

Assessment of Undiscovered Oil and Gas Resources of the Powder River Basin Province of Wyoming and Montana—2006 Update

Using a geology-based assessment method, the U.S. Geological Survey estimated means of 16.6 trillion cubic feet of undiscovered natural gas, 639 million barrels of undiscovered oil, and 131 million barrels of natural gas liquids in the Powder River Basin Province.

Introduction

The U.S. Geological Survey (USGS) has completed an update of the 1995 assessment (USGS Fact Sheet FS-146-02) of the potential for undiscovered resources in conventional oil and gas accumulations of the Powder River Basin Province of northeastern Wyoming and southeastern Montana (fig. 1). The 2002 assessment of continuous (unconventional) oil and gas accumulations were not reassessed. The current assessment of conventional oil and gas resources, based on geologic elements such as hydrocarbon source rocks (source rock maturation and hydrocarbon generation and migration), reservoir rocks (sequence stratigraphy and petrophysical properties), and hydrocarbon traps (trap formation and timing), includes five Total Petroleum Systems (TPS) identified in the province by the USGS; eight assessment units (AU) were defined within the TPSs. Estimates of the undiscovered conventional oil and gas resource in these eight AUs, in addition to the estimates of undiscovered continuous oil and gas resources within the province that were reported in USGS Fact Sheet FS-146-02 are presented in table 1.



Figure 1. Powder River Basin Province of northeastern Wyoming and southeastern Montana.

Resource Summary

The USGS estimated means of 16.6 trillion cubic feet of gas, 639 million barrels of oil, and 131 million barrels of total natural gas liquids for undiscovered continuous and conventional resources in the Powder River Basin Province (table 1). Most of the undiscovered gas resource (93 percent, or 15.5 trillion cubic feet) is continuous. Of the 1.16 trillion cubic feet

of conventional gas at the mean, about 91 percent, or 1.05 trillion cubic feet is estimated to be from the Fall River-Lakota and Muddy Sandstones AUs of the Mowry TPS. Of the 215 million barrels of conventional oil at the mean: (1) about 30 percent, or 64 million barrels, is estimated to be from the Fall River-Lakota Sandstone AU; (2) about 28 percent, or 61 million barrels, is estimated to be from the Minnelusa-Tensleep-Leo Sandstones AU of the Pennsylvanian-Permian TPS; and (3) about

Table 1. Powder River 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 denotes a 95 percent chance of at least the amount tabulated; other fractiles are defined similarly. Fractiles are additive under the assumption of perfect positive correlation. TPS, Total Petroleum System; AU, Assessment Unit. Gray shading indicates not applicable.]

	Total Petroleum Systems (TPS) and Assessment Units (AU)	Field type	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Conventional Oil and Gas Resources	Pennsylvanian-Permian Composite TPS													
	Minnelusa-Tensleep-Leo AU	<i>Oil</i>	21.38	56.48	112.13	60.51	0.87	2.52	5.85	2.83	0.02	0.08	0.25	0.10
		<i>Gas</i>					3.34	7.26	13.39	7.32	0.17	0.41	0.86	0.44
	Mowry TPS													
	Fall River-Lakota Sandstone AU	<i>Oil</i>	18.14	58.58	127.53	64.05	18.58	64.98	162.77	74.70	1.03	3.81	10.25	4.48
		<i>Gas</i>					104.85	507.46	1,257.06	574.51	9.72	49.36	131.97	57.47
	Muddy Sandstone AU	<i>Oil</i>	10.95	40.62	106.81	47.34	31.03	122.43	360.08	149.14	2.71	10.89	32.87	13.43
		<i>Gas</i>					52.61	214.07	564.62	248.77	4.93	20.79	58.58	24.85
	Niobrara TPS													
	Frontier-Turner Sandstones AU	<i>Oil</i>	2.46	9.12	21.37	10.18	8.72	34.44	93.45	40.47	0.59	2.41	6.97	2.91
	Sussex-Shannon Sandstones AU	<i>Oil</i>	2.75	7.97	16.98	8.67	2.25	7.09	17.30	8.09	0.17	0.55	1.45	0.65
	Mesaverde-Lewis Sandstones AU	<i>Oil</i>	1.55	5.19	13.20	6.00	1.90	6.97	19.84	8.41	0.13	0.48	1.44	0.59
	Tertiary-Upper Cretaceous Coalbed Methane TPS													
Eastern Basin Margin Upper Ft. Union Sandstone AU	<i>Gas</i>					0.00	0.00	107.43	27.37	0.00	0.00	0.00	0.00	
Paleozoic-Mesozoic TPS														
Basin Margin AU	<i>Oil</i>	4.79	16.30	36.76	17.93	3.46	12.58	32.89	14.66	0.11	0.44	1.23	0.53	
Total Conventional Resources		62.02	194.26	434.78	214.68	227.61	979.80	2,634.68	1,156.27	19.58	89.22	245.87	105.45	
Continuous Oil and Gas Resources	Tertiary-Upper Cretaceous Coalbed Methane TPS													
	Wasatch Formation AU	<i>CBG</i>					1,011.94	1,815.71	3,257.89	1,934.09	0.00	0.00	0.00	0.00
	Upper Fort Union Formation AU	<i>CBG</i>					7,232.13	11,635.87	18,721.10	12,132.50	0.00	0.00	0.00	0.00
	Lower Fort Union-Lance Formation AU	<i>CBG</i>					0.00	171.67	440.90	197.90	0.00	0.00	0.00	0.00
	Mowry TPS													
	Mowry Continuous Oil AU	<i>Oil</i>	116.99	189.32	306.38	197.61	103.35	185.50	332.95	197.61	5.56	10.91	21.37	11.86
	Niobrara TPS													
	Niobrara Continuous Oil AU	<i>Oil</i>	135.53	217.49	349.03	226.67	119.54	213.10	379.87	226.67	6.43	12.53	24.40	13.60
	Cretaceous Biogenic Gas TPS													
	Shallow Continuous Biogenic Gas AU	<i>Gas</i>					341.92	712.15	1,483.26	786.64	0.00	0.00	0.00	0.00
	Total Continuous Resources		252.52	406.81	655.41	424.28	8,808.88	14,734.00	24,615.97	15,475.41	11.99	23.44	45.77	25.46
	Total Undiscovered Oil and Gas Resources		314.54	601.07	1,090.19	638.96	9,036.49	15,713.80	27,250.65	16,631.68	31.57	112.66	291.64	130.91

22 percent, or 47 million barrels is estimated to be from the Muddy Sandstone AU (table 1).

The Frontier-Turner, Sussex-Shannon, and Mesaverde-Lewis Sandstones AUs from the Niobrara TPS are estimated to contain means of 25 million barrels of conventional oil (12 percent) and 57.0 billion cubic feet of gas (5 percent) of the total undiscovered conventional resource (table 1).

The Basin Margin AU of the Paleozoic-Mesozoic TPS is estimated to contain a mean of 18 million barrels and 14.7 billion cubic feet of total undiscovered conventional resource (table 1).

The Eastern Basin Margin-Upper Ft. Union Sandstone AU of the Tertiary-Upper Cretaceous Coalbed Methane TPS is estimated to contain a mean of 27.4 billion cubic feet of total undiscovered conventional gas resource (table 1).

For Further Information

Supporting geologic studies and reports on the assessment method used in the Powder River Basin Province assessments of conventional resources are in preparation (2006). Assessment results are available at the USGS Central Energy Team website, <http://energy.cr.usgs.gov/oilgas/noga>.

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