Survey of Oklahoma Oil and Gas Leases

for the

Oklahoma Commission on

Marginally Producing Oil and Gas Wells

by
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Purpose

The Commission on Marginally Producing Oil and Gas Wells commissioned the Center for Economic and Management Research to conduct a survey of operators of oil and gas leases in Oklahoma. The primary purpose of the survey was to estimate the distribution of stripper wells by lease by level of production, estimate costs of production, and determine expectations for future lease development.

Sampling Procedure

A simple random sample of 1,000 oil leases and 1,000 gas leases was taken from a listing provided by Geo Information Systems at The University of Oklahoma Energy Center. The population from which the sample was selected included any lease with production of either oil or natural gas during 1994. In several cases an operator received questionnaires regarding more than one lease.

Questionnaires were mailed to the sample of lease operators in October 1995. A reminder postcard was mailed to all operators ten days after the initial mailing. A second mailing of the questionnaire followed roughly four weeks subsequent to the first mailing. After data editing and consistency checks, 250 oil questionnaires and 252 gas questionnaires were used in the analysis.

Questionnaire Design

The questionnaire was designed by the Center for Economic and Management Research with input from the Commission on Marginally Producing Oil and Gas Wells. Lease operators were asked several questions involving daily production from each well and monthly production costs for the lease. In order to obtain the most current data possible, operators were asked to limit their responses to activity that occurred during the first six months of 1995.

Operators were asked to provide details of operating costs including labor cost (pumper and supervision), electricity, gas, water disposal, chemicals, trucking, and overhead costs. Costs related to routine maintenance and subsurface maintenance and repairs, including workovers, were also solicited.

Other questions pertained to the number of disposal and injection- wells- by- lease, number of wells plugged during the first six months of 1995, and expectations for lease development during the next three years.

Summary of Results

An estimated 67,247 stripper wells were operating on oil leases in Oklahoma during 1995, averaging 2.38 barrels of oil per day (BOPD) and 8.05 MCF of gas per day (Table 1). Interestingly, 34 percent of stripper wells produced 1 BOPD or less and 58 percent produced 2 BOPD or less. In all, oil and casinghead gas production from strippers wells

accounted for approximately 70 percent of oil production in Oklahoma. Remarkably, operators reported that nearly 22,000 oil wells were inactive at the time of the survey.

Costs of Production

Many oil leases produced gas in large quantities relative to the total energy content of production: gas accounted for 34 percent of barrels of oil equivalent (BOE) produced by oil leases. Chart 1 shows that average operating costs per BOE were much lower for leases with high ratios of gas-to-oil production. However, these leases also brought much lower prices per BOE than did leases that produced mostly oil (Chart 2). Overall, operating costs averaged $5.80 per barrel of oil equivalent (BOE) for oil leases, with an estimated net revenue of $11.77 BOE (Table 5). Leases with higher oil production as a percent of energy incurred much higher costs of production. For example, stripper wells on leases that produced 75 percent oil in total energy content experienced average production costs of $9.64 BOE.

Overhead and pumper costs (labor) were the largest items of cost, followed by workover and electricity costs. Again, costs per BOE in each category increase as the ratio of oil to gas increases.

Disposal, Injection, and Plugged Wells

Operators reported 5,573 disposal wells and 6,688 injection wells on oil leases in 1995 (Table 12). Estimates of the number of wells plugged in 1995 did not meet reliability requirements and will not be reported.

Water Production

On average, 5.8 barrels of water was produced with each barrel of oil, making water disposal a major expense for many leases (Table 13).

Production Depth

Nearly two-thirds of oil production occurred at depths of 5,900 feet or less, while most gas production from oil leases tended to occur from greater depths. Interestingly, production costs per BOE drop with increasing depth as shown in Chart 3, while the water cut--the percent of water in liquids produced--decreases with production depth (Table 6).

