

# Assessment of Undiscovered Oil and Gas Resources of the Williston Basin Province of North Dakota, Montana, and South Dakota, 2008

*Using a geology-based assessment method, the U.S. Geological Survey estimated mean undiscovered volumes of 3.8 billion barrels of undiscovered oil, 3.7 trillion cubic feet of associated/dissolved natural gas, and 0.2 billion barrels of undiscovered natural gas liquids in the Williston Basin Province, North Dakota, Montana, and South Dakota.*

## Introduction

The U.S. Geological Survey (USGS) completed an assessment of the undiscovered oil and gas resources in conventional and continuous accumulations of the Williston Basin Province of North Dakota, eastern Montana, and northwestern South Dakota (fig. 1). The assessment is based on geologic elements of a total petroleum system (TPS) that include (1) source-rock distribution, thickness, organic richness, maturation, petroleum generation, and migration; (2) reservoir-rock type (conventional or continuous), distribution, and quality; and (3) character of traps and time of formation with respect to petroleum generation and migration. Detailed

framework studies in stratigraphy and structural geology and the modeling of petroleum geochemistry, combined with historical exploration and production analyses, were used in estimating the undiscovered, technically recoverable oil and gas resources of the entire stratigraphic section in the U.S. part of the basin. Using this framework, the USGS defined 11 TPSs and 19 assessment units (AU) within them, and undiscovered oil and gas resources were quantitatively estimated within each AU (table 1). The assessment of the Bakken Formation is included here, and it was also published previously as USGS Fact Sheet 2008-3021.

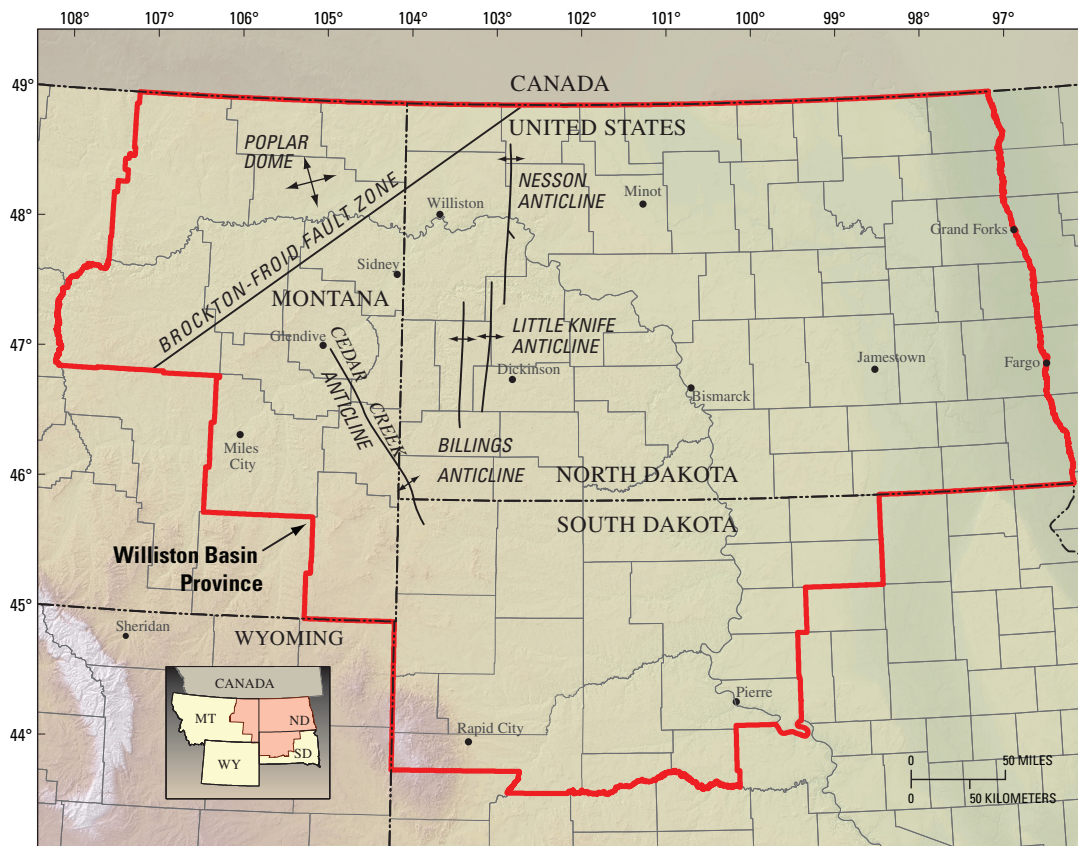
## Resource Summary

The USGS estimated means of 3,844 million barrels of oil (MMBO), 3,705 billion cubic feet of gas (BCFG), and 202 million barrels of total natural gas liquids (MMBNGL) for undiscovered continuous and conventional resources in the Williston Basin Province (table 1).

