

Assessment of Undiscovered Conventional and Continuous Gas Resources in the Mesaverde Group and Lance Formation in the Southwestern Wyoming Province, Wyoming, Utah, and Colorado, 2025

Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean conventional and continuous resources of 4.7 trillion cubic feet of gas in the Mesaverde Group and Lance Formation in the Southwestern Wyoming Province, Wyoming, Utah, and Colorado.

Introduction

The U.S. Geological Survey (USGS) completed an assessment of the conventional and continuous gas resources in the Late Cretaceous Santonian to Campanian Mesaverde Group and Maastrichtian Lance Formation in the Southwestern Wyoming Province of Wyoming, Utah, and Colorado (fig. 1). The Mesaverde Group and Lance Formation are elements of the Cretaceous–Cenozoic Composite Total Petroleum System (TPS), which lies within the western half of the Southwestern Wyoming Province. The province is bounded on the west by the Wyoming salient of the Sevier orogenic belt, on the north and south by Laramide uplifts, and on the east by the pinchout of the Late Cretaceous Lewis Shale. Substantial composite TPS field production is tied to the intrabasin Laramide Pinedale Anticline and Jonah field structural features (DuBois, 2014).

The Cretaceous–Cenozoic Composite TPS was previously assessed by the USGS in 2005 (Finn and others, 2005), and four assessment units (AUs) were defined at that time. Three AUs were defined for this assessment, based on structural setting, source rock maturity, and production characteristics: the Mesaverde–Lance Conventional Gas AU, Mesaverde–Lance Jonah Pinedale Continuous Gas AU, and Mesaverde–Lance Continuous Gas AU (fig. 1).

