HYCARE

AN INNOVATIVE APPROACH FOR RENEWABLE ENERGY STORAGE BY A COMBINATION OF HYDROGEN CARRIERS AND HEAT STORAGE

Project ID	826352
PRR 2024	Pillar 2 – H_2 storage and distribution
Call topic	FCH-02-5-2018: Hydrogen carriers for stationary storage of excess renewable energy
Project total cost	EUR 2 024 230.00
Clean H_2 JU max. contribution	EUR 1 999 230.00
Project period	1.1.2019–31.7.2023
Coordinator	Università degli Studi di Torino, Italy
Beneficiaries	Centre national de la recherche scientifique, ENGIE, Fondazione Bruno Kessler, GKN Powder Metallurgy Engineering GmbH, Helmholtz-Zentrum Hereon GmbH, Institutt for energiteknikk, Parco Scientifico Tecnologico per l'Ambiente Environment Park Torino SpA, Stuehff GmbH (now SMasch), Tecnodelta SRL, Stühff Maschinen- und Anlagenbau GmbH

http://www.hycare-project.eu/

PROJECT AND GENERAL OBJECTIVES

The main objective of the Hycare project was to develop a prototype hydrogen storage tank using a solid-state hydrogen carrier on a large scale. The tank was based on an innovative concept combining hydrogen and heat storage to improve the energy efficiency of the whole system. The tank developed was joined with a proton exchange membrane electrolyser, as the hydrogen provider, and a proton exchange membrane fuel cell, as the hydrogen user, at the ENGIE Lab Crigen, located in Île-de-France. Hycare's integrated system was commissioned in spring 2023, and system testing and validation was performed up to October 2023.

NON-QUANTITATIVE OBJECTIVES

- **Safety.** The project aims to achieve low temperatures and pressures for storing hydrogen using carriers.
- **Energy efficiency.** The project aims to improve the energy efficiency of hydrogen storage using heat storage through phase change materials.

PROGRESS AND MAIN ACHIEVEMENTS

Those involved in the Hycare project were able to create a pilot plant with the capacity to store up to 46 kg of hydrogen at less than 50 bar and less than 100 °C in a 20 ft container. The pilot plant demonstrates that efficient energy storage by a solid-state hydrogen carrier is possible at a large scale and provides insights for further research and development and technology implementation at the societal level.

FUTURE STEPS AND PLANS

The project has finished.

The hydrogen storage tank will be available at SMasch's premises in Germany. SMasch will give potential customers and partners the opportunity to visit the Hycare hydrogen storage tank and its system, adding value to the project's results and the future development of the apparatus.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
Project's own objectives	Hydrogen storage capacity of the system	kgH_2	–	35.0 measured; 46.3 estimated		260	2021
	Cyclability	number of full cycles until a 2 % reduction in the gravimetric capacity of the H_2 carrier is reached	250	250		N/A	N/A
	Volumetric capacity of H_2 carrier	kgH_2 per unit of volume of carrier	–	Reversible capacity at 55 °C between 1 and 25 bar of less than 70 (69.3)	✓	N/A	2021
	Gravimetric capacity of H_2 carrier	wt% of H_2 in the carrier	–	Reversible capacity at 55 °C between 2 and 20 bar of 1.1		N/A	
	Maximum pressure of the H_2 carrier tank	bar	< 50	40		N/A	2021

Clean Hydrogen Partnership
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