WILLIAM S.
Spears School
OF BUSINESS

The Economics of Deep Drilling in Oklahoma

Deep Drilling Update 2000 - 2007

Prepared by:

Suzette Barta
Research Economist

Mark C. Snead
Research Economist and Director

Center for Applied Economic Research
Spears School of Business
Oklahoma State University
www.economy.okstate.edu

Released 4/3/2008

The Economics of Deep Drilling in Oklahoma: 2000-2007

Introduction[1]

A "deep well" is generally defined as a well drilled below depths of 15,000 feet. While it is believed that great reserves of natural gas dwell at these depths, the U.S has historically relied on more shallow wells of about 5,000 feet for the bulk of the nation's natural gas production. Since the early 1970s, the barriers to reaching these deep reservoirs have been mostly economic. However, recent advances in technology and higher gas prices have combined to make deep well drilling more economically feasible and have led to rapid growth in deep drilling in Oklahoma.

The State of Oklahoma has recognized the role of gas production from deep wells in maintaining energy production in the state and is currently encouraging the development of deep well resources through a temporary severance tax abatement program.[2] Providing incentives for deep drilling reflects the economic potential of deep wells in Oklahoma and makes efficient use of the investment in public and private infrastructure already in place in the oil and gas producing areas of the state. It is also likely that the successful mining of these deep gas reserves will be necessary to meet the nation's growing demand for natural gas and to maintain Oklahoma's position among the leading natural gas-producing states.

In February 2005, the Center for Applied Economic Research at Oklahoma State University published a report titled *The Economics of Deep Drilling in Oklahoma*.[3] Using a database of production and cost data on wells drilled at various depths in Oklahoma in the 2000 to 2004 period, the report illustrated how the economic impact of drilling and production activity increased along with well depth. The report estimated that the cost impact of deep wells (15,000 feet and deeper) was 6 times that of shallow wells and that the production impact of deep wells was even greater at 11 times that of shallow wells.

The current report serves as an update to the 2005 study and uses a database of production and cost data for a large sample of deep wells drilled in Oklahoma in the 2000 to 2007 period. In the period since 2000, 50 companies have drilled 933 deep wells[4] in Oklahoma at an estimated cost of $6.1 billion, or more than $6.5 million per well. In the period, an estimated 14.6% of all natural gas production statewide came from deep wells. Deep wells as a percentage of all wells drilled statewide increased from 2.9% of wells in 2001 to 7.9% of wells in 2006.

---

[1] The article is available online at http://economy.okstate.edu.

[2] Under current Oklahoma tax law, wells with a spud date between July 1, 2002 and July 1, 2008 are eligible for an exemption from the gross production tax. The exemption varies as to duration in relation to the depth of the well, where wells 12,500 to 14,999 are exempt for 28 months, wells 15,000 to 17,499 are exempt for 48 months, and wells 17,500 feet or greater are exempt for 60 months.

[3] "The Economics of Deep Drilling in Oklahoma." Mark Snead, Center for Applied Economic Research, Oklahoma State University: http://economy.okstate.edu

[4] The latest data available from the Oklahoma Corporation Commission records well completions only through the third quarter of 2007.

In terms of economic impact, the findings of the current report confirm the results of the previous study - particularly that the expected impact on the state economy becomes increasingly greater as well depth increases due to both increasing levels of investment and higher rates of production. For all wells in the new sample, the cost of a deep well is about 6 times the cost of a shallow well, while production from deep wells is about 7 times that of a shallow well.

Deep Drilling in Oklahoma

From January 2000 through September 2007, the Oklahoma Corporation Commission reports that 933 deep wells were drilled in Oklahoma, with roughly one-third of the deep wells below 17,500 feet. (see Table 1 and Figure 1) Deep gas exploration in the state intensified in 2004 when 162 deep wells were drilled, and then peaked in 2006 with 192 deep well completions. A slowdown in deep drilling appears likely in 2007 based on data for the first nine months of the year, with the state on pace to complete only 125 deep wells in 2007.

