
ASSESSMENT OF OIL AND GAS INDUSTRY
2012 INDUSTRY ECONOMIC AND FISCAL CONTRIBUTIONS IN COLORADO

Conducted by:

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INTRODUCTION

The oil and gas industry, along with nearly all extraction industries, inherently provides substantial economic benefits due to its integrated supply chain, high wage jobs, and propensity to sell nationally and globally. It brings in outside investment and often operates in rural areas where high-wage jobs are scarce and industry is fleeting.

Much of Colorado's oil and gas is sold outside of the state, contributing wealth to owners, employees, governments, and schools, all of which are beneficiaries of oil and gas revenues. In 2012, Colorado's oil and gas industry recorded \$9.3 billion in production value, accounting for some 29,300 direct drilling, extraction, and support jobs with average annual wages in excess of \$101,000. Coupled with the oil and gas supply chain within Colorado—transportation, refining, wholesalers, parts manufacturers, and gasoline stations—direct employment totaled more than 51,200 jobs, with average wages over \$74,800, which are 49% higher than the state average for all industries. Collectively, this industry contributed slightly more than \$3.8 billion in employee income to Colorado households in 2012, or 2.8% of total Colorado salary and wages. In addition, \$614 million went to private land owners in 2012, assuming private land owners capture royalty and lease terms similar to those of the government.

The oil and gas industry contributed substantial public revenues in 2012—totaling nearly \$1.6 billion, of which \$1 billion was derived directly from severance taxes, public leases, public royalties, and property taxes. This industry is subject to taxes and assessments beyond what other industries contribute. Ad valorem taxes, for instance, are 3 times higher for oil and gas production than for commercial property within the state and 11 times higher than residential property. Oil and gas property taxes exceeded an estimated \$600 million in 2012. Severance taxes paid by the industry totaled \$163 million in 2012. The industry also paid \$275 million in royalties to state and federal governments in 2012, of which \$160 million stayed within Colorado. The State of Colorado received almost \$80.7 million in state lease revenue from oil and gas in 2012, a record high. Oil and gas prices tended to be relatively volatile from 2000–2012, causing government revenue driven by production value to fluctuate year to year. Prices have demonstrated greater stability since 2010, and price stability is expected moving forward, primarily due to greater reserve estimates and technological improvements in drilling and extraction.

While this industry has substantial operations on state and federal lands, a vast majority—more than 69%—transpires on private lands. As oil production ramps up in Colorado, oil and gas in the state is no longer dominated by gas production. In 2012, gas accounted for 51% of total sales-based value of production, followed by oil at 45.6%.

METHODOLOGY

The oil and gas industry is a significant employer in the state of Colorado, with a vast supply chain that includes surveyors, extractors, transporters, and refinery workers. The industry also contributes substantial revenue to state and local governments in the form of income and sales taxes, property taxes, royalties, and fees. The authors completed a comprehensive Colorado state and county report commissioned by the Colorado Oil & Gas Association (COGA) in 2011. This 2013 report, commissioned by COGA, updates the statewide Colorado impacts with data through 2012.

This study examined economic impacts and public revenues associated with the oil and gas industry in Colorado. The analysis relied on publicly available secondary data—no surveying was conducted for the study. To this end, the available known statewide data specific to the industry includes:

- Employment
- Wages
- Assessed property values (land, improvements, and personal)
- Royalties (federal and state)
- Leases (federal and state)
- Severance taxes
- Rig counts
- Well counts
- Production
- Prices

Collected data were used to estimate statewide undisclosed or unknown variables related to the industry, such as sales and income taxes. The research team used the known variables, such as employment and production by county, to estimate each county's contribution to royalties, severance taxes, leases, and so on. The estimates that result from this methodology treat constant the prices and quality of oil and gas from basin to basin, as well as keep the ratio of public to private land constant from county to county in order to formulate county-level estimates.

High-level economic comparisons for the state of Colorado were conducted using IMPLAN input-output modeling software.² IMPLAN generates industry multipliers based on trade flows and industry profiles of the study area. Multipliers refer to the interindustry relationships within a study area in terms of input-output (I-O) economic impacts.³ Multipliers are useful for analyzing project decisions to understand the incremental impacts that such activities have on the local economy. IMPLAN multipliers are static and thus

²Minnesota IMPLAN Group, Inc. (MIG), Hudson, WI, www.implan.com.

³Bureau of Economic Analysis, Regional Multipliers, <http://www.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf>, retrieved January 20, 2010.

do not consider large-scale disruptive impacts on the economic fabric without calculating specific infrastructure changes.

For the purpose of this study, all multipliers are comprised of direct, indirect, and induced effects. *Direct* refers to direct spending or employment in the study industry or firm. *Indirect* is the spending or employment in related industries impacted by spending or employment in the study industry or firm. *Induced* refers to changes in household expenditures impacted by spending or employment in the study industry or firm.

State and local fiscal impacts are aggregated by the IMPLAN model based on tax rates and tax burdens absorbed by industries. The fiscal impacts are based on activity that occurs in Colorado. When public reporting allowed for the aggregation of detailed data, this superseded IMPLAN data (e.g., oil and gas severance taxes, property taxes).

LITERATURE REVIEW

Several studies of the oil and gas industry's economic impact have been conducted recently. Among these, economic impact reports have been conducted that estimate the industry's output, employment, and fiscal impacts on the states of Louisiana, Utah, California, Colorado, New Mexico, Ohio, and Wyoming. Oil and gas companies' economic output make up a material portion of these states' gross state product—6.1% in Colorado and 18.8% in Louisiana, for example. Different studies present strikingly diverse multipliers for this output. In New Mexico \$1 million of direct output generates \$0.20 million of indirect output, according to Cara Meghan Downes Consulting, while in California \$1 million of direct output generates \$1.91 million of indirect output, according to the California Economic Strategy Panel. Employment multipliers, too, vary. In Louisiana, 1,000 direct jobs are estimated to generate 899 jobs, according to the LSU Center for Energy Studies, while in Wyoming 1,000 direct jobs are estimated to generate 3,645 jobs, according to the University of Wyoming. The average wage in oil and gas was consistently reported as higher than states' average wages. The industry's economic impact outlook is bolstered by the potential to produce unconventional gas, such as the development of Ohio's Utica shale formation.

The oil and gas industry's fiscal impact was addressed in many studies. According to a study conducted by the LECG Corporation in 2008, Colorado imposes the fourth-highest tax burden on oil-producing companies of the top 10 oil-producing states. Each oil-producing state has a different strategy for taxing the industry. Impacts measured include \$18.2 million property taxes paid in Utah in 2006, plus \$30.3 million federal mineral royalties, according to a University of Utah study, and \$2.0 billion in extraction taxes paid in Wyoming, plus more than \$62.8 million in sales and use taxes paid. Although currently being phased out, a

program that allowed in-kind tax payments by oil and gas companies was particularly lucrative for the government, according to a study by the Bureau of Ocean Energy Management, Regulation and Enforcement.

