

National Assessment of Oil and Gas Fact Sheet

Assessment of Undiscovered Oil and Gas Resources of the U.S. Portion of the Michigan Basin, 2004

By using a geology-based assessment methodology, the U.S. Geological Survey estimated the following quantities of undiscovered, technically recoverable oil and gas resources in the U.S. portion of the Michigan Basin: (1) a mean of 990 million barrels of oil, (2) a mean of 11 trillion cubic feet of natural gas, and (3) a mean of 220 million barrels of natural gas liquids.

Introduction

The U.S. Geological Survey (USGS) has completed an assessment of the undiscovered oil and gas potential of the U.S. portion of the Michigan Basin (fig. 1). The assessed area includes the State of Michigan, as well as parts of Illinois, Indiana, Minnesota, Ohio, and Wisconsin. The assessment is based on the geologic elements of each total petroleum system (TPS) defined in the basin. These geologic elements include the hydrocarbon source rocks, reservoir rocks, and hydrocarbon traps. By using this geologic framework, the USGS defined 6 total petroleum systems and 13 assessment units (AUs) within the basin and estimated the quantity of undiscovered technically recoverable oil and gas resources within 9 of the 13 AUs (table 1).

Total Petroleum Systems

The six total petroleum systems identified in the U.S. portion of the Michigan Basin are the (1) Precambrian Nonesuch TPS, (2) Ordovician Foster TPS, (3) Ordovician to Devonian Composite TPS, (4) Silurian Niagara/Salina TPS, (5) Devonian Antrim TPS, and (6) Pennsylvanian Saginaw TPS. Each TPS is named according to the petroleum source rock(s) of that system. For most of the systems, each TPS is associated with only one source rock. The Ordovician to Devonian Composite TPS, however, is a composite petroleum system having contributions from one or more of the following different source rocks: Ordovician Collingwood Shale, Devonian Detroit River Group, and the Devonian Antrim Shale.



Figure 1. Map showing the assessed area (U.S. portion) of the Michigan Basin (boundary in red).

Assessment Units

Nine of the AUs are characterized as conventional oil and gas accumulations, and four of the AUs are characterized as continuous accumulations. The nine conventional AUs are the (1) Precambrian Nonesuch AU; (2) Ordovician Sandstones and Carbonates AU, which includes the Prairie du Chien Group, St. Peter Sandstone, Glenwood Formation, and equivalent stratigraphic units within the basin; (3) Ordovician Trenton/Black River AU; (4) Silurian Burnt Bluff AU; (5) Silurian Niagara AU; (6) Silurian A-1 Carbonate AU; (7) Devonian Sylvania Sandstone AU; (8) Middle Devonian Carbonates AU, which includes the Detroit River Group, Dundee Limestone, and Traverse Group; and (9) Devonian to Mississippian Berea/Michigan Sandstones AU. All of these conventional AUs were assessed quantitatively, except for the Precambrian Nonesuch AU.

The four continuous AUs are the (1) Ordovician Collingwood Shale Gas AU, (2) Devonian Antrim Continuous Oil AU, (3) Devonian Antrim Continuous Gas AU, and (4) Pennsylvanian Saginaw Coal Bed Gas AU. Of these four continuous AUs, only the Devonian Antrim Continuous Gas AU was assessed quantitatively.

Resource Summary

For the U.S. portion of the Michigan Basin, the USGS estimated the following quantities of undiscovered, technically recoverable oil and gas resources (table 1):

- (1) a mean of 990 million barrels of oil;
- (2) a mean of 11 trillion cubic feet of natural gas; and
- (3) a mean of 220 million barrels of natural gas liquids.

The Ordovician Trenton/Black River AU has the greatest potential for undiscovered oil, having an estimated mean of 723 million barrels of undiscovered, technically recoverable oil. The Devonian Antrim Continuous Gas AU has the greatest potential for undiscovered gas, having an estimated mean of 7 trillion cubic feet of

undiscovered, technically recoverable gas. The Silurian Niagara AU, the Ordovician Sandstones and Carbonates AU, and the Ordovician Trenton/Black River AU also have significant potential for undiscovered, technically recoverable gas.

Additional Information

Supporting geologic studies of the U.S. portion of the Michigan Basin total petroleum systems and assessment units are in progress. Assessment results, as well as information on the assessment methodology, are posted on the USGS Web site <http://energy.cr.usgs.gov/oilgas/noga> as they become available.

Michigan Basin Assessment Team

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Table 1. Michigan Basin oil and gas assessment results.