Table 1. Number of Deep Wells Drilled in Oklahoma

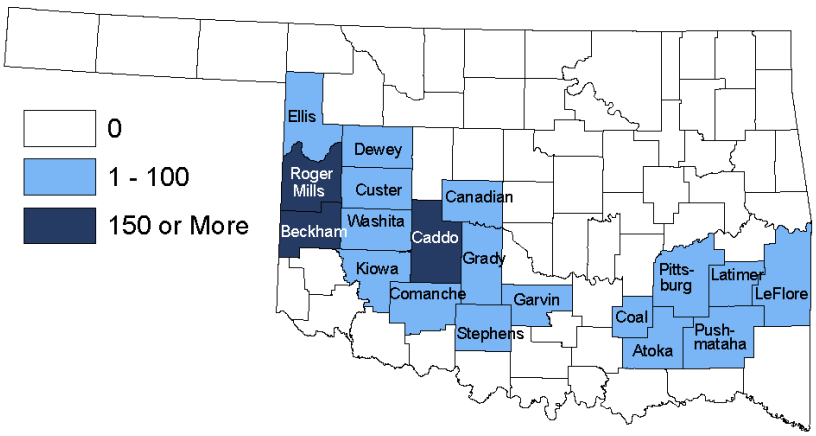
Well Depth	2000	2001	2002	2003	2004	2005	2006	2007[a]	Total
15,000 ft to 17,499 ft	27	41	39	73	104	124	139	74	621
>= 17,500 ft	27	27	41	40	58	44	53	22	312
Total	54	68	80	113	162	168	192	96	933
All Wells Completed (all Depths)	1,531	2,348	2,339	2,117	2,299	2,369	2,427	na	15,430[b]
Deep Wells as Percent of Total	3.5%	2.9%	3.4%	5.3%	7.0%	7.1%	7.9%	na	5.4%[b]

[a] Data for 2007 is for Jan-Sep only. [b] 2000 through 2006
Source: Oklahoma Corporation Commission

As a percentage of all wells drilled, deep wells more than doubled in share statewide since 2000. In 2006, a total of 2,427 oil and gas wells were drilled in Oklahoma at all depths; thus, 7.9% of wells were deep wells, up from 2.9% in 2001. On average, from 2000 through 2006, 5.4% of all wells drilled in Oklahoma were 15,000 feet or deeper.

Figure 1 shows the regional distribution of deep wells by county in the sample of wells provided for this study. Deep wells are largely located in the traditional gas exploration areas of western and southwestern Oklahoma and in a contiguous six-county region in southeast Oklahoma stretching from Coal to Le Flore County. Of the 933 deep wells drilled in Oklahoma since 2000, 236 (28%) were drilled in Beckham County. A distant second in terms of number of deep wells is Caddo County with 158, followed by Roger Mills County with 150. In all, deep wells have been drilled in 19 counties across

Figure 1. Locations of Oklahoma deep wells drilled since 2000.



the state since 2000, with nearly 98% of all deep wells drilled in the top 9 counties and more than 60% drilled in the top 3.

One of the difficulties in assessing the economic impact of exploration activities is a lack of timely and accurate data on the cost of drilling oil and gas wells. In order to assess the economics of shifting to deeper drilling, this report uses a dataset comprising cost and production data on 2,731 Oklahoma wells drilled by Chesapeake Energy in Oklahoma since February 2000. Chesapeake is Oklahoma's largest natural gas producer, its most active operator, and its most active explorer for Oklahoma deep natural gas reserves. The Chesapeake dataset provides a large representative sample of drilling costs and production rates for wells at all depths across the state. For the 304 deep wells included in the sample, average cost, average depth, and annualized gas production by county in the 2000 to 2007 period are provided in Table 2.

Table 2. Deep Wells Drilled in Oklahoma by County (Total 2000-2007)

County	Deep Wells Completed	Cumulative % of Deep Wells	Deep Wells in Sample	Average Well Depth[a]	Average Well Cost[a]	Annualized Gas Production[b] (MCF)
Beckham	263	28.2%	103	18,681	$7,328,104	376,472,052
Caddo	158	45.1%	31	17,494	7,385,899	91,716,827
Roger Mills	150	61.2%	40	16,531	5,393,173	37,677,480
Grady	98	71.7%	18	16,900	5,137,440	26,266,308
Washita	91	81.5%	33	17,739	6,368,852	21,323,160
Stephens	78	89.8%	60	17,181	6,488,659	48,636,734
Custer	43	94.4%	8	16,224	5,873,824	6,070,930
Latimer	21	96.7%	3	16,780	4,810,897	2,209,976
Dewey	10	97.7%	1	16,260	5,609,750	6,462,105
Comanche	5	98.3%	2	17,250	7,839,239	1,010,402
Kiowa	3	98.6%	1	15,250	1,976,259	0
Le Flore	3	98.9%	0	---	---	---
Canadian	2	99.1%	1	15,600	3,110,144	398,762
Ellis	2	99.4%	0	---	---	---
Garvin	2	99.6%	0	---	---	---
Atoka	1	99.7%	0	---	---	---
Coal	1	99.8%	1	16,700	175,626	0
Pittsburg	1	99.9%	1	16,100	6,166,056	0
Pushmataha	1	100.0%	0	---	---	---
Total	933	100.0%	304	17,630	$6,539,203	618,261,453

[a] Depth and cost averages are calculated from the sample of 304 deep wells.