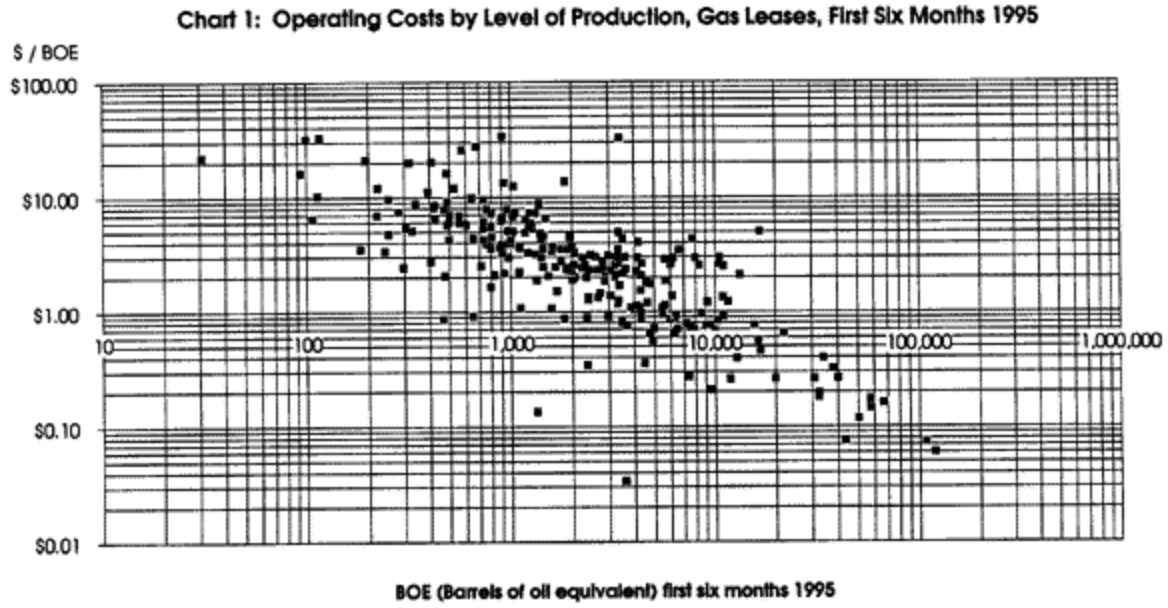
Expectations for Future Lease Development

A large portion of operators of both oil leases (36 percent) and gas leases (28 percent) expect to shut-in or plug wells during the next three years. Oil lease operators expect to shut-in more than 28,000 wells in the coming three years, accounting for annual production of 31 million BOE. Operators of gas leases expect to shut-in 26 percent of wells, cutting annual production by 17.6 million BOE.

Very few operators -- 2 percent gas and 1 percent oil -- plan to drill new wells during the next three years, suggesting that current production will not soon be replaced by discoveries of additional reserves.

Detailed data from the survey are presented in Tables 1 through 14. Open-ended comments from lease operators are reported on pages B1 and B2 (printed version only), followed by copies of the survey instruments.