While the oil and gas industry is a boon to states' economies, its positive impacts may be waning. Cost efficiencies are on the decline; the energy return on energy investment of finding and extracting oil gradually decreased over the past century. A study conducted by the Science Applications International Corporation and the Gas Technology Institute in 2010 projected economic impacts of the oil and gas industry over the long haul. The study forecasted increasing consumer prices and decreasing oil and gas employment over the next 20 years.

ECONOMIC OVERVIEW

Gas Production and Price Stability

The oil and gas industry's economic and fiscal impacts considered in this study occur at a time of economic volatile, notably, the recession of 2007–2009 and the subsequent recovery. While commodity volatility has been true over the past half-decade, analysts' expectations for natural gas are for comparatively lower volatility in both the short run and the long run due to reserve discoveries (e.g., shale gas), technological improvements in drilling and extraction, greenhouse gas (GHG) rules, and integrated national and continental pipelines. Compounding the impacts of price volatility on state and local revenues, the Office of Natural Resources Revenue cut federal mineral royalty disbursements to states due to federal sequestration.

According to the *Annual Energy Outlook 2013* by the Energy Information Administration (EIA), the share of gas production by shale gas will grow from 34% in 2011 to 50% in 2040. The *Annual Energy Outlook 2012* states the Rocky Mountain Region will remain among the largest national gas producers in the lower 48 states, with production increasing 18% from 2010 through 2035. The Henry Hub price for gas is expected to increase 2.4% annually, to \$7.83 by 2040—a gain of 2.4% per year. Lower 48 onshore and offshore oil production is expected to increase at annual rates of 0.3% and 0.7%, respectively, through 2040, while wellhead prices will increase at an annual rate of 1.8%, to \$160.38 per barrel (2011 dollars).

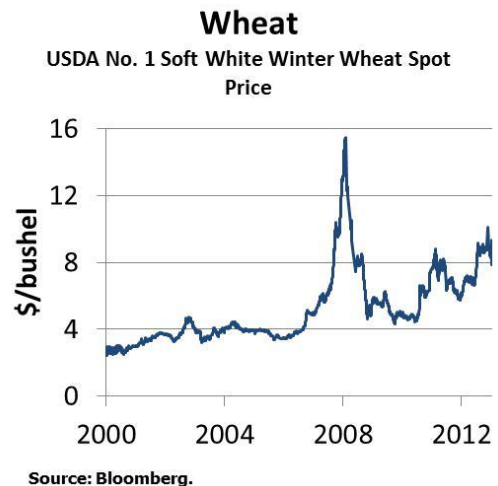
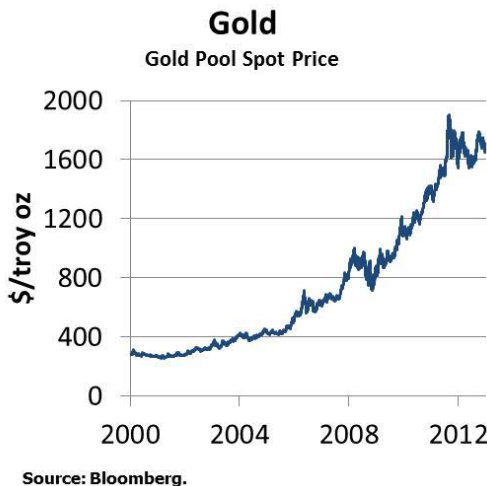
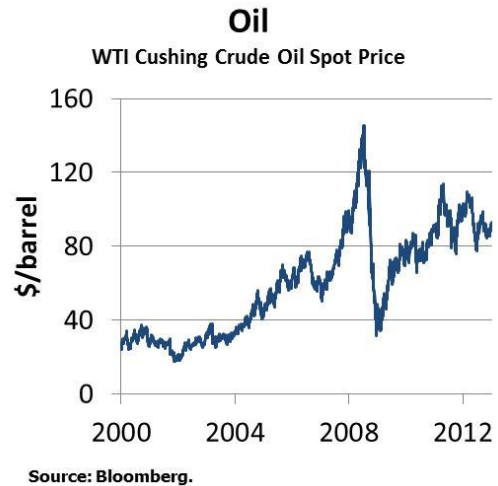
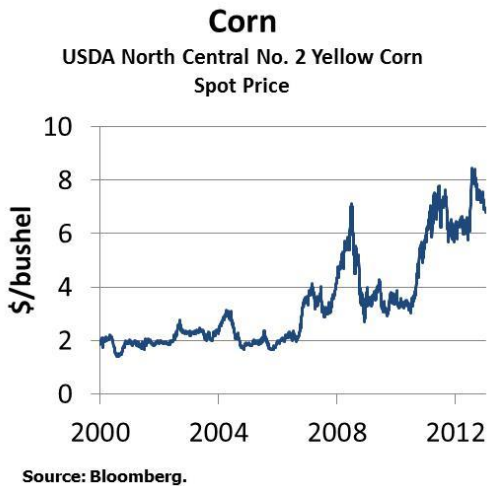
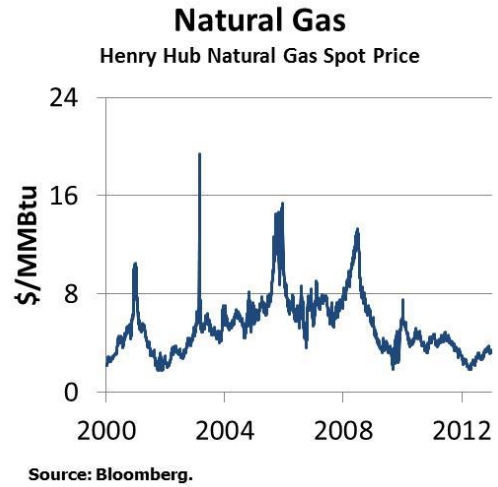
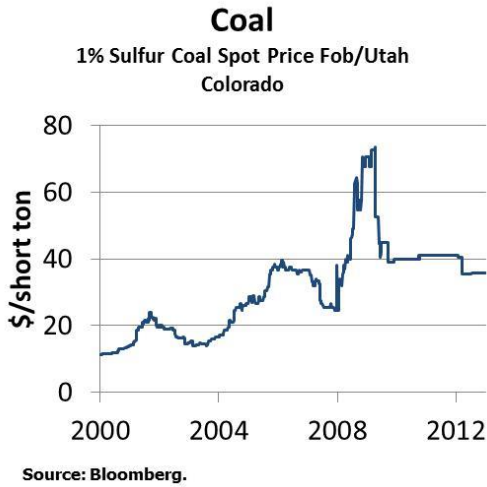
Gas supply and demand expectations are growing. According to the International Energy Agency's *World Energy Outlook 2011*, unconventional gas now accounts for 60% of marketed production in the United States. Global demand, according to this report, will drive the share of natural gas in the energy mix from 21% to 25% by 2035, with domestic supply increasing 1.1% per year and demand increasing 0.6% per year.