[b] Wells with recent spud dates do not necessarily have production.

Source: Oklahoma Corporation Commission, Chesapeake Energy, and OSU Center for Applied Economic Research

The greatest production levels are concentrated in Beckham County where 376 million MCF of gas was produced by wells in the sample, or more than 60% of total gas from deep wells statewide. The local economic impact of this production is highlighted in a recent report of county employment trends where Beckham County ranked 9th in the state in terms of job growth in the 2003 to 2006 period—increasing by 17.5% over the 3 years.[5] The top 6 deep gas producing counties account for more than 97% of statewide gas output from deep wells.

[5] See: Mark Snead and Suzette Barta. 2007. "Economic Recovery Growth Patterns in Oklahoma: 2003-2006." Center for Applied Economic Research, Oklahoma State University: http://economy.okstate.edu.

Companies Engaged in Deep Drilling in Oklahoma

The 933 deep wells reported by the Oklahoma Corporation Commission as completed between 2000 and the third quarter of 2007 were drilled by 50 individual companies. The state has averaged more than twenty firms annually drilling for deep gas in the period. As shown in Table 3, the number of companies actively engaged in deep drilling in the state in any single year peaked in 2005 at 26.

Table 3. Number of Companies Drilling Deep Wells in Oklahoma by Depth

Number of Companies by Depth	2000	2001	2002	2003	2004	2005	2006	2007*
15,000 ft -17,499 ft	12	17	14	18	22	25	24	19
>=17,500 ft	10	13	10	11	12	8	10	8
All Companies , 15,000 ft and deeper	15	22	19	20	25	26	25	20

* Data for 2007 is for Jan-Sep only.
Source: Oklahoma Corporation Commission

Most of the expansion in the number of companies entering the deep drilling segment is found in the shallower tier of deep wells. The number of companies drilling wells less than 17,500 feet roughly doubled since 2000 to two dozen firms, while the number drilling wells below 17,500 feet remained relatively steady in the period at around ten companies.

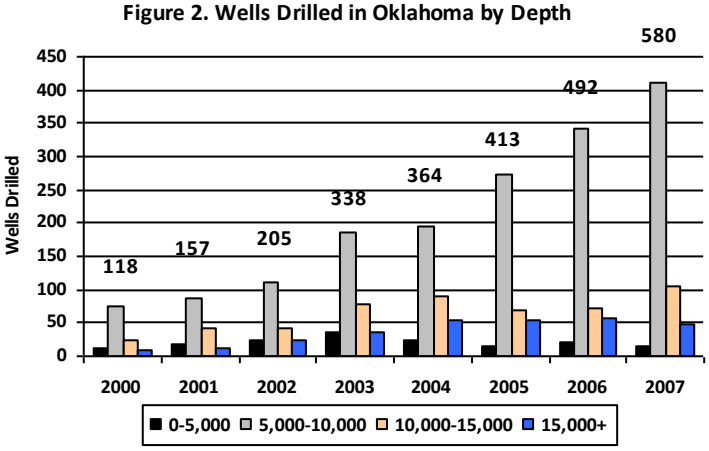
Six companies each drilled more than 50 deep wells over the time frame shown, including Apache, Chesapeake, Dominion, Marathon, Sanguine, and St. Mary (See Table 4). The top 10 companies drilled 78% of the deep wells in the state. Chesapeake Energy's domestic drilling program included the completion of 290 deep wells in Oklahoma, approximately 30 percent of the total deep wells completed in the period.[6]

Table 4. Top 10 Drillers of Deep Wells in Oklahoma

Rank	Company	Deep Wells 2000-07
1	Chesapeake Energy	290
2	Apache Corp.	72
3	St. Mary Land & Exp Co.	71
4	Marathon Oil Company	66
5	Dominion Resources	58
6	Sanguine Gas Exp LLC	51
7	JMA Energy Co. LLC	43
8	Ward Petroleum Corp.	35
9	BP America Prod. Co.	25
10	Key Prod. Co.	21
	All Others Drillers	201
	Total Wells (through 2007Q3)	933