Chart 1



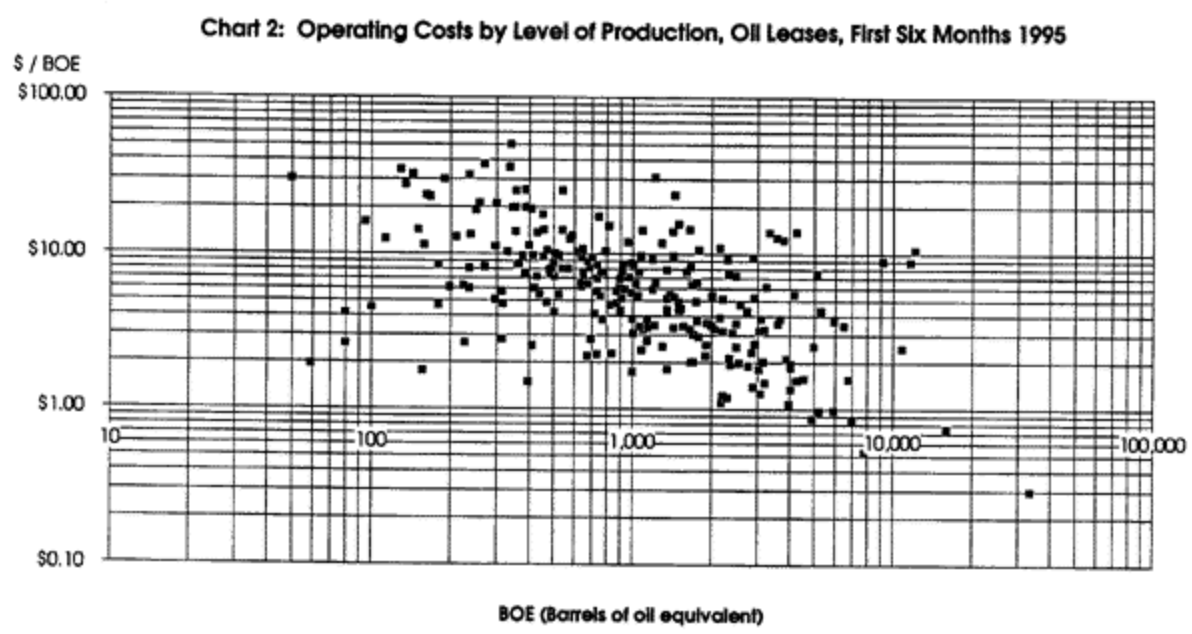


Chart 2: Operating Costs by Level of Production, Oil Leases, First Six Months 1995
$ / BOE
$100.00
$10.00
$1.00
$0.10
10
100
1,000
10,000
100,000
BOE (Barrels of oil equivalent)

Chart 3

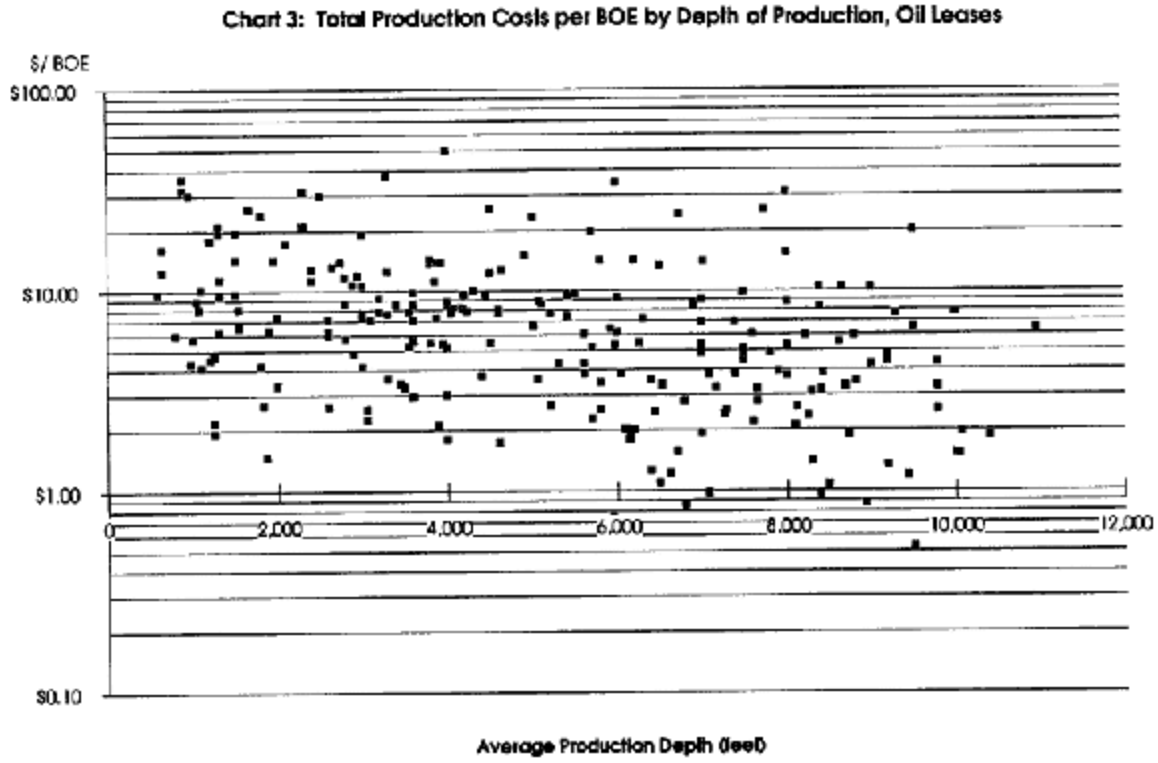


Chart 3: Total Production Costs per BOE by Depth of Production, Oil Leases
$/ BOE
$100.00
$10.00
$1.00
$0.10
0
2,000
4,000
6,000
8,000
10,000
12,000
Average Production Depth (feet)

