Paper #5-1

MACROECONOMIC IMPACTS OF THE DOMESTIC OIL & GAS INDUSTRY

Prepared for the
Macroeconomic Subgroup

On September 15, 2011, The National Petroleum Council (NPC) in approving its report, *Prudent Development: Realizing the Potential of North America's Abundant Natural Gas and Oil Resources*, also approved the making available of certain materials used in the study process, including detailed, specific subject matter papers prepared or used by the study's Task Groups and/or Subgroups. These Topic and White Papers were working documents that were part of the analyses that led to development of the summary results presented in the report's Executive Summary and Chapters.

These Topic and White Papers represent the views and conclusions of the authors. The National Petroleum Council has not endorsed or approved the statements and conclusions contained in these documents, but approved the publication of these materials as part of the study process.

The NPC believes that these papers will be of interest to the readers of the report and will help them better understand the results. These materials are being made available in the interest of transparency.

The attached paper is one of 57 such working documents used in the study analyses. Also included is a roster of the Subgroup for which this paper was developed or submitted. Appendix C of the final NPC report provides a complete list of the 57 Topic and White Papers and an abstract for each. The full papers can be viewed and downloaded from the report section of the NPC website (www.npc.org).

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MACROECONOMIC SUBGROUP

Macroeconomic Impacts of the Domestic Oil & Gas Industry

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1. Contributions of the oil & gas industry to the domestic economy

The total macroeconomic impact of the U.S. oil and natural gas industry is significant. One study estimated that in 2009, the industry was directly and indirectly responsible for over $1 trillion of value-added, or 7.7% of Gross Domestic Product (GDP). [1] The same study estimated that the oil and natural gas industry's total impact on labor income in 2009 was $534 billion (including benefits), which flow to 9.2 million Americans in jobs directly or indirectly in the industry or in jobs supported by those in the industry. In 2007, it is estimated that the industry directly and indirectly contributed approximately $280 billion of revenue to federal, state and local governments.

The industry's impact goes beyond the operations of the companies actively engaged in exploration and production (upstream), and transportation, refining and marketing (downstream) of crude oil, natural gas, and petroleum products. Through their operations and capital investment activities, oil and gas companies buy goods and services from suppliers and contractors, who in turn employ people and buy goods and services of their own. Oil and gas companies also employ people and pay other kinds of incomes. These incomes are taxed and spent on goods and services, which generate further income and employment.

To present a complete account of how various activities of the oil and gas industry flow through the economy, it is therefore necessary to separate the industry's overall macroeconomic impact into direct, indirect and induced effects. The direct effect covers the oil and gas industry's own employment, contribution to GDP (often referred to as value-added), labor income, contribution to government revenue, etc. The indirect effect describes the impact on other industries that provide goods and services to the oil and gas industry. The induced effect accounts for additional impacts resulting from household and business spending of wage and other income derived either directly or indirectly from the oil and gas industry.

Methodology

Most of the studies on the North American oil and gas industry's macroeconomic impact have used input-output analysis in one way or another. Input-output (I-O) analysis has its origins in the 1930s and 1940s in the theoretical work of Nobel Laureate Wassily Leontief.[2]

I-O analysis can have both sectoral and geographic dimensions. It relates a specific industry's or region's output value to the goods and services it purchases as inputs from other industries and/or regions. These relationships are represented as linear equations, resulting in input-output tables, which ultimately produce an input-output model. By manipulating the matrices of equations, the model calculates the overall impacts on the economy. In essence, the I-O model starts with various economic indicators of the industry or region in question, and then traces supply and demand for all products and services using backward inter-industry and inter-region linkages and the final demand linkage.

There are several modeling systems for analyzing the US input-output patterns. All are based largely on research by the US Bureau of Economic Analysis, which has been publishing I-O tables since 1965, with major benchmark revisions every five years. The latest benchmark tables are for 2002. The Bureau of Economic Analysis has also published an introduction to input-output methodologies.[3]

In practice, a single direct impact measure, for example employment, is usually used to first estimate other direct impacts, such as gross output, value added, income and government revenue. Then, these direct measures are fed into the IMPLAN system to obtain the overall impacts on all variables. In addition to reporting the direct, indirect and induced impacts in levels, researchers also use the input-output

[1] PriceWaterhouseCoopers, *The Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy in 2009: Employment, Labor Income and Value Added*, May 2011.

[2] Leontief, Wassily, *Input-Output Economics*, 2nd ed., New York: Oxford University Press, 1986.

[3] US Bureau of Economic Analysis, *Concepts and Methods of the US Input-Output Accounts*, April 2009.

multipliers to describe the combined impacts. For example, an employment multiplier describes the ratio between the overall number of jobs gained in the economy vs. one additional job in a particular industry and/or region. This standardized representation of the macroeconomic impact is particularly useful in comparing different studies' findings.

The IMPLAN system has been used in almost all studies on the macroeconomic impacts of the US oil and gas industry. However, the existing literature shows large variations in the scope and definition of the oil and gas industry, time frame and sample period, major economic indicator and data source.

Limitations

Input-Output modeling is a powerful tool, but it does have some limitations. By its nature, I-O analysis relies on a static snapshot of the economy, based on fixed linear relationships between inputs and outputs that hold at a particular point in time. In reality, however, technological change modifies the technical relationships between inputs and outputs. A good example is improvements in drilling technology, which require less of everything (steel, drilling services, labor) for any given amount of reserve additions. At the same time, increasing difficulty of exploration because of resource depletion or reduced access to new fields has the opposite effect. A response to this limitation of I-O analysis is that technology changes slowly enough so that the results of the analysis are still valid in the short run.

In addition, I-O cannot analyze directly the effect of relative prices, which lead both producers and consumers to substitute, to the extent they can, less costly goods and services, or do with less. This effect works more powerfully in the longer run. For example, expensive gasoline induces people to replace cars with higher mileage vehicles. However, some switching in response to price changes happens even in the short run.

Both limitations can be addressed through analysis independent of the I-O model, if the technology and price effects are important enough. The results of this analysis can then be fed through the I-O model to calculate the indirect and induced effects.

US National Analysis

Definition

As the NARD study covers the entire oil and natural gas industry, it requires a definition of the industry that is both accurate and as wide as possible, in order to fully account for the overall macroeconomic impact. It should include upstream, downstream and their related construction and supporting activities, from exploration through the distribution and marketing of the final petroleum and natural gas products. However, the petrochemical industry is not included, even though modern day technology has integrated refinery and petrochemical activities, particularly on a company basis. Other end user sectors such as electricity generation are excluded too. Most existing studies have been based on the North American Industry Classification System (NAICS).

The study *The Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy in 2009: Employment, Labor Income and Value Added* was prepared by PricewaterhouseCoopers (PWC (2011)) for the American Petroleum Institute. It uses 2009 U.S. data and covers 14 direct NAICS categories/subcategories including: oil and gas extraction, drilling, and support activities; natural gas distribution; oil and gas pipeline construction, and pipeline transportation; refineries, lubricant, asphalt manufacturing; wholesale of petroleum products, fuel dealers and gas stations. It has state-by-state as well as national level analysis of the impacts related to the industry's operational expenses in terms of employment, value added and labor income. In addition, at the national level, it accounts for the impacts originating from the industry's capital investment. Due to the comprehensiveness of this study, it is used as a benchmark to compare with other similar studies.

