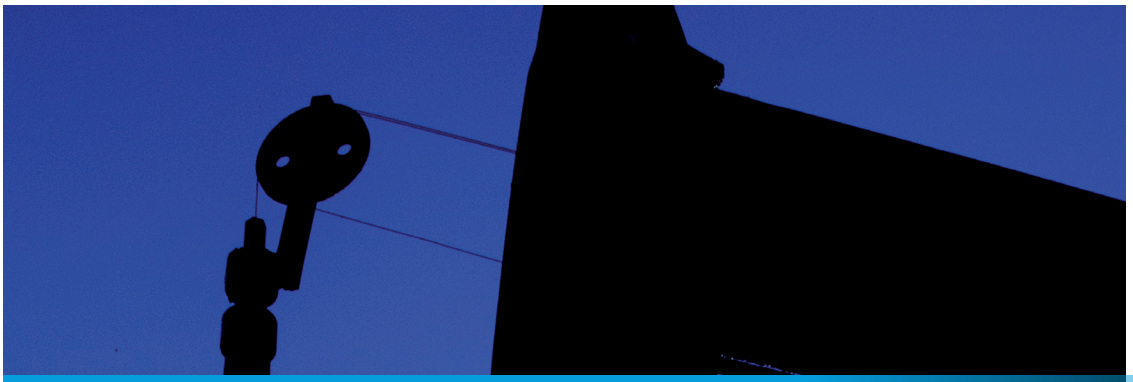

An IHS Report

October 2012

America's New Energy Future:

The Unconventional Oil and Gas Revolution and the US Economy

Volume 1: National Economic Contributions

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This report offers an independent assessment of the contribution of unconventional oil and gas to the US economy. This research was supported by the American Petroleum Institute, Institute for 21st Century Energy, the American Chemistry Council, and Natural Gas Supply Association. IHS is exclusively responsible for this report and all of the analysis and content contained herein. The analysis and metrics developed during the course of this research represent the independent views of IHS and are intended to contribute to the national dialogue on the role of the unconventional oil and gas production, employment, economic growth, and energy security.

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Foreword

Just half a decade ago, the outlook for meeting America's demand for oil and natural gas was increasingly focused on non-domestic sources of supply. The standard view held that domestic production would inevitably decline and imports would consequently rise. Indeed, US oil production had been falling for nearly four decades. The country was on a path to spending several hundreds of billions of dollars more a year on imports to meet oil and natural gas demand.

Unconventional oil and natural gas activity is now unlocking new domestic sources of supply. Net petroleum imports have fallen from 60% of total consumption in 2005 to 42% today. The decline is due, in part, to moderating energy demand during the slow recovery in the wake of the Great Recession, but greater fuel efficiency in autos and a slowing of the growth in total vehicle miles will continue to constrain the growth of demand. However, the decline in imports has also been achieved through significant supply side changes resulting from increased domestic oil production. US oil production, which has risen 25% since 2008, is expected to reach 8.5 million barrels per day in 2012.[1] The largest element of this increase comes from what has become the major new advance in energy development: tight oil.

Similarly remarkable is the transformation in the natural gas market emanating from the rapid expansion of unconventional natural gas production. A dozen years ago, shale gas production was only 2% of total US natural gas production. Today, it represents 37%. This burgeoning supply, and its impact on market prices, is a significant factor supporting a manufacturing renaissance. It is also prompting a national discourse about wider markets for natural gas. This includes a dialogue both about natural gas as a vehicle fuel and about liquefied natural gas—not how much the United States imports but rather how much it should export.

Fueling these advances in domestic production are lengthy, complex supply chains for which increased activity means increased employment. As a result, unconventional energy development has become an engine of job creation and economic growth. In 2012, employment in the entire unconventional upstream sector will account for more than 1.7 million jobs and by the end of the decade almost 3 million jobs.

All of these are significant changes. This report addresses the implications of unconventional oil and natural gas for the broader US economy, including increases in capital expenditures, jobs, economic value added, and government revenues.

IHS Advisory Board

[1] Energy Information Administration (EIA), Monthly Energy Review, September 2012. "Oil", as used in this report, includes crude oil, lease condensate, and natural gas liquids (NGLs). Condensate" as we use the word in this report is the same as "lease condensate" used by the EIA.

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The IHS Advisory Board provides insight and guidance on study methodology and review of publications and documents resulting from this series of reports. The Advisory Board consists of the following members.

Daniel Yergin is Vice Chairman of IHS and Founder of IHS Cambridge Energy Research Associates (IHS CERA). He is author of the Pulitzer-Prize winning book *The Prize* and, recently, *The Quest*, both of which have been national best sellers. Dr. Yergin serves on the US Secretary of Energy Advisory Board and was a member of the Board's subcommittee that issued its report on shale gas at the request of President Obama. He chaired the US Department of Energy's Task Force on Strategic Energy Research and Development. Dr. Yergin holds a B.A. from Yale University and a Ph.D. from Cambridge University, where he was a Marshall Scholar.

Nariman Behravesh is Chief Economist of IHS and author of *Spin-Free Economics: A No-Nonsense, Nonpartisan Guide to Today's Global Economic Debates*. Directing the entire economic forecasting process at IHS, he is responsible for developing the economic outlook and risk analyses for the United States, Europe, and Japan, China and emerging markets. Dr. Behravesh and his team have ranked among the top economic forecasters over the years in surveys by Reuters, *USA Today*, *MarketWatch* and *The Wall Street Journal*. He holds Ph.D. and M.A. degrees in economics from the University of Pennsylvania, and a B.Sc. from the Massachusetts Institute of Technology.

David Hobbs, IHS Chief Energy Strategist, is an expert on energy industry structure and strategies. He has led several influential studies of shale gas and oil and their technical, policy and economic impacts. He previously managed IHS CERA's energy research activities. Mr. Hobbs is IHS CERA's representative on the management board of the Global Energy Executive MBA program run jointly between the Haskayne School of Business at the University of Calgary and IHS CERA. He is also a member of the Scientific Advisory Board of the FondazioneEni Enrico Mattei.

James Rosenfield is Senior Vice President of IHS. Cofounder of IHS CERA, Mr. Rosenfield led its growth over three decades and was responsible for its development and strategy. He created and co-chairs IHS CERAWeek, the premiere international energy gathering, and he has spearheaded numerous influential IHS CERA studies. He was a Senior Fellow at Harvard's Kennedy School of Government, attended Harvard College, and holds an M.B.A. from Boston University.

Key Findings

Unconventional oil and natural gas activity is already revolutionizing America's energy future and bringing enormous benefits to its economy. Unlocking unconventional energy will generate millions of jobs and billions in government receipts. It will make significant contributions to the US economy through direct employment, its many and diverse connections with supplier industries, the amount of spending this direct and indirect activity supports throughout the economy, and the revenues that flow to federal and state and local governments. As the production of unconventional oil and natural gas expands over the next 25 years, the economic contribution of the industry will also expand. IHS Global Insight expects substantial growth in capital expenditures and employment to occur in support of the expansion of production within the unconventional sector:

- More than $5.1 trillion in capital expenditures will take place between 2012 and 2035 across unconventional oil and natural gas activity, of which:
    - Over $2.1 trillion in capital expenditures will take place between 2012 and 2035 in unconventional oil activity.
    - Close to $3.0 trillion in capital expenditures will take place between 2012 and 2035 in unconventional natural gas activity.
- Employment attributed to upstream unconventional oil and natural gas activity will support more than 1.7 million jobs in 2012, growing to some 2.5 million jobs in 2015, 3 million jobs in 2020, and 3.5 million jobs in 2035.
- On average, direct employment will represent about 20% of all jobs resulting from unconventional oil and natural gas activity with the balance contributed by indirect and induced employment.
- In 2012, unconventional oil and natural gas activity will contribute nearly $62 billion in federal, state and local tax receipts. By 2020, total government revenues will grow to just over $111 billion. On a cumulative basis, unconventional oil and natural gas activity will generate more than $2.5 trillion in tax revenues between 2012 and 2035.

What Does Unconventional Mean?

"Unconventional" oil and natural gas is exactly the same commodity as "conventional" oil and natural gas. The word "unconventional" is typically applied to major new advances in extraction technology, in the oil and natural gas industry, that allow access to resources not technically or economically recoverable. In recent years, "unconventionals" have included oil sands, extra-heavy oil extraction technologies and deepwater drilling technologies. In this report we focus on one category of unconventionals—oil and natural gas that is produced using a combination of horizontal drilling, which exposes more of the subsurface to the well, and hydraulic fracturing, which creates pathways that allow the oil and natural gas to flow through the dense rock into that wellbore. What adds to the unconventionality is the rock itself.

Executive Summary

An unconventional oil and natural gas revolution is transforming America's energy economy, with far-reaching impacts on the US economy. It has already created over 1.7 million jobs and, by the end of the decade, will have contributed a total of nearly 3 million jobs. Against a backdrop of a historically slow economic recovery and persistently high unemployment following the Great Recession, the surge in spending associated with unconventional oil and natural gas activity is proving to be an important engine for jobs creation.

America has the opportunity to benefit from a new energy future quite different—and much more positive—than that envisioned just half a decade ago. The opportunity is fueled by a growing domestic supply of oil and natural gas unlocked by a series of technological innovations, primarily the combination of horizontal drilling with hydraulic fracturing, but also by advances in seismic imaging and other technologies.

How important is unconventional oil and natural gas to the United States? In just five years, unconventional oil and natural gas activity has thrust the nation into an unexpected position. It is now the global growth leader in crude oil production capacity growth, adding nearly 1.2 million barrels per day (mbd) of capacity.[2] And the United States is now the largest natural gas producer, at 65 billion cubic feet (Bcf) per day.[3] Additionally, unconventional activity is spurring the growth of natural gas liquids (NGLs) production, adding over 500,000 barrels of oil equivalent (boe) per day since 2008.[4] This has brought the total increase in oil production capacity to some 1.7 mbd since 2008.

Unconventional Gas

Over the past five years, US natural gas production has risen from 52 billion cubic feet (Bcf) per day to 65 Bcf per day—a 25% increase. This rapid rise was driven primarily by shale gas production. Today shale gas accounts for 37% of total natural gas production. In 2000, shale gas accounted for just 2% of total natural gas production.

Today, unconventional natural gas—which includes shale gas, as well as natural gas from tight sands formations and coal bed methane—accounts for nearly 65% of US natural gas production. Natural gas production is currently growing faster than demand, creating a temporary surplus. By the end of the decade, natural gas production will likely reach nearly 80 Bcf per day—almost 75% of which will originate from unconventional activity.

This rapid rise in unconventional production has also enhanced US energy security. Five years ago, because of constrained production, the United States seemed locked into importing increasing amounts of liquefied natural gas (LNG), heading toward eventually spending as much as $100 billion dollars for those imports. Now, these newly unlocked resources ensure that the United States will need, at most, minimal LNG imports to balance supply with demand. Instead of debates over US imports, there is a discussion today about exporting some of the domestic surplus, as well as the potential for using natural gas in some classes of vehicles.

Defining Oil

"Crude oil", as used in this report, includes crude oil and condensate. "Oil", as used in this report, incudes crude oil, condensate, and natural gas liquids

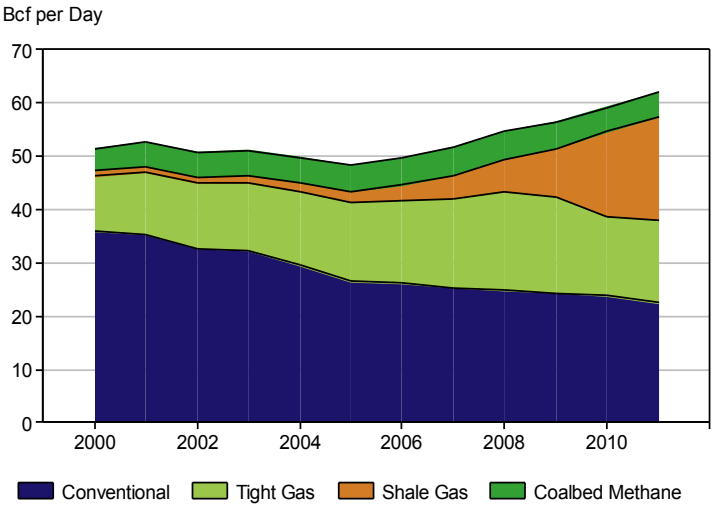
[2] EIA—Monthly Energy Review http://www.eia.gov/totalenergy/data/monthly/pdf/sec3_3.pdf

[3] BP Statistical Review of World Energy 2012.

[4] EIA—Monthly Energy Review http://www.eia.gov/totalenergy/data/monthly/pdf/sec3_3.pdf

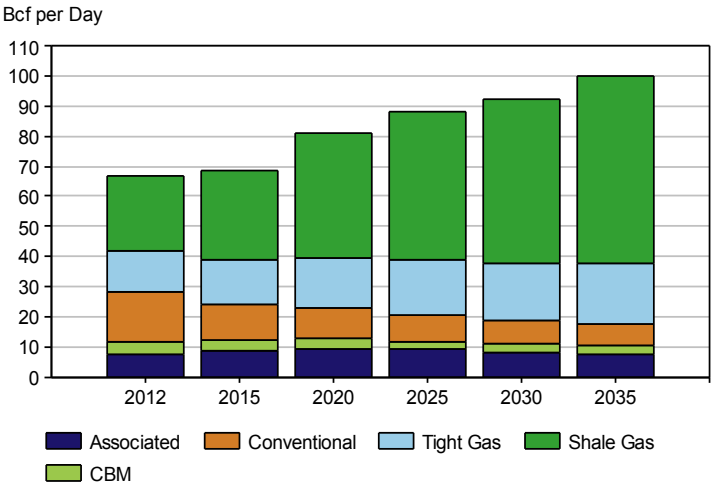
Capital investments and permits are being evaluated for export terminal facilities along the Gulf Coast and Middle Atlantic region for the purpose of LNG export activity. New "greenfield" export terminal projects have also been proposed in the Gulf and Pacific coast regions. Projects for exports to countries with which the United States has free trade agreements receive automatic approval, but this is not the case for projects that would export to non-FTA countries, which comprise most of the nations of the world. One project has thus far received authorization for exports to non-FTA countries. The very fact that an LNG export dialogue has begun underscores the energy and economic revolution in our midst.

US Lower 48 Natural Gas Production by Type: 2000 to 2011



Source: Energy Information Administration, IHS CERA

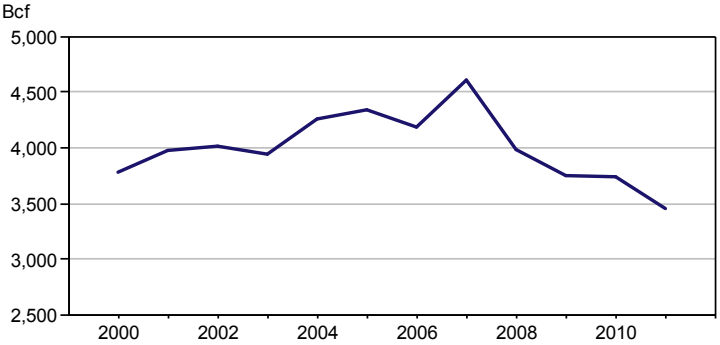
US Lower 48 Natural Gas Productive Capacity* Outlook by Type: 2012 to 2035



NOTE: *Productive capacity is the amount of gas that can be produced if unconstrained by infrastructure bottlenecks.

Source: IHS CERA

US Average Annual Natural Gas Net Imports: 2000 to 2011



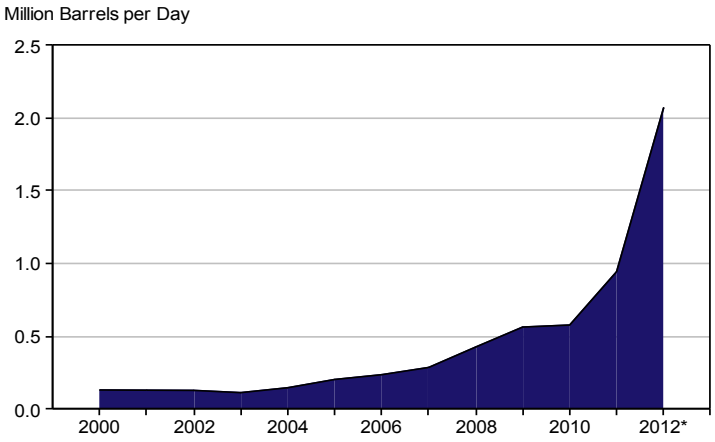
NOTE: Net natural gas imports represents total natural gas imports minus total natural gas exports.

Source: EIA

Unconventional Oil

Prior to the unconventional revolution, US oil production had experienced a long period of decline. From 1970 to 2008, crude oil production fell from 9.6 mbd to 5mbd.[5] However, the application of technological innovations—first developed for natural gas recovery from unconventional resources (shale and tight sand)—to unconventional oil has played a significant role in reversing this production decline. Production of what has become known as "tight oil" or "unconventional"—crude oil and condensate production from sources such as shale and other low permeability rocks—has increased from 100,000 barrels per day in 2003 and is expected to average over 2 million barrels per day in 2012. Growth in unconventional oil production has more than offset declining production elsewhere in the country and has resulted in a gain of 1.2 million barrels per day between 2008 and 2012.

Average Daily US Tight Oil Production: 2000 to 2012

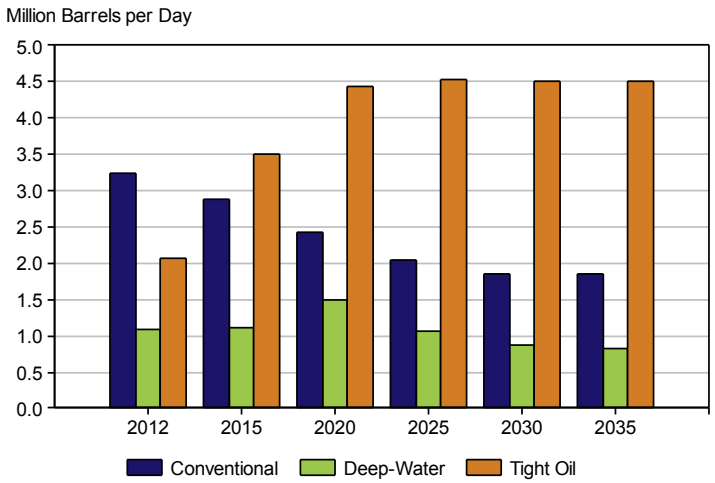


NOTE: *Projected.

Source: IHS CERA

Strong growth in tight oil production is anticipated to continue. By the end of the decade, tight oil production of nearly 4.5 mbd is expected, representing nearly two-thirds of domestic crude oil and condensate production.

US Tight Oil Production Outlook: 2012 to 2035



Source: IHS CERA

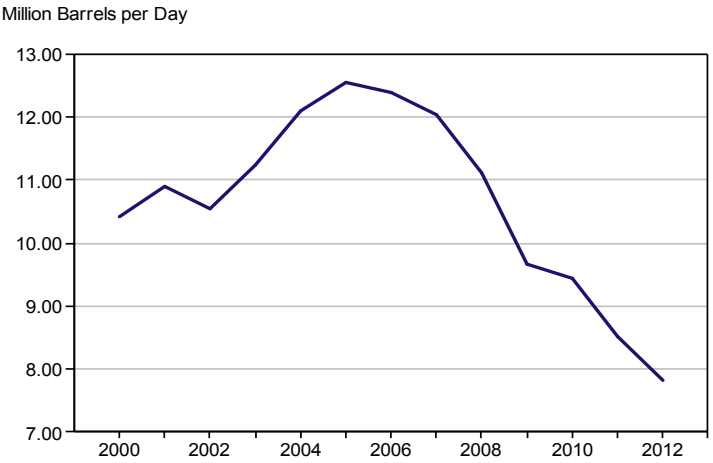
The first growth in US oil production since 1970 began in 2005—strikingly, the same year US oil consumption peaked. The economic climate of the past several years partially explains the decline in demand, but greater fuel efficiency in autos and a slowing, or even reversal, of the growth in total vehicle miles will continue to constrain the growth of demand. On the supply side, however, increasing domestic oil production driven by unconventional oil—when combined with fuel efficiency and demographic factors—will continue to reduce US oil imports in the years ahead. The economic impact is already clear in terms of international trade. At the current pace, 2012 net oil imports are projected to reach $319 billion, equivalent to approximately 45% of our estimated 2012 trade deficit of $695 billion. Oil imports would have cost the United States $70 billion more—and therefore the trade deficit would have risen by about 10%—had the 1.7 mbd increase in production capacity brought about by tight oil since 2008 not been realized.

[5] "Crude oil" includes both crude oil and condensate.

Continuing increases in domestic oil production will also result in a significantly lower trade deficit than would otherwise be the case.

At the current pace of development, the net US oil import requirement could be about 6.0 mbd less by 2020 than it was as recently as 2005. Using the average oil price for the first nine months of 2012 of $112 per barrel, this represents an annual reduction in the oil import bill of nearly $185 billion.[6]

US Average Net Oil Imports*: 2000 to 2012



NOTE: Net oil imports equals oil and oil products imports minus oil and oil products

Source: EIA

Natural Gas Liquids

Finally, this unconventional activity has also contributed to the rise in natural gas liquids—ethane, propane, butanes and natural gasoline or light naphtha. The growth in NGLs production has significant implications for the downstream energy sector. Many of the unconventional oil deposits also contain rich gas, that is, natural gas accompanied by natural gas liquids as well as crude oil. In addition, many of the unconventional gas plays—the so-called "wet gas" plays—contain significant proportions of NGLs. These NGLs are feedstocks for the petrochemical industry and the building blocks for countless industrial and consumer goods. After decades of relatively flat production, unconventional activity unleashed the first rapid growth in domestic production of these liquids. From 2008 to 2012, overall NGL production in the United States grew by over 500,000 barrels per day—a 29% increase that was largely attributable to unconventional activity. Further, production of NGLs from unconventional activity is anticipated to more than double, from 1.8 mbd in 2012 to 3.8 mbd by 2020.[7] The greater availability of natural gas liquids can be expected to support the expansion of US petrochemical manufacturing which uses NGLs as feedstock and will be explored in our future analysis.

Economic Contributions to the United States

This growth in oil and natural gas production is fueled by the exploration and production industry, which is driving the unconventional revolution with over $87 billion in capital expenditures in 2012. Since the majority of the technology, tools, and knowhow are home grown, an overwhelming majority of every dollar spent throughout this supply chain remains in the United States and supports domestic jobs. Extensive supply chains—across many states, including states that do not directly produce unconventional oil and natural gas—reach into multiple facets of the American economy. Below, we present the contribution from the unconventional revolution in terms of capital expenditures, jobs, economic value added, and government revenues.

[6] EIA Average Brent Spot Price FOB (Dollars per Barrel) Jan-Sept 2012

[7] Natural gas liquids (contained) represents unprocessed liquids potentially recoverable from the production of gas and oil

$172 Billion Annual Capital Expenditures By 2020

US Lower 48 Capital Expenditures: Total Unconventional Activity* (Current $M)				
	2012	**2020**	**2035**	**2012-2035****
Drilling Capital Expenditure	28,027	57,680	122,430	1,761,012
Completion Capital Expenditure	46,873	92,322	188,284	2,737,444
Facilities Capital Expenditure	6,701	12,620	24,479	370,727
Gathering System Capital Expenditure	5,701	9,919	17,883	279,326
TOTAL UPSTREAM CAPITAL EXPENDITURE	**87,301**	**172,542**	**353,076**	**5,148,509**

NOTES: *Total unconventional activity represents the sum of unconventional oil and unconventional gas activity.

**2012-2035 represents the total for all years including those years not reported.

Source: IHS Global Insight

As the production of unconventional oil and natural gas expands over the next 25 years, the industry's economic contribution will also expand. While today's capital expenditures are over $87 billion, annual capital expenditures in support of unconventional energy activity will grow to $172.5 billion by the end of the decade, widely impacting the US economy. Cumulative capital expenditures on unconventional oil and natural gas development are expected to exceed $5.1 trillion by 2035 (an average of some $200 billion annually over the entire period). This spending takes place in upstream unconventional oil and natural gas activity and includes drilling, completion, facilities and gathering systems. Spending will feed into the broader supply chain through capital-intensive purchases of heavy equipment, iron and steel, and rig parts, as well as technical skills and services and information technology among others.

3 Million American Jobs By 2020

US Lower 48 Employment Contribution (Number of workers)			
	2012	**2020**	**2035**
Unconventional Oil Activity*	845,929	1,345,987	1,390,197
Unconventional Gas Activity**	902,675	1,639,181	2,108,481
Total Unconventional Activity	**1,748,604**	**2,985,168**	**3,498,678**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

The economic contribution of unconventional energy activity to employment is measured by the sum of (1) the direct contribution, (2) the indirect contribution from supplying industries, and (3) the induced economic contribution that results from workers spending their incomes throughout the entire economy.

These employment opportunities have particular resonance at a time that reigniting the economy, and job growth in particular, is one of the dominant issues on the national agenda. The numbers are striking:

- In 2012, unconventional energy activity supported over 360,000 direct jobs, over 537,000 indirect jobs in supplying industries, and over 850,000 induced jobs—a total of more than 1.7 million jobs in the lower 48 US states.

- The greatest future job growth will occur between 2012 and 2020, during which we forecast unconventional oil and natural gas activity will stimulate the addition of nearly 1.3 million jobs, bringing the total to 3 million workers. These jobs will comprise over 600,000 direct, over 900,000 indirect, and nearly 1.5 million induced jobs.
- Beyond this, by 2035, the industry will add nearly 500,000 jobs, bringing the total contribution to just less than 3.5 million. IHS Global Insight expects that total employment contribution for upstream unconventional activity will account for 1.5% of the overall US workforce on average over the near-term (2012-2015), 1.9% during the intermediate term (2016-2020) and 2% in the long-term (2020-2035).

$416 Billion in Value Added to the US Economy By 2020

US Lower 48 Value Added Contribution
(2012 $M)

	2012	2020	2035
Unconventional Oil Activity*	116,014	191,081	187,858
Unconventional Gas Activity**	121,670	225,470	287,127
Total Unconventional Activity	**237,684**	**416,551**	**474,985**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

In terms of the value-added contribution to gross domestic product (GDP), upstream unconventional energy activity will contribute more than $237 billion in 2012 alone. As industrial activity and capital expenditures expand, the industry's contribution to the overall economy will also grow. The value added contributions will increase to more than $416 billion in 2020 and $475 billion by the end of the forecast.[8]

$111 Billion in Annual Tax Revenues to Federal and State Treasuries By 2020

US Lower 48 Estimated Government Revenue: Total Unconventional Activity*
(2012 $M)

	2012	2020	2035	2012-2035**
Federal Taxes	28,936	50,229	57,846	1,137,602
State and Local Taxes	30,931	57,731	64,967	1,317,506
Federal Royalty Payments	1,964	3,204	1,593	62,141
Total Government Revenue	**61,832**	**111,164**	**124,406**	**2,517,248**
Lease Payments to Private Landowners	504	913	1,232	23,599

NOTES: *Total unconventional activity represents the sum of unconventional oil and unconventional gas activity.

**2012-2035 represents the total for all years including those years not reported.

Source: IHS Global Insight

At a time when government budgets are of great concern, the unconventional revolution has had a considerable fiscal impact: industrial activity and employment associated with unconventional oil, natural gas and NGLs development will contribute nearly $62 billion in federal, state and local tax receipts for 2012 alone.

[8] All dollars are in 2012 constant amounts.

These revenues include personal and corporate taxes from the supply chain of industries, as well as tax revenues from income earned by direct, indirect, and induced employees. Tax revenue includes: (1) federal—corporate and personal income taxes; (2) state and local—corporate and personal income taxes, state severance taxes, and state *ad valorem* levies; and (3) federal royalties—payment for exploration on federal lands. In addition to government taxes and revenues, lease payments to private landowners are also reported.

Federal tax revenues and royalties currently account for nearly $31 billion, while state and local taxes account for another $31 billion. By 2020, total government revenues from unconventional oil and natural gas will grow to just over $111 billion. On a cumulative basis, unconventional activity will generate more than $2.5 trillion in tax revenues between 2012 and 2035. Over the entire 2012 to 2035 forecast interval, state and local tax revenues are roughly as large as federal revenues. While federal personal tax receipts are significantly greater than state personal tax receipts, the addition of corporate taxes at the state level as well as ad valorem and severance tax collections will equalize state and local revenues with federal tax revenues.

Conclusion

Unconventional oil and natural gas activity is reshaping America's energy future and bringing very significant benefits to the economy—in terms of jobs, government revenues, and GDP. This study provides the foundation for a dialogue focused on the evolving and transformative economic effects of this unconventional revolution. It assesses the contribution in terms of the economic impacts to the US and the security of its energy supply. This research explores how the development of new sources of unconventional oil and natural gas is fundamentally changing the US energy outlook and the nation's economic future.

IHS expects cumulative capital expenditures on unconventional oil and natural gas development to reach $5.1 trillion by 2035, or an average of over $200 billion annually. This spending will make contributions to the US economy both through direct employment within the oil and natural gas industry and indirect employment across the diverse suppliers that support the industry. When direct and indirect employees spend their incomes—on food, housing, and other sundries of daily living—they support induced employment throughout the entire economy. Supporting this build-out of upstream unconventional activity are more than 1.7 million jobs today. But, by the end of the decade, the industry will support 3 million jobs and is on a path to supporting 3.5 million jobs in 2035.

Introduction and Research Objectives

Across America's widening energy landscape, the economic impacts of unconventional oil and natural gas are increasingly discernible. These effects are visible within the energy value chain and are extending into the broader reaches of the US economy.

Previous IHS research has demonstrated the appreciable economic impacts derived from unconventional natural gas development, and the very same technologies driving this growth—including hydraulic fracturing and horizontal drilling—have also led to a take-off in production of domestic unconventional tight oil. The confluence of technology, newly identified resources, and slow economic growth is stimulating a fresh dialogue about the emergence of "America's New Energy Future."

In little more than five years, many of the old expectations for the energy and economic future have been upended by the resurgence of US oil and natural gas production. This rebound in crude oil and condensate production has propelled the United States into the lead as the fastest growing producer of oil worldwide.[9]

In the crosscurrents of the slow economic recovery from the deepest economic downturn since the Great Depression, unconventional hydrocarbons are supporting domestic job growth within the energy sector and in the lengthy supply chain that supports energy production. Beyond direct exploration, development, and production activity around the wellhead and well pad, unconventional energy is fueling orders in an array of supply sectors. These include off-highway equipment, steel pipe manufacturing, and information technology services, such as those associated with seismic data visualization and management.

The focus of this report is to assess the evolving national economic contributions of unconventional upstream oil and natural gas development activity. Unique to this analysis are the discrete economic contributions generated by unconventional oil—including crude oil and condensate—and unconventional natural gas—defined as shale gas and tight gas, and the corresponding NGL production from both unconventional oil and natural gas activities. This analysis demonstrates the economic contributions—to employment, national income, and tax revenues—associated with this unconventional oil and natural gas activity, and examines the contribution to direct, indirect and induced employment. This study seeks to quantify how unconventional upstream activity creates economic value in the broader economy through an examination of the exploration and production activity that specifically isolates the various hydrocarbon resources on a major play-by-play basis.

The economic and fiscal contributions of upstream unconventional oil and natural gas activities are presented at the national level. Further research will examine state-by-state contributions. Upstream activity has demonstrated clear economic benefits of oil and natural gas producing plays in various states, such as the Marcellus formation in Pennsylvania, Niobrara in Colorado, Eagle Ford in Texas, as well as formations in other oil and natural gas producing states. However, IHS' analysis demonstrates that non-producing states also realize economic benefits, as do a long list of industries in the energy value chain. For example, Illinois, with its significant industrial manufacturing base, supports upstream activity by producing the capital goods used on drilling sites. These types of linkages will be investigated more thoroughly during our research to assess how widespread the economic effect of the unconventional revolution can be on a sub-regional and sub-sectoral level. Correspondingly, IHS will also assess the evolving fiscal impacts at the state level, at a time when state budgets are under great pressure.

Finally, building from the national and state level assessments, we will ultimately assess the potential for US manufacturing. Our research will explore the employment and competitiveness trends within the manufacturing sector related to upstream unconventional oil and natural gas activity. In particular, we

[9] IHS CERA, US Energy Information Administration, International Energy Agency. NOTE: Crude oil, condensate, and natural gas liquids.

will examine the effects of an ample, affordable domestic supply of oil, natural gas, and NGLs on our manufacturing base—including the petrochemical, steel and other energy-intensive industries as well as the economic activity associated with the supply chains that sustain this expansion. At the conclusion of the full research program, we will have generated three Special Reports:

- The national economic contributions of unconventional upstream oil and natural gas activity in the lower 48 US states (this study);
- The state-level economic contributions of unconventional upstream oil and natural gas activity in the lower 48 US states;
- The economic contributions and prospects for a domestic manufacturing renaissance resulting from unconventional upstream oil and natural gas activity in the lower 48 US states.

Report Structure

This report, the first in the series, is divided into five sections.

- Executive Summary offers an overview of the results.
- An Introduction to Unconventional Oil and Natural Gas offers an overview of the unconventional oil and natural gas industry and explains the differences between unconventional or tight oil, shale gas, tight gas and natural gas liquids.
- An Unconventional Oil and Gas Revolution presents the critical inputs to the economic analysis, namely the production profile and capital expenditure outlook for unconventional oil and natural gas. Since any discussion of production profiles must be bound by market principles, we preface this section with an overview of the US market supply and demand outlook through 2035.
- Economic Contributions details the results of IHS' economic contribution analysis for the unconventional oil and natural gas resources.
- Conclusion provides the key conclusions of the national report.

We also provide several appendices to provide the readers with a deeper understanding of the methodologies, research and data utilized for our analysis. The appendices—available at http://www.ihs.com/info/ecc/a/americas-new-energy-future.aspx—present more detailed results from our study.

- Appendix A contains the underlying methodology and detailed data related to the assumed future production profile and capital expenditure outlook for unconventional oil and natural gas and natural gas liquids.
- Appendix B provides more detailed results of the economic contribution assessment.
- Appendix C presents the economic contribution results at a three digit NAICS industry level.
- Appendix D presents the data and modeling approach underlying the economic contribution analysis.

An Introduction to Unconventional Oil and Natural Gas

What is Unconventional Oil and Gas?

In a conventional hydrocarbon reservoir, oil and natural gas migrate over geologic time from a deeper source rock in which they were originally formed and through other permeable rocks or conduits until the oil or natural gas encounters an impermeable layer of rock or barrier that traps the hydrocarbon in an underlying reservoir. A well is drilled into the reservoir to allow the oil and/or natural gas to flow into the wellbore and then to the surface. Depending on geological conditions, conventional well completion techniques have traditionally included vertical drilling and, in many cases, hydraulic fracturing and other stimulation technologies to facilitate hydrocarbon flow.

Unconventional or "tight oil" is produced from a variety of geological formations using techniques that were pioneered to produce unconventional natural gas. There are significant differences in terms of geology, recovery technology, and productivity of hydrocarbons when comparing conventional and unconventional oil and natural gas reservoirs; the techniques for producing oil from unconventional formations, on the other hand, are essentially the same as those used to produce unconventional natural gas.

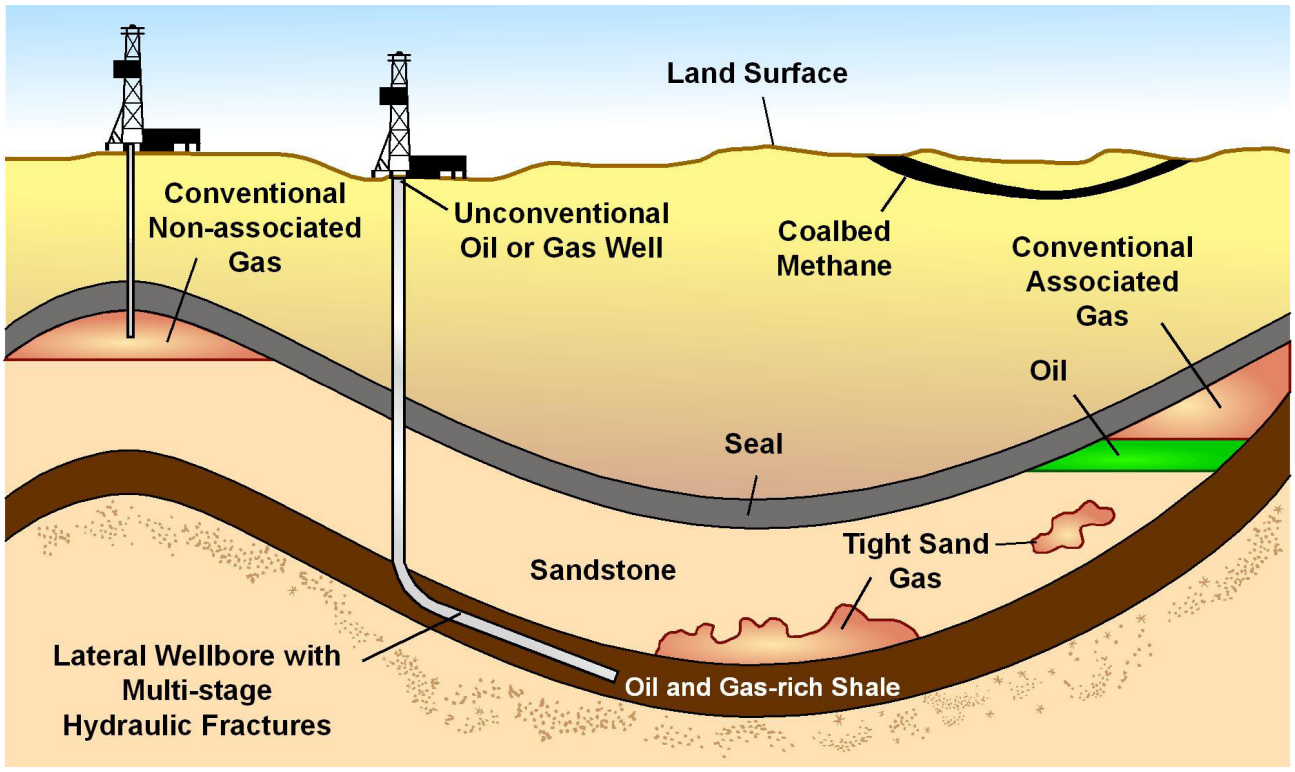
The major characteristic common to both unconventional oil and natural gas is that hydrocarbons are produced from geological formations that previously prevented the hydrocarbons from flowing at commercial rates; hence, production from these formations had generally not been economic until recently. Shale gas is contained in low-permeability shale rock; tight sands gas is contained in low-permeability sandstones and carbonates; and tight oil is contained in shales and low-permeability carbonates, and sandstones. Because all of these rocks have low permeability, they are informally referred to as being "tight." Permeability—a measure of how easily gases and liquids can flow through rock—is one of the factors driving the choice of techniques for the extraction of natural gas or oil from the rock formation.