Table 1: Production Characteristics of Oil Leases in Oklahoma, First Six Months 1995

BBL per day per Well	Number of Wells	Percent of Total	Production as Percent of Total: Total Barrels	Total MCF	Total BOE
Inactive	21,920	23.37%	0	0	0
.01-.99	23,406	24.95%	6.59%	25.47%	12.93%
1.00-1.99	16,905	18.02%	11.03%	15.47%	12.52%
2.00-2.99	9,102	9.70%	9.66%	10.17%	9.83%
3.00-3.99	5,759	6.14%	7.08%	8.74%	7.64%
4.00-4.99	5,387	5.74%	9.83%	11.40%	10.36%
5.00-5.99	1,300	1.39%	2.66%	0.52%	1.94%
6.00-6.99	929	0.99%	3.11%	0.32%	2.17%
7.00-7.99	743	0.79%	2.46%	0.00%	1.63%
8.00-8.99	1,672	1.78%	5.57%	1.33%	4.15%
9.00-9.99	2,043	2.18%	7.64%	5.14%	6.80%
10.00-10.99	1,486	1.58%	6.22%	1.42%	4.61%
11.00-14.99	743	0.79%	5.66%	1.36%	4.22%
15.00-19.99	929	0.99%	5.88%	2.93%	4.89%
20.00-34.99	1,300	1.39%	11.49%	6.00%	9.65%
35.00-49.99	0	0.00%	0.00%	0.00%	0.00%
50.00+	186	0.20%	5.12%	9.73%	6.67%
Total	93,811	100.00%	100.00%	100.00%	100.00%
Stripper Wells	67,247	71.68%	65.62%	78.55%	69.96%

Table 2: Production Characteristics of Gas Leases in Oklahoma, First Six Months 1995

MCF per day per Well	Number of Wells	Percent of Total	Production as Percent of Total: MCF	Bbl	Total BOE
Inactive	1,584	5.73%	0	0	0
0.01-9.99	2,729	9.87%	0.49%	1.06%	0.51%
10.0-19.9	2,465	8.92%	0.96%	0.39%	0.94%
20.0-29.9	2,905	10.51%	1.65%	2.87%	1.68%
30.0-39.9	2,113	7.64%	1.90%	1.57%	1.89%
40.0-49.9	1,056	3.82%	1.03%	0.63%	1.02%
50.0-59.9	1,408	5.10%	1.79%	0.70%	1.76%
60.0-69.9	792	2.87%	1.31%	0.25%	1.28%
70.0-79.9	440	1.59%	0.67%	0.06%	0.65%
80.0-89.9	880	3.18%	1.37%	0.48%	1.35%
90.0-99.9	792	2.87%	1.61%	0.19%	1.57%
100.0-149.9	3,785	13.69%	11.80%	5.11%	11.62%
150.0-199.9	1,320	4.78%	5.42%	1.60%	5.32%
200.0-299.9	2,025	7.32%	12.07%	0.63%	11.76%
300.0-399.9	1,232	4.46%	9.83%	1.92%	9.62%
400.0-499.9	352	1.27%	8.56%	0.71%	8.35%
500.0+	1,760	6.37%	39.54%	81.84%	40.68%
Total	27,639	100.00%	100.00%	100.00%	100.00%

Table 3: Sources of Power for Wells on Oil Leases

BBL per day per Well	Number of Wells: Electric Motor	Gas Engine	Other Devices
Inactive			
.01-.99	15,790	4,273	3,344
1.00-1.99	9,288	6,130	1,486
2.00-2.99	4,830	2,601	1,672
3.00-3.99	3,344	1,486	929
4.00-4.99	3,344	1,672	372
5.00-5.99	557	372	372
6.00-6.99	743	186	0
7.00-7.99	372	186	186
8.00-8.99	1,300	372	0
9.00-9.99	1,115	372	557
10.00-10.99	743	186	557
11.00-14.99	372	372	0
15.00-19.99	743	372	0
20.00-34.99	743	557	0
35.00-49.99	0	0	0
50.00+	0	0	186
Total	43,283	19,134	9,660