On the national level, *The Contributions of the Natural Gas Industry to the US National and State Economies*, prepared by IHS Global Insight for America's Natural Gas Alliance (IHS (2009)), is the most

comparable analysis to PWC (2011). The study focuses only on the U.S. natural gas industry, covering 3 years from 2006 to 2008. It includes 13 direct NAICS categories/subcategories, most of which are consistent with PWC (2011)'s industry definition, such as the upstream and pipeline sectors. The study adds manufacture of equipment, compressors, pumps, building of offshore platforms, and geophysical services but excludes both wholesale and retail sales employment. The innovation is the separation of combined upstream jobs into separate natural gas related jobs vs. oil related jobs. The study also uses detailed industry data at the state level and takes more careful consideration of gas related jobs that are not counted by official data such as self-employed proprietors who contract for production services.

Total impact analysis

Both PWC (2011) and IHS (2009) use the direct industry employment as the key driving variable in the IMPLAN model to estimate the direct, indirect and induced economic impacts on employment, value added and labor income. The following table compares the two studies' findings on the national level.

Exhibit 1.1

National-level studies on oil & gas industry economic impact

Study	Scope	Year	Variable	Direct	Indirect and Induced	Total	Multiplier
PWC (2011)	Oil and gas	2009	Value added ($bn)	$465	$617	$1,082	2.33
			Employment ('000s)	2,192	6,968	9,161	4.18
			Labor income ($bn)	$176	$357	$534	3.03
IHS (2009)	Natural gas	2008	Value added ($bn)	$172	$213	$385	2.24
			Employment ('000s)	622	2,206	2,828	4.54
			Labor income ($bn)	$70	$111	$181	2.59

According to PWC, in 2009, the oil and gas industry produced $465 billion of direct value added and $617 billion of indirect and induced value added, accounting for a combined 7.7% of GDP. It employed 2.2 million workers directly, who received $176 billion in wages, salaries and benefits, or almost $80,500 on average. The industry also employed 7.0 million workers indirectly, who received $357 billion of direct and indirect and induced income.[4] Total (direct, indirect and induced) employment accounted for a combined 7.1% of December 2009 nonfarm payrolls of 129.3 million employees.

According to IHS Global Insight, in 2008, the natural gas industry alone contributed $385 billion of value added, 2.8 million jobs and $181 billion of labor income.[5] As an industry, oil and gas clearly is a major contributor to the U.S. economy.

More strikingly, despite the differences in scope of analysis, industry definition, data source and modeling treatments, the multiplier effects estimated by the two studies are remarkably consistent, for all three economic variables. Every dollar of value added directly produced by the industry will lead, approximately, to an additional $1.2–1.3 of value added to the general economy. For every worker hired directly by the industry, the economy will add roughly another 3.2–3.5 workers overall. For every dollar earned directly by the industry's employees, another $1.60–2.0 of income is derived for others working indirectly in the industry or in jobs supported by those in the industry spending their incomes.

The impacts of the oil and gas industry are felt throughout the economy. The PWC study separates the impact between operations and capital investment. The operational impact is felt mostly in services, wholesale and retail trade, finance/ insurance/ real estate/ leasing (FIRE), manufacturing, transportation,

[4] PriceWaterhouseCoopers *Economic Impacts*.

[5] IHS Global Insight, *The Contributions of the Natural Gas Industry to the US National and State Economies*, September 2009.

construction and information. The capital investment impact goes mainly to services, manufacturing, trade, FIRE, transportation and information. For example, the total employment impact of the industry is 3.4 million jobs in services, 1.1 million in wholesale and retail trade, 895 thousand in FIRE, 593 thousand in manufacturing, 301 thousand in transportation, 150 thousand in information and 132 thousand in construction. Labor income and value-added impacts are distributed in broadly similar proportions.

US Regional and State Analysis

Both PWC (2011) and IHS (2009) report state level impacts by industry, although they rely on different approaches to deriving the state/industry level estimates. PWC (2011) uses the results from IMPLAN model while IHS (2009) uses a separate proprietary modeling system to disaggregate the national impacts into state and industry impacts. In general, indirect and induced effects of the industry first occur within state and then cross the state boundaries into other states. The state analysis reflects that higher diversification of industry exhibits a higher multiplier effect.

The results of the analysis show that, in absolute terms, the oil & gas industry accounts for the most jobs, value-added and labor income in the state of Texas, followed by California. In terms of the percentage of total state jobs attributable to the oil & gas industry, the top five states are Wyoming (15.8%), Louisiana (15.1%), Texas (14.3%), Oklahoma (14.1%), and Alaska (10.3%). The U.S. average is 4.6%, and the District of Columbia is at the bottom, with 1.2%.

The same five states are at the top in terms of the percentage of state labor income attributable to the industry, albeit in slightly different order: Wyoming (19.9%), Oklahoma (19.3%), Texas (18.9%), Louisiana (18.0%) and Alaska (14.1%). The U.S. average is 5.3%, and the District of Columbia is at the bottom, with 1.2%.

In terms of the percentage of state value-added income attributable to the industry, the top five states are once again: Oklahoma (27.1%), Texas (24.3%), Wyoming (24.3%), Louisiana (22.8%) and Alaska (16.9%). The U.S. average is 6.8%, and the District of Columbia is at the bottom, with 1.4%.

In addition to the national studies, there have been several individual state-level studies specific to the development of oil and gas resources, with the majority focusing on shale gas (NETL (2010)[6], NRE (2010)[7], Penn State (2009)[8], CERI (2007)[9], LSU (2002)[10], OSU (2008)[11], IHS (2010)[12], UTSA (2011)[13]). A summary of these studies is given in Exhibit 1.2. Their methodologies and scopes differ, and the estimated multipliers range from roughly 1.3 to 4.2, depending on economic indicators used. For example, the estimated multipliers on value added range from 1.5 to 2.3, while the estimated multipliers on employment range from 1.5 to 4.2. In comparison, we show in Exhibit 1.3, for these same states, the

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[6] National Energy Technology Laboratory, Department of Energy, *Projecting the Economic Impact of Marcellus Shale Gas Development in West Virginia: A Preliminary Analysis Using Publicly Available Data*, March 2010.

[7] Natural Resource Economics, Inc., *The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia*, July 2010.

[8] Considine, Timothy, Robert Watson, Rebecca Entler and Jeffrey Sparks, *An Emerging Giant: Prospects and Economic Impacts of Developing the Marcellus Shale Natural Gas Play*; The Pennsylvania State University, July 2009.

[9] Colorado Energy Research Institute, *Oil and Gas Economic Impact Analysis*, Colorado School of Mines. June 2007.