The assessment indicates that most of the undiscovered oil and gas resides within the Bakken Formation as a continuous reservoir with a mean of 3,645 MMBO, whereas undiscovered oil

from conventional reservoirs has a mean of 197 MMBO. All of the undiscovered continuous gas resides in the Bakken with a mean of 1,848 BCFG, and in coalbed gas with a mean of 882 BCFG.

Most of the undiscovered conventional oil resides in the Mission Canyon–Charles AU with a mean of 45 MMBO, and the Red River Fairway AU with a mean of 30 MMBO. The remainder from Paleozoic AUs is estimated to contain a mean of 122 MMBO. Undiscovered conventional gas resources reside in Paleozoic and shallow biogenic gas AUs with a mean of 975 BCFG.



**Figure 1.** Williston Basin Province of North Dakota, Montana, and South Dakota.

**Table 1.** Williston Basin Province assessment results.

[MMBO, million barrels of oil; BCFG, billion cubic feet of gas; MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. For gas accumulations, all liquids are included as NGL (natural gas liquids). F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. TPS, total petroleum system; AU, assessment unit. Gray shading indicates not applicable]

Total Petroleum System and Assessment Unit	Field Type	Total Undiscovered Resources											
		Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
		F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
<b>Continuous Oil and Gas Resources</b>													
<b>Bakken-Lodgepole TPS</b>													
Elm Coulee-Billings Nose AU	<b>Oil</b>	374	410	450	410	118	198	332	208	8	16	29	17
Central Basin-Poplar Dome AU	<b>Oil</b>	394	482	589	485	134	233	403	246	10	18	35	20
Nesson-Little Knife Structural AU	<b>Oil</b>	818	908	1,007	909	260	438	738	461	19	34	64	37
Eastern Expulsion Threshold AU	<b>Oil</b>	864	971	1,091	973	278	469	791	493	20	37	68	39
Northwest Expulsion Threshold AU	<b>Oil</b>	613	851	1,182	868	224	411	754	440	16	32	64	35
<b>Coalbed Gas TPS</b>													
Fort Union Coalbed Gas AU	<b>Gas</b>					368	791	1,701	882	0	0	0	0
<b>Total Continuous Resources</b>					<b>3,645</b>				<b>2,730</b>				<b>148</b>
<b>Conventional Oil and Gas Resources</b>													
<b>Bakken-Lodgepole TPS</b>													
Middle Sandstone Member AU	<b>Oil</b>	1	4	8	4	0	1	3	2	0	0	0	0
	<b>Gas</b>					0	0	0	0	0	0	0	0
Lodgepole AU	<b>Oil</b>	2	7	18	8	1	4	11	5	0	0	1	0
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Winnipeg-Deadwood TPS</b>													
Winnipeg-Deadwood AU	<b>Oil</b>	1	4	10	5	3	9	24	11	0	0	1	0
	<b>Gas</b>					56	161	358	178	3	8	20	9
<b>Red River TPS</b>													
Red River Fairway AU	<b>Oil</b>	12	29	51	30	11	28	55	30	1	3	6	3
	<b>Gas</b>					58	155	314	167	11	30	67	33
Red River East Margin AU	<b>Oil</b>	0	2	4	2	0	0	1	0	0	0	0	0
	<b>Gas</b>					0	0	0	0	0	0	0	0
Interlake-Stonewall-Stony Mountain AU	<b>Oil</b>	9	22	44	24	8	22	47	24	1	2	5	2
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Winnepigosis TPS</b>													
Winnepigosis AU	<b>Oil</b>	4	11	22	11	2	6	14	7	0	1	1	1
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Duperow TPS</b>													
Dawson Bay-Souris River AU	<b>Oil</b>	2	5	12	6	1	3	6	3	0	0	0	0
	<b>Gas</b>					0	0	0	0	0	0	0	0
Duperow-Birdbear AU	<b>Oil</b>	13	26	44	27	9	20	38	22	1	2	4	2
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Cedar Creek Paleozoic Composite TPS</b>													
Cedar Creek Structural AU	<b>Oil</b>	6	19	41	20	3	12	28	13	0	1	2	1
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Madison TPS</b>													
Mission Canyon-Charles AU	<b>Oil</b>	13	43	85	45	9	33	72	36	1	3	7	3
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Tyler TPS</b>													
Tyler Sandstone AU	<b>Oil</b>	4	14	31	15	1	3	7	3	0	0	0	0
	<b>Gas</b>					0	0	0	0	0	0	0	0
<b>Shallow Biogenic Gas TPS</b>													
Shallow Biogenic Gas AU	<b>Gas</b>					48	418	1,091	475	0	0	0	0
<b>Total Conventional Resources</b>					<b>197</b>				<b>976</b>				<b>54</b>
<b>Total Undiscovered Oil and Gas Resources</b>					<b>3,844</b>				<b>3,705</b>				<b>202</b>

**For Further Information**

Supporting geologic studies and reports on the assessment method used in the Williston Basin Province assessments of conventional resources are in preparation. Assessment results are available at the USGS Central Energy Team website at URL <http://energy.cr.usgs.gov/oilgas/noga>.

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