

New USGS Assessment of Continuous Oil Resources of the Bakken and Three Forks Formations in the Williston Basin (North Dakota and Montana, USA)

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Abstract

The U.S. Geological Survey (USGS) recently completed a new quantitative, geology-based assessment of continuous oil resources in the Bakken and Three Forks Formations in the U.S. portion of the Williston Basin. The Bakken and Three Forks Formations are part of the Bakken Total Petroleum System, which includes strata from the Upper Devonian Three Forks Formation, Upper Devonian to Lower Mississippian Bakken Formation, and the lowermost section of the Lower Mississippian Lodgepole Formation. Oil generated within the two organic rich upper and lower Bakken shale members has locally migrated into the informal middle member and the lowermost Pronghorn Member of the Bakken Formation, as well as into dolomitized intervals of the underlying Three Forks Formation. Currently, more than 17,500 wells have been drilled into the Bakken and Three Forks, where horizontal laterals primarily target the informal middle Bakken Member and upper and middle units of the Three Forks Formation. Wells with the highest production and greatest estimated ultimate recoveries (EURs) typically occur where increased shale thickness, higher thermal maturity, and overpressure facilitate increased oil saturations into various reservoir facies.

The USGS previously assessed the Bakken Formation in 1995, 2008, and 2013, whereas the Three Forks Formation was initially assessed in 2013. In the 2013 assessment, the Bakken Formation was assessed at a mean of 3.65 billion barrels of oil (BBO) and the Three Forks was assessed at a mean of 3.74 BBO, for a combined reported mean estimate of 7.4 BBO. The USGS assesses undiscovered, technically recoverable resource volumes, which are based on current drilling and technology practices. The quantitative assessment is completed by evaluating the uncertainty about the productive area, the drainage areas, the EURs, the percentage of untested area, and future success ratios for each geologically defined assessment unit (AU). For 2021, a total of 9 continuous Bakken and 7 continuous Three Forks AUs were defined. The estimated mean total is 4.29 BBO, with approximately 1.95 BBO attributed to the Bakken Formation and 2.34 BBO attributed to the Three Forks Formation. The decrease from the 2013 estimates is related to the substantial increase in drilling across the basin, where more than 10,500 additional wells were drilled in the Bakken and Three Forks Formations since the previous assessment. Overall, variations in drainage areas, differences in EURs across the basin, and the percentage of untested area (related to the amount of current drilling) had the biggest impact on the assessment values. Despite the change in the mean resource estimates for the Bakken and Three Forks Formations, the Williston Basin represents a significant oil resource for the United States and remains second behind the Permian Basin in terms of domestic onshore estimated oil resource volumes.

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