

Hydrogen UnderGround (HUG)

Timo J. Hietava, Taina H. Karvonen, Geological Survey of Finland

Jonna A. Poikolainen, Sweco Finland Oy

Summary

Hydrogen underground (HUG) is a hydrogen storage research project in Finland aiming towards establishing geological parameters for a Lined Rock Cavern (LRC) concept. As the search for low-carbon technologies has progressed in recent years, the emergence of the hydrogen economy is gaining momentum in Finland and elsewhere in Europe. The storage of hydrogen is one of the main questions within the Finnish hydrogen framework yet to be solved. As Finland does not have suitable geological formations for larger scale hydrogen storage such as in e.g. Europe, the Lined Rock Cavern concept would be the only practical solution for a hydrogen storage concept within the hard crystalline geological setting in Finland. HUG has six workpackages including e.g. economical, technical and safety related topics, but in this abstract the focus is on the geological aspects.

Method

The goal of geological part of the project is to provide geological, rock mechanical, geochemical and other related parameters to establish boundary conditions for planning and designing working parameters to excavate a site with a demonstrated capability of storing large volumes of hydrogen, generated with renewable technologies such as wind power and possibly solar power.

The project will discuss the LRC concept from different perspectives from site selection principles (lineament and bedrock block analysis) to outcrop mapping and geological data collection on site. Data acquisition methodologies such as core drilling, geophysical/petrophysical measurements, hydrological and hydrogeological measurements, rock mechanical parameters with rock stress conditions, geochemical data with reactivity of H₂ in bedrock will be discussed during the project.

Also, other factors such as risks related to gas leakage, uplift failure, hydrogen embrittlement and cavern stability will be analyzed. Cavern rock engineering features such as dimensions and shape, shaft and access tunnel design and initial cost estimations will be discussed.

As the storage facility would have cyclic loading conditions with fluctuating amounts of H₂ in the system, monitoring activities to estimate temperature conditions and pressure control would need to be established. The developed guidelines for rock engineering design and safe construction, operation and monitoring will all be based on detailed geological, hydrogeological and geomechanical site investigations and modelling.

Results

The results of this project will be the different geological data sets that will be used in geological characterization of the LRC site. These will be combined with other necessary design parameters to gain better understanding of the feasibility of an LRC site and the concept in general. The results will also provide supporting evidence for socioeconomic issues related to hydrogen storage strategies.

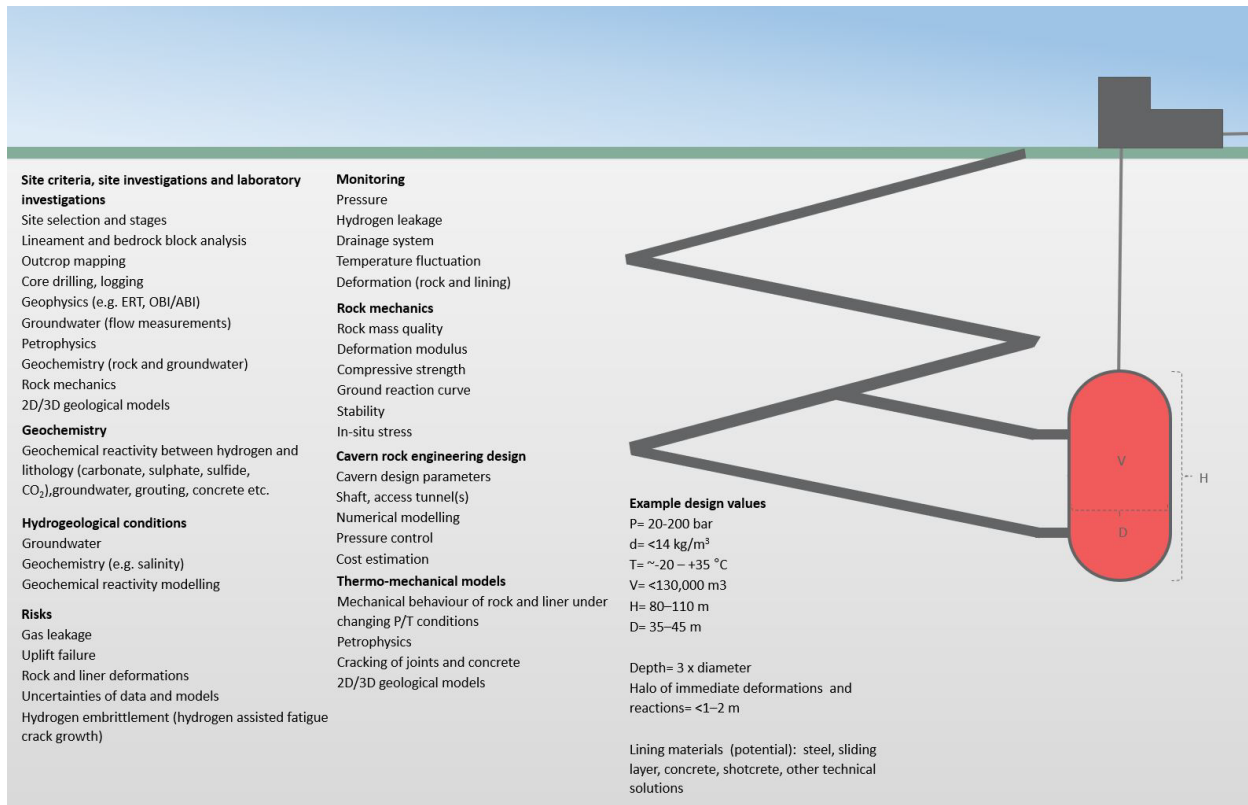


Figure 1. Schematic of the LRC concept with descriptions of geological investigations among other related methodologies.

Additive Information

The results from this project can be used by regulators and legislators to generate working principles for administrative processes to be used in permitting the LRC concept.

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References

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