It has long been known that low-permeability reservoirs, including the source rocks that fed conventional reservoirs, existed and that they contained significant amounts of natural gas and oil. However, traditional completion techniques did not yield sufficient production for economic development. Through years of applied research and testing in formations such as the East Texas Barnett shale, production techniques have been developed to extract oil and natural gas from these low permeability rocks.

In particular, the combination of horizontal drilling and hydraulic fracturing has proved critical to unconventional oil and natural gas development. Both have a long history of use. Horizontal drilling involves drilling a vertical well to the desired depth and then drilling laterally, or horizontally, to access a larger portion of the intended reservoir. Hydraulic fracturing involves the injection of fluid (usually a mixture of water, sand, and small amounts of chemicals) through the wellbore under high pressure into low-permeability reservoirs to create artificial fractures that create conduits through which hydrocarbons can flow. The sand or "proppant" is left behind in those cracks or "fractures" to prevent them from closing after the pressurized fluids are removed. These propped fractures offer pathways (permeability) for oil and natural gas to flow more easily through the wellbore and then to the surface.

Horizontal drilling and hydraulic fracturing techniques have been refined and improved in recent years, increasing productivity from unconventional reservoirs. Much of this refinement is play specific, since each formation behaves slightly differently. The use of these two techniques in combination allows a larger surface area of the reservoir to be exposed to a single well and thus a larger area across which reservoir fluids can flow into the wellbore. As a result, these techniques allow commercial production of significant amounts of hydrocarbons that have been unable to escape over millions of years from ultra-tight, low-permeability formations.

The Geology of Conventional and Unconventional Oil and Gas



Source: EIA

Unconventional natural gas is typically classified according to the type of formation from which it is extracted: shale, tight sandstone, and coal seams.[10] In practice, many natural gas plays contain combinations of these, and the designation of a particular play as a shale gas play or a tight gas play is typically the result of geologists' consensus based on the predominant rock characteristics. Portions of a play can vary from shale-dominant to tight sands-dominant by depth or geographical location. Similarly, the hydrocarbon content across the play may transition from dry gas to wet gas and condensate, to crude oil, all generally designated as "tight" gas or oil depending on the source rock.

The Production of Unconventional Oil and Natural Gas

Oil and natural gas produced from conventional and unconventional sources are virtually identical in the fundamental aspects of their exploration, development, production, transportation, processing, and marketing. They differ primarily in terms of well construction. Wells for unconventional hydrocarbons tend to be more expensive than those for conventional production from a similar depth reservoir due to the long horizontal wellbores required and the far greater complexity of well completion. The latter requires creating fractures through a multi-stage hydraulic fracture completion, performed in the production start-up stage. The major components of oil and natural gas production are briefly described below.

Prospecting and Exploration

Numerous geological evaluations, seismic surveys, pilot drilling and testing are required to determine whether an oil or natural gas field has the potential for commercial development—typically after significant investment has been made in securing leases. Development plans are formulated with an eye toward minimizing environmental and other local disturbances and ensuring that all necessary permits are

[10] This study examined only shale gas and tight sands.

secured for well locations that would access the most economically recoverable quantities of oil and natural gas.

Well Construction

Well construction starts with detailed planning of a well's location, both at the surface and for the trajectory and target below ground. Once a well location has been surveyed and staked out, and a drilling permit has been granted by state and/or local regulatory authorities (or by federal authorities on federal land), the site is prepared for drilling.

Drilling

A drilling rig penetrates the ground by means of a rotating drill bit attached to the bottom of a steel pipe assembly known as the drill string. Specialized "mud" is continuously pumped down the drill string and up the wellbore in order to keep the drill bit cool and lift rock cuttings away from the bit and up to the surface. As drilling progresses, steel sleeves, or casing, are lowered and cemented in place, starting at the surface and moving downward. The steel casing and cement surrounding it isolate the contents of the wellbore from the adjacent rock formations and from underground sources of potable water. After drilling the vertical segment, the drill bit is directed to "kick off" in an arc until it achieves a target horizontal trajectory, where it continues with a lateral segment to a designated length, typically between 5,000 and 15,000 feet.

Completion

Well completion is the process of preparing a well, after drilling, to begin production. Completion steps include installation of the remainder of the casing, followed by perforation. The perforation step creates holes through the casing wall and enclosing cement layer to connect the wellbore to the hydrocarbon-bearing reservoir. Those holes are created in the target zone only, and apart from allowing inflow of oil and natural gas, they also facilitate the outflow of water at high pressure in order to create hydraulic fractures in the rock. Perforation is accomplished by means of controlled explosive charges set off in the wellbore and mounted in specially designed perforating "guns" that are electrically triggered from the surface. Once the casing is perforated, the target zone area accessed by the well is ready to be hydraulically fractured. Pumps inject large volumes of completion fluid—mostly water and sand with small quantities of additives—down the wellbore under very high pressure. The pressure from the pumps is propagated by the fluid coursing down the wellbore and against the reservoir rock, creating fractures in the rock. After fracturing is complete for all portions of the horizontal wellbore, valves on surface are opened up, allowing water to flow back from the rock face, leaving sand behind to keep the fractures propped open. As the completion fluid is removed from the wellbore, oil and/or natural gas can migrate into the fractures, travel along the fractures to the wellbore, up to the surface wellhead, and on to gathering facilities leading to processing plants and then to sales and marketing pipelines.

Production

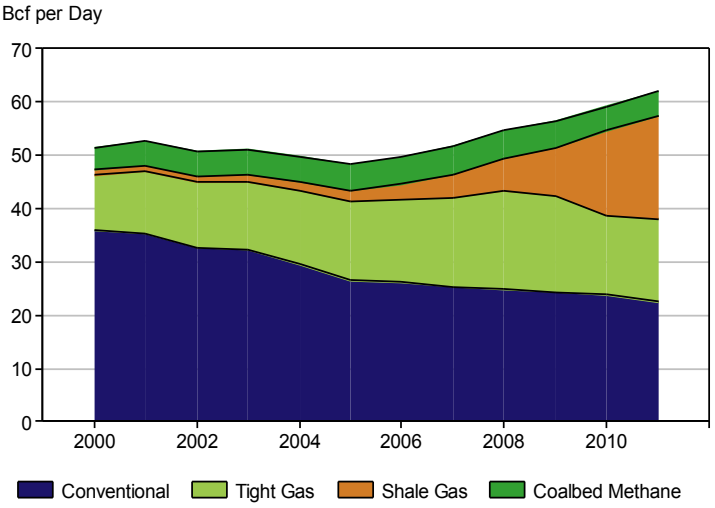
After completion, production goes into full swing, assuming that there is sufficient transport and processing capability. Local production tie-in lines lead to compression stations located in the production area. Formation water mingled with oil and natural gas — a byproduct of production—is stripped out by means of separators and dehydrators, and the cleaner hydrocarbon is transported through a network of gathering pipelines that continually collect oil and natural gas from various operators' leases, feeding natural gas to processing plants and oil to a pipelines for eventual refining. Gas processing plants extract natural gas liquids such as ethane, propane, butane, isobutene, and pentane for sale in their respective markets. Dry gas then enters a pipeline for delivery to end markets, such as power generation or manufacturing plants or urban distribution networks.

An Unconventional Oil and Gas Revolution: Supply and Demand

The Shale Gale—Abundant Natural Gas

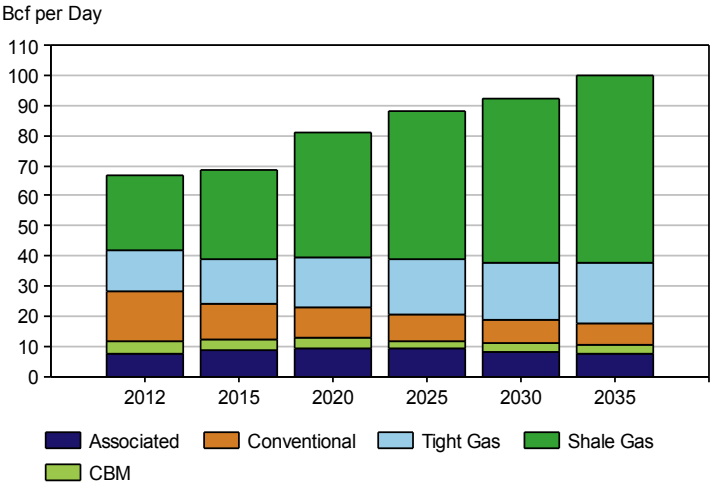
The prospect of an abundant long-term natural gas supply has revolutionized the US natural gas market. As recently as 2007 it was commonly believed that the US natural gas resource base had matured or was economically inaccessible and that increasing imports of liquefied natural gas ("LNG") would be required to meet demand. But then shale gas production began to grow. The key efforts to capture natural gas from shale rock began in the early 1980s in the Barnett Shale in Texas. But it was not until the late 1990s and the first years of this century that the technologies came together.[11] Natural gas production in the US Lower 48 grew from nearly 50 Bcf per day in January 2007 to roughly 56 Bcf per day in July 2008—an increase of nearly 13% in just 18 months. Total natural gas production has now grown to 65 Bcf per day, of which 50% is shale and tight gas. Natural gas supply is no longer in doubt. In fact, the US natural gas market, which was once considered supply-constrained, is now demand-constrained. This means the outlook for shale gas production depends in considerable part on the outlook for natural gas demand.

US Lower 48 Natural Gas Production by Type: 2000 to 2011



Source: Energy Information Administration, IHS CERA

US Lower 48 Natural Gas Productive Capacity* Outlook by Type: 2012 to 2035



NOTE: *Productive capacity is the amount of gas that can be produced if unconstrained by infrastructure bottlenecks.

Source: IHS CERA

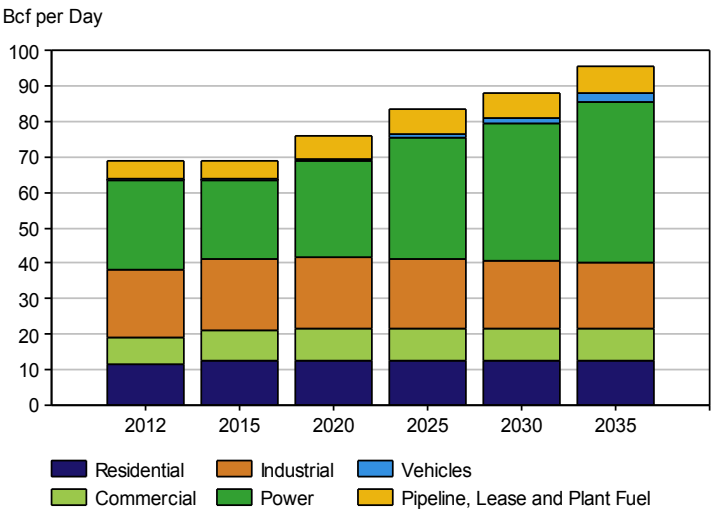
IHS CERA expects total domestic natural gas production to continue to grow over the long term, in line with expanding natural gas consumption. Almost all of the future growth of US natural gas production is expected to come from shale gas and tight gas plays. By 2035, total natural gas production is expected to approach 100 Bcf per day of which nearly 80% will come from shale gas and tight gas alone.

Since the nation's endowment of recoverable natural gas has expanded so rapidly as a result of unconventional technologies, the United States is expected to be able to meet future demand growth almost entirely from North American sources. Little or no LNG imports will be required, and any imports will only be for seasonal balancing purposes. IHS CERA's long-term outlook for natural gas demand envisions lower US 48 demand increasing from almost 70 Bcf per day in 2012 to 96 Bcf per day

[11] Daniel Yergin, "The Natural Gas Revolution," chapter 16, *The Quest: Energy Security and the Remaking of the Modern World* (New York: Penguin, 2012).

by 2035. Much of this increase occurs in the power sector, where demand will more than double over this period, with additional demand coming from petrochemicals and other natural gas-intensive industries, as well as some development of natural gas-fueled vehicles. Relatively little growth is expected for the residential and commercial sectors.

US Lower 48 Natural Gas Demand by Type: 2012 to 2035



Source: IHS CERA

Environmental emissions regulations, renewable energy mandates, investment economics, and more flexible time frames—all will work to promote increased natural gas use for power generation. US Environmental Protection Agency regulations aimed at restricting emissions of sulfur, mercury, particulate matter, and potentially carbon dioxide are increasing the costs of operating coal generation units and sometimes are hastening their retirement. Since natural gas is a cleaner-burning fuel than coal, with only half the carbon content, and is available at relatively lower prices, natural gas is increasingly being favored over coal for power generation.

Economics also favor natural gas. Gas-generation plants have lower capital costs than most other types of generation units, and they can often be built more quickly than coal or nuclear units. Moreover, the low price of natural gas makes it a stronger competitor against coal in electric dispatch. Recently, utilization of existing gas-fired capacity has increased with the fuel share for gas rising from 20% in 2008 to 29% in 2012.

Finally, the increasing share of renewables in power generation capacity, driven in part by state Renewable Portfolio Standards, favors natural gas for backup generation when wind and solar power are unavailable. IHS CERA expects total additions to generation capacity to be nearly 500 gigawatts (GW) between 2012 and 2035. Retirements of coal plants will reach 93 GW over this period. Gas-fired capacity will account for 53% of this additional capacity, with 40% furnished by wind and other renewables, 5% from nuclear, and 2% from advanced coal technologies. This translates into an increase in power sector demand for natural gas from 21 Bcf per day in 2011 to 45 Bcf per day by 2035.

Industrial demand also has growth potential. The development of shale gas and associated natural gas from tight oil plays is dramatically increasing the availability and potential supply of attractively priced natural gas liquids (NGLs), which are commonly used as a petrochemical feedstock. Production from these plays includes varying amounts of hydrocarbons other than methane. These include ethane, propane, normal butane, isobutane, and natural gasoline (sometimes referred to as "pentanes plus"). The petrochemical feedstock represents the single most important end-use sector for NGLs in North America, accounting for more than half of the total demand for NGLs. The production of NGLs from shale gas and tight gas plays and from associated natural gas in tight oil plays will grow from 1.8 million barrels of oil equivalent (mboe) per day in 2012 to 4.8 mboe per day by 2035.[12]

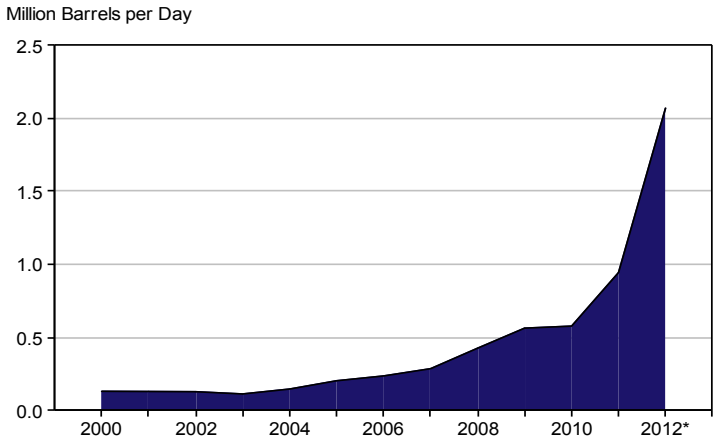
[12] Natural gas liquids (contained) represents unprocessed liquids potentially recoverable from the production of gas and oil.

The Great Revival—New Oil

As the natural gas Shale Gale was taking off, operators in North Dakota and Montana were already drilling horizontal wells and working to determine if the same drilling techniques involving hydraulic fracturing could be successful in unconventional oil formations. These techniques did indeed prove themselves and, as with shale gas, led to a rapid increase in US oil production over the past few years. The Bakken play in North Dakota and the Eagle Ford play in Texas are prime examples of this growth. From less than 100,000 barrels per day (bd) in 2005, North Dakota's production is now near 700,000 barrels per day as a result of growth in the Bakken play. The Eagle Ford in Texas, another significant play, has risen from virtually nothing in 2005 and is expected to average 515,000 barrels per day in 2012. Operators quickly used these techniques to develop other formations such as in the Niobrara play in Colorado, and to begin to explore new plays such as the Utica in Ohio. They are also now using these techniques to rejuvenate major mature regions—most notably the Permian Basin in West Texas—by going back to poor-quality reservoirs within conventional plays.

The production of tight oil (crude oil and condensate from unconventional sources) is expected to increase from 2 mbd in 2012 to 4.5 mbd by 2035, accounting for about 63% of total US crude oil and condensate production.

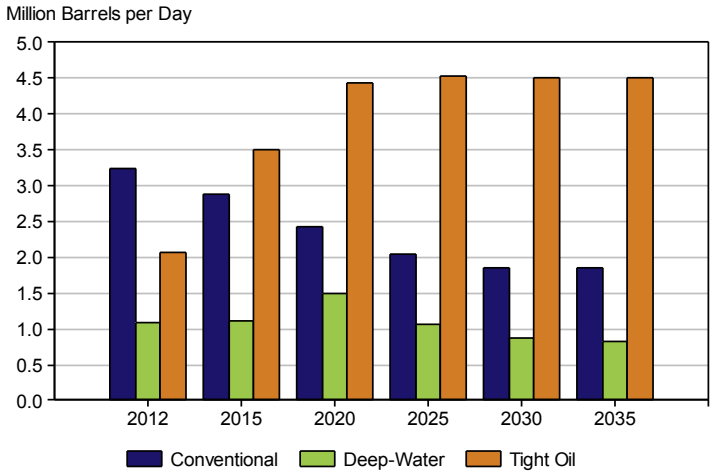
Average Daily US Tight Oil Production: 2000 to 2012



NOTE: *Projected.

Source: IHS CERA

US Tight Oil Production Outlook: 2012 to 2035



Source: IHS CERA

At this point, recoverable crude oil from unconventional plays is estimated to be approximately 38 billion barrels, with about one-third of this in mature poor-quality conventional plays. The experience of the shale gas revolution shows that productivity rates can increase dramatically as the industry gains knowledge and experience using its new production technologies. However, since tight oil is a new resource and production is in the early stages of development, there is more uncertainty about its ultimate potential.

Production Profiles for Unconventional Oil and Gas Plays

The outlooks for both production and the corresponding capital expenditures for the unconventional oil and natural gas industry are required to accurately assess economic contribution. Within our framework, the capital requirement is a function of underlying production. That is, IHS CERA projects production and then derives the corresponding capital expenditures necessary to support that level of production.

In developing our production profiles and capital expenditure outlooks from 2012 through 2035, IHS CERA's outlook considered production from 20 major plays—seven tight oil plays, nine shale gas plays and four tight gas plays. IHS' outlook for unconventional oil and natural gas production in the lower US 48 states includes production from the following plays considered in this study:

Tight Oil Plays	Shale Gas Plays	Tight Sands Gas Plays
Bakken	Eagle Ford Shale Wet Gas	Uinta-Piceance
Eagle Ford Oil and Volatile Oil	Eagle Ford Shale Dry Gas	Jonah-Pinedale
Delaware Basin—Bone Spring	Marcellus Shale	Cotton Valley
Midland Basin—Spraberry-Wolfcamp	Utica Shale (Gas)	Granite Wash—Colony Wash
Mississippian	Woodford Shale	
Cleveland-Tonkawa	Haynesville Shale	
Utica (Oil)	Fayetteville shale	
	Barnett Shale	
	Niobrara	

The variables used to derive production profiles for each of these 20 plays were obtained from IHS databases and internal research. These variables include:

- Rig count (including assumptions about ramp up, maximum rigs, time at plateau, ramp down);
- Number of days to drill and complete a well;
- Type curves showing production profiles over time for a typical well;
- Acreage (total area to be developed);
- Well spacing;
- Probability of geologic success.

The number of possible locations to be developed was derived from the last three items. Type curves were derived for each play using IHS databases and software tools (Enerdeq and PowerTools) based on actual well production data.

The number of days to drill a well (including mobilization and demobilization of the rigs) was also obtained from well data in IHS databases. Rig forecasts were developed for each play based on historic rig counts and on estimated active rig counts operating in 2012, along with the per-well economics of each individual play.

US Lower 48 Annual Unconventional Oil and Gas Production and Well Completions	2012	2015	2020	2035
PRODUCTION				
Unconventional Oil* (mbd)	**2.07**	**3.50**	**4.43**	**4.50**
Tight Oil	1.49	2.65	3.28	3.26
Shale Gas Condensate	0.30	0.49	0.71	0.83
Tight Gas Condensate	0.28	0.36	0.44	0.41
Unconventional Gas (Bcf per day)**	**36.12**	**44.27**	**59.53**	**80.05**
Associated Gas***	2.59	4.90	6.62	7.09
Shale Gas	23.83	27.82	37.67	54.17
Tight Gas	9.70	11.54	15.25	18.79
Natural Gas Liquids (Contained)** (mbdoe per day)**	**1.81**	**2.67**	**3.82**	**4.84**
Associated Gas	0.44	0.84	1.10	1.19
Shale Gas	0.85	1.13	1.67	2.44
Tight Gas	0.52	0.70	1.06	1.21
WELL COMPLETIONS				
Unconventional Oil[t]	**7,179**	**8,472**	**8,636**	**8,934**
Unconventional Gas[tt]	**7,766**	**9,004**	**10,210**	**11,203**
Shale Gas	5,086	5,545	6,688	7,503
Tight Gas	2,681	3,459	3,521	3,700
PRICE INDICES				
WTI Price (2012 $US per bbl)	$95.04	$77.34	$89.54	$86.81
Henry Hub Price (2012 $US per MMBtu)	$2.57	$4.37	$4.16	$5.07

NOTES: *Unconventional oil production represents oil and condensate recovered from tight oil, shale gas and tight gas plays.

**Unconventional gas production represents natural gas recovered from unconventional shale gas and tight gas plays and associated gas recovered from tight oil plays.

***Associated gas represents gas recovered from the production of oil in tight oil plays.

****Natural gas liquids (contained) represents unprocessed liquids potentially recoverable from the production of associated gas in tight oil plays and liquids rich gas in shale gas and tights gas plays.

t Well completions in plays designated as tight oil.

tt Well completions in plays designated as shale gas and tight gas.

Source: IHS CERA

Drilling Costs and Capital Expenditures

An unconventional oil or gas well in a shale or tight sand target can cost anywhere between $3 million and $12 million to drill and prepare for production. Well costs vary depending on several physical factors, including the vertical depth of the oil or gas reservoir, the length of the lateral pipe, the reservoir pressure, rock characteristics, and number of fracture stages, as well as commercial factors such as ease of access to materials and services, and the price and supply of water, fluid, sand, drilling, and completion services. There are four categories of upstream capital expenditures in this study: drilling, completion, facilities, and gathering. Compression is included in both facilities and gathering. Capital costs for processing are included but are treated separately. Lease acquisition costs are not included,

as most of the known active plays are heavily leased, and these costs should be treated as sunk costs. While we anticipate some additional leasing, most of the activity will be through acquisitions and divestitures, which are highly variable and difficult to predict.

Well productivity and costs are roughly similar for shale or tight sand gas wells. Differences in production costs are driven by the characteristics and complexities of individual plays or well requirements rather than by the play's designation as shale or tight gas. In comparison to conventional natural gas, production per well for all types of unconventional natural gas is usually much higher, which drives down unit costs of production. The same is true in comparing tight oil plays and in comparing tight oil with onshore conventional oil.

Well costs are divided into three main categories. (They are further subdivided into the level of consumable goods and services in Appendix A). The three main cost categories are:

Well Capital Expenditures

Expenditure Category	Percentage
Drilling	35%
Completion	55%
Facilities	10%

All capital costs were escalated using a normalized version of the Upstream Capital Cost Index for Land developed for IHS CERA's Upstream Capital Cost Forum to reflect projected cost increases in excess of projected inflation for the inputs to oil and natural gas development.

IHS CERA estimated the costs associated with the production outlook for unconventional oil and natural gas based on data and analysis from IHS databases and proprietary models (these are also detailed in Appendix A). IHS CERA expects over $5.1 trillion in capital expenditures for unconventional oil and natural gas development to take place between 2012 and 2035. Over this period, unconventional tight oil development will account for $2.2 trillion of this total. It should be noted that while tight oil production is essentially unchanged from 2020 through 2035, the level of capital expenditures (in nominal terms) rises rapidly. This reflects the amount of capital required to maintain the steady state level of production in the face of declines in tight oil production from known plays today.

Shale gas and tight gas together will account for almost $3 trillion ($1.9 trillion for shale gas and nearly $1 trillion for tight gas). These expenditures will drive economic contribution, in terms of jobs, value added, labor income, and tax revenues. These economic contributions are discussed in the following section.

US Lower 48 Annual Capital Expenditure by Type (Current $M)	2012	2015	2020	2035	2012-2035*
Unconventional Oil Activity**					
Drilling Capital Expenditure	13,502	19,889	24,448	50,345	755,774
Completion Capital Expenditure	20,889	30,475	36,665	68,015	1,074,492
Facilities Capital Expenditure	3,608	5,109	6,300	11,621	189,170
Gathering System Capital Expenditure	2,707	4,006	4,930	10,373	152,871
TOTAL UPSTREAM CAPITAL EXPENDITURE	**40,706**	**59,480**	**72,343**	**140,353**	**2,172,307**
Unconventional Gas Activity***					
Drilling Capital Expenditure	14,525	21,573	33,232	72,086	1,005,238
Completion Capital Expenditure	25,984	36,719	55,657	120,269	1,662,952
Facilities Capital Expenditure	3,092	4,459	6,319	12,858	181,557
Gathering System Capital Expenditure	2,994	4,057	4,989	7,510	126,454
TOTAL UPSTREAM CAPITAL EXPENDITURE	**46,595**	**66,808**	**100,198**	**212,723**	**2,976,202**
Total Unconventional Activity					
Drilling Capital Expenditure	28,027	41,463	57,680	122,430	1,761,012
Completion Capital Expenditure	46,873	67,194	92,322	188,284	2,737,444
Facilities Capital Expenditure	6,701	9,568	12,620	24,479	370,727
Gathering System Capital Expenditure	5,701	8,063	9,919	17,883	279,326
TOTAL UPSTREAM CAPITAL EXPENDITURE	**87,301**	**126,288**	**172,542**	**353,076**	**5,148,509**

NOTES: *2012-2035 represents the total for all years including those years not reported.

**Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

***Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS CERA

Economic Contribution Assessment

Approach and Methodology

How to Define the Economic Contribution

The objective of measuring the economic contribution is to fully "size" the industry's economic influence by capturing all of the supply-chain and income effects associated with upstream unconventional oil and unconventional natural gas activity in the United States. The results of the production and capital expenditure analyses discussed in the previous section were integrated into a modeling system to capture the comprehensive contribution of these sectors to the US economy.

The steps used to derive the economic contribution of any industry can be summarized as follows:

- Any dollar of industrial expenditure, in this case the upstream unconventional energy industry's capital expenditure and operating expenditure, represented by value of production, results in direct benefits to the economy.
- These expenditures also result in indirect effects on final demand. In theory, an increase of unconventional energy activity, with all else constant, would lead to more revenue and output among supplier industries, such as oil field machinery and professional services. This increase would also result in higher US demand for manufactured products such as pumps and compressors, which in turn require more fabricated metal and steel. These are a few of the numerous reverberations in the supply chain resulting from the change in the target industries, in this case upstream unconventional oil and natural gas.

Unconventional oil and natural gas drilling and production use many different types of products and services from various industrial sectors of the economy. As a result, a change in unconventional activity would result in both a direct contribution (through production and capital expenditures) and an indirect contribution (via supply-chain dynamics) across a broad spectrum of sectors. The contribution of these supplier industries has implications for each supplier industry's own supply chains, magnifying the indirect contribution.

As explained below, the net effects on the US economy and its industrial sectors, due to these contributions, are divided into three stages: the **direct** contribution, the **indirect** contribution and the **induced economic** contribution.

For each stage in the analysis, the economic contribution is quantified in terms of employment, value added contribution to GDP, and labor income. Overall estimates of federal, state and local tax revenues are also calculated:

- The **direct contribution** is the effect of the core industry's output, employment, and income. For example, unconventional oil and natural gas direct contributions are generated by the exploration, production, transport, and delivery of their products to downstream elements or by providing critical on-site services. Investments in these activities result in a direct contribution to production output, the number of workers employed by the industry and how much those workers are paid and otherwise compensated.
- Any changes in the purchasing patterns or activities by the unconventional oil and natural gas segment initiate the **indirect contributions** to all of the supplier industries that support unconventional activities. Changes in demand from the direct industries lead to corresponding changes in output, employment, and income throughout their supply chains and inter-industry linkages. The affected supplier activities span the majority of industries in the US economy.

- Finally, workers and their families in both the direct and indirect industries spend their income on food, housing, leisure, autos, household appliances, furniture, clothing, and other consumer items. The additional output, employment, and income effects that result from their consumer spending activities are categorized as the **induced economic contribution**.

Modeling the Economic Contribution

As discussed in a prior section of this report, production and associated capital expenditures reflect market forces in the economy that take into account supply and demand conditions and market-clearing prices. Therefore, a team from IHS CERA and IHS Global Insight collaborated to develop two "profiles." The first profile aggregated the projected number of wells to be drilled and the expected production during each year of the forecast's time horizon. A second profile, for capital expenditures, summarized the anticipated annual expenditures on drilling, completion, facilities, gathering and processing. By incorporating the timing and sequencing of changes in production levels and the various classes of capital expenditures, this resulted in a nuanced set of "bottom-up" production and capital spending assumptions associated with unconventional activity.

IHS Global Insight utilized the IMPLAN model to evaluate changes, within the context of a comprehensive, linked industrial structure of an economy. To capture tailored capital expenditures, we decided not to enter data in the standard, aggregate categories of the IMPLAN model (i.e., drilling). Using our proprietary industry data and analyses, IHS instead focused on the unique mix of equipment, materials, and services to create a customized set of industry activities within the IMPLAN model. In this manner, we developed modified production functions for oil- and natural gas-related industries reflecting the unique purchasing and investment characteristics of each subsector. The capital expenditure profiles were used to compile customized technology requirements for each relevant activity. This process transformed the following subcategories of capital expenditures into a set of sector-level transactions for commodities and services that serves as inputs to the IMPLAN model.

Components of Unconventional Oil and Gas Capital Expenditures			
Drilling	Completion	Facilities	Gathering & Processing
Steel	Equipment	Materials	Pipelines
Consumables (incl. bits)	Hydraulic Fracturing Other	Fabrication	Machinery
Rigs	Hydraulic Fracturing Rental	Project Management	
Rig Labor	Labor	Other	
Cement	Other		
Well Wireline Services			
Other			
Source: IHS CERA			
NOTE: Other includes Architectural & Engineering Services, Truck Transportation, Insurance, etc.			

This approach provided more focused and appropriate estimates of capital expenditures for unconventional oil and natural gas, which were used as inputs to the IMPLAN model. For example, the requirements for drilling are comprised of cement, manufactured steel products, and construction, while the other drilling category reflects mostly architectural, engineering, and insurances services. Similarly, each capital expenditure category was examined in detail to designate the best corresponding industry categories of the model (Appendix D contains more details).

The IMPLAN model was used to quantify the direct and indirect contributions of unconventional oil, shale gas and tight gas. When combined, the direct and indirect contributions represent all of the production, marketing, and sales activities required to bring primary products to the marketplace in a consumable

form. IMPLAN's input-output framework allows one to enter direct contributions, by industry, in order to analyze and quantify direct and indirect contributions. The sum of all contributions relative to the total size of the economy provides initial benchmark estimates to evaluate the importance of a given industry.

The induced economic contributions represent the changes in consumer spending when their incomes are altered. The broad range of consumer spending means that induced contributions tend to be dynamic and reactive to shifts in consumer sentiment and employment outlooks. For the purposes of this study, IHS Global Insight utilized its US Macroeconomic Model (Macro Model) to enhance IMPLAN's standard methodology of measuring the induced economic contributions. The Macro Model's dynamic equilibrium modeling methodology provides a more robust determination of the induced economic contributions than could be obtained from IMPLAN's static modeling approach.

IHS Global Insight established an algorithm for linking IMPLAN's and the Macro Model's direct and indirect contributions. Both models were run using the initial set of input assumptions to produce direct and indirect contributions. The results were evaluated, and both the IMPLAN and Macro Model were refined and calibrated and run again in an iterative fashion, repeating the refinement and calibration process, until IMPLAN's and the Macro Model's direct and indirect contributions were consistent. Finally, the Macro Model was solved endogenously to produce the total economic contribution. The difference between the Macro Model and IMPLAN results (direct plus indirect) represents the expenditure-induced contributions of value added, labor income and employment.

Measuring the Economic Contributions

A baseline macroeconomic forecast of the US economy was used to evaluate and assess the contribution of the unconventional oil and natural gas industries over the next 25 years. The US economy is resilient and self-adjusts to a long-run state of full equilibrium. Hence, any contributions, policy changes, and external shocks will initially change the economic state with a longer-term convergence to the baseline. In other words, the economic ripples that result from a one-time shock this year, such as a federal stimulus program or natural disaster, will dissipate over the long term and bring the US economy back to its equilibrium state.

Consistent with this framework, the IHS Global Insight US macroeconomic baseline forecast has the unemployment rate in the short term at well above its long-term equilibrium growth level, with unemployment at 7.8% in 2012, 7.0% in 2015, and not dropping below 6% until 2020. Eventually the unemployment rate reaches its long-term growth equilibrium level in 2035, at 5%. The high unemployment rate is an indicator of short-term growth in GDP below its long-term potential.

In 2012, employment in the entire unconventional upstream sector will account for more than 1.7 million jobs, increasing to over 2.5 million jobs in 2015, almost 3 million jobs in 2020, and almost 3.5 million jobs by 2035, the end of the forecast period. Value added and labor income mirror this uninterrupted upward trend, with value added increasing from approximately $238 billion in 2012 to an average of $400 billion between 2020 and 2035. Labor income is forecast to double from about $125 billion in 2012 to $250 billion in 2035. A sector-by-sector discussion of each of these measures is presented in the next section.

US Lower 48 Economic Contribution Summary				
Employment				
(Number of workers)				
	2012	**2015**	**2020**	**2035**
Unconventional Oil Activity*	845,929	1,209,485	1,345,987	1,390,197
Unconventional Gas Activity**	902,675	1,301,178	1,639,181	2,108,481
Shale Gas Activity	605,384	848,856	1,096,040	1,404,510
Tight Gas Activity	297,291	452,322	543,141	703,971
Total Unconventional Activity	**1,748,604**	**2,510,663**	**2,985,168**	**3,498,678**
Value Added				
(2012 $M)				
Unconventional Oil Activity*	116,014	169,146	191,081	187,858
Unconventional Gas Activity**	121,670	180,387	225,470	287,127
Shale Gas Activity	80,899	118,583	151,690	195,039
Tight Gas Activity	40,771	61,804	73,780	92,088
Total Unconventional Activity	**237,684**	**349,533**	**416,551**	**474,985**
Labor Income				
(2012 $M)				
Unconventional Oil Activity*	60,488	87,260	97,779	98,709
Unconventional Gas Activity**	64,053	93,509	117,353	150,248
Shale Gas Activity	42,798	61,229	78,704	100,996
Tight Gas Activity	21,255	32,280	38,650	49,252
Total Unconventional Activity	**124,541**	**180,770**	**215,132**	**248,957**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

Employment Contribution

IHS Global Insight estimates that unconventional *oil* activity in 2012 will contribute more than 845,000 jobs to the US economy. By 2015 that figure will increase more than 40%, to more than 1.2 million jobs, reflecting the expected expansion of unconventional production and capital expenditures. By 2020, it will contribute an estimated 1.3 million jobs.

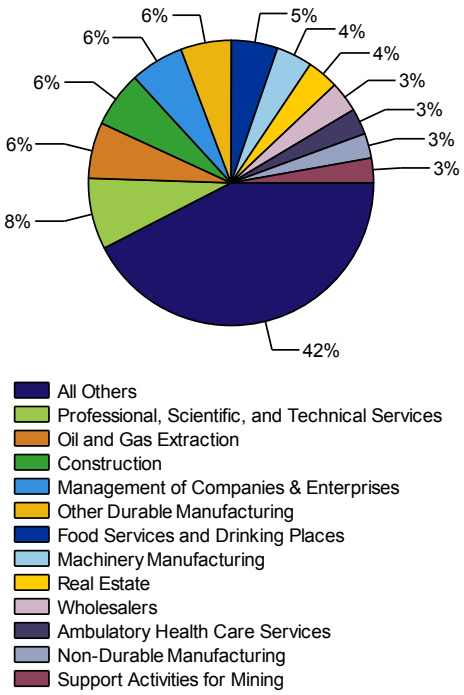
Unconventional *natural gas* activity will contribute 900,000-plus jobs in 2012, increasing by more than 44% in 2015 to nearly 1.3 million jobs. This estimate will exceed 1.6 million jobs in 2020 and 2 million jobs by the end of the forecast period in 2035. It is important to mention that the production processes across both unconventional oil and natural gas activity are fundamentally the same, permitting those who can work in the unconventional oil sector to move easily to the unconventional natural gas activity sector and vice versa, depending on each sector's market-driven growth.

