

# Bakken Holds Oil Bonanza, USGS Says

RESTON, VA.—The U.S. Geological Survey estimates the Bakken formation that underlies parts of North Dakota and Montana holds as much as 4.3 billion barrels of undiscovered, technically recoverable oil. In addition, the agency says, the formation could hold 1.8 trillion cubic feet of natural gas and 148.0 million barrels of natural gas liquids.

According to the agency, its Bakken formation estimate is larger than any other formation assessment in the lower-48 states, and is the largest continuous oil accumulation ever assessed by USGS. The next largest continuous oil accumulation in the contiguous United States is in the Austin Chalk of Texas and Louisiana, the agency points out, with an undiscovered estimate of 1.0 billions of barrels of technically recoverable oil.

The assessment shows a 25-fold increase in the amount of oil that can be recovered from the Bakken formation using available technology and industry practices, compared with the agency's 1995 estimate of 151 million barrels, USGS reports. The agency says the formation produced 105 million barrels through 2007.

The agency says new geologic models applied to the formation, advances in drilling and production technologies, and oil discoveries led to its substantially larger oil assessment. The USGS says it undertook the study as part of a nationwide project assessing domestic petroleum basins using standardized methodology and protocol as required by the Energy Policy and Conservation Act of 2000.

Working with the North Dakota Geological Survey, petroleum companies and independents, universities and other experts, the agency says it developed a geological understanding of the formation. These groups provided critical information and feedback on geologic and engineering concepts important to building the geologic and production models used in the assessment, USGS points out.

The study identified five continuous assessment units and calculated the resources held in each: Elm Coulee-Billings Nose (410 million barrels), Central Basin-Poplar Dome (485 MMbbl), Nesson-Little Knife Structural (909 MMbbl), Eastern Expulsion Threshold (973 MMbbl), and Northwest Expulsion Threshold (868 MMbbl). The agency defined a sixth hypothetical conventional unit, the Middle Sandstone Member, as external to the oil generation area.

At the time of the assessment, the agency says, a limited number of wells had produced oil from three of the units: Central Basin-Poplar Dome, Eastern Expulsion Threshold, and Northwest Expulsion Threshold. Montana's Elm Coulee oil field, discovered in 2000, has produced 65 million of the 105 million barrels of oil recovered from the formation, the USGS points out.

## Marine Shales

The Upper Devonian-Lower Mississippian Bakken formation is a thin but widespread unit within the central and deeper portions of the Williston Basin in Montana, North Dakota, and the Canadian Provinces of Saskatchewan and Manitoba, the USGS says. The formation consists of three members:

- Lower—a 50-foot thick black marine shale;
- Middle—an 85-foot thick interbedded layer of limestone, siltstone, dolomite, and sandstone; and
- Upper—a 23-foot thick black marine shale.

Both the upper and lower shale members are organic-rich marine shales of fairly consistent lithology that are the petroleum source rocks and part of the continuous reservoir for hydrocarbons produced from the formation, the USGS details.

According to the U.S. Energy Information Administration, although operators and the USGS have known about the resource potential of the Bakken formation for many years, several factors made it very difficult to produce these resources:

- Early drilling in the Bakken formation targeted the shale members. Success hinged on connecting conventional vertical well bores with a natural fracture system while not ruining the well bore in the process with drilling fluids.
- The shale itself is highly reactive with water and swells when exposed, which can seal off a productive fracture system.

- The formation sediments contain iron pyrite. This mineral forms an iron hydroxide precipitate when exposed to hydrochloric acid, and there are reports of this causing irreparable well damage.

These challenges reduced the likelihood of success and discouraged most operators from trying to produce Bakken oil, the EIA says. Science and technology now are unlocking more of the formation's resources, the agency reports.

New horizontal fracturing technology is being used on Bakken laterals, the agency says. Lyco Energy Corporation and Halliburton have published a paper on Bakken formation fracture stimulation. Their technique calls for aligning the well bore such that induced fractures have longitudinal orientation, the EIA details. The fractured formation produces back through an uncemented pre-perforated liner.

## State Responses

Price and pipeline capacity issues could hinder any acceleration in the rate of developing the Bakken formation, warns the EIA. As production in Montana and North Dakota increases, the transportation system is becoming a bottleneck. The existing pipeline system for the Williston Basin area, which also is used to move tar-sand oil from Canada, is utilized fully, the agency says.

Rather than sell oil at a discounted price to get it into the pipeline, some U.S. operators have announced shut-ins and have postponed drilling, the EIA points out. State governments are working with operators and pipeline companies to address the issue. In May 2006, North Dakota Governor John Hoeven hosted a summit with legislators, oil industry officials from both the United States and Canada, pipeline companies, producers, and railroad officials to help address the challenge of increasing oil pipeline capacity in western North Dakota.

"We are producing more oil, and we need to be able to get it to market so our producers and mineral owners do not suffer unfair discounts," Hoeven said.

He added the states and industry were developing more pipeline capacity and taking other steps, including investigating transportation using railroad tank cars. □

## Coming In June

In *The Reporter's Offshore & Subsea* special report, readers will learn about leading independents' Gulf of Mexico projects, and their plans for the next 12-18 months. Reports also spotlight innovative geophysical technologies such as ocean-bottom wide-azimuth 3-D, the latest round of subsea tieback projects, subsea processing technology and OTC coverage.