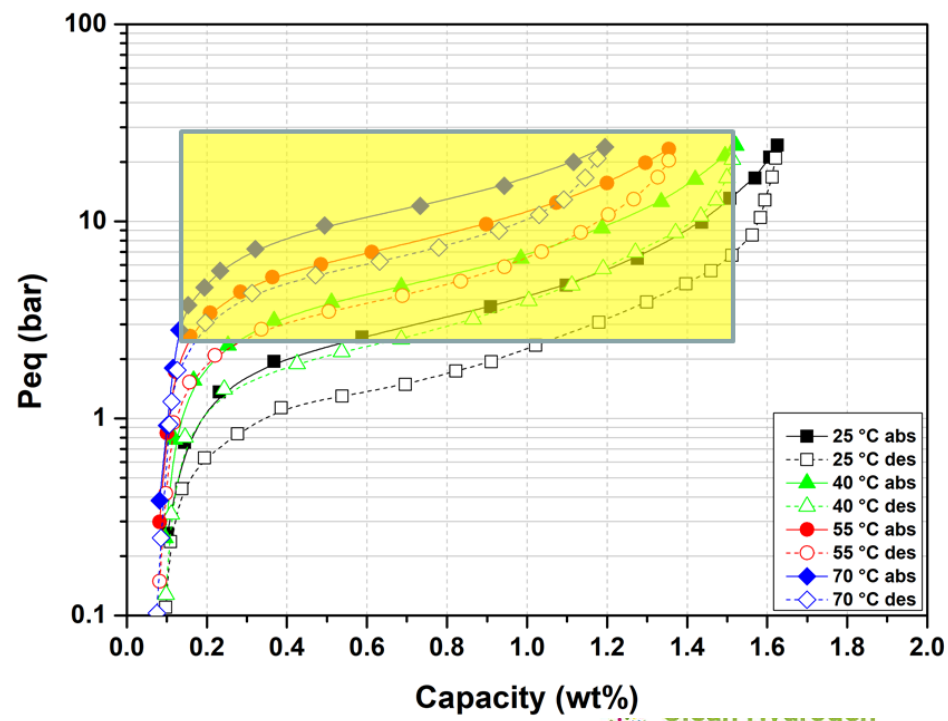
## Temperature and pressure

**Achievement to-date**

COMMERCIAL  
ALLOYS  
< 70 °C  
< 100 bar



HyCARE  
FeTi alloy  
55 °C  
25-2 bar



**Safety**  
**< 30 bar**  
**Low pressure storage**

**Safety**  
**< 70 °C**  
**Low temperature storage**

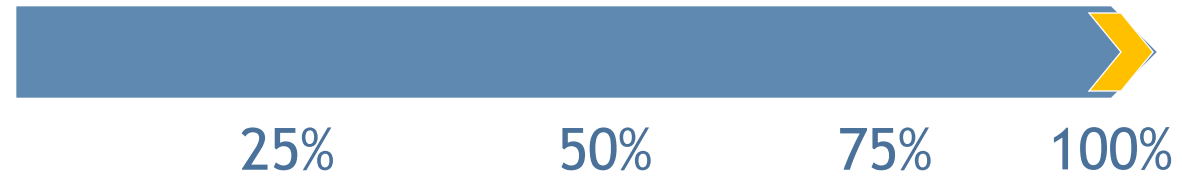


# Project Progress/Actions

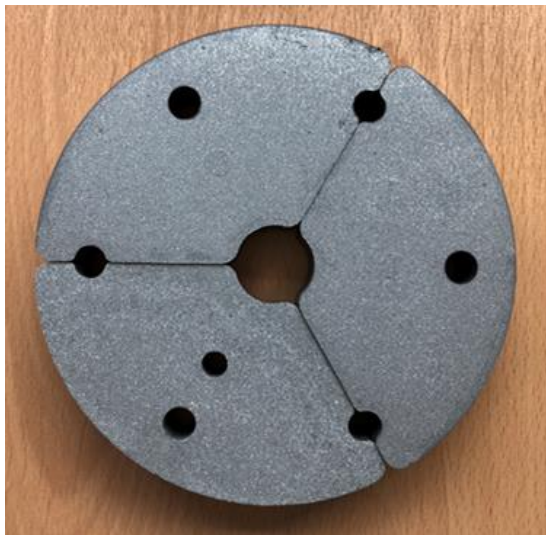
## Amount of stored hydrogen

### Achievement to-date

LAB SCALE  
COMMERCIAL  
TANKS  
< 1 kg



HyCARE  
46 kg



Quantity

**50 kgH<sub>2</sub>**

High quantity  
of stored hydrogen

# Project Progress/Actions

## Energy efficiency

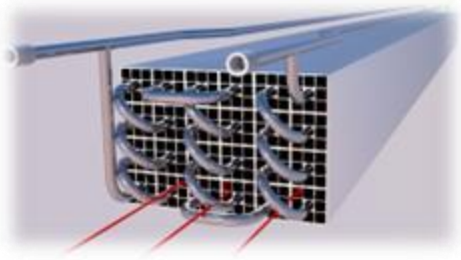
Achievement to-date

COMMERCIAL  
TANKS  
NO HEAT  
RECOVERY



25% 50% 75% 100%

HyCARE  
HEAT  
RECOVERY  
WITH PCM  
>90%



Efficiency

> 70 %

Total round trip  
energy efficiency

Environmental impact

< 5.0 kWh/kg H<sub>2</sub>

External energy source with  
innovative design  
for large scale storage and use  
of non-critical raw materials