Public sentiment on unconventional gas will have a material impact on gas production in coming years. According to the International Energy Agency's *World Energy Outlook 2012*, such social and environmental concerns as land use, surface and groundwater contamination, and air pollution must be addressed successfully in order to realize unconventional gas production's potential. The report suggests that policy makers, regulators, operators, and others apply principles that emphasize full transparency, rigorous efforts to reduce environmental impacts, and engagement with local communities. The report estimates such efforts will result in 7% higher financial costs for developing a typical shale-gas well, but also more than a threefold increase in global production of unconventional gas by 2035.

Commodity Prices

On the whole, commodity prices followed an upward trend over the decade of the 2000s, climbing to a peak in 2007–2008. Although investor sentiment and business cycles influenced this surge, the central driver was mounting global demand, particularly from emerging economies, coupled with limited resources. For the most part, commodity prices fell in the second half of 2008 as demand slowed during the global recession. They have since rebounded. Some key commodities, however, followed different paths. Gold prices rallied for most of the decade, finishing at more than five times the price in 2000. Natural gas prices, although particularly volatile, maintained a flatter trajectory compared to most commodities; gas ended the decade at less than twice its price in 2000.

FIGURE 1: COMMODITY PRICES, 2000–2012



Like other commodities, oil and gas prices exhibited volatility from 2000 to 2012. One measure of volatility is the standard deviation of price changes each month. This measure ranks gold the least volatile of the six commodities shown in Table 1, with a standard deviation of 5 percentage points. Natural gas, oil, and corn are the three most volatile commodities of the group. Natural gas price monthly changes had a comparatively large standard deviation, 20.8 percentage points, over 2000–2012. When considering a time period that excludes the volatile years leading up to 2008 when many commodities reached peak price levels, measured volatility decreased for many commodities, notably those that are energy related. Natural gas standard deviation decreased from 20.8 to 11.5 percentage points, coal from 7.4 to 2.3 percentage points, and oil from 9.6 to 7.9 percentage points. During this same period, wheat decreased modestly in volatility, from 8.1 to 7.9 percentage points, and both corn and gold increased.

TABLE 1: COMMODITY PRICE VOLATILITY, 2000–2012

Commodity	Average Monthly % Change (Continuous Compounding)		Standard Deviation of Month-to-Month % Change	
	2000-2012	2010-2012	2000-2012	2010-2012
	Coal	0.74%	-0.31%	7.43%
Corn	0.81%	1.71%	9.58%	10.69%
Gold	1.15%	1.18%	4.99%	5.20%
Natural Gas	0.15%	-1.47%	20.82%	11.48%
Oil	0.77%	0.41%	9.56%	7.91%
Wheat	0.69%	1.53%	8.06%	7.86%

Source: Data from Bloomberg, calculations by the BRD research team.

OIL AND GAS INDUSTRY ECONOMIC IMPACT

The oil and gas industry is a compilation of distinct activities with interrelated, cogent functions that contributed \$29.6 billion to Colorado’s economy in 2012 through direct and indirect activities. Mapping the industry illustrates the integrated supply chain within the state of Colorado, including oil and gas drilling, extraction, support activities, transportation, refining, and sales. Much of the oil, gas, and CO₂ is sold outside the state, making the industry an important primary employer that brings in outside investment that benefits Colorado employees, industry, and public goods (specifically schools).

TABLE 2: OIL AND GAS TOTAL ECONOMIC IMPACT (DIRECT, INDIRECT, INDUCED), 2012

Source	Employment	Employee Compensation (Millions)	Value Added (Millions)	Output (Millions)
Drilling	4,935	\$319.17	\$1,054.36	\$1,556.59
Extraction and Support Activities	67,572	\$3,942.23	\$9,580.08	\$18,701.75
Petroleum Refineries	4,746	\$245.89	\$1,133.73	\$4,789.86
Transportation	2,889	\$178.85	\$263.18	\$791.88
Gasoline Stations	18,646	\$466.24	\$1,000.47	\$1,649.90
All Other	12,688	\$687.31	\$1,194.55	\$2,078.18
Total	111,476	\$5,839.68	\$14,226.37	\$29,568.16

Prices and Production

Production of oil and gas increased from 2011 to 2012, but value of production decreased in 2012 on lower pricing. Oil and gas production in the state totaled more than \$9.3 billion in 2012, with natural gas accounting for 51% of sales-based value, oil accounting for 46%, and carbon dioxide, 3% (Table 3). Oil and gas production is primarily sourced from private lands. Examining oil production and value, more than 69% of value of production occurs on private land, with 24% on federal land and the remainder on state land (Table 4).

TABLE 3: VALUE OF OIL AND GAS PRODUCTION BY RESOURCE, 2011

Commodity	Value (Millions)	Percentage
Gas	\$4,746	51.0%
Oil	4,244	45.6%
CO2	313	3.4%
Total	\$9,302	100.0%

Source: Colorado Geological Survey, Colorado Oil and Gas Conservation Commission.

TABLE 4: PRODUCTION AND REVENUE BY OWNERSHIP, 2012 (IN MILLIONS)

Oil and Gas	Federal ^a	State	Private	Total ^b
Value of Production	\$2,233.1	\$644.3	\$6,424.9	\$9,302.4
Leases/Bonuses	\$14.9	\$80.7	\$213.40	\$309.0
Royalties	\$230.3	\$44.8	\$614.26	\$889.4
Share of Total Value	24.0%	6.9%	69.1%	100.0%

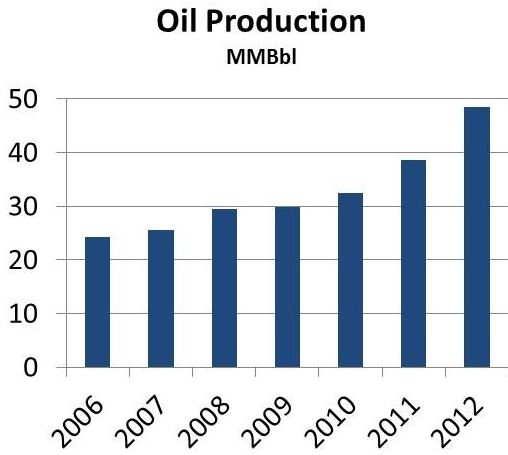
^aLeases/bonuses and royalties represent total federal collections.

^bEstimated.

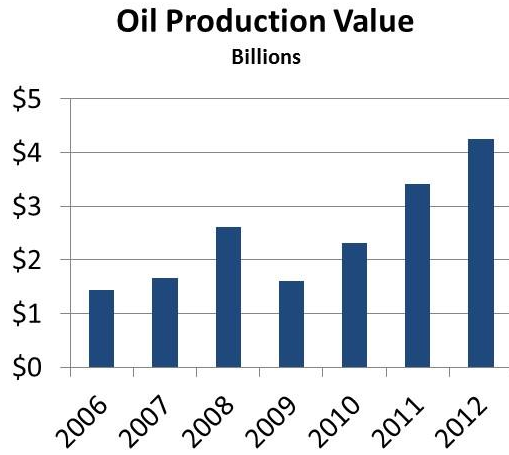
Sources: Office of Natural Resources Revenue, Colorado Geological Survey, Colorado Department of Local Affairs, Colorado Oil and Gas Conservation Commission.