Table 4: Number of Flowing Wells and Sources of Power, Gas Leases

MCF per day per Well	Number of Wells: Flowing	Gas Devices	Electric
0.01-9.99	1,578	498	249
10.0-19.9	1,412	581	166
20.0-29.9	1,495	747	332
30.0-39.9	1,495	415	0
40.0-49.9	581	415	0
50.0-59.9	830	332	166
60.0-69.9	332	166	0
70.0-79.9	249	166	166
80.0-89.9	581	83	83
90.0-99.9	581	166	0
100.0-149.9	2,159	1,329	83
150.0-199.9	830	498	0
200.0-299.9	1,495	249	166
300.0-399.9	747	83	0
400.0-499.9	83	0	0
500.0+	1,744	332	2,462
Total	16,193	6,062	3,874

Table 5: Average Operating Costs per Barrel Equivalent, Oil and Gas Leases, 1995

Category	Average All Oil Leases ($ per BOE)	Leases with Stripper Wells Only, At Least 50% Oil ($ per BOE)	Leases with Stripper Wells Only, At Least 75% Oil ($ per BOE)	All Gas Leases ($ per BOE)
Pumper	1.034	1.800	2.036	0.213
Direct supervision and other labor	0.417	0.573	0.593	0.095
Electricity	0.650	1.088	1.252	0.011
Gas for pumps	0.081	0.118	0.144	0.009
Water disposal	0.419	0.932	1.002	0.087
Chemicals	0.247	0.375	0.400	0.044
Trucking	0.112	0.263	0.311	0.008
Overhead and paperwork	1.399	1.766	1.824	0.550
Routine maintenance and repair of surface equipment	0.504	0.878	1.000	0.107
Subsurface repairs and maintenance, workovers and remedial work	0.928	1.175	1.149	0.228
Other	0.008	0.009	0.011	0.050
Total Operating Cost	5.799	8.975	9.644	1.402
Gross Price ($/BOE)	$14.465	$16.179	$16.439	$8.606
Estimated Price per BOE Net of Royalties and Gross Production Tax:	$11.770	$13.166	$13.377	$7.003

Note: percentage of oil in lease is determined by barrel of oil equivalents (BOE); 'At Least 50% Oil' indicates that production in BOE consists of at least 50% oil.

Table 8: Estimated Costs of Compliance with Environmental Laws and Regulators, 1995

	Oil Leases	**Gas Leases**
Operating Costs	$24,303,818	$8,714,638
Equipment and construction	$14,387,424	$19,013,850
Total	**$38,691,242**	**$27,728,488**

Table 9: Postponed or Cancelled Maintenance and Repairs, 1995

	Oil Leases	Gas Leases
Total	$148,103,188	$111,924,018

Table 10: Major Purchases of Equipment and Construction, 1995

	Oil Leases	Gas Leases
Total	$225,631,934	$80,193,056

Table 11: Production of Hydrogen Sulfide and Use of Secondary or Tertiary Production Methods

	Gas Leases	Oil Leases
Producers of Hydrogen Sulfide	1.19%	N/A
Leases that use secondary or tertiary production methods*	50.40%	7.44%

*Such as compressor, pumping unit, gas lift, plunger lift for gas leases; waterflood, enhanced recovery for oil leases

Table 12: Number of Injection Wells and Disposal Wells on Oil Leases, 1995

	Oil Leases
Injection Wells	6,688
Disposal Wells	5,573

Table 13: Production of Water on Oil and Gas Leases, 1995

	Oil Leases	Gas Leases
Total (bbl)	730,290,791	198,538,226
Bbl Water / BOE	5.83	0.10

Table 14: Expectations for the Next Three Years Assuming Current Prices for Oil, Natural Gas, Condensate, and Casinghead Gas

	Oil Leases	Gas Leases
Expect no change	60.74%	64.29%
Drill new wells	1.24%	1.98%
Increase production by workovers	4.96%	6.75%
Shut down or plug wells	36.36%	28.17%
Expected Number of:		
New wells	929	440
Workovers	3,344	1,584
Shut-ins or plugging	28,422	7,306
Percent of Total Wells	30.30%	26.43%
Production decline due to shut-in		
BBL	16,265,038	1,507,760
MCF	92,316,917	96,676,990
BOE	31,651,191	17,620,592
Percent of Total BOE	25.25%	6.43%

Table 15: Estimated and Actual Prices of Production, First Six Months 1995

	Estimated from Survey	Actual*
Oil ($/bbl)	$16.99	$17.15
Condensate ($/bbl)	$17.03	$17.31
Casinghead Gas ($/mcf)	$1.59	$1.43
Natural Gas ($/mcf)	$1.40	$1.38

*Prices for taxable sales as reported by the Oklahoma Tax Commission

Expected changes in drilling activity were also calculated. Assuming a continuation of the trends seen between 1990 and 1994, total well completions are expected to decline by an annual average rate of 4.7 percent. The worst case scenario shows well completions falling by a 9.3 percent annual average rate. However, under the best case scenario, total well completions are expected to rise at an annual average rate of 2 percent.

