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INFLUENCE OF A GAS CAVERN'S SURFACE AREA ON THERMODYNAMIC BEHAVIOUR AND OPERATION

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Abstract

Gas caverns have already started to become a trading tool and this development will even gain momentum in the near future. A gas cavern storage as a trading tool can be defined as follows.

It is the superposition of many different possible modes of operation which in turn, depending on the requirements, can be flexibly arranged. Some of the important components of the trading tool are listed below:

Annual production cycle
+ Multiple cycles – multiple gas turnover
+ Hourly nomination of gas quantities
+ Leasing of gas quantity, capacity and deliverability
+ Withdrawal and injection at very high volume rates

⇒ Cavern storage as a trading tool

In this connection it is becoming increasingly important to predict with high accuracy the thermodynamic behaviour of the cavern in relation to nominated gas quantities (Dresen, 2010).

The predicted cavern temperature, which depends on the nomination, allows a correspondingly accurate estimate of the wellhead temperature by considering pressure and temperature losses, which then in combination with the volume rate determines the efficiency of the surface installations. These installations include, for instance, the pre-heater, compressor and the drying unit.

Besides the above-mentioned parameters, naturally the thermodynamically relevant salt parameters, the cavern volume and the cavern surface area are also pivotal as regards the possible storage capacity of the cavern.

During recent years it has become increasingly evident that the thermodynamically effective surface area of a cavern has a considerable influence on the development of pressure and temperature. However, until recently it had not been possible to accurately determine this surface area. It could be only roughly estimated from the cavern volume, the cavern height and the average cavern radius.

Recognizing the need for an accurate estimate, SOCON Sonar Control Kavernenvermessung GmbH has developed a software tool – based on SOCON sonar surveys in gas caverns – for a realistically estimating the effective cavern surface area and therefore for determining the temperature during withdrawal, standstill and injection.

Key words: Caverns for Gas Storage, Computer Modelling, Thermodynamic, Heat Flux