

National and Global Petroleum Assessment

Assessment of Unconventional Oil and Gas Resources in Northeast Mexico, 2014

Using a geology-based assessment methodology, the U.S. Geological Survey estimated means of 0.78 billion barrels of unconventional oil, 23.5 trillion cubic feet of unconventional gas, and 0.88 billion barrels of natural gas liquids in the Sabinas Basin, Burgos Basin, and Tampico-Misantla Basin provinces of northeast Mexico.

Introduction

The U.S. Geological Survey (USGS), in cooperation with the U.S. Department of State, quantitatively assessed the potential for unconventional oil and gas resources within the Sabinas Basin, Burgos Basin, and Tampico-Misantla Basin provinces of northeast Mexico (fig. 1). Resources of the Veracruz Basin were not quantitatively assessed due to a lack of reservoir information. Unconventional resources include shale gas, shale oil, tight gas, tight oil, and coalbed gas. Undiscovered conventional oil and gas resources were assessed in Mexico in 2012 (Schenk and others, 2012).



Figure 1. Map showing locations of the Sabinas Basin, Burgos Basin, and Tampico-Misantla Basin provinces assessed in this study.

The USGS assessment methodology consists of a well-performance approach (Charpentier and Cook, 2011) that recognizes the geologic variability within assessed reservoirs. For assessments outside of the United States, the USGS assesses shale-gas or shale-oil reservoirs that (1) have greater than 2 weight percent total organic carbon; (2) are within the proper thermal maturity window for oil or gas generation; (3) have greater than 15 meters (m) of organic-rich shale; and (4) contain Type I or II organic matter (Charpentier and Cook, 2011). Areas that do not meet these criteria are unlikely to have significant resource potential without major technological improvements or price increases. When applied to any given shale-oil or shale-gas reservoir, these specific USGS criteria might significantly reduce the potential resource area compared to maps made with greater than 1 percent total organic carbon (TOC). For example, the area of potential reservoir of the Pimienta Shale in the Tampico-Misantla Basin with greater than 2 weight percent TOC is only about 21 percent of the total area of thermally mature Pimienta Shale.

An important part of the geologic phase of this study was a formal USGS-PEMEX (Petróleos Mexicanos) Workshop on Unconventional Resources convened in Mexico City in June 2012, during which the geology and current exploration results from within the various shale-oil and shale-gas assessment units of northeast Mexico were discussed in detail. Several maps with geologic data (as outlined above) that were critical to the USGS assessment were supplied by PEMEX. These maps were combined to produce areas within the Sabinas, Burgos, and Tampico-Misantla Basins that were then considered for quantitative USGS assessment using the criteria outlined above.

The input data for each unconventional assessment unit is shown in table 1.

Resource Summary

The USGS quantitatively assessed unconventional oil and gas resources in 11 assessment units within 3 geologic provinces (table 2). For unconventional oil resources, the mean total is 776 million barrels of oil (MMBO), with a range of 353–1,365 MMBO; for unconventional gas, the mean total is 23,474 billion cubic feet (BCFG), with a range of 7,431–44,630 BCFG; and a mean total of 883 million barrels of natural gas liquids (MMBNGL), with a range of 278–1,690 MMBNGL.

Of the mean unconventional oil total of 776 MMBO, about 82 percent is in the Tampico-Misantla Basin. Within the basin, 55 percent (426 MMBO) is estimated to be in the Agua Nueva Shale Oil Assessment Unit (AU), and 27 percent (212 MMBO) is in the Pimienta Shale Oil AU. The Agua Nueva Shale Oil AU in the Burgos Basin contains the remaining 18 percent (138 MMBO).

For the mean unconventional gas total of 23,474 BCFG, about 66 percent (15,591 BCFG) is estimated to be in the Burgos Basin; 25 percent (5,822 BCFG) is in the Sabinas Basin; and 9 percent (2,061 BCFG) is in the Tampico-Misantla Basin.