Again, the two sectors combined show uninterrupted job growth over the entire 2012-2035 forecast period. In the very short-term, through 2015 and beyond, these sectors could provide help to offset the significant unemployment and underemployment rates in the overall economy.

Unconventional oil and natural gas activities generate infrastructure on an almost continuous basis. Unlike other industries in the US economy in which infrastructure activity represents only the front end of an overall project and its effect reduced in the steady-state operating phase, infrastructure development continues on a recurring basis for the unconventional oil and natural gas industries. The resulting production at a given site is capital intensive; however, infrastructure related activity moves to another location, on a year in and year out basis. Thus, unconventional oil and natural gas is an investment-intensive industry with continuing infrastructure requirements.

This phenomenon is consistent with the significant employment results of this study. The substantial levels and growth of employment are related to the nature of capital investment requirements for the upstream unconventional sectors. Employment shares, by industry, for the combined upstream unconventional sector in 2012 are virtually consistent with employment shares throughout the forecast interval. This relatively consistent share of employment by industry is an indication that the infrastructure phase will continue unabated as production expands. Specific industries that are sustained throughout the forecast period include construction, machinery manufacturing, and support activities for mining.

Employment by Industry, 2012



Source: IHS Global Insight

Another key reason for the profound economic contributions associated with unconventional oil and natural gas activity is the "employment multiplier." The employment multiplier measures the contribution that jobs make to the economy through the indirect and induced jobs created relative to direct jobs to support an industry. Some individual industries generate a larger contribution than other industries. The larger the multiplier, the greater the ripple effect of every dollar spent within an industry in terms of creating residual economic benefits across the broader economy. Upstream unconventional oil and natural gas activity, on average, demonstrates one of the larger employment multipliers placing it ahead of such notable industries as finance, construction, and many of the manufacturing sectors. This is the result of two primary factors that drive the industry's indirect and induced job creation.

US Lower 48 Employment Contribution

(Number of workers)

2012	Direct	Indirect	Induced	Total
Unconventional Oil Activity*	173,096	259,775	413,058	845,929
Unconventional Gas Activity**	187,360	277,888	437,427	902,675
Total Unconventional Activity	360,456	537,663	850,485	1,748,604
2015				
Unconventional Oil Activity*	242,607	371,062	595,816	1,209,485
Unconventional Gas Activity**	263,288	399,379	638,511	1,301,178
Total Unconventional Activity	505,895	770,441	1,234,327	2,510,663
2020				
Unconventional Oil Activity*	265,612	412,777	667,598	1,345,987
Unconventional Gas Activity**	334,808	503,011	801,362	1,639,181
Total Unconventional Activity	600,420	915,788	1,468,960	2,985,168
2035				
Unconventional Oil Activity*	287,606	428,459	674,132	1,390,197
Unconventional Gas Activity**	436,773	645,696	1,026,012	2,108,481
Total Unconventional Activity	724,379	1,074,155	1,700,144	3,498,678

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

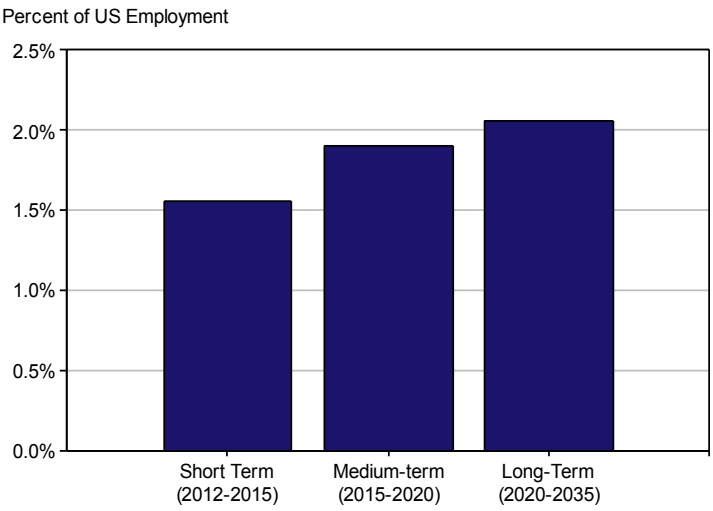
Source: IHS Global Insight

First, unconventional oil and natural gas activity is capital intensive, with nearly 50% of the revenues generated spent on construction, fabricated metals, and heavy equipment suppliers. Additionally, their operating expenses span a broad range of other materials and service sectors such as legal and financial services.

However, it is not just the large capital expenditures or the wide-ranging supplier base that increase economic contributions. Another critical reason is the strength of domestic suppliers—the United States is a world leader in all aspects of the unconventional oil and natural gas activity. Unlike other industries in this country, there is an extensive domestic supply chain, which means a larger portion of the dollars spent here stay here and support American jobs.

As a result of these factors, IHS Global Insight estimates that the employment contribution of upstream unconventional activity as a proportion of total US employment will average 1.5% over the

Unconventional Oil and Gas Contribution to Employment



Source: IHS Global Insight

short-term (2012-2015), 1.9% over the intermediate term (2015-2020), and 2% over the long-term (2020-2035).

Second, the economic contribution does not end with jobs within the industry and among its suppliers. It also includes induced employment from the contribution of income expenditures from direct and indirect sources. The quality of these jobs is a reflection of the higher income expenditure levels originating from direct and indirect jobs linked to unconventional activity. Given the technologically innovative nature of unconventional oil and natural gas activities, the jobs attributed to these activities stand out from other employment opportunities. Using BLS total annual salary payments for all employees, including supervisory workers and number of employees by sector in extraction and drilling, one can calculate an average hourly wage rate for all workers that implies $51.00 per hour. At the same time, we can compare BLS average hourly wage rates for production workers in the oil and natural gas extraction sector, where it is $35.15 per hour, to other industries—it is more than the hourly wage in the general economy (at $23.07 per hour) and more than wage rates paid in manufacturing (at $23.70 per hour), wholesale trade, education and many other industries.[13] This creates a larger multiplier and induced impact because more income is spent on general goods and services by workers in unconventional oil and natural gas activity than in other industries or in the economy generally.

The extent of high-quality employment in the unconventional sector extends beyond traditional white-collar occupations to include both skilled and semi-skilled blue-collar jobs. An examination of the occupations accounting for nearly 75% of employment in upstream unconventional activity reveals the extent of these high-quality jobs. While traditional white-collar occupations and related professions are paid at the highest level—$35 to more than $67 dollars per hour (for petroleum engineers)—there are nonetheless robust hourly wages for skilled and semi-skilled blue-collar occupations. Skilled workers include plumbers, pipefitters and steamfitters, cement masons and concrete finishers, industrial machinery mechanics, and petroleum pump operators. Some semi-skilled workers, such as welders, inspectors, and testers, earn almost $20 per hour. For many of these occupations, the educational requirement is often a high school diploma or equivalent plus some amount of vocational and/or on-the-job training, opening positions to a wider range of candidates.

[13] Bureau of Labor Statistics, Employment Statistics Survey

Average Hourly Wages by Occupation in the Oil and Gas, and Related Industries*		
Occupation	Occupation Code	Avg. Hourly Wages
Management, Business and Financial		
General and Operations Managers	111021	$63.03
Construction Managers	119021	$45.42
Engineering Managers	119041	$64.74
Cost Estimators	131051	$32.12
Accountants and Auditors	132011	$34.83
Professional and Related		
Architects, Except Landscape and Naval	171011	$37.79
Surveyors	171022	$27.44
Civil Engineers	172051	$40.18
Electrical Engineers	172071	$43.98
Mechanical Engineers	172141	$39.42
Petroleum Engineers	172171	$67.55
Engineers, all other	172199	$47.99
Architectural and Civil Drafters	173011	$24.00
Civil Engineering Technicians	173022	$23.22
Surveying and Mapping Technicians	173031	$19.98
Geoscientists, Except Hydrologists and Geographers	192042	$63.61
Geological and Petroleum Technicians	194041	$27.65
Sales and Related		
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	414012	$31.85
Office and Administrative Support		
First-Line Supervisors/Managers of Office and Administrative Support Workers	431011	$27.62
Bookkeeping, Accounting, and Auditing Clerks	433031	$17.56
Secretaries and Administrative Assistants	436010	$18.60
Office Clerks, General	439061	$14.95
Skilled Blue Collar		
First-Line Supervisors/Managers of Construction Trades and Extraction Workers	471011	$32.63
Carpenters	472031	$23.29
Cement Masons and Concrete Finishers	472051	$19.33
Paving, Surfacing, and Tamping Equipment Operators	472071	$18.97
Operating Engineers and Other Construction Equipment Operators	472073	$21.70
Electricians	472111	$27.49
Plumbers, Pipefitters, and Steamfitters	472152	$26.99
Derrick Operators, Rotary Drill Operators and Service Unit Operators, Oil and Gas	475010	$23.28
Mobile Heavy Equipment Mechanics, Except Engines	493042	$22.22
Industrial Machinery Mechanics	499041	$24.36
Maintenance and Repair Workers, General	499071	$19.96
Petroleum Pump System Operators, Refinery Operators, and Gaugers	518093	$26.83

Average Hourly Wages by Occupation in the Oil and Gas, and Related Industries* (Continued)		
Occupation	Occupation Code	Avg. Hourly Wages
Crane and Tower Operators	537021	$24.55
Pump Operators and Wellhead Pumpers	537070	$21.59
Semi-skilled Blue Collar		
Roustabouts, Oil and Gas	475071	$16.72
Helpers--Extraction Workers and Other Extraction Workers	475080	$17.62
Welders, Cutters, Solderers, and Brazers	514121	$19.08
Inspectors, Testers, Sorters, Samplers, and Weighers	519061	$19.39
Truck Drivers, Heavy and Tractor-Trailer	533032	$18.37
Excavating and Loading Machine and Dragline Operators	537032	$19.25
Unskilled Blue Collar		
Construction Laborers	472061	$16.54
Fence Erectors	474031	$15.25
Laborers and Freight, Stock, and Material Movers, Hand	537062	$13.62

NOTE: *Average hourly wages by occupation in 2011 were calculated utilizing weights based on 2010 employment estimates for the following industries: Oil and Gas Extraction (NAICS 2111); Support Activities for Mining (NAICS 2131); Nonresidential Building Construction (NAICS 2362); Other Specialty Trade Contractors (NAICS 2389); Agriculture, Construction, and Mining Machinery Manufacturing (NAICS 3331); and Architectural, Engineering, and Related Services (NAICS 5413).

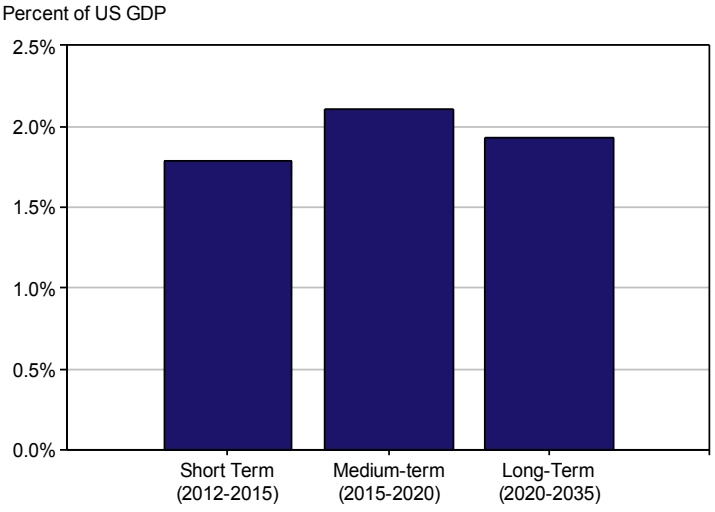
Source: Bureau of Labor Statistics, May 2011 Occupational Employment Statistics

Additionally, the growth in unconventional exploration and production activity has pushed up earnings for blue-collar oil and natural gas workers regardless of their educational attainment. US Bureau of Labor Statistics data for 2010 indicate median annual wages for extraction and for oil and natural gas workers exceed the national median wage by 15% and 11%, respectively. State economies driven by employment in unconventional upstream activity include North Dakota, Oklahoma and Texas; these states also reflect stronger oil and NGL-rich play activity as a result of the widening price spread between oil and natural gas over the past few years.

Value Added Contribution to GDP

Value added is the difference between the production costs of products or services and the sales prices. The constantly cited GDP measure is simply the sum of value added across all products and services produced in the United States. GDP is generally considered the broadest measure of the health of the US economy. The value-added contribution of unconventional oil and natural gas activity demonstrates the vital role it plays in the overall economy. On a total direct, indirect, and induced basis, IHS Global Insight expects value added for overall upstream unconventional activity to average almost 1.8% of GDP over the short-term (2012-2015), 2.1% over the intermediate term (2015-2020), and more

Unconventional Oil and Gas Value Added Contribution to GDP



Source: IHS Global Insight

than 1.9% over the long-term (2020-2035). The timing and path of the unconventional activity fits well with the growth of the US economy during next 20 years. The unconventional activity will initially fuel the economy to recover and support the path in the later decade. While IHS Global Insight's outlook for the US economy through 2020 is moderate compared to the value added contribution of the unconventional activity, economic growth accelerates during the last 15 years of the forecast, outpacing a relatively slower growth of jobs from unconventional upstream activity during the same period.

US Lower 48 Value Added Contribution

(2012 $M)

2012	Direct	Indirect	Induced	Total
Unconventional Oil Activity*	47,605	32,563	35,846	116,014
Unconventional Gas Activity**	49,096	34,608	37,967	121,670
Total Unconventional Activity	**96,700**	**67,171**	**73,813**	**237,684**
2015				
Unconventional Oil Activity*	70,584	46,861	51,701	169,146
Unconventional Gas Activity**	74,697	50,282	55,409	180,387
Total Unconventional Activity	**145,281**	**97,142**	**107,110**	**349,533**
2020				
Unconventional Oil Activity*	80,726	52,432	57,924	191,081
Unconventional Gas Activity**	92,766	63,159	69,545	225,470
Total Unconventional Activity	**173,492**	**115,591**	**127,469**	**416,551**
2035				
Unconventional Oil Activity*	75,958	53,390	58,510	187,858
Unconventional Gas Activity**	117,272	80,806	89,049	287,127
Total Unconventional Activity	**193,230**	**134,195**	**147,559**	**474,985**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

A common measure of the relative contribution of an industry to the overall economy is the worker productivity–the higher the ratio, the greater each worker's individual contribution to GDP. Worker productivity is calculated as the ratio of value added to employment, so a higher ratio reflects more efficient labor. In 2012, the average worker directly employed in the unconventional oil industry will contribute $275,000 to GDP. That is projected to increase to over $303,000 per employee in 2020 and $264,000 in 2035. For unconventional natural gas, the estimates are $262,000, $277,000 and $268,000 in 2012, 2020, and 2035, respectively. The contribution by indirect and induced jobs to overall GDP growth will be more subdued. For the entire economy, the most recent estimate of national average value added per employee is $116,000. Thus, the unconventional upstream sector stands in stark contrast to value-added measures for the general economy, with a 137% higher contribution for unconventional oil and a 126% higher contribution for unconventional natural gas.

US Lower 48 Value Added Per Employee (2012 $)				
2012	**Direct**	**Indirect**	**Induced**	**Total**
Unconventional Oil Activity*	275,020	125,350	86,783	137,144
Unconventional Gas Activity**	262,039	124,539	86,796	134,789
Total Unconventional Activity	**268,273**	**124,931**	**86,789**	**135,928**
2015				
Unconventional Oil Activity*	290,941	126,288	86,773	139,850
Unconventional Gas Activity**	283,707	125,899	86,778	138,634
Total Unconventional Activity	**287,176**	**126,087**	**86,776**	**139,219**
2020				
Unconventional Oil Activity*	303,924	127,023	86,764	141,964
Unconventional Gas Activity**	277,072	125,561	86,784	137,550
Total Unconventional Activity	**288,951**	**126,220**	**86,775**	**139,540**
2035				
Unconventional Oil Activity*	264,104	124,609	86,793	135,130
Unconventional Gas Activity**	268,498	125,145	86,791	136,177
Total Unconventional Activity	**266,753**	**124,931**	**86,792**	**135,761**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

Labor-Income Contributions

Workers' earnings from all unconventional upstream activities is estimated at over $124 billion in 2012, $215 billion in 2020, and almost $250 billion in 2035. On a direct basis, labor income per employee for all unconventional activity is estimated at almost $121,000 in 2012, nearly twice as high as labor income on an economy-wide basis at $64,500 per employee and almost 52% higher than the average wage in the manufacturing sector.[14]

In 2020, 65% of unconventional oil economic activity will be related to production, while 35% will be related to capital investment. By 2035, 56% of unconventional oil economic activity will be related to production and 44% will be related to capital investment. This shift in the mix of employment type will lead to a decrease in average labor productivity, which leads to an increase in employment without a corresponding increase in labor income.

[14] Bureau of Labor Statistics—Current Employment Statistics and National Compensation Survey.

US Lower 48 Labor Income Contribution

(2012 $M)

2012	Direct	Indirect	Induced	Total
Unconventional Oil Activity*	21,272	18,974	20,242	60,488
Unconventional Gas Activity**	22,337	20,276	21,440	64,053
Total Unconventional Activity	**43,608**	**39,250**	**41,682**	**124,541**
2015				
Unconventional Oil Activity*	30,915	27,150	29,195	87,260
Unconventional Gas Activity**	33,006	29,215	31,289	93,509
Total Unconventional Activity	**63,921**	**56,365**	**60,484**	**180,770**
2020				
Unconventional Oil Activity*	34,827	30,243	32,709	97,779
Unconventional Gas Activity**	41,304	36,778	39,272	117,353
Total Unconventional Activity	**76,131**	**67,021**	**71,981**	**215,132**
2035				
Unconventional Oil Activity*	34,424	31,245	33,040	98,709
Unconventional Gas Activity**	52,780	47,183	50,286	150,248
Total Unconventional Activity	**87,204**	**78,428**	**83,326**	**248,957**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Labor Income Per Employee (2012 $)				
2012	**Direct**	**Indirect**	**Induced**	**Total**
Unconventional Oil Activity*	122,889	73,040	49,006	71,504
Unconventional Gas Activity**	119,218	72,966	49,013	70,959
Total Unconventional Activity	**120,981**	**73,002**	**49,010**	**71,223**
2015				
Unconventional Oil Activity*	127,429	73,168	49,000	72,147
Unconventional Gas Activity**	125,359	73,150	49,003	71,865
Total Unconventional Activity	**126,352**	**73,159**	**49,002**	**72,001**
2020				
Unconventional Oil Activity*	131,120	73,267	48,995	72,645
Unconventional Gas Activity**	123,366	73,115	49,006	71,593
Total Unconventional Activity	**126,796**	**73,184**	**49,001**	**72,067**
2035				
Unconventional Oil Activity*	119,692	72,923	49,012	71,004
Unconventional Gas Activity**	120,840	73,073	49,011	71,259
Total Unconventional Activity	**120,384**	**73,013**	**49,011**	**71,158**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

Government Revenues and Taxes

Increased activity in the unconventional oil and gas sectors will also increase federal, state and local government taxes paid by energy producers, their employees, the energy supply chain and companies in ancillary industries. IHS Global Insight estimates that annual government revenues from all unconventional activity will increase from almost $62 billion in 2012 to more than $91 billion in 2015 and $111 billion in 2020. By 2035, the last year of the forecast period, government revenues will exceed $124 billion. Over the entire forecast interval, more than $2.5 trillion will be collected by government entities.

How Big is $31 Billion in Federal Revenues?

The $31 billion in associated federal taxes and royalties in 2012 is sufficient to fund close to 80% of the U.S. Department of Interior annual budget ($11 billion), the U.S. Department of Commerce budget ($11 billion), and NASA's budget ($18 billion) combined.

Source: US Office of Management and Budget.

For all of the activities combined, another $711 million in private lease payments paid by operators will be realized by 2015 and will surpass $1.2 billion by 2035. Lease payments over the entire forecast period will total more than $23 billion. While private lease payments will have an income effect on the economy, royalties paid to the federal government will, in addition to the income effect, contribute to federal and state and local budgets. In addition, state budgets will benefit from direct federal payments based on each state's participation in production on federal lands. In fact, the nearly $31 billion in state and local tax receipts in 2012 represent approximately 5% of the US lower 48 US states' total expenditures—$647 billion—and 41% of the estimated 2012 budget gaps—$75 billion.

Contribution to US Lower 48 Government Revenue (2012 $M)	2012	2015	2020	2035	2012-2035*
Unconventional Oil Activity**					
Federal Taxes	**14,076**	**20,379**	**22,898**	**22,917**	**502,486**
Personal Taxes	10,726	15,438	17,271	17,538	381,337
Corporate Taxes	3,351	4,940	5,628	5,379	121,149
State and Local Taxes	**15,769**	**23,256**	**28,054**	**27,526**	**617,495**
Personal Taxes	1,718	2,479	2,779	2,802	61,180
Corporate Taxes	9,403	13,854	15,771	15,089	339,682
Severance Taxes	2,963	4,458	6,081	6,166	138,414
Ad Valorem Taxes	1,686	2,465	3,423	3,469	78,219
Federal Royalty Payments	**974**	**1,365**	**1,845**	**950**	**37,069**
Total Government Revenue	**30,820**	**45,000**	**52,798**	**51,393**	**1,157,049**
Lease Payments to Private Landowners	**243**	**341**	**387**	**507**	**10,178**
Unconventional Gas Activity**					
Federal Taxes	**14,860**	**21,804**	**27,330**	**34,928**	**635,116**
Personal Taxes	11,384	16,564	20,811	26,676	483,860
Corporate Taxes	3,476	5,240	6,519	8,252	151,256
State and Local Taxes	**15,162**	**23,326**	**29,676**	**37,441**	**700,011**
Personal Taxes	1,818	2,656	3,333	4,266	77,469
Corporate Taxes	9,748	14,685	18,253	23,097	423,482
Severance Taxes	2,487	4,199	5,688	7,276	141,469
Ad Valorem Taxes	1,109	1,786	2,403	2,803	57,590
Federal Royalty Payments	**990**	**1,274**	**1,359**	**644**	**25,073**
Total Government Revenue	**31,012**	**46,404**	**58,366**	**73,013**	**1,360,199**
Lease Payments to Private Landowners	**261**	**370**	**526**	**726**	**13,421**
Total Unconventional Activity					
Federal Taxes	**28,936**	**42,183**	**50,229**	**57,846**	**1,137,602**
Personal Taxes	22,110	32,003	38,082	44,214	865,197
Corporate Taxes	6,827	10,180	12,147	13,631	272,405
State and Local Taxes	**30,931**	**46,582**	**57,731**	**64,967**	**1,317,506**
Personal Taxes	3,536	5,136	6,112	7,067	138,650
Corporate Taxes	19,150	28,539	34,024	38,186	763,165
Severance Taxes	5,450	8,657	11,769	13,442	279,882
Ad Valorem Taxes	2,795	4,251	5,825	6,272	135,809
Federal Royalty Payments	**1,964**	**2,639**	**3,204**	**1,593**	**62,141**
Total Government Revenue	**61,832**	**91,404**	**111,164**	**124,406**	**2,517,248**
Lease Payments to Private Landowners	**504**	**711**	**913**	**1,232**	**23,599**

NOTES: *2012-2035 represents the total for all years including those years not reported.

**Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

***Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

Conclusion

Unconventional oil and natural gas activity is already revolutionizing America's energy future and bringing enormous benefits to the US economy. Unlocking unconventional energy will generate millions of jobs and billions in government receipts. It will make significant contributions to the US economy through direct employment, the many and diverse connections it has with supplier industries, the amount of spending this direct and indirect activity supports throughout the entire economy, and the revenues that flow to federal and state and local governments. As the production of unconventional oil and gas expands over the next 25 years, the economic contribution of the industry will also expand.

To support the expansion of production within the unconventional sector, IHS Global Insight expects substantial growth in capital expenditures and employment to occur:

- More than $5.1 trillion in capital expenditures will take place between 2012 and 2035 across unconventional oil and natural gas activity. Of this:
    - Over $2.1 trillion in capital expenditures will take place between 2012 and 2035 in unconventional oil activity.
    - Close to $3 trillion in capital expenditures will take place between 2012 and 2035 in unconventional natural gas activity.
- Employment attributed to upstream unconventional oil and natural gas activity on a direct, indirect, and induced basis will support more than 1.7 million jobs in 2012, 2.5 million jobs in 2015, 3 million jobs in 2020, and 3.5 million jobs in 2035.
- On average, direct jobs will represent about 20% of all jobs contributed by unconventional production activity with the remainder provided by indirect and induced jobs.

This IHS baseline view of expanded domestic unconventional oil and natural gas activity and the economic contributions stemming from that expansion rests on the assumption of an unchanged policy framework governing unconventional activity, including environmental policies and regulations. IHS has not examined, in this report, the impact of policies that would either inhibit unconventional production or expand production beyond our baseline view.

America's New Energy Future:
The Unconventional Oil and Gas Revolution and the US Economy

Volume 1 – National Economic Contributions

Appendix A. Production and Capital Expenditure Modeling Methodology and Detailed Outlook

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About IHS (www.ihs.com)

IHS (NYSE: IHS)) is a leading source of information and insight in critical areas that shape today's business landscape, including energy and power; design and supply chain; defense, risk and security; environmental, health and safety, and sustainability; country and industry forecasting; and commodities, pricing and cost. IHS has been in business since 1959 and became a publicly traded company on the New York Stock Exchange in 2005. Headquartered in Englewood, Colorado, USA, IHS employs more than 5,100 people in more than 30 countries around the world.

About IHS CERA

IHS CERA is a leading advisor to energy companies, consumers, financial institutions, technology providers and governments. The IHS CERA product suite covers all major energy sectors – oil and refined products, natural gas, and electric power – on a global and regional basis and delivers strategic knowledge and independent analysis on energy markets, geopolitics, industry trends, and strategy.

About IHS Global Insight

IHS Global Insight is one of the leading economic analysis and forecasting firms in the world, with an established track record for providing rigorous, objective data and forecast analysis to governments and businesses. Among its areas of expertise are the economic impact, tax implications, and job-creation dynamics of multiple sectors core to national, state and local economies. It also helps companies and governments at all levels interpret the impact of proposed investments, policies, programs, and projects.

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Appendix A. Production and Capital Expenditure Modeling Methodology and Detailed Outlook

The production outlook for tight oil, shale gas, tight gas (from tight sands) in the US Lower 48 states was based on play-level production profiles and well construction costs developed from IHS CERA's proprietary databases and internal research. Estimates of play-level production are consistent with IHS CERA's outlook for oil and natural gas demand, price, and infrastructure.

Production Profiles

The variables used to derive production profiles for each play were obtained from IHS databases and internal research. These variables include

- Rig count (including assumptions about ramp up, maximum rigs, time at plateau, ramp down)
- Number of days to drill and complete a well
- Type curves showing production decline rates over time for a typical well
- Acreage (total area to be developed)
- Well spacing
- Possibility of geologic success

The number of possible locations available to be developed was derived through an examination of the combination of acreage, well spacing, and the possibility of geological success. Type curves were derived for each play using the IHS databases and software tools (Enerdeq and Power Tools) based on actual well production data. The three driving variables in a type curve are initial production, estimated ultimate recovery per well, and the rate of decline of the well.

Number of days to drill a well (including mobilization and demobilization of the rigs) was obtained from well data available in IHS databases. Rig forecasts were developed for each play based on historic rig counts, along with the per-well economics of each individual play.

Well Capital Expenditures

Capital expenditures associated with unconventional oil and gas depend on well costs, which were estimated from IHS CERA proprietary databases. Well capital expenditures were divided into the following three main categories.

Well Capital Expenditures	
Expenditure Category	Percentage
Drilling	35%
Completion	55%
Facilities	10%

Each of these main capital expenditures categories where then further subdivided as detailed below:

Drilling Capital Expenditure Sub-Categories

Bits, Rig Consulmables (Mud, etc.)
Casings
Cement
Conductor and Intermediate Casing
Consumables
Contingency
Drilling
Drilling Cement
Insurance
Logging
Rig Crew
Rig Labor
Rig Rental
Rigs

Completions Capital Expenditure Sub-Categories

Completion Casing
Contingency
Frac-Equipment
Hydraulic Fracturing Proppants, Fluids
Insurance
Liner and Tubing Equipment
Proving Well Production Rates
Rentals of Compressors or Pumps and Containers
Rig and Crew
Rig Hire
Sand and Fluid
Testing
Xmas Trees, Well Head, Sleeves, Packers

Facilities Capital Expenditure Sub-Categories

Compressors, Separators, Tanks
Gathering Production From Lease to Main Gathering Systems
Lease Gathering Lines
Lease Infrastructure
Moving Liquid Production
Other Lease Equipment
Pads and Road Construction
Rods and Pumps
Water Disposal Well

Capital expenditures for midstream gathering infrastructure were assumed to be approximately $500,000 per well depending on the Expected Ultimate Recovery of the well. This is based on a 10% rate of return given 20 years of paying a 3rd party for use of its gathering system.

All capital costs were escalated using a normalized version of the Upstream Capital Cost Index for Land developed by IHS CERA's Upstream Capital Cost Forum to reflect projected cost increases in excess of projected inflation for the inputs to oil and gas development.

Global Oil Modeling Methodology and Process Description

IHS CERA's crude oil demand projections are based on product-by-product analysis at the regional and, in some cases, country level. Oil demand is satisfied by liquid fuels. IHS CERA does not separate ethanol or other non-traditional liquids from our oil demand projections—ethanol demand is included as part of oil demand. A number of variables feed into our product, country, and regional outlooks. These include

- **Economic growth**. There is a relationship between the rate of economic growth and demand for oil products. This relationship depends on the specific characteristics of a given region, but there is generally a positive correlation between economic growth and product demand. The orientation of an economy—service or manufacturing—has a critical bearing on how economic growth translates into oil consumption.
- **Price**. The price of refined products influences demand trends. Global market prices for refined products, which are heavily influenced by crude oil prices, are a key factor in price determination, but domestic policy can also influence prices through the use of price controls and tax policy. For example, European countries generally have a high tax on gasoline, which means that changes in crude oil prices have a less pronounced impact on demand than in the United States, where taxes on refined products are lower.
- **Population**. The rates of population growth and age composition have a significant influence on demand trends. A rapidly growing working-age population, for example, tends to be associated with potential for strong oil demand growth. The number of eligible drivers, generally age 16 and over, is also an important determinant of the use of transport fuels in personal vehicles.
- **Income levels and distribution**. Rising incomes tend to be associated with rising product demand, particularly where countries move from low income to middle or high income status. The distribution of income is also important. For example, if a country is experiencing rapid economic growth, but the distribution of wealth is highly concentrated within a small segment of the population, then the impact on oil demand is likely to be less than for a country with income growth more evenly distributed.
- **Vehicle and jet fleet**. A large share of oil consumption, but especially gasoline and diesel, is for road transportation. The size and growth trend of a region's personal vehicle population as well as commercial trucking vehicle fleet affects demand for gasoline and diesel fuel. For jet fuel, the size of the jet passenger fleet and air cargo carriers is critical.
- **Fuel efficiency**. For both ground and air transport, new vehicle (automobiles, trucks, and aircraft) and fleet average fuel efficiency assumptions are important elements built into our outlook.
- **Changes in the fuel mix**. Oil competes with other fuels in space heating, industrial applications, petrochemical feedstock, and power generation. Oil's competitive position,

which is influenced by price, policy, and infrastructure, determines its competitive position relative to other fuels.

Liquid Production Capacity

Liquids refer to crude oil, condensate, and natural gas liquids. IHS CERA also includes nontraditional liquid fuels such as biofuels (ethanol and biodiesel), extra-heavy oil (Canadian oil sands, Venezuelan tar sands), gas-to-liquids (GTL), coal-to-liquids, and oil shale. Liquids are processed to varying degrees into refined products, except for a small volume of crude oil that is directly used for power generation.

IHS CERA's production capacity and production projections for the *Dawn of a New Age* scenarios are based on CERA's reference case for liquids, which represents a view on future liquid production capacity assuming business continues as usual. The reference case accounts for some seasonal maintenance and includes:

- how existing fields are likely to evolve
- timing of the sanctioning and start-up of new projects, including exotic fuels
- estimates of new capacity provided by future exploration
- depletion assumptions for existing and future production

The reference case does not take into account the impact of dramatic oil price swings, extreme weather, strikes, civil unrest, war, and political changes that affect liquid production capacity and actual production on a regional and a global basis. It provides an aggregate picture of how liquids capacity evolves without major disruption and provides a base line reference case. The *Dawn of a New Age* scenarios use the reference case as a starting point and then adjustments are made based on assumptions about these aboveground factors that can lead to capacity and production deviating from our reference case. These scenarios are the basis for our market analysis.

Oil Prices

The foundation of IHS CERA's crude oil and refined product price projections is the balance between world oil demand and supply that is built up from our demand and liquid capacity analysis. The price of crude oil is the single most important price in the oil market. The crude oil price projections are based to a large extent on the following factors:

- **Relative balance between demand and supply**. A finely balanced market generally supports a high price environment compared with one where supply is far in excess of demand. An indicator of how supply levels compare with demand is the level of oil held in inventories. At the global level this is an implied figure since there are no global inventory figures. The production figures used in this analysis are based on our liquid production capacity work, described above. However, our production projections take into account any supply disruptions or production problems that are in line with the parameters of a given scenario. Disruptions or other production problems are not shown in our liquid production capacity outlooks unless the disruption has a material impact on production capacity.
- **Spare production capacity**. Spare crude oil production capacity is the oil market's shock absorber since it plays a critical role in offsetting unexpected supply losses. The volume of spare crude oil production in future years will be a strong influence on oil

prices and in determining the impact of aboveground concerns and events on the price of oil.

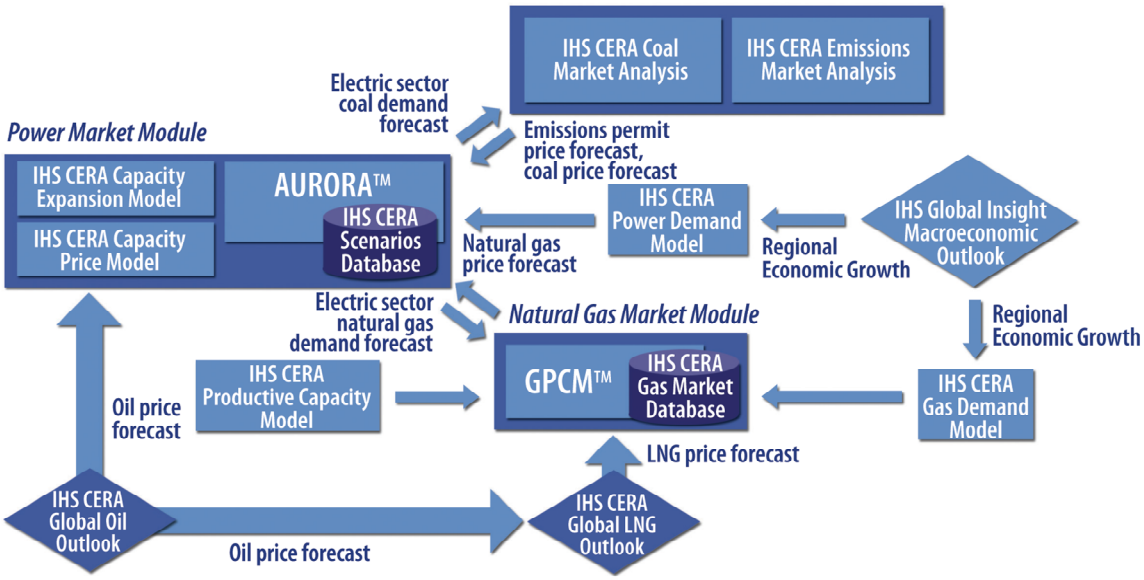
- **Refining capacity and demand trends**. Product prices can exert a pull on crude oil prices when refining capacity is limited or imbalanced relative to product demand trends and crude quality. At first glance the notion of refining limitations being supportive of crude oil prices may seem counterintuitive. After all, if there is limited refining capacity, that could mean limited demand for refinery feedstock—namely crude oil. In a simple world with little variance in refining complexity or crude quality, it would be difficult for refined product margins to exert significant upward price pressure for crude oil apart from the impact of a demand surge. However, the real world is not that simple. Crude oil quality varies a great deal, and the structure of refining capacity is highly varied—from refineries with only simple distillation units to conversion refineries with sophisticated secondary processing capacity. In a world of high utilization of marginal (nonconversion) refining and strong light product demand growth, product margins tend to be high, which can exert a pull on light, sweet crude oil prices as simple refiners attempt to maximize output of light products. Trends in refining capacity and product demand also underpin our projections of refined product margins. In addition, product quality issues, such as sulfur levels, are another factor that can influence product prices and margins, especially during times of transition to new fuel specifications.
- **Geopolitical environment**. The price of oil and geopolitics are intertwined. This is because a large share of oil production occurs in regions prone to bouts of instability. The Middle East is the most important example of this. When instability—or fear of potential instability—hits an oil-producing region, it generates fear about the future reliability and adequacy of oil supplies. Fear of what could happen in the geopolitical sphere—along with what actually happens—can exert a strong influence on oil prices. The degree of this influence cannot be easily quantified—i.e., it is a key qualitative judgment that feeds into projected oil prices.

North American Gas Modeling Methodology and Process Description

The US natural gas market outlook was developed using IHS CERA's integrated modeling system. This approach was required in order to assess the production outlook in the context of overall market supply and demand. In other words, when potential supply greatly exceeds demand, as is the case today, simply having the capability to understand the geologic potential of the various shale gas and tight gas plays is insufficient to predict production capacity. A prediction of operator behavior must be tested against what the market can bear through system-wide modeling of the entire North American market. IHS CERA has developed an integrated modeling system, which was used for this study.