[10] Baumann, Robert H., David E. Dismukes, Dmitry V. Mesyanzhinov and Allan G. Pulsipher, *Analysis of the Economic Impact Associated with Oil and Gas Activities on State Leases*; Louisiana State University Center for Energy Studies, March 2002.

[11] Snead, Mark and Suzette Barta, *The Economic Impact of Oil and Gas Production and Drilling on the Oklahoma Economy*; Oklahoma State University, October 2008.

[12] IHS Global Insight. *The Economic Impact of the Gulf of Mexico Offshore Oil and Natural Gas Industry and the Role of the Independents*, July 2010.

[13] University of Texas at San Antonio, *Economic Impact of the Eagle Ford Shale*, February 2011.

impact on value added and employment from PWC (2011). The ranges of estimated multipliers generally conform to those based on the individual studies summarized in Exhibit 1.2.

Exhibit 1.2

Recent state level studies

State	Scope	Year	Variable	Direct	Indirect and induced	Total	Multiplier
West Virginia	Marcellus Shale Gas	2008	Gross Output $mm	$267	$105	$371	1.39
NETL (2010)	Capex & Opex	2008	Value Added $mm			$189	
		2008	Employment	1,466	781	2,247	1.53
		2008	Tax $Mm			$68	
West Virginia	Marcellus Shale Gas	2009	Gross Output 2010 $mm	$918	$409	$1,327	1.45
NRE (2010)	Capex & Opex	2009	Value Added 2010 $mm	$633	$307	$939	1.48
		2009	Employment	8,436	4,814	13,250	1.57
		2009	Tax 2010 $mm			$220	
Pennsylvania	Marcellus Shale Gas	2008	Gross Output $mm	$2,180	$2,045	$4,226	1.94
Penn State (2009)	Capex & Opex	2008	Value Added $mm	$1,136	$1,127	$2,263	1.99
		2008	Employment	14,307	14,977	29,284	2.05
		2008	Tax $mm			$592	
Pennsylvania	Marcellus Shale Gas	2009	Gross Output 2010 $mm	$3,769	$3,401	$7,170	1.90
NRE (2010)	Capex & Opex	2009	Value Added 2010 $mm	$1,982	$1,895	$3,877	1.96
		2009	Employment	21,778	22,319	44,097	2.02
		2009	Tax 2010 $mm			$1,446	
New York	Marcellus Sha1e Gas	2015	Value Added 2010 $mm	$862	$843	$1,705	1.98
NRE (2010)	Capex & Opex	2015	Employment	8,196	7,532	15,728	1.92
		2015	Tax 2010 $mm			$454	
Colorado	Oil and Gas	2005	Gross Revenue $mm	$16,567	$5,090	$21,657	1.31
CERI (2007)	Capex & Opex	2005	Employment, Drilling & Extraction	$15,601	$37,387	$52,988	3.40
		2005	Employment, overall				2.67
		2005	Tax, Royalty & Lease $mm			$1,961	
Louisiana, LSU (2002)	Oil and Gas	1997-2000	Expenditure $mm	$733	$250	$983	1.34
Oklahoma,	Oil and Gas	2007	Gross Output $bn	$40	$29	$69	1.73
OSU (2008)		2007	Value Added $bn	$25	$18	$43	1.75
		2007	Employment	76297	245827	322124	4.22
Gulf of Mexico	Offshore Oil and Gas	2009	Value Added $bn	$43	$27	$70	1.64
IHS (2010)	Opex	2009	Employment	91,173	291,077	382,250	4.19
		2009	Labor Income	$16	$15	$30	1.94
Gulf of Mexico	Offshore Oil and Gas	2009-2020	Value Added $bn	$5	$7	$13	2.31
IHS (2010)	Capex	2009-2020	Employment	54,753	82,750	137,503	2.51
		2009-2020	Labor Income $bn	$4	$4	$8	2.09
Texas	Eagle Ford Shale Oil and Gas	2010	Gross Output $mm	$2,135	$734	$2,869	1.34
UTSA (2011)	Capex & Opex	2010	Employment	6,769	5,832	12,601	1.86
		2010	Labor Income $mm	$311	$201	$512	1.65

Exhibit 1.3

Figure 3: State level impacts reported by PWC (2011)

State	Scope	Year	Variable	Direct	Indirect and Induced	Total	Multiplier
West Virginia	Oil and Gas	2009	Value Added $mm	$3,414	$2,473	$5,887	1.72
PWC (2011)	Opex		Employment	29,068	34,238	63,306	2.18
Pennsylvania	Oil and Gas	2009	Value Added $mm	$10,905	$17,535	$28,440	2.61
PWC (2011)	Opex		Employment	77,526	198,037	275,563	3.55
New York	Oil and Gas	2009	Value Added $mm	$10,919	$21,979	$32,898	3.01
PWC (2011)	Opex		Employment	56,715	189,233	245,948	4.34
Colorado	Oil and Gas	2009	Value Added $mm	$10,456	$10,011	$20,467	1.96
PWC (2011)	Opex		Employment	54,240	107,025	161,265	2.97
Louisiana	Oil and Gas	2009	Value Added $mm	$23,769	$19,241	$43,010	1.81
PWC (2011)	Opex		Employment	116,923	258,323	375,246	3.21
Oklahoma	Oil and Gas	2009	Value Added $mm	$29,159	$13,162	$42,321	1.45
PWC (2011)	Opex		Employment	111,461	187,632	299,093	2.68
Texas	Oil and Gas	2009	Value Added $mm	$169,660	$127,850	$297,510	1.75
PWC (2011)	Opex		Employment	474,393	1,507,747	1,982,140	4.18

Related industries

A healthy domestic oil & gas industry promotes economic growth as described above and the support of an increased use of natural gas as a transportation and/or power generation fuel promotes energy security and environmental benefits. However, the growth of the domestic oil and gas industry, particularly that of natural gas, could lead to the loss of employment and value added from industries providing other fuel sources, such as coal, and the industries that are significantly supported by the coal industry, such as Class I railroads.

Coal Industry

Much like the oil & natural gas industry, the domestic coal industry plays an important role in the U.S. economy. Studies that estimate the impacts of the coal industry on the domestic economy utilize a similar Input-Output model approach as studies on the impacts of the oil & natural gas industry on the domestic economy. Penn State's 2006 study utilized the IMPLAN model to estimate that the coal industry will contribute, directly and indirectly, $1.05 trillion (in 2005 $'s) of gross economic output, $362 billion of annual household incomes and 6.8 million jobs in the year 2015.[14] However, this study takes a very broad view of the "coal industry" by including coal-fired electricity generation. PWC (2011) does not go as far as to include end-use consumers of oil and natural gas in the scope of its study. This complicates any comparison of the findings from the Penn State (2006) study to the PWC (2011) study.

Moore Economics, in another study utilizing Input-Output modeling methodology, estimates that each coal mining job creates 3.5 additional jobs and that each $1 of direct payroll in the coal mining industry generates an additional $1.98 of indirect payroll.[15] Moore Economics also estimates that the coal mining industry pays $8.1 billion in total payroll and income taxes.

