

August 2014

**The Economic Benefits of Oil and Natural
Gas Production:**
An Analysis of Effects on the United States
and Major Energy-Producing States

THE PERRYMAN GROUP

510 N. Valley Mills Dr.
Suite 300
Waco, TX 76710
ph. 254.751.9595
fax 254.751.7855
info@perrymangroup.com
www.perrymangroup.com



Table of Contents

Introduction.....	1
Economic Benefits of Oil and Natural Gas Drilling and Production.....	3
State-Level Results.....	4
Conclusion	9
APPENDICES.....	10
Detailed Sectoral Results for the United States.....	11
Methods Used.....	12
About The Perryman Group.....	15

Introduction

The resurgence of the oil industry over the past few years has been dramatic. Production levels have reached totals not seen since the late 1980s and continue to increase. In 2012, total US production was almost 2.4 billion barrels, with 2013 rising to more than 2.7 billion. It appears that the United States will be the world's leading producer by the end of 2014. Although the United States still relies on imports to meet about 40% of crude oil needs, the increase in domestic supplies has helped reduce dependency on foreign oil and improve the US trade situation.

A primary reason for this growth is technological advancements including horizontal drilling and hydraulic fracturing, which have unlocked previously unrecoverable oil and natural gas reserves in shale plays. Early experiments in hydraulic fracturing began in the 1980s, but it was decades later before the technique developed (and prices increased) to the point of making drilling within shale plays economically feasible. With horizontal drilling and better exploration tools, the nation's shale plays have become primary sources of new production. These advances have also allowed for the rejuvenation of wells in older fields, further enhancing activity in the industry. Other factors include (1) a price situation that reflects growing world demand; (2) a lack of leverage in funding the gains, thus providing greater resilience to fluctuations; and (3) actual increases in production from newly available resources.

The **oil surge has also been important to the economic recovery from the recent recession**. While market conditions and price levels are currently less favorable to extensive natural gas exploration, there is nonetheless a significant level of investment in

developing natural gas resources. Although direct employment in the industry is a small percentage of total jobs, the work is often well paying. Moreover, the ripple effects through the economy of this high value-added industry are large, especially in states which have a substantial concentration of support services.

The Perryman Group (TPG) recently analyzed the economic benefits of oil and natural gas drilling and exploration activity in the United States and major energy-producing states. Results of this assessment are summarized in this report.

Economic Benefits of Oil and Natural Gas Drilling and Production

Exploration and production generates business activity across a spectrum of industries. In states where the energy segment is well developed, ripple effects are even larger as the network of suppliers and support industries are able to meet the needs of oil and gas companies. The Perryman Group first estimated the direct investment in oil and natural gas exploration and production (including various oilfield support activities), then quantified the total economic benefits of this activity when multiplier effects through the economy are considered. (For more information regarding the methods and terms used, see page 8 and the Appendices to this report.)

The total economic benefits of oil and gas exploration and development activity (including multiplier effects) are estimated to include almost \$1.2 trillion in gross product each year, as well as more than 9.3 million permanent jobs in the United States. By both measures, this activity represents nearly 7% of the US economy.

The Annual Economic Benefits of Oil and Gas Exploration and Production: Gains in US Business Activity (Monetary Values in Constant 2014 Dollars)	
Total Expenditures	\$3,411,010,049,109
Gross Product	\$1,171,303,677,484
Personal Income	\$658,311,398,569
Retail Sales	\$242,646,639,893
Employment (Permanent Jobs)	9,312,478
Note: Direct activity is based on various measures of industry performance as reported by the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the Energy Information Administration. Total activity (including indirect and induced effects) is based on simulations of the US Multi-Regional Impact Assessment System. Source: The Perryman Group	

The Perryman Group also found that the **economic benefits of oil and natural gas production have more than doubled over the past 10 years even after accounting for the effects of inflation.** Moreover, **the new jobs created by this sector since the recovery from the recession began are responsible for about 30% of the national increase.** The ability to produce oil and gas from shale plays using advanced recovery methods has been the driving force behind this renaissance in the US energy segment.

