Assessment of Continuous Oil and Gas Resources of the Cooper Basin, Australia, 2016

Using a geology-based assessment methodology, the U.S. Geological Survey estimated mean continuous resources of 482 million barrels of oil and 29.8 trillion cubic feet of gas in the Cooper Basin of Australia.

Introduction

The U.S. Geological Survey (USGS) quantitatively assessed the potential for technically recoverable, continuous oil and gas resources in the Cooper Basin of Australia (fig. 1). The Cooper Basin is within the Eromanga Basin Province as defined by the USGS (Klett and others, 1997). For this assessment, the USGS defined a Cooper-Eromanga Composite Total Petroleum System (TPS) with Permian-age coal as the primary source rock for oil and gas in the Cooper Basin (Menpes and others, 2013). Seven continuous assessment units (AUs) were defined within this composite TPS to encompass the continuous oil and gas accumulations. They are (1) Patchawarra Trough Tight Gas AU, (2) Nappamerri Trough Tight Gas AU, (3) Queensland Troughs Tight Gas AU, (4) Patchawarra Trough Coal Oil AU, (5) Nappamerri Trough Coal Oil AU, (6) Queensland Troughs Coal Oil AU, and (7) Weena Trough Coalbed Gas AU.

Geologic Models for Assessment

The geologic model for continuous (tight) gas is for (1) gas generated from coals (or from cracking of oil) to form overpressure and (2) migration of gas into tight reservoirs resulting in regional gas saturation of tight sandstones. In this study, the model includes the potential for deep coalbed gas. The geologic model for the occurrence of continuous oil is for some portion of the oil and (or) condensate generated within coalbeds to be retained within the coal as a self-sourced reservoir system. Similarly, coalbed gas in the Weena Trough represents the part of generated gas that is retained within coal beds. Geologic analogs from U.S. continuous oil and gas accumulations were used to estimate well drainage areas, estimated ultimate recoveries, and well success ratios. The assessment input data for the seven continuous AUs are shown in table 1.

Continuous Resource Summary

The USGS quantitatively assessed technically recoverable, continuous oil and gas resources in seven assessment units within the Cooper Basin (table 2). For continuous resources, the mean totals are 482 million barrels of oil (MMBO), with an F95–F5 range from 0 to 1,444 MMBO; 29,784 billion cubic feet of gas (BCFG), with an F95–F5 range from 7,803 to 58,965 BCFG; and 80 million barrels of natural gas liquids (MMBNGL), with an F95–F5 range from 11 to 205 MMBNGL. About half of the continuous gas resource is predicted to be in the Nappamerri Trough Tight Gas AU. Given that known resources of conventional oil and gas in Cooper Basin strata are estimated at 42 MMBO and 5.5 trillion cubic feet of gas (IHS Energy, 2015), mean continuous oil and gas volumes of 482 MMBO and 29,781 BCFG represent significant potential resources in the Cooper Basin. The probability distributions for undiscovered oil resources reflect considerable geologic uncertainty (table 2), and it is uncertain how much of the assessed oil resource may ultimately be condensate rather than oil.

Acknowledgments

EXPLANATION

— Cooper Basin
— Patchawarra Trough Tight Gas AU
— Nappamerri Trough Tight Gas AU
— Queensland Troughs Tight Gas AU
— Patchawarra Trough Coal Oil AU
— Nappamerri Trough Coal Oil AU
— Queensland Troughs Coal Oil AU
— Weena Trough Coalbed Gas AU
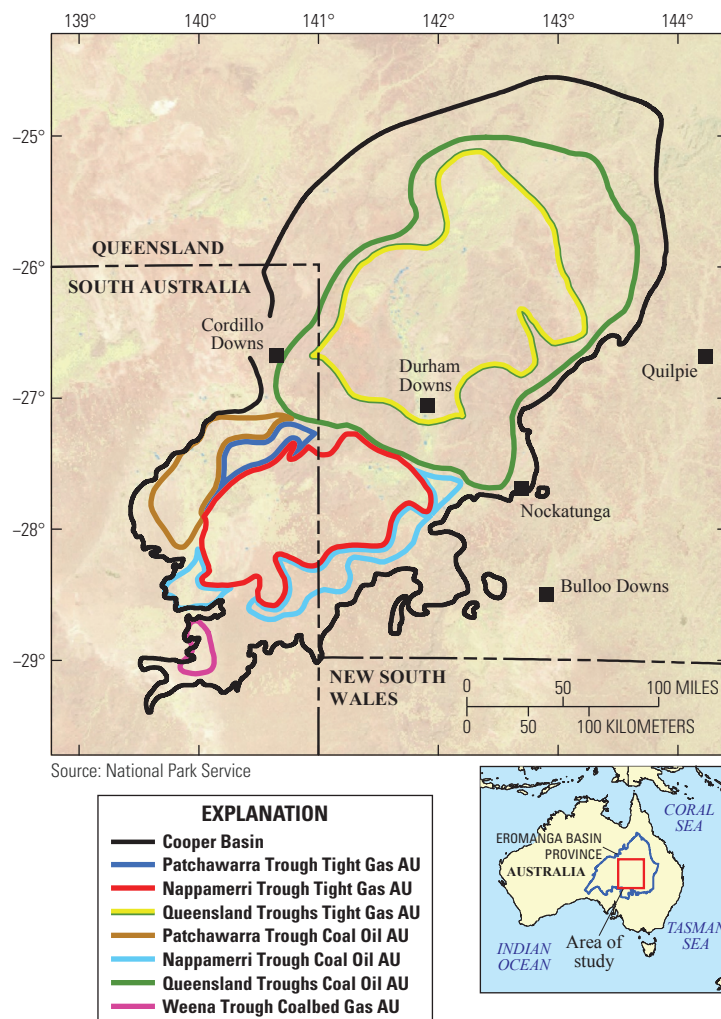
Source: National Park Service

