STORAGE OPERATION EXPERT - The Software Solution for Simulation and Optimization of Gas Storage Plant Operation

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Abstract

Obtaining an accurate model of a gas storage facility is the key element for conducting economic plant operation and for an optimal utilization of the plant's potential. We present Storage Operation Expert (SOE) - a software solution for optimizing the operation of underground gas storage plants. The main goal of the software is to maximize plant capabilities and to minimize energy usage, while ensuring compliance with operational safety barriers. Obtaining such a compromise requires taking into account several complex factors, e.g., without an accurate model of the withdrawal and injection flow potential, the overall plant capabilities might be artificially underutilized. SOE enables the operator not only to choose the optimal configuration of the plant components and caverns, but also to forecast the plant's flow potential for a longer time-horizon (e.g. 7 days). The plant model implemented here is based on real operational data and caters for geological boundary conditions as defined by expert rock mechanical reports. The software includes: a) a thermodynamic model of the gas caverns, b) rock-mechanic constraints for cavern operation, c) a model of the above-ground facilities, and d) several predefined strategies for cavern utilization. In this paper we explain the components of a simulation procedure which produces sets of optimal decision rules that constitute the most optimal strategy of gas storage operation. Miscellaneous optimization aspects are highlighted. Our strategy is intended to be used for a variety of gas demand scenarios by utilizing different configurations of gas caverns and choosing compressors with optimal performance parameters accordingly. Exemplary results of tests with different configurations are discussed. The simulations draw a detailed picture of the plant state, for example providing trajectories of cavern wellhead pressures, temperatures and the fulfillment of rock-mechanical restrictions. The trajectory of the plant flow potential can be easily converted into the expected available nomination limits, allowing the storage users a better matching between gas demand and supply. Moreover, SOE solution is an appropriate application for calculating an optimal technical profile for a balanced and economic utilization of caverns for given gas nominations. It allows also to perform WHAT-IF simulations which facilitate the development of service plans for underground storage facilities for optimal plant maintenance.

Key words: Cavern Operation, Caverns for Gas Storage, Computer Modeling, Computer Software, Gas storage, Rock Mechanics