[All tabulated results are for technically recoverable resources. MMBO is million barrels of oil. BCFG is billion cubic feet of gas. MMBNGL is million barrels of natural gas liquids. Results shown are fully risked estimates. For gas fields, all liquids are included under the NGL (natural gas liquids) category. F95 represents a 95-percent chance of at least the amount tabulated. Other fractions are defined similarly. TPS is total petroleum system. AU is assessment unit. Gray shade indicates not applicable or not assessed quantitatively]

| Total Petroleum Systems and Assessment Units | Field Type | Total Undiscovered Resources | | | | | | | | | | | |
|--|------------|------------------------------|---------------|-----------------|---------------|-----------------|------------------|------------------|------------------|--------------|---------------|---------------|---------------|
| | | Oil (MMBO) | | | | Gas (BCFG) | | | | NGL (MMBNGL) | | | |
| | | F95 | F50 | F5 | Mean | F95 | F50 | F5 | Mean | F95 | F50 | F5 | Mean |
| Silurian Niagara/Salina TPS | | | | | | | | | | | | | |
| Devonian Sylvania Sandstone AU | Oil | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Gas | | | | | 0.00 | 10.69 | 23.90 | 10.31 | 0.00 | 0.66 | 1.63 | 0.66 |
| Silurian Niagara AU | Oil | 95.61 | 207.73 | 335.95 | 211.22 | 179.41 | 414.73 | 759.36 | 434.69 | 12.75 | 31.43 | 63.46 | 33.91 |
| | Gas | | | | | 286.98 | 622.92 | 1,038.49 | 640.45 | 16.68 | 38.87 | 72.49 | 40.99 |
| Ordovician to Devonian Composite TPS | | | | | | | | | | | | | |
| Devonian to Mississippian Berea/Michigan Sandstones AU | Oil | 1.98 | 5.03 | 9.84 | 5.27 | 0.90 | 2.40 | 5.25 | 2.63 | 0.03 | 0.09 | 0.22 | 0.11 |
| | Gas | | | | | 11.36 | 31.84 | 66.94 | 34.58 | 0.42 | 1.24 | 2.85 | 1.38 |
| Middle Devonian Carbonates AU | Oil | 10.77 | 45.35 | 108.35 | 50.53 | 5.07 | 21.95 | 56.92 | 25.27 | 0.38 | 1.70 | 4.74 | 2.02 |
| | Gas | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Silurian A-1 Carbonate AU | Oil | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Gas | | | | | 26.26 | 94.56 | 213.73 | 104.25 | 0.49 | 1.84 | 4.52 | 2.08 |
| Silurian Burnt Bluff AU | Oil | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Gas | | | | | 43.81 | 138.86 | 285.77 | 149.42 | 0.82 | 2.70 | 6.08 | 2.99 |
| Ordovician Trenton/Black River AU | Oil | 178.56 | 671.09 | 1,426.96 | 722.98 | 333.30 | 1,301.49 | 3,039.52 | 1,445.06 | 21.95 | 88.51 | 223.93 | 101.20 |
| | Gas | | | | | 122.36 | 502.39 | 1,171.51 | 556.96 | 2.30 | 9.72 | 24.81 | 11.15 |
| Ordovician Foster TPS | | | | | | | | | | | | | |
| Ordovician Sandstones and Carbonates AU | Oil | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Gas | | | | | 148.66 | 524.06 | 1,073.90 | 558.90 | 5.74 | 21.37 | 48.15 | 23.45 |
| Precambrian Nonesuch TPS | | | | | | | | | | | | | |
| Precambrian Nonesuch AU | | not assessed quantitatively | | | | | | | | | | | |
| Total Conventional Resources | | 286.92 | 929.20 | 1,881.10 | 990.00 | 1,158.11 | 3,665.89 | 7,735.29 | 3,962.52 | 61.56 | 198.13 | 452.88 | 219.94 |
| Continuous Oil and Gas Resources | | | | | | | | | | | | | |
| Pennsylvanian Saginaw TPS | | | | | | | | | | | | | |
| Pennsylvanian Saginaw Coal Bed Gas AU | Gas | not assessed quantitatively | | | | | | | | | | | |
| Devonian Antrim TPS | | | | | | | | | | | | | |
| Devonian Antrim Continuous Gas AU | Gas | | | | | 5,483.97 | 7,356.74 | 9,869.05 | 7,475.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ordovician to Devonian Composite TPS | | | | | | | | | | | | | |
| Devonian Antrim Continuous Oil AU | Oil | not assessed quantitatively | | | | | | | | | | | |
| Ordovician Collingwood Shale Gas AU | Gas | not assessed quantitatively | | | | | | | | | | | |
| Total Continuous Resources | | | | | | 5,483.97 | 7,356.74 | 9,869.05 | 7,475.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Undiscovered Oil and Gas Resources | | 286.92 | 929.20 | 1,881.10 | 990.00 | 6,642.08 | 11,022.63 | 17,604.34 | 11,437.54 | 61.56 | 198.13 | 452.88 | 219.94 |