State-Level Results

An assessment of several major energy-producing states indicates that Texas realizes the largest economic benefits both from the substantial oil and gas reserves in the state and the long history of the industry and resulting supporting sectors. By contrast, in states where oil production has only recently begun to escalate, such as North Dakota, support

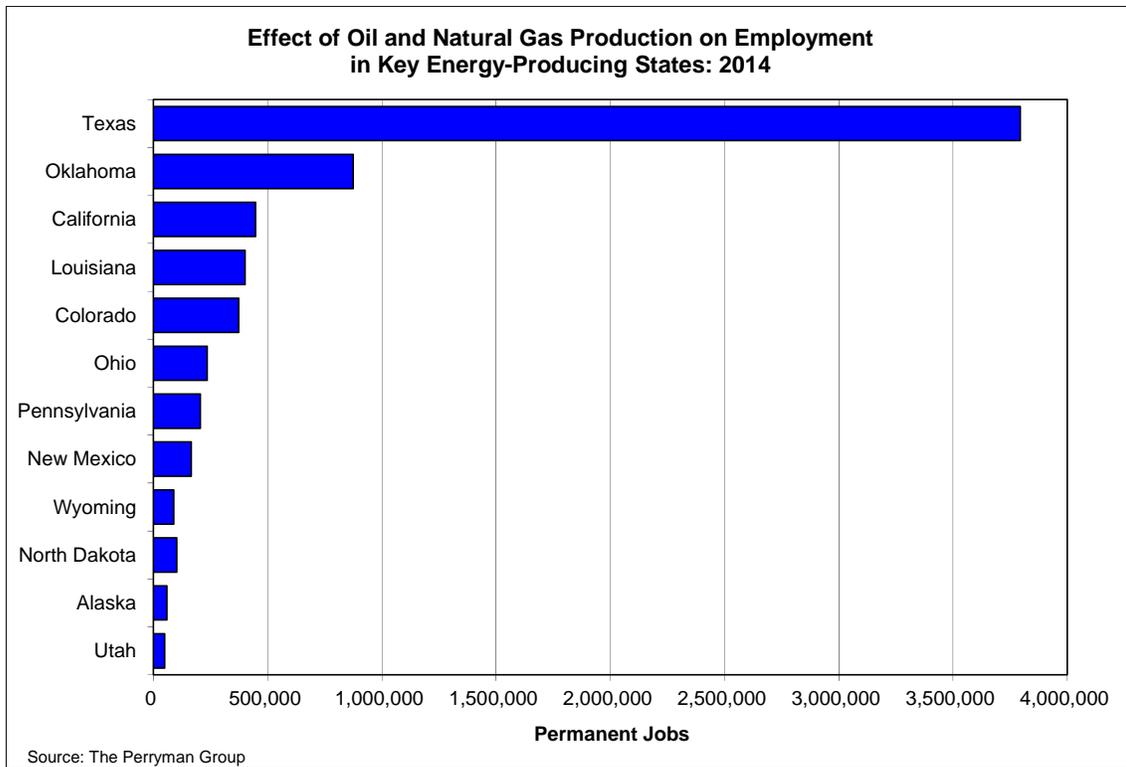
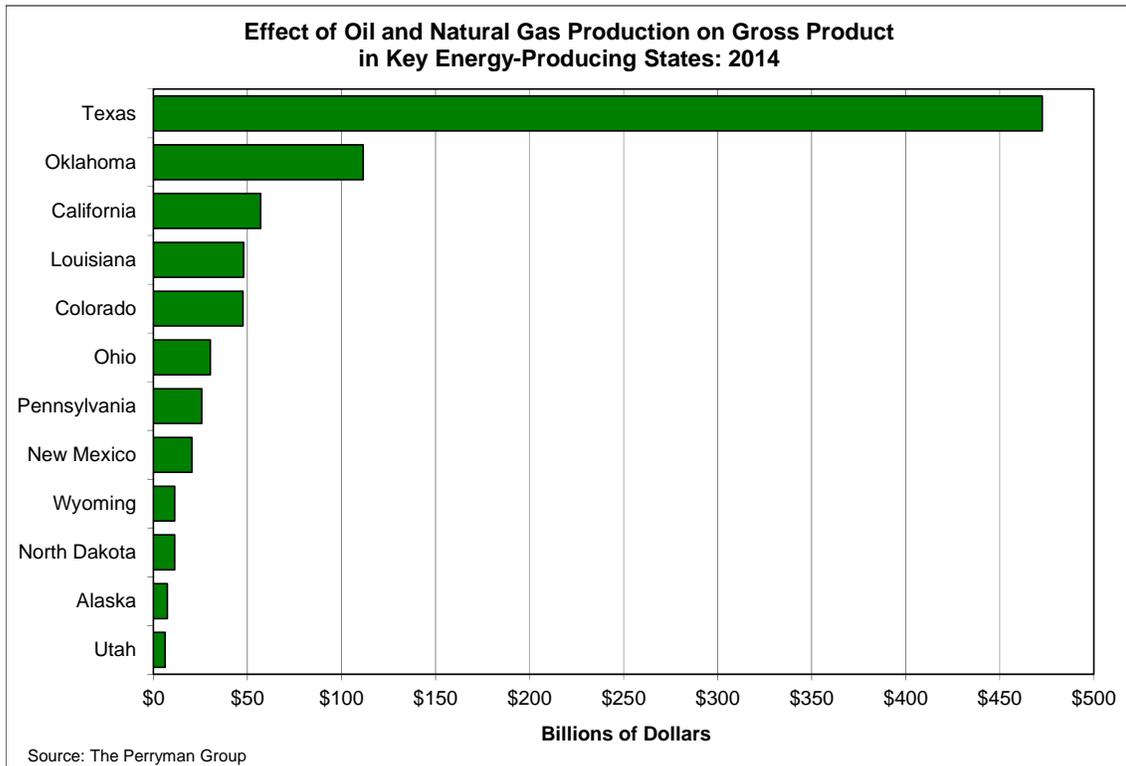
industries are still developing and ripple effects through the state economy are smaller. It should be noted, however, that North Dakota sees benefits of more than 100,000 jobs in an economy with total employment of only about 500,000. In the newly emerging areas, overall economic effects can be expected to rise over time.