Source: Oklahoma Corporation Commission

Figure 2. Wells Drilled in Oklahoma by Depth

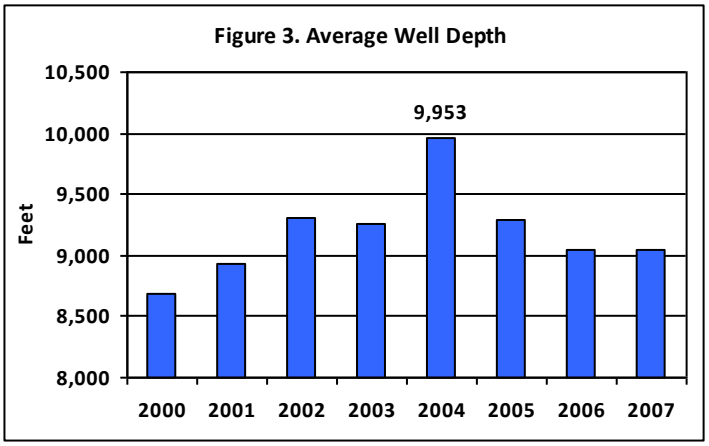


Deep vs. Shallow Drilling Trends: 2000-2007

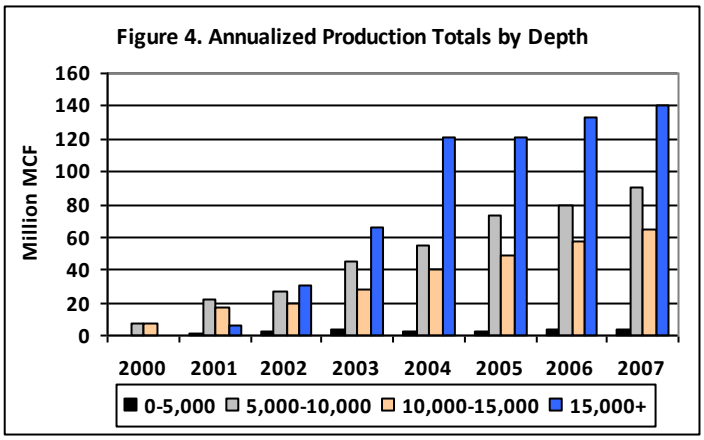
This section uses the Chesapeake sample of wells at all depths (both deep and shallow) for both producing and non-producing wells to analyze trends in drilling, depth, production, and

[6] The discrepancy between the number of wells reported by Chesapeake and the Oklahoma Corporation Commission (OCC) are due to differences in reporting period. OCC reports well completions only through the third quarter of 2007.

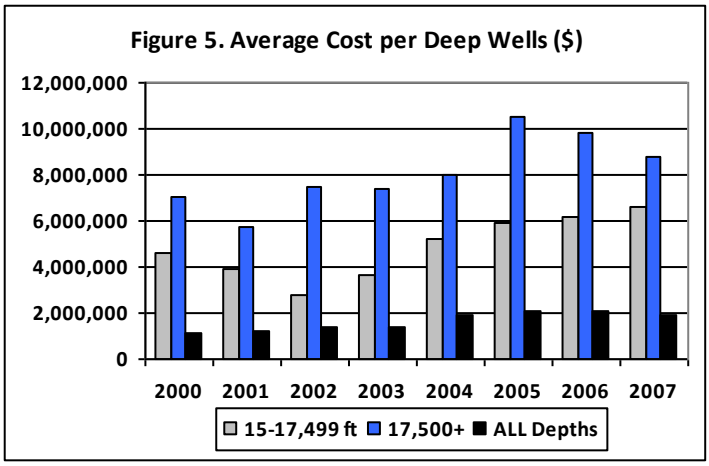
cost. Cost data and monthly production data were provided on the sample of wells drilled between February 2000 and November 2007. Monthly production data is used to form annualized estimates of gas production for each year in the 2000 to 2007 period.



As shown in Figure 2, the number of new wells drilled has risen steadily each year since 2000. The category of well drilled most commonly is one of 5,000-10,000 feet. The number of these wells drilled has increased annually since 2000, with 411 completed in 2007. The number of new deep wells (>15,000 feet) in the Chesapeake sample increased noticeably each year from 2000 through 2004, but the growth trend in deep wells has flattened out at about 50 wells annually since 2005. Wells of 10,000-15,000 feet had their highest number of new wells (105) in 2007.