# Project Progress/Actions

## Integration

➤ Achievement to-date

NO  
COMMERCIAL  
SYSTEMS

HyCARE  
INTEGRATED  
SYSTEM



25%

50%

75%

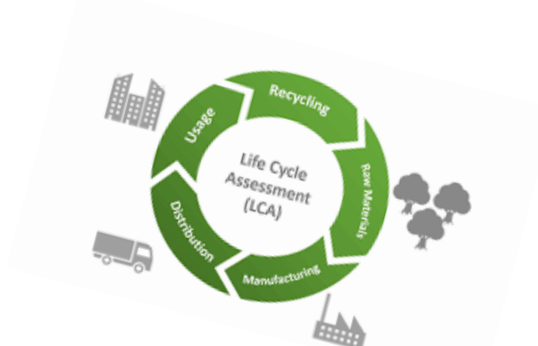
100%



HyCARE Exhibition Meeting  
Paris, April 21°, 2023

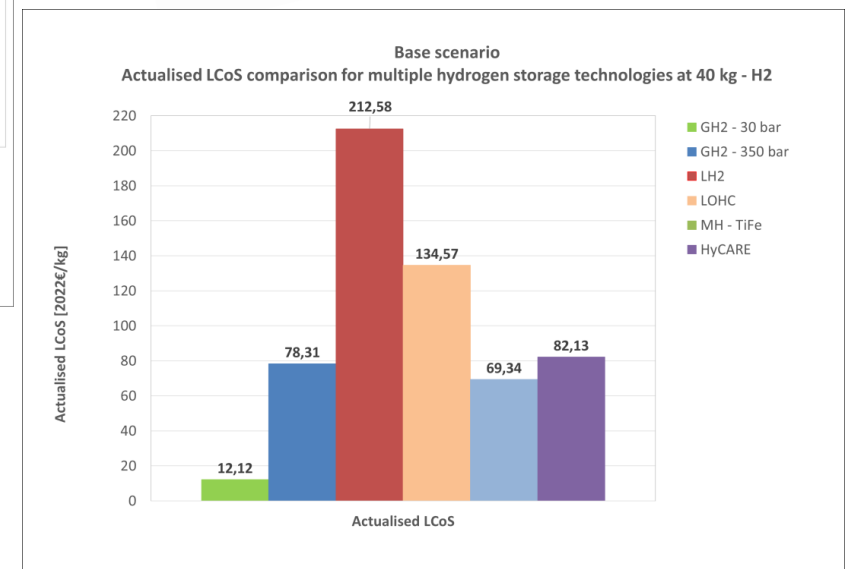
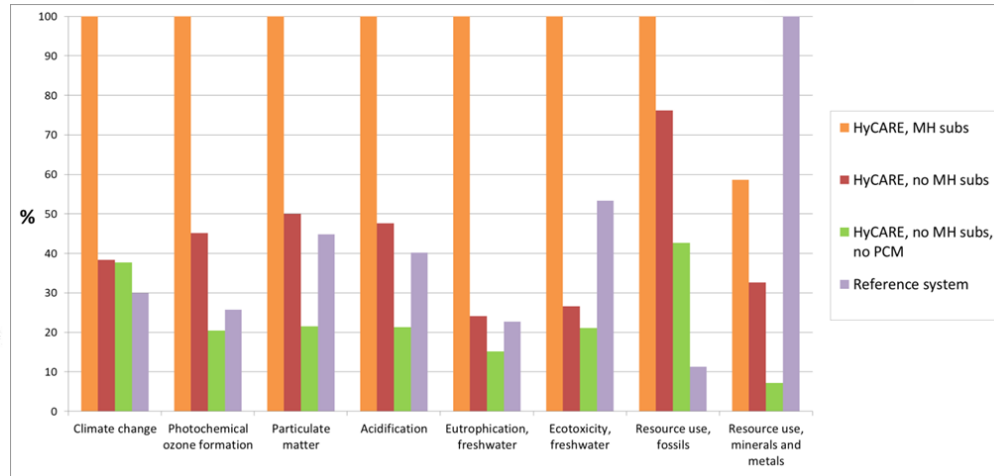
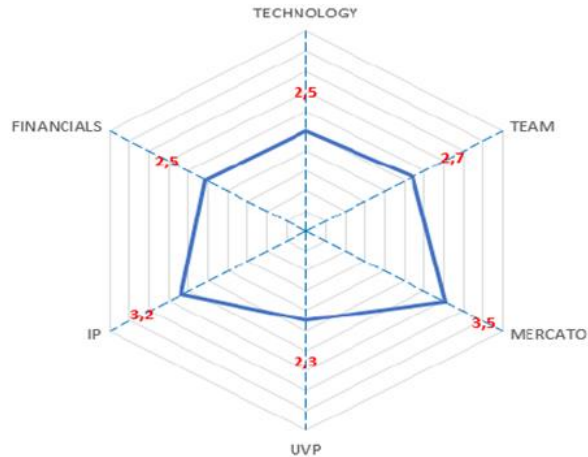