**The Current Economic Benefits of
Oil and Gas Exploration and Production:
Gains in Selected Major Energy-Producing States**

	Gross Product (Billions of 2014 Dollars)	Employment (Permanent Jobs)
Texas	\$472.535	3,794,527
Oklahoma	\$111.569	874,456
California	\$57.010	446,800
Louisiana	\$47.925	401,191
Colorado	\$47.686	373,349
Ohio	\$30.343	234,807
Pennsylvania	\$25.716	205,478
New Mexico	\$20.543	164,626
Wyoming	\$11.389	88,548
North Dakota	\$11.322	102,087
Alaska	\$7.405	58,201
Utah	\$6.221	49,054
US TOTAL	\$1,171.304	9,312,478

Source: The Perryman Group

**The Economic Benefits of Oil and Natural Gas Production:
An Analysis of Effects on the United States and Major Energy Producing States**



These results are based on estimates of oil and natural gas exploration activity and the overall size of the industry and related direct spending. The Perryman Group's impact assessment system was then used to quantify the associated multiplier effects. In this way, the total economic benefits stemming from oil and gas exploration activity were determined.

Measuring Economic Impacts

Any economic stimulus (such as direct spending, investments, or corporate activity) generates multiplier effects throughout the economy. In this instance, direct investment in oil and gas exploration and production was determined based on various measures of industry performance as reported by the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the Energy Information Administration. Once the direct stimulus was quantified, the associated multiplier effects were measured.