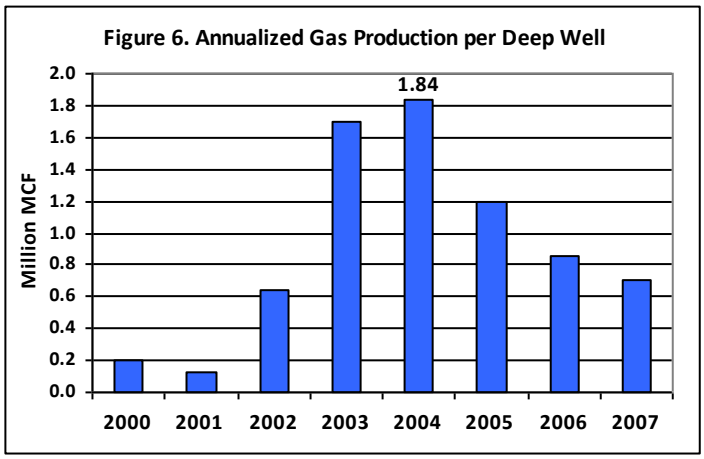
In 2000, the average depth for wells in the full sample was 8,683 feet. The average well depth rose to as high as 9,953 feet in 2004, but has decreased back to about 9,000 feet for 2006 and 2007. (see Figure 3) While the most commonly drilled well is one of 5,000 to 10,000 feet, by 2002 as increasing deep production came online, deep wells had become the largest producing category - as shown in Figure 4. Total production increased from all well depths from 2000 to 2007, but production from deep wells surged from 2000 to 2004. Although total deep well production was flat from 2004 to 2005, it resumed growth in 2006 and 2007.



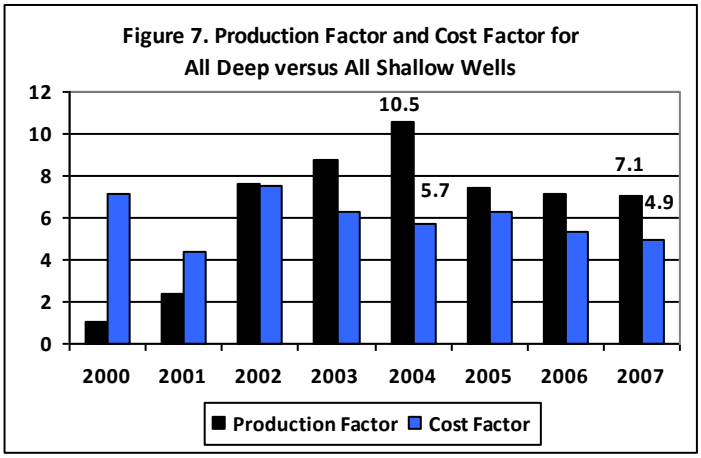
As Figure 5 shows, the costs of drilling a deep well are much greater than the cost of the average well. For example, the average cost[7] to drill a well between 15,000-17,500 feet is $5.5 million in the period, while the average cost for wells greater than

[7] Average cost figures in Figure 4 are calculated from all wells in the data set, including those with no production.

17,500 feet was $8.7 million. The average for all wells, on the other hand, was about $1.8 million. For the deepest wells, the average cost per well fluctuated from 2000 to 2003, but increased significantly in 2004 and 2005. Average costs for the deepest wells are down again slightly for 2006 and 2007 but remain well over the $8 million mark. Wells of 15,000-17,500 feet follow a smoother trend. After declining in both 2001 and 2002, the average cost of this depth of well has increased each year and reached $6.6 million in 2007. For all wells in the sample, the average cost has remained at about $2 million since 2004.



While the incidence of deep wells increased during the time period shown, 2000-2007, the fastest growth occurred between 2000 and 2004. The same is true of annual gas production from deep wells with average production per well (see Figure 6) reaching a peak in 2004. The production factor for deep wells relative to shallow wells also peaked in 2004 when deep wells were nearly 11 times more productive than shallow wells, on average. As Figure 7 shows, production in 2007 from deep wells was 7.1 times the average production from shallow wells, while the cost to drill a deep well was 4.9 times the cost of a typical shallow well.[8]



Assessing the Economic Impact of Deep vs. Shallow Drilling in Oklahoma, 2000-2007

As state gas production becomes increasingly dependent upon deep resources, it is important to understand how the changing business dynamics of exploration may impact the overall state economy. Estimated economic impacts from deep drilling and deep gas production are formed using the drilling cost and production data summarized in Tables 6A and 6B.