Production value in Colorado has been rather volatile over the past seven years; much of the volatility is due to price swings. Oil sales grew every year between 2006 and 2012, with sales totaling 48.6 million barrels in 2012. The greatest increase in both absolute and percentage growth came in 2012, increasing by 10 million barrels, or nearly 26%. The value of sales was much more volatile, dipping 39% in 2009, then growing 45% in 2010, 47% in 2011, and 24% in 2012. Gas sales followed a similar trend over this period, registering growth each year, but increases were modest in 2011 (1.2%) and 2012 (0.4%) with soft prices. These low gas prices were responsible for negative growth in the value of gas production five of the past seven years. CO2 prices have remained stable over the past three years, while production has been more volatile. In sum, 2012 production value of oil and gas in Colorado was \$9.3 billion.

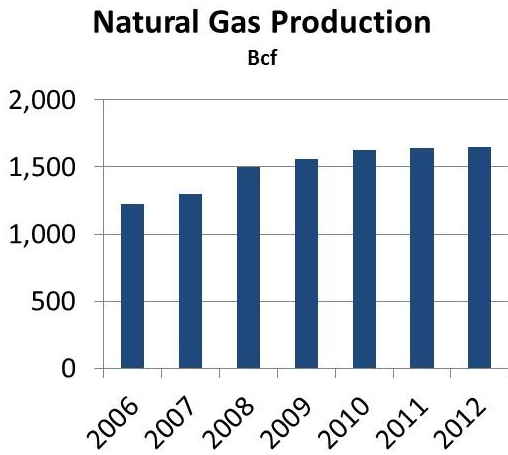
FIGURE 2: COLORADO OIL AND GAS PRODUCTION AND VALUE, 2006–2012



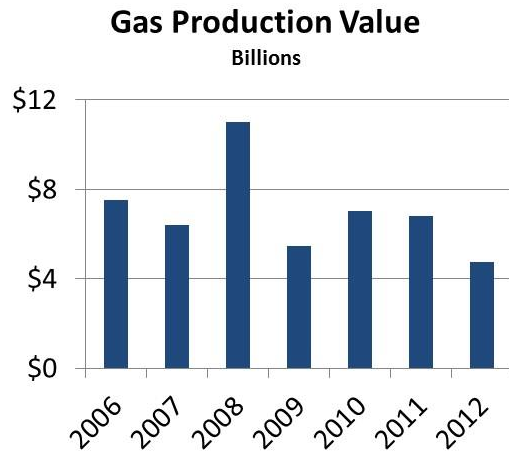
Source: Colorado Geological Survey.



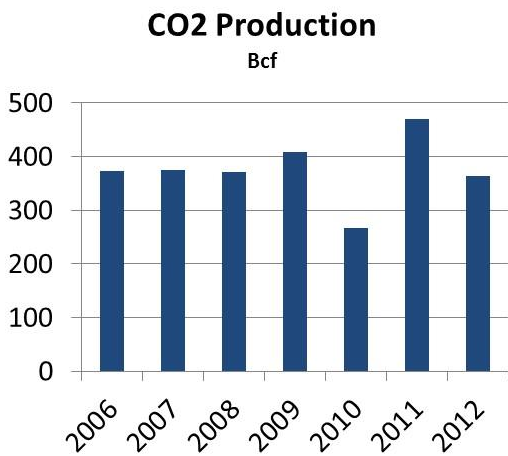
Source: Colorado Geological Survey.



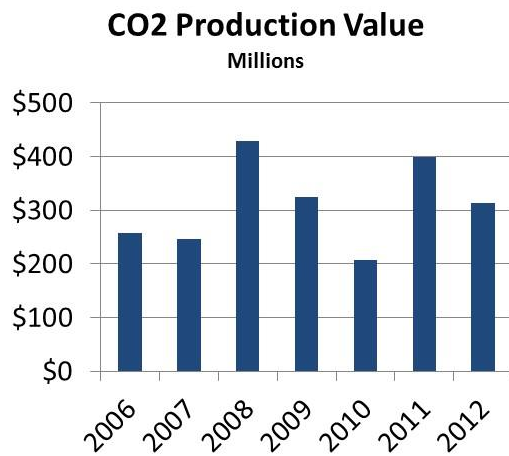
Source: Colorado Geological Survey.



Source: Colorado Geological Survey.



Source: Colorado Geological Survey.



Source: Colorado Geological Survey.

TABLE 5: COLORADO OIL AND GAS PRODUCTION AND VALUE BY YEAR

	2006	2007	2008	2009	2010	2011	2012
Oil (MMBBL)	24.2	25.5	29.5	29.9	32.4	38.6	48.6
Sales Change	5.2%	5.4%	15.7%	1.4%	8.4%	19.1%	25.9%
Value (Millions)	\$1,446	\$1,669	\$2,619	\$1,600	\$2,323	\$3,420	\$4,244
Value Change	16.9%	15.4%	56.9%	-38.9%	45.2%	47.2%	24.1%
Natural Gas							
Natural Gas (Bcf)	1,227.0	1,300.0	1,497.0	1,559.0	1,626.0	1,644.8	1,651.1
Sales Change	9.6%	5.9%	15.2%	4.1%	4.3%	1.2%	0.4%
Value (Millions)	\$7,524	\$6,412	\$10,993	\$5,485	\$7,032	\$6,819	\$4,746
Value Change	-10.3%	-14.8%	71.4%	-50.1%	28.2%	-3.0%	-30.4%
CO2							
CO2 (Bcf)	373.0	375.0	371.0	408.0	267.0	470.0	363.6
Sales Change	375.0%	0.5%	-1.1%	10.0%	-34.6%	76.0%	-22.6%
Value (Millions)	\$258	\$246	\$429	\$324	\$208	\$400	\$313
Value Change	28.4%	-4.7%	74.4%	-24.5%	-35.8%	92.2%	-21.8%

Source: Colorado Geological Survey.

The volatility in unit prices for oil, gas, and CO2 can be seen in Table 6. The national gas price is reflected in the Henry Hub Index, a natural gas price benchmark. The index's daily prices reflect natural gas prices for next-day delivery at the Henry Hub. The average annual prices for this index were calculated by taking the arithmetic averages of the Henry Hub Index's daily closing spot prices over the year.