Figure 1. Map showing the locations of the seven continuous assessment units in the Cooper Basin, Australia.

Table 1. Key assessment input data for the seven continuous assessment units in the Cooper Basin, Australia.

[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 and shale-oil analogs. The average EUR input is the minimum, median, maximum, and calculated mean. Shading indicates not applicable]

Assessment input data	Patchawarra Trough Tight Gas AU				Nappamerri Trough Tight Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	5,000	510,000	701,000	405,333	10,000	2,775,000	4,181,000	2,322,000
Average drainage area of wells (acres)	40	80	120	80	40	80	120	80
Success ratios (%)	50	70	90	70	70	80	90	80
Average EUR (BCFG)	0.4	0.6	1.0	0.619	0.4	0.6	1.0	0.619
AU probability	1.0				1.0			

	Queensland Troughs Tight Gas AU				Patchawarra Trough Coal Oil AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	5,000	3,790,000	7,580,000	3,791,667	1,000	697,000	1,072,000	590,000
Average drainage area of wells (acres)	40	80	120	80	80	160	240	160
Success ratios (%)	10	50	90	50	10	50	90	50
Average EUR (BCFG, gas; MMBO, oil)	0.2	0.4	0.6	0.407	0.04	0.08	0.2	0.086
AU probability	1.0				0.7			

	Nappamerri Trough Coal Oil AU				Queensland Troughs Coal Oil AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	1,000	533,000	1,567,000	700,333	1,000	1,527,000	6,943,000	2,823,667
Average drainage area of wells (acres)	80	160	240	160	80	160	240	160
Success ratios (%)	10	50	90	50	10	40	80	43
Average EUR (MMBO)	0.04	0.08	0.2	0.086	0.02	0.04	0.1	0.043
AU probability	0.7				0.7			

	Weena Trough Coalbed Gas AU			
	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	1,000	79,000	229,000	103,000
Average drainage area of wells (acres)	40	80	160	93.3
Success ratios (%)	50	70	90	70
Average EUR (BCFG)	0.03	0.35	1.0	0.38
AU probability	1.0			

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Table 2. Assessment results for the seven continuous assessment units in the Cooper Basin, Australia.

[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 natural gas liquids (NGL) 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 system (TPS) and assessment units (AUs)	AU probability	Accumulation type	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Cooper-Eromanga Composite TPS														
Patchawarra Trough Tight Gas AU	1.0	Gas					708	2,215	3,981	2,259	2	7	15	8
Nappamerri Trough Tight Gas AU	1.0	Gas					4,645	14,547	25,705	14,781	6	21	43	22
Queensland Troughs Tight Gas AU	1.0	Gas					2,378	8,975	20,829	9,926	3	13	34	15
Patchawarra Trough Coal Oil AU	0.7	Oil	0	98	314	113	0	437	1,541	531	0	6	24	8
Nappamerri Trough Coal Oil AU	0.7	Oil	0	108	400	134	0	680	2,715	886	0	8	37	12
Queensland Troughs Coal Oil AU	0.7	Oil	0	174	730	235	0	781	3,534	1,102	0	11	51	15
Weena Trough Coalbed Gas AU	1.0	Gas					72	259	660	299	0	0	1	0
Total undiscovered continuous resources			**0**	**380**	**1,444**	**482**	**7,803**	**27,894**	**58,965**	**29,784**	**11**	**66**	**205**	**80**

References Cited

IHS Energy, 2015, International petroleum exploration and production database: IHS Energy, 15 Inverness Way East, Englewood, CO 80112.

Klett, T.R., Ahlbrandt, T.S., Schmoker, J.W., and Dolton, G.L., 1997, Ranking of the World's oil and gas provinces by known petroleum volumes: U.S. Geological Survey Open-File Report 97–463, CD–ROM.

Menpes, S.A., Hill, A.J., and Pepicelli, Dominic, 2013, Characteristics of the Gidgealpa Group composite resource play in the Cooper Basin, South Australia, *in* Unconventional Resources Technology Conference, Denver, Colorado, August 12–14, 2013, Proceedings: Society of Exploration Geophysicists, American Association of Petroleum Geologists, Society of Petroleum Engineers, URTeC Control Number 158265, p. 2621–2630.

For More Information

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