For Further Information

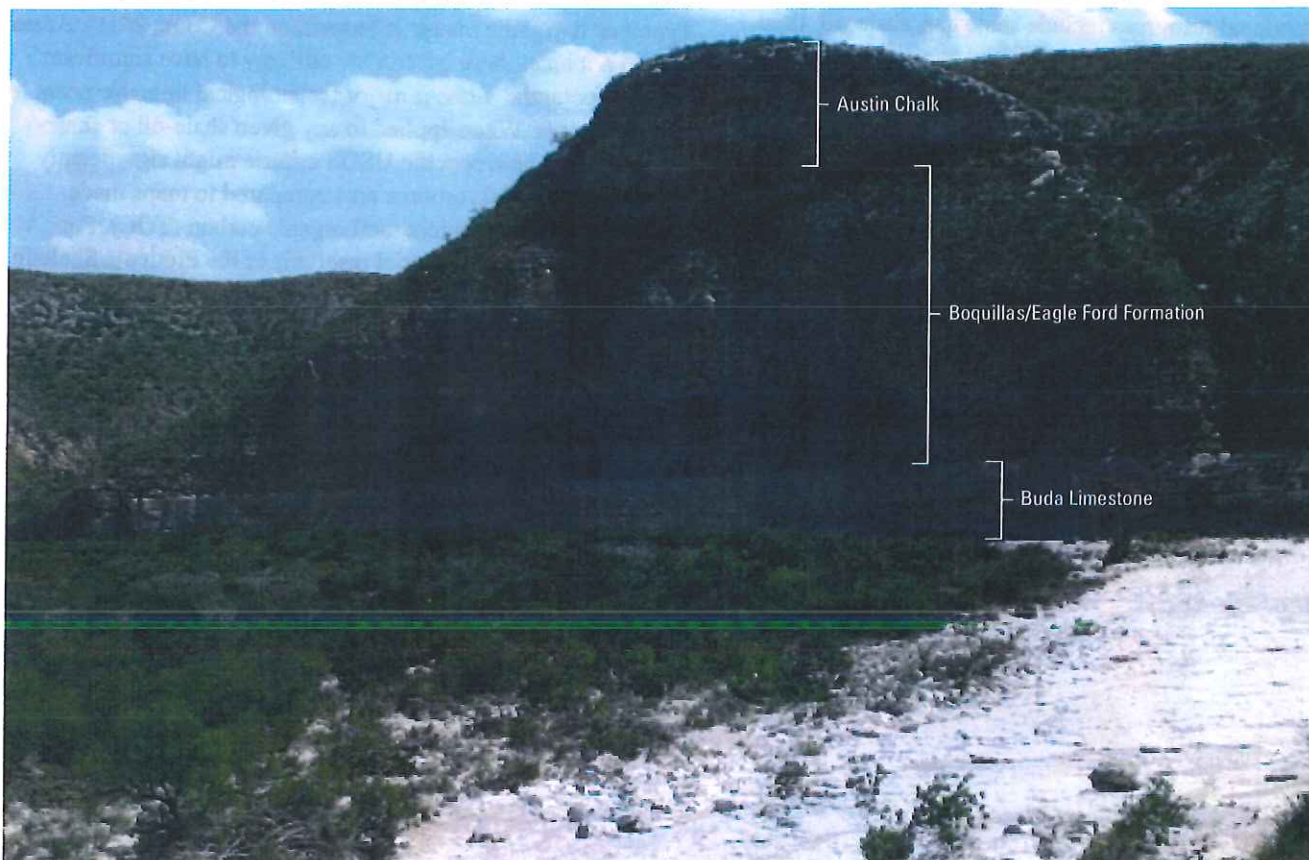
Supporting studies of the geologic models and the methodology used in the assessment of northeast Mexican unconventional resources are in progress. Assessment results are available at the USGS Energy Resources Program website, <http://energy.usgs.gov/oilgas/>.

References Cited

- Charpentier, R.R., and Cook, T.A., 2011, USGS methodology for assessing continuous petroleum resources: U.S. Geological Survey Open-File Report 2011–1167, 75 p., <http://pubs.usgs.gov/of/2011/1167/>.
- Schenk, C.J., Charpentier, R.R., Cook, T.A., Klett, T.R., Pitman, J.K., Pollastro, R.M., and Weaver, J.N., 2012, Assessment of undiscovered conventional oil and gas resources of Mexico, Guatemala, and Belize, 2012: U.S. Geological Survey Fact Sheet 2012–3069, 4 p., <http://pubs.usgs.gov/fs/2012/3069/>.

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Exposure of Boquillas/Eagle Ford Formation on south bank of Langtry Creek in Pump Canyon, Val Verde County Texas. Photograph taken by Michael Lewan, August 19, 2010.

Table 1. Key assessment input data for unconventional assessment units in northeast Mexico.

[EUR (estimated ultimate recovery per well), well drainage area, and success ratios are from U.S. shale-gas, shale-oil, tight-gas, and coalbed gas analogs. MMBO, million barrels of oil; BCFG, billion cubic feet of gas; AU, assessment unit, %, percent. The average EUR input is the minimum, median, maximum, and calculated mean.]

