Conversion of hydrocarbon reservoirs to underground gas storage (UGS) – case study of the northern part of Vienna Basin

Miroslava Zubalová
Euro-Geologic, a.s.[1]

A b s t r a c t : The article deals with one of the important stages of conversion of hydrocarbon reservoirs to UGS, which is preparation of detailed geological maps and petrophysical parameters for the mathematical simulation of the conversion process.

Steady supply of natural gas throughout the year from distant source areas and uneven consumption of consumers during summer caused the need of building UGS especially near industrial sites in the second half of the 20th century. UGS are very important for ensuring energy stability during the whole year, particularly in countries, which lack their own sufficient funds. Most frequently UGS is built in three types of natural rock structures – in depleted reservoir, in aquifer structures and in caverns of salt diapir or rock massifs. The most common type of UGS is in depleted reservoir. To build UGS in such environment, it must undergo a process called conversion. Conversion means the transition from reservoir extraction phase to the utilization of natural rock structures for cyclic gas storage. During the project conversion a 3D geological model is constructed. Model shows, if the reservoir meets the main criteria, which must be considered by selecting natural gas storage objects. The main geological criteria are depth of reservoir rocks, volume of pore space, which can be filled with gas, permeability and thickness of reservoir rocks, existence of an impermeable layer above the gas storage, degree of homogeneousness lithological development of the horizon in horizontal and vertical directions, tectonic structure of horizon and degree of tightness of fault elements. Economic criteria are taken into account too, i.e. distance from the main pipeline systems and gas consumers.

For conversion into UGS in the northern part of the Vienna Basin the ,,Lab horizon,, of Middle Badenian age was selected. First it was necessary to resolve detailed geological and tectonic structure of the reservoir based on the interpretation of seismic measurements and well data, i.e. construction of

[1] Miroslava Zubalová, Tomášikova 26, 821 01 Bratislava, zubalova@egeo.sk

structure maps of the top and base of individual horizons. Reservoir is formed by two separate blocks, which are bound to conjugate faults of Schrattenberg fault system. Lab horizon is formed by complex of three sandy layers with two shaly intercalations. Gross thickness of the horizon is up to 43 meters. In such lithological development of reservoir there was very important to apply an appropriate complex of well logs. Good quantitative well logs analysis had irreplaceable task, too (Fig. 1). Calibration of logging measurements onto results of laboratory analysis of drilling cores and onto reservoir fluids was important as well. Based on well log data it was necessary to determine the total and effective thickness and provide a detailed analysis of petrophysical properties of rocks in horizontal and vertical directions. Due to different development of Lab horizon sandy layers on individual tectonic blocks, each layer was divided into several levels. Porosity, permeability, initial hydrocarbons and water saturation was determined between different levels of horizon. For processing, data analysis and model construction was used Software Geographics Discovery and Nexus of company Halliburton.

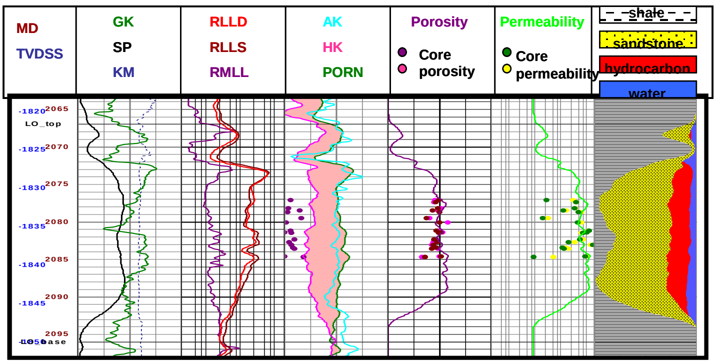

Fig. 1. Well log analysis.

The result of the work is a 3D model of the distribution of petrophysical properties of the reservoir. This model describes in detail the geological structure of hydrocarbon-bearing horizon with its reservoir characteristics. Such a model serves as the bass for the next step in the conversion – mathematic simulation, which determines optimum operating parameters of new UGS.

Key words: underground gas storage, well log, geological model, reservoir properties,