The integrated modeling system for North America employs a number of analytical models: the AURORA™ power market simulation model and the GPCM™, both using proprietary IHS CERA inputs, and our expert analysis of environmental policies and markets. IHS CERA also incorporates its upstream and downstream oil analytical frameworks. These models and analyses are used as a basis for IHS CERA's gas, power and oil services.

The models (depicted below) are maintained and regularly updated by a team of qualified researchers.



North American Gas Modeling Methodology

IHS CERA's natural gas projections are developed based on several detailed analytical models, as well as judgments formed by IHS CERA's research. The projections cover the United States, Canada, and Mexico, treating North America as an integrated continental market.

Natural gas supply estimates are stated in terms of productive capacity at the wellhead, as opposed to production. These estimates are developed at the geographic play level. The basic approach is to assess the geologic potential of the producing area, projects known to be under development, the potential results of new development activity, and anticipated changes in the investment behavior of major producers. Assessments of geological potential take into consideration both oil and gas reserves. New development activity is projected by using trends in initial production rates, decline rates, and reserve amounts associated with a new completion. The investment behavior of major producers is a major factor in the projection of productive capacity. IHS CERA estimates this effect based on its conversations with various companies as well as on its observations of behavior by the same companies.

The methodology IHS CERA employs to develop its supply forecast has been enhanced by its completion of several multi-client studies including *Diminishing Returns: The Cost of North American Gas Supply in an Unconventional Era* (February 2007); *Rising to the Challenge* (February 2009); *Fueling North America's Energy Future* (January 2010); and *Cream of the Crop* (February 2010). These studies made extensive use of the IHS well and production database to develop an understanding of the resource base and cost picture for North American gas supply. In these efforts, it is important to note that costs were calculated utilizing the entire IHS catalogue of North American well and production information, rather than from a subset of wells or from a collection of publications. Selected third-party rig and cost information was purchased to augment the IHS databases. Finally, IHS CERA made several benchmarking efforts to check calculated estimates. The result is a productive capacity outlook for individual plays. This analysis has produced, among other insights, a detailed understanding of initial

production rates and decline curves by play, and is used to estimate rig activity on a localized basis.

Two IHS CERA groups, the North American Natural Gas and Global Liquefied Natural Gas (LNG) teams, develop the LNG import outlook jointly within the context of a global supply/demand balance for LNG. These projections take into consideration price, regulatory hurdles, and conditions in the global LNG market that may impose constraints on LNG import levels.

Residential and commercial demand is forecast based on weather normalized to a rolling 15-year historical period and then projected to the state level. The forecast is influenced by several other variables including GDP growth, efficiency gains, and market penetration by gas, as opposed to other fuels.

Industrial demand is developed on a state basis by examining the economic role played by gas in key industrial sectors, as well as through regression analysis. Projections of future gas use are made based on several factors, including GDP growth, projected growth by sector, the impact of gas prices on margins in the sector, fuel switching potential and activity, and plant closures. In this effort, IHS CERA makes use of detailed macro- and microeconomic forecasts produced by IHS Global Insight.

Gas burned in the generation of electricity is estimated based on a dispatch model (Aurora™) maintained by the North American Electric Power team. The dispatch model analyzes the North American power industry by assessing future activity in local markets.

In certain states, such as those with large metropolitan areas or significant gas transmission constraints, demand and supply projections are broken down geographically below the state level. This process involves allocations that take into account historical activity levels, population trends, manufacturing employment, local seasonality, and the addition or retirement of industrial or generation facilities.

The projected figures are reviewed on a continental basis to assess the reasonableness of the overall supply-demand balance. Upon completion of this review, one or more of the preceding steps may be revisited. Detailed analysis follows a satisfactory balancing of the continental aggregates.

The allocated state level detail is loaded into the RBAC's Gas Pipeline Competition Model (GPCM™). The GPCM™ system was developed in 1997 and has been commercially available since 1998. It is widely used in the gas industry to assess market fundamentals, including flows and prices. A key member of IHS CERA's North American Natural Gas team, working with the software developer, developed the specifications for the system and generated the original database for the GPCM™ system. IHS CERA's North American Natural Gas team includes individuals whose combined experience with this system exceeds 20 years.

GPCM™ is a network linear programming system designed to optimize flows across complex systems such as pipeline networks. In addition to IHS CERA's supply and demand projections, the system requires a model of the North American gas grid to produce results. The grid model provided by the software developer has been customized by IHS CERA based on a variety of publicly available data, including pipeline schematics filed by interstate pipelines with the US government (now no longer publicly available), data from pipeline bulletin boards, regulatory filings, Energy Information Administration data, federal data on storage activity, a census of storage facilities performed by Natural Gas Intelligence, the American Gas Association Survey of Underground Storage of Natural Gas, IHS CERA's assessment of discounting behavior, and conversations with industry personnel.

The GPCM™ system develops an equilibrium set of spot prices and flows based on the specified inputs. The objective function seeks to maximize the sum of producer and consumer surplus, less transportation cost.

IHS CERA maintains a proprietary version of supply and demand projections and an outlook for infrastructure expansions that are the product of our independent research and analysis. These projections are then entered into IHS CERA's customized GPCM™ database. IHS CERA's GPCM™ database included 207 pipelines broken into 932 pipeline segments. The model also includes 439 storage facilities. Connecting these elements are 3,688 nodes. Demand is modeled in 110 geographic areas for each of the four customer classes. Supply is forecast for 275 plays throughout North America that are then aggregated into 178 producing regions for modeling purposes. These producing regions are spread over 130 geographic locations. Model output includes a flow and a price for each location for each month, which IHS CERA summarizes into several standard reports. However, data can be mined below the detail included in standard reports. It is important to note that the degree to which the model can discriminate between geographic areas in terms of price or flows is limited by the level of detail specified for supply, demand, and infrastructure.

While several detailed models are used in the development of a projection, the results that IHS CERA ultimately reports to a client represent IHS CERA's best judgment informed by the analysis performed, and do not necessarily agree with model output. For example, IHS CERA may, in its judgment, adjust the output obtained to account for market conditions that differ from those that would be obtained in a purely spot market.

The following pages present our estimates of production and well completions in the US Lower 48 states over the 2012-2035 period for unconventional oil, unconventional gas and NGLs. We then present snapshots of US Lower 48 annual capital expenditures associated with activity around unconventional oil, unconventional gas and its shale gas and tight gas components, and total unconventional development in five-year increments. Finally, we present cumulative capital expenditures in five-year increments, again, over the 2012-2035 timeframe for the same set of activities listed above.

US Lower 48 Annual Unconventional Oil and Gas Production and Well Completions

	2012	2015	2020	2025	2030	2035
PRODUCTION						
Unconventional Oil* (mbd)	**2.07**	**3.50**	**4.43**	**4.53**	**4.50**	**4.50**
Tight Oil	1.49	2.65	3.28	3.29	3.27	3.26
Shale Gas Condensate	0.30	0.49	0.71	0.81	0.83	0.83
Tight Gas Condensate	0.28	0.36	0.44	0.43	0.39	0.41
Unconventional Gas (Bcf per day)**	**36.12**	**44.27**	**59.53**	**69.61**	**73.06**	**80.05**
Associated Gas***	2.59	4.90	6.62	6.96	7.23	7.09
Shale Gas	23.83	27.82	37.67	46.47	49.56	54.17
Tight Gas	9.70	11.54	15.25	16.18	16.27	18.79
Natural Gas Liquids (Contained)** (mbdoe per day)**	**1.81**	**2.67**	**3.82**	**4.47**	**4.74**	**4.84**
Associated Gas	0.44	0.84	1.10	1.13	1.18	1.19
Shale Gas	0.85	1.13	1.67	2.09	2.31	2.44
Tight Gas	0.52	0.70	1.06	1.26	1.25	1.21
WELL COMPLETIONS						
Unconventional Oil [t]	**7,179**	**8,472**	**8,636**	**9,156**	**9,853**	**8,934**
Unconventional Gas [tt]	**7,766**	**9,004**	**10,210**	**10,435**	**10,131**	**11,203**
Shale Gas	5,086	5,545	6,688	7,207	6,942	7,503
Tight Gas	2,681	3,459	3,521	3,228	3,188	3,700
PRICE INDICES						
WTI Price (2012 $US per bbl)	$95.04	$77.34	$89.54	$93.61	$92.54	$86.81
Henry Hub Price (2012 $US per Mcf)	$2.57	$4.37	$4.16	$4.45	$4.73	$5.07

NOTES: *Unconventional oil production represents oil and condensate recovered from tight oil, shale gas and tight gas plays.

**Unconventional gas production represents natural gas recovered from unconventional shale gas and tight gas plays and associated gas recovered from tight oil plays.

***Associated gas represents gas recovered from the production of oil in tight oil plays.

****Natural gas liquids (contained) represents unprocessed liquids potentially recoverable from the production of associated gas in tight oil plays and liquids rich gas in shale gas and tights gas plays.

[t] Well completions in plays designated as tight oil.

[tt] Well completions in plays designated as shale gas and tight gas.

Source: IHS CERA

US Lower 48 Annual Capital Expenditure by Type: Unconventional Oil Activity*

(Current $M)

	2012	2015	2020	2025	2030	2035	2012-2035**
Drilling Capital Expenditure	**13,502**	**19,889**	**24,448**	**32,301**	**42,896**	**50,345**	**755,774**
Drilling	9,047	13,326	16,380	21,641	28,741	33,731	506,369
Support Services	4,456	6,564	8,068	10,659	14,156	16,614	249,405
Completion Capital Expenditure	**20,889**	**30,475**	**36,665**	**45,607**	**58,916**	**68,015**	**1,074,492**
Hydraulic Fracturing	16,711	24,380	29,332	36,485	47,133	54,412	859,594
Other	4,178	6,095	7,333	9,121	11,783	13,603	214,898
Facilities Capital Expenditure	**3,608**	**5,109**	**6,300**	**8,208**	**10,721**	**11,621**	**189,170**
Material	2,165	3,065	3,780	4,925	6,432	6,972	113,502
Fabricaton	902	1,277	1,575	2,052	2,680	2,905	47,292
Project Management	180	255	315	410	536	581	9,458
Other	361	511	630	821	1,072	1,162	18,917
Gathering System Capital Expenditure	**2,707**	**4,006**	**4,930**	**6,448**	**8,718**	**10,373**	**152,871**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**40,706**	**59,480**	**72,343**	**92,563**	**121,251**	**140,353**	**2,172,307**

NOTES: *Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.
**2012-2035 represents the total for all years including those years not reported.
Source: IHS CERA

US Lower 48 Annual Capital Expenditure by Type: Unconventional Gas Activity*

(Current $M)

	2012	2015	2020	2025	2030	2035	2012-2035**
Drilling Capital Expenditure	**14,525**	**21,573**	**33,232**	**45,961**	**56,382**	**72,086**	**1,005,238**
Drilling	9,732	14,454	22,266	30,794	37,776	48,297	673,509
Support Services	4,793	7,119	10,967	15,167	18,606	23,788	331,729
Completion Capital Expenditure	**25,984**	**36,719**	**55,657**	**75,483**	**91,098**	**120,269**	**1,662,952**
Hydraulic Fracturing	20,787	29,375	44,525	60,386	72,879	96,215	1,330,362
Other	5,197	7,344	11,131	15,097	18,220	24,054	332,590
Facilities Capital Expenditure	**3,092**	**4,459**	**6,319**	**8,074**	**9,592**	**12,858**	**181,557**
Material	1,855	2,675	3,792	4,845	5,755	7,715	108,934
Fabricaton	773	1,115	1,580	2,019	2,398	3,215	45,389
Project Management	155	223	316	404	480	643	9,078
Other	309	446	632	807	959	1,286	18,156
Gathering System Capital Expenditure	**2,994**	**4,057**	**4,989**	**5,585**	**5,831**	**7,510**	**126,454**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**46,595**	**66,808**	**100,198**	**135,104**	**162,903**	**212,723**	**2,976,202**

NOTES: *Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.
**2012-2035 represents the total for all years including those years not reported.
Source: IHS CERA

US Lower 48 Annual Capital Expenditure by Type: Shale Gas Activity

(Current $M)

	2012	2015	2020	2025	2030	2035	2012-2035*
Drilling Capital Expenditure	**9,609**	**12,881**	**20,275**	**28,790**	**35,267**	**43,488**	**621,693**
Drilling	6,438	8,630	13,584	19,289	23,629	29,137	416,534
Support Services	3,171	4,251	6,691	9,501	11,638	14,351	205,159
Completion Capital Expenditure	**19,327**	**25,536**	**39,448**	**54,581**	**63,106**	**77,598**	**1,157,766**
Hydraulic Fracturing	15,462	20,429	31,558	43,665	50,485	62,079	926,212
Other	3,865	5,107	7,890	10,916	12,621	15,520	231,553
Facilities Capital Expenditure	**1,710**	**2,287**	**3,528**	**4,800**	**5,600**	**7,436**	**104,081**
Material	1,026	1,372	2,117	2,880	3,360	4,462	62,449
Fabricaton	427	572	882	1,200	1,400	1,859	26,020
Project Management	85	114	176	240	280	372	5,204
Other	171	229	353	480	560	744	10,408
Gathering System Capital Expenditure	**1,803**	**2,323**	**3,190**	**3,896**	**3,981**	**4,987**	**83,329**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**32,449**	**43,028**	**66,440**	**92,068**	**107,953**	**133,510**	**1,966,868**

NOTES: *2012-2035 represents the total for all years including those years not reported.
Source: IHS CERA

US Lower 48 Annual Capital Expenditure by Type: Tight Gas Activity
(Current $M)

	2012	2015	2020	2025	2030	2035	2012-2035*
Drilling Capital Expenditure	**4,916**	**8,692**	**12,958**	**17,171**	**21,115**	**28,597**	**383,545**
Drilling	3,294	5,824	8,682	11,505	14,147	19,160	256,975
Support Services	1,622	2,868	4,276	5,667	6,968	9,437	126,570
Completion Capital Expenditure	**6,657**	**11,183**	**16,209**	**20,901**	**27,992**	**42,671**	**505,187**
Hydraulic Fracturing	5,326	8,946	12,967	16,721	22,394	34,137	404,149
Other	1,331	2,237	3,242	4,180	5,598	8,534	101,037
Facilities Capital Expenditure	**1,383**	**2,171**	**2,792**	**3,274**	**3,993**	**5,422**	**77,476**
Material	830	1,303	1,675	1,965	2,396	3,253	46,486
Fabricaton	346	543	698	819	998	1,356	19,369
Project Management	69	109	140	164	200	271	3,874
Other	138	217	279	327	399	542	7,748
Gathering System Capital Expenditure	**1,191**	**1,734**	**1,800**	**1,689**	**1,850**	**2,523**	**43,126**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**14,147**	**23,780**	**33,758**	**43,036**	**54,950**	**79,213**	**1,009,334**

NOTES: *2012-2035 represents the total for all years including those years not reported.
Source: IHS CERA

US Lower 48 Annual Capital Expenditure by Type: Total Unconventional Activity*
(Current $M)

	2012	2015	2020	2025	2030	2035	2012-2035**
Drilling Capital Expenditure	**28,027**	**41,463**	**57,680**	**78,261**	**99,279**	**122,430**	**1,761,012**
Drilling	18,778	27,780	38,646	52,435	66,517	82,028	1,179,878
Support Services	9,249	13,683	19,035	25,826	32,762	40,402	581,134
Completion Capital Expenditure	**46,873**	**67,194**	**92,322**	**121,089**	**150,014**	**188,284**	**2,737,444**
Hydraulic Fracturing	37,498	53,756	73,858	96,872	120,011	150,627	2,189,955
Other	9,375	13,439	18,464	24,218	30,003	37,657	547,489
Facilities Capital Expenditure	**6,701**	**9,568**	**12,620**	**16,282**	**20,313**	**24,479**	**370,727**
Material	4,020	5,741	7,572	9,769	12,188	14,687	222,436
Fabricaton	1,675	2,392	3,155	4,071	5,078	6,120	92,682
Project Management	335	478	631	814	1,016	1,224	18,536
Other	670	957	1,262	1,628	2,031	2,448	37,073
Gathering System Capital Expenditure	**5,701**	**8,063**	**9,919**	**12,034**	**14,549**	**17,883**	**279,326**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**87,301**	**126,288**	**172,542**	**227,667**	**284,154**	**353,076**	**5,148,509**

NOTES: *Total unconventional activity represents the sum of unconventional oil and unconventional gas activity.
**2012-2035 represents the total for all years including those years not reported.
Source: IHS CERA

US Lower 48 Five Year Capital Expenditure by Type: Unconventional Oil Activity*

(Current $M)

	2012-2015	2016-2020	2021-2025	2026-2030	2031-2035
Drilling Capital Expenditure	**67,801**	**115,397**	**143,646**	**190,546**	**238,383**
Drilling	45,427	77,316	96,243	127,666	159,717
Support Services	22,374	38,081	47,403	62,880	78,666
Completion Capital Expenditure	**104,173**	**175,363**	**207,798**	**262,891**	**324,266**
Hydraulic Fracturing	83,338	140,290	166,239	210,313	259,413
Other	20,835	35,073	41,560	52,578	64,853
Facilities Capital Expenditure	**17,639**	**29,650**	**36,703**	**48,297**	**56,880**
Material	10,584	17,790	22,022	28,978	34,128
Fabricaton	4,410	7,412	9,176	12,074	14,220
Project Management	882	1,482	1,835	2,415	2,844
Other	1,764	2,965	3,670	4,830	5,688
Gathering System Capital Expenditure	**13,609**	**23,364**	**28,743**	**38,331**	**48,824**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**203,222**	**343,775**	**416,891**	**540,065**	**668,354**

NOTES: *Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

Source: IHS CERA

US Lower 48 Five Year Capital Expenditure by Type: Unconventional Gas Activity*

(Current $M)

	2012-2015	2016-2020	2021-2025	2026-2030	2031-2035
Drilling Capital Expenditure	**72,191**	**141,800**	**207,434**	**256,415**	**327,397**
Drilling	48,368	95,006	138,981	171,798	219,356
Support Services	23,823	46,794	68,453	84,617	108,041
Completion Capital Expenditure	**125,530**	**239,012**	**343,688**	**412,043**	**542,679**
Hydraulic Fracturing	100,424	191,210	274,950	329,634	434,143
Other	25,106	47,802	68,738	82,409	108,536
Facilities Capital Expenditure	**15,145**	**27,921**	**37,478**	**43,859**	**57,153**
Material	9,087	16,753	22,487	26,315	34,292
Fabricaton	3,786	6,980	9,370	10,965	14,288
Project Management	757	1,396	1,874	2,193	2,858
Other	1,515	2,792	3,748	4,386	5,715
Gathering System Capital Expenditure	**14,197**	**23,157**	**27,355**	**27,947**	**33,799**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**227,063**	**431,890**	**615,956**	**740,264**	**961,028**

NOTES: *Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS CERA

US Lower 48 Five Year Capital Expenditure by Type: Shale Gas Activity

(Current $M)

	2012-2015	2016-2020	2021-2025	2026-2030	2031-2035
Drilling Capital Expenditure	**44,857**	**85,638**	**128,476**	**158,920**	**203,802**
Drilling	30,054	57,378	86,079	106,476	136,547
Support Services	14,803	28,261	42,397	52,443	67,255
Completion Capital Expenditure	**89,634**	**167,648**	**246,952**	**289,768**	**363,764**
Hydraulic Fracturing	71,707	134,118	197,561	231,815	291,011
Other	17,927	33,530	49,390	57,954	72,753
Facilities Capital Expenditure	**7,973**	**15,004**	**21,923**	**25,429**	**33,753**
Material	4,784	9,002	13,154	15,257	20,252
Fabricaton	1,993	3,751	5,481	6,357	8,438
Project Management	399	750	1,096	1,271	1,688
Other	797	1,500	2,192	2,543	3,375
Gathering System Capital Expenditure	**8,264**	**14,119**	**18,627**	**18,884**	**23,435**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**150,727**	**282,410**	**415,977**	**493,001**	**624,753**

Source: IHS CERA

US Lower 48 Five Year Capital Expenditure by Type: Tight Gas Activity

(Current $M)

	2012-2015	2016-2020	2021-2025	2026-2030	2031-2035
Drilling Capital Expenditure	**27,334**	**56,162**	**78,959**	**97,496**	**123,595**
Drilling	18,314	37,628	52,902	65,322	82,808
Support Services	9,020	18,533	26,056	32,174	40,786
Completion Capital Expenditure	**35,896**	**71,364**	**96,736**	**122,274**	**178,915**
Hydraulic Fracturing	28,717	57,091	77,389	97,820	143,132
Other	7,179	14,273	19,347	24,455	35,783
Facilities Capital Expenditure	**7,172**	**12,917**	**15,556**	**18,430**	**23,401**
Material	4,303	7,750	9,334	11,058	14,040
Fabricaton	1,793	3,229	3,889	4,607	5,850
Project Management	359	646	778	921	1,170
Other	717	1,292	1,556	1,843	2,340
Gathering System Capital Expenditure	**5,933**	**9,037**	**8,728**	**9,063**	**10,364**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**76,336**	**149,481**	**199,979**	**247,263**	**336,275**

Source: IHS CERA

US Lower 48 Five Year Capital Expenditure by Type: Total Unconventional Activity*

(Current $M)

	2012-2015	2016-2020	2021-2025	2026-2030	2031-2035
Drilling Capital Expenditure	**139,992**	**257,198**	**351,081**	**446,962**	**565,780**
Drilling	93,795	172,322	235,224	299,464	379,072
Support Services	46,197	84,875	115,857	147,497	186,707
Completion Capital Expenditure	**229,703**	**414,375**	**551,487**	**674,934**	**866,946**
Hydraulic Fracturing	183,763	331,500	441,189	539,947	693,556
Other	45,941	82,875	110,297	134,987	173,389
Facilities Capital Expenditure	**32,785**	**57,571**	**74,182**	**92,156**	**114,034**
Material	19,671	34,543	44,509	55,293	68,420
Fabricaton	8,196	14,393	18,545	23,039	28,508
Project Management	1,639	2,879	3,709	4,608	5,702
Other	3,278	5,757	7,418	9,216	11,403
Gathering System Capital Expenditure	**27,806**	**46,521**	**56,098**	**66,278**	**82,623**
TOTAL UPSTREAM CAPITAL EXPENDITURE	**430,285**	**775,665**	**1,032,848**	**1,280,329**	**1,629,382**

NOTES: *Total unconventional activity represents the sum of unconventional oil and unconventional gas activity.
Source: IHS CERA

America's New Energy Future:
The Unconventional Oil and Gas Revolution and the US Economy

Volume 1 – National Economic Contributions

Appendix B. Economic Contribution Assessment: Detailed Tables

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Appendix B. Economic Contribution Assessment: Detailed Tables

Appendix B contains tables that expand upon the summary tables presented in the body of the report to include a complete array of forecast years – 2012, 2015, 2020, 2025, 2030, and 2035 – and all of the detailed set of activities, including unconventional oil, unconventional gas, shale gas, tight gas and total unconventional. Direct, indirect, and induced economic contributions are presented for employment, value added, and labor income for each of the aforementioned activities. In addition, the contributions to government revenue are presented for each of the above referenced activities, for each of the forecast years and on a cumulative 2012-2035 basis.

US Lower 48 Employment Contribution
(Number of workers)

2012	Direct	Indirect	Induced	Total
Unconventional Oil Activity*	173,096	259,775	413,058	845,929
Unconventional Gas Activity**	187,360	277,888	437,427	902,675
Shale Gas	126,709	186,398	292,277	605,384
Tight Gas	60,651	91,490	145,150	297,291
Total Unconventional Activity	**360,456**	**537,663**	**850,485**	**1,748,604**
2015				
Unconventional Oil Activity*	242,607	371,062	595,816	1,209,485
Unconventional Gas Activity**	263,288	399,379	638,511	1,301,178
Shale Gas	170,389	260,398	418,069	848,856
Tight Gas	92,899	138,981	220,442	452,322
Total Unconventional Activity	**505,895**	**770,441**	**1,234,327**	**2,510,663**
2020				
Unconventional Oil Activity*	265,612	412,777	667,598	1,345,987
Unconventional Gas Activity**	334,808	503,011	801,362	1,639,181
Shale Gas	222,082	336,540	537,418	1,096,040
Tight Gas	112,726	166,471	263,944	543,141
Total Unconventional Activity	**600,420**	**915,788**	**1,468,960**	**2,985,168**
2025				
Unconventional Oil Activity*	284,093	435,987	700,071	1,420,151
Unconventional Gas Activity**	390,063	583,066	930,438	1,903,567
Shale Gas	267,475	404,569	647,572	1,319,616
Tight Gas	122,588	178,497	282,866	583,951
Total Unconventional Activity	**674,156**	**1,019,053**	**1,630,509**	**3,323,718**
2030				
Unconventional Oil Activity*	303,761	457,250	724,762	1,485,773
Unconventional Gas Activity**	404,083	600,643	958,327	1,963,053
Shale Gas	274,339	414,408	665,568	1,354,315
Tight Gas	129,744	186,235	292,759	608,738
Total Unconventional Activity	**707,844**	**1,057,893**	**1,683,089**	**3,448,826**
2035				
Unconventional Oil Activity*	287,606	428,459	674,132	1,390,197
Unconventional Gas Activity**	436,773	645,696	1,026,012	2,108,481
Shale Gas	285,022	429,878	689,610	1,404,510
Tight Gas	151,751	215,818	336,402	703,971
Total Unconventional Activity	**724,379**	**1,074,155**	**1,700,144**	**3,498,678**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Value Added Contribution

(2012 $M)

2012	Direct	Indirect	Induced	Total
Unconventional Oil Activity*	47,605	32,563	35,846	116,014
Unconventional Gas Activity**	49,096	34,608	37,967	121,670
Shale Gas	32,383	23,146	25,370	80,899
Tight Gas	16,713	11,462	12,596	40,771
Total Unconventional Activity	**96,700**	**67,171**	**73,813**	**237,684**
2015				
Unconventional Oil Activity*	70,584	46,861	51,701	169,146
Unconventional Gas Activity**	74,697	50,282	55,409	180,387
Shale Gas	49,417	32,888	36,278	118,583
Tight Gas	25,279	17,394	19,131	61,804
Total Unconventional Activity	**145,281**	**97,142**	**107,110**	**349,533**
2020				
Unconventional Oil Activity*	80,726	52,432	57,924	191,081
Unconventional Gas Activity**	92,766	63,159	69,545	225,470
Shale Gas	62,693	42,359	46,637	151,690
Tight Gas	30,073	20,799	22,908	73,780
Total Unconventional Activity	**173,492**	**115,591**	**127,469**	**416,551**
2025				
Unconventional Oil Activity*	83,124	55,092	60,747	198,963
Unconventional Gas Activity**	107,802	73,225	80,748	261,775
Shale Gas	75,822	50,970	56,197	182,989
Tight Gas	31,979	22,255	24,552	78,786
Total Unconventional Activity	**190,926**	**128,317**	**141,495**	**460,738**
2030				
Unconventional Oil Activity*	83,261	57,263	62,899	203,423
Unconventional Gas Activity**	110,701	75,372	83,168	269,241
Shale Gas	78,394	52,288	57,756	188,437
Tight Gas	32,307	23,085	25,412	80,804
Total Unconventional Activity	**193,962**	**132,636**	**146,067**	**472,664**
2035				
Unconventional Oil Activity*	75,958	53,390	58,510	187,858
Unconventional Gas Activity**	117,272	80,806	89,049	287,127
Shale Gas	80,998	54,197	59,844	195,039
Tight Gas	36,275	26,609	29,205	92,088
Total Unconventional Activity	**193,230**	**134,195**	**147,559**	**474,985**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Labor Income Contribution

(2012 $M)

2012	Direct	Indirect	Induced	Total
Unconventional Oil Activity*	21,272	18,974	20,242	60,488
Unconventional Gas Activity**	22,337	20,276	21,440	64,053
Shale Gas	14,873	13,598	14,327	42,798
Tight Gas	7,464	6,678	7,113	21,255
Total Unconventional Activity	**43,608**	**39,250**	**41,682**	**124,541**
2015				
Unconventional Oil Activity*	30,915	27,150	29,195	87,260
Unconventional Gas Activity**	33,006	29,215	31,289	93,509
Shale Gas	21,673	19,070	20,486	61,229
Tight Gas	11,333	10,144	10,803	32,280
Total Unconventional Activity	**63,921**	**56,365**	**60,484**	**180,770**
2020				
Unconventional Oil Activity*	34,827	30,243	32,709	97,779
Unconventional Gas Activity**	41,304	36,778	39,272	117,353
Shale Gas	27,738	24,630	26,336	78,704
Tight Gas	13,565	12,148	12,936	38,650
Total Unconventional Activity	**76,131**	**67,021**	**71,981**	**215,132**
2025				
Unconventional Oil Activity*	36,325	31,900	34,303	102,528
Unconventional Gas Activity**	48,023	42,637	45,598	136,258
Shale Gas	33,489	29,616	31,734	94,839
Tight Gas	14,534	13,021	13,864	41,420
Total Unconventional Activity	**84,348**	**74,537**	**79,901**	**238,786**
2030				
Unconventional Oil Activity*	37,229	33,382	35,519	106,130
Unconventional Gas Activity**	49,457	43,917	46,965	140,338
Shale Gas	34,515	30,345	32,614	97,474
Tight Gas	14,942	13,572	14,350	42,864
Total Unconventional Activity	**86,686**	**77,299**	**82,483**	**246,468**
2035				
Unconventional Oil Activity*	34,424	31,245	33,040	98,709
Unconventional Gas Activity**	52,780	47,183	50,286	150,248
Shale Gas	35,732	31,470	33,794	100,996
Tight Gas	17,048	15,713	16,492	49,252
Total Unconventional Activity	**87,204**	**78,428**	**83,326**	**248,957**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

Contribution to US Lower 48 Government Revenue: Unconventional Oil Activity*
(2012 $M)

	2012	2015	2020	2025	2030	2035	2012-2035**
Federal Taxes	**14,076**	**20,379**	**22,898**	**23,955**	**24,698**	**22,917**	**502,486**
Personal Taxes	10,726	15,438	17,271	18,138	18,827	17,538	381,337
Corporate Taxes	3,351	4,940	5,628	5,817	5,871	5,379	121,149
State and Local Taxes	**15,769**	**23,256**	**28,054**	**29,299**	**29,553**	**27,526**	**617,495**
Personal Taxes	1,718	2,479	2,779	2,913	3,014	2,802	61,180
Corporate Taxes	9,403	13,854	15,771	16,309	16,463	15,089	339,682
Severance Taxes	2,963	4,458	6,081	6,410	6,432	6,166	138,414
Ad Valorem Taxes	1,686	2,465	3,423	3,666	3,644	3,469	78,219
Federal Royalty Payments	**974**	**1,365**	**1,845**	**1,893**	**1,489**	**950**	**37,069**
Total Government Revenue	**30,820**	**45,000**	**52,798**	**55,147**	**55,740**	**51,393**	**1,157,049**
Lease Payments to Private Landowners	**243**	**341**	**387**	**453**	**512**	**507**	**10,178**

NOTES: *Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.
**2012-2035 represents the total for all years including those years not reported.
Source: IHS Global Insight

Contribution to US Lower 48 Government Revenue: Unconventional Gas Activity*
(2012 $M)

	2012	2015	2020	2025	2030	2035	2012-2035**
Federal Taxes	**14,860**	**21,804**	**27,330**	**31,731**	**32,667**	**34,928**	**635,116**
Personal Taxes	11,384	16,564	20,811	24,163	24,894	26,676	483,860
Corporate Taxes	3,476	5,240	6,519	7,568	7,773	8,252	151,256
State and Local Taxes	**15,162**	**23,326**	**29,676**	**34,700**	**35,457**	**37,441**	**700,011**
Personal Taxes	1,818	2,656	3,333	3,869	3,985	4,266	77,469
Corporate Taxes	9,748	14,685	18,253	21,184	21,753	23,097	423,482
Severance Taxes	2,487	4,199	5,688	6,896	6,955	7,276	141,469
Ad Valorem Taxes	1,109	1,786	2,403	2,750	2,763	2,803	57,590
Federal Royalty Payments	**990**	**1,274**	**1,359**	**1,030**	**782**	**644**	**25,073**
Total Government Revenue	**31,012**	**46,404**	**58,366**	**67,461**	**68,905**	**73,013**	**1,360,199**
Lease Payments to Private Landowners	**261**	**370**	**526**	**644**	**673**	**726**	**13,421**

NOTES: *Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.
**2012-2035 represents the total for all years including those years not reported.
Source: IHS Global Insight

Contribution to US Lower 48 Government Revenue: Shale Gas Activity
(2012 $M)

	2012	2015	2020	2025	2030	2035	2012-2035*
Federal Taxes	**9,914**	**14,296**	**18,349**	**22,118**	**22,747**	**23,560**	**433,018**
Personal Taxes	7,616	10,838	13,949	16,804	17,263	17,891	328,953
Corporate Taxes	2,298	3,458	4,400	5,314	5,484	5,669	104,065
State and Local Taxes	**9,802**	**15,035**	**19,515**	**23,814**	**24,432**	**25,103**	**470,015**
Personal Taxes	1,214	1,740	2,235	2,694	2,769	2,869	52,737
Corporate Taxes	6,439	9,683	12,309	14,865	15,340	15,862	291,174
Severance Taxes	1,510	2,575	3,490	4,390	4,395	4,452	88,316
Ad Valorem Taxes	639	1,037	1,481	1,865	1,927	1,921	37,789
Federal Royalty Payments	**126**	**206**	**308**	**392**	**425**	**427**	**8,058**
Total Government Revenue	**19,842**	**29,537**	**38,172**	**46,324**	**47,604**	**49,089**	**911,090**
Lease Payments to Private Landowners	**173**	**221**	**321**	**403**	**421**	**438**	**8,294**

NOTES: *2012-2035 represents the total for all years including those years not reported.
Source: IHS Global Insight

Contribution to US Lower 48 Government Revenue: Tight Gas Activity

(2012 $M)

	2012	2015	2020	2025	2030	2035	2012-2035*
Federal Taxes	**4,947**	**7,508**	**8,981**	**9,613**	**9,920**	**11,368**	**202,098**
Personal Taxes	3,769	5,726	6,862	7,359	7,631	8,785	154,907
Corporate Taxes	1,178	1,782	2,119	2,254	2,289	2,583	47,191
State and Local Taxes	**5,360**	**8,291**	**10,161**	**10,887**	**11,025**	**12,338**	**229,996**
Personal Taxes	604	917	1,097	1,176	1,216	1,397	24,732
Corporate Taxes	3,309	5,002	5,943	6,319	6,413	7,235	132,309
Severance Taxes	977	1,624	2,199	2,506	2,560	2,824	53,153
Ad Valorem Taxes	470	748	922	885	836	883	19,801
Federal Royalty Payments	**864**	**1,067**	**1,051**	**638**	**356**	**217**	**17,015**
Total Government Revenue	**11,170**	**16,867**	**20,193**	**21,137**	**21,301**	**23,924**	**449,109**
Lease Payments to Private Landowners	**88**	**149**	**205**	**241**	**252**	**288**	**5,127**

NOTES: *2012-2035 represents the total for all years including those years not reported.

Source: IHS Global Insight

Contribution to US Lower 48 Government Revenue: Total Unconventional Activity*

(2012 $M)

	2012	2015	2020	2025	2030	2035	2012-2035**
Federal Taxes	**28,936**	**42,183**	**50,229**	**55,686**	**57,365**	**57,846**	**1,137,602**
Personal Taxes	22,110	32,003	38,082	42,301	43,721	44,214	865,197
Corporate Taxes	6,827	10,180	12,147	13,385	13,644	13,631	272,405
State and Local Taxes	**30,931**	**46,582**	**57,731**	**63,999**	**65,009**	**64,967**	**1,317,506**
Personal Taxes	3,536	5,136	6,112	6,783	6,999	7,067	138,650
Corporate Taxes	19,150	28,539	34,024	37,493	38,217	38,186	763,165
Severance Taxes	5,450	8,657	11,769	13,306	13,387	13,442	279,882
Ad Valorem Taxes	2,795	4,251	5,825	6,417	6,407	6,272	135,809
Federal Royalty Payments	**1,964**	**2,639**	**3,204**	**2,923**	**2,271**	**1,593**	**62,141**
Total Government Revenue	**61,832**	**91,404**	**111,164**	**122,608**	**124,645**	**124,406**	**2,517,248**
Lease Payments to Private Landowners	**504**	**711**	**913**	**1,096**	**1,185**	**1,232**	**23,599**

NOTES: *Total unconventional activity represents the sum of unconventional oil and unconventional gas activity.

**2012-2035 represents the total for all years including those years not reported.

Source: IHS Global Insight

America's New Energy Future:
The Unconventional Oil and Gas Revolution and the US Economy

Volume 1 – National Economic Contributions

Appendix C. Economic Contribution Assessment: Detailed Tables by Industry

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Appendix C. Economic Contribution Assessment: Detailed Tables by Industry

Appendix C provides economic contributions for each industry at the 3-digit NAICS level. For each industry, the total contribution only (i.e., the sum of direct, indirect, and induced contributions) is presented for each of the following five unconventional activities: unconventional oil, unconventional gas, shale gas, tight gas and total unconventional. Within each category, total economic contributions are generated for employment, value added and labor income for the complete set of forecast years – 2012, 2015, 2020, 2025, 2030, and 2035. For reference, we first present a crosswalk between the NAICS Code and the Industry Description.

