

UNDERGROUND HYDROGEN STORAGE IN ITALY

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Hydrogen is largely recognised as one of the main alternatives to fossil fuels because it does not emit any carbon dioxide when used. It is therefore an important part of the solution to meet the 2050 climate neutrality goal of the European Green Deal.

Since hydrogen does not exist in nature in its pure state, it has to be separated from chemical compounds, by electrolysis from water or by chemical processes from hydrocarbons or other hydrogen carriers, through energy-consuming processes.

The overall efforts are moving toward the “green” hydrogen, produced from water by electrolysers powered by renewable energies, which do not produce carbon emissions but are subjected to intermittent, and seasonal and geographically constraints. For this reason and in the perspective of an increase in green H₂ production, underground hydrogen storage assumes a strategic importance.

There are cases of pure hydrogen underground storage in salt caverns in Europe (e.g. in Teeside, UK since 1972), but no examples of industrial pure hydrogen storage in depleted hydrocarbon fields or aquifers, which could allow a potential larger storage capacity compared to salt caverns.

The EU H2020 Hystories “Hydrogen Storage in European Subsurface” project aims at studying the potentialities of pure hydrogen underground storage in depleted hydrocarbon fields and aquifers in Europe, by identifying the suitable sites and providing subsurface technical and economic feasibility studies.

The know-how from the underground natural gas and CO₂ geological storage is a starting point to define guidelines for hydrogen storage, i.e. to set the geological characteristics of the caprock-reservoir system. Nevertheless, the specific characteristics of the H₂ molecule require an in-depth study, because of the high capacity of H₂ to create chemical bonds and to feed the microbial activity inside the reservoir, which could lead to an alteration of pure H₂ and/or to hydrogen-consuming processes (e.g. Heinemann *et al.*, 2021).

The National Institute of Oceanography and Applied Geophysics-OGS is the only Italian research partner involved in the Hystories project, as Third Party through CO₂GeoNet. In the frame of the project, OGS identified several sites potentially suitable for hydrogen storage in the Italian subsoil both on- and offshore, in aquifers and in depleted hydrocarbon fields, which will be briefly presented and discussed. We also performed a more detailed, site-specific study of an onshore site in north-eastern Italy, which consists in a petrophysical characterization of the potential hydrogen storage reservoir by using the available geophysical dataset and theoretical models.

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