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Estimating CO_2 Storage Capacity under Geological Uncertainty Using 3D Geological Modeling of Unconventional Reservoir Rocks in Block nv32, Shenvsi Oilfield, China

Authors : Ayman Mutahar Alrassas, Shaoran Ren, Renyuan Ren, Hung Vo Thanh, Mohammed Hail Hakimi, Zhenliang Guan

Abstract : The significant effect of CO_2 on global climate and the environment has gained more concern worldwide. Enhance oil recovery (EOR) associated with sequestration of CO_2 particularly into the depleted oil reservoir is considered the viable approach under financial limitations since it improves the oil recovery from the existing oil reservoir and boosts the relation between global-scale of CO_2 capture and geological sequestration. Consequently, practical measurements are required to attain large-scale CO_2 emission reduction. This paper presents an integrated modeling workflow to construct an accurate 3D reservoir geological model to estimate the storage capacity of CO_2 under geological uncertainty in an unconventional oil reservoir of the Paleogene Shahejie Formation (Es1) in the block Nv32, Shenvsi oilfield, China. In this regard, geophysical data, including well logs of twenty-two well locations and seismic data, were combined with geological and engineering data and used to construct a 3D reservoir geological modeling. The geological modeling focused on four tight reservoir units of the Shahejie Formation (Es1-x1, Es1-x2, Es1-x3, and Es1-x4). The validated 3D reservoir models were subsequently used to calculate the theoretical CO_2 storage capacity in the block Nv32, Shenvsi oilfield. Well logs were utilized to predict petrophysical properties such as porosity and permeability, and lithofacies and indicate that the Es1 reservoir units are mainly sandstone, shale, and limestone with a proportion of 38.09%, 32.42%, and 29.49, respectively. Well log-based petrophysical results also show that the Es1 reservoir units generally exhibit 2–36% porosity, 0.017 mD to 974.8 mD permeability, and moderate to good net to gross ratios. These estimated values of porosity, permeability, lithofacies, and net to gross were up-scaled and distributed laterally using Sequential Gaussian Simulation (SGS) and Simulation Sequential Indicator (SIS) methods to generate 3D reservoir geological models. The reservoir geological models show there are lateral heterogeneities of the reservoir properties and lithofacies, and the best reservoir rocks exist in the Es1-x4, Es1-x3, and Es1-x2 units, respectively. In addition, the reservoir volumetric of the Es1 units in block Nv32 was also estimated based on the petrophysical property models and fund to be between 0.554368

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