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A new infrastructure to characterize Underground Hydrogen Storage and White Hydrogen sites

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Green hydrogen is one of the solutions in the European energy transition strategy towards Net Zero, despite the high production costs and associated risks.

Underground hydrogen storage (UHS) can help mitigate energy security issues related to hydrogen production in foreign countries and seasonality of green hydrogen production from renewable wind and solar sources. UHS requires in-depth knowledge of the subsurface and long-term monitoring to minimise the risks associated with hydrogen storage.

Here, we present FUSE (Open Infrastructure on Future Underground Hydrogen Storage), a partnership between OGS, the University of Trieste and the University of Udine, and funded by the Friuli Venezia Giulia Region (NE Italy). The project aims to create an open, integrated and distributed infrastructure designed to link academia and industry for the investigation, characterisation, and de-risking of potential UHS sites and accelerate white hydrogen exploration.

Within the project we will integrate geophysical instrumentation with advanced laboratory facilities and multi-scale numerical modelling to characterize reservoir/caprock systems and assess potential hazards related to hydrogen injection, storage and extraction. The infrastructure includes:

- The acquisition of high-resolution imaging and monitoring equipment including borehole logging systems, seismic and geoelectric arrays, and optical DAS cable for monitoring purposes. This will enable both the characterisation of potential UHS sites and the continuous observation of pressure-induced changes and fluid migration patterns within the reservoir once hydrogen storage begins.
- The development of multi-platform remote sensing capabilities through the acquisition of airborne and drone-based magnetic and gravity systems to map subsurface heterogeneities and structural discontinuities.

- The enhancement of experimental petrophysical and fluid-dynamics laboratories to define hydrogen–rock–fluid interactions and processes. These facilities are essential to quantify the petrophysical properties affecting hydrogen containment and recovery and fluid migration within the reservoir/caprock system.
- The integration of predictive modelling software suites to derisk site selection and quantify fluid-dynamic processes in the subsurface.

Furthermore, FUSE aims to provide new tools to support the emerging exploration of natural (white) hydrogen. Overall, FUSE will boost opportunities for research and industry realms in the identification of potential UHS sites and help de-risk future efforts aimed at initiating large scale hydrogen storage.