

National and Global Petroleum Assessment

Assessment of Undiscovered Continuous Oil and Gas Resources in the Dnieper-Donets Basin and North Carpathian Basin Provinces, Ukraine, Romania, Moldova, and Poland, 2015

Using a geology-based methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean resources of 13 million barrels of oil and 2,643 billion cubic feet of natural gas in the Dnieper-Donets Basin and North Carpathian Basin Provinces of Ukraine, Romania, Moldova, and Poland.

Introduction

The U.S. Geological Survey (USGS) completed an assessment of continuous (unconventional) oil and gas resources in geologic provinces of Ukraine, Romania, Moldova, and part of Poland (fig. 1). The areas and resources that were evaluated and assessed included Paleozoic shale gas and tight-sandstone gas in the Dnieper-Donets Basin Province in Ukraine, continuous oil in the Oligocene Menilite Shale of the North Carpathian Basin Province of Ukraine (however, parts in some areas can be as young as lower Miocene [Koltun and others, 1998; Pawlewicz, 2006]), and lower Paleozoic (mainly Silurian) shale gas that extends across several geologic provinces of Ukraine, Romania, Moldova, and a small part of Poland.

In the Dnieper-Donets Basin Province, two total petroleum systems (TPSs) were identified: (1) a Paleozoic Composite TPS containing the Carboniferous Tight Sandstone Gas AU and (2) the Carboniferous Rudov Bed TPS containing the Carboniferous Rudov Bed Shale Gas AU. In the North Carpathian Basin Province and neighboring geologic provinces, a Paleozoic Composite TPS and an Oligocene Menilite Shale TPS were identified. This TPS contains the East European Lower Paleozoic Shale Gas AU, which includes mainly Silurian mudstones and some Ordovician mudstones. An Oligocene Menilite Shale TPS and corresponding Oligocene Menilite Shale Continuous Oil AU were also delineated.

The USGS assessment methodology for continuous resources outside of the United States requires that potential source rocks in the AU meet certain criteria, including the following: (1) contain at least 2 weight percent or more total organic carbon; (2) contain Type I, Type II, or Type IIS kerogen; (3) are thermally mature to generate oil and natural gas; and (4) contain organic-rich shale greater than 15 meters in thickness (Charpentier and Cook, 2011). All four continuous TPSs meet these geologic criteria. Analogs for shale-gas, continuous oil, and tight-sandstone gas accumulations in the United States were used to quantitatively assess the AUs in this study. Specifically, mean estimated ultimate recoveries from populations of shale-gas, continuous oil, and tight-sandstone gas wells; mean drainage areas of drilled wells; and ranges of average well success ratios were used to estimate the undiscovered continuous oil and gas resources. Principal input data used in the assessment are listed in table 1.



Source: U.S. Department of the Interior National Park Service

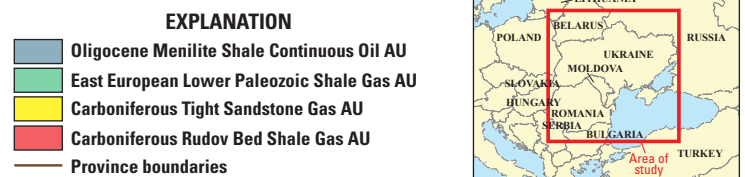


Figure 1. Map showing locations of continuous oil and gas assessment unit (AU) boundaries in Ukraine, Romania, Moldova, and Poland.

Undiscovered Resources Summary

The USGS quantitatively assessed oil and gas resources in three continuous gas AUs and one continuous oil AU within the Dnieper-Donets Basin and North Carpathian Basin Provinces of Ukraine, Romania, Moldova, and Poland (table 2). For total undiscovered resources, the estimated means are 13 million barrels of continuous oil (MMBO) with an F95–F5 range from 3 to 29 MMBO, 2,643 billion cubic feet of natural gas (BCFG) with an F95–F5 range from 8 to 8,487 BCFG, and 37 million barrels of natural gas liquids (MMBNGL) with an F95–F5 range from 0 to 123 MMBNGL. For

gas accumulations, zeros at F95 reflect the chance that continuous gas might not exist in the AU, and the geologic AU probability (risk) was estimated to be less than one.