NAICS Code	Industry Description
111	Crop Production
112	Animal Production
113	Forestry and Logging
114	Fishing, Hunting and Trapping
115	Support Activities for Agriculture and Forestry
211	Oil and Gas Extraction
212	Mining (except Oil and Gas)
213	Support Activities for Mining
221	Utilities
230	Construction
311	Food Manufacturing
312	Beverage and Tobacco Product Manufacturing
313	Textile Mills
314	Textile Product Mills
315	Apparel Manufacturing
316	Leather and Allied Product Manufacturing
321	Wood Product Manufacturing
322	Paper Manufacturing
323	Printing and Related Support Activities
324	Petroleum and Coal Products Manufacturing
325	Chemical Manufacturing
326	Plastics and Rubber Products Manufacturing
327	Nonmetallic Mineral Product Manufacturing
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
333	Machinery Manufacturing
334	Computer and Electronic Product Manufacturing
335	Electrical Equipment, Appliance, and Component Manufacturing
336	Transportation Equipment Manufacturing
337	Furniture and Related Product Manufacturing
339	Miscellaneous Manufacturing
420	Wholesale Trade
441	Motor Vehicle and Parts Dealers
442	Furniture and Home Furnishings Stores
443	Electronics and Appliance Stores
444	Building Material and Garden Equipment and Supplies Dealers
445	Food and Beverage Stores
446	Health and Personal Care Stores
447	Gasoline Stations
448	Clothing and Clothing Accessories Stores
451	Sporting Goods, Hobby, Book, and Music Stores
452	General Merchandise Stores
453	Miscellaneous Store Retailers
454	Nonstore Retailers

NAICS Code	Industry Description (continued)
481	Air Transportation
482	Rail Transportation
483	Water Transportation
484	Truck Transportation
485	Transit and Ground Passenger Transportation
486	Pipeline Transportation
487	Scenic and Sightseeing Transportation
491	Postal Service
492	Couriers and Messengers
493	Warehousing and Storage
511	Publishing Industries (except Internet)
512	Motion Picture and Sound Recording Industries
515	Broadcasting (except Internet)
517	Telecommunications
518	Data Processing, Hosting, and Related Services
519	Other Information Services
521	Monetary Authorities-Central Bank
522	Credit Intermediation and Related Activities
523	Securities, Commodity Contracts, and Other Financial Investments and Related Activities
524	Insurance Carriers and Related Activities
525	Funds, Trusts, and Other Financial Vehicles
531	Real Estate
532	Rental and Leasing Services
533	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
541	Professional, Scientific, and Technical Services
550	Management of Companies and Enterprises
561	Administrative and Support Services
562	Waste Management and Remediation Services
611	Educational Services
621	Ambulatory Health Care Services
622	Hospitals
623	Nursing and Residential Care Facilities
624	Social Assistance
711	Performing Arts, Spectator Sports, and Related Industries
712	Museums, Historical Sites, and Similar Institutions
713	Amusement, Gambling, and Recreation Industries
721	Accommodation
722	Food Services and Drinking Places
811	Repair and Maintenance
812	Personal and Laundry Services
813	Religious, Grantmaking, Civic, Professional, and Similar Organizations
814	Private Household
GOV	Government Services

Source: US Bureau of Census 2002 Classifications.

US Lower 48 Economic Contribution Summary: Crop Production (NAICS 111)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	4,624	6,620	7,376	7,770	8,119	7,599
Unconventional Gas Activity**	4,972	7,166	9,068	10,540	10,880	11,695
Shale Gas Activity	3,358	4,705	6,097	7,339	7,528	7,803
Tight Gas Activity	1,614	2,461	2,971	3,201	3,352	3,892
Total Unconventional Activity	**9,596**	**13,786**	**16,444**	**18,310**	**18,999**	**19,294**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	295	422	470	495	517	484
Unconventional Gas Activity**	316	456	577	670	692	743
Shale Gas Activity	213	299	387	466	478	496
Tight Gas Activity	103	157	189	204	213	247
Total Unconventional Activity	**611**	**878**	**1,047**	**1,165**	**1,209**	**1,227**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	112	161	179	189	197	184
Unconventional Gas Activity**	120	174	219	255	263	283
Shale Gas Activity	81	114	147	177	182	189
Tight Gas Activity	39	60	72	78	81	94
Total Unconventional Activity	**233**	**334**	**398**	**444**	**460**	**467**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Animal Production (NAICS 112)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,770	5,430	6,076	6,381	6,618	6,164
Unconventional Gas Activity**	4,000	5,827	7,314	8,495	8,749	9,376
Shale Gas Activity	2,675	3,813	4,904	5,908	6,070	6,290
Tight Gas Activity	1,325	2,014	2,410	2,587	2,679	3,086
Total Unconventional Activity	**7,770**	**11,257**	**13,390**	**14,876**	**15,367**	**15,540**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	140	202	226	237	246	229
Unconventional Gas Activity**	149	217	272	316	326	349
Shale Gas Activity	100	142	183	220	226	234
Tight Gas Activity	49	75	90	96	100	115
Total Unconventional Activity	**289**	**419**	**499**	**554**	**572**	**578**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	37	53	59	62	65	60
Unconventional Gas Activity**	39	57	72	83	86	92
Shale Gas Activity	26	37	48	58	59	62
Tight Gas Activity	13	20	24	25	26	30
Total Unconventional Activity	**76**	**110**	**131**	**145**	**150**	**152**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Forestry and Logging (NAICS 113)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	566	804	888	939	986	926
Unconventional Gas Activity**	606	866	1,087	1,264	1,305	1,402
Shale Gas Activity	406	563	725	874	897	930
Tight Gas Activity	200	303	362	390	408	472
Total Unconventional Activity	**1,172**	**1,670**	**1,975**	**2,203**	**2,291**	**2,328**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	48	68	75	80	84	79
Unconventional Gas Activity**	51	73	92	107	111	119
Shale Gas Activity	34	48	62	74	76	79
Tight Gas Activity	17	26	31	33	35	40
Total Unconventional Activity	**99**	**142**	**168**	**187**	**194**	**197**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	27	38	42	44	46	43
Unconventional Gas Activity**	28	41	51	59	61	66
Shale Gas Activity	19	26	34	41	42	44
Tight Gas Activity	9	14	17	18	19	22
Total Unconventional Activity	**55**	**78**	**92**	**103**	**107**	**109**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Fishing, Hunting & Trapping (NAICS 114)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	255	368	411	432	448	417
Unconventional Gas Activity**	271	394	494	573	593	634
Shale Gas Activity	182	258	331	399	411	426
Tight Gas Activity	89	136	163	174	182	208
Total Unconventional Activity	**526**	**762**	**905**	**1,005**	**1,041**	**1,051**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	7	10	11	12	12	11
Unconventional Gas Activity**	7	11	13	15	16	17
Shale Gas Activity	5	7	9	11	11	11
Tight Gas Activity	2	4	4	5	5	6
Total Unconventional Activity	**14**	**21**	**24**	**27**	**28**	**28**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	4	5	6	6	6	6
Unconventional Gas Activity**	4	6	7	8	9	9
Shale Gas Activity	3	4	5	6	6	6
Tight Gas Activity	1	2	2	3	3	3
Total Unconventional Activity	**8**	**11**	**13**	**15**	**15**	**15**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Support Activities for Agriculture & Forestry (NAICS 115)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	2,186	3,121	3,469	3,659	3,831	3,588
Unconventional Gas Activity**	2,347	3,376	4,261	4,953	5,112	5,496
Shale Gas Activity	1,582	2,210	2,857	3,441	3,530	3,659
Tight Gas Activity	765	1,166	1,404	1,512	1,582	1,837
Total Unconventional Activity	**4,533**	**6,497**	**7,730**	**8,612**	**8,943**	**9,084**

Value Added

(2012 $M)

Unconventional Oil Activity*	47	68	75	79	83	78
Unconventional Gas Activity**	51	73	92	107	111	119
Shale Gas Activity	34	48	62	74	76	79
Tight Gas Activity	17	25	30	33	34	40
Total Unconventional Activity	**98**	**140**	**167**	**186**	**193**	**196**

Labor Income

(2012 $M)

Unconventional Oil Activity*	65	93	104	109	115	107
Unconventional Gas Activity**	70	101	127	148	153	164
Shale Gas Activity	47	66	85	103	106	109
Tight Gas Activity	23	35	42	45	47	55
Total Unconventional Activity	**136**	**194**	**231**	**257**	**267**	**272**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Oil and Gas Extraction (NAICS 211)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	56,213	86,888	102,315	102,766	97,905	86,483
Unconventional Gas Activity**	54,892	89,446	108,443	125,764	128,245	133,265
Shale Gas Activity	34,969	59,660	73,762	89,604	93,504	96,258
Tight Gas Activity	19,923	29,786	34,681	36,160	34,741	37,007
Total Unconventional Activity	**111,105**	**176,334**	**210,758**	**228,530**	**226,150**	**219,748**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	34,262	52,957	62,360	62,635	59,672	52,711
Unconventional Gas Activity**	33,457	54,517	66,095	76,653	78,164	81,223
Shale Gas Activity	21,314	36,362	44,957	54,613	56,990	58,668
Tight Gas Activity	12,143	18,155	21,137	22,039	21,174	22,555
Total Unconventional Activity	**67,718**	**107,474**	**128,454**	**139,288**	**137,836**	**133,934**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	12,290	18,996	22,369	22,468	21,405	18,908
Unconventional Gas Activity**	12,001	19,556	23,709	27,496	28,038	29,136
Shale Gas Activity	7,645	13,044	16,127	19,590	20,443	21,045
Tight Gas Activity	4,356	6,512	7,582	7,906	7,596	8,091
Total Unconventional Activity	**24,291**	**38,552**	**46,078**	**49,964**	**49,444**	**48,044**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Mining (except Oil & Gas) (NAICS 212)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	15,722	21,092	21,990	23,579	26,122	25,338
Unconventional Gas Activity**	19,257	25,104	32,631	38,161	39,705	44,042
Shale Gas Activity	14,187	17,327	22,969	27,443	27,456	28,463
Tight Gas Activity	5,070	7,777	9,662	10,718	12,249	15,579
Total Unconventional Activity	**34,979**	**46,196**	**54,621**	**61,740**	**65,827**	**69,380**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	2,179	2,938	3,080	3,302	3,646	3,529
Unconventional Gas Activity**	2,641	3,467	4,503	5,264	5,474	6,059
Shale Gas Activity	1,933	2,380	3,154	3,770	3,780	3,919
Tight Gas Activity	708	1,087	1,349	1,493	1,695	2,140
Total Unconventional Activity	**4,821**	**6,405**	**7,583**	**8,566**	**9,120**	**9,588**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,472	1,978	2,066	2,215	2,451	2,376
Unconventional Gas Activity**	1,798	2,348	3,052	3,568	3,712	4,115
Shale Gas Activity	1,322	1,618	2,145	2,563	2,566	2,660
Tight Gas Activity	476	730	907	1,005	1,146	1,455
Total Unconventional Activity	**3,270**	**4,327**	**5,118**	**5,783**	**6,163**	**6,491**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Support Activities for Mining (NAICS 213)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	22,742	31,027	33,134	36,162	40,160	39,043
Unconventional Gas Activity**	26,230	35,367	46,540	54,809	57,322	62,680
Shale Gas Activity	18,500	23,204	31,135	37,551	38,382	39,807
Tight Gas Activity	7,730	12,163	15,405	17,258	18,940	22,873
Total Unconventional Activity	**48,972**	**66,394**	**79,674**	**90,971**	**97,482**	**101,723**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	5,327	7,280	7,814	8,527	9,497	9,248
Unconventional Gas Activity**	6,210	8,363	11,127	13,097	13,696	15,017
Shale Gas Activity	4,413	5,523	7,493	9,026	9,195	9,537
Tight Gas Activity	1,797	2,840	3,634	4,072	4,501	5,480
Total Unconventional Activity	**11,537**	**15,643**	**18,941**	**21,624**	**23,193**	**24,265**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	2,144	2,926	3,127	3,413	3,791	3,686
Unconventional Gas Activity**	2,475	3,337	4,396	5,177	5,414	5,921
Shale Gas Activity	1,746	2,190	2,942	3,548	3,626	3,760
Tight Gas Activity	729	1,147	1,454	1,629	1,789	2,161
Total Unconventional Activity	**4,619**	**6,263**	**7,522**	**8,590**	**9,205**	**9,608**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Utilities (NAICS 221)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	10,163	13,891	14,709	15,620	16,871	16,121
Unconventional Gas Activity**	11,917	15,984	20,300	23,684	24,553	26,942
Shale Gas Activity	8,551	10,874	14,103	16,893	17,035	17,656
Tight Gas Activity	3,366	5,110	6,197	6,791	7,518	9,286
Total Unconventional Activity	**22,080**	**29,875**	**35,009**	**39,304**	**41,424**	**43,063**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	3,696	5,189	5,658	5,970	6,317	5,959
Unconventional Gas Activity**	4,145	5,782	7,321	8,523	8,811	9,563
Shale Gas Activity	2,887	3,870	5,011	6,018	6,120	6,341
Tight Gas Activity	1,258	1,912	2,310	2,505	2,691	3,221
Total Unconventional Activity	**7,840**	**10,971**	**12,980**	**14,493**	**15,127**	**15,522**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,415	1,961	2,108	2,231	2,384	2,263
Unconventional Gas Activity**	1,623	2,220	2,815	3,280	3,396	3,706
Shale Gas Activity	1,148	1,498	1,941	2,328	2,357	2,443
Tight Gas Activity	475	722	874	952	1,039	1,263
Total Unconventional Activity	**3,038**	**4,180**	**4,922**	**5,511**	**5,780**	**5,969**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Construction (NAICS 23)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	53,915	75,383	81,480	86,627	91,092	85,439
Unconventional Gas Activity**	56,621	80,362	99,021	115,773	120,023	128,540
Shale Gas Activity	37,535	51,495	64,942	78,660	81,518	84,593
Tight Gas Activity	19,086	28,867	34,079	37,113	38,505	43,947
Total Unconventional Activity	**110,536**	**155,745**	**180,501**	**202,400**	**211,115**	**213,979**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	3,430	4,811	5,216	5,535	5,803	5,434
Unconventional Gas Activity**	3,597	5,125	6,314	7,379	7,646	8,183
Shale Gas Activity	2,383	3,289	4,147	5,023	5,205	5,400
Tight Gas Activity	1,214	1,836	2,167	2,357	2,441	2,782
Total Unconventional Activity	**7,027**	**9,936**	**11,530**	**12,914**	**13,449**	**13,616**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	3,217	4,511	4,890	5,189	5,440	5,094
Unconventional Gas Activity**	3,372	4,805	5,918	6,917	7,168	7,670
Shale Gas Activity	2,234	3,083	3,886	4,708	4,879	5,062
Tight Gas Activity	1,139	1,722	2,032	2,210	2,289	2,608
Total Unconventional Activity	**6,589**	**9,316**	**10,808**	**12,107**	**12,608**	**12,764**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Food Manufacturing (NAICS 311)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	4,985	7,178	8,036	8,442	8,754	8,154
Unconventional Gas Activity**	5,285	7,705	9,675	11,227	11,569	12,390
Shale Gas Activity	3,534	5,040	6,485	7,811	8,027	8,315
Tight Gas Activity	1,751	2,665	3,190	3,416	3,542	4,075
Total Unconventional Activity	**10,270**	**14,883**	**17,711**	**19,669**	**20,323**	**20,544**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	448	645	722	758	787	733
Unconventional Gas Activity**	475	692	869	1,009	1,040	1,114
Shale Gas Activity	318	453	583	702	721	748
Tight Gas Activity	157	239	287	307	319	367
Total Unconventional Activity	**924**	**1,337**	**1,592**	**1,768**	**1,826**	**1,847**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	278	400	448	471	488	455
Unconventional Gas Activity**	295	430	540	626	645	691
Shale Gas Activity	197	281	362	436	448	464
Tight Gas Activity	98	148	178	191	198	228
Total Unconventional Activity	**573**	**830**	**988**	**1,097**	**1,134**	**1,146**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Beverage & Tobacco Product Manufacturing (NAICS 312)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	725	1,044	1,169	1,226	1,271	1,185
Unconventional Gas Activity**	769	1,120	1,406	1,634	1,684	1,801
Shale Gas Activity	515	733	942	1,136	1,167	1,209
Tight Gas Activity	254	387	464	498	517	592
Total Unconventional Activity	**1,494**	**2,164**	**2,575**	**2,860**	**2,955**	**2,986**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	246	354	397	416	432	402
Unconventional Gas Activity**	261	380	477	554	571	612
Shale Gas Activity	175	249	320	386	396	410
Tight Gas Activity	86	131	157	169	175	201
Total Unconventional Activity	**507**	**734**	**874**	**971**	**1,003**	**1,014**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	73	105	118	123	128	119
Unconventional Gas Activity**	77	113	142	164	169	181
Shale Gas Activity	52	74	95	114	117	122
Tight Gas Activity	26	39	47	50	52	60
Total Unconventional Activity	**150**	**218**	**259**	**288**	**297**	**301**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Textile Mills (NAICS 313)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	485	697	775	818	849	793
Unconventional Gas Activity**	516	749	939	1,088	1,122	1,206
Shale Gas Activity	345	490	630	757	778	809
Tight Gas Activity	171	259	309	331	344	397
Total Unconventional Activity	**1,001**	**1,446**	**1,714**	**1,906**	**1,971**	**1,999**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	33	47	53	56	58	54
Unconventional Gas Activity**	35	51	64	74	77	82
Shale Gas Activity	24	33	43	52	53	55
Tight Gas Activity	12	18	21	23	24	27
Total Unconventional Activity	**68**	**98**	**117**	**130**	**134**	**136**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	27	39	44	46	48	45
Unconventional Gas Activity**	29	42	53	61	63	68
Shale Gas Activity	19	28	35	43	44	45
Tight Gas Activity	10	15	17	19	19	22
Total Unconventional Activity	**56**	**81**	**97**	**107**	**111**	**112**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Textile Product Mills (NAICS 314)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	456	657	734	772	802	745
Unconventional Gas Activity**	485	706	886	1,029	1,058	1,137
Shale Gas Activity	324	463	594	715	734	762
Tight Gas Activity	161	243	292	314	324	375
Total Unconventional Activity	**941**	**1,363**	**1,620**	**1,801**	**1,860**	**1,882**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	31	44	49	52	54	50
Unconventional Gas Activity**	33	47	59	69	71	76
Shale Gas Activity	22	31	40	48	49	51
Tight Gas Activity	11	16	20	21	22	25
Total Unconventional Activity	**63**	**91**	**109**	**121**	**125**	**126**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	22	32	36	38	39	37
Unconventional Gas Activity**	24	35	43	50	52	56
Shale Gas Activity	16	23	29	35	36	37
Tight Gas Activity	8	12	14	15	16	18
Total Unconventional Activity	**46**	**67**	**79**	**88**	**91**	**92**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Apparel Manufacturing (NAICS 315)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	775	1,116	1,248	1,311	1,362	1,265
Unconventional Gas Activity**	822	1,196	1,506	1,746	1,797	1,925
Shale Gas Activity	551	783	1,009	1,214	1,245	1,290
Tight Gas Activity	271	413	497	532	552	635
Total Unconventional Activity	**1,597**	**2,312**	**2,754**	**3,057**	**3,159**	**3,190**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	52	75	84	88	92	85
Unconventional Gas Activity**	55	81	101	117	121	130
Shale Gas Activity	37	53	68	82	84	87
Tight Gas Activity	18	28	33	36	37	43
Total Unconventional Activity	**107**	**156**	**185**	**206**	**213**	**215**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	36	52	58	61	63	59
Unconventional Gas Activity**	38	56	70	81	84	90
Shale Gas Activity	26	37	47	57	58	60
Tight Gas Activity	13	19	23	25	26	30
Total Unconventional Activity	**75**	**108**	**129**	**143**	**147**	**149**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Leather & Allied Product Manufacturing (NAICS 316)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	108	155	174	181	190	176
Unconventional Gas Activity**	114	165	209	242	249	267
Shale Gas Activity	75	108	140	168	173	179
Tight Gas Activity	39	57	69	74	76	88
Total Unconventional Activity	**222**	**320**	**383**	**423**	**439**	**443**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	6	9	10	11	11	11
Unconventional Gas Activity**	7	10	12	15	15	16
Shale Gas Activity	5	7	8	10	10	11
Tight Gas Activity	2	3	4	4	5	5
Total Unconventional Activity	**13**	**19**	**23**	**25**	**26**	**27**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	5	7	8	9	9	8
Unconventional Gas Activity**	5	8	10	11	12	13
Shale Gas Activity	4	5	7	8	8	8
Tight Gas Activity	2	3	3	3	4	4
Total Unconventional Activity	**10**	**15**	**18**	**20**	**21**	**21**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Wood Product Manufacturing (NAICS 321)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,850	2,603	2,844	3,024	3,196	3,011
Unconventional Gas Activity**	1,976	2,803	3,510	4,086	4,225	4,546
Shale Gas Activity	1,325	1,813	2,327	2,804	2,885	2,994
Tight Gas Activity	651	990	1,183	1,282	1,340	1,552
Total Unconventional Activity	**3,826**	**5,406**	**6,354**	**7,110**	**7,421**	**7,557**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	111	156	170	181	191	180
Unconventional Gas Activity**	118	168	210	244	253	272
Shale Gas Activity	79	108	139	168	173	179
Tight Gas Activity	39	59	71	77	80	93
Total Unconventional Activity	**229**	**323**	**380**	**425**	**444**	**452**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	88	123	135	143	152	143
Unconventional Gas Activity**	94	133	166	194	200	216
Shale Gas Activity	63	86	110	133	137	142
Tight Gas Activity	31	47	56	61	64	74
Total Unconventional Activity	**181**	**256**	**301**	**337**	**352**	**358**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Paper Manufacturing (NAICS 322)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,045	2,915	3,234	3,425	3,608	3,389
Unconventional Gas Activity**	2,201	3,144	3,970	4,602	4,742	5,103
Shale Gas Activity	1,479	2,049	2,656	3,189	3,266	3,386
Tight Gas Activity	722	1,095	1,314	1,413	1,476	1,717
Total Unconventional Activity	**4,246**	**6,059**	**7,204**	**8,027**	**8,350**	**8,492**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	264	377	419	443	465	437
Unconventional Gas Activity**	284	406	513	594	612	659
Shale Gas Activity	191	265	343	412	422	438
Tight Gas Activity	93	141	170	182	190	221
Total Unconventional Activity	**548**	**783**	**931**	**1,037**	**1,078**	**1,095**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	193	274	305	322	339	319
Unconventional Gas Activity**	207	296	373	433	446	480
Shale Gas Activity	139	193	250	300	307	319
Tight Gas Activity	68	103	124	133	139	161
Total Unconventional Activity	**399**	**570**	**678**	**755**	**785**	**799**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Printing & Related Support Activities (NAICS 323)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,973	4,269	4,773	5,026	5,242	4,896
Unconventional Gas Activity**	3,158	4,579	5,759	6,680	6,880	7,379
Shale Gas Activity	2,110	2,985	3,850	4,634	4,756	4,932
Tight Gas Activity	1,048	1,594	1,909	2,046	2,124	2,447
Total Unconventional Activity	**6,131**	**8,848**	**10,532**	**11,706**	**12,122**	**12,275**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	249	358	400	421	439	410
Unconventional Gas Activity**	265	384	483	560	577	619
Shale Gas Activity	177	250	323	388	399	413
Tight Gas Activity	88	134	160	172	178	205
Total Unconventional Activity	**514**	**742**	**883**	**981**	**1,016**	**1,029**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	184	264	295	310	324	302
Unconventional Gas Activity**	195	283	356	412	425	456
Shale Gas Activity	130	184	238	286	294	305
Tight Gas Activity	65	98	118	126	131	151
Total Unconventional Activity	**379**	**546**	**650**	**723**	**748**	**758**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Petroleum & Coal Products Manufacturing (NAICS 324)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	767	1,091	1,204	1,275	1,343	1,261
Unconventional Gas Activity**	831	1,185	1,499	1,750	1,809	1,947
Shale Gas Activity	562	776	1,003	1,212	1,243	1,288
Tight Gas Activity	269	409	496	538	566	659
Total Unconventional Activity	**1,598**	**2,276**	**2,703**	**3,025**	**3,152**	**3,208**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	393	559	619	654	688	646
Unconventional Gas Activity**	424	607	770	897	928	999
Shale Gas Activity	287	398	516	622	638	662
Tight Gas Activity	137	210	254	276	289	337
Total Unconventional Activity	**818**	**1,167**	**1,388**	**1,551**	**1,616**	**1,645**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	251	357	395	417	439	412
Unconventional Gas Activity**	271	387	491	572	591	637
Shale Gas Activity	183	253	329	396	407	422
Tight Gas Activity	88	134	162	176	184	215
Total Unconventional Activity	**522**	**744**	**885**	**989**	**1,030**	**1,049**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Chemical Manufacturing (NAICS 325)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	6,345	8,864	9,690	10,284	11,060	10,526
Unconventional Gas Activity**	7,288	10,052	13,053	15,207	15,753	17,222
Shale Gas Activity	5,157	6,772	8,999	10,785	10,906	11,307
Tight Gas Activity	2,131	3,280	4,054	4,422	4,847	5,915
Total Unconventional Activity	**13,633**	**18,916**	**22,743**	**25,491**	**26,813**	**27,748**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	2,001	2,820	3,106	3,284	3,499	3,316
Unconventional Gas Activity**	2,274	3,174	4,112	4,790	4,956	5,402
Shale Gas Activity	1,599	2,136	2,832	3,396	3,442	3,567
Tight Gas Activity	675	1,038	1,281	1,394	1,514	1,835
Total Unconventional Activity	**4,276**	**5,994**	**7,218**	**8,074**	**8,456**	**8,718**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	946	1,322	1,446	1,535	1,649	1,570
Unconventional Gas Activity**	1,088	1,502	1,953	2,275	2,356	2,577
Shale Gas Activity	771	1,013	1,348	1,615	1,633	1,693
Tight Gas Activity	317	488	605	660	723	884
Total Unconventional Activity	**2,034**	**2,824**	**3,399**	**3,810**	**4,005**	**4,147**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Plastics & Rubber Products Manufacturing (NAICS 326)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,787	5,395	5,987	6,316	6,622	6,209
Unconventional Gas Activity**	4,079	5,835	7,345	8,506	8,758	9,426
Shale Gas Activity	2,752	3,824	4,938	5,931	6,059	6,284
Tight Gas Activity	1,327	2,011	2,407	2,575	2,699	3,142
Total Unconventional Activity	**7,866**	**11,230**	**13,332**	**14,822**	**15,380**	**15,635**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	376	535	593	626	657	617
Unconventional Gas Activity**	406	579	729	845	870	937
Shale Gas Activity	274	380	490	589	602	624
Tight Gas Activity	132	200	239	256	268	313
Total Unconventional Activity	**781**	**1,114**	**1,322**	**1,471**	**1,528**	**1,554**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	233	332	368	388	407	382
Unconventional Gas Activity**	251	359	452	523	539	580
Shale Gas Activity	169	235	304	365	373	387
Tight Gas Activity	82	124	148	158	166	194
Total Unconventional Activity	**484**	**690**	**819**	**911**	**946**	**962**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Nonmetallic Mineral Product Manufacturing (NAICS 327)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,497	3,435	3,691	4,012	4,387	4,205
Unconventional Gas Activity**	2,719	3,736	4,756	5,572	5,810	6,285
Shale Gas Activity	1,837	2,382	3,110	3,756	3,875	4,023
Tight Gas Activity	882	1,354	1,646	1,816	1,935	2,262
Total Unconventional Activity	**5,216**	**7,171**	**8,447**	**9,584**	**10,197**	**10,490**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	370	509	547	599	659	634
Unconventional Gas Activity**	404	556	714	839	878	951
Shale Gas Activity	273	354	465	564	583	606
Tight Gas Activity	130	202	249	276	295	345
Total Unconventional Activity	**773**	**1,064**	**1,261**	**1,438**	**1,536**	**1,585**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	190	261	281	306	335	321
Unconventional Gas Activity**	207	285	363	426	444	481
Shale Gas Activity	140	181	237	287	296	308
Tight Gas Activity	67	103	126	139	148	174
Total Unconventional Activity	**397**	**546**	**644**	**732**	**779**	**803**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Primary Metal Manufacturing (NAICS 331)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	9,692	13,175	14,089	15,657	17,600	17,162
Unconventional Gas Activity**	10,608	14,339	18,556	21,646	22,549	24,506
Shale Gas Activity	7,117	8,900	11,861	14,267	14,663	15,280
Tight Gas Activity	3,491	5,439	6,695	7,379	7,886	9,226
Total Unconventional Activity	**20,300**	**27,514**	**32,645**	**37,303**	**40,149**	**41,668**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,351	1,837	1,966	2,185	2,455	2,393
Unconventional Gas Activity**	1,474	1,995	2,586	3,020	3,148	3,420
Shale Gas Activity	987	1,236	1,649	1,985	2,043	2,130
Tight Gas Activity	487	759	937	1,035	1,105	1,290
Total Unconventional Activity	**2,825**	**3,832**	**4,551**	**5,205**	**5,604**	**5,813**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	927	1,259	1,347	1,497	1,683	1,641
Unconventional Gas Activity**	1,013	1,369	1,774	2,070	2,157	2,344
Shale Gas Activity	679	849	1,132	1,363	1,402	1,461
Tight Gas Activity	334	520	641	708	756	884
Total Unconventional Activity	**1,939**	**2,629**	**3,121**	**3,568**	**3,840**	**3,985**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Fabricated Metal Product Manufacturing (NAICS 332)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	21,175	29,149	31,797	34,484	37,622	35,511
Unconventional Gas Activity**	21,984	30,165	37,710	42,811	43,812	47,885
Shale Gas Activity	14,259	18,683	24,400	28,919	29,155	30,708
Tight Gas Activity	7,725	11,482	13,310	13,892	14,657	17,177
Total Unconventional Activity	**43,159**	**59,314**	**69,507**	**77,295**	**81,434**	**83,396**

Value Added

(2012 $M)

Unconventional Oil Activity*	2,283	3,140	3,428	3,719	4,059	3,827
Unconventional Gas Activity**	2,359	3,236	4,039	4,576	4,679	5,116
Shale Gas Activity	1,524	1,998	2,608	3,087	3,110	3,279
Tight Gas Activity	835	1,239	1,431	1,489	1,569	1,838
Total Unconventional Activity	**4,641**	**6,377**	**7,467**	**8,295**	**8,737**	**8,944**

Labor Income

(2012 $M)

Unconventional Oil Activity*	1,398	1,924	2,099	2,276	2,484	2,343
Unconventional Gas Activity**	1,449	1,988	2,484	2,817	2,882	3,151
Shale Gas Activity	938	1,230	1,606	1,902	1,917	2,020
Tight Gas Activity	510	758	878	915	965	1,131
Total Unconventional Activity	**2,847**	**3,912**	**4,582**	**5,094**	**5,366**	**5,495**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Machinery Manufacturing (NAICS 333)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	33,700	45,918	49,390	54,863	62,091	60,910
Unconventional Gas Activity**	38,008	50,852	66,340	76,835	79,652	86,962
Shale Gas Activity	25,924	32,065	43,157	51,517	52,334	54,475
Tight Gas Activity	12,084	18,787	23,183	25,318	27,318	32,487
Total Unconventional Activity	**71,708**	**96,770**	**115,730**	**131,698**	**141,743**	**147,872**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	3,770	5,127	5,499	6,076	6,862	6,720
Unconventional Gas Activity**	4,295	5,705	7,373	8,484	8,754	9,590
Shale Gas Activity	2,947	3,636	4,862	5,773	5,814	6,055
Tight Gas Activity	1,347	2,069	2,511	2,711	2,940	3,535
Total Unconventional Activity	**8,064**	**10,832**	**12,872**	**14,561**	**15,616**	**16,310**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	2,778	3,780	4,058	4,494	5,080	4,980
Unconventional Gas Activity**	3,155	4,200	5,445	6,278	6,487	7,099
Shale Gas Activity	2,160	2,667	3,574	4,251	4,292	4,469
Tight Gas Activity	994	1,533	1,871	2,028	2,195	2,629
Total Unconventional Activity	**5,932**	**7,980**	**9,504**	**10,772**	**11,567**	**12,078**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Computer & Electronic Product Manufacturing (NAICS 334)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	5,045	6,838	7,448	8,154	8,971	8,360
Unconventional Gas Activity**	4,956	6,768	8,530	9,677	9,945	10,974
Shale Gas Activity	3,109	4,023	5,330	6,333	6,405	6,842
Tight Gas Activity	1,847	2,745	3,200	3,344	3,540	4,132
Total Unconventional Activity	**10,001**	**13,606**	**15,978**	**17,831**	**18,916**	**19,334**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	525	716	782	852	932	871
Unconventional Gas Activity**	524	719	907	1,032	1,062	1,167
Shale Gas Activity	332	434	573	682	691	735
Tight Gas Activity	191	285	334	350	371	433
Total Unconventional Activity	**1,049**	**1,435**	**1,688**	**1,884**	**1,994**	**2,038**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	488	664	725	791	866	809
Unconventional Gas Activity**	485	666	839	954	982	1,080
Shale Gas Activity	307	401	529	630	638	679
Tight Gas Activity	178	265	310	325	344	402
Total Unconventional Activity	**973**	**1,330**	**1,564**	**1,745**	**1,848**	**1,889**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Electrical Equipment, Appliance, & Component Manufacturing (NAICS 335)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,866	2,584	2,804	3,025	3,295	3,160
Unconventional Gas Activity**	2,073	2,837	3,578	4,111	4,223	4,596
Shale Gas Activity	1,414	1,836	2,393	2,847	2,872	2,988
Tight Gas Activity	659	1,001	1,185	1,264	1,351	1,608
Total Unconventional Activity	**3,939**	**5,421**	**6,382**	**7,136**	**7,518**	**7,756**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	292	405	440	474	516	495
Unconventional Gas Activity**	325	444	560	643	660	719
Shale Gas Activity	221	287	375	446	450	468
Tight Gas Activity	104	157	185	197	211	251
Total Unconventional Activity	**617**	**849**	**1,000**	**1,117**	**1,177**	**1,214**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	146	202	219	237	258	247
Unconventional Gas Activity**	162	222	280	321	330	359
Shale Gas Activity	110	143	187	223	224	234
Tight Gas Activity	52	78	93	99	106	126
Total Unconventional Activity	**308**	**424**	**499**	**558**	**588**	**607**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Transportation Equipment Manufacturing (NAICS 336)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,183	4,578	5,124	5,372	5,573	5,193
Unconventional Gas Activity**	3,394	4,927	6,190	7,181	7,401	7,934
Shale Gas Activity	2,277	3,236	4,167	5,012	5,146	5,328
Tight Gas Activity	1,117	1,691	2,023	2,169	2,255	2,606
Total Unconventional Activity	**6,577**	**9,505**	**11,314**	**12,553**	**12,974**	**13,127**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	336	484	541	567	589	549
Unconventional Gas Activity**	358	520	654	759	781	838
Shale Gas Activity	240	342	440	529	543	562
Tight Gas Activity	118	179	214	229	238	275
Total Unconventional Activity	**694**	**1,004**	**1,195**	**1,326**	**1,370**	**1,386**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	287	414	463	485	504	469
Unconventional Gas Activity**	306	445	559	649	668	717
Shale Gas Activity	206	292	376	453	465	481
Tight Gas Activity	101	153	183	196	204	235
Total Unconventional Activity	**594**	**859**	**1,022**	**1,134**	**1,172**	**1,186**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Furniture & Related Product Manufacturing (NAICS 337)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	1,260	1,814	2,024	2,126	2,209	2,058
Unconventional Gas Activity**	1,339	1,942	2,441	2,830	2,914	3,122
Shale Gas Activity	894	1,271	1,637	1,969	2,022	2,093
Tight Gas Activity	445	671	804	861	892	1,029
Total Unconventional Activity	**2,599**	**3,756**	**4,465**	**4,956**	**5,123**	**5,180**

Value Added

(2012 $M)

Unconventional Oil Activity*	79	114	128	134	139	130
Unconventional Gas Activity**	84	122	154	178	184	197
Shale Gas Activity	56	80	103	124	127	132
Tight Gas Activity	28	42	51	54	56	65
Total Unconventional Activity	**164**	**237**	**281**	**312**	**323**	**327**

Labor Income

(2012 $M)