Table 6A summarizes the drilling cost and gas production levels for the 2,396 wells in the dataset with spud dates between February 2000 and November 2007 and with some production in at least one year. The sample is summarized by five depth categories. Table 6B presents the same information but examines only deep wells versus shallow wells.

[8] The production factor has outweighed the cost factor every year except 2000 and 2001. Keep in mind, however, that only 1 deep well was producing in 2000 and just 13 were producing in 2001.

A well was included in the data set for any year that it had production of gas. Thus, a well with a spud data in 2006 may be in the data set for 2006 and for 2007, and a well spud in 2000 might possibly be in the data set for all 8 years (and some are). Wells that cease to produce any gas for a given year fall out of the production calculations for that year. The production estimates include all wells with some natural gas production in 2000-2007, with part-year production levels annualized in order to produce an annual production estimate. For example, if a well with a spud date of July 2000 began to produce gas in September 2000, and produced for four months - September through December - then production for that well was "annualized" by taking the average of the four monthly production figures and multiplying by 12. Annualized production totals for each year are summed at a given depth to calculate total production for the given depth.

Table 6A. Sample of Drilling Activity in Oklahoma 2000 to 2007 by Depth

	Well Depth (Thousand Feet)					
	Shallow Wells			Deep Wells		
	0-5,000 ft	5-10,000 ft	10-15,000 ft	15-17,500 ft	>17,500 ft	All Depths, All Years
Producing Wells	150	1530	446	165	105	2,396
Percent of all Wells in Sample	6.3%	63.9%	18.6%	7%	4.4%	100%
Average Vertical Depth (Feet)	3,216	7,327	12,529	16,337	19,617	9,197
Average Well Cost	$576,852	$849,058	$2,373,707	$5,453,755	$8,669,955	$1,775,632
Average Well Cost per Foot	$179.35	$115.88	$189.46	$333.83	$441.95	$193.06
Total Drilling Cost	$86,527,800	$1,299,059,240	$1,058,611,638	$899,869,504	$910,345,229	$4,254,413,413
Annualized Total Gas Production (MCF)	19,197,580	399,691,400	283,886,197	242,192,185	376,069,267	1,321,036,630
% of Total Production in Sample	1.5%	30.3%	21.5%	18.3%	28.5%	100.0%
Annualized Gas Prod. (MCF) per well	127,984	261,236	636,516	1,467,831	3,581,612	551,351

Table 6B. Sample of Drilling Activity in Oklahoma 2000 to 2007: Shallow vs. Deep Wells

	Well Depth		
	All Shallow Wells <15,000 ft	All Deep Wells >=15,000 ft	All Depths, All Years
Producing Wells	2,126	270	2,396
Percent of all Wells in Sample	88.7%	11.3%	100%
Average Vertical Depth (Feet)	8,198	17,630	9,197
Average Well Cost	$1,149,670	$6,704,499	$1,775,632
Average Well Cost per Foot	$140.24	$380.29	$193.06
Total Drilling Cost	$2,444,198,679	$1,810,214,734	$4,254,413,413
Annualized Total Gas Production (MCF)	702,775,177	618,261,453	1,321,036,630
Percent of all production in sample	53.2%	46.8%	100%
Annualized Gas Production (MCF) per well	330,562	2,289,857	551,351

The Economic Impact of Deep Gas Drilling and Production

The results in Tables 6A and 6B illustrate how the business model for exploration becomes increasingly capital intensive as well-depth increases:

- Wells up to 5,000 feet in depth cost an average of $576,852, while the deepest wells in excess of 17,500 feet cost 15 times more, or an average of $8.7 million to complete.

- The average per-foot drilling cost for the deepest wells ($442/foot) is nearly four times the cost of wells 5,000-10,000 feet.
- **When comparing all deep wells to all shallow wells, the average deep well costs 5.8 times as much to drill as the average shallow well.**

The production rates in Tables 6A and 6B also illustrate the potential payoff from deep drilling:

- The average annual gas production for wells less than 5,000 feet deep was 127,984 MCF versus 3,581,612 MCF for deep wells in excess of 17,500 feet; therefore, the deepest wells out-produce the shallowest wells by a factor of 28, on average.
- The deepest wells out-produce the most commonly drilled wells (5,000-10,000 feet) by a factor of nearly 14.
- **All deep wells (greater than 15,000 feet) on average produce 6.9 times more output than the average for all wells less than 15,000 feet deep.**

Given that there were 933 deep wells drilled by 50 unique companies in Oklahoma from 2000 to 2007, cost and production figures from the sample may be used to extrapolate an estimate for total statewide spending on deep well drilling in Oklahoma from 2000 to 2007 and for total statewide natural gas production from deep wells.

