

National and Global Petroleum Assessment

Assessment of Undiscovered Conventional Oil and Gas Resources of the Perth Basin, NW Shelf, Browse Basin, and Bonaparte Gulf Basin Provinces of Western Australia, 2020

Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean resources of 906 million barrels of oil and 132.8 trillion cubic feet of gas in four geologic provinces of Western Australia.

Introduction

The U.S. Geological Survey (USGS) quantitatively assessed the potential for undiscovered, technically recoverable conventional oil and gas resources in four geologic provinces of Western Australia (fig. 1). This assessment encompasses the Perth Basin, NW Shelf, Browse Basin, and Bonaparte Gulf Basin provinces. Five geologic assessment units (AUs) were defined within these provinces, and each AU was assessed for undiscovered oil, gas, and natural gas liquids.

Petroleum source rocks within the western continental margin reflect the tectonic history. Source rocks consist of Permian lacustrine and marine shales, Permian coals and carbonaceous shales, Triassic marine shales, Jurassic coals and carbonaceous shales, and Cretaceous marine shales. Burial by as much as 6 kilometers of sediment along the continental margin has placed most source rocks within the thermal gas generation window, although there are complex spatial patterns of thermal maturation, source rock thickness, and source rock quality across this expansive, structured margin (Preston and Edwards, 2000; Volk and others, 2012; Abbassi and others, 2014; Palu and others, 2017; Ghori, 2018).

Geologic variability and uneven geochemical understanding of the several potential petroleum source rocks contributed to the definition of five composite total petroleum systems (TPS) within the four provinces. Within these composite TPS, five AUs were defined with the understanding that the AUs encompass the geologic and geochemical variability. Key assessment input data are summarized in table 1.

Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered conventional oil, gas, and natural gas liquids resources within four geologic provinces of Western Australia (table 2). The fully risked mean totals for Western Australia are 906 million barrels of oil (MMBO) or 0.9 billion barrels of oil, with a F95–F5 fractile range from 594 to 1,300 MMBO; 132,837 billion cubic feet of gas (BCFG), or 132.8 trillion cubic feet, with an F95–F5 fractile range from 76,942 to 203,932 BCFG; and 2,508 million barrels of natural gas liquids (MMBNGL), or 2.5 billion barrels of natural gas liquids, with an F95–F5 fractile range from 1,436 to 3,877 MMBNGL. Of the mean total of 132,837 BCFG, about 81 percent, or 108,393 BCFG, is estimated to be in the NW Shelf Province.

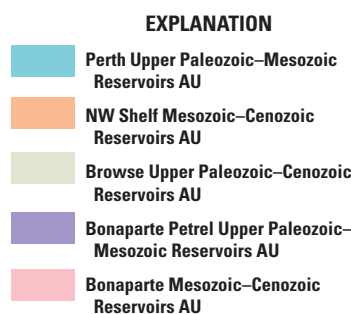
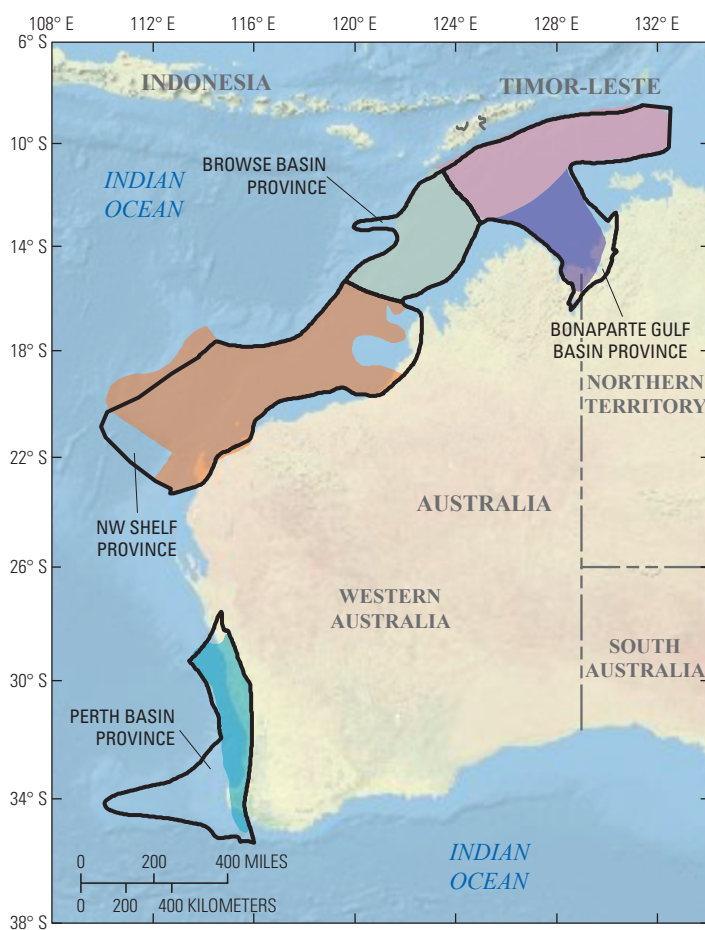