The Perryman Group's input-output assessment model (the US Multi-Regional Impact Assessment System) was developed by the firm over 30 years ago and has been consistently maintained and updated since that time. It has been used in hundreds of analyses for clients ranging from major corporations to government agencies. The system uses a variety of data (from surveys, industry information, and other sources) to describe the various goods and services (known as resources or inputs) required to produce another good/service. This process allows for estimation of the total economic impact (including multiplier effects) of oil and gas exploration and production. The submodels used in the current analysis reflect the specific industrial composition and characteristics of the US economy and major energy-producing states.

These total economic effects are quantified for key measures of business activity.

- **Total expenditures** (or total spending) measure the dollars changing hands as a result of the economic stimulus.
- **Gross product** (or output) is production of goods and services that will come about in each area as a result of the activity. This measure is parallel to the gross domestic product numbers commonly reported by various media outlets and is a subset of total expenditures.
- **Personal income** is dollars that end up in the hands of people in the area; the vast majority of this aggregate derives from the earnings of employees, but payments such as interest and rents are also included.
- **Job gains** are expressed as permanent jobs since the industry will have ongoing annual effects.

Monetary values were quantified on a constant (2014) basis. See the Appendices for more information.

Conclusion

Investments in oil and gas exploration and production generate substantial economic gains, as well as other benefits such as increased energy independence. The Perryman Group estimates that the industry as a whole generates an economic stimulus of almost **\$1.2 trillion in gross product each year, as well as more than 9.3 million permanent jobs across the nation.**

Three primary factors determine future oil and gas production: prices, geology, and the technology available for exploration and recovery. Technology has already played a major role in increased production, with the development of hydraulic fracturing and other innovative recovery methods unlocking oil and natural gas from shale plays. While changing market conditions will lead to cycles in the industry, the oil and gas industry will be a driver of substantial economic activity for many years to come.

APPENDICES

Detailed Sectoral Results for the United States

Estimated Current Annual Impact (as of 2014) of Oil and Natural Gas Production on Business Activity in the US				
Detailed Industrial Category				
	Total Expenditures	Gross Product	Personal Income	(Permanent Jobs)
Agriculture	\$31,766,471,741	\$9,606,696,326	\$6,211,932,184	93,415
Mining	\$1,574,739,913,297	\$358,622,309,964	\$177,214,028,901	1,046,790
Construction	\$124,245,671,237	\$67,053,527,450	\$55,256,283,456	743,808
Nondurable Manufacturing	\$368,651,619,937	\$97,100,227,554	\$49,888,563,606	761,838
Durable Manufacturing	\$128,028,391,737	\$49,575,257,078	\$32,923,226,572	433,803
Transportation and Utilities	\$199,373,164,178	\$70,566,783,937	\$39,656,131,456	398,652
Information	\$37,862,452,498	\$23,299,764,975	\$10,045,497,416	88,991
Wholesale Trade	\$71,833,587,691	\$48,554,487,588	\$27,996,948,815	298,890
Retail Trade (including Restaurants)	\$242,646,639,893	\$180,666,672,006	\$104,757,309,511	3,100,906
FIRE	\$387,828,774,400	\$125,739,379,138	\$39,072,063,064	373,363
Business Services	\$81,588,918,620	\$47,852,880,844	\$39,035,686,377	453,382
Health Services	\$54,482,396,231	\$38,074,616,941	\$32,192,441,286	507,487
Other Services	\$107,962,047,650	\$54,591,073,685	\$44,061,285,925	1,011,155
TOTAL	\$3,411,010,049,109	\$1,171,303,677,484	\$658,311,398,569	9,312,478

