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Underground Hydrogen Storage – Current Developments and Opportunities

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Summary

The overall objective of the research project H2STORE was to build practical experience on a laboratory scale on biochemical and geochemical processes with different hydrogen/natural gas mixtures. All tests were run on different reservoir rocks of various, German reservoirs. The research project HyINTEGER focused more on the interaction of the different reservoir rocks with the wellbore cement and the casing.

The transformation of the European energy market requires new options for the energy supply of the future. This includes methods for a sustainable and large-scale energy storage. Two innovative future technologies, firstly the adiabatic methane conversion of natural gas into hydrogen and secondly the electrolysis of electricity into hydrogen, could enable the future use of the gas-infrastructure and the underground-gas-storages (UGS).

Currently only limited experience is globally existing in the underground storage of hydrogen in porous rock storages with one site in Argentina and the other site in Austria.

Therefore, a high demand is existing for a responsible underground gas storage operator to adjust to the global changes.

Due to this situation Uniper participated in various, international research projects like H2STORE or HyINTEGER covering extensive laboratory tests with reservoir rocks under hydrogen conditions. Uniper performed also various internal studies and tests to further extend the understanding of specific storage sites.

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The research projects as well as the internal studies showed that the biochemical and geochemical subsurface processes are mostly dependent on the salinity of the water as well as the temperature of the reservoir rock. The laboratory experiments showed also that even under perfect conditions the biochemical and geochemical processes are extremely hard to stimulate

In addition, Uniper holds also experience from the early 1970ies on the underground storage of town-gas, which is up to 60% hydrogen. No incidents were reported from that time.
All results combined show the general feasibility of underground hydrogen storages (UHS). Therefore, now the opportunity is existing to increase the scale and test as a subsurface application the underground hydrogen storage in a porous reservoir.
The results of this subsurface application will also support as a reference case the future development of technical standards and regulatory frameworks for the injection of hydrogen into the gas-infrastructure.

An industry application for an underground hydrogen storage is therefore a very innovative and essential preparation for the transformation of the German and the European gas-infrastructure and underground-gas-storages. The results will help the future decisions on cost scenarios for hydrogen developments and operational schemes as well as the asset integrity.