- Drilling costs for both producing and non-producing deep wells in the sample totaled nearly $2 billion suggesting **total statewide spending of $6.1 billion on deep wells from 2000 to 2007**.[9]
- Total annualized natural gas production from deep wells in the sample totaled more than 618 million MCF from 304 wells (producing and non-producing), suggesting **total statewide production of 1.9 billion MCF from deep wells from 2000 to 2007**.
- Based on estimated volume from deep wells totaling 1.9 billion MCF statewide in 2000-2007, **approximately 14.6% of all gas production in the state originated from deep wells** in the period.

Spillover Economic Impacts

While the expected economic impact per dollar spent on drilling and production is essentially the same for both shallow and deep wells, the much larger upfront investment in drilling costs and proportionately greater production of gas from deep wells generates a larger total economic impact on the state economy. The expected impacts from drilling a deep well and the production from a deep well are detailed in Table 7.

[9] The estimates assume that Chesapeake's cost structure is representative of the entire industry. It is likely that Chesapeake may have efficiencies of scale that make them a low cost producer. This would make the overall cost estimates conservative when applied to the full set of wells drilled.

The economic impact estimates indicate that each additional $1 million spent on deep oil and gas drilling in the state provides employment for 2.4 oil and gas workers with annual earnings of $121,423. Through multiplier effects, these direct impacts support an estimated 4.9 additional jobs statewide with earnings of $186,247. A typical deep well, at a cost of about $6.7 million, will support 16 oil and gas workers with annual earnings of $814,000. Multiplier effects support an additional 33 jobs statewide with annual earnings of $1.2 million.

Recall that the drilling of a deep well (greater than 15,000 feet) is estimated to cost about 5.8 times that of a shallow well; thus, the drilling of a deep well is expected to produce about 5.8 times the economic impact of drilling a shallow well (less than 15,000 feet). The deepest wells (>17,500 feet) cost about 10 times more to drill on average than the most common category of wells (5,000-10,000 feet) and similarly would produce about 10 times the impact.

Table 7. Economic Impact of Drilling and Production

	Drilling		Production	
Estimated Economic Impacts	**Per $1 Million of Drilling Activity**	**Per Average $6.7 Million Deep Well**	**Per $1 Million of Production Activity**	**Per Deep Well W/Annual Prod. of $4.4 Mil.**
Employment - Direct Impact (jobs)	2.4	16.1	2.7	12.0
Employment - Indirect Impact (jobs)	4.9	33.1	5.5	23.8
Total Employment Impact (jobs)	7.3	49.2	8.2	35.8
Labor Income - Direct Impact	$121,423	$813,532	$210,163	$917,761
Labor Income - Indirect Impact	186,247	$1,247,858	216,738	946,471
Total Labor Income Impact	$307,670	$2,061,390	$426,901	$1,864,232

In terms of oil and gas production (extraction), each additional $1 million of production from deep wells supports 2.7 oil and gas industry workers with annual earnings of $210,163. More than half of the earnings on the production side accrue to self-employed workers. Multiplier effects from the $1 million of oil and gas production support an estimated 5.5 additional jobs statewide with earnings of $216,738 annually.[10]

The dollar value of production from a typical deep well that produces about 630,000 MCF in gas per year is approximately $4.4 million at 2007 gas prices.[11] Using this dollar amount, a deep well can be expected to support 36 jobs (direct and indirect) per year with annual earnings of $1.9 million.

Because average production from deep wells (>15,000 feet) is 6.9 times that of wells less than 15,000 feet deep, the economic impact of production from a deep well is estimated at 6.9 times that of a well drilled less than 15,000 feet deep. The deepest wells (>17,500 feet) on

[10] The reported economic impacts are generated from an IMPLAN input-output model of the State of Oklahoma using the 2004 Oklahoma IMPLAN dataset. For details, refer to IMPLAN Professional: User's guide, analysis guide, data guide. Minnesota IMPLAN Group, 1998. Stillwater, MN.

[11] The Henry Hub spot price for natural gas averaged $6.93 per MCF in 2007. See: *Natural Gas Year-In-Review 2007.* March 2008. Office Of Oil and Gas, Energy Information Administration, U.S. Dept of Energy.

average produce 13.7 times as much gas volume as the most common category of wells (5,000-10,000 feet) and generate 13.7 times the impact.