[14] Rose, Adam Z. and Dan Wei, *The Economic Impacts of Coal Utilization and Displacement in the Continental United States, 2015*; The Pennsylvania State University, July 2006.

[15] Moore Economics, *The Economic Contributions of U.S. Mining in 2007 – Providing Vital Resources for America*, February 2009.

The domestic coal industry has felt significant impacts from the recent recession. The electricity generation industry accounts for over 90% of the total US coal consumption. This share has been growing steadily over the years. In 2010, electricity generation accounted for 93% of coal's consumption, up from 87% in 1990.[16] As a result of this predominance, developments in the power sector directly affect the coal industry. From 2008 to 2009, domestic coal consumption decreased by 10.7 percent following an equivalent reduction in coal-fired generation, due to the recession impact on electric demand and, in some regions, the displacement of coal by natural gas which benefitted from low prices.[17] The narrowing price differentials between the two fuels observed in 2008 were further exacerbated by a rapid increase in coal spot prices that followed a surge of Appalachian coal demand from overseas during that year. Furthermore, economic, regulatory and, more recently, environmental concerns have led to a shift in the supply of new power generation capacity. Although coal still generates approximately 45 percent of the nation's electricity, in 2009, approximately half of all new electric power generation capacity additions was natural gas-based. In general, coal remains the lowest cost fuel for electric power generation. However, the cost of coal for electricity generation increased from $1.20 per MMBTU in 2000 to $2.21 per MMBTU in 2009, or 84.2 percent. By comparison, the cost of natural gas for electricity generation increased from $4.30 per MMBTU in 2000 to $4.74 per MMBTU, or 10.2 percent, although with much greater volatility than coal. That volatility was prominent in 2009, when the average delivered cost of natural gas fell by 47.5 percent to $4.74 per MMBTU.[18] The historic volatility in natural gas prices is a disadvantage in comparison to coal as a fuel for electricity generation.

The graph below illustrates the shifting trends in energy sources for domestic electricity generation since 1996. Electricity generation in terms of megawatt hours has increased by 18.0 percent from 1997 through 2010.[19]

[16] U.S. Energy Information Administration, *Monthly Energy Review*, June 2011.

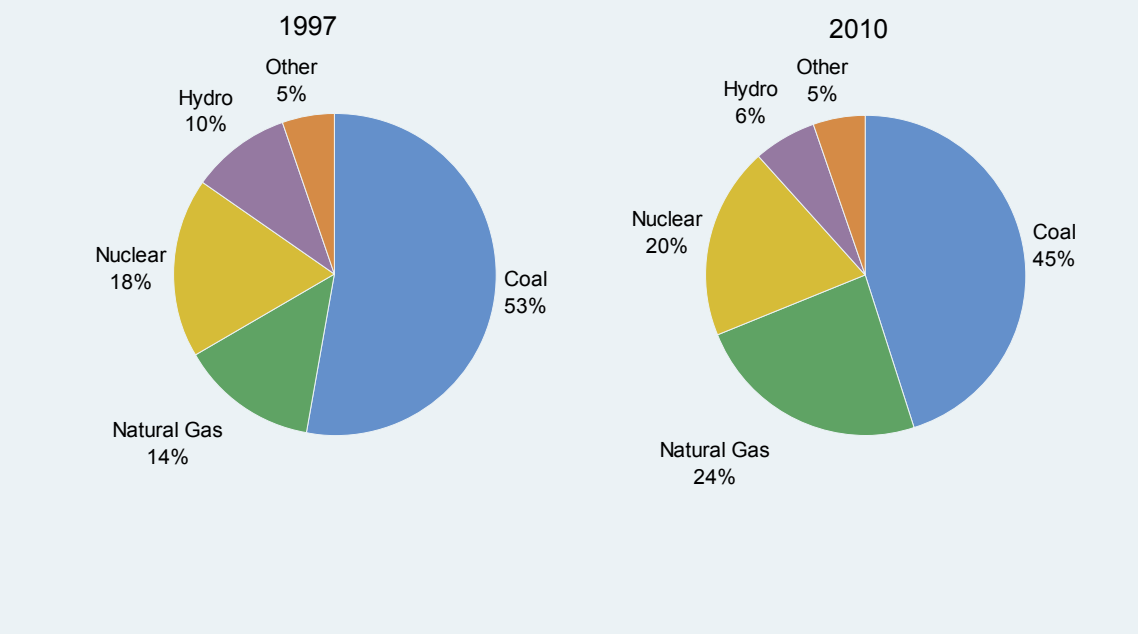
[17] National Mining Association, *2009 Coal Producer Survey*, May 2010.

[18] U.S. Energy Information Administration, *Electric Power Annual 2009*, Office of Electricity, Renewables, and Uranium Studies, April 2011.

[19] U.S. Energy Information Administration, *Electric Power Monthly*, July 2011.

Exhibit 1.4

Net Electricity Generation by Energy Source

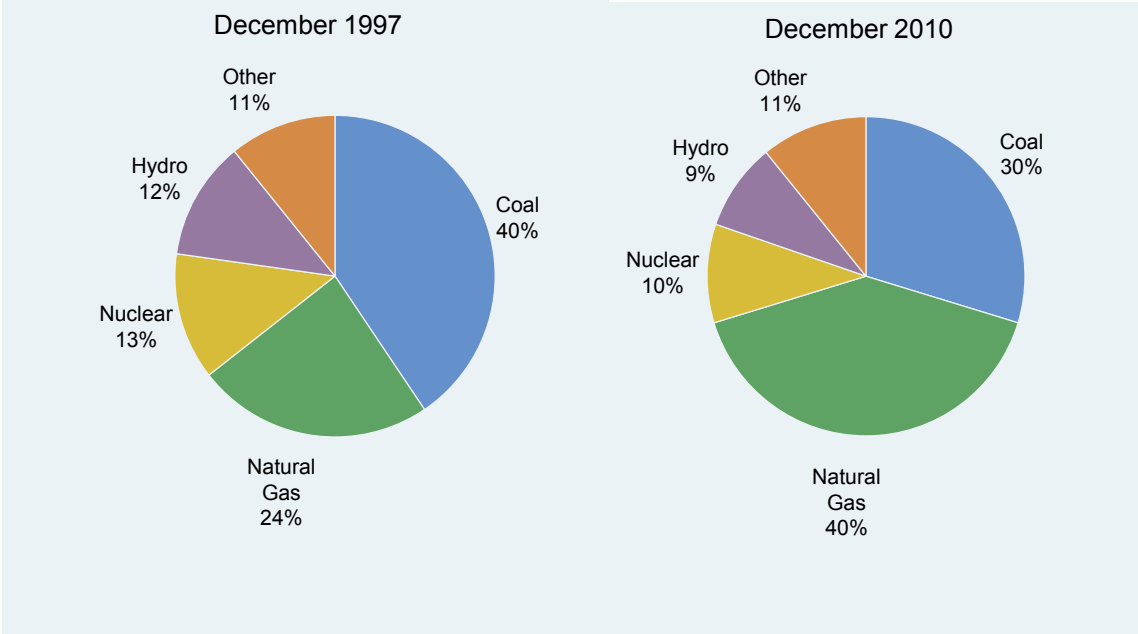


Source: EIA, Electric Power Monthly, July 2011

The graph below shows the shift in operating generation capacity. In December 1997, natural gas fired capacity accounted for 24 percent of total installed capacity in the U.S. By December 2010, that share had grown to 41%. In fact, while coal-fired installed capacity has remained largely unchanged over the last twenty years, natural gas-fired capabilities have almost tripled. Natural gas-fired plants have accounted for almost 80% of all new capacity additions to the electricity system since 1990.

