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Hydrogen Storage in the Netherlands – Latest findings from demonstration project HyStock for underground storage of hydrogen in salt caverns

Patrick Roordink
N.V. Nederlandse Gasunie, Groningen, The Netherlands

Birgit Horváth, Jürgen Kepplinger, Raimar Haydl
DEEP.KBB, Hannover, Germany

Abstract

In the course of the energy transition the N.V. Nederlandse Gasunie (Gasunie) works on the implementation of the first large-scale project for underground hydrogen storage in salt caverns in the Netherlands, called HyStock. For this, a demonstration project is currently in progress on the cavern borehole Zuidwendig A8A at the location of Gasunie's subsidiary EnergyStock, to test the basic system requirements and prove a safe hydrogen application in future. The overall concept for the implementation of this first-time to be realized scope was developed together with DEEP.KBB GmbH (DEEP.KBB).

In general, the overall approach of the pilot project at the well Zuidwendig A8A is comprised of two stages: Firstly, in conducting an adequate mechanical integrity test (MIT) to check the tightness related to hydrogen. Secondly, to execute a systematic hydrogen storage test run over a period of several months to check the "H2-readiness" of equipment, involved services and the operational setup.

The fundamental precondition for the execution of the pilot storage phase is the proof of the well's tightness against hydrogen. Therefore, a test concept for a related MIT was developed and executed. Based on a state-of-the-art test method, a two-step-procedure was applied to verify the gas tightness of the borehole. Initially, to prove the general tightness based on a standard MIT for natural gas storage caverns and thereafter, to explicitly demonstrate the tightness against hydrogen. Based on the results obtained, a comparison of the standard procedure and the MIT with hydrogen as test medium is possible. Looking forward, this approach provides also the opportunity to further develop the procedure and criteria based on the various parameters recorded. The tightness of the borehole was proven in the first step with nitrogen and in the second with hydrogen as test medium. This "combined MIT" (coMIT) approach was successfully executed and demonstrated the suitability of the well for the subsequent pilot storage phase.

The second stage of the pilot project was comprised of conducting the main operational steps of a regular natural gas storage operation. This included the installation of subsurface completion equipment, the hydrogen filling process, snubbing operation and the essential part of "simulating" the hydrogen storage operation in different patterns. During the course of the aforementioned phases related well interventions and operational observations represent essential aspects of this test.

The aim of this paper is to present the executed project steps of the hydrogen demonstration project and derived findings with particular reference to the influence of hydrogen on the execution including related adjustments as well as safety aspects.

Key words: salt cavern, hydrogen storage, HyStock, mechanical integrity test (MIT)