Figure 1. Map showing the location of five conventional assessment units (AUs) in four geologic provinces of Western Australia.

Table 1. Key input data for five conventional assessment units in provinces of Western Australia.

[Shading indicates not applicable. AU, assessment unit; NW, northwest; MMBO, million barrels of oil; BCFG, billion cubic feet of gas]

Assessment input data— Conventional AUs	Perth Upper Paleozoic–Mesozoic Reservoirs AU				NW Shelf Mesozoic–Cenozoic Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	25	50	25.6	1	30	60	30.7
Number of gas fields	1	150	300	153.7	1	280	560	286.8
Size of oil fields (MMBO)	1	4	12	4.3	5	8	100	10.5
Size of gas fields (BCFG)	6	24	6,000	99.5	30	72	14,000	248.0
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Browse Upper Paleozoic–Cenozoic Reservoirs AU				Bonaparte Petrel Upper Paleozoic–Mesozoic Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	20	40	20.5	1	5	10	5.1
Number of gas fields	1	130	260	133.2	1	40	80	41.0
Size of oil fields (MMBO)	5	8	20	8.4	5	8	20	8.4
Size of gas fields (BCFG)	30	72	14,000	248.0	30	60	400	71.3
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Bonaparte Mesozoic–Cenozoic Reservoirs AU							
	Minimum	Median	Maximum	Calculated mean				
Number of oil fields	1	30	60	30.7				
Number of gas fields	1	80	160	82.0				
Size of oil fields (MMBO)	5	8	20	8.4				
Size of gas fields (BCFG)	30	60	2,500	109.2				
AU probability	1.0							

Table 2. Results for five conventional assessment units in provinces of Western Australia.

[Results shown are fully risked estimates. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. Shading indicates not applicable. MMBO, million barrels of oil; BCFG, billion cubic feet of gas; NGL, natural gas liquids; MMBNGL, million barrels of natural gas liquids]

Total petroleum system 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
Permian–Jurassic Composite Total Petroleum System														
Perth Upper Paleozoic–Mesozoic Reservoirs AU	1.0	Oil	73	107	155	109	65	96	141	98	0	0	0	0
		Gas					8,178	14,669	24,399	15,288	82	147	245	153
Mesozoic Composite Total Petroleum System														
NW Shelf Mesozoic–Cenozoic Reservoirs AU	1.0	Oil	202	313	474	322	465	721	1,091	741	9	14	22	15
		Gas					42,866	69,129	107,302	71,316	641	1,036	1,613	1,070
Upper Paleozoic–Mesozoic Composite Total Petroleum System														
Browse Upper Paleozoic–Cenozoic Reservoirs AU	1.0	Oil	116	169	243	173	289	421	609	432	3	5	7	5
		Gas					17,703	31,682	52,628	32,962	532	951	1,579	989
Upper Paleozoic–Mesozoic Composite Total Petroleum System														
Bonaparte Petrel Upper Paleozoic–Mesozoic Reservoirs AU	1.0	Oil	29	42	62	43	5	8	14	9	0	0	0	0
		Gas					1,908	2,844	4,188	2,921	23	34	50	35
Mesozoic Composite Total Petroleum System														
Bonaparte Mesozoic–Cenozoic Reservoirs AU	1.0	Oil	174	253	366	259	85	126	187	130	6	9	13	9
		Gas					5,378	8,678	13,373	8,940	140	266	348	232
Total undiscovered conventional resources			594	884	1,300	906	76,942	128,374	203,932	132,837	1,436	2,462	3,877	2,508

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For More Information

Assessment results are also available at the USGS Energy Resources Program website, <https://www.usgs.gov/energy-and-minerals/energy-resources-program>.

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