

Assessment of Undiscovered Oil and Gas Resources of the Dnieper–Donets Basin Province and Pripyat Basin Province, Russia, Ukraine, and Belarus, 2010

The U.S. Geological Survey, using a geology-based assessment methodology, estimated mean volumes of technically recoverable, conventional, undiscovered petroleum resources at 84 million barrels of crude oil, 4.7 trillion cubic feet of natural gas, and 130 million barrels of natural gas liquids for the Dnieper–Donets Basin Province and 39 million barrels of crude oil, 48 billion cubic feet of natural gas, and 1 million barrels of natural gas liquids for the Pripyat Basin Province.

Introduction

The U.S. Geological Survey (USGS) estimated technically recoverable, conventional, undiscovered oil and gas resources of the Dnieper–Donets Basin Province and Pripyat Basin Province in Russia, Ukraine and Belarus as part of a program to estimate these resources for priority basins around the world. The Dnieper–Donets Basin Province encompasses about 99,000 square kilometers and the Pripyat Basin Province, 35,000 square kilometers (fig. 1). These assessments were based on published geologic information and on commercial data from oil and gas wells and fields, and field production records. The USGS approach is to define total petroleum systems and assessment units, and assess the potential for undiscovered oil and gas resources.

Total Petroleum Systems and Assessment Units

One total petroleum system (TPS), the Paleozoic Composite, was defined for the Dnieper–Donets Basin and Pripyat Basin Provinces (table 1). It was defined to include petroleum source rocks ranging in age from Upper Devonian through Carboniferous. Two assessment units (AU) were defined geologically within the TPS, each encompassing the respective provinces—Clastic and Carbonate Reservoirs for the Dnieper–Donets Basin Province and Carbonate Reservoirs for the Pripyat Basin Province (figs. 1 and 2). Two additional AUs containing continuous accumulations, Continuous Basin–Centered Gas and Visean Shale Gas, were identified in the Dnieper–Donets Basin Province, but were not quantitatively assessed in this study.

In the Dnieper–Donets Basin Province, source rocks include the Visean Rudov Bed, Carboniferous mudstones and coals, and possibly Frasnian and lower Famennian mudstones (Ulmishek and others, 1994; Ulmishek, 2001). These source rocks at present are in the lower part of the oil window and upper part of the gas window; however, they attained maximum maturation during the Late Permian. Reservoir rocks are mainly Carboniferous to Lower Permian sandstones. Other reservoirs are in Lower Carboniferous and Lower Permian carbonate rocks, fractured metamorphic basement rocks, and Devonian carbonate rocks. Seal rocks include Devonian and Permian evaporites and intraformational mudstones. Traps are mostly structural, associated with salt and fault blocks, drapes, reef facies, and stratigraphic pinchouts. Undiscovered accumulations could exist in deeper structural and stratigraphic traps and in association with complex salt structures.

Source rocks in the Pripyat Basin Province primarily are Frasnian (Moiseev Bed) and lower Famennian mudstones (Ulmishek and others, 1994). Reservoir rocks include Devonian carbonate rocks and Carboniferous to Lower Permian sandstones. Devonian and Permian evaporites and intraformational mudstones serve as seal rocks. Traps are mostly structural, associated with salt and fault blocks, drapes, reef facies, and pinchouts. Nearly all of the known accumulations



Figure 1. Generalized map showing the boundaries of the Pripyat Basin and Dnieper–Donets Basin geologic provinces (red lines), centerpoints of oil and gas fields (green and red circles, respectively), and the location of geologic cross section A–A' shown in figure 2 (green line). Country boundaries are represented by blue lines. Field data from IHS Energy (2009); geologic province boundaries from Persits and others (1998).

Table 1. Dnieper–Donets Basin Province and Pripjat Basin Province assessment results (technically recoverable, conventional undiscovered resources).

[MMB, million barrels; BCF, billion cubic feet. Results shown are fully risked estimates. For gas fields, all liquids are included under the natural gas liquids (NGL) category. 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	Mean (expected) largest field size (MMB or BCF)	Total undiscovered resources											
			Oil (MMB)					Gas (BCF)				NGL (MMB)		
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Dnieper–Donets Basin Province, Paleozoic Composite TPS														
Clastic and Carbonate Reservoirs AU	Oil	16	46	80	134	84	142	267	492	286	4	9	17	9
	Gas	1,141					1,957	4,115	8,055	4,453	47	105	243	120
Pripjat Basin Province, Paleozoic Composite TPS														
Carbonate Reservoirs AU	Oil	6	20	36	64	39	11	28	63	31	0	1	2	1
	Gas	16					0	13	42	17	0	0	1	<1
Total undiscovered petroleum resources						123				4,787				130

are in the northern part of the Carbonate Reservoirs AU (fig. 1), probably because of an underlying magmatic body that increased thermal maturation of the source rocks. Undiscovered accumulations could exist in traps similar to those already discovered in the northern part of the AU.