Geologic Summary

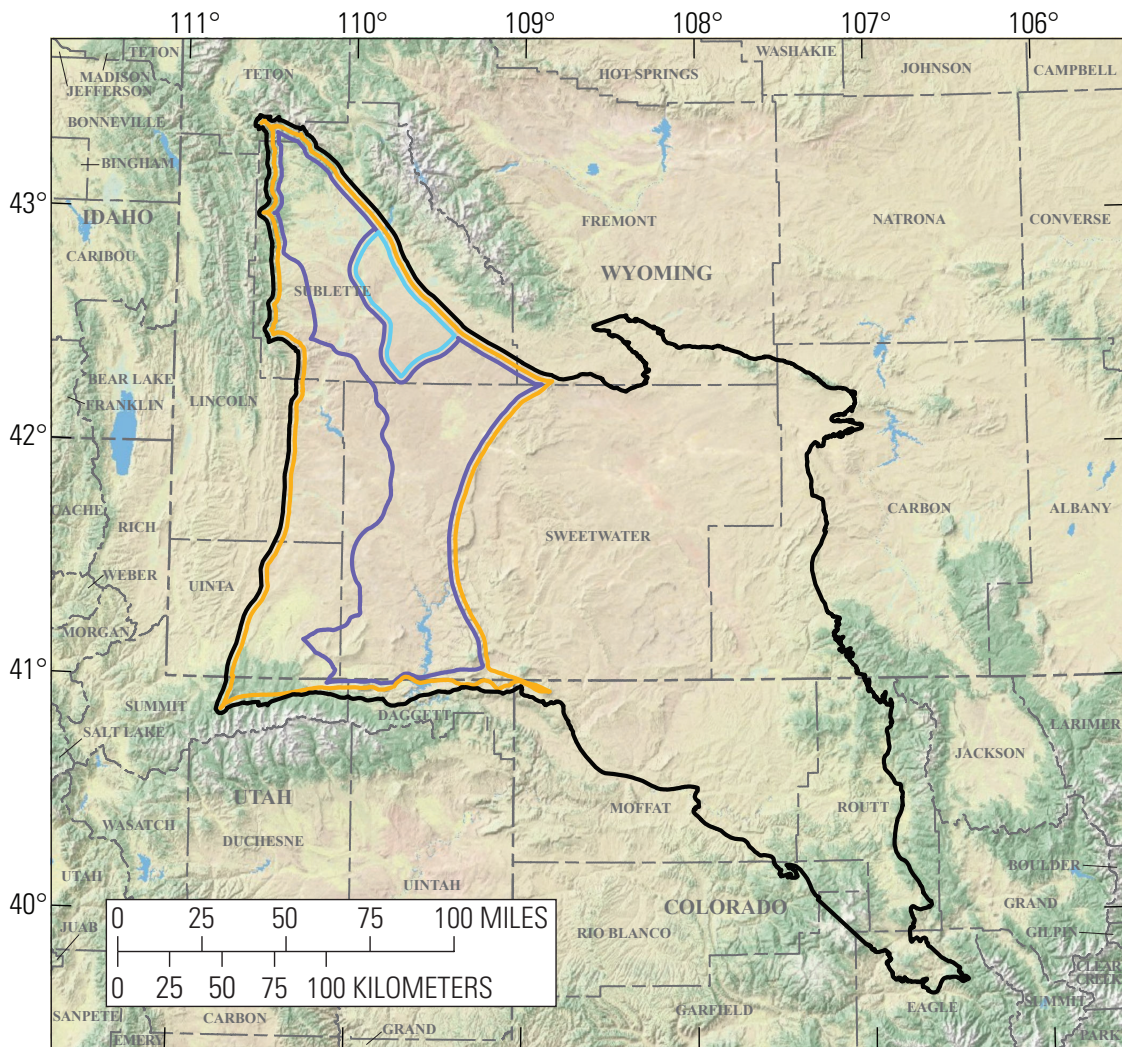
The predominately gas-prone Cretaceous–Cenozoic Composite TPS consists of four Upper Cretaceous formations, which comprise alluvial, deltaic, and minor marginal marine siliciclastics, deposited roughly perpendicular to the southwest–northeast shoreline of the Western Interior Seaway (Roehler, 1990). In stratigraphic order, the formations are the Rock Springs Formation, Ericson Sandstone, and Almond Formation of the Mesaverde Group, and the Lance Formation. The primary source rocks for the composite TPS are Type III thermally mature coal beds in the Rock Springs Formation, which have a modeled vitrinite reflectance (R_o) greater than 0.8 percent (Law, 1984). Although coal beds are also present in the Ericson Sandstone and the Almond and Lance Formations, USGS thermal maturity modeling indicates they are likely too immature to contribute to

hydrocarbon production, because their R_o values are less than 0.8 percent. The undifferentiated alluvial, deltaic, and marginal marine sandstone beds in the Mesaverde Group and the alluvial sandstone beds in the Lance Formation are the reservoirs for the composite TPS. However, with its more favorable porosity, permeability, and net reservoir thickness, the Lance Formation is the primary producer for the composite TPS and for the entire Southwestern Wyoming Province (DuBois, 2014; Law and Spencer, 2014; Rudolph and others, 2015).

Total Petroleum System and Assessment Units

The USGS defined one conventional and two continuous AUs within the Cretaceous–Cenozoic Composite TPS (table 1). The boundaries of the Mesaverde–Lance Conventional Gas AU are defined by Sevier- and Laramide-age uplift and depositional pinchout of the composite TPS intervals; it is the largest of the three AUs. The Mesaverde–Lance Continuous Gas AU boundaries are also defined by the same uplift and depositional pinchout features as the conventional AU on its northern, southern, and eastern boundaries; however, its western boundary is defined by the 0.8-percent modeled R_o thermal maturity line for gas in the Rock Springs Formation (fig. 1). The Mesaverde–Lance Jonah Pinedale Continuous Gas AU boundaries are defined by the structural relief and faults associated with the Pinedale Anticline and Jonah field, and the boundaries of vertical and horizontal well development, around which most of the composite TPS production is centered. Although the Mesaverde–Lance fields within the Mesaverde–Lance Conventional Gas AU are generally normally pressured and may contain gas–water contacts (Kovach and others, 2003), both continuous AUs are overpressured and lack defined gas–water contacts (Law and Spencer, 2014).

