Estimating Ultimate Recoveries of Unconventional Reservoirs: Knowledge Gained from the Developments Worldwide and Egyptian Challenges

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Abstract

Supertight oil and gas reservoirs have always been considered uneconomical. Their high stimulation costs, forecasting the future production and estimating the ultimate recovery (EUR), have long been problematic. They should be constantly updated during the lifetime of a reservoir, besides; their accuracy depends on the amount of available data and the adopted method. However, after the enormous production in North America, exploring and developing unconventional hydrocarbon resources are gaining more interest worldwide. Nowadays, the Egyptian government is targeting tight layers/zones, in the western desert, to increase the high domestic energy demand and hence, increase the annual production of the conventional ï high permeability ï reservoirs. Several zones within Khatatba source rock in the Shoushan basin as well as in the Abu Gharadig basin are now being studied and evaluated to maximize their productivity and identify the optimal technology for future developments. In the present work, various approaches, used in predicting the performance of unconventional reservoirs, are investigated and compared through their forecasting future production and their estimated ultimate recovery (EUR). Traditional Arpsô decline, for low permeability reservoirs, over-forecasts reserves. Power-law exponential decline (PLED), stretched-exponential decline (SEPD), logistic-growth model (LGM), and Duongôs method have been used to represent the rate/time production data for the standard well completion in a multiple-fractured horizontal well in a shale play. These methods provide different forecasts as they are based on different equation forms. Unfortunately, previously mentioned methods are not satisfactorily adequate to forecast production for all unconventional reservoirs. The rate transient analytical (RTA) models require certain modifications of the reservoir and fracture parameters to provide optimistic EURs when compared to the numerical simulation. In this research, based on the production forecast and EUR prediction, different models for forecasting unconventional well data have been reviewed and compared. Production data has been used to validate the accuracy of the models, show the similarity of reserves estimation, and reveal the relationship to the reservoir theory. This work might help the Egyptian operating companies to better understand the production dynamics of unconventional reservoirs and suggest a more reliable model EURôs estimation.

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