# Exploitation Plan/Expected Impact



## Exploitation

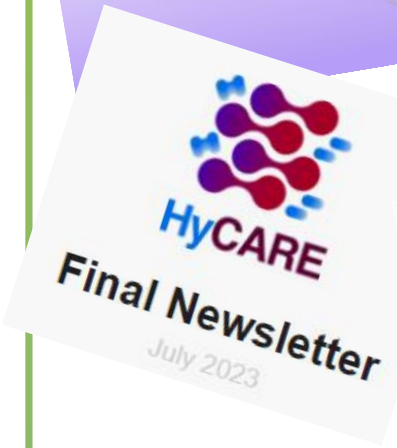
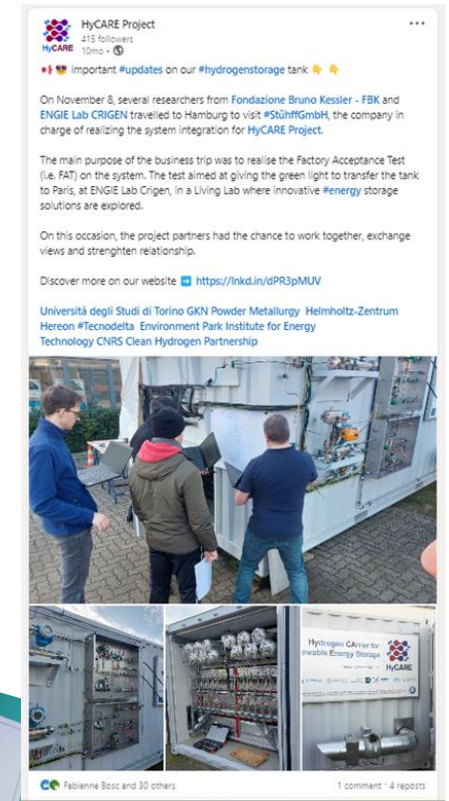
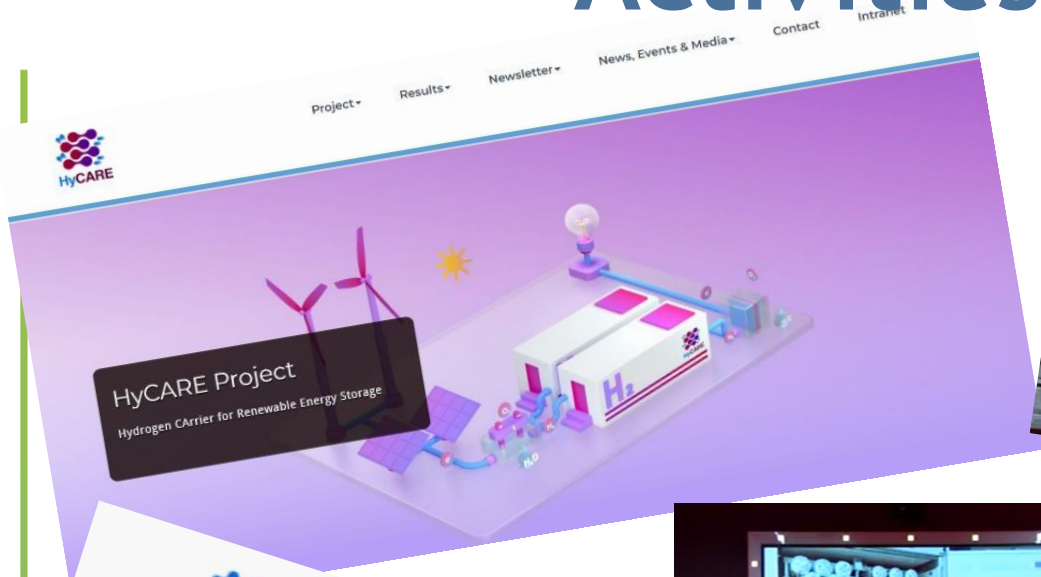
## Impact



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# Communications and Dissemination Activities



Clean Hydrogen Partnership



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