Assessment Results

Estimates of volumes of technically recoverable, conventional, and undiscovered oil and gas resources are shown in table 1. No attempt was made to estimate economically recoverable resources because it is beyond the scope of this study. The mean volumes of undiscovered petroleum in the Dnieper–Donets Basin Province are estimated at approximately 84 million barrels (MMB) of crude oil, 4,739 billion cubic feet (BCF) of natural gas (286 BCF of associated and dissolved natural gas and 4,453 BCF of nonassociated natural gas), and 130 MMB of natural gas liquids. The mean volumes of undiscovered petroleum in the Pripjat Basin Province are estimated at approximately 39 MMB of crude oil, 48 BCF of natural gas (31 BCF of associated and dissolved natural gas and 17 BCF of nonassociated natural gas), and 1 MMB of natural gas liquids. The mean volumes of undiscovered petroleum for both provinces combined are approximately 123 MMB of crude oil, 4,787 BCF of natural gas (317 BCF of associated and dissolved natural gas and 4,470 BCF of nonassociated natural gas), and 130 MMB of natural gas liquids.

References Cited

IHS Energy, 2009 [includes data current through October 2009], International exploration and production database: Englewood, Colo., IHS Energy.

Law, B.E., Ulmishek, G.F., Clayton, J.L., Kabyshev, B.P., Pashova, N.T., and Krivosheya, V.A., 1998, Basin-centered gas evaluated in Dnieper–Donets basin, Donbas foldbelt, Ukraine: Oil and Gas Journal, v. 96, no. 47, p. 74–78.

Persits, F.M., Ulmishek, G.F., and Steinshouer, D.W., 1998, Map showing geology, oil and gas fields, and geologic provinces of the former Soviet Union: U.S. Geological Survey Open-File Report 97–470E, CD-ROM.

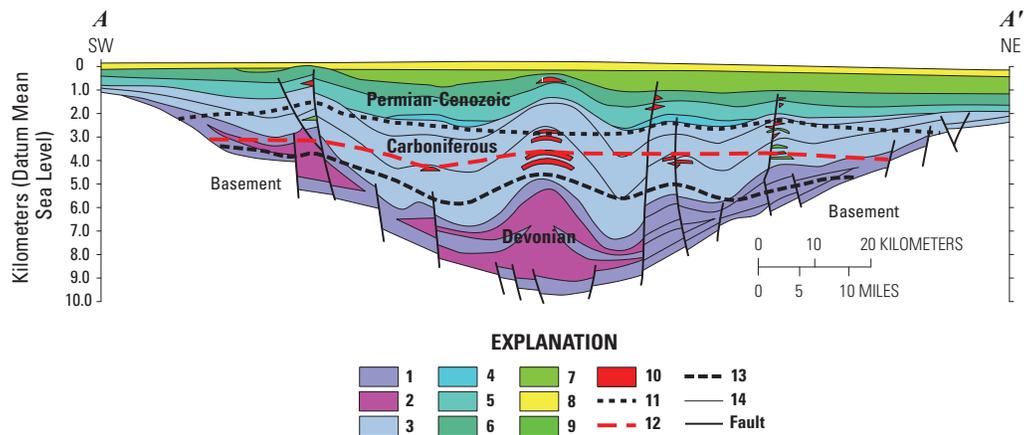


Figure 2. Geologic cross section for the Dnieper–Donets Basin. See figure 1 for location. Modified from Ulmishek (2001) and Law and others (1998). Explanation: 1, Upper Devonian; 2, Devonian evaporites; 3, Carboniferous; 4, Permian; 5, Triassic; 6, Jurassic; 7, Cretaceous; 8, Cenozoic; 9, oil accumulation; 10, gas accumulation; 11, top of overpressure; 12, 100° C isotherm; 13, 0.9 percent vitrinite reflectance isochore; 14, stratigraphic boundary.

Ulmishek, G.F., 2001, Petroleum geology and resources of the Dnieper–Donets Basin, Ukraine and Russia: U.S. Geological Survey Bulletin 2201–E, 14 p.

Ulmishek, G.F., Bogino, V.A., Keller, M.B., and Poznyakevich, Z.L., 1994, Structure, stratigraphy, and petroleum geology of the Pripjat and Dnieper–Donets Basins, Byelarus (sic) and Ukraine, in Landon, S.M., ed., Interior rift basins: American Association of Petroleum Geologists Memoir 59, p. 125–156.

For Further Information

Publications detailing the geology for the Dnieper–Donets Basin Province, Pripjat Basin Province, and the assessment methodology and results are available at the USGS Central Energy Resources Science Center web site, <http://energy.cr.usgs.gov/oilgas/>.

Dnieper–Donets Basin Province Assessment Team

T.R. Klett (tklett@usgs.gov), Christopher J. Schenk, Ronald R. Charpentier, Michael E. Brownfield, Janet K. Pitman, Richard M. Pollastro, Troy A. Cook, and Marilyn E. Tennyson.