Exhibit 1.5

Installed Capacity (GW)

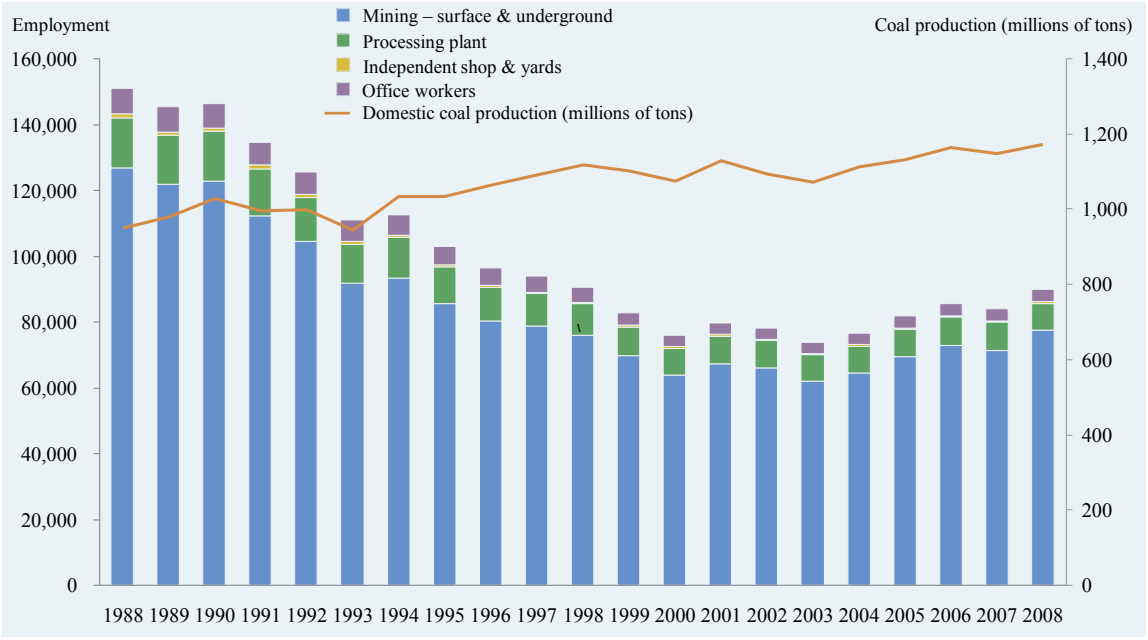


Source: Edison Electric Institute

Recent low natural gas prices can explain some of the impacts that the natural gas industry can have on the coal industry, but many other factors have influenced the declining employment in the coal industry. Productivity improvements, efficiency measures, environmental concerns, regulatory challenges and other factors have contributed to the 40.4 percent decrease in coal mining employment from 1988 to 2008. The graph below illustrates the significant decline in direct coal mining employment from 1988 – 2008.

Exhibit 1.6

Direct employment in the coal mining industry



Source: National Mining Association, *Mining Industry Employment in the United States*, January 2010; EIA

According to the Bureau of Labor Statistics, the average earnings for people in coal mining industry were $23.11 per hour for the May 2010 period, the latest for which data is available. This equates to approximately $48,069 per year.

Railroad Industry

Domestic coal production is focused on a few key coal-rich areas like the Appalachian Mountain and the Rocky Mountain regions and several Mid-Western states. However, coal is consumed widely across the country. Our nation's extensive railroad system accounts for approximately 70 percent of coal deliveries and makes this wide distribution of coal logistically possible and cost-effective. In 2008, coal accounted for approximately 25 percent of carloads, 45 percent of tonnage and 23 percent of the $60.5 billion of gross freight revenue for the Class I railroads.[20] Clearly, the performance of the railroad industry and the coal industry are linked. By comparison to the figures previously mentioned for the coal and the oil and natural gas industries, the U.S. freight railroad industry employed 183,743 people in 2008 that earned an average of $71,303 in 2008.[21]

[20] Association of American Railroads, *Railroads and Coal*, 2010.

[21] Association of American Railroads, *Class I Railroad Statistics,* 2010.

2. Taxes and the oil & gas industry

Aside from the economic benefits the consuming public derives from the oil & gas industry in the forms of employment, value added and resource availability, the oil & gas industry also benefits the public by paying a significant tax burden. Literature on the topic of taxation refers to total "government take", or the total amount of revenues that the federal, state & local governments collect in all forms of taxes from the industry.

Much of the information available on total government take from the oil & gas industry focuses on the upstream exploration & production sector. Oil & gas companies pay the standard federal and state corporate income taxes that companies in other industries pay. Upstream companies also pay severance and ad valorem taxes based on the amount of hydrocarbons they produce and pay bonuses and royalties to the owners of the mineral interests from whom they are leased. The largest mineral interest owners are federal and state governments. For 2007, direct payments by oil and gas corporations to the federal and state governments were approximately $50 billion: $29.8 billion in federal corporate income taxes, $10.7 billion in state severance taxes, and $9.4 billion in federal royalties.[22]

In addition, oil & gas companies pay significant other taxes directly, including excise fuel taxes, sales, property and use taxes ($86 billion), and by generating employment income they indirectly support federal, state and local governments ($140 billion).

Once all these taxes are added together, they amount to approximately $276 billion in our reference year 2007. This total does not include excise and other taxes levied by states and localities on piped natural gas, and several other industry products. We expect that a fuller analysis would push the total closer to $300 billion.

This amount is not surprising. The industry generates $1 trillion in value-added or 7.5% of GDP. Given that total receipts by all levels of government in 2007 was 28% of Gross Domestic Product, a rough estimate of the total amount of federal, state and local revenue provided directly or indirectly by the oil and gas industry would be close to $280 billion. [23]

