



**HyCARE PROJECT: an innovative approach for renewable energy storage, now reality.**

***The exhibition event of this European Project took place in Paris, on April 21<sup>st</sup>, 2023, with the presentation of the project activities and the demonstration of the prototype.***

*Paris, April 21<sup>st</sup>, 2023*

The event entitled “*The HyCARE system. Opportunities and challenges of the energy storage sector*” was held in Paris, hosted by ENGIE Lab Crigen in cooperation with CNRS, to show the main results of activities carried out during the HyCARE Project, supported by the Clean Hydrogen Partnership, and coordinated by the University of Turin.

Hydrogen is considered as an energy carrier for the storage of excess renewables. Funded under the Horizon 2020 program, the HyCARE project made possible to develop a hydrogen storage tank with the use of a solid-state hydrogen carriers in large scale. With its innovative concept, the tank links hydrogen and heat storage for stationary applications. Therefore, it improves energy efficiency of the process and reduces the footprint of the whole system. Linked to a 55 kW Proton Exchange Membrane (PEM) electrolyser as hydrogen provider and a 20 kW PEM fuel cell as hydrogen user, 40 kg hydrogen stored in the metal hydride hydrogen storage system, the innovative HyCARE system has been installed at the site of ENGIE Lab CRIGEN, a research and operational expertise centre dedicated to gas, new energy sources and emerging technologies.

The event, organized by the University of Turin in cooperation with ENGIE Lab CRIGEN and the French National Center for Scientific Research (CNRS), was open to all project partners and stakeholders.

The Project Consortium is composed by five highly-skilled research institutes, two SMEs and two large corporations in the energy sector. The University of Turin (Italy), Fondazione Bruno Kessler



through the Centre for Sustainable Energy (Italy), Helmholtz-Zentrum hereon GmbH (Germany), IFE - Institute for Energy Technology (Norway), and the CNRS (France) provided high-level knowledge and expertise in the development and characterization of metal hydrides for H<sub>2</sub> storage, structural, chemical and thermo-fluido-dynamic characterization, system modelling, design, construction and testing. GKN Hydrogen - a spin-off of GKN Sinter Metals Engineering GMBH (Germany), Tecnodelta Impianti Srl (Italy), and Stühff Maschinen- und Anlagenbau GmbH (Germany) provided the key components of the HyCARE system. GKN supplied the metal-hydride pellets for hydrogen storage, while the heat recovery system with Phase Change Materials was the work of Tecnodelta. The metal hydride storage system (in accordance with European standards), together with plant, instrumentation and control technology, including automation, was installed together with the heat recovery system in compliance with the highest safety requirements in a 20 ft container by Stühff Maschinen- und Anlagenbau. The innovative HyCARE demonstrator was brought to the premises of ENGIE Lab CRIGEN (France) for activation and commissioning. Initial tests have been already carried out with the HyCARE system.

The stakeholder's participation was fundamental, and representatives of well-known hydrogen associations such as the International Energy Agency, the French Federation of Hydrogen Energy, the French National Centre for Scientific Research and its Task Force on Energy have been invited to a roundtable to discuss on the latest trends and developments in the hydrogen and energy sector. COSMHYC, SHERLOHCK and HyPSTER are three projects funded by the Clean Hydrogen Partnership and working on similar topics, that have been invited to be presented and foster a discussion on the state of art of the various hydrogen storage technologies.

The initiative met high interest, registering more than 40 in-person participants, from research, business and public administration.

The proceedings were opened by HyCARE Coordinator, Marcello Baricco, Professor at the Department of Chemistry and NIS at the University of Turin, and from the hosting organisation ENGIE Lab Crigen.

After the presentation of the project and its relevance in the field of energy storage, there was a presentation of the project activities, with the participation of Fermin Cuevas (Director of Research at CNRS, head of the Interaction of Hydrogen and Matter group at ICMPE/CNRS), Mirko Ante (Hydrogen Advanced Technology Engineer at GKN Hydrogen GmbH), Carlo Luetto (CEO of Tecnodelta), Holger H. Stühff (CEO at Stühff Maschinen- und Anlagenbau GmbH), Jose M. Bellosta von Colbe (Senior scientist at Hereon), Quentin Nouvelot (Deputy Head of H<sub>2</sub> Lab, ENGIE), Matteo Testi (Head of Hydrogen Technologies Area at the Centre for Sustainable Energy of FBK), Stefano Deledda (Senior Researcher at IFE) and Marianna Franchino (Sustainability Manager at Environment Park S.p.A.).

The presentations outlined the process for testing and tailoring the hydrogen carrier as well as those related to the production and processing. Heat management was also a fundamental topic, together with the description of the design and building of the tank, the system integration, its commissioning, and validation. Finally, the techno-economic analysis was explained together with a short overview of exploitation and dissemination activities implemented.

Following the Partners' presentations, the second section of the event consisted in two main parts. In the first part, the three EU projects COSMHYC, SHERLOHCK and HyPSTER presented their activities.

