HYSTORIES

HYDROGEN STORAGE IN EUROPEAN SUBSURFACE

Project ID	101007176
PRR 2024	Pillar 2 – H_2 storage and distribution
Call topic	FCH-02-5-2020: Underground storage of renewable hydrogen in depleted gas fields and other geological stores
Project total cost	EUR 2 499 911.75
Clean H_2 JU max. contribution	EUR 2 499 911.75
Project period	1.1.2021–30.6.2023
Coordinator	Geostock SAS, France
Beneficiaries	Consejo Superior de Investigaciones Científicas, Bureau de Recherches Geologiques et Minieres, Česká geologická služba, Réseau d'excellence européen sur le stockage géologique de CO_2, Ethniko Kentro Erevnas Kai Technologikis Anaptyxis, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Geoinženiring družba za geološki inženiring d.o.o., Geological Survey of Denmark and Greenland, Geologische Bundesanstalt, Geosphere Austria – Bundesanstalt für Geologie, Geophysik, Klimatologie und Meteorologie, Główny Instytut Górnictwa, Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum GFZ, Institut royal des Sciences naturelles de Belgique, Instituto Geológico y Minero de España, Institutul Național de Cercetare – Dezvoltare pentru Geologie și Geoecologie Marin –GeoEcoMar, Instytut Gospodarki Surowcami Mineralnymi i Energia PAN, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Ludwig-Bölkow-Systemtechnik GmbH, Micropro GmbH, Middle East Technical University, Montanuniversität Leoben, NORCE Norwegian Research Centre AS, Sveučilište u Zagrebu Rudarsko-geološko-naftni fakultet, Tallinna Tehnikaülikool, UK Research and Innovation, Universidade De Évora

https://hystories.eu/

PROJECT AND GENERAL OBJECTIVES

The Hystories project, explored underground hydrogen storage in Europe from 1 January 2021 to 30 June 2023. Led by Geostock, it involved key partners across Europe and gathered geological data from 23 countries. The project focused on salt caverns and porous media (depleted liquid or gaseous hydrocarbon reservoirs, saline aquifers).

The current industrial experience of pure hydrogen storage is limited, with only a few projects in Europe and the United States. While the storage of town gas (a mixture containing hydrogen) in porous media has a historical precedent, the storage of pure hydrogen presents new challenges, particularly due to Hydrogen's reactivity, its ability to embrittle steels and its low viscosity and volumetric energy density.

The main objectives of the Hystories project were to bring technical developments to large-scale renewable hydrogen storage in depleted fields or aquifers and to assess how underground hydrogen storage could facilitate the transition to a CO_2-emission-neutral energy system in the EU by 2050.

PROGRESS AND MAIN ACHIEVEMENTS

The project identified potential underground hydrogen storage sites in porous media and estimated their total hydrogen storage capacity at 6 850 TWh (19 000 TWh including offshore sites) in the EU and neighbouring countries.

A risk analysis method associated with microbial activity in future underground hydrogen storage was proposed, and hydrogen consumption was modelled. The results showed hydrogen consumption of 0.06 % at the laboratory scale and 0.004 % at the storage scale after five seasonal hydrogen injection and withdrawal cycles. A dozen common steel grades for oil tubing were tested in the presence of hydrogen, and recommendations were issued on the type of steel to be used in storage.

In conclusion, underground hydrogen storage has significant potential to contribute to the decarbonisation of energy networks and societies, especially in Europe. Storage in salt caverns is considered technically mature. No major technical impediments of storage in depleted fields or aquifers were identified, although questions remain regarding the quality of the gas released and the potential costs of treatment required to enable its reinjection into hydrogen distribution networks. The project also highlighted the importance of the regulatory framework and business models for the deployment of storage sites, and the need for further investigation into cost estimation and the role of underground hydrogen storage in the energy value chain.

FUTURE STEPS AND PLANS

The project has finished.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
MAWP addendum (2018–2020)	Large-scale H_2 storage / capital cost	€/kg	0.6	0.017 (salt); 0.011 (porous)	✓
	Energy used in large-scale H_2 storage / release	MWh/kg	9.3	1.7 (salt); 2.5 (porous)	
	Large-scale H_2 storage / chain efficiency	%	72	95 (salt); 92.5 (porous)	

Clean Hydrogen Partnership
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