Federal Corporate Income Taxes

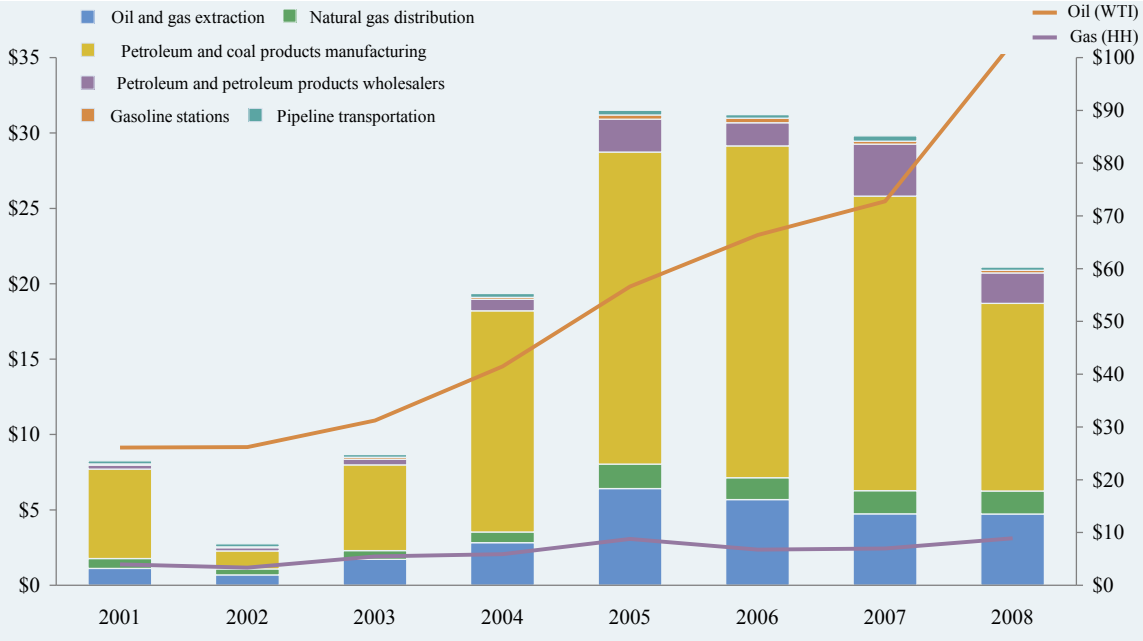
Corporate income taxes are a function of a company's taxable income, the rate at which that income is taxable and any tax credits available to the company. The oil and gas industry as a whole has been taxed at a steady rate of around 35% with tax credits varying slightly over the years. The wide variations observed since 2001 are mostly due to changes in taxable income.

[22] See following sections.

[23] OECD, *Revenue Statistics 1965-2008, 2009 Edition,* Centre for Tax Policy and Administration, 2009.

Exhibit 2.1

Federal taxes paid by corporations ($bn)

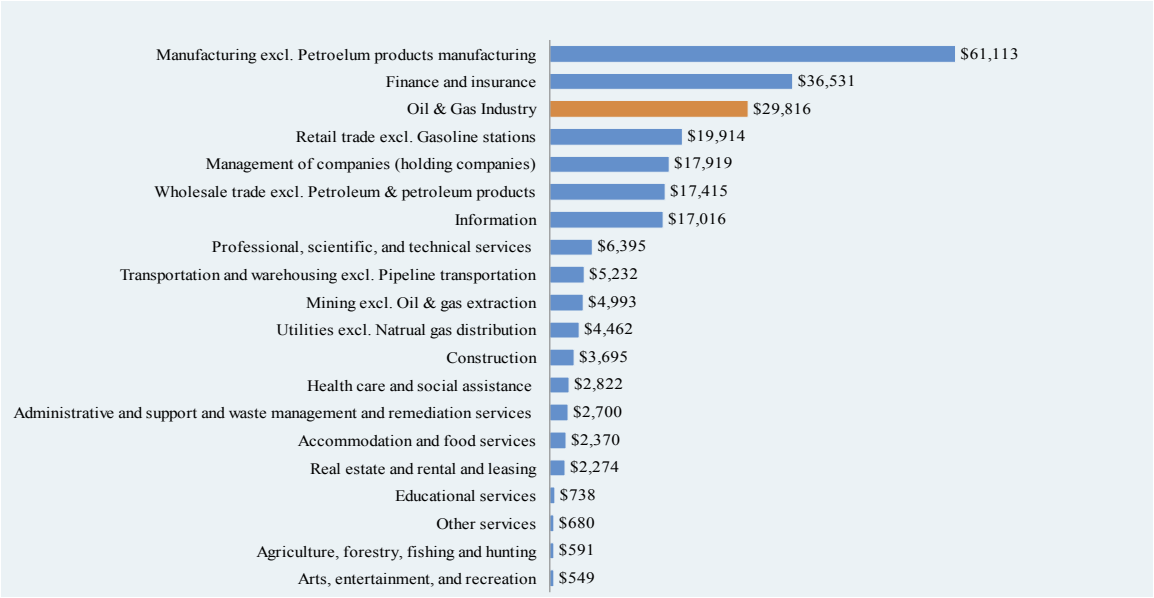


Source: United States Department of the Treasury

The industry represents a growing share of the federal government's tax income. In 2007, the industry contributed to 9% of government's receipts from active corporations, up from 2% in 2002. The vast majority of those receipts come from refiners (65% in 2007). Extraction activities come in second at 16%. The oil and gas industry is one of the largest contributors to the federal government corporate tax income. When compared to all other industry segments reported by the IRS, the oil & gas industry ranks 4th out of 20 broad industry segments. The chart below illustrates the contributions of each industry group to the total federal income taxes paid by corporations.

Exhibit 2.2

2008 Federal taxes paid by corporations ($bn)



Source: United States Department of the Treasury

Severance taxes

Twenty-seven States collect severance taxes from oil & natural gas producers. The table below highlights the sixteen states that receive over 1% of their state tax collections from severance taxes. The remaining states either do not collect severance taxes or their severance tax collections account for less than 1% of their total state tax collections.

Exhibit 2.3

2007 state severance taxes

	Collections (US$ millions)	As a % of state tax collections	Rank	Percent change in collections between 2004 and 2007
United States	10,728.9	1.4%		
Alabama	144.2	1.6%	13	26.94%
Alaska	2,216.0	64.4%	1	242.56%
Colorado	136.9	1.5%	14	18.12%
Kansas	132.3	1.9%	11	34.86%
Kentucky	275.3	2.8%	10	47.14%
Louisiana	904.2	8.3%	7	89.72%
Mississippi	81.8	1.3%	15	52.04%
Montana	264.7	11.4%	5	217.01%
Nevada	62.2	1.0%	16	65.43%
New Mexico	843.9	16.2%	4	43.62%
North Dakota	391.3	21.9%	3	122.84%
Oklahoma	942.1	10.6%	6	43.81%
Texas	2,762.9	6.9%	9	45.66%
Utah	101.5	1.7%	12	112.34%
West Virginia	328.3	7.1%	8	60.85%
Wyoming	803.6	39.7%	2	17.62%

Source: National Conference of State Legislatures

The increased drilling activity targeting the Marcellus Shale in the New York, Pennsylvania and West Virginia region has prompted New York and Pennsylvania to propose implementation of severance taxes. Pennsylvania projects that its proposed severance tax will increase state government revenue by $107 million in the 2009-2010 budget period and will increase to $632 million by 2013–2014.[24]