For continuous gas resources in the Dnieper-Donets Basin Province, the estimated means for the Carboniferous Tight Sandstone Gas AU are 590 BCFG with an F95–F5 range from 0 to 1,771 BCFG and 12 MMBNGL with an F95–F5 range from

0 to 36 MMBNGL. For continuous shale-gas resources, the estimated means for the Carboniferous Rudov Bed Shale Gas AU are 624 BCFG with an F95–F5 range from 0 to 1,984 BCFG and 12 MMBNGL with an F95–F5 range from 0 to 41 MMBNGL.

For continuous resources in the North Carpathian Basin Province, the estimated means for the East European Lower Paleozoic Shale Gas AU are 1,391 BCFG

with an F95–F5 range from 0 to 4,642 BCFG and 11 MMBNGL with an F95–F5 range from 0 to 40 MMBNGL. The estimated means for the Oligocene Menilite Shale Continuous Oil AU are 13 MMBO with an F95–F5 range from 3 to 29 MMBO, 38 BCFG with an F95–F5 range from 8 to 90 BCFG, and 2 MMBNGL with an F95–F5 range from 0 to 6 MMBNGL.

Table 1. Key assessment input data for the four continuous assessment units in the Dnieper-Donets Basin Province and the North Carpathian Basin Province.

[AU, assessment unit; %, percent; EUR, estimated ultimate recovery per well; BCFG, billion cubic feet of gas; MMBO, million barrels of oil. EUR, well drainage area, and success ratios are from U.S. shale-gas, continuous oil, and tight-sandstone gas analogs. The average EUR input is the minimum, median, maximum, and calculated mean. Shading indicates not applicable]

Assessment input data— Continuous AU	Carboniferous Tight Sandstone Gas AU				Carboniferous Rudov Bed Shale Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	5,000	100,000	710,000	271,667	5,000	100,000	690,000	265,000
Average drainage area of wells (acres)	60	90	150	100	80	100	140	107
Success ratios (%)	10	50	90	50	10	50	90	50
Average EUR (BCFG)	0.1	0.5	1.4	0.544	0.1	0.7	1.3	0.72
AU probability	0.8				0.7			
	Oligocene Menilite Shale Continuous Oil AU				East European Lower Paleozoic Shale Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	1,000	75,000	190,000	88,667	5,000	1,000,000	9,470,000	3,491,667
Average drainage area of wells (acres)	200	250	350	267	120	160	200	160
Success ratios (%)	10	50	90	50	10	50	90	50
Average EUR (MMBO, oil; BCFG, gas)	0.04	0.07	0.2	0.077	0.1	0.15	0.8	0.185
AU probability	1.0				0.7			

Table 2. Assessment results for the four continuous assessment units in the Dnieper-Donets Basin Province and the North Carpathian Basin Province.

[AU, assessment unit; 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 under the NGL (natural gas liquids) category. F95 represents 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. Shading indicates not applicable]

Total petroleum systems and assessment units (AUs)	AU prob- ability	Accu- mulation type	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Dnieper-Donets Basin Province														
Paleozoic Composite Total Petroleum System														
Carboniferous Tight Sandstone Gas AU	0.8	Gas					0	434	1,771	590	0	8	36	12
Carboniferous Rudov Bed Total Petroleum System														
Carboniferous Rudov Bed Shale Gas AU	0.7	Gas					0	444	1,984	624	0	9	41	12
North Carpathian Basin Province														
Paleozoic Composite Total Petroleum System														
East European Lower Paleozoic Shale Gas AU	0.7	Gas					0	853	4,642	1,391	0	6	40	11
Oligocene Menilite Shale Total Petroleum System														
Oligocene Menilite Shale Continuous Oil AU	1.0	Oil	3	11	29	13	8	32	90	38	0	2	6	2
Total continuous resources			3	11	29	13	8	1,763	8,487	2,643	0	25	123	37

References Cited

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For More Information

Assessment results are available at the USGS Energy Resources Program Web site at <http://energy.usgs.gov/>.