TABLE 6: OIL AND GAS PRICES 2006–2012

Commodity Indices	2006	2007	2008	2009	2010	2011	2012
Henry Hub Average Price, Calendar Year \$/MMBtu	\$6.73	\$6.97	\$8.89	\$3.94	\$4.37	\$4.00	\$2.75
Colorado Gas Weighted Average Prices \$/MMBtu, FY	\$7.21	\$5.40	\$4.04	NA	NA	NA	NA
Colorado Gas Weighted Average Prices \$/MMBtu, CY	\$5.76	\$4.85	NA	NA	NA	NA	NA
Colorado Oil Price Composite Index \$/Bbl, FY	\$60.64	\$56.83	\$89.33	\$60.20	\$66.56	\$82.19	\$87.66
Colorado Oil Price Composite Index \$/Bbl, CY	\$60.32	\$65.48	\$90.03	\$53.62	\$71.32	\$87.91	\$86.58
CO2 \$/Mcf	\$0.69	\$0.66	\$1.16	\$0.79	\$0.78	\$0.85	\$0.86

Sources: Federal Reserve Bank of St. Louis; Colorado Oil and Gas Conservation Commission; Division of Property Taxation, Colorado Department of Local Affairs.

Colorado prices differ from national index prices, largely because of transportation costs. The Colorado Oil and Gas Conservation Commission (COGCC) computes and tracks composite indices for oil and gas prices in Colorado. The Colorado Oil Price Composite Index is COGCC's weighted average of oil prices in each quadrant of the state; the price for oil produced in the northwest receives a 35% weight; the price for southwest production, 5%; the price for northeast production, 40%; and the price for southeast production, 20%. The Colorado Gas Price Index, reported by COGCC through November 2007, weighted three prices of natural gas produced in Colorado: the price for gas supplying to the Northwest Pipeline System (20%

weight), the price for gas supplying the El Paso Natural Gas pipeline (50% weight), and the price for gas in the Colorado Interstate Basin in the U.S. Rocky Mountains.

The average annual price of CO2 was calculated by dividing Colorado production value by production. Oil and gas prices peaked and then fell sharply in 2008. Like the others listed, CO2 average annual prices reached a high in 2008; the price has since slumped, to \$0.86 per thousand cubic feet in 2012.

Another gauge of production activity in Colorado is the number of approved drilling permits and recompletion permits. In 2012, the state approved 3,773 drilling permits (Table 7). This permit activity was 19% lower compared to the 4,659 approved drilling permits in 2011 and 53% lower than the peak of 8,027 approved in 2008.

TABLE 7: APPROVED DRILLING AND RECOMPLETION PERMITS

Year	Approved Drilling Permits	Percent Change	Approved Recompletion Permits	Percent Change
2006	5,904	35.1%	315	50.7%
2007	6,368	7.9%	214	-32.1%
2008	8,027	26.1%	287	34.1%
2009	5,159	-35.7%	334	16.4%
2010	5,996	16.2%	515	54.2%
2011	4,659	-22.3%	320	-37.9%
2012	3,773	-19.0%	168	-47.5%

Source: Colorado Oil and Gas Conservation Commission, Staff Report.

Output

The entire oil and gas supply chain impact on total output was \$29.6 billion in 2012, with \$20.3 billion for core activities (drilling, extraction, and support) and \$9.3 billion related to noncore activities (pipeline, refineries, gasoline stations, and equipment manufacturers). Output is the total value of goods and services produced in an economy, including intermediate goods and services. Output calculations are based on a number of known variables, including production, value of production, employment, wages, severance taxes, property taxes, royalties, and leases.

TABLE 8: COLORADO OIL AND GAS, OUTPUT SUMMARY, 2012 (IN MILLIONS)

Source	Direct	Indirect	Induced	Total
Drilling	\$1,190.3	\$141.9	\$224.4	\$1,556.6
Extraction and Support Activities	\$12,289.3	\$3,167.2	\$3,245.3	\$18,701.8
Petroleum Refineries	\$4,067.4	\$460.7	\$261.8	\$4,789.9
Transportation	\$507.7	\$155.0	\$129.1	\$791.9
Gasoline Stations	\$1,017.2	\$301.7	\$331.0	\$1,649.9
All Other	\$1,235.4	\$356.5	\$486.2	\$2,078.2
Total	\$20,307.4	\$4,583.1	\$4,677.8	\$29,568.2

The impact of direct core activities resulted in \$13.5 billion in economic activity. Of this, \$12.3 billion was from extraction and support activities, and \$1.2 billion was from drilling activities.

Value Added

The value added by the entire oil and gas supply chain totaled \$14.2 billion in 2012, with \$10.6 billion for core activities (drilling, extraction, and support) and \$3.6 billion related to noncore activities (e.g., pipeline refineries, gasoline stations, and equipment manufacturers). Value added is gross output net of intermediate input costs.

TABLE 9: COLORADO OIL AND GAS, VALUE ADDED SUMMARY, 2012 (IN MILLIONS)

Source	Direct	Indirect	Induced	Total
Drilling	\$828.0	\$84.1	\$142.2	\$1,054.4
Extraction and Support Activities	\$5,578.4	\$1,944.4	\$2,057.3	\$9,580.1
Petroleum Refineries	\$687.7	\$279.9	\$166.1	\$1,133.7
Transportation	\$84.4	\$96.9	\$81.8	\$263.2
Gasoline Stations	\$590.5	\$200.1	\$209.8	\$1,000.5
All Other	\$673.3	\$213.1	\$308.2	\$1,194.5
Total	\$8,442.3	\$2,818.6	\$2,965.5	\$14,226.4

Employment

The oil and gas industry, in its most inclusive definition, accounted for 51,230 direct jobs in 2012, including drilling, extraction, pipeline, equipment manufacturing, and gasoline station workers. Most of these workers (84%) were employees of firms, while others (16%) were considered nonemployers (i.e., self-employed). Total employment (direct, indirect, and induced) was estimated at 111,476 in 2012.

TABLE 10: COLORADO OIL AND GAS, EMPLOYMENT SUMMARY, 2012

Source	Direct	Indirect	Induced	Total
Drilling	2,402	780	1,753	4,935
Extraction and Support Activities	26,853	15,363	25,356	67,572
Petroleum Refineries	501	2,193	2,052	4,746
Transportation	801	1,080	1,009	2,889
Gasoline Stations	14,062	1,998	2,586	18,646
All Other	6,611	2,278	3,799	12,688
Total	51,230	23,691	36,554	111,476

Drilling, extraction, and support activities accounted for 29,254 jobs in 2012. Downstream employment in related activities—pipeline, equipment manufacturing, and gasoline stations—totaled 21,977 jobs in 2012.

TABLE 11: OIL AND GAS EMPLOYMENT

Employment	2008	2009	2010	2011	2012
Drilling, Extraction, and Support Activities	25,895	21,736	22,408	25,879	29,254
Pipeline, Refining, Equipment Manufacturing, Fueling	23,586	21,982	21,210	22,231	21,977
Total	49,481	43,717	43,618	48,111	51,231
All Industries	2,725,528	2,622,194	2,603,403	2,647,969	2,682,743

Sources: Bureau of Labor Statistics, Quarterly Census of Employment and Wages; U.S. Census Bureau.