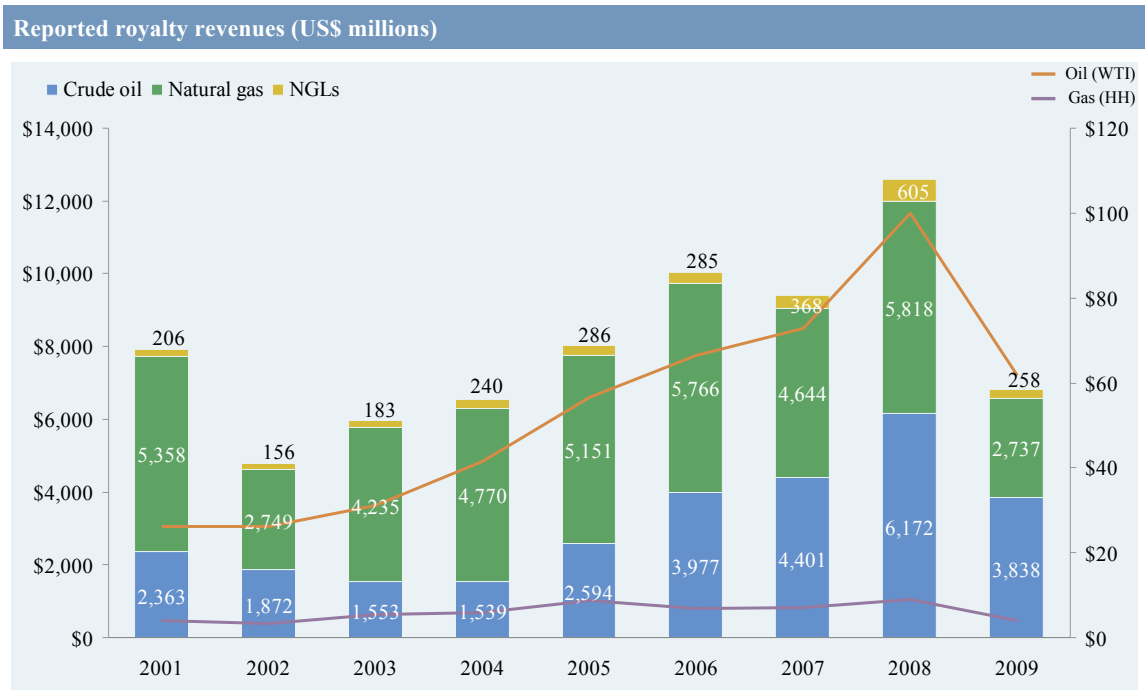
Royalties

Producers of crude oil and natural gas pay royalties to the owners of the mineral rights for the privilege of extracting the resources. Royalty rates vary by commodity and by jurisdiction. Onshore, the federal government charges a statutory minimum 12.5% royalty and offshore the royalty rate ranges from 12.5% to 18.75%.

Under the Mineral Revenue Management (MRM) program, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEM, formerly known as the Minerals Management Service) collects, accounts for and distributes revenues associated with offshore and onshore oil, gas and mineral production from leased federal and Indian lands. The graph below shows the reported royalty revenues collected by the BOEM for crude oil, natural gas and NGLs from 2001–2009.

[24] Congressional Research Service, *Unconventional Gas Shales: Development, Technology, and Policy Issues*, October 2009.

Exhibit 2.4



Source: Bureau of Ocean Energy Management;

The BOEM collected over $72 billion from 2001 – 2009. Each year, the BOEM disburses its revenue to states, counties, parishes, the US Treasury, American Indian Tribes, individual American Indian mineral owners, the Reclamation Fund for water projects, the Land & Water Conservation Fund and the Historic Preservation Fund. In fiscal year 2009, the BOEM disbursed approximately $10.7 billion from revenues collected from energy and mineral production on Federal and American Indian lands. Thirty-five States received a total of almost $2.0 billion directly from the BOEM as part of this disbursement.

Other Taxes Generated Directly by the Industry

The oil and gas industry pays significant federal and state excise taxes on fuels[25]. The combined weighted average tax rates per gallon tax rates were 38.6 cents for gasoline and 45.2 cents for diesel in 2007. Applied to the 139 billion gallons of gasoline and 40 billion gallons of diesel sold in 2007, these tax rates generated $72 billion, which is the largest tax item paid by the industry.

Oil and gas companies also pay significant amounts of sales, use and property taxes, which were estimated at $3.2 billion in 2007.[26] However this is not the full story. Most gas stations are not directly owned by oil & gas companies, and convenience stores associated with gas stations sell approximately $180 billion of non-fuel merchandise.[27] Applying the national sales tax average rate[28] of 7.3% to that amount provides an estimate of $13 billion in sales taxes generated by the broader oil & gas retail industry. Admittedly some retail items are not taxed in all states, but others, such as alcohol and tobacco, are taxed at much

[25] Estimated on the basis of Federal Highway Administration data on taxable gasoline and diesel sales, and average gasoline and diesel taxes (federal plus state) per gallon for 2007

[26] American Petroleum Institute, *America's Oil and Gas Industry,* 2010.

[27] National Association of Convenience Stores

[28] Tax Foundation, 2011. A weighted average of state and local sales tax rates was calculated using gross state product shares as provided by the Bureau of Economic Analysis.

higher rates. Based on this analysis, an estimate of $14 billion in total sales, use and property taxes is not unreasonable, bringing the total of other taxes generated directly by the industry to $86 billion.

Taxes Indirectly Generated by the Industry

The $559 billion in employment income of employees, suppliers, contractors, retailers, and others directly and indirectly supported by the industry also generated:

- An estimated $54 billion in payroll taxes (Social Security and Medicare)[29]
- $23 billion in federal income taxes[30]
- $15 billion in state income taxes, $20 billion in property, $23 billion in sales, and $5 billion other personal taxes at the state and local level[31]

These conservatively estimated items add up to $140 billion.

Other

Although it is beyond the scope of this paper to address impacts of domestic tax policy on the competitiveness of US-based companies abroad, research has demonstrated that home country fiscal systems play an important role in the competition for access to new oil & natural gas resources.[32] When compared against investor-owned companies (IOCs) based outside of the US and national oil companies operating internationally, US-based investor-owned companies have lost significant ground since the 1970s. US IOCs have seen production, acreage held, and exploration wells drilled outside of North America decline since the 1970s.

Tax expenditures for the oil & natural gas industry

A review of the tax burden on the oil & gas industry would be incomplete without referencing the significant tax benefits utilized by these companies. President Obama's 2012 budget includes proposals to eliminate eight of these tax benefits, or "tax expenditures" in the language of federal budget planning, and one oil & gas research & development program. According to President Obama's 2012 budget, eliminating these eight tax expenditures (also referred to as "loopholes" in the President's budget) and one R&D program will generate over $43 billion in additional tax revenue over the next ten years. The table below summarizes the tax expenditures and R&D program that are proposed for termination.

[29] Assuming 71% of employment income consists of wages and salaries and 29% consists of benefits (including 3.65% in FICA withholdings), based on Bureau of Labor Statistics averages(http://www.bls.gov/news.release/ecec.nr0.htm). The combined Social Security and Medicare revenue from employees and employers is 13.6% of wages and salaries.