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Methods Used

- The basic modeling technique employed in this study is known as dynamic input-output analysis. This methodology essentially uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services (known as resources or inputs) required to produce one unit (a dollar's worth) of output for a given sector. Once the base information is compiled, it can be mathematically simulated to generate evaluations of the magnitude of successive rounds of activity involved in the overall production process.
- There are two essential steps in conducting an input-output analysis once the system is operational. The first major endeavor is to accurately define the levels of direct activity to be evaluated; this process was described within the report. In the case of a prospective evaluation, it is necessary to first calculate reasonable estimates of the direct activity. The process used to determine the input information was described within the report.
- The second major phase of the analysis is the simulation of the input-output system to measure overall economic effects of the oil and gas related stimulus. The present study was conducted within the context of the US Multi-Regional Impact Assessment System (USMRIAS) which was developed and is maintained by The Perryman Group. This model has been used in hundreds of diverse applications across the country and has an excellent reputation for accuracy and credibility. The systems used in the current simulations reflect the unique industrial structures of the economies of the United States and each state analyzed.
- The USMRIAS is somewhat similar in format to the Input-Output Model of the United States and the Regional Input-Output Modeling System, both of which are maintained by the US Department of Commerce. The model developed by TPG, however, incorporates several important enhancements and refinements. Specifically, the expanded system includes (1) comprehensive 500-sector coverage for any county, multi-county, or urban region; (2) calculation of both total expenditures and value-added by industry and region; (3) direct estimation of expenditures for multiple basic input choices (expenditures, output, income, or employment); (4) extensive parameter localization; (5) price adjustments for real and nominal assessments by sectors and areas; (6) measurement of the induced impacts associated with payrolls and consumer spending; (7) embedded modules to estimate multi-sectoral direct spending effects; (8) estimation of retail spending activity by consumers; and (9) comprehensive linkage and integration capabilities with a wide variety of econometric, real estate, occupational, and fiscal impact models. Moreover, the model uses specific local taxing patterns to estimate the fiscal effects of activity on a detailed sectoral basis. The models used for the present investigation have been thoroughly tested for reasonableness and historical reliability.
- The impact assessment (input-output) process essentially estimates the amounts of all types of goods and services required to produce one unit (a dollar's worth) of a specific type of output. For purposes of illustrating the nature of the system, it is useful to think of inputs and outputs in dollar (rather than physical) terms. As an example, the construction of a new building will require specific dollar amounts of

lumber, glass, concrete, hand tools, architectural services, interior design services, paint, plumbing, and numerous other elements. Each of these suppliers must, in turn, purchase additional dollar amounts of inputs. This process continues through multiple rounds of production, thus generating subsequent increments to business activity. The initial process of building the facility is known as the *direct effect*. The ensuing transactions in the output chain constitute the *indirect effect*.

- Another pattern that arises in response to any direct economic activity comes from the payroll dollars received by employees at each stage of the production cycle. As workers are compensated, they use some of their income for taxes, savings, and purchases from external markets. A substantial portion, however, is spent locally on food, clothing, health care services, utilities, housing, recreation, and other items. Typical purchasing patterns in the relevant areas are obtained from the *ACCRA Cost of Living Index*, a privately compiled inter-regional measure which has been widely used for several decades, and the *Consumer Expenditure Survey* of the US Department of Labor. These initial outlays by area residents generate further secondary activity as local providers acquire inputs to meet this consumer demand. These consumer spending impacts are known as the *induced effect*. The USMRIAS is designed to provide realistic, yet conservative, estimates of these phenomena.
- Sources for information used in this process include the Bureau of the Census, the Bureau of Labor Statistics, the Regional Economic Information System of the US Department of Commerce, and other public and private sources. The pricing data are compiled from the US Department of Labor and the US Department of Commerce. The verification and testing procedures make use of extensive public and private sources.
- Impacts were measured in constant 2014 dollars to eliminate the effects of inflation. Note that totals may not add due to rounding.
- The USMRIAS generates estimates of the effects on several measures of business activity. The most comprehensive measure of economic activity used in this study is **Total Expenditures**. This measure incorporates every dollar that changes hands in any transaction. For example, suppose a farmer sells wheat to a miller for \$0.50; the miller then sells flour to a baker for \$0.75; the baker, in turn, sells bread to a customer for \$1.25. The Total Expenditures recorded in this instance would be \$2.50, that is, \$0.50 + \$0.75 + \$1.25. This measure is quite broad, but is useful in that (1) it reflects the overall interplay of all industries in the economy, and (2) some key fiscal variables such as sales taxes are linked to aggregate spending.
- A second measure of business activity frequently employed in this analysis is that of **Gross Product**. This indicator represents the regional equivalent of Gross Domestic Product, the most commonly reported statistic regarding national economic performance. In other words, the Gross Product of Texas is the amount of US output that is produced in that state; it is defined as the value of all final goods produced in a given region for a specific period of time. Stated differently, it captures the amount of value-added (gross area product) over intermediate goods and services at each stage of the production process, that is, it eliminates the double counting in the Total Expenditures concept. Using the example above, the