Total employment was calculated as the sum of employees and nonemployers (considered self-employed) (Table 12). Publicly available employment and nonemployer data were used to estimate nonemployer detail that is not disclosed. Employment figures were collected and estimated for core oil and gas activities: extraction, drilling, and support activities. To reflect the oil and gas industry's reach more comprehensively, employment numbers were also collected and estimated for related areas in the broad supply chain. These related employment figures range from jobs in petroleum refineries to jobs at gasoline stations.

Core oil and gas jobs and related jobs made up about 1.9% of Colorado's total employment in 2012, surpassing the 2008 peak. In 2012, core employment in oil and gas was an estimated 29,254 jobs; related employment accounted for 21,977 jobs.

TABLE 12: OIL AND GAS EMPLOYMENT

NAICS	Industry	2008	2009	2010	2011	2012
211	Extraction	10,928	10,769	10,871	11,633	13,998
213111	Drilling Wells	4,169	2,122	2,258	2,683	2,402
213112	Support Activities	10,798	8,845	9,279	11,564	12,855
23712	Oil and gas pipeline and related structures const.	4,955	3,792	3,420	4,389	3,869
32411	Petroleum refineries	589	622	620	557	501
324191	Petroleum lubricating oil and grease mfg.	57	52	44	44	44
32412	Asphalt paving, roofing, and saturated materials mfg.	291	231	214	225	226
333132	Oil and gas field machinery and equipment mfg.	238	232	235	259	298
4247	Petroleum and petro products merchant wholesalers	1,630	1,535	1,460	1,470	1,480
486	Pipeline transportation	900	1,005	970	809	804
44711	Gasoline stations with convenience stores	12,957	12,627	12,414	12,645	13,108
44719	Other gasoline stations	1,271	1,176	1,122	1,123	954
45431	Fuel dealers	699	710	711	710	694
Total	Total Core and Non Core Employees	49,481	43,717	43,618	48,111	51,231
All	Total-All Industries	2,725,528	2,622,194	2,603,403	2,647,969	2,682,743

Employee Compensation

While the oil and gas industry is extremely capital intensive, resulting in high output per worker, the industry paid just over \$3.8 billion to workers across the state, or 2.8% of total Colorado earnings (Table 13). This resulted in total wage impacts of \$6.5 billion in 2012 (Table 14).

Much like employment numbers, wage data were collected and estimated for employees and the self-employed in core oil and gas industries and related industries. Wages paid to core oil and gas employees totaled \$2.96 billion in 2012, surpassing the 2008 and 2011 peaks of \$2.70 billion and \$2.71 billion. Related industries accounted for the remaining \$873 million in industry wages in Colorado.

TABLE 13: OIL AND GAS TOTAL WAGES (IN MILLIONS)

Wages	2008	2009	2010	2011	2012
Total Oil and Gas	\$3,713	\$2,854	\$3,057	\$3,594	\$3,833
All Industries in Colorado	\$127,215	\$121,285	\$122,895	\$127,948	\$135,045

Note: Includes wage and salary earnings and nonemployer receipts.

Sources: Bureau of Labor Statistics, Quarterly Census of Employment and Wages; U.S. Census Bureau.

TABLE 14: OIL AND GAS, WAGE SUMMARY, 2012 (IN MILLIONS)

Source	Direct	Indirect	Induced	Total
Drilling	\$208.1	\$47.0	\$64.1	\$319.2
Extraction and Support Activities	\$2,751.5	\$890.0	\$926.9	\$4,568.4
Petroleum Refineries	\$65.0	\$122.7	\$58.1	\$245.9
Transportation	\$87.7	\$49.2	\$35.6	\$172.4
Gasoline Stations	\$290.3	\$81.4	\$94.5	\$466.2
All Other	\$430.0	\$118.4	\$138.9	\$687.3
Total	\$3,832.6	\$1,308.7	\$1,318.1	\$6,459.5

The percent of *wages* from oil and gas activities consistently exceeds the percent of *employment* from oil and gas activities because oil and gas jobs tend to pay more than the average job (

Table 15). Average wages were calculated by dividing the total wages of employees and the receipts of self-employed by the number of employees and nonemployers. The average core oil and gas job in Colorado earned around twice the average Colorado job over the past five years. In 2012, the average core oil and gas wage was \$101,171, which is 101% higher than Colorado's average wage that year (\$50,339).

Particularly lucrative areas include extraction, petroleum refineries, and pipeline transportation. Gasoline station and fuel dealer wages were the only oil and gas wages that were lower statewide than the average Colorado wage. Including related jobs, oil and gas activities recorded an average wage of \$74,811 in 2012, which is 48.6% higher than the average wage in Colorado.

TABLE 15: OIL AND GAS AVERAGE WAGES

Average Wages	2008	2009	2010	2011	2012
Core	\$104,433	\$91,683	\$99,195	\$104,722	\$101,171
Noncore	\$42,775	\$39,185	\$39,341	\$39,759	\$39,723
Total	\$75,042	\$65,286	\$70,090	\$74,704	\$74,811
All Industries in Colorado	\$46,675	\$46,253	\$47,206	\$48,319	\$50,339

Sources: Bureau of Labor Statistics, Quarterly Census of Employment and Wages; U.S. Census Bureau.

OIL AND GAS INDUSTRY PUBLIC REVENUE

In 2012, the oil and gas industry contributed nearly \$1.6 billion in revenues to state and local governments, schools districts, and special districts (Table 16). Sources of public revenue include severance, property taxes (including ad valorem), royalties, leases, bonuses, income taxes, and sales taxes.

TABLE 16: OIL AND GAS CONTRIBUTIONS TO COLORADO PUBLIC REVENUES BY SOURCE (IN MILLIONS)

Severance	Property	Leases	Royalties	Personal Income	Corporate Income	Sales Taxes	COGCC Tax	Total
\$163.0	\$600.7	\$87.9	\$159.9	\$100.6	\$14.9	\$453.8	\$4.7	\$1,585.5

Property Taxes

Total property taxes related to land, improvements, and personal property were estimated at \$600.7 million in 2012 (Table 17). Property taxes depend on the property's taxable assessment and tax rates. An oil and gas property's taxable assessed value is based on its total actual value (market value) adjusted using assessment ratios. The prior year's primary and secondary production values (Table 18), reported by oil and gas operators, are assessed at 87.5% and 75%, respectively. Equipment, buildings, fixtures, and leasehold improvements are assessed at 29% of actual value, the commercial property assessment ratio. The appropriate tax rates are then applied to the final assessed property value.

Publicly available assessed values and average mill levies were used to estimate property tax revenues from oil and gas activities. Colorado's statewide property tax estimates were calculated using assessed property values and the total average county levy (Table 17).

Annual property tax revenue estimates for the state were calculated using each year's average levy and historic assessed values. These property tax estimates excluded municipal levies to reflect the location of most oil and gas properties. Assessed property values, and consequently property taxes, peaked in 2009. High 2008 prices that boosted production value likely contributed to this.