[30] Assumes a median tax incidence rate of 5.93%, based on analysis by the Tax Policy Center (http://www.taxpolicycenter.org/taxfacts/displayafact.cfm?Docid=226). 71% of employment income was assumed to be wages and salaries.

[31] Calculated using average tax incidence rates calculated from 2007 data on compensation of employees from Table 10, Bureau of Economic Analysis (http://www.bea.gov/newsreleases/national/gdp/2010/pdf/gdp2q10_3rd.pdf), and Census Bureau data on state and local finances (http://www.census.gov/govs/estimate/). The rates are 3.9%, 5.2% and 1.3% respectively. 71% of employment income was assumed to be wages and salaries.

[32] IHS CERA, *Fiscal Fitness: How Taxes at Home Help Determine Competitiveness Abroad*, August 2010.

Exhibit 2.5

Funding summary (US$ millions)							
	2012	2013	2014	2015	2016	2012–16	2012–21
Total proposed changes from current law	(3,492)	(5,400)	(4,908)	(4,631)	(4,586)	(23,017)	(43,762)
Repeal enhanced oil recovery credit	0	0	0	0	0	0	0
Repeal credit for oil & gas produced from marginal wells	0	0	0	0	0	0	0
Repeal expensing of intangible drilling costs	(1,875)	(2,512)	(1,762)	(1,403)	(1,331)	(8,883)	(12,447)
Repeal deduction for tertiary injectants	(6)	(10)	(10)	(10)	(10)	(46)	(92)
Repeal exception to passive loss limitations for working interests in oil & natural gas properties	(23)	(27)	(24)	(22)	(21)	(117)	(203)
Repeal percentage depletion for oil & natural gas wells	(607)	(1,038)	(1,079)	(1,111)	(1,142)	(4,977)	(11,202)
Repeal domestic manufacturing tax deduction for oil and natural gas companies	(902)	(1,558)	(1,653)	(1,749)	(1,842)	(7,704)	(18,260)
Increase geological and geophysical amortization period for independent producers to Seven years	(59)	(215)	(330)	(306)	(230)	(1,140)	(1,408)
Terminate oil & gas research & development program	(20)	(40)	(50)	(30)	(10)	(150)	(150)

Source: President Obama's Fiscal Year 2012 Budget, *Terminations, Reductions & Savings*, pages 52–53

Supporters of the elimination of these tax expenditures argue that they primarily benefit multi-billion dollar oil companies that would remain profitable without these tax expenditures.[33] Opponents of the elimination of these tax expenditures maintain that this system has evolved over time to direct capital to critical industries to develop our domestic resources and mitigate our dependence on foreign sources of fossil fuels.[34]

Wood Mackenzie analyzed the impacts of the elimination of two of the tax expenditures: the expensing of intangible drilling costs (IDC) and the domestic manufacturing tax deduction for oil & natural gas companies. This analysis included the evaluation of the economic viability of 230 discrete domestic oil and natural gas plays under current commodity price conditions. Assuming that oil & gas companies lose both the manufacturing tax deduction and the ability to expense IDC, Wood Mackenzie estimates that the average natural gas price needed to achieve a 15% internal rate of return (IRR) would increase by $0.60/mcf to $6.00/mcf. Using this 15% IRR as the breakeven threshold puts approximately 3 bcf/d of production additions at risk in 2011 and 27 Tcf of gas resources at risk through 2020.[35]

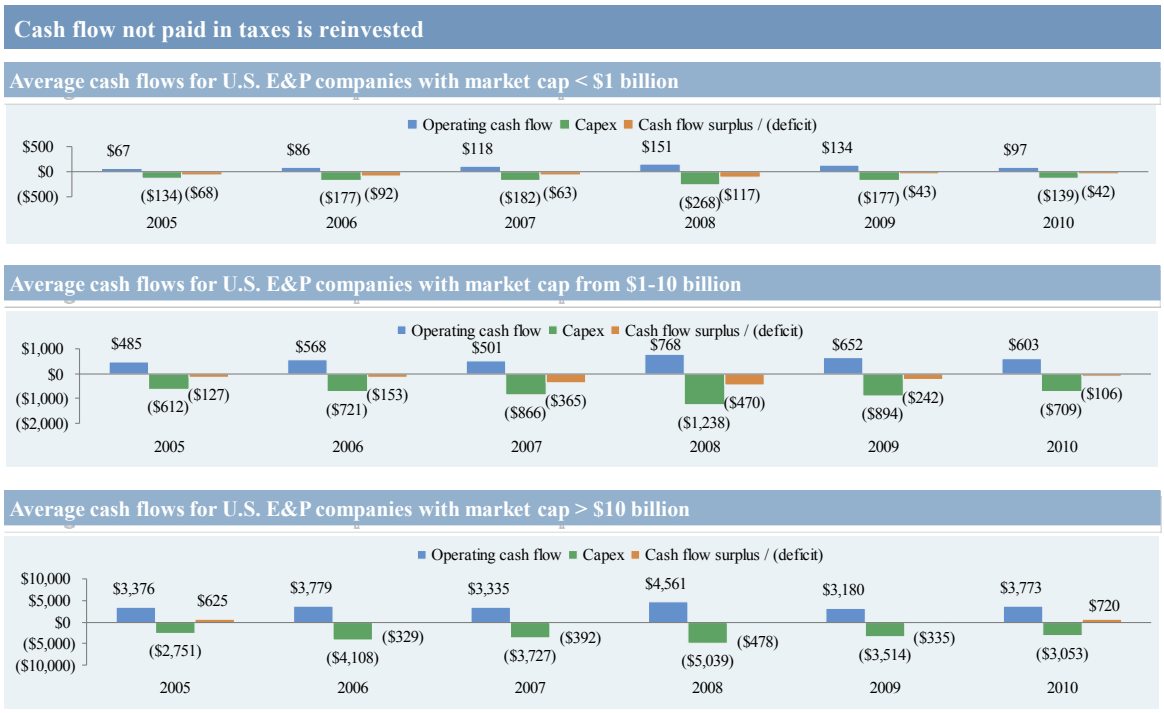
[33] Gandhi, *Eliminating Tax Subsidies for Oil Companies*, Center for American Progress, 2010. .

[34] Hodge, *Who Benefits Most from Targeted Corporate Tax Incentives?* Tax Foundation, 2010.

[35] Wood Mackenzie, *Evaluation of Proposed Tax Changes on the US Oil & Gas Industry*, August 2010.

The graphs below illustrate the spending patterns of U.S. independent E&P companies. The data set includes information from January 1, 2005, through December 31, 2010 for 58 publicly traded independent E&P companies. Large (market capitalization in excess of $10 billion), medium (market capitalization greater than $1 billion, but less than $10 billion) and small (market capitalization less than $1 billion) independent E&P companies, on average, have all outspent their cash flow from operations over this time horizon. Cash flow from operations is an after-tax figure. This implies that, on average, dollars not spent on taxes are reinvested (and predominantly reinvested domestically) in capital expenditures to find and develop additional oil & natural gas resources.

Exhibit 2.6



Source: FactSet as of 7/1/11. Note: All figures in USD millions

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