Unconventional Oil Activity*	57	82	92	97	100	94
Unconventional Gas Activity**	61	88	111	129	133	142
Shale Gas Activity	41	58	74	90	92	95
Tight Gas Activity	20	31	37	39	41	47
Total Unconventional Activity	**118**	**171**	**203**	**225**	**233**	**236**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Miscellaneous Manufacturing (NAICS 339)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,278	3,225	3,561	3,777	4,016	3,794
Unconventional Gas Activity**	2,494	3,510	4,415	5,080	5,211	5,637
Shale Gas Activity	1,691	2,297	2,978	3,555	3,605	3,741
Tight Gas Activity	803	1,213	1,437	1,525	1,606	1,896
Total Unconventional Activity	**4,772**	**6,735**	**7,976**	**8,857**	**9,227**	**9,431**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	244	347	383	406	430	406
Unconventional Gas Activity**	267	377	474	546	560	605
Shale Gas Activity	180	247	319	381	387	402
Tight Gas Activity	86	130	154	164	173	203
Total Unconventional Activity	**511**	**723**	**857**	**952**	**991**	**1,011**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	194	275	303	322	342	323
Unconventional Gas Activity**	212	299	376	433	444	480
Shale Gas Activity	144	196	253	303	307	318
Tight Gas Activity	68	103	122	130	137	161
Total Unconventional Activity	**406**	**574**	**679**	**754**	**785**	**803**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Wholesalers (NAICS 42)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	29,290	41,436	45,774	48,694	51,702	48,769
Unconventional Gas Activity**	31,583	44,739	56,520	65,406	67,392	72,725
Shale Gas Activity	21,241	29,027	37,698	45,220	46,176	47,963
Tight Gas Activity	10,342	15,712	18,822	20,186	21,216	24,762
Total Unconventional Activity	**60,873**	**86,175**	**102,294**	**114,100**	**119,094**	**121,494**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	4,072	5,761	6,364	6,770	7,188	6,781
Unconventional Gas Activity**	4,391	6,220	7,858	9,094	9,370	10,111
Shale Gas Activity	2,953	4,036	5,241	6,287	6,420	6,669
Tight Gas Activity	1,438	2,185	2,617	2,807	2,950	3,443
Total Unconventional Activity	**8,463**	**11,981**	**14,222**	**15,864**	**16,558**	**16,892**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	2,369	3,352	3,703	3,939	4,182	3,945
Unconventional Gas Activity**	2,555	3,619	4,572	5,291	5,452	5,883
Shale Gas Activity	1,718	2,348	3,050	3,658	3,735	3,880
Tight Gas Activity	837	1,271	1,523	1,633	1,716	2,003
Total Unconventional Activity	**4,924**	**6,971**	**8,275**	**9,230**	**9,634**	**9,828**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Motor Vehicle & Parts Dealers (NAICS 441)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	8,495	12,262	13,741	14,398	14,883	13,832
Unconventional Gas Activity**	8,982	13,129	16,450	19,102	19,672	21,048
Shale Gas Activity	5,996	8,597	11,032	13,297	13,672	14,164
Tight Gas Activity	2,986	4,532	5,418	5,805	6,000	6,884
Total Unconventional Activity	**17,477**	**25,391**	**30,191**	**33,500**	**34,555**	**34,880**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	540	780	874	915	946	879
Unconventional Gas Activity**	571	835	1,046	1,215	1,251	1,338
Shale Gas Activity	381	547	702	845	869	901
Tight Gas Activity	190	288	345	369	381	438
Total Unconventional Activity	**1,111**	**1,615**	**1,920**	**2,130**	**2,197**	**2,218**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	428	618	692	725	749	697
Unconventional Gas Activity**	452	661	828	962	991	1,060
Shale Gas Activity	302	433	556	670	689	713
Tight Gas Activity	150	228	273	292	302	347
Total Unconventional Activity	**880**	**1,279**	**1,520**	**1,687**	**1,740**	**1,757**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Furniture & Home Furnishings Stores (NAICS 442)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,563	3,698	4,144	4,344	4,491	4,175
Unconventional Gas Activity**	2,710	3,960	4,966	5,765	5,937	6,354
Shale Gas Activity	1,809	2,593	3,330	4,013	4,126	4,275
Tight Gas Activity	901	1,367	1,636	1,752	1,811	2,079
Total Unconventional Activity	**5,273**	**7,658**	**9,110**	**10,109**	**10,428**	**10,529**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	165	239	268	280	290	270
Unconventional Gas Activity**	175	256	321	372	383	410
Shale Gas Activity	117	167	215	259	266	276
Tight Gas Activity	58	88	106	113	117	134
Total Unconventional Activity	**340**	**495**	**588**	**653**	**673**	**680**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	103	148	166	174	180	167
Unconventional Gas Activity**	109	159	199	231	238	255
Shale Gas Activity	73	104	134	161	166	171
Tight Gas Activity	36	55	66	70	73	83
Total Unconventional Activity	**212**	**307**	**365**	**406**	**418**	**422**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Electronics & Appliance Stores (NAICS 443)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,387	3,447	3,861	4,047	4,183	3,887
Unconventional Gas Activity**	2,524	3,690	4,623	5,369	5,528	5,916
Shale Gas Activity	1,685	2,416	3,101	3,737	3,842	3,981
Tight Gas Activity	839	1,274	1,522	1,632	1,686	1,935
Total Unconventional Activity	**4,911**	**7,137**	**8,484**	**9,416**	**9,711**	**9,803**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	144	208	233	244	252	234
Unconventional Gas Activity**	152	222	278	323	333	356
Shale Gas Activity	101	145	187	225	231	240
Tight Gas Activity	51	77	92	98	102	117
Total Unconventional Activity	**296**	**430**	**511**	**567**	**585**	**590**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	117	169	190	199	205	191
Unconventional Gas Activity**	124	181	227	263	271	290
Shale Gas Activity	83	119	152	183	189	195
Tight Gas Activity	41	63	75	80	83	95
Total Unconventional Activity	**241**	**350**	**416**	**462**	**477**	**481**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Building Material & Garden Equipment & Supplies Dealers (NAICS 444)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	5,479	7,908	8,862	9,287	9,603	8,925
Unconventional Gas Activity**	5,795	8,468	10,616	12,326	12,695	13,585
Shale Gas Activity	3,869	5,545	7,120	8,580	8,822	9,140
Tight Gas Activity	1,926	2,923	3,496	3,746	3,873	4,445
Total Unconventional Activity	**11,274**	**16,376**	**19,478**	**21,613**	**22,298**	**22,510**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	353	509	571	598	618	575
Unconventional Gas Activity**	373	545	683	794	817	875
Shale Gas Activity	249	357	458	552	568	588
Tight Gas Activity	124	188	225	241	249	286
Total Unconventional Activity	**726**	**1,054**	**1,254**	**1,391**	**1,435**	**1,449**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	218	314	352	369	381	354
Unconventional Gas Activity**	230	336	422	490	504	539
Shale Gas Activity	154	220	283	341	350	363
Tight Gas Activity	76	116	139	149	154	177
Total Unconventional Activity	**448**	**650**	**774**	**858**	**886**	**894**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Food & Beverage Stores (NAICS 445)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	12,015	17,341	19,434	20,366	21,060	19,576
Unconventional Gas Activity**	12,709	18,571	23,282	27,032	27,840	29,793
Shale Gas Activity	8,485	12,161	15,614	18,817	19,347	20,043
Tight Gas Activity	4,224	6,410	7,668	8,215	8,493	9,750
Total Unconventional Activity	**24,724**	**35,912**	**42,716**	**47,398**	**48,900**	**49,369**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	570	822	922	966	999	928
Unconventional Gas Activity**	603	881	1,104	1,282	1,320	1,413
Shale Gas Activity	402	577	741	892	917	951
Tight Gas Activity	200	304	364	390	403	462
Total Unconventional Activity	**1,173**	**1,703**	**2,026**	**2,248**	**2,319**	**2,341**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	372	538	602	631	653	607
Unconventional Gas Activity**	394	576	722	838	863	924
Shale Gas Activity	263	377	484	583	600	621
Tight Gas Activity	131	199	238	255	263	302
Total Unconventional Activity	**766**	**1,113**	**1,324**	**1,469**	**1,516**	**1,531**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Health & Personal Care Stores (NAICS 446)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	4,635	6,690	7,497	7,857	8,125	7,552
Unconventional Gas Activity**	4,903	7,164	8,983	10,429	10,740	11,494
Shale Gas Activity	3,274	4,691	6,024	7,260	7,463	7,733
Tight Gas Activity	1,629	2,473	2,959	3,169	3,277	3,761
Total Unconventional Activity	**9,538**	**13,854**	**16,480**	**18,286**	**18,865**	**19,046**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	281	405	454	476	492	458
Unconventional Gas Activity**	297	434	544	632	651	697
Shale Gas Activity	198	284	365	440	452	469
Tight Gas Activity	99	150	179	192	199	228
Total Unconventional Activity	**578**	**840**	**999**	**1,108**	**1,143**	**1,154**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	179	258	290	303	314	292
Unconventional Gas Activity**	189	277	347	403	415	444
Shale Gas Activity	126	181	233	280	288	299
Tight Gas Activity	63	96	114	122	127	145
Total Unconventional Activity	**368**	**535**	**636**	**706**	**729**	**736**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Gasoline Stations (NAICS 447)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,616	5,218	5,848	6,129	6,337	5,890
Unconventional Gas Activity**	3,824	5,589	7,006	8,135	8,376	8,964
Shale Gas Activity	2,553	3,660	4,699	5,663	5,821	6,031
Tight Gas Activity	1,271	1,929	2,307	2,472	2,555	2,933
Total Unconventional Activity	**7,440**	**10,807**	**12,854**	**14,264**	**14,713**	**14,854**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	262	379	424	445	460	427
Unconventional Gas Activity**	277	405	508	590	608	650
Shale Gas Activity	185	265	341	411	422	437
Tight Gas Activity	92	140	167	179	185	213
Total Unconventional Activity	**540**	**784**	**932**	**1,035**	**1,067**	**1,078**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	115	166	186	195	202	188
Unconventional Gas Activity**	122	178	223	259	267	286
Shale Gas Activity	81	117	150	180	186	192
Tight Gas Activity	41	61	74	79	81	93
Total Unconventional Activity	**237**	**344**	**410**	**455**	**469**	**473**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Clothing & Clothing Accessories Stores (NAICS 448)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	6,648	9,596	10,754	11,270	11,654	10,833
Unconventional Gas Activity**	7,033	10,277	12,884	14,959	15,406	16,487
Shale Gas Activity	4,696	6,729	8,641	10,413	10,706	11,091
Tight Gas Activity	2,337	3,548	4,243	4,546	4,700	5,396
Total Unconventional Activity	**13,681**	**19,873**	**23,638**	**26,229**	**27,060**	**27,320**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	344	496	556	583	603	560
Unconventional Gas Activity**	364	532	667	774	797	853
Shale Gas Activity	243	348	447	539	554	574
Tight Gas Activity	121	184	220	235	243	279
Total Unconventional Activity	**708**	**1,028**	**1,223**	**1,357**	**1,400**	**1,413**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	168	243	272	285	295	274
Unconventional Gas Activity**	178	260	326	378	390	417
Shale Gas Activity	119	170	219	263	271	281
Tight Gas Activity	59	90	107	115	119	136
Total Unconventional Activity	**346**	**503**	**598**	**664**	**685**	**691**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Sporting Goods, Hobby, Book, & Music Stores (NAICS 451)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,318	4,790	5,367	5,625	5,816	5,406
Unconventional Gas Activity**	3,509	5,129	6,429	7,466	7,688	8,227
Shale Gas Activity	2,343	3,358	4,312	5,197	5,342	5,535
Tight Gas Activity	1,166	1,771	2,117	2,269	2,346	2,692
Total Unconventional Activity	**6,827**	**9,919**	**11,796**	**13,091**	**13,504**	**13,633**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	123	178	200	209	216	201
Unconventional Gas Activity**	131	191	239	278	286	306
Shale Gas Activity	87	125	160	193	199	206
Tight Gas Activity	43	66	79	84	87	100
Total Unconventional Activity	**254**	**369**	**439**	**487**	**502**	**507**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	75	108	121	127	131	122
Unconventional Gas Activity**	79	116	145	168	174	186
Shale Gas Activity	53	76	97	117	121	125
Tight Gas Activity	26	40	48	51	53	61
Total Unconventional Activity	**154**	**224**	**266**	**295**	**305**	**308**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: General Merchandise Stores (NAICS 452)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	12,324	17,788	19,934	20,890	21,602	20,079
Unconventional Gas Activity**	13,036	19,050	23,881	27,729	28,556	30,559
Shale Gas Activity	8,704	12,474	16,016	19,302	19,844	20,559
Tight Gas Activity	4,332	6,576	7,865	8,427	8,712	10,000
Total Unconventional Activity	**25,360**	**36,838**	**43,815**	**48,619**	**50,158**	**50,638**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	507	732	820	860	889	826
Unconventional Gas Activity**	537	784	983	1,141	1,175	1,258
Shale Gas Activity	358	513	659	794	817	846
Tight Gas Activity	178	271	324	347	359	412
Total Unconventional Activity	**1,044**	**1,516**	**1,803**	**2,001**	**2,064**	**2,084**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	341	492	552	578	598	556
Unconventional Gas Activity**	361	527	661	767	790	846
Shale Gas Activity	241	345	443	534	549	569
Tight Gas Activity	120	182	218	233	241	277
Total Unconventional Activity	**702**	**1,019**	**1,213**	**1,346**	**1,388**	**1,401**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Miscellaneous Store Retailers (NAICS 453)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	6,107	8,815	9,877	10,351	10,703	9,948
Unconventional Gas Activity**	6,458	9,438	11,832	13,737	14,147	15,139
Shale Gas Activity	4,312	6,180	7,935	9,562	9,831	10,186
Tight Gas Activity	2,146	3,258	3,897	4,175	4,316	4,953
Total Unconventional Activity	**12,565**	**18,253**	**21,709**	**24,088**	**24,850**	**25,087**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	207	298	334	350	362	336
Unconventional Gas Activity**	218	319	400	465	479	512
Shale Gas Activity	146	209	268	323	333	345
Tight Gas Activity	73	110	132	141	146	168
Total Unconventional Activity	**425**	**617**	**734**	**815**	**841**	**849**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	143	206	231	242	250	233
Unconventional Gas Activity**	151	221	277	321	331	354
Shale Gas Activity	101	145	186	224	230	238
Tight Gas Activity	50	76	91	98	101	116
Total Unconventional Activity	**294**	**427**	**508**	**564**	**581**	**587**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Nonstore Retailers (NAICS 454)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	7,688	11,098	12,436	13,031	13,470	12,518
Unconventional Gas Activity**	8,130	11,882	14,890	17,288	17,804	19,050
Shale Gas Activity	5,427	7,780	9,985	12,034	12,374	12,820
Tight Gas Activity	2,703	4,102	4,905	5,254	5,430	6,230
Total Unconventional Activity	**15,818**	**22,980**	**27,326**	**30,319**	**31,274**	**31,568**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	440	635	712	746	771	717
Unconventional Gas Activity**	465	680	853	990	1,019	1,091
Shale Gas Activity	311	446	572	689	709	734
Tight Gas Activity	155	235	281	301	311	357
Total Unconventional Activity	**906**	**1,316**	**1,565**	**1,736**	**1,791**	**1,808**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	128	184	206	216	224	208
Unconventional Gas Activity**	135	197	247	287	296	316
Shale Gas Activity	90	129	166	200	205	213
Tight Gas Activity	45	68	81	87	90	103
Total Unconventional Activity	**263**	**381**	**454**	**503**	**519**	**524**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Air Transportation (NAICS 481)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,633	2,334	2,596	2,741	2,874	2,692
Unconventional Gas Activity**	1,749	2,514	3,169	3,675	3,789	4,074
Shale Gas Activity	1,175	1,641	2,121	2,551	2,614	2,712
Tight Gas Activity	574	873	1,048	1,124	1,175	1,362
Total Unconventional Activity	**3,382**	**4,848**	**5,765**	**6,416**	**6,663**	**6,766**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	200	285	318	335	351	329
Unconventional Gas Activity**	214	308	388	450	463	498
Shale Gas Activity	144	201	259	312	320	332
Tight Gas Activity	70	107	128	138	144	167
Total Unconventional Activity	**414**	**593**	**705**	**785**	**815**	**828**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	153	219	244	257	270	253
Unconventional Gas Activity**	164	236	297	345	355	382
Shale Gas Activity	110	154	199	239	245	254
Tight Gas Activity	54	82	98	106	110	128
Total Unconventional Activity	**317**	**455**	**541**	**602**	**625**	**635**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Rail Transportation (NAICS 482)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,273	1,790	1,968	2,103	2,250	2,133
Unconventional Gas Activity**	1,388	1,953	2,495	2,904	3,006	3,251
Shale Gas Activity	943	1,270	1,664	2,001	2,048	2,126
Tight Gas Activity	445	683	831	903	958	1,125
Total Unconventional Activity	**2,661**	**3,743**	**4,463**	**5,007**	**5,256**	**5,384**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	314	442	486	520	556	527
Unconventional Gas Activity**	343	482	617	718	743	803
Shale Gas Activity	233	314	411	494	506	525
Tight Gas Activity	110	169	205	223	237	278
Total Unconventional Activity	**657**	**925**	**1,103**	**1,237**	**1,299**	**1,330**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	135	190	209	223	238	226
Unconventional Gas Activity**	147	207	264	308	318	345
Shale Gas Activity	100	135	176	212	217	225
Tight Gas Activity	47	72	88	96	102	119
Total Unconventional Activity	**282**	**397**	**473**	**531**	**557**	**571**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Water Transportation (NAICS 483)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	252	359	398	422	445	418
Unconventional Gas Activity**	270	387	491	572	591	636
Shale Gas Activity	182	252	328	395	406	421
Tight Gas Activity	88	135	163	177	185	215
Total Unconventional Activity	**522**	**746**	**889**	**994**	**1,036**	**1,054**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	49	70	77	82	86	81
Unconventional Gas Activity**	52	75	95	111	115	123
Shale Gas Activity	35	49	64	77	79	82
Tight Gas Activity	17	26	32	34	36	42
Total Unconventional Activity	**101**	**145**	**173**	**193**	**201**	**204**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	25	35	39	42	44	41
Unconventional Gas Activity**	27	38	48	56	58	63
Shale Gas Activity	18	25	32	39	40	41
Tight Gas Activity	9	13	16	17	18	21
Total Unconventional Activity	**51**	**73**	**88**	**98**	**102**	**104**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Truck Transportation (NAICS 484)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	15,216	21,365	23,611	25,254	27,336	26,125
Unconventional Gas Activity**	17,270	23,998	31,602	36,814	38,152	41,663
Shale Gas Activity	12,079	15,940	21,518	25,800	26,157	27,143
Tight Gas Activity	5,191	8,058	10,084	11,014	11,995	14,520
Total Unconventional Activity	**32,486**	**45,363**	**55,213**	**62,068**	**65,488**	**67,788**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,072	1,505	1,663	1,779	1,925	1,840
Unconventional Gas Activity**	1,216	1,690	2,226	2,593	2,687	2,935
Shale Gas Activity	851	1,123	1,516	1,817	1,842	1,912
Tight Gas Activity	366	568	710	776	845	1,023
Total Unconventional Activity	**2,288**	**3,195**	**3,889**	**4,372**	**4,613**	**4,775**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	803	1,128	1,247	1,333	1,443	1,379
Unconventional Gas Activity**	912	1,267	1,668	1,944	2,014	2,200
Shale Gas Activity	638	842	1,136	1,362	1,381	1,433
Tight Gas Activity	274	425	532	581	633	767
Total Unconventional Activity	**1,715**	**2,395**	**2,915**	**3,277**	**3,457**	**3,579**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Transit & Ground Passenger Transport (NAICS 485)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,769	3,941	4,374	4,629	4,873	4,575
Unconventional Gas Activity**	2,973	4,252	5,367	6,225	6,417	6,908
Shale Gas Activity	2,000	2,772	3,590	4,315	4,418	4,584
Tight Gas Activity	973	1,480	1,777	1,910	1,999	2,324
Total Unconventional Activity	**5,742**	**8,193**	**9,741**	**10,854**	**11,290**	**11,483**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	100	143	158	167	176	166
Unconventional Gas Activity**	108	154	194	225	232	250
Shale Gas Activity	72	100	130	156	160	166
Tight Gas Activity	35	54	64	69	72	84
Total Unconventional Activity	**208**	**296**	**352**	**393**	**408**	**415**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	70	100	111	117	124	116
Unconventional Gas Activity**	75	108	136	158	163	175
Shale Gas Activity	51	70	91	109	112	116
Tight Gas Activity	25	38	45	48	51	59
Total Unconventional Activity	**146**	**208**	**247**	**275**	**286**	**291**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Pipeline Transportation (NAICS 486)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	516	769	883	905	901	819
Unconventional Gas Activity**	528	811	1,003	1,166	1,196	1,263
Shale Gas Activity	347	538	679	822	851	878
Tight Gas Activity	181	273	324	344	345	385
Total Unconventional Activity	**1,044**	**1,580**	**1,886**	**2,071**	**2,097**	**2,082**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	216	323	371	380	378	344
Unconventional Gas Activity**	222	341	421	489	502	531
Shale Gas Activity	146	226	285	345	357	369
Tight Gas Activity	76	115	136	144	145	162
Total Unconventional Activity	**438**	**663**	**792**	**870**	**880**	**874**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	150	223	257	263	262	238
Unconventional Gas Activity**	153	236	292	339	347	367
Shale Gas Activity	101	156	197	239	247	255
Tight Gas Activity	53	80	94	100	100	112
Total Unconventional Activity	**303**	**459**	**548**	**602**	**609**	**605**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Scenic & Sightseeing Transportation (NAICS 487)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,938	4,184	4,646	4,918	5,181	4,869
Unconventional Gas Activity**	3,167	4,530	5,745	6,675	6,889	7,420
Shale Gas Activity	2,137	2,959	3,848	4,629	4,742	4,918
Tight Gas Activity	1,030	1,571	1,897	2,046	2,147	2,502
Total Unconventional Activity	**6,105**	**8,714**	**10,391**	**11,593**	**12,070**	**12,289**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	283	404	448	475	500	470
Unconventional Gas Activity**	306	437	554	644	665	716
Shale Gas Activity	206	286	371	447	458	475
Tight Gas Activity	99	152	183	197	207	241
Total Unconventional Activity	**589**	**841**	**1,003**	**1,119**	**1,165**	**1,186**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	217	309	344	364	383	360
Unconventional Gas Activity**	234	335	425	494	510	549
Shale Gas Activity	158	219	285	342	351	364
Tight Gas Activity	76	116	140	151	159	185
Total Unconventional Activity	**452**	**645**	**769**	**857**	**893**	**909**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Postal Service (NAICS 491)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,526	5,046	5,625	5,931	6,212	5,818
Unconventional Gas Activity**	3,791	5,455	6,898	8,000	8,244	8,870
Shale Gas Activity	2,556	3,576	4,637	5,574	5,705	5,915
Tight Gas Activity	1,235	1,879	2,261	2,426	2,539	2,955
Total Unconventional Activity	**7,317**	**10,501**	**12,523**	**13,931**	**14,456**	**14,688**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	261	373	416	439	459	430
Unconventional Gas Activity**	280	403	510	592	610	656
Shale Gas Activity	189	264	343	412	422	437
Tight Gas Activity	91	139	167	179	188	219
Total Unconventional Activity	**541**	**777**	**926**	**1,030**	**1,069**	**1,086**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	283	405	451	476	498	467
Unconventional Gas Activity**	304	437	553	642	661	711
Shale Gas Activity	205	287	372	447	457	474
Tight Gas Activity	99	151	181	195	204	237
Total Unconventional Activity	**587**	**842**	**1,004**	**1,117**	**1,159**	**1,178**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Couriers & Messengers (NAICS 492)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	4,220	6,047	6,752	7,120	7,457	6,985
Unconventional Gas Activity**	4,538	6,539	8,293	9,627	9,925	10,678
Shale Gas Activity	3,060	4,286	5,574	6,704	6,864	7,117
Tight Gas Activity	1,478	2,253	2,719	2,923	3,061	3,561
Total Unconventional Activity	**8,758**	**12,586**	**15,045**	**16,747**	**17,382**	**17,663**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	282	404	451	476	498	467
Unconventional Gas Activity**	303	437	554	643	663	713
Shale Gas Activity	204	286	372	448	459	475
Tight Gas Activity	99	150	182	195	204	238
Total Unconventional Activity	**585**	**841**	**1,005**	**1,119**	**1,161**	**1,180**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	173	248	277	292	306	286
Unconventional Gas Activity**	186	268	340	395	407	438
Shale Gas Activity	126	176	229	275	281	292
Tight Gas Activity	61	92	112	120	126	146
Total Unconventional Activity	**359**	**516**	**617**	**687**	**713**	**724**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Warehousing & Storage (NAICS 493)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,324	4,699	5,193	5,532	5,887	5,557
Unconventional Gas Activity**	3,585	5,075	6,428	7,439	7,667	8,281
Shale Gas Activity	2,412	3,289	4,284	5,138	5,245	5,450
Tight Gas Activity	1,173	1,786	2,144	2,301	2,422	2,831
Total Unconventional Activity	**6,909**	**9,774**	**11,621**	**12,971**	**13,554**	**13,838**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	224	317	350	373	397	374
Unconventional Gas Activity**	242	342	433	501	516	558
Shale Gas Activity	163	222	289	346	353	367
Tight Gas Activity	79	120	144	155	163	191
Total Unconventional Activity	**466**	**658**	**783**	**874**	**913**	**932**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	164	232	256	273	290	274
Unconventional Gas Activity**	177	250	317	367	378	409
Shale Gas Activity	119	162	211	254	259	269
Tight Gas Activity	58	88	106	114	120	140
Total Unconventional Activity	**341**	**482**	**574**	**640**	**669**	**683**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Publishing Industries (NAICS 511)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	3,856	5,533	6,183	6,509	6,785	6,329
Unconventional Gas Activity**	4,086	5,921	7,437	8,614	8,871	9,515
Shale Gas Activity	2,726	3,859	4,972	5,979	6,135	6,362
Tight Gas Activity	1,360	2,062	2,465	2,635	2,736	3,153
Total Unconventional Activity	**7,942**	**11,454**	**13,620**	**15,123**	**15,656**	**15,844**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	454	650	726	765	799	745
Unconventional Gas Activity**	480	694	872	1,010	1,040	1,116
Shale Gas Activity	319	451	582	700	718	745
Tight Gas Activity	160	243	290	310	322	371
Total Unconventional Activity	**933**	**1,344**	**1,598**	**1,775**	**1,838**	**1,861**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	293	420	469	494	516	481
Unconventional Gas Activity**	310	449	564	653	672	722
Shale Gas Activity	207	292	377	453	464	482
Tight Gas Activity	103	157	187	200	208	240
Total Unconventional Activity	**603**	**869**	**1,033**	**1,147**	**1,188**	**1,203**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Motion Picture & Sound Recording Industries (NAICS 512)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	2,060	2,962	3,312	3,484	3,625	3,381
Unconventional Gas Activity**	2,188	3,175	3,990	4,627	4,764	5,108
Shale Gas Activity	1,462	2,074	2,672	3,216	3,300	3,422
Tight Gas Activity	726	1,101	1,318	1,411	1,464	1,686
Total Unconventional Activity	**4,248**	**6,137**	**7,302**	**8,111**	**8,389**	**8,489**

Value Added

(2012 $M)

Unconventional Oil Activity*	215	310	346	364	379	353
Unconventional Gas Activity**	229	332	417	484	498	534
Shale Gas Activity	153	217	279	336	345	358
Tight Gas Activity	76	115	138	148	153	176
Total Unconventional Activity	**444**	**642**	**764**	**848**	**877**	**887**

Labor Income

(2012 $M)

Unconventional Oil Activity*	134	193	216	227	236	220
Unconventional Gas Activity**	143	207	260	301	310	333
Shale Gas Activity	95	135	174	210	215	223
Tight Gas Activity	47	72	86	92	95	110
Total Unconventional Activity	**277**	**400**	**476**	**528**	**546**	**553**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Broadcasting (except Internet) (NAICS 515)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,994	2,863	3,196	3,368	3,519	3,289
Unconventional Gas Activity**	2,123	3,071	3,860	4,469	4,600	4,936
Shale Gas Activity	1,419	2,002	2,582	3,103	3,181	3,299
Tight Gas Activity	704	1,069	1,278	1,366	1,419	1,637
Total Unconventional Activity	**4,117**	**5,934**	**7,056**	**7,837**	**8,119**	**8,225**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	447	642	717	755	789	737
Unconventional Gas Activity**	476	688	865	1,002	1,032	1,107
Shale Gas Activity	318	449	579	696	713	740
Tight Gas Activity	158	240	286	306	318	367
Total Unconventional Activity	**923**	**1,330**	**1,582**	**1,758**	**1,820**	**1,844**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	441	633	708	746	779	728
Unconventional Gas Activity**	470	679	854	989	1,018	1,092
Shale Gas Activity	314	443	571	687	704	730
Tight Gas Activity	156	237	283	302	314	362
Total Unconventional Activity	**911**	**1,313**	**1,562**	**1,735**	**1,797**	**1,820**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Telecommunications (NAICS 517)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	5,207	7,465	8,328	8,776	9,162	8,563
Unconventional Gas Activity**	5,547	8,019	10,086	11,697	12,047	12,931
Shale Gas Activity	3,714	5,233	6,750	8,121	8,329	8,637
Tight Gas Activity	1,833	2,786	3,336	3,576	3,718	4,294
Total Unconventional Activity	**10,754**	**15,484**	**18,414**	**20,473**	**21,209**	**21,494**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,260	1,806	2,015	2,123	2,217	2,072
Unconventional Gas Activity**	1,342	1,940	2,440	2,830	2,915	3,128
Shale Gas Activity	898	1,266	1,633	1,965	2,015	2,090
Tight Gas Activity	444	674	807	865	900	1,039
Total Unconventional Activity	**2,602**	**3,747**	**4,455**	**4,953**	**5,132**	**5,201**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	467	669	746	786	821	767
Unconventional Gas Activity**	497	719	904	1,048	1,079	1,159
Shale Gas Activity	333	469	605	728	746	774
Tight Gas Activity	164	250	299	320	333	385
Total Unconventional Activity	**964**	**1,387**	**1,650**	**1,834**	**1,900**	**1,926**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Internet Service Providers, Web Search Portals, & Data Processing Services (NAICS 518)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,140	1,641	1,836	1,929	2,004	1,869
Unconventional Gas Activity**	1,211	1,761	2,210	2,563	2,640	2,829
Shale Gas Activity	809	1,151	1,481	1,782	1,830	1,897
Tight Gas Activity	402	610	729	781	810	932
Total Unconventional Activity	**2,351**	**3,402**	**4,046**	**4,492**	**4,644**	**4,698**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	135	194	218	229	237	221
Unconventional Gas Activity**	143	209	262	304	313	335
Shale Gas Activity	96	136	175	211	217	225
Tight Gas Activity	48	72	86	93	96	110
Total Unconventional Activity	**278**	**403**	**479**	**532**	**550**	**556**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	90	130	145	153	159	148
Unconventional Gas Activity**	96	139	175	203	209	224
Shale Gas Activity	64	91	117	141	145	150
Tight Gas Activity	32	48	58	62	64	74
Total Unconventional Activity	**186**	**269**	**321**	**356**	**368**	**372**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Other Information Services (NAICS 519)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,404	2,037	2,292	2,397	2,469	2,289
Unconventional Gas Activity**	1,476	2,174	2,720	3,155	3,246	3,466
Shale Gas Activity	982	1,423	1,825	2,199	2,261	2,342
Tight Gas Activity	494	751	895	956	985	1,124
Total Unconventional Activity	**2,880**	**4,211**	**5,012**	**5,552**	**5,715**	**5,755**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	413	599	674	705	727	674
Unconventional Gas Activity**	435	639	801	929	955	1,021
Shale Gas Activity	289	419	537	647	665	689
Tight Gas Activity	146	221	264	282	290	332
Total Unconventional Activity	**848**	**1,238**	**1,475**	**1,634**	**1,682**	**1,695**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	139	201	227	237	244	226
Unconventional Gas Activity**	146	215	269	312	321	343
Shale Gas Activity	97	141	180	217	224	232
Tight Gas Activity	49	74	89	95	97	111
Total Unconventional Activity	**285**	**416**	**496**	**549**	**565**	**569**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Monetary Authorities, Central Bank (NAICS 521)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	10,166	14,634	16,368	17,193	17,851	16,636
Unconventional Gas Activity**	10,798	15,711	19,743	22,929	23,624	25,314
Shale Gas Activity	7,227	10,281	13,234	15,944	16,381	16,974
Tight Gas Activity	3,571	5,430	6,509	6,985	7,243	8,340
Total Unconventional Activity	**20,964**	**30,345**	**36,111**	**40,122**	**41,475**	**41,950**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	2,026	2,916	3,261	3,426	3,557	3,315
Unconventional Gas Activity**	2,152	3,130	3,934	4,569	4,707	5,044
Shale Gas Activity	1,440	2,049	2,637	3,177	3,264	3,382
Tight Gas Activity	712	1,082	1,297	1,392	1,443	1,662
Total Unconventional Activity	**4,177**	**6,046**	**7,195**	**7,994**	**8,264**	**8,359**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	772	1,112	1,244	1,306	1,356	1,264
Unconventional Gas Activity**	821	1,194	1,500	1,742	1,795	1,923
Shale Gas Activity	549	781	1,005	1,211	1,245	1,290
Tight Gas Activity	271	413	495	531	550	634
Total Unconventional Activity	**1,593**	**2,305**	**2,744**	**3,048**	**3,151**	**3,187**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Credit Intermediation & Related Activities (NAICS 522)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	5,392	7,752	8,666	9,112	9,474	8,835
Unconventional Gas Activity**	5,726	8,320	10,457	12,137	12,503	13,404
Shale Gas Activity	3,830	5,438	7,004	8,435	8,661	8,978
Tight Gas Activity	1,896	2,882	3,453	3,702	3,842	4,426
Total Unconventional Activity	**11,118**	**16,072**	**19,123**	**21,249**	**21,977**	**22,239**

Value Added

(2012 $M)

Unconventional Oil Activity*	798	1,147	1,282	1,348	1,402	1,307
Unconventional Gas Activity**	847	1,231	1,547	1,795	1,850	1,983
Shale Gas Activity	567	804	1,036	1,248	1,281	1,328
Tight Gas Activity	280	426	511	548	568	655
Total Unconventional Activity	**1,645**	**2,377**	**2,829**	**3,143**	**3,251**	**3,290**

Labor Income

(2012 $M)

Unconventional Oil Activity*	512	736	822	865	899	838
Unconventional Gas Activity**	543	789	992	1,152	1,187	1,272
Shale Gas Activity	364	516	665	800	822	852
Tight Gas Activity	180	273	328	351	365	420
Total Unconventional Activity	**1,055**	**1,525**	**1,815**	**2,016**	**2,086**	**2,110**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Securities, Commodity Contracts, & Other Financial Investments & Related Activities (NAICS 523)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	11,246	16,020	17,775	18,815	19,800	18,602
Unconventional Gas Activity**	12,087	17,310	21,872	25,401	26,207	28,195
Shale Gas Activity	8,137	11,288	14,621	17,591	18,032	18,702
Tight Gas Activity	3,950	6,022	7,251	7,810	8,175	9,493
Total Unconventional Activity	**23,333**	**33,330**	**39,647**	**44,216**	**46,007**	**46,797**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,483	2,113	2,344	2,482	2,612	2,453
Unconventional Gas Activity**	1,594	2,283	2,885	3,350	3,457	3,719
Shale Gas Activity	1,073	1,489	1,928	2,320	2,378	2,467
Tight Gas Activity	521	794	956	1,030	1,078	1,252
Total Unconventional Activity	**3,078**	**4,396**	**5,229**	**5,832**	**6,068**	**6,172**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,456	2,074	2,302	2,436	2,564	2,409
Unconventional Gas Activity**	1,565	2,241	2,832	3,289	3,394	3,651
Shale Gas Activity	1,054	1,462	1,893	2,278	2,335	2,422
Tight Gas Activity	512	780	939	1,011	1,059	1,229
Total Unconventional Activity	**3,021**	**4,316**	**5,134**	**5,725**	**5,957**	**6,060**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Insurance Carriers & Related Activities (NAICS 524)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	14,732	21,017	23,349	24,802	26,116	24,563
Unconventional Gas Activity**	15,644	22,569	28,590	33,345	34,503	36,989
Shale Gas Activity	10,437	14,573	18,889	22,816	23,551	24,417
Tight Gas Activity	5,207	7,996	9,701	10,529	10,952	12,572
Total Unconventional Activity	**30,376**	**43,586**	**51,939**	**58,147**	**60,619**	**61,552**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,930	2,753	3,058	3,249	3,422	3,219
Unconventional Gas Activity**	2,050	2,957	3,746	4,369	4,521	4,847
Shale Gas Activity	1,367	1,909	2,474	2,989	3,085	3,199
Tight Gas Activity	682	1,048	1,272	1,380	1,436	1,648
Total Unconventional Activity	**3,980**	**5,710**	**6,804**	**7,618**	**7,943**	**8,066**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,186	1,692	1,880	1,997	2,103	1,978
Unconventional Gas Activity**	1,260	1,817	2,302	2,685	2,779	2,979
Shale Gas Activity	841	1,173	1,521	1,837	1,896	1,966
Tight Gas Activity	419	644	781	848	882	1,013
Total Unconventional Activity	**2,446**	**3,510**	**4,182**	**4,682**	**4,882**	**4,957**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Funds, Trusts, & Other Financial Vehicles (NAICS 525)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,262	1,821	2,042	2,141	2,215	2,060
Unconventional Gas Activity**	1,335	1,951	2,448	2,844	2,929	3,133
Shale Gas Activity	891	1,277	1,640	1,978	2,034	2,107
Tight Gas Activity	444	674	808	866	895	1,026
Total Unconventional Activity	**2,597**	**3,772**	**4,490**	**4,985**	**5,144**	**5,193**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	64	93	104	109	113	105
Unconventional Gas Activity**	68	99	125	145	149	160
Shale Gas Activity	45	65	84	101	104	107
Tight Gas Activity	23	34	41	44	46	52
Total Unconventional Activity	**132**	**192**	**229**	**254**	**262**	**265**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	103	148	166	175	181	168
Unconventional Gas Activity**	109	159	200	232	239	255
Shale Gas Activity	73	104	134	161	166	172
Tight Gas Activity	36	55	66	71	73	84
Total Unconventional Activity	**212**	**308**	**366**	**406**	**419**	**423**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Real Estate (NAICS 531)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	30,270	43,663	48,937	51,345	53,194	49,496
Unconventional Gas Activity**	32,043	46,768	58,723	68,168	70,204	75,167
Shale Gas Activity	21,397	30,595	39,354	47,414	48,728	50,494
Tight Gas Activity	10,646	16,173	19,369	20,754	21,476	24,673
Total Unconventional Activity	**62,313**	**90,431**	**107,660**	**119,513**	**123,398**	**124,663**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	4,203	6,063	6,795	7,130	7,386	6,873
Unconventional Gas Activity**	4,449	6,494	8,154	9,466	9,748	10,438
Shale Gas Activity	2,971	4,248	5,465	6,584	6,766	7,012
Tight Gas Activity	1,478	2,246	2,690	2,882	2,982	3,426
Total Unconventional Activity	**8,653**	**12,557**	**14,950**	**16,595**	**17,135**	**17,311**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	887	1,279	1,434	1,504	1,559	1,450
Unconventional Gas Activity**	939	1,370	1,721	1,997	2,057	2,202
Shale Gas Activity	627	896	1,153	1,389	1,428	1,479
Tight Gas Activity	312	474	568	608	629	723
Total Unconventional Activity	**1,826**	**2,650**	**3,154**	**3,502**	**3,616**	**3,653**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Rental & Leasing Services (NAICS 532)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	5,321	7,668	8,583	9,000	9,318	8,670
Unconventional Gas Activity**	5,640	8,228	10,329	12,007	12,373	13,246
Shale Gas Activity	3,772	5,391	6,926	8,353	8,589	8,899
Tight Gas Activity	1,868	2,837	3,403	3,654	3,784	4,347
Total Unconventional Activity	**10,961**	**15,896**	**18,912**	**21,007**	**21,691**	**21,916**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	596	861	964	1,010	1,043	969
Unconventional Gas Activity**	631	924	1,159	1,347	1,389	1,486
Shale Gas Activity	422	606	778	938	966	1,000
Tight Gas Activity	209	318	381	409	423	486
Total Unconventional Activity	**1,228**	**1,785**	**2,123**	**2,357**	**2,432**	**2,455**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	332	480	537	563	582	540
Unconventional Gas Activity**	352	515	646	751	774	828
Shale Gas Activity	235	338	433	523	538	557
Tight Gas Activity	117	177	212	228	236	271
Total Unconventional Activity	**684**	**995**	**1,183**	**1,314**	**1,356**	**1,368**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Lessors of Nonfinancial Intangible Assets (except Copyrighted Works) (NAICS 533)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	2,068	3,152	3,677	3,723	3,607	3,222
Unconventional Gas Activity**	2,057	3,271	3,995	4,632	4,732	4,951
Shale Gas Activity	1,325	2,174	2,711	3,287	3,417	3,523
Tight Gas Activity	732	1,097	1,284	1,345	1,315	1,428
Total Unconventional Activity	**4,125**	**6,423**	**7,672**	**8,355**	**8,339**	**8,173**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	3,153	4,806	5,606	5,677	5,501	4,913
Unconventional Gas Activity**	3,135	4,989	6,092	7,065	7,217	7,550
Shale Gas Activity	2,020	3,316	4,134	5,012	5,212	5,373
Tight Gas Activity	1,115	1,672	1,958	2,052	2,006	2,177
Total Unconventional Activity	**6,289**	**9,795**	**11,699**	**12,742**	**12,719**	**12,463**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	285	434	506	513	497	444
Unconventional Gas Activity**	283	450	550	638	652	682
Shale Gas Activity	182	299	373	453	471	485
Tight Gas Activity	101	151	177	185	181	197
Total Unconventional Activity	**568**	**884**	**1,056**	**1,150**	**1,148**	**1,125**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Professional, Scientific, & Technical Services (NAICS 541)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	68,535	98,418	110,332	116,488	121,821	113,832
Unconventional Gas Activity**	72,667	105,412	133,587	155,190	160,110	171,885
Shale Gas Activity	48,540	68,547	88,972	107,208	110,186	114,346
Tight Gas Activity	24,127	36,865	44,615	47,982	49,924	57,539
Total Unconventional Activity	**141,202**	**203,830**	**243,919**	**271,678**	**281,931**	**285,717**