David Colomar - from the European Institute for Energy Research and Coordinator of COSMHYC- explained the evolution of the initial idea into a series of three projects, based on the technologies for optimal combination of mechanical and metal hydride compression. The first project developed and tested the first

COSMHYC prototype in an environment simulating a hydrogen refuelling station. It was then followed by a scale-up of the COSMHYC compression solution for extra-large scale hydrogen refuelling stations and finally by its demonstration in a public hydrogen refuelling station in Tours, France. The objective is to demonstrate the reliability, efficiency, and low noise level of the COSMHYC compression solution in real-life conditions, as well as to reduce the costs of the compression and related costs of hydrogen refuelling.

The second project, SHERLOHCK, was presented by its Coordinator, Vincent Faucheux from CEA Grenoble, who described the material to system approach used to obtain an innovative, cost-efficient and sustainable catalytic solution for LOHC technology with improved energy efficiency. The Liquid Organic Hydrogen Carrier technology absorbs and releases hydrogen through chemical reactions. The project focuses on improving the catalyst system for LOHC and its validation in a demo unit (>10 kW, >200 hours).

Finally, Murielle Grange – from Storengy and Coordinator of HyPSTER project – outlined the importance of hydrogen underground storage facilities, which can act as an intermediary between intermittent production and variable hydrogen demand, allowing hydrogen technologies to be implemented at a European scale. The project aims to demonstrate the technical feasibility of underground hydrogen storage in terms of safety and environmental impact, and to determine the cost of hydrogen storage, the place of underground storage in the hydrogen value chain and the quality level of hydrogen after extraction from a salt cavern, located between 500 and 1.500 meters below our feet.

The three presentations gave an overview of applications in the sector but also how the research is looking at the topic from different angles.

The second part was more interactive and consisted in a Stakeholder Roundtable moderated by HyCARE Coordinator, Marcello Baricco, with Patricia De Rango - Member of Task 40 of Hydrogen Technology Collaboration Programme (Hydrogen TCP) within the International Energy Agency, Olivier Joubert - director of the French Federation of Hydrogen Energy FRH2, Abdelilah Slaoui - director of the CNRS Task Force on Energy and co-director of the PEPRH2, Pierre Roy, Director of European Strategic Collaborative Program, Enterprise relationships Directorate at CNRS. The discussion focused on the big challenges of hydrogen storage in the future.

The event wrapped up with the visit to the demonstrator guided by Jose M. Bellosta von Colbe - expert on metal hydrides from Hereon, who explained the functioning and components in the container, followed by the visit to the laboratories of ENGIE Lab CRIGEN guided by Reda Bellahcene and Olivier Lefranc, from ENGIE.

*"It has been a great challenge" - says prof. Marcello Baricco, of the University of Turin and project coordinator - "but we are now happy to demonstrate the use of hydrogen as an energy carrier. The theoretical studies on metal hydrides, performed in last years in European laboratories, find now a real application at a large scale. The combination of Metal Hydrides with Phase Change Materials for the thermal management of a hydrogen storage system was claimed since a while, but now it is a reality. We really thank the Clean Hydrogen Partnership for the financial support to the project. All partners have worked together with professionalism and enthusiasm, allowing to reach the final goal of the HyCARE project."*

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## Reference Links:

HyCARE Project - <https://hycare-project.eu/>  
University of Turin - <https://en.unito.it/>  
ENGIE Lab CRIGEN - <https://www.engie.com/en/innovation-transition-energetique/centres-de-recherche/crigen>  
The French National Center for Scientific Research - <https://www.cnrs.fr/en>  
Fondazione Bruno Kessler, FBK - <https://www.fbk.eu/en/about-fbk/>  
Centre for Sustainable Energy at FBK - <https://energy.fbk.eu/>  
Helmholtz-Zentrum hereon GmbH - <https://www.hereon.de/index.php.en>  
IFE - Institute for Energy Technology - <https://ife.no/en/front-page/>  
GKN Sinter Metals Engineering GMBH / GKN Hydrogen GmbH - <https://www.gknhydrogen.com>  
Tecnodelta Impianti Srl - <http://www.tecnodeltaimpianti.com/main.php?l=en>  
Stühff Maschinen- und Anlagenbau GmbH - <https://www.stuehff-gmbh.de/eng/>  
International Energy Agency - <https://www.ieahydrogen.org/>  
Task 40 of Hydrogen Technology Collaboration Programme (Hydrogen TCP) within the International Energy Agency - <https://www.ieahydrogen.org/>  
French Federation of Hydrogen Energy - <https://frh2.cnrs.fr/>  
CNRS Task Force on Energy PEPRH2 - <https://www.celluleenergie.cnrs.fr/pepr/>  
COSMHYC project - <https://cosmhyc.eu/>  
SHERLOHCK project - <https://sherlohck.eu/>  
HYPSTER project - <https://hypster-project.eu/>  
The European Institute for Energy Research - <https://www.eifer.kit.edu/>  
CEA Grenoble - <https://www.cea.fr/Pages/le-cea/les-centres-cea/grenoble.aspx>  
Storengy - <https://www.storengy.com/en>



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