Log-based Resource Assessment of A Gas Shale Reservoir - A Case Study of the Barnett Shale

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Abstract

This study estimates reservoir quality and free-gas storage capacity of the Barnett Shale in the main natural-gas producing area of the Fort Worth basin by mapping log-derived thickness, porosity, and porosity-feet. In the Barnett Shale, the density porosity (DPHI) log curve is a very useful tool to quantitatively assess shale gas resources, and gamma-ray (GR) and neutron porosity log curves are important factors in identifying the shale gas reservoir. The key data were digital logs from 146 wells selected based on the availability of GR and density log curves, log quality, and good spatial distribution. The Barnett Shale pay zone was deter-mined on the basis of (1) DPHI >5%, (2) high GR values (commonly >~90 API units), (3) no significant intercalated carbonate-rich beds, and (4) individual pay zones being thick enough to be commercially successful for the current design of horizontal wells. In the study area, the Barnett Shale pay zone varies from about 165 ft. (50 m) to 420 ft. (128 m) in thickness (H). Average DPHI values of individual wells for the pay zone vary from 8.5 to 14.0%. Porosity-feet maps of the pay zone show that areas of high DPHIH values coincide with areas of high natural gas production, indicating that log-derived porosity-feet maps are a good method for evaluating reservoir quality and assessing natural gas resource in the Barnett Shale play. A limitation to this method is shown in the northwestern corner of the study area, which is located in the liquids-rich window with lower thermal maturity.