Value Added

(2012 $M)

Unconventional Oil Activity*	6,840	9,828	11,018	11,624	12,142	11,340
Unconventional Gas Activity**	7,250	10,524	13,318	15,466	15,950	17,118
Shale Gas Activity	4,841	6,848	8,877	10,695	10,990	11,403
Tight Gas Activity	2,408	3,676	4,441	4,771	4,960	5,715
Total Unconventional Activity	**14,090**	**20,352**	**24,336**	**27,090**	**28,092**	**28,458**

Labor Income

(2012 $M)

Unconventional Oil Activity*	5,637	8,097	9,080	9,584	10,018	9,359
Unconventional Gas Activity**	5,975	8,671	10,989	12,766	13,171	14,138
Shale Gas Activity	3,991	5,640	7,320	8,821	9,067	9,409
Tight Gas Activity	1,984	3,031	3,669	3,946	4,104	4,730
Total Unconventional Activity	**11,611**	**16,769**	**20,070**	**22,351**	**23,189**	**23,497**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Management of Companies & Enterprises (NAICS 55)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	16,548	23,990	27,006	28,252	29,136	27,039
Unconventional Gas Activity**	17,473	25,658	32,196	37,339	38,411	41,081
Shale Gas Activity	11,651	16,823	21,628	26,050	26,764	27,725
Tight Gas Activity	5,822	8,835	10,568	11,289	11,647	13,356
Total Unconventional Activity	**34,021**	**49,648**	**59,202**	**65,591**	**67,547**	**68,120**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	2,713	3,932	4,427	4,631	4,776	4,432
Unconventional Gas Activity**	2,864	4,206	5,277	6,120	6,296	6,734
Shale Gas Activity	1,910	2,757	3,545	4,270	4,387	4,544
Tight Gas Activity	954	1,448	1,732	1,850	1,909	2,189
Total Unconventional Activity	**5,577**	**8,138**	**9,704**	**10,751**	**11,072**	**11,166**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	2,024	2,934	3,303	3,455	3,563	3,307
Unconventional Gas Activity**	2,137	3,138	3,938	4,567	4,698	5,024
Shale Gas Activity	1,425	2,058	2,645	3,186	3,273	3,391
Tight Gas Activity	712	1,081	1,292	1,381	1,424	1,634
Total Unconventional Activity	**4,161**	**6,072**	**7,241**	**8,022**	**8,261**	**8,331**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Administrative & Support Services (NAICS 561)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	51,554	73,705	82,108	86,723	90,901	85,127
Unconventional Gas Activity**	55,026	79,243	99,979	115,989	119,561	128,494
Shale Gas Activity	36,876	51,629	66,810	80,376	82,416	85,498
Tight Gas Activity	18,150	27,614	33,169	35,613	37,145	42,996
Total Unconventional Activity	**106,580**	**152,948**	**182,087**	**202,712**	**210,462**	**213,621**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	2,238	3,198	3,563	3,763	3,945	3,695
Unconventional Gas Activity**	2,389	3,439	4,339	5,033	5,188	5,576
Shale Gas Activity	1,601	2,241	2,899	3,488	3,576	3,710
Tight Gas Activity	788	1,198	1,439	1,545	1,612	1,866
Total Unconventional Activity	**4,626**	**6,637**	**7,901**	**8,796**	**9,133**	**9,271**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,770	2,530	2,819	2,977	3,121	2,922
Unconventional Gas Activity**	1,889	2,720	3,432	3,981	4,104	4,411
Shale Gas Activity	1,266	1,772	2,293	2,759	2,829	2,935
Tight Gas Activity	623	948	1,139	1,222	1,275	1,476
Total Unconventional Activity	**3,659**	**5,251**	**6,251**	**6,959**	**7,225**	**7,333**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Waste Management & Remediation Service (NAICS 562)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	1,584	2,260	2,510	2,651	2,782	2,608
Unconventional Gas Activity**	1,700	2,441	3,081	3,578	3,689	3,969
Shale Gas Activity	1,144	1,595	2,063	2,483	2,544	2,639
Tight Gas Activity	556	846	1,018	1,095	1,145	1,330
Total Unconventional Activity	**3,284**	**4,701**	**5,591**	**6,229**	**6,471**	**6,577**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	169	241	268	283	297	278
Unconventional Gas Activity**	181	260	328	381	393	423
Shale Gas Activity	122	170	220	265	271	281
Tight Gas Activity	59	90	108	117	122	142
Total Unconventional Activity	**350**	**501**	**596**	**664**	**690**	**701**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	106	151	167	177	185	174
Unconventional Gas Activity**	113	163	205	238	246	265
Shale Gas Activity	76	106	137	165	170	176
Tight Gas Activity	37	56	68	73	76	89
Total Unconventional Activity	**219**	**313**	**373**	**415**	**431**	**438**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Educational Services (NAICS 611)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	12,856	18,568	20,824	21,817	22,552	20,957
Unconventional Gas Activity**	13,595	19,885	24,940	28,956	29,820	31,911
Shale Gas Activity	9,078	13,026	16,730	20,162	20,729	21,476
Tight Gas Activity	4,517	6,859	8,210	8,794	9,091	10,435
Total Unconventional Activity	**26,451**	**38,453**	**45,764**	**50,773**	**52,372**	**52,868**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	488	704	790	827	855	795
Unconventional Gas Activity**	516	754	946	1,098	1,131	1,210
Shale Gas Activity	344	494	635	765	786	814
Tight Gas Activity	171	260	311	334	345	396
Total Unconventional Activity	**1,003**	**1,458**	**1,736**	**1,926**	**1,986**	**2,005**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	444	641	718	753	778	723
Unconventional Gas Activity**	469	686	861	999	1,029	1,101
Shale Gas Activity	313	449	577	696	715	741
Tight Gas Activity	156	237	283	303	314	360
Total Unconventional Activity	**913**	**1,327**	**1,579**	**1,752**	**1,807**	**1,824**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Ambulatory Health Care Services (NAICS 621)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	25,136	36,242	40,596	42,582	44,106	41,037
Unconventional Gas Activity**	26,629	38,847	48,766	56,620	58,319	62,451
Shale Gas Activity	17,797	25,432	32,700	39,400	40,491	41,957
Tight Gas Activity	8,832	13,415	16,066	17,220	17,828	20,494
Total Unconventional Activity	**51,765**	**75,089**	**89,362**	**99,202**	**102,425**	**103,488**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	2,187	3,153	3,531	3,704	3,837	3,570
Unconventional Gas Activity**	2,317	3,379	4,242	4,925	5,073	5,433
Shale Gas Activity	1,548	2,212	2,845	3,427	3,522	3,650
Tight Gas Activity	768	1,167	1,398	1,498	1,551	1,783
Total Unconventional Activity	**4,503**	**6,532**	**7,773**	**8,630**	**8,910**	**9,003**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,736	2,503	2,804	2,941	3,047	2,835
Unconventional Gas Activity**	1,839	2,683	3,368	3,911	4,028	4,314
Shale Gas Activity	1,229	1,757	2,259	2,721	2,797	2,898
Tight Gas Activity	610	927	1,110	1,189	1,231	1,416
Total Unconventional Activity	**3,576**	**5,186**	**6,172**	**6,852**	**7,075**	**7,148**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Hospitals (NAICS 622)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	16,385	23,621	26,455	27,753	28,753	26,756
Unconventional Gas Activity**	17,363	25,321	31,789	36,910	38,018	40,714
Shale Gas Activity	11,605	16,576	21,315	25,683	26,393	27,348
Tight Gas Activity	5,758	8,745	10,474	11,227	11,625	13,366
Total Unconventional Activity	**33,748**	**48,942**	**58,244**	**64,663**	**66,771**	**67,470**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,139	1,642	1,839	1,929	1,999	1,860
Unconventional Gas Activity**	1,207	1,760	2,210	2,566	2,643	2,831
Shale Gas Activity	807	1,152	1,482	1,786	1,835	1,901
Tight Gas Activity	400	608	728	781	808	929
Total Unconventional Activity	**2,346**	**3,403**	**4,049**	**4,495**	**4,642**	**4,691**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	1,085	1,564	1,751	1,837	1,903	1,771
Unconventional Gas Activity**	1,149	1,676	2,104	2,443	2,517	2,695
Shale Gas Activity	768	1,097	1,411	1,700	1,747	1,810
Tight Gas Activity	381	579	693	743	770	885
Total Unconventional Activity	**2,234**	**3,240**	**3,856**	**4,281**	**4,420**	**4,467**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Nursing & Residential Care Facilities (NAICS 623)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	11,140	16,066	17,999	18,877	19,547	18,184
Unconventional Gas Activity**	11,799	17,218	21,612	25,094	25,846	27,674
Shale Gas Activity	7,885	11,273	14,493	17,464	17,948	18,597
Tight Gas Activity	3,914	5,945	7,119	7,630	7,898	9,077
Total Unconventional Activity	**22,939**	**33,284**	**39,611**	**43,971**	**45,393**	**45,858**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	398	574	643	675	699	650
Unconventional Gas Activity**	422	615	772	897	924	989
Shale Gas Activity	282	403	518	624	641	665
Tight Gas Activity	140	212	254	273	282	324
Total Unconventional Activity	**820**	**1,190**	**1,416**	**1,572**	**1,622**	**1,639**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	384	554	620	651	674	627
Unconventional Gas Activity**	407	593	745	865	891	954
Shale Gas Activity	272	389	499	602	619	641
Tight Gas Activity	135	205	245	263	272	313
Total Unconventional Activity	**791**	**1,147**	**1,365**	**1,515**	**1,564**	**1,580**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Social Assistance (NAICS 624)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	14,047	20,275	22,729	23,825	24,644	22,911
Unconventional Gas Activity**	14,865	21,721	27,251	31,641	32,587	34,880
Shale Gas Activity	9,929	14,225	18,278	22,027	22,643	23,460
Tight Gas Activity	4,936	7,496	8,973	9,614	9,944	11,420
Total Unconventional Activity	**28,912**	**41,996**	**49,980**	**55,466**	**57,231**	**57,791**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	374	540	606	635	657	610
Unconventional Gas Activity**	396	579	726	843	868	929
Shale Gas Activity	265	379	487	587	603	625
Tight Gas Activity	132	200	239	256	265	304
Total Unconventional Activity	**770**	**1,119**	**1,332**	**1,478**	**1,525**	**1,540**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	310	448	502	526	544	506
Unconventional Gas Activity**	328	480	602	699	719	770
Shale Gas Activity	219	314	404	486	500	518
Tight Gas Activity	109	165	198	212	220	252
Total Unconventional Activity	**638**	**927**	**1,103**	**1,225**	**1,264**	**1,276**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Performing Arts, Spectator Sports, & Related Industries (NAICS 711)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	6,777	9,734	10,876	11,444	11,922	11,128
Unconventional Gas Activity**	7,208	10,448	13,135	15,238	15,693	16,834
Shale Gas Activity	4,822	6,824	8,796	10,588	10,864	11,264
Tight Gas Activity	2,386	3,624	4,339	4,650	4,829	5,570
Total Unconventional Activity	**13,985**	**20,182**	**24,011**	**26,682**	**27,615**	**27,962**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	256	367	409	431	450	420
Unconventional Gas Activity**	272	394	495	574	592	635
Shale Gas Activity	182	257	332	399	409	424
Tight Gas Activity	90	137	164	175	182	211
Total Unconventional Activity	**528**	**761**	**905**	**1,006**	**1,042**	**1,055**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	203	291	324	342	356	333
Unconventional Gas Activity**	216	312	392	455	469	503
Shale Gas Activity	144	204	263	316	324	336
Tight Gas Activity	71	108	130	139	145	167
Total Unconventional Activity	**418**	**603**	**717**	**797**	**825**	**836**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Museums, Historical Sites, & Similar Institution (NAICS 712)

Employment

(Number of workers)

	2012	2015	2020	2025	2030	2035
Unconventional Oil Activity*	453	654	733	768	795	739
Unconventional Gas Activity**	479	701	878	1,020	1,051	1,124
Shale Gas Activity	320	459	589	710	730	756
Tight Gas Activity	159	242	289	310	321	368
Total Unconventional Activity	**932**	**1,355**	**1,611**	**1,788**	**1,846**	**1,863**

Value Added

(2012 $M)

Unconventional Oil Activity*	30	43	48	51	52	49
Unconventional Gas Activity**	32	46	58	67	69	74
Shale Gas Activity	21	30	39	47	48	50
Tight Gas Activity	10	16	19	20	21	24
Total Unconventional Activity	**61**	**89**	**106**	**118**	**121**	**123**

Labor Income

(2012 $M)

Unconventional Oil Activity*	26	37	42	44	45	42
Unconventional Gas Activity**	27	40	50	58	60	64
Shale Gas Activity	18	26	33	40	41	43
Tight Gas Activity	9	14	16	18	18	21
Total Unconventional Activity	**53**	**77**	**91**	**102**	**105**	**106**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Amusement, Gambling, & Recreation Industries (NAICS 713)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	7,703	11,090	12,410	13,029	13,523	12,594
Unconventional Gas Activity**	8,172	11,896	14,941	17,345	17,863	19,142
Shale Gas Activity	5,465	7,784	10,016	12,066	12,392	12,843
Tight Gas Activity	2,707	4,112	4,925	5,279	5,471	6,299
Total Unconventional Activity	**15,875**	**22,986**	**27,351**	**30,374**	**31,386**	**31,736**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	382	550	616	647	670	623
Unconventional Gas Activity**	405	590	741	860	885	948
Shale Gas Activity	270	386	497	598	615	637
Tight Gas Activity	134	204	244	261	271	311
Total Unconventional Activity	**786**	**1,140**	**1,357**	**1,506**	**1,555**	**1,572**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	214	308	345	362	375	349
Unconventional Gas Activity**	227	330	415	481	496	531
Shale Gas Activity	152	216	278	335	344	356
Tight Gas Activity	75	114	137	146	152	175
Total Unconventional Activity	**440**	**638**	**759**	**843**	**871**	**880**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Accommodation (NAICS 721)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	6,525	9,320	10,366	10,947	11,476	10,753
Unconventional Gas Activity**	6,984	10,038	12,651	14,671	15,119	16,257
Shale Gas Activity	4,690	6,550	8,468	10,182	10,432	10,822
Tight Gas Activity	2,294	3,488	4,183	4,489	4,687	5,435
Total Unconventional Activity	**13,509**	**19,358**	**23,017**	**25,618**	**26,595**	**27,010**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	446	637	708	748	784	735
Unconventional Gas Activity**	477	686	864	1,003	1,033	1,111
Shale Gas Activity	321	448	579	696	713	739
Tight Gas Activity	157	238	286	307	320	372
Total Unconventional Activity	**923**	**1,323**	**1,573**	**1,750**	**1,817**	**1,846**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	248	354	393	416	436	408
Unconventional Gas Activity**	265	381	480	557	574	617
Shale Gas Activity	178	249	321	387	396	411
Tight Gas Activity	87	132	159	170	178	206
Total Unconventional Activity	**513**	**735**	**874**	**972**	**1,010**	**1,025**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Food Services & Drinking Places (NAICS 722)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	44,543	63,944	71,413	75,159	78,314	73,108
Unconventional Gas Activity**	47,402	68,675	86,394	100,254	103,290	110,816
Shale Gas Activity	31,739	44,870	57,856	69,648	71,479	74,108
Tight Gas Activity	15,663	23,805	28,538	30,606	31,811	36,708
Total Unconventional Activity	**91,945**	**132,619**	**157,807**	**175,413**	**181,604**	**183,924**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	1,396	2,004	2,238	2,356	2,454	2,291
Unconventional Gas Activity**	1,486	2,152	2,708	3,142	3,237	3,473
Shale Gas Activity	995	1,406	1,813	2,183	2,240	2,323
Tight Gas Activity	491	746	894	959	997	1,150
Total Unconventional Activity	**2,882**	**4,156**	**4,946**	**5,498**	**5,692**	**5,764**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	945	1,356	1,514	1,594	1,661	1,550
Unconventional Gas Activity**	1,005	1,456	1,832	2,126	2,190	2,350
Shale Gas Activity	673	952	1,227	1,477	1,516	1,572
Tight Gas Activity	332	505	605	649	675	778
Total Unconventional Activity	**1,950**	**2,812**	**3,346**	**3,720**	**3,851**	**3,900**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Repair & Maintenance (NAICS 811)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	12,049	17,208	19,118	20,182	21,128	19,779
Unconventional Gas Activity**	12,857	18,506	23,283	27,040	27,887	29,949
Shale Gas Activity	8,617	12,061	15,557	18,732	19,227	19,939
Tight Gas Activity	4,240	6,445	7,726	8,308	8,660	10,010
Total Unconventional Activity	**24,906**	**35,714**	**42,401**	**47,222**	**49,015**	**49,728**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	872	1,243	1,378	1,457	1,529	1,433
Unconventional Gas Activity**	932	1,338	1,684	1,955	2,017	2,168
Shale Gas Activity	625	871	1,124	1,353	1,389	1,440
Tight Gas Activity	307	467	560	602	629	727
Total Unconventional Activity	**1,804**	**2,580**	**3,062**	**3,412**	**3,546**	**3,601**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	501	715	793	838	879	823
Unconventional Gas Activity**	535	769	968	1,124	1,160	1,246
Shale Gas Activity	359	501	646	778	799	828
Tight Gas Activity	176	268	322	346	361	418
Total Unconventional Activity	**1,036**	**1,484**	**1,761**	**1,962**	**2,038**	**2,069**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Personal & Laundry Services (NAICS 812)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	8,264	11,907	13,332	13,990	14,504	13,501
Unconventional Gas Activity**	8,759	12,764	16,029	18,608	19,166	20,529
Shale Gas Activity	5,855	8,353	10,746	12,945	13,301	13,784
Tight Gas Activity	2,904	4,411	5,283	5,663	5,865	6,745
Total Unconventional Activity	**17,023**	**24,671**	**29,361**	**32,598**	**33,670**	**34,030**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	399	575	644	676	701	652
Unconventional Gas Activity**	423	617	774	899	926	991
Shale Gas Activity	283	403	519	625	642	666
Tight Gas Activity	140	213	255	273	283	326
Total Unconventional Activity	**822**	**1,192**	**1,418**	**1,574**	**1,626**	**1,643**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	209	301	337	354	367	342
Unconventional Gas Activity**	222	323	406	471	485	519
Shale Gas Activity	148	211	272	328	337	349
Tight Gas Activity	73	112	134	143	148	171
Total Unconventional Activity	**431**	**624**	**743**	**825**	**852**	**861**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Religious, Grantmaking, Civic, Professional, & Similar Organizations (NAICS 813)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	14,258	20,599	23,108	24,210	25,019	23,250
Unconventional Gas Activity**	15,073	22,050	27,656	32,109	33,064	35,376
Shale Gas Activity	10,060	14,441	18,548	22,354	22,984	23,812
Tight Gas Activity	5,013	7,609	9,108	9,755	10,080	11,564
Total Unconventional Activity	**29,331**	**42,649**	**50,764**	**56,319**	**58,083**	**58,626**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	372	537	603	632	653	607
Unconventional Gas Activity**	393	575	722	838	863	923
Shale Gas Activity	263	377	484	583	600	621
Tight Gas Activity	131	199	238	255	263	302
Total Unconventional Activity	**765**	**1,113**	**1,324**	**1,470**	**1,516**	**1,530**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	520	751	842	883	912	848
Unconventional Gas Activity**	549	804	1,008	1,171	1,205	1,290
Shale Gas Activity	367	526	676	815	838	868
Tight Gas Activity	183	277	332	356	367	422
Total Unconventional Activity	**1,069**	**1,555**	**1,851**	**2,053**	**2,118**	**2,137**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Private Households (NAICS 814)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	9,389	13,566	15,218	15,941	16,470	15,302
Unconventional Gas Activity**	9,927	14,525	18,215	21,149	21,779	23,302
Shale Gas Activity	6,627	9,515	12,220	14,728	15,143	15,688
Tight Gas Activity	3,300	5,010	5,995	6,421	6,636	7,614
Total Unconventional Activity	**19,316**	**28,091**	**33,433**	**37,090**	**38,249**	**38,604**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	82	119	133	140	144	134
Unconventional Gas Activity**	87	127	159	185	191	204
Shale Gas Activity	58	83	107	129	133	137
Tight Gas Activity	29	44	52	56	58	67
Total Unconventional Activity	**169**	**246**	**293**	**325**	**335**	**338**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	72	104	116	122	126	117
Unconventional Gas Activity**	76	111	139	162	166	178
Shale Gas Activity	51	73	93	113	116	120
Tight Gas Activity	25	38	46	49	51	58
Total Unconventional Activity	**148**	**215**	**255**	**283**	**292**	**295**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

US Lower 48 Economic Contribution Summary: Government Services (NAICS GOV)						
Employment						
(Number of workers)						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Unconventional Oil Activity*	5,680	8,145	9,091	9,570	9,981	9,326
Unconventional Gas Activity**	6,069	8,773	11,053	12,832	13,230	14,202
Shale Gas Activity	4,075	5,742	7,413	8,925	9,157	9,492
Tight Gas Activity	1,994	3,031	3,640	3,907	4,073	4,710
Total Unconventional Activity	**11,749**	**16,918**	**20,144**	**22,402**	**23,211**	**23,528**
Value Added						
(2012 $M)						
Unconventional Oil Activity*	511	734	820	862	897	837
Unconventional Gas Activity**	545	790	996	1,157	1,192	1,279
Shale Gas Activity	366	518	669	805	826	857
Tight Gas Activity	179	272	327	351	366	423
Total Unconventional Activity	**1,056**	**1,524**	**1,816**	**2,019**	**2,089**	**2,117**
Labor Income						
(2012 $M)						
Unconventional Oil Activity*	447	641	715	753	785	733
Unconventional Gas Activity**	477	690	870	1,010	1,041	1,117
Shale Gas Activity	320	452	584	702	721	747
Tight Gas Activity	157	238	286	307	320	370
Total Unconventional Activity	**924**	**1,331**	**1,585**	**1,762**	**1,826**	**1,851**

NOTES: Numbers may not sum due to rounding.

*Unconventional oil activity represents the production of oil and condensate and associated gas recovered from tight oil plays.

**Unconventional gas activity represents the production of gas and liquids recovered from shale gas and tight gas plays.

Source: IHS Global Insight

America's New Energy Future:
The Unconventional Oil and Gas Revolution and the US Economy

Volume 1 – National Economic Contributions

Appendix D. Economic Contribution Assessment Methodology and Model Documentation

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Appendix D. Economic Contribution Assessment Methodology and Model Documentation

Data Requirements and Assumptions

Data Requirements

IHS Global Insight compiled the data required to undertake an economic contribution assessment of unconventional oil and unconventional gas activities in the United States. The upstream, unconventional natural gas activity was segmented to distinguish the economic activity of shale gas and tight gas. The direct contributions of unconventional oil and gas activity, in terms of production and capital expenditures, were used as inputs to the IMPLAN model as well as the IHS Global Insight US Macroeconomic Model (US Macro Model). The models require average annual estimates for production and related activity metrics. The following sector activities were determined to be the major, direct contributors:

- oil and natural gas extraction
- oil and natural gas drilling
- support activities for oil and natural gas
- construction of facilities, related materials and machinery for hydraulic fracturing and completions, and construction of natural gas pipeline

The IMPLAN model required production values in dollar terms, whereas the US Macro Model's inputs were transformed into quadrillion British thermal units (Btus). Capital expenditure inputs for the IMPLAN model were in nominal dollars, whereas the US Macro Model inputs were in real 2005 dollars. Unconventional oil and gas production data were forecast for years 2012 to 2035 to generate a baseline scenario. The production levels were transformed into value of output using the IHS CERA Henry Hub price outlook. Capital expenditures and support services for drilling, completion, facilities, gathering and processing were provided in nominal dollars for the baseline outlook period.

We first present national-level unconventional oil and unconventional gas, respectively, for production quantities and values. Next, we present the mapping between the types of capital expenditures and the IMPLAN categories by type and capital expenditure for the same sectors.

For the IMPLAN model, forecasts of production were transformed into the value of output. Drilling capital expenditures and support services for oil and natural gas operations directly correspond to sectors within the model. The breakdown of completion, facilities, gathering and processing were mapped to the detailed categories of the IMPLAN model.

For the US Macro model, production forecasts were transformed into quadrillion Btus by using corresponding conversion ratios. Drilling, completion, facilities, and gathering capital expenditures were summed to represent total investment in non-residential structures for the mining and petroleum sector. This sector is a standalone investment category in the US Macro Model. All dollar estimates were converted to 2005-based estimates and input into the US Macro Model.

US Lower 48 Production, Prices, and Value of Production: Unconventional Oil and Unconventional Gas						
Unconventional Oil						
	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Production (Mbbl)	754,835	1,276,416	1,617,907	1,652,852	1,640,735	1,643,150
Value of Production (2012 $US Million)	71,740	98,718	144,867	154,724	151,834	142,642
Unconventional Gas						
Production (Bcf)	13,183	16,158	21,728	25,408	26,665	29,219
Value of Production (2012 $US Million)	33,881	70,608	90,390	113,066	126,127	148,142
WTI Price (2012 $US per bbl)	$95.04	$77.34	$89.54	$93.61	$92.54	$86.81
Henry Hub Price (2012 $US per Mcf)	$2.57	$4.37	$4.16	$4.45	$4.73	$5.07

Source: IHS CERA

Distribution of Capital Expenditure Categories by IMPLAN Sectors			
Capital Expenditure Categories	Percent of Category Expenditure	IMPLAN Sector	Description
DRILLING CAPEX			
Steel	21.00%	171	Steel product manufacturing from purchased steel
Consumables	21.00%	220	Cutting tool and machine tool accessory manufacturing
Rigs	21.00%	36	Construction of other new nonresidential structures
Rig labor	7.00%	28	Drilling oil and gas wells
Cement	8.10%	29	Support activities for oil and gas operations
	0.90%	160	Cement manufacturing
Well Wireline Services	12.00%	29	Support activities for oil and gas operations
Other	1.80%	369	Architectural, engineering, and related services
	1.80%	29	Support activities for oil and gas operations
	3.60%	357	Insurance carriers
	1.80%		LEASE PAYMENTS
COMPLETIONS CAPEX			
Equipment	5.25%	206	Mining and oil and gas field machinery manufacturing
	2.25%	226	Pump and pumping equipment manufacturing
	1.13%	227	Air and gas compressor manufacturing
	1.13%	201	Fabricated pipe and pipe fitting manufacturing
	5.25%	36	Construction of other new nonresidential structures
	9.00%	29	Support activities for oil and gas operations
Hydraulic Fracturing	7.22%	33	Water, sewage and other systems
Materials and Other	14.44%	26	Sand, gravel, clay, and ceramic and refractory minerals mining and quarrying
	7.22%	125	All other basic inorganic chemical manufacturing
	7.22%	121	Industrial gas manufacturing
	1.90%	335	Truck transportation
	5.00%	29	Support activities for oil and gas operations
	8.00%	28	Drilling oil and gas wells
Hydraulic Fracturing Rentals	5.00%	226	Pump and pumping equipment manufacturing
	5.00%	227	Air and gas compressor manufacturing
	1.00%	335	Truck transportation
	9.00%	206	Mining and oil and gas field machinery manufacturing
	5.00%	28	Drilling oil and gas wells
FACILITIES CAPEX			
Materials	17.50%	201	Fabricated pipe and pipe fitting manufacturing
	24.50%	189	Metal tank (heavy gauge) manufacturing
	7.00%	251	Industrial process variable instruments manufacturing
	10.50%	247	Other electronic component manufacturing
	7.00%	36	Construction of other new nonresidential structures
	3.50%	256	Other measuring and controlling device manufacturing
Fabrication	8.25%	206	Mining and oil and gas field machinery manufacturing
	8.25%	36	Construction of other new nonresidential structures
	1.63%	222	Turbine and turbine generator set units manufacturing
	3.63%	226	Pump and pumping equipment manufacturing
	1.63%	227	Air and gas compressor manufacturing
	1.63%	188	Power boiler and heat exchanger manufacturing
Project Management	5.00%	369	Architectural, engineering, and related services
GATHERING CAPEX			
Gathering capex	10.80%	201	Fabricated pipe and pipe fitting manufacturing
	23.60%	206	Mining and oil and gas field machinery manufacturing
	65.60%	227	Air and gas compressor manufacturing

Source: IHS Global Insight and IHS CERA

Macroeconomic Assumptions

The following macroeconomic assumptions and baseline forecasts are consistent with the baseline contribution assessment for unconventional oil and gas presented in the main body of the report.

Macroeconomic Inputs to the Model
Output: Annual growth of about 2.5% per year between now and 2042
US Population: Annual rate of 0.9%, reaching 412 million in 2042
Productivity: Growth of approximately 1.9% per year during 2012-2042
Unemployment: Settling around 5%
CPI inflation: Averaging around 2% per year, consumer confidence remains constant
Real oil prices remain near current levels, stablizing around 2030
Imports: 4.0% growth
Exports: 5.6% growth
Business fixed investment as a share of GDP will average 12.2%

Policy Inputs to the Model
The federal budget deficit, averages about 3.5% of GDP
Real increase in federal spending will average an annual growth rate of 0.6%
Federal outlays share of GDP will be about 24.7%
No change in corporate taxes, assumed at 35%
Federal funds rate will increase gradually, up to 4% and settling at about 2.0%

Inputs to the US Macro Model: Unconventional Oil and Gas	2012	2015	2020	2025	2030	2035
Production (Quad BTU)						
Unconventional Oil	4.2	7.7	9.8	10.0	10.1	10.1
Shale Gas	10.0	13.9	20.2	24.1	25.5	27.3
Tight Gas	4.4	5.3	7.2	7.8	8.4	8.7
Total	**18.6**	**26.9**	**37.2**	**41.9**	**44.0**	**46.1**
Mining and Petroleum Nonresidential Structures Investment (Current $M)	87,301	126,288	172,542	227,667	284,154	353,076

Source: IHS CERA and IHS Global Insight

Methodology

The economic contribution of all unconventional oil and gas activity can be traced through all industries that make up the US economy. In this section, we define key terms and the conceptual framework that underlie the impact analysis of these activities. IHS Global Insight has utilized a comprehensive approach in which we integrate both an industry model (IMPLAN) and a US Macro model to arrive at the total contributions. Documentation for these models is provided in a later section.

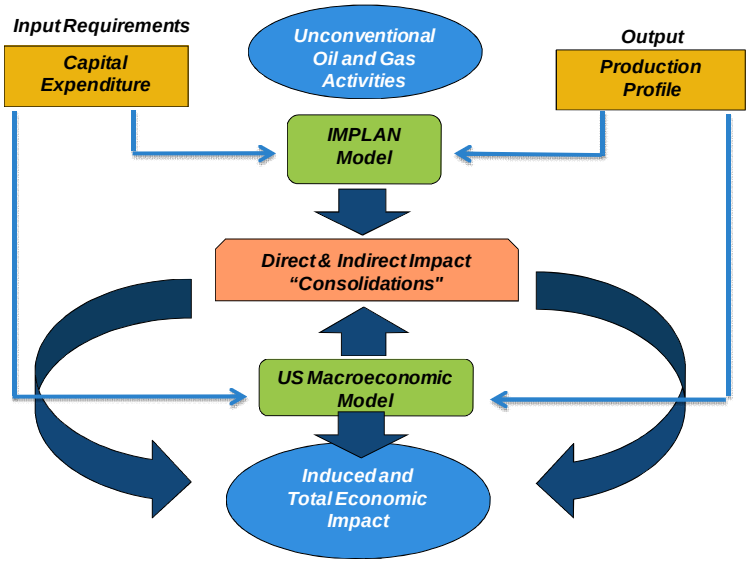
Integrated Approach

To utilize the strengths and avoid the weaknesses of various modeling systems, IHS Global Insight has taken the initiative to build an integrated methodology, using two sets of modeling systems. The methodology has captured the following important aspects:

- Determination of direct and indirect impacts by industry. The IMPLAN model has a very detailed and up-to-date input-output system, which traces the impact via the complete supplier chain through the US economy and its industrial sectors.
- IHS Global Insight's US Macro Model is an econometric dynamic equilibrium model that strives to incorporate the best insights of many theoretical approaches. This structure guarantees that short-run cyclical developments will converge to a robust long-run equilibrium solution. The Macro Model is the preferred modeling approach in evaluating the long-term income impacts of the shale gas sector.

Our methodology employed the outlook of production and capital expenditure results taken from IHS Energy Practice's research and evaluated the direct and indirect contribution via the IMPLAN model. The results were then incorporated into the US Macro Model to measure the expenditure-induced contribution

Enhanced Economic Impact Analysis Methodology Schematic



Modeling Objectives

The primary objective of this type of study is to present a complete account of how the impact of a policy or an industrial sector flows through the national industrial economy. IHS Global Insight used an internally consistent set of modeling and database capabilities to measure the impact on the US economy.

To summarize, any dollar of industrial revenue results in both direct and indirect repercussions on final demand. In theory, a reduction of production, with everything else constant, would lead to less revenue and output for industries that supply unconventional oil and unconventional gas activity, e.g., machinery equipment and professional services. This decline would also result in lower US demand for manufactured products such as pumps and compressors, which in turn would require fewer fabricated metal products. These repercussions are only a few in the complex chain that results from an isolated initial change in an industry.

Because unconventional oil and gas drilling and production use many different products and services, many of the three digit NAICS industries would be indirectly influenced by a change in these activities. The impact on these industries would have repercussions on all other producing industries, magnifying the indirect impact due to the supply-chain process.

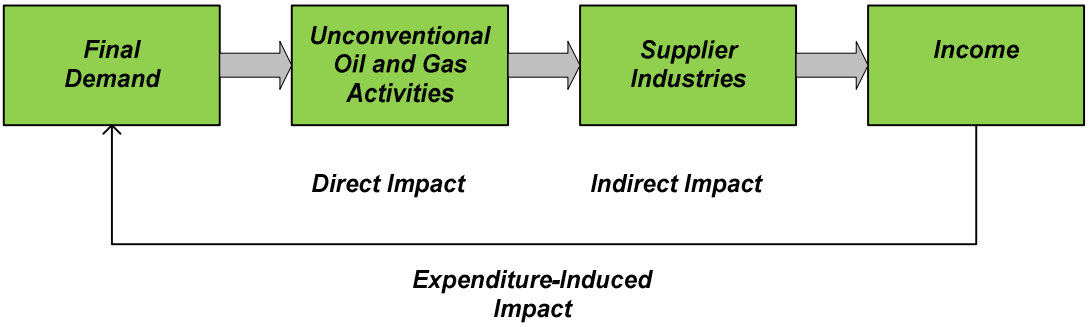
The net effects of these changes on the US industrial sectors due to the direct impact are divided into two stages: *indirect impact* and *expenditure-induced impact*.