Table 8 presents an estimate of statewide annual economic impacts resulting from deep well activities given current approximate levels of deep drilling and production.[12] The data indicate that total deep well completions each year have a substantial impact on the state. Using an average of 165 deep wells drilled per year since 2004 and an average deep well completion cost of about $6.7 million, the impact of drilling totals $1.11 billion per year statewide. These expenditures support 8,118 jobs statewide (both direct and indirect) with total annual earnings of $340 million (direct and indirect).

In addition to annual drilling impacts, deep wells produced an average of 129 million MCF each year since 2004 and generated a total impact roughly equivalent to that generated by the drilling side. Based on the 2007 average price of $6.93 per MCF, the current annual value of deep well gas production is about $893 million. This production activity supports 7,462 jobs (direct and indirect) each year with annual income of $389 million (direct and indirect). Between these two activities - deep drilling and deep gas production – economic activity totaling $2 billion annually supports more than 15,500 jobs in the state each year with earnings of nearly $730 million.

Table 8. Annual Economic Impact of Deep Well Activity

	Drilling	Gas Production
Value of Activity	$1.106 billion	$893 million
Employment - Direct Impact (jobs)	2,657	2,496
Employment - Indirect Impact (jobs)	5,462	4,966
Total Employment Impact (jobs)	8,118	7,462
Labor Income - Direct Impact	$134,232,780	$191,630,784
Labor Income - Indirect Impact	205,896,570	197,625,614
Total Labor Income Impact	$340,129,350	$389,256,398

In addition to the larger employment and income impacts from deep wells, royalty payments are significantly higher due to the greater production rates experienced with deep wells. The 304 deep wells in the sample produced $543 million in royalty payments from 2000 to 2007, or nearly $1.8 million per well. In comparison, the shallow wells in the sample produced an average of only $210,630 per well in royalty income from 2000 to 2007.[13] Annual statewide gas production from deep wells valued at $893 million (Table 8) will result in royalty payments to deep well resource owners of an estimated $160 million annually.[14]

[12] While Table 8 presents impacts solely from gas production, it should be noted that these wells also produce some incidental oil as well.
[13] Source: Chesapeake Energy internal royalty payment data.
[14] The annual royalty total assumes an average gas royalty rate of 17.9 percent-calculated from Chesapeake royalty data.

Summary

Statewide from 2000 to 2007, 50 individual gas exploration companies drilled 933 deep wells at an approximate cost of $6.1 billion. These deep wells produced a cumulative total of 1.9 billion MCF of natural gas, or 14.6 percent of total statewide gas production in the period. The impact of deep drilling expenditures is largely concentrated in western and southwestern Oklahoma; however, southeastern Oklahoma is also experiencing some of this activity as deep wells have been drilled in Pittsburg, Latimer, Le Flore, and other counties. The impact of the production activity from deep wells is distributed more broadly geographically and accrues to oil and gas firms and royalty owners statewide.

After comparing cost and production data from a sample of 2,396 producing wells, it was found that the impact of drilling deep wells (>15,000 feet) provides an estimated economic impact 5.8 times that of a well drilled less than 15,000 feet deep. The production impact of deep wells is estimated at 6.9 times that of the average well less than 15,000 feet deep.

Higher costs and production rates for deep wells translate into greater economic impacts for the state. A typical deep well that costs $6.7 million to drill results in 49 direct and indirect jobs statewide and produces $2.1 million in annual payroll impacts (direct and indirect.) The production of gas from a typical deep well results in another 36 jobs and annual income of $1.9 million. On an annual basis this translates into impacts from $2 billion in deep well drilling and gas production activity that supports more than 15,500 jobs statewide each year with annual income of nearly $730 million.

In addition to employment and payroll impacts, owners of deep wells also receive greater royalties per well. Deep wells in the sample created nearly $1.8 million in royalties per well from 2000 to 2007 compared to shallow wells that paid $210,630 per well. Statewide, an estimated $160 million in royalties is paid each year to owners of deep well resources.

Ongoing technological advancements will continue to improve the economic viability of recovering deep gas reserves, and drilling a deep well will remain a much more significant economic event than drilling a typical shallow well of past decades. Deep drilling requires increasingly larger capital investments and provides the potential for a comparatively larger economic impact than a typical shallow well. Greater upfront drilling and exploration costs and larger quantities of oil and gas produced translate into added employment and income gains from deep wells.