TABLE 17: OIL AND GAS ASSESSED PROPERTY, LEVIES, AND TAXES, 2007–2012 (IN MILLIONS)

Assessed Value	2007	2008	2009	2010	2011	2012
Land	\$6,406.60	\$6,497.00	\$10,177.70	\$4,665.40	\$6,862.50	\$7,885.34
Improvements	\$14.40	\$16.30	\$13.30	\$7.30	\$6.20	\$6.30
Personal	\$802.80	\$1,163.90	\$1,667.50	\$1,576.80	\$1,707.40	\$1,854.94
Total	\$7,223.80	\$7,677.10	\$11,858.60	\$6,249.50	\$8,576.10	\$9,746.58
<i>Percent of Total</i>	7.22%	7.43%	10.25%	5.63%	8.08%	9.01%
Average Mill Levies						
County Mill Levy	18.55	18.32	17.74	18.22	18.95	19.507
Average School Levy	36.88	36.49	34.47	36.54	37.63	39.129
Average Special Levy	2.73	2.78	2.69	2.85	2.92	2.995
Property Taxes						
Land	\$372.60	\$374.20	\$558.80	\$268.80	\$408.30	\$485.98
Improvements	\$0.80	\$0.90	\$0.70	\$0.40	\$0.40	\$0.39
Personal	\$46.70	\$67.00	\$91.50	\$90.80	\$101.60	\$114.32
Total Taxes	\$420.10	\$442.10	\$651.00	\$360.00	\$510.20	\$600.69
Colorado Total Property Taxes						
Property Tax Revenue	\$6,199.00	\$6,362.00	\$6,815.00	\$6,794.00	\$6,612.10	\$6,939.14
<i>Est. Percent from Oil and Gas</i>	6.78%	6.95%	9.55%	5.30%	7.72%	8.66%

Source: Division of Property Taxation, Colorado Department of Local Affairs, 2007–2011 Annual Reports.

Note: Property tax estimate from BRD, and excludes municipal levy.

TABLE 18: DOLA-REPORTED OIL AND GAS PRODUCTION, 2007–2012

Resource	2007	2008	2009	2010	2011	2012
Oil (Primary) (Bbl)	17,457,655	19,481,263	23,555,544	23,169,312	27,143,116	34,277,963
Oil (Secondary) (Bbl)	6,882,410	7,071,305	6,604,535	6,068,288	5,445,675	5,324,448
Gas (Primary) (Mcf)	1,155,090,829	1,326,542,361	1,417,698,106	1,472,780,075	1,579,450,357	1,613,911,822
Gas (Secondary) (Mcf)	263,286	356,897	104,639	123,329	577,138	1,408,074
Helium (Mcf)	0	0	0	0	0	0
Oil Shale (Mcf)	0	0	0	0	0	0
Natural Gas Liquids and/or Oil and Gas Condensates (Bbl)	6,900,429	22,142,783	28,568,318	45,052,620	144,696,611	198,296,836
CO2 (Mcf)	357,649,836	356,752,872	341,620,702	1,957,251	571,157,301	474,062,640

Source: Division of Property Taxation, Colorado Department of Local Affairs.

The majority of property taxes come from what is classified as land value. Based on the assessed production value for the previous year, land contributed 80.9% of total 2012 oil and gas property taxes. The second-largest contributor to oil and gas property taxes, accounting for nearly one-fifth, was personal property. The remainder was from improvements on the land, by far the smallest contributor to property taxes.

Public Leases and Royalties

Oil and gas exploration and development on public lands provide additional public revenue. Federal onshore leases generated revenue of \$7.2 million in 2012 disbursed back to Colorado (Table 19). Federal lease income includes fixed annual rent payments, generally between \$1.50 and \$2.00 per acre.

Additionally, for lands offered by competitive bidding, premiums paid above rent payments are called bonuses. Federal lease revenue in Colorado in 2012 was up from \$4.9 million in 2011.

The State of Colorado, too, leases land. The State Land Board auctions off leases to determine the rents oil and gas companies pay for state parcels. The base rate, \$1.50 per acre until changed to \$2.50 per acre in 2011, is collected and classified as rental income. Similar to federal lease bonuses, premiums bid over the base price, classified as bonus revenue, are also lease income. The State of Colorado received almost \$80.7 million in state lease revenue from oil and gas in 2012, by far its highest level over the previous five years (Table 19).

In addition to lease revenue, oil and gas activity on public lands provides royalty revenue. On federal lands, minimum annual royalty payments, much like rents, are required until production begins. When production exceeds minimal levels, royalty payments are based on production volume and negotiated sales prices of the oil and gas produced. Companies are allowed to deduct from royalty value costs associated with transporting and processing the oil and gas. Royalties disbursed back to Colorado from oil and gas activities on federal onshore lands in Colorado totaled nearly \$115.2 million in 2012 (Table 19).⁴ Federal royalties were highest in 2008, when disbursements reached \$125.5 million.

When mineral resources are discovered on state land, oil and gas companies pay Colorado monthly royalties based on production volume and sales prices. For the state’s ownership share, Colorado charges a portion of proceeds from oil and gas sales; the full royalty rate was 12.5% until the State Land Board authorized a change to 16.67% in June 2010. State royalties totaled nearly \$44.8 million in 2012 (Table 19).

TABLE 19: REVENUE FROM ACTIVITIES ON PUBLIC LAND, FY2007–FY2012 (IN THOUSANDS)

Source of Revenue	2007	2008	2009	2010	2011	2012
Federal Leases Disbursements	\$14,127.80	\$19,223.80	\$64,557.70	\$8,205.70	\$4,903.08	\$7,181.57
State Leases	\$5,068.70	\$8,167.30	\$5,447.30	\$16,476.70	\$64,663.49	\$80,698.16
Estimated Total Public Leases	\$19,196	\$27,391	\$70,005	\$24,682	\$69,567	\$87,880
Federal Royalty Disbursements	\$84,041.90	\$125,498.70	\$105,621.60	\$96,252.00	\$116,736.02	\$115,161.53
State Royalties	\$27,665.30	\$32,568.00	\$31,879.10	\$27,509.20	\$33,663.09	\$44,785.32
Estimated Total Public Royalties	\$111,707	\$158,067	\$137,501	\$123,761	\$150,399	\$159,947

Sources: Office of Natural Resources Revenue; State Land Board, 2012 Annual Income and Inventory Report.

Severance Taxes

Severance taxes are those that states charge for the removal of nonrenewable natural resources. In Colorado, oil and gas wells with production exceeding stripper-well levels incur severance taxes. The marginal rate for this tax ranges from 2% to 5%, depending on gross income from production (Table 20).

⁴Includes carbon dioxide gas, coal bed methane, oil, processed (residue) gas, unprocessed (wet) gas, gas plant products, and fuel gas.