The direct impact is the effect of an industrial sector on the core industry's output, employment, and income. A detailed industry model (the IMPLAN model) can evaluate that change in the context of a linked, comprehensive industrial structure for a given economy. For instance, the change in the value of production of unconventionals and the differential requirements of capital expenditures for drilling and facilities is the direct impact and was calculated for each selected forecast year starting with 2012. The production and capital expenditure requirements were provided for upstream including gathering and processing segments and were translated into the IMPLAN requirements. The mechanism through which these direct output values are analyzed in the context of input-output modeling is as an inputted "change."

The change in purchasing activities of an industry and its immediate impact on the 3 digit NAICS industries within mining, manufacturing, transportation, and other sectors leads to indirect effects on output, employment, and income that are attributable to those sectors, their suppliers, and suppliers' inter-industry linkages. Supplier activities will include the majority of industries in the US economy.

Lastly, because workers and their families in both the direct and indirect industries spend their income on food, housing, autos, household appliances, furniture, clothing, and other consumer items, additional output, employment, and income effects are part of the expenditure-induced impact.

The Flow of Economic Contribution



The direct and indirect impacts represent all of the production, marketing, and sales activities that are required to bring the primary products to the marketplace in a consumable form. The use of input-output analysis allows an analysis and quantification of indirect and indirect impacts. The sum of all impacts relative to the economy's total size provides initial benchmark estimates to evaluate the importance of a given industry.

The expenditure-induced impact represents the changes consumers make when their incomes are altered. To use a dynamic equilibrium model to measure this impact introduces a very solid modeling system of measurement and departs from the static input-output framework.

Methodology Implementation for this Study

For the direct and indirect impact, IHS Global Insight used the IMPLAN model to quantify the impact of the unconventional oil and unconventional gas activities on the US national and industrial economy. The IMPLAN model closely follows the accounting conventions used in the US Bureau of Economic Analysis's publication, *Input-Output Study of the U.S. Economy*, and is flexible enough to evaluate changes via the value of output or employment from the source industry. When possible, IHS Global Insight customized the inputs to the IMPLAN model to correspond with industry s capital expenditure requirements. This process allowed examination of the impacts of selected large elements of the unconventional upstream sector and of the interactions with other sectors.

For purposes of this study, IHS Global Insight enhanced the standard methodology of measuring the expenditure-induced impact and used its US Macro Model instead. The primary reason for this was to depart from the static determination of the income effect and rely on a more comprehensive dynamic equilibrium modeling methodology. The production and capital expenditure assumptions were inserted in the US Macro Model, and the resulting direct and indirect employment contributions, along with changes in target industry other property income, were linked to the IMPLAN model. The US Macro Model was then run to provide a robust determination of the induced contribution.

IMPLAN Model

The direct and indirect job estimates in this report were quantified through input-output modeling using the IMPLAN model. This modeling effort also produced estimates of value added and labor income related to direct and indirect jobs. This appendix provides additional information

about the IMPLAN model. The discussion is based in part on descriptions by Minnesota IMPLAN Group, Inc., (MIG), the model's sponsor.[1]

IMPLAN, short for "Impact Analysis for Planning," is a widely used commercially available model for input-output analysis. MIG is responsible for the production of the IMPLAN data, model, and software. Using classic input-output analysis in combination with regionally specific social accounting matrices and multiplier models, IMPLAN provides a highly accurate and adaptable model for its users. The IMPLAN system was designed to serve three functions:

- data retrieval
- data reduction and model development
- impact analysis

Comprehensive and detailed data coverage for the US economy and the ability to incorporate user-supplied data at each stage of the model-building process provide a high degree of flexibility in terms of both geographic coverage and model formulation. The IMPLAN system has two components: the databases and the software. The databases provide information needed to create IMPLAN models. The software performs the calculations and provides an interface for the user to make final demand changes.

The IMPLAN system includes:

- a national-level technology matrix
- estimates of sectoral activity for final demand, final payments, industry output, and employment for the United States

Input-output accounting describes commodity flows from producers to intermediates and final consumers. The total industry purchases of commodities, services, employment compensation, value added, and imports are equal to the value of the commodities produced.

Purchases for final use (final demand) drive the model. Industries produce goods and services for final demand and purchase goods and services from other producers. These other producers, in turn, purchase goods and services. This buying of goods and services (indirect purchases) continues until leakages from the region (imports and value added) stop the cycle.

These indirect and induced effects (the impact of household spending assessed from the IHS US Macro Model) can be mathematically derived. The derivation is called the Leontief inverse. The resulting sets of multipliers describe the change of output for every regional industry caused by a one dollar change in final demand for any given industry.

Creating regional input-output models requires a tremendous amount of data. The costs of surveying industries within each region to derive a list of commodity purchases production functions are prohibitive. IMPLAN was developed as a cost-effective means to develop regional input-output models.

IMPLAN easily allows the user to do the following:

- develop a complete Social Accounting Matrix (SAM) for a regional economy
- develop Multiplier models for predicting economic impacts
- modify components of the SAM including
    - industry-specific information such as employment and income values
    - production functions
    - by-products

[1] www.IMPLAN.com.

    - trade flows
- create custom impact analyses based on the nature of an event
- generate a wide variety of reports describing the social accounts, the multiplier model, and the direct, indirect, and induced effects of an economic event
- examine how the effects of economic impact in a single region ripple into surrounding regions
- view tax impacts of economic changes

IMPLAN Software

Minnesota IMPLAN Group developed the current version of IMPLAN Version 3.0 in 2009. It is a Windows-based software package that performs the calculations necessary to create the predictive model. The software reads the database and creates the complete set of SAMs and the input-output accounts. Next the IMPLAN software derives the predictive multipliers. The software enables the user to make changes to the data, the trade flows, or technology. It also enables the user to make final demand changes that result in the impact assessment.

Features of the IMPLAN Version 3.0 include:

- direct export to Excel for ease of report manipulation or printing
- advanced data editing functions with balancing features
- complete SAM
- a choice of trade-flow assumptions
    - IMPLAN National Trade Flows model
    - econometric regional purchase coefficients
    - supply/demand pooling
- libraries for storing custom activities and the ability to import already created IMPLAN libraries
- flexible model aggregation tools—allowing for aggregation of the model or the results
- single reports location—all results can be viewed, exported and printed from a single screen
- Study Area, Social Accounts, Industry Accounts, and Multiplier Reports demonstrating all stages of model building and analysis
- activity menu structure for easy intuitive impact analysis
- event-based impact databases
- built-in and editable margins and deflators
- model data in MS Access Database format

Database

For this project IHS Global Insight t used the 2008 IMPLAN databases. Each database contains information on the following components for each industrial sector in the IMPLAN model.

- **Employment** is total wages for salary jobs as well as self-employment jobs in the US economy.
- **Value added** is an industry's or an establishment's total output less the cost of intermediate inputs. Value added is further divided into three subcomponents:
    - **Labor income** captures all forms of employment income, including employee compensation (wages and benefits, employer-paid payroll taxes, unemployment

taxes, etc.) and proprietor income (payments received by self-employed individuals and unincorporated business owners).
    - **Other property type income** consists of payments from rents, royalties, and dividends. This includes payments to individuals in the form of rents received on property, royalties from contracts, and dividends paid by corporations. This also includes corporate profits earned by corporations.
    - **Indirect business taxes** consist primarily of excise and sales taxes paid by individuals to businesses. These taxes are collected during the normal operation of these businesses but do not include taxes on profit or income.
- **Final demand** includes goods and services purchased for their ultimate use by an end user. For a region this would include exports as that is a final use for that product. In an input-output framework final demands are allocated to producing industries, with margins allocated to the service sectors (transportation, wholesale and retail trade, insurance) associated with providing that good to the final user. Thus final demands are in producer prices, and the model provides them by components of gross domestic product (GDP).
- **Personal consumption expenditures (PCE)** consist of payments by individuals/households to industries for goods and services used for personal consumption. Individuals tend to buy little directly from industries other than retail trade. However, in an input-output table, purchases made by individuals for final consumption are shown as payments made directly to the industry producing the good. PCE is the largest component of final demand.
- **Federal government purchases** are divided among military purchases, nonmilitary uses, and capital formation. Federal military purchases are those made to support the national defense. Goods range from food for troops to missile launchers. Nonmilitary purchases are made to supply all other government functions. Payments made to other governmental units are transfers and are not included in federal government purchases.
- **State (provincial) and local government purchases** are divided among public education, non-education, and capital formation. Public education purchases are for elementary, high school, and higher education. Non-education purchases are for all other government activities. These include state (provincial) government operations, including police protection and sanitation. Private sector education purchases are not counted here. Private education purchases show up in IMPLAN sectors 495 and 496.
- **Inventory purchases** are made when industries do not sell all output created in one year, which is generally the case. Each year a portion of output goes to inventory. Inventory sales occur when industries sell more than they produce and need to deplete inventory. Inventory purchases and sales generally involve goods-producing industries (e.g., agriculture, mining, and manufacturing).
- **Capital formation** is private expenditures made to obtain capital equipment. The dollar values in the IMPLAN database are expenditures made to an industrial sector producing the capital equipment. The values are not expenditures by the industrial sector.
- **Foreign exports** are demands made to industries for goods for export beyond national borders. These represent goods and services demanded by foreign parties. Domestic exports are calculated during the IMPLAN model creation and are not part of the database.

IMPLAN Multipliers

The notion of a multiplier rests upon the difference between the initial effect of a change in final demand and the total effects of that change. Total effects can be calculated either as direct and indirect effects or as direct, indirect, and induced effects (via the IHS US Macro Model). Direct effects are production changes associated with the immediate effects or final demand changes. Indirect effects are production changes in backward-linked industries cause by the changing input needs of directly affected industries (for example, additional purchases to produce additional output). Induced effects are the changes in regional household spending patterns caused by changes in household income generated from the direct and indirect effects, which were assessed using the IHS US Macro Model.

For the US model used in this study, the IMPLAN model estimated Type I multipliers for direct, indirect, and induced impacts.

Type I Multipliers

A Type I multiplier is the direct effect produced by a change in final demand plus the indirect effect, divided by the direct effect. Increased demands are assumed to lead to increased employment and population, with the average income level remaining constant. The Leontief inverse (Type I multipliers matrix) is derived by inverting the direct coefficients matrix. The result is a matrix of total requirement coefficients, the amount each industry must produce in order for the purchasing industry to deliver one dollar's worth of output to final demand.

IHS Global Insight US Macroeconomic Model

The Model's Theoretical Position

As an econometric dynamic equilibrium growth model, the IHS Global Insight model strives to incorporate the best insights of many theoretical approaches to the business cycle: Keynesian, New Keynesian, neoclassical, monetarist, and supply-side. In addition the IHS Global Insight model embodies the major properties of the neoclassical growth models developed by Robert Solow. This structure guarantees that short-run cyclical developments will converge to robust long-run equilibrium.

In growth models the expansion rate of technical progress, the labor force, and the capital stock determine the productive potential of an economy. Both technical progress and the capital stock are governed by investment, which in turn must be in balance with post-tax capital costs, available savings, and the capacity requirements of current spending. As a result monetary and fiscal policies will influence both the short- and the long-term characteristics of such an economy through their impacts on national saving and investment.

A modern model of output, prices, and financial conditions is melded with the growth model to present the detailed, short-run dynamics of the economy. In specific goods markets the interactions of a set of supply and demand relations jointly determine spending, production, and price levels. Typically the level of inflation-adjusted demand is driven by prices, income, wealth, expectations, and financial conditions. The capacity to supply goods and services is keyed to a production function combining the basic inputs of labor hours, energy usage, and the capital stocks of business equipment and structures, and government infrastructure. The "total factor productivity" of this composite of tangible inputs is driven by expenditures on research and development (R&D) that produce technological progress.

Prices adjust in response to gaps between current production and supply potential and to changes in the cost of inputs. Wages adjust to labor supply-demand gaps (indicated by a demographically adjusted unemployment rate), current and expected inflation (with a unit long-run elasticity), productivity, tax rates, and minimum wage legislation. The supply of labor positively responds to the perceived availability of jobs, to the after-tax wage level, and to the growth and age-sex mix of the population. Demand for labor is keyed to the level of output in the economy and the productivity of labor, capital, and energy. Because the capital stock is largely fixed in the short run, a higher level of output requires more employment and energy inputs. Such increases are not necessarily equal to the percentage increase in output because of the improved efficiencies typically achieved during an upturn. Tempering the whole process of wage and price determination is the exchange rate; a rise signals prospective losses of jobs and markets unless costs and prices are reduced.

For financial markets the model predicts exchange rates, interest rates, stock prices, loans, and investments interactively with the preceding GDP and inflation variables. The Federal Reserve sets the supply of reserves in the banking system and the fractional reserve requirements for deposits. Private sector demands to hold deposits are driven by national income, expected inflation, and by the deposit interest yield relative to the yields offered on alternative investments. Banks and other thrift institutions, in turn, set deposit yields based on the market yields of their investment opportunities with comparable maturities and on the intensity of their need to expand reserves to meet legal requirements. In other words the contrast between the supply and demand for reserves sets the critical short-term interest rate for interbank transactions, the federal funds rate. Other interest rates are keyed to this rate, plus expected inflation, US Treasury borrowing requirements, and sectoral credit demand intensities.

The old tradition in macroeconomic model simulations of exogenous fiscal or environmental policy changes was to hold the Federal Reserve's supply of reserves constant at baseline levels. While this approach makes static analysis easier in the classroom, it sometimes creates unrealistic policy analyses when a dynamic model is appropriate. In the IHS Global Insight model, "monetary policy" is defined by a set of targets, instruments, and regular behavioral linkages between targets and instruments. The model user can choose to define unchanged monetary policy as unchanged reserves or as an unchanged reaction function in which interest rates or reserves are changed in response to changes in such policy concerns as the price level and the unemployment rate.

Monetarist Aspects

The model pays due attention to valid lessons of monetarism by carefully representing the diverse portfolio aspects of money demand and by capturing the central bank's role in long-term inflation phenomena.

The private sector may demand money balances as one portfolio choice among transactions media (currency, checkable deposits), investment media (bonds, stocks, short-term securities), and durable assets (homes, cars, equipment, structures). Given this range of choice, each medium's implicit and explicit yield must therefore match expected inflation, offset perceived risk, and respond to the scarcity of real savings. Money balances provide benefits by facilitating spending transactions and can be expected to rise nearly proportionately with transactions requirements unless the yield of an alternative asset changes.

Now that even demand deposit yields can float to a limited extent in response to changes in Treasury bill rates, money demand no longer shifts quite as sharply when market rates change. Nevertheless the velocity of circulation (the ratio of nominal spending to money demand) is still far from stable during a cycle of monetary expansion or contraction. The simple monetarist link

from money growth to price inflation or nominal spending is therefore considered invalid as a rigid short-run proposition.

Equally important, as long-run growth models demonstrate, induced changes in capital formation can also invalidate a naive long-run identity between monetary growth and price increases. Greater demand for physical capital investment can enhance the economy's supply potential in the event of more rapid money creation or new fiscal policies. If simultaneous, countervailing influences deny an expansion of the economy's real potential, the model will translate all money growth into a proportionate increase in prices rather than in physical output.

"Supply-Side" Economics

Since 1980, "supply-side" political economists have pointed out that the economy's growth potential is sensitive to the policy environment. They focused on potential labor supply, capital spending, and savings impacts of tax rate changes. The IHS Global Insight model embodies supply-side hypotheses to the extent supportable by available data, and this is considerable in the many areas that supply-side hypotheses share with long-run growth models. These features, however, have been fundamental ingredients of our model since 1976.

Rational Expectations

As the rational expectations school has pointed out, much of economic decision-making is forward looking. For example the decision to buy a car or a home is not only a question of current affordability but also one of timing. The delay of a purchase until interest rates or prices decline has become particularly common since the mid-1970s when both inflation and interest rates were very high and volatile. Consumer sentiment surveys, such as those conducted by the University of Michigan Survey Research Center, clearly confirm this speculative element in spending behavior.

However, households can be shown to base their expectations, to a large extent, on their past experiences: they believe that the best guide to the future is an extrapolation of recent economic conditions and the changes in those conditions. Consumer sentiment about whether this is a "good time to buy" can therefore be successfully modeled as a function of recent levels and changes in employment, interest rates, inflation, and inflation expectations. Similarly inflation expectations (influencing financial conditions) and market strength expectations (influencing inventory and capital spending decisions) can be modeled as functions of recent rates of increase in prices and spending.

This largely retrospective approach is not, of course, wholly satisfactory to pure adherents to the rational expectations doctrine. In particular this group argues that the announcement of macroeconomic policy changes would significantly influence expectations of inflation or growth prior to any realized change in prices or spending. If an increase in government expenditures is announced, the argument goes; expectations of higher taxes to finance the spending might lead to lower consumer or business spending in spite of temporarily higher incomes from the initial government spending stimulus. A rational expectations theorist would thus argue that multiplier effects will tend to be smaller and more short-lived than a mainstream economist would expect.

These propositions are subject to empirical evaluation. Our conclusions are that expectations do play a significant role in private sector spending and investment decisions; but until change has occurred in the economy, there is very little room for significant changes in expectations in advance of an actual change in the variable about which the expectation is formed. The rational expectations school thus correctly emphasizes a previously understated element of decision making, but exaggerates its significance for economic policy-making and model building.

The IHS Global Insight model allows a choice in this matter. On the one hand, the user can simply accept IHS Global Insight's judgments and let the model translate policy initiatives into initial changes in the economy, simultaneous or delayed changes in expectations, and subsequent changes in the economy. On the other hand, the user can manipulate the clearly identified expectations variables in the model, i.e., consumer sentiment, and inflation expectations. For example if the user believes that fear of higher taxes would subdue spending, the consumer sentiment index could be reduced accordingly. Such experiments can be made "rational" through model iterations that bring the current change in expectations in line with future endogenous changes in employment, prices, or financial conditions.

Theory as a Constraint

The conceptual basis of each equation in the IHS Global Insight model was thoroughly worked out before the regression analysis was initiated. The list of explanatory variables includes a carefully selected set of demographic and financial inputs. Each estimated coefficient was then thoroughly tested to be certain that it meets the tests of modern theory and business practice. This attention to equation specification and coefficient results has eliminated the "short circuits" that can occur in evaluating a derivative risk or an alternative policy scenario. Because each equation will stand up to a thorough inspection, the IHS Global Insight model is a reliable analytical tool and can be used without excessive iterations. The model is not a black box: it functions like a personal computer spreadsheet in which each interactive cell has a carefully computed, theoretically consistent entry and thus performs logical computations simultaneously.

Major Sectors

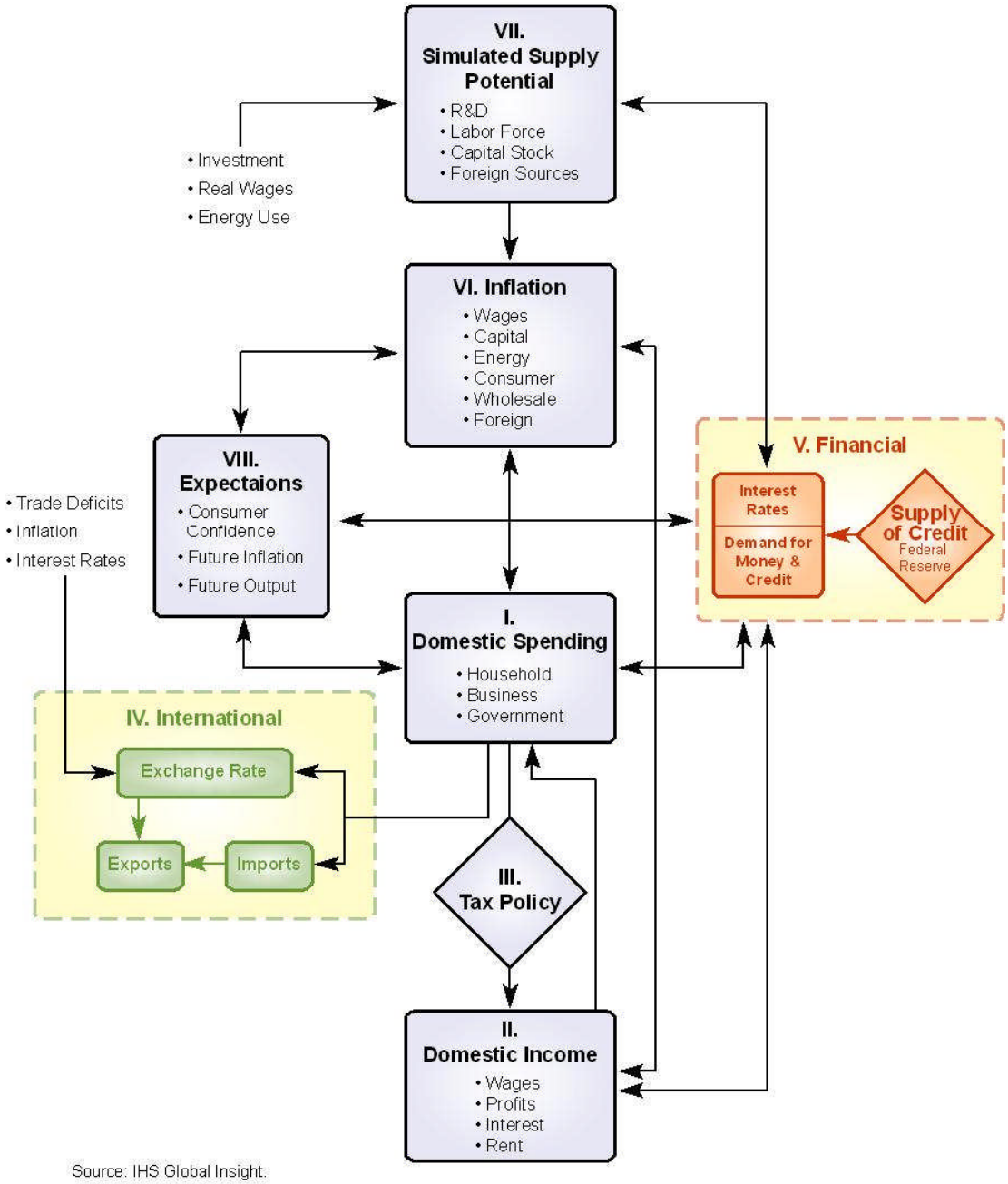
The IHS Global Insight model captures the full simultaneity of the US economy, forecasting over 1,400 concepts spanning final demands, aggregate supply, prices, incomes, international trade, industrial detail, interest rates, and financial flows. Figure C-5 summarizes the structure of the eight interactive sectors (noted in Roman numerals). The following discussion presents the logic of each sector and the significant interactions with other sectors.

Spending—Consumer

The domestic spending (I), income (II), and tax policy (III) sectors model the central circular flow of behavior as measured by the national income and product accounts. If the rest of the model were "frozen," these blocks would produce a Keynesian system similar to the models pioneered by Tinbergen and Klein, except that neoclassical price factors have been imbedded in the investment and other primary demand equations.

Figure C-5

The IHS Global Insight Macroeconomic Model of the US Economy



Source: IHS Global Insight.
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Consumer spending on durable goods is divided into 12 categories: two new vehicles categories; two net purchases of used cars categories; motor-vehicle parts and accessories; furnishings and durable household equipment; computers; software; calculators, typewriters and other; other recreational goods and services; therapeutic appliances and equipment; and "other." Spending on nondurable goods is divided into seven categories: food; clothing and shoes; motor vehicle fuels, lubricants, and fluids; fuel oil and other fuels; tobacco; pharmaceutical and other medical products; and "other." Spending on services is divided into 17 categories: housing, three utilities categories, four transportation categories, health care, recreation, food, accommodation, two financial categories, insurance, telecommunication, and "other." In addition, there is an additional services category for final consumption of nonprofit institutions serving households. In nearly all cases, real consumption expenditures are motivated by real income and the user price of a particular category relative to the prices of other consumer goods. Durable and semidurable goods are also especially sensitive to current financing costs, and consumer speculation on whether it is a "good time to buy." The University of Michigan Survey of Consumer Sentiment monitors this last influence, with the index itself modeled as a function of current and lagged values of inflation, unemployment, and the prime rate.

Spending—Business Investment

Business spending includes nine fixed investment categories within equipment and software: four information processing equipment categories, industrial equipment, three transportation equipment categories, and other producers' durable equipment. Within structures there are three building categories; mining and petroleum structures, power and communication structures, land and all others. Equipment and (non-utility, non-mining) structures spending components are determined by their specific effective post-tax capital costs, capacity utilization, and replacement needs. The cost terms are sophisticated blends of post-tax debt and equity financing costs (offset by expected capital gains) and the purchase price of the investment good (offset by possible tax credits and depreciation-related tax benefits). This updates the well-known work of Dale Jorgenson, Robert Hall, and Charles Bischoff.

Given any cost/financing environment, the need to expand capacity is monitored by recent growth in national goods output weighted by the capital intensity of such production. Public utility structure expenditures are motivated by similar concepts, except that the output terms are restricted to utility output rather than total national goods output. Net investment in mining and petroleum structures responds to movements in real oil and natural gas prices and to oil and natural gas production.

Inventory demand is the most erratic component of GDP, reflecting the procyclical, speculative nature of private sector accumulation during booms and decumulation during downturns. The forces that drive the six nonfarm inventory categories are changes in spending, short-term interest rates and expected inflation, surges in imports, and changes in capacity utilization or the speed of vendor deliveries. Surprise increases in demand lead to an immediate drawdown of stocks and then a rebuilding process over the next year; the reverse naturally holds for sudden reductions in final demand. Inventory demands are sensitive to the cost of holding the stock, measured by such terms as interest costs adjusted for expected price increases and by variables monitoring the presence of bottlenecks. The cost of a bottleneck that slows delivery times is lost sales: an inventory spiral can therefore be set in motion when all firms accelerate their accumulation during a period of strong growth but then try to deplete excessive inventories when the peak is past.

Spending—Residential Investment

The residential investment sector of the model includes two housing starts categories (single and multifamily starts) and three housing sales categories (new and existing single family sales, and new single family units for sale). Housing starts and sales, in turn, drive investment demand in five GDP account categories: single family housing, multifamily housing, improvements, miscellaneous, and residential equipment.

Residential construction is typically the first sector to turn down in a recession and the first to rebound in a recovery. Moreover, the magnitude of the building cycle is often the key to that of the subsequent macroeconomic cycle. The housing sector of the IHS Global Insight model explains new construction as a decision primarily based on the after-tax cost of home ownership relative to disposable income. This cost is estimated as the product of the average new home price adjusted for changes in quality, and the mortgage rate, plus operating costs, property taxes, and an amortized down payment. "Lever variables" allow the model user to specify the extent to which mortgage interest payments, property taxes, and depreciation allowances (for rental properties) produce tax deductions that reduce the effective cost.

The equations also include a careful specification of demographic forces. After estimating the changes in the propensity for specific age-sex groups to form independent households, the resulting "headship rates" were multiplied by corresponding population statistics to estimate the trend expansion of single- and multifamily households. The housing equations were then specified to explain current starts relative to the increase in trend households over the past year, plus pent-up demand and replacement needs. The basic phenomenon being scrutinized is therefore the proportion of the trend expansion in households whose housing needs are met by current construction. The primary determinants of this proportion are housing affordability, consumer confidence, and the weather. Actual construction spending in the GDP accounts is the value of construction "put-in-place" in each period after the start of construction (with a lag of up to six quarters in the case of multifamily units) plus residential improvements and brokerage fees.

Spending—Government

The last sector of domestic demand for goods and services, the government, is largely exogenous (user-determined) at the federal level and endogenous (equation-determined) at the state and local level. The user sets the real level of federal nondefense and defense purchases (for compensation, consumption of fixed capital, commodity credit corporation, inventory change, other consumption, and gross investment), medical and nonmedical transfer payments, and medical and nonmedical grants to state and local governments. The model calculates the nominal values through multiplication by the relevant estimated prices. Transfers to foreigners, wage accruals, and subsidies (agricultural, housing, and other) are also specified by the user but in nominal dollars. One category of federal government spending—interest payments—is determined within the model because of its dependence on the model's financial and tax sectors. Federal interest payments are determined by the level of privately held federal debt, short and long-term interest rates, and the maturity of the debt.

The presence of a large and growing deficit imposes no constraint on federal spending. This contrasts sharply with the state and local sector where legal requirements for balanced budgets mean that declining surpluses or emerging deficits produce both tax increases and reductions in spending growth. State and local purchases (for compensation, consumption of fixed capital, other consumption, and construction) are also driven by the level of federal grants (due to the matching requirements of many programs), population growth, and trend increases in personal income.

Income

Domestic spending, adjusted for trade flows, defines the economy's value-added or gross national product (GNP) and GDP. Because all value added must accrue to some sector of the economy, the expenditure measure of GNP also determines the nation's gross income. The distribution of income among households, business, and government is determined in sectors II and III of the model.

Pretax income categories include private and government wages, corporate profits, interest, rent, and entrepreneurial returns. Each pretax income category except corporate profits is determined by some combination of wages, prices, interest rates, debt levels, and capacity utilization or unemployment rates. In some cases, such as wage income, these are identities based on previously calculated wage rates, employment, and hours per week.

Profits are logically the most volatile component of GNP on the income side. When national spending changes rapidly, the contractual arrangements for labor, borrowed funds, and energy imply that the return to equity holders is a residual that will soar in a boom and collapse in a recession. The model reflects this by calculating wage, interest, and rental income as thoroughly reliable near-identities (e.g., wages equal average earnings multiplied by hours worked) and then subtracting each nonprofit item from national income to solve for profits.

Taxes

Since post-tax rather than pretax incomes drive expenditures, each income category must be taxed at an appropriate rate; the model therefore tracks personal, corporate, payroll, and excise taxes separately. Users may set federal tax rates; tax revenues are then simultaneously projected as the product of the rate and the associated pretax income components. However, the model automatically adjusts the effective average personal tax rate for variations in inflation and income per household, and the effective average corporate rate for credits earned on equipment, utility structures, and R&D. Substitutions or additions of "flat" taxes and value-added taxes for existing taxes are accomplished with specific tax rates and new definitions of tax bases. As appropriate, these are aggregated into personal, corporate, or excise tax totals.

State and local corporate profits and social insurance (payroll) tax rates are exogenous in the model, while personal income and excise taxes are fully endogenous: the model makes reasonable adjustments automatically to press the sector toward the legally required approximate budget balance. The average personal tax rate rises with income and falls with the government operating surplus. Property and sales taxes provide the bulk of state excise revenue and reflect changes in oil and natural gas production, gasoline purchases, and retail sales, as well as revenue requirements. The feedback from expenditures to taxes and taxes to expenditures works quite well in reproducing both the secular growth of the state and local sector and its cyclical volatility.

International

The international sector (IV) is a critical block that can either add or divert strength from the central circular flow of domestic income and spending. Depending on the prices of foreign output, the US exchange rate, and competing domestic prices, imports capture varying shares of domestic demand.

Depending on similar variables and the level of world GDP, exports can add to domestic spending on US production. The exchange rate itself responds to international differences in inflation, interest rates, trade deficits, and capital flows between the United States and its competitors. In preparing forecasts, IHS Global Insight's US Economic Service and the World

Service collaborate in determining internally consistent trade prices and volumes, interest rates, and financial flows.

Eight categories of goods and two service categories are separately modeled for both imports and exports, with one additional goods category for oil imports. For example export and import detail for computers is included as a natural counterpart to the inclusion of the computer component of producers' durable equipment spending. The computers detail allows more accurate analysis because computers are rapidly declining in effective quality-adjusted prices relative to all other goods, and because such equipment is rising so rapidly in prominence as businesses push ahead with new production and information processing technologies.

Investment income flows are also explicitly modeled. The stream of huge current account deficits incurred by the United States has important implications for the investment income balance. As current account deficits accumulate, the US net international investment position and the US investment income balance deteriorate. US foreign assets and liabilities are therefore included in the model, with the current account deficit determining the path of the net investment position.

Financial

The use of a detailed financial sector (V) and of interest rate and wealth effects in the spending equations recognizes the importance of credit conditions on the business cycle and on the long-run growth prospects for the economy.

Interest rates, the key output of this sector, are modeled as a term structure, pivoting off the federal funds rate. As noted earlier, the model gives the user the flexibility of using the supply of reserves as the key monetary policy instrument, reflecting the Federal Reserve's open market purchases or sales of Treasury securities, or using a reaction function as the policy instruction. If the supply of reserves is chosen as the policy instrument, the federal funds rate depends upon the balance between the demand and supply of reserves to the banking system. Banks and other thrift institutions demand reserves to meet the reserve requirements on their deposits and the associated (exogenous) fractional reserve requirements. The private sector in turn demands deposits of various types, depending on current yields, income, and expected inflation.

If the reaction function is chosen as the monetary policy instrument, the federal funds rate is determined in response to changes in such policy concerns as inflation and unemployment. The reaction function recognizes that monetary policy seeks to stabilize prices (or to sustain a low inflation rate) and to keep the unemployment rate as close to the natural rate as is consistent with the price objective. A scenario designed to display the impact of a fiscal or environmental policy change in the context of "unchanged" monetary policy is arguably more realistic when "unchanged" or traditional reactions to economic cycles are recognized than when the supply of reserves is left unchanged.

Longer-term interest rates are driven by shorter-term rates as well as factors affecting the slope of the yield curve. In the IHS Global Insight model such factors include inflation expectations, government borrowing requirements, and corporate financing needs. The expected real rate of return varies over time and across the spectrum of maturities. An important goal of the financial sector is to capture both the persistent elements of the term structure and to interpret changes in this structure. Twenty interest rates are covered in order to meet client needs regarding investment and financial allocation strategies.

Inflation

Inflation (VI) is modeled as a carefully controlled, interactive process involving wages, prices, and market conditions. Equations embodying a near accelerationist point of view produce substantial secondary inflation effects from any initial impetus such as a change in wage demands or a rise in foreign oil prices. Unless the Federal Reserve expands the supply of credit, real liquidity is reduced by any such shock; given the real-financial interactions described above, this can significantly reduce growth. The process also works in reverse: a spending shock can significantly change wage-price prospects and then have important secondary impacts on financial conditions. Inspection of the simulation properties of the IHS Global Insight model, including full interaction among real demands, inflation, and financial conditions, confirms that the model has moved toward central positions in the controversy between fiscalists and monetarists, and in the debates among neoclassicists, institutionalists, and "rational expectationists."

The principal domestic cost influences are labor compensation, nonfarm productivity (output per hour), and foreign input costs; the latter are driven by the exchange rate, the price of oil, and foreign wholesale price inflation. Excise taxes paid by the producer are an additional cost fully fed into the pricing decision. This set of cost influences drives each of the 19 industry-specific producer price indexes, in combination with a demand pressure indicator and appropriately weighted composites of the other 18 producer price indexes. In other words the inflation rate of each industry price index is the reliably weighted sum of the inflation rates of labor, energy, imported goods, and domestic intermediate goods, plus a variable markup reflecting the intensity of capacity utilization or the presence of bottlenecks. If the economy is in balance — with an unemployment rate near 5 percent, manufacturing capacity utilization steady near 80–85% and foreign influences neutral — then prices will rise in line with costs, and neither will show signs of acceleration or deceleration.

Supply

The first principle of the market economy is that prices and output are determined simultaneously by the factors underlying both demand and supply. As noted above, the "supply-siders" have not been neglected in the IHS Global Insight model; indeed substantial emphasis on this side of the economy (VII) was incorporated as early as 1976. In the IHS Global Insight model aggregate supply is estimated by a Cobb-Douglas production function that combines factor input growth and improvements in total factor productivity. The output measure in the production function is a gross output concept that equals private GDP, excluding housing services, plus net energy imports.

Factor input equals a weighted average of labor, business fixed capital, public infrastructure, and energy. Based on each factor's historical share of total input costs, the elasticity of potential output with respect to labor is 0.65 (i.e., a 1 percent increase in the labor supply increases potential GDP 0.65 percent); the business capital elasticity is 0.26; the infrastructure elasticity is 0.025; and the energy elasticity is 0.07. Factor supplies are defined by estimates of the full employment labor force, the full employment capital stock, end-use energy demand, and the stock of infrastructure. To avoid double-counting energy input, the labor and capital inputs are both adjusted to deduct estimates of the labor and capital that produce energy. Total factor productivity depends upon the stock of R&D capital and trend technological change.

Potential GDP is the sum of the aggregate supply concept derived from the production function, less net energy imports, plus housing services and the compensation of government employees.

Taxation and other government policies influence labor supply and all investment decisions, thereby linking tax changes to changes in potential GDP. An expansion of potential reduces first prices and then credit costs, and thus spurs demand. Demand rises until it equilibrates with the potential output. Thus the growth of aggregate supply is the fundamental constraint on the long-term growth of demand.

Inflation created by demand that exceeds potential GDP or by a supply-side shock or excise tax increase raises credit costs and weakens consumer sentiment, thus putting the brakes on aggregate demand.

Expectations

The contributions to the model and its simulation properties of the rational expectations school are as rich as the data will support. Expectations (Sector VIII) impact several expenditure categories in the IHS Global Insight model, but the principal nuance relates to the entire spectrum of interest rates. Shifts in price expectations or the expected capital needs of the government are captured through price expectations and budget deficit terms, with the former affecting the level of rates throughout the maturity spectrum and the latter affecting intermediate and long-term rates, and hence the shape of the yield curve. On the expenditure side, inflationary expectations have an impact on consumption via consumer sentiment, while growth expectations affect business investment.