Gross Product is \$1.25 (the value of the bread) rather than \$2.50. Alternatively, it may be viewed as the sum of the value-added by the farmer, \$0.50; the miller, \$0.25 (\$0.75 - \$0.50); and the baker, \$0.50 (\$1.25 - \$0.75). The total value-added is, therefore, \$1.25, which is equivalent to the final value of the bread. In many industries, the primary component of value-added is the wage and salary payments to employees.

- The third gauge of economic activity used in this evaluation is **Personal Income**. As the name implies, Personal Income is simply the income received by individuals, whether in the form of wages, salaries, interest, dividends, proprietors' profits, or other sources. It may thus be viewed as the segment of overall impacts which flows directly to the citizenry.
- The fourth measure, **Retail Sales**, represents the component of Total Expenditures which occurs in retail outlets (general merchandise stores, automobile dealers and service stations, building materials stores, food stores, drugstores, restaurants, and so forth). Retail Sales is a commonly used measure of consumer activity.
- The final aggregates used are **Permanent Jobs and Person-Years of Employment**. The Person-Years of Employment measure reveals the full-time equivalent jobs generated by an activity. It should be noted that, unlike the dollar values described above, Permanent Jobs is a "stock" rather than a "flow." In other words, if an area produces \$1 million in output in 2010 and \$1 million in 2011, it is appropriate to say that \$2 million was achieved in the 2010-2011 period. If the same area has 100 people working in 2010 and 100 in 2011, it only has 100 Permanent Jobs. When a flow of jobs is measured, such as in a construction project or a cumulative assessment over multiple years, it is appropriate to measure employment in Person-Years (a person working for a year). This concept is distinct from Permanent Jobs, which anticipates that the relevant positions will be maintained on a continuing basis.

About The Perryman Group

- This study was prepared as a public service by The Perryman Group (TPG), an economic research and analysis firm based in Waco, Texas. The firm has more than 30 years of experience in assessing the economic impact of corporate expansions, regulatory changes, real estate developments, public policy initiatives, and myriad other factors affecting business activity. TPG has conducted hundreds of impact analyses for local areas, regions, and states throughout the United States. Impact studies have been performed for hundreds of clients including many of the largest corporations in the world, governmental entities at all levels, educational institutions, major health care systems, utilities, and economic development organizations.
- Dr. M. Ray Perryman, founder and President of the firm, developed the US Multi-Regional Impact Assessment System (USMRIAS—used in this study) in the early 1980s and has consistently maintained, expanded, and updated it since that time. The model has been used in hundreds of diverse applications and has an excellent reputation for reliability.
- The firm has also conducted numerous investigations related to the oil and gas industry. These analyses include an assessment of the effects of offshore drilling for the US Department of the Interior, several studies of specific production areas, major pipeline and refinery investments, public policy studies related to oil and gas regulation, and projections of natural gas prices and output. Information has been prepared for the Interstate Oil Compact Commission, the US Department of Energy, the Texas Railroad Commission, and numerous legislative committees regarding energy policy.