The contact between the Mesaverde–Lance Conventional Gas AU and the two continuous AUs—the Mesaverde–Lance Jonah Pinedale Continuous Gas AU and Mesaverde–Lance Continuous Gas AU—cannot be uniquely defined. Each gas field within the boundaries of the composite TPS was assigned to either a conventional or continuous AU based on its production characteristics and the absence or presence of overpressure and gas–water contacts. Assessment input data are summarized in tables 1 and 2 and Lagesse (2025).



Base map from U.S. Department of the Interior, National Park Service

EXPLANATION

- **Mesaverde-Lance Conventional Gas AU**
- **Mesaverde-Lance Jonah Pinedale Continuous Gas AU**
- **Mesaverde-Lance Continuous Gas AU**
- **Southwestern Wyoming Province boundary**



Figure 1. Map showing the location of one conventional and two continuous assessment units (AUs) in the Southwestern Wyoming Province.

Undiscovered Resources Summary

The USGS quantitatively assessed gas resources in one conventional and two continuous AUs in the Mesaverde Group and Lance Formation in the Southwestern Wyoming

Province (tables 1, 2). The fully risked, estimated mean totals are 4,652 billion cubic feet of gas (BCFG), or 4.7 trillion cubic feet of gas, with an F95–F5 fractile range from 1,189 to 9,150 BCFG; and 158 million barrels of natural gas liquids (MMBNGL) with an F95–F5 range from 41 to 313 MMBNGL.

Table 1. Key input data for one conventional and two continuous assessment units in the Mesaverde Group and Lance Formation within the Cretaceous–Cenozoic Composite Total Petroleum System in the Southwestern Wyoming Province.

[Gray shading indicates not applicable. The average estimated ultimate recovery (EUR) input is the minimum, median, maximum, and calculated mean. AU, assessment unit; %, percent; BCFG, billion cubic feet of gas]

Assessment input data— Conventional AUs	Mesaverde-Lance Conventional Gas AU							
	Minimum	Median	Maximum	Calculated mean				
Number of gas fields	1	2	6	2.1				
Size of gas fields (BCFG)	3	12	50	13.3				
AU probability	0.9							
Assessment input data— Continuous AUs	Mesaverde-Lance Jonah Pinedale Continuous Gas AU				Mesaverde-Lance Continuous Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area (acres)	1,000	258,700	428,600	229,433	1,000	1,806,000	3,010,000	1,605,667
Average drainage area (acres)	250	280	310	280.0	250	280	310	280
Success ratio (%)	70	85	99	84.7	10	70	99	59.7
Untested area (%)	40	52	65	52.3	98	99	99.5	98.8
Average EUR (BCFG, gas)	2	3	4	3.034	0.5	1	2	1.047
AU probability	1.0				1.0			

Table 2. Results for one conventional and two continuous assessment units in the Mesaverde Group and Lance Formation within the Cretaceous–Cenozoic Composite Total Petroleum System in the Southwestern Wyoming Province.

[Gray shading indicates not applicable. Results shown are fully risked estimates. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. 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							
			Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean
Cretaceous–Cenozoic Composite Total Petroleum System										
Mesaverde-Lance Conventional Gas AU	0.9	Gas	0	25	51	26	0	1	2	1
Total conventional resources			0	25	51	26	0	1	2	1
Mesaverde-Lance Jonah Pinedale Continuous Gas AU	1.0	Gas	349	1,100	1,863	1,101	12	37	64	37
Mesaverde-Lance Continuous Gas AU	1.0	Gas	840	3,222	7,236	3,525	29	110	247	120
Total continuous resources			1,189	4,322	9,099	4,626	41	147	311	157
Total undiscovered resources			1,189	4,347	9,150	4,652	41	148	313	158

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For More Information

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

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