

## Economic Timeline of Drilling an Oil and Gas Well in Oklahoma

**INTRODUCTION:** This analysis evaluates the current timeline and cost of drilling a representative oil and gas well in Oklahoma. The representative well is a horizontal well drilled in the STACK play in the Meramec shale formation and assumes a 9,500 foot vertical well with two lateral length scenarios: 1) 5,000 foot lateral; and 2) 10,000 foot lateral. The estimates are derived using proprietary information from active Oklahoma drillers provided to RegionTrack by the Oklahoma Oil and Gas Association (OKOGA). Cost estimates are either averaged across drillers or a representative estimate is used.

<b>DRILLING TIMELINE (Days)</b>	<b>Lateral Length</b>	
Lateral	<b>5,000 feet</b>	<b>10,000 feet</b>
Well Location	NW Oklahoma	NW Oklahoma
Formation	STACK Play	STACK Play
Well Type	Horizontal	Horizontal
Vertical Depth	9,500 feet	9,500 feet
<b>Well Stages (in days)</b>	<b>5,000 feet</b>	<b>10,000 feet</b>
<b>Pre-Production</b>		
Leasing, Permitting, and Site Preparation	180	180
Drilling (Total Measured Depth: 14,500 feet and 19,500 feet)	18	25
Hydraulic Fracturing	10	22
Well Completion	15	15
Gathering System	10	10
All Stages	<b>233 days</b>	<b>252 days</b>
Drilling, Fracturing, Completion, and Gathering	<b>53 days</b>	<b>72 days</b>
Wells Drilled per Rig per Year at Full Capacity (Drilling only)	<b>20.3</b>	<b>14.6</b>
Rig Annual Utilization Rate	<b>90.0%</b>	<b>90.0%</b>
Wells Drilled per Rig per Year at Operating Capacity (Drilling only)	<b>18.3</b>	<b>13.1</b>

<b>WELL INVESTMENT</b>	<b>Lateral Length</b>	
<b>Well Stages - Upfront Investment</b>	<b>5,000 feet</b>	<b>10,000 feet</b>
Leasing, Permitting, and Site Preparation	\$1,148,146	\$1,148,146
Drilling	2,189,963	2,615,000
Hydraulic Fracturing	2,306,500	4,750,000
Well Completion	1,028,275	1,028,275
Gathering system	307,356	307,356
All Stages	<b>\$6,980,240</b>	<b>\$9,848,777</b>
<b>Well Investment - Direct and Spillover Economic Impacts</b>	<b>5,000 feet</b>	<b>10,000 feet</b>
<b>Economic Output</b>		
Indirect/Induced	3,572,826	5,041,083
<b>Total Effect</b>	<b>\$10,553,066</b>	<b>\$14,889,860</b>
<b>Employment (Jobs created over 1 calendar year)</b>		
Indirect/Induced	25.0	35.3
<b>Total Effect</b>	<b>36.6</b>	<b>51.9</b>
<b>Labor Income (Employees &amp; Proprietors)</b>		
Indirect/Induced	1,112,911	1,570,263
<b>Total Effect</b>	<b>\$2,092,054</b>	<b>\$2,951,786</b>
<b>Direct Tax Payments</b>		
Sales and Use Tax Incurred by Operators	97,881	181,133
State & Local Sales Tax From Labor Income Purchases	53,794	75,901
Income Tax on Labor Income	44,061	62,169

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## **Methodology Report**

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### **Overview**

This project provides an evaluation of the economic flows derived from the drilling of a ‘representative’ oil and gas well in Oklahoma. The analysis is based on proprietary survey data provided by the Oklahoma Oil and Gas Association (OKOGA) from several active oil and gas operators in Oklahoma.

Operators provided detailed data concerning the time requirements and costs associated with the following stages of a representative well’s economic life:

1. Leasing/acquisition
2. Permitting – state/local permits and bonding requirements
3. Site preparation and construction
4. Drilling – vertical drilling, horizontal drilling, liquid/waste disposal
5. Hydraulic fracturing
6. Completion

The representative wells are located in the STACK play in the Meramec shale formation in western Oklahoma at a vertical depth of 9,500 feet. Two wells with differing lateral lengths are evaluated. The first well has a 5,000-foot horizontal lateral while the second has a 10,000-foot horizontal lateral. The total measured depth of the two wells is 14,500 feet and 19,500 feet, respectively.

The drilling analysis is presented in two sections: 1) A timeline describing each step in the wells economic life in number of days; 2) A summary of the upfront well investment by cost for each major stage in the drilling process and estimated economic spillover effects.

### **Well Timeline**

The well timeline is based on reported operator responses for each stage of the drilling process. For convenience in presentation and reporting, the first three stages (leasing/acquisition, permitting, and site preparation and construction) are combined into a single category that reflects total pre-drilling costs. Some operator’s performance of all three stages overlaps within the same timeframe while other

operators perform each stage distinctly and sequentially. The remaining drilling stages are delineated as follows:

The drilling stage begins with spud and terminates at drilling rig release. The hydraulic fracture stage encompasses all activities between drilling rig release and rig down move out (RDMO) of the completion unit utilized for well plug drill-out. The well completion stage encompasses all activities after RDMO of the completion unit through 30 days after Turn-In-Line (TIL) date. The initiation of the production stage is focused on installation of gathering systems and encompasses all activities 30 days after TIL date.