Assessment input data	Burgos Basin Rio Escondido Basin Olmos Coalbed Gas AU 53000281				Burgos Basin La Casita Shale Gas AU 53000361			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	10,000	250,000	750,000	336,667	100,000	828,000	2,500,000	1,142,667
Average drainage area of wells (acres)	40	80	160	93	80	120	160	120
Percent of AU untested	100	100	100	100	100	100	100	100
Success ratios (%)	50	70	90	70	40	60	80	60
Average EUR (MMBO, oil; BCFG, gas)	0.03	0.2	1	0.24	0.3	0.6	0.9	0.61
	Burgos Basin Agua Nueva Shale Oil AU 53000461				Burgos Basin Agua Nueva Shale Gas AU 53000462			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	100,000	704,000	1,100,000	634,667	100,000	2,259,000	3,530,000	1,963,000
Average drainage area of wells (acres)	160	280	400	280	80	120	160	120
Percent of AU untested	100	100	100	100	100	100	100	100
Success ratios (%)	50	70	90	70	50	70	90	70
Average EUR (MMBO, oil; BCFG, gas)	0.04	0.08	0.2	0.086	0.4	0.8	1.2	0.813
	Burgos Basin Wilcox-Lobo Tight Gas AU 53000561				Sabinas Basin La Casita Shale Gas AU 53230161			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	10,000	550,000	700,000	420,000	94,000	565,000	1,882,000	847,000
Average drainage area of wells (acres)	40	110	180	110	80	120	160	120
Percent of AU untested	100	100	100	100	100	100	100	100
Success ratios (%)	50	70	90	70	10	50	90	50
Average EUR (MMBO, oil; BCFG, gas)	0.25	0.6	1.5	0.645	0.3	0.6	0.9	0.610
	Sabinas Basin Agua Nueva Shale Gas AU 53230261				Tampico-Misantla Basin Pimienta Shale Oil AU 53010261			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	100,000	704,000	2,400,000	1,068,000	100,000	695,000	2,100,000	965,000
Average drainage area of wells (acres)	80	120	160	120	140	240	300	227
Percent of AU untested	100	100	100	100	100	100	100	100
Success ratios (%)	10	50	90	50	40	60	80	60
Average EUR (MMBO, oil; BCFG, gas)	0.4	0.8	1.2	0.813	0.03	0.08	0.14	0.082
	Tampico-Misantla Basin Pimienta Shale Gas AU 53010262				Tampico-Misantla Basin Agua Nueva Shale Oil AU 53010361			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	10,000	33,000	100,000	47,667	1,052,000	2,104,000	2,735,000	1,963,667
Average drainage area of wells (acres)	80	120	160	120	160	280	400	280
Percent of AU untested	100	100	100	100	100	100	100	100
Success ratios (%)	40	60	80	60	50	70	90	70
Average EUR (MMBO, oil; BCFG, gas)	0.3	0.6	0.9	0.610	0.04	0.08	0.2	0.086
	Tampico-Misantla Basin Agua Nueva Shale Gas AU 53010362							
	Minimum	Mode	Maximum	Calculated mean				
Potential production area of AU (acres)	10,000	128,000	368,000	168,667				
Average drainage area of wells (acres)	80	120	160	120				
Percent of AU untested	100	100	100	100				
Success ratios (%)	50	70	90	70				
Average EUR (MMBO, oil; BCFG, gas)	0.4	0.8	1.2	0.813				

Table 2. Northeast Mexico unconventional oil and gas resource assessment results.

[MMBO, million barrels of oil. BCFG, billion cubic feet of gas; MMBNGL, million barrels of natural gas liquids; TPS, total petroleum system; AU, assessment unit. Results shown are fully risked estimates. For gas fields, 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. Shading indicates not applicable.]

Total Petroleum Systems (TPS) and Assessment Units (AU)	AU Prob-ability	Field Type	Total Undiscovered Resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
BURGOS BASIN														
Olmos Coalbed Gas TPS														
Rio Escondido Basin Olmos Coalbed Gas AU 53000281	1.0	Gas					125	479	1,544	612	0	0	0	0
Upper Jurassic La Casita TPS														
La Casita Shale Gas AU 53000361	1.0	Gas					1,148	3,253	6,730	3,516	69	195	407	211
Turonian Agua Nueva TPS														
Agua Nueva Shale Oil AU 53000461	1.0	Oil	52	129	251	138	96	252	533	275	2	5	11	6
Agua Nueva Shale Gas AU 53000462	1.0	Gas					3,211	9,320	15,982	9,403	127	368	654	376
Paleogene TPS														
Wilcox-Lobo Tight Gas AU 53000561	1.0	Gas					535	1,675	3,431	1,785	5	16	36	18
SABINAS BASIN														
Upper Jurassic La Casita TPS														
La Casita Shale Gas AU 53230161	1.0	Gas					577	1,899	4,687	2,172	17	56	144	65
Turonian Agua Nueva TPS														
Agua Nueva Shale Gas AU 53230261	1.0	Gas					941	3,189	7,922	3,650	37	127	321	146
TAMPICO-MISANTLA BASIN														
Upper Jurassic Pimienta TPS														
Pimienta Shale Oil AU 53010261	1.0	Oil	69	194	412	212	82	232	498	254	2	7	15	8
Pimienta Shale Gas AU 53010262	1.0	Gas					58	136	272	147	2	4	8	4
Turonian Agua Nueva TPS														
Agua Nueva Shale Oil AU 53010361	1.0	Oil	232	402	702	426	406	789	1,502	852	7	16	32	17
Agua Nueva Shale Gas AU 53010362	1.0	Gas					252	754	1,529	808	10	30	62	32
VERACRUZ BASIN														
Turonian Maltrata TPS														
Maltrata Shale Oil AU 53020261		Oil	Not quantitatively assessed											
Maltrata Shale Gas AU 53020262		Gas	Not quantitatively assessed											
Total unconventional resources			353	725	1,365	776	7,431	21,978	44,630	23,474	278	824	1,690	883

