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Hydrogen Storage
Integration of Salt Cavern Storage

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THYSSEN VERMÖGENSVERWALTUNG
GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG

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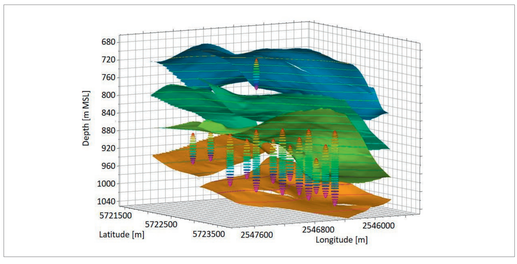
Objective

To balance a volatile hydrogen production and a largely constant demand, a hydrogen storage system is required. For large-scale applications, underground storages such as solution mined salt caverns provide sufficient capacity. As the Lower Rhine region is known for its rock salt deposits, a solution has been developed to provide storage capacities specially tailored to the needs for chemical conversion processes.

Strategy
Geological, technical and commercial feasibility

At first the geological boundary conditions have been investigated based on historical data and the geological potential for cavern development was quantified. In the next step various technical options were developed with the aim to maximize the exploitation of the geological potential and to adjust the timeline of storage deployment to the customers needs. Finally, an economical assessment was carried out focussing on costs for erection and operation as well as storage revenues.



Exemplary positions and dimensions of potential caverns (boundaries) in the upper and lower Werra salt (vertical axis stretched by factor 5).

Solution process
Development and evaluation of options

The development of the technical options started with the design of potential storage wells depending on the local stratigraphy and with the placement of the starting points for drilling on the surface. Furthermore, the cavern leaching process was developed with emphasis on the quick creation of cavity volumes. The options for brine disposal were identified and the technology for leaching under hydrogen was developed to accelerate storage provision.

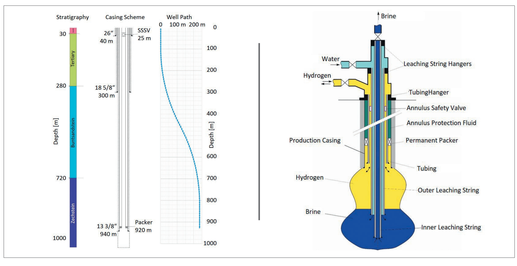
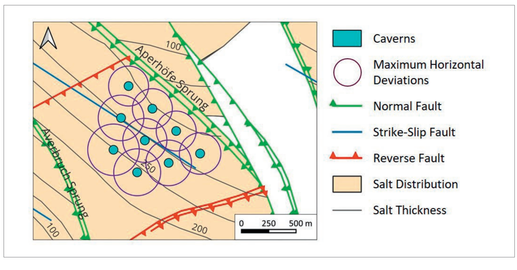


Illustration of stratigraphy, casing scheme and well path for an exemplary well (left) and schematic of equipment and process for leaching under hydrogen (right).

Results
Success subject to significant uncertainties

In all three evaluation steps the feasibility of the development of a salt cavern hydrogen storage was shown. However, significant uncertainties remain regarding suitability of the salt formation, the accessibility of the caverns with directional drilling and the quantitative development of the hydrogen market. These should be included in the scope of further research to unlock investments in large-scale hydrogen storage.



Exemplary positioning of caverns in the investigated salt formation and maximal horizontal deviations of the cavern wells with directional drilling.

A KEY BUILDING BLOCK FOR THE CLIMATE PROTECTION

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