The operators report a 233-day timeframe for the full process of drilling a representative well with a 5,000-foot lateral, and a 252-day timeframe for a 10,000-foot lateral well. The pre-drilling activities of leasing, permitting, and site preparation required an average of 180 days across operators, and did not vary by lateral length. The reported time to drill the well, perform hydraulic fracturing, complete the well, and install the gathering system is 53 days and 72 days, respectively, for the two lateral lengths. Based on a drilling time of 18 days for a 5,000-foot lateral and 25 days for a 10,000-foot lateral, a rig can complete 20.3 wells and 14.6 wells by respective lateral length in one year operating full-time. Operators report a typical rig utilization rate of 90% across a calendar year. Adjusting for downtime, a rig can drill 18.3 short lateral wells or 13.1 long lateral wells in one year. This rate of drilling is consistent with historical ratios between rig counts and well completions in Oklahoma.

### **Well Investment and Spillover Effects**

The well investment section is based on reported costs incurred by the operators to perform each of the stages identified above. The estimates represent reported average costs across operators that are incurred for the 5,000-foot lateral and 10,000 foot lateral scenarios. Because the estimates are averages, the realized cost of completing any stage for any given operator in Oklahoma may be higher or lower than reported in the analysis.

Well operators report an average cost of \$6.98 million for the short lateral well and \$9.85 million for the long lateral well, a 41% difference in total cost. The pre-drilling costs of leasing, permitting, and site preparation are equal for both wells at \$1.15 million. Hydraulic fracturing is generally the most expensive stage of the drilling process with an average cost of \$2.3 million and \$4.75 million, respectively, for the two wells. Drilling closely follows fracturing as the second most costly step. Drilling a short lateral well costs a reported \$2.19 million, or 17% less than the \$2.65 million for a long lateral well. The reported cost to complete the well is approximately \$1 million for both lateral lengths. Installing, or connecting to, the gathering system is typically the least expensive step in the drilling process at approximately \$300,000 for both lateral lengths.

A series of direct economic outcomes arise from the well investment including added economic output, employment of wage and salary workers and proprietors, labor income earned by both wage and salary workers and proprietors, and tax revenues. These direct economic outcomes are estimated by using the upfront investment in each representative well as a measure of added output of goods and services (\$6.98

million for a short lateral well and \$9.85 million for a long lateral well). The expected employment (11.7 jobs for a short lateral well and 16.6 for a long lateral well) and labor income (\$980,000 for a short lateral well and \$1.38 million for a long lateral well) are derived as a share of output based on ratios from an IMPLAN input-output model of Oklahoma (Industry sector: Drilling Oil and Gas Wells). Employment estimates are interpreted as the number of wage and salary workers and proprietors employed on average over one calendar year as a result of drilling a representative well. Labor income produced during the well investment stage includes both employee compensation earned by wage and salary employees and proprietor income earned.

The various direct economic effects from drilling the representative wells are accompanied by estimates of indirect and induced spillover effects based on IMPLAN multipliers. Indirect effects represent economic activity created by the purchase of goods and services that are made within the region by oil and gas operators during the well investment stage. Induced effects constitute economic activity created in other sectors of the economy as a result of new household spending in the region out of employee and proprietor earnings received as part of the direct and indirect effects. The total effect is the sum of the direct, indirect, and induced effects.

Estimated spillover effects for a short lateral well include: 1) the \$6.98 million in output from drilling a new short lateral well supports an additional \$3.6 million in output in the state economy through indirect and induced effects; 2) the employment estimates suggest that slightly more than two additional jobs are supported in the broader Oklahoma economy by each worker directly engaged in drilling a short lateral well; and 3) the estimated \$980,000 in direct labor income earned by workers in the process of drilling a short lateral well supports an additional \$1.1 million in labor income in the state economy.

For a long lateral well, the spillover effects suggest that: 1) the \$9.85 million in output from drilling a new long lateral well supports an additional \$5.0 million in output in the state economy through indirect and induced effects; 2) the employment estimates similarly indicate that slightly more than two additional jobs are supported in the broader Oklahoma economy by each job directly involved in drilling a long lateral well; and 3) the estimated \$1.38 million in direct labor income earned by workers in the process of drilling a long lateral well supports an additional \$1.57 million in labor income in the state economy.

Tax revenue estimates (\$196,000 for a short lateral well and \$319,00 for a long lateral well) represent direct tax payments only with no spillover effects assumed in the analysis. The tax estimates are derived in three components: 1) operator responses for sales tax payments made during the well investment stage and evaluated using IMPLAN model estimates; 2) individual income tax levied on labor income at an effective rate of 4.5%; and 3) taxable purchases (subject to state and local sales tax) arising from the expenditure of labor income is taxed at a combined state and local tax rate of 8.2%. Taxable purchases comprise two-thirds of labor income based on estimates of consumption expenditures derived from the Consumer Expenditure Survey Annual Report for 2015.