

HYDROGEN STORAGE IN SALT CAVERNS – STATE OF THE ART; NEW DEVELOPMENTS AND R&D PROJECTS

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Abstract

The conversion of the German energy supply system from fossil/nuclear to renewable energy sources is going ahead at full steam. Because of the weather-dependent character of the wind and solar power generation, there will be times when there are longer periods of excess electricity generation in future which cannot be integrated within the power grid. If these large amounts of energy are to be put to good use in future instead of just turning off wind power converters as practiced today, it will be necessary to build large scale storages. Above a certain storage capacity, hydrogen salt caverns become a very promising option.

The first part of the paper summarizes and assesses the existing experience with the underground storage of pure hydrogen, as well as illumination gas with a high concentration of hydrogen.

The second part of the paper presents the results of ongoing R&D projects on various aspects of hydrogen cavern storage. Even though hydrogen is already stored successfully in Europe and in the USA, there is need for additional investigations because of stronger safety requirements nowadays in Europe, and increasing participation by the public and NGOs.

One major aspect has been the selection of metallic and non-metallic materials in the access wells to guarantee the long term safe operation of the cased boreholes for an approval period of approx. 30 years. The mechanical and thermal stress on the production string was simulated based on the forecast operation of a future hydrogen cavern with the aim of assessing the risks associated with the impact of hydrogen on the materials. The resulting options to minimize the risk of hydrogen-induced damage, taking into account the dynamic stresses acting during the operation of the cavern, are presented and discussed. Other investigations were related to the tightness of rock salt in a high pressure hydrogen environment and the effect of a blow-out.

The paper ends with a summary of concrete research projects which are currently starting up at a national and an European level.

Key words: caverns for hydrogen storage, Illuminating Gas, R&D requirements