Estimated Changes in Wage and Salary Employment

Any substantial changes in oil and gas production will have direct impacts on the levels of wage and salary employment for the sector. To estimate changes in employment levels for the sector, the ratio of 1993 employment to physical output was calculated. Applying this ratio to the estimated changes in oil and gas production under the three scenarios presented above results in estimated employment changes.

Under the baseline assumption, total wage and salary employment in the sector is expected to fall by 25.9 percent between 1993 and 2000 for a total loss of 8,088 jobs. If oil and gas prices decline, then employment could fall by as much as 40.9 percent or 12,638 jobs. On the other hand, a rise in oil and gas prices would be expected to produce a 7.9 percent increase in employment for a gain of 2,509 jobs in the sector.

Conclusion

Oil and gas production and drilling activity are very important sources of jobs, income, and output for the Oklahoma economy. Many Oklahoma businesses and workers depend on these sectors for sales and income.

The following impacts result for each $1 million increase in oil and gas production, using 1993 prices for oil and gas:

- $1.8 million in output,
- 23 jobs,
- $550 thousand in employees' earnings,
- $1.08 million in value added,
- $27,000 in state income and sales tax revenue,
- $9,400 in local sales tax revenue, and
- $70,000 in severance tax revenue.

Impacts for $1 million in drilling activity are:

- $2.1 million in output,
- 34 jobs,
- $640 thousand in employees' earnings,
- $1.16 million in value added,
- $25,400 in state income and sales tax revenue, and
- $9,600 in local sales tax revenue.

Table 7: Distribution of Production and Average Operating Costs by Depth, Gas Leases

Average Depth of Production (Feet)	Distribution				Average Operating Cost ($/BOE)
	Wells	Bbl	MCF	BOE	
Less than 2,000	14.29%	0.10%	1.43%	1.39%	$3.35
2,000 - 3,900	13.21%	0.10%	6.97%	6.79%	$1.99
4,000 - 5,900	13.93%	1.87%	13.52%	13.20%	$1.10
6,000 - 7,900	28.93%	19.26%	33.57%	33.18%	$1.39
8,000 - 9,900	13.57%	73.54%	18.52%	20.04%	$1.22
10,000 +	16.07%	5.14%	25.99%	25.41%	$1.43
	100.00%	100.00%	100.00%	100.00%	

Table 6: Distribution of Production, Average Operating Costs, and Water Production by Depth, Oil Leases

Average Depth of Production (Feet)	Distribution				Average Operating Cost ($/BOE)	Water as Percent of Total Liquid*
	Wells	Bbl	MCF	BOE		
Less than 2,000	23.98%	8.34%	0.72%	5.78%	$10.20	93.61%
2,000 - 3,900	29.16%	25.91%	6.49%	19.39%	$8.88	95.13%
4,000 - 5,900	17.71%	31.01%	17.91%	26.61%	$6.44	92.57%
6,000 - 7,900	16.89%	17.05%	29.37%	21.19%	$4.90	63.43%
8,000 - 9,900	10.35%	9.58%	27.53%	15.61%	$4.04	35.68%
10,000+	1.91%	8.11%	17.98%	11.43%	$1.13	2.07%
	100.00%	100.00%	100.00%	100.00%		

*Total liquid defined as barrels of oil plus barrels of water

End Nnotes

1 The author wishes to express his appreciation and thanks to several persons whose efforts contributed to this study: Loretta Newton, Center for Economic and Management Research; Kathy Hines, Geo Information Systems, Sarkey's Energy Center; Jack Shadle, Jr., Michael B. Earls, and LaKeta Marty, Oklahoma Commission on Marginally Producing Oil and Gas Wells.

2 This study uses a six to one ratio when converting gas (MCF) to barrels of oil equivalent.