Severance tax returns are complicated by the ad valorem property tax credit. When the credit is available, producers deduct from their severance tax bills 87.5% of ad valorem property taxes paid on production, net of ad valorem property taxes on stripper wells.

TABLE 20: SEVERANCE TAX RATE SCHEDULE

Total Gross Income Range	Corresponding Severance Tax
Under \$25,000	2% of gross income
\$25,000 - \$99,999	\$500 plus 3% of the excess over \$24,999
\$100,000 - \$299,999	\$2,750 plus 4% of the excess over \$99,999
\$300,000 and over	\$10,750 plus 5% of the excess over \$299,999

Source: Colorado Department of Revenue, Form DR 0021D.

In 2012, severance taxes in Colorado totaled \$163.0 million (Table 21). This is up from 2011 levels, when severance taxes amounted to \$130.7 million.

TABLE 21: SEVERANCE TAXES, FY2007–FY2012 (IN THOUSANDS)

Source of Revenue	2007	2008	2009	2010	2011	2012
Severance	\$126,457	\$139,552	\$272,653	\$63,705	\$130,703	\$163,046

Source: Colorado Department of Revenue.

Revenue from the Local Government Severance Tax Fund and the Federal Mineral Lease Fund is annually paid out to Colorado communities. In 2012, oil and gas severance and lease distributions made up 91.6% of all such distributions in Colorado (Table 22).

TABLE 22: SEVERANCE AND MINERAL LEASE DISTRIBUTIONS, FY2009-FY2012 (IN MILLIONS)

Source of Revenue	2009	2010	2011	2012
Oil/Gas Distribution Amount	\$41.00	\$9.60	\$20.60	\$24.46
Total Distributions in Colorado	\$44.50	\$11.90	\$22.70	\$26.69
Oil/Gas Percent of Total	92.1%	80.7%	90.7%	91.6%

Source: Colorado Department of Local Affairs.

COGCC Taxes

Oil and gas companies pay COGCC a conservation levy every quarter. As of July 2007, the charge is 0.07% of oil, natural gas, and CO₂ production sales, less exemptions. The levy rate is designed to meet the expenses of the agency. In tandem with production value, COGCC levy revenue peaked in 2008, at \$8.7 million. After dropping to \$4.6 million in 2009, levy revenue rebounded to \$6.3 million in 2010 and \$7.1 million in 2011. Revenues dropped to \$4.7 million in FY2012 (Table 23).

TABLE 23: COGCC CONSERVATION LEVY, 2007–2012 (IN THOUSANDS)

Source of Revenue	2007	2008	2009	2010	2011	2012
COGCC Tax	\$5,182.70	\$8,734.20	\$4,612.80	\$6,336.10	\$7,126.00	\$4,680.52

Source: Colorado Oil and Gas Conservation Commission, <http://cogcc.state.co.us/>.

Income and Sales Taxes

Because average wages for jobs in oil and gas tend to be higher than those of the average job in Colorado, income taxes paid per worker are also higher than average. Although Colorado's state income tax rate is a flat 4.63%, individuals often pay less as a result of deductions. Tax rate estimates were calculated by dividing actual taxes paid per person in each income range by the midpoint of each income range. Income taxes paid by industry were calculated by pairing tax rate estimates with average wages in their corresponding income ranges and then applying estimated tax rates to total wages for the industry.

In 2012, income taxes paid by individuals working in oil and gas were estimated to total \$100.6 million (Table 24). Core employment generated \$82.2 million in income taxes; the largest contributor was extraction. Corporate income taxes and sales taxes were estimated using the IMPLAN model, contributing a combined \$469 million in revenue.

TABLE 24: INCOME TAXES, OIL AND GAS, 2012

NAICS	Industry	Average Wage	Estimated Colorado Effective Tax Rate	Total Wages (Millions)	Estimated Income Taxes (Millions)
211	Extraction	\$121,909.2	2.7%	\$1,706.4	\$46.44
213111	Drilling Wells	\$86,658.0	2.9%	\$208.1	\$5.9
213112	Support Activities	\$81,301.4	2.9%	\$1,045.1	\$29.9
23712	Oil and gas pipeline and related structures construction	\$65,440.3	2.5%	\$253.2	\$6.5
32411	Petroleum refineries	\$129,898.4	2.7%	\$65.0	\$1.8
324191	Petroleum lubricating oil and grease mfg.	\$57,784.7	2.5%	\$2.6	\$0.1
32412	Asphalt paving, roofing, and saturated materials mfg.	\$65,281.7	2.5%	\$14.8	\$0.4
333132	Oil and gas field machinery and equipment mfg.	\$108,344.0	2.5%	\$32.3	\$0.8
4247	Petroleum and petroleum products merchant wholesalers	\$64,448.5	2.5%	\$95.4	\$2.4
486	Pipeline transportation	\$109,034.7	2.7%	\$87.7	\$2.4
44711	Gasoline stations with convenience stores	\$19,865.4	1.1%	\$260.4	\$2.7
44719	Other gasoline stations	\$31,370.0	1.9%	\$29.9	\$0.6
45431	Fuel dealers	\$45,854.1	2.3%	\$31.8	\$0.7
Total	Total Core and Non Core Employees	\$74,810.8	-	\$3,832.6	\$100.6

Sources: Colorado Individual Statistics of Income, Federal AGI and Tax, All Full-Year Resident Returns, 2009 Individual Income Tax Returns; Bureau of Labor Statistics, Quarterly Census of Employment and Average Wages; U.S. Census Bureau, Nonemployer.

CONCLUSION

This study quantified the economic and fiscal contributions of Colorado's oil and gas industry in 2012. The oil and gas industry generated \$29.6 billion output in Colorado's economy and directly contributed almost \$1.6 billion to public revenue in 2012. A major source of economic activity was employment. The broad oil and gas supply chain accounted for some 51,200 jobs, many of which are among Colorado's more lucrative positions; core jobs in drilling, extraction, and support activities pay wages more than twice Colorado's

average wage. A major contributor of the public revenue collected from the oil and gas industry was property taxes. Largely due to a high assessment ratio used to value production, property taxes amounted to some \$600.7 million in 2012.

Further research is needed to capture the full impact of the oil and gas industry in Colorado. For example, the scope of this study required that private leases and royalties be estimated using government rates, while actual rates may be significantly higher. Also, as this report focuses on the impact in 2012, updates in future years would help describe this constantly changing industry.

While our study illustrated the market contributions of the oil and gas industry, there are many potentially positive and potentially negative nonmarket economic impacts related to the oil and gas industry (e.g., locally sourced energy, air quality, substitution, water usage, etc.). While environmental and societal impacts of this extraction industry are currently being fiercely debated, the economic contributions of the industry should be present in the discussions calling for drilling moratoriums, understanding that in Colorado, the industry impacts thousands of jobs and billions in wages, funds state and local government (including schools), and makes purchases from every industry. Future research could attempt to quantify these nonmarket economic impacts and include them in the overall cost-benefit analysis.

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