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Economic Impacts of the Onshore Upstream Subsector of the Oil and Natural Gas Industry in Selected States in 2019

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Table of Contents

Economic Impacts of the Onshore Upstream Subsector of the Oil and Natural Gas Industry in Selected States in 2019

Executive Summary

The American Petroleum Institute engaged PwC to quantify the economic impacts of the onshore upstream subsector of the oil and natural gas industry in 14 states: Alaska, California, Colorado, Louisiana, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, and Wyoming. This report provides PwC's economic impact estimates for 2019.

The economic impacts are the result of three channels: direct impacts from the employment and production within the onshore upstream subsector in the 14 states; indirect impacts through the subsector's purchases of intermediate and capital goods from a variety of other US industries in these states; and induced impacts from the personal purchases of employees and business owners both within the subsector and its supply chain, as well as from the personal spending by shareholders out of the dividends received from onshore upstream oil and natural gas companies in these states.[1]

As shown in **Table E-1**, below, the onshore upstream subsector of the oil and natural gas industry directly provided 690,500 jobs, paid out $126.2 billion in labor income, and generated $221.6 billion in value added in 2019 in the 14 states studied. Including direct, indirect, and induced impacts, the total impacts of this subsector on the 14 states were 3.2 million jobs, $297.2 billion in labor income, and $493.1 billion in value added.

[1] These economic impacts represent the entire *backward linkages* of the onshore upstream subsector of the US oil and natural gas industry to its suppliers. They do not capture *forward linkages* (i.e., the economic impact on production in sectors that use oil and natural gas as an input).

Table E-1. The Economic Impact of the Onshore Upstream Subsector of the Oil and Natural Gas Industry in Selected States, 2019

(Thousands of jobs; Billions of dollars)

State	Employment[1]		Labor Income[2]		Value Added	
	Direct	Total	Direct	Total	Direct	Total
Alaska	9.3	28.6	$1.7	$2.9	$5.1	$7.3
California	29.1	399.4	$2.8	$34.1	$7.0	$58.0
Colorado	42.2	235.4	$12.5	$25.2	$10.7	$30.7
Louisiana	43.4	153.4	$6.0	$11.9	$8.8	$19.4
Montana	4.5	21.1	$0.5	$1.3	$0.5	$1.8
New Mexico	28.2	72.7	$2.4	$4.6	$9.3	$13.3
North Dakota	23.5	58.4	$2.6	$4.7	$5.8	$9.2
Ohio	17.5	146.0	$0.8	$9.2	$9.9	$23.9
Oklahoma	94.9	257.6	$8.7	$18.4	$21.3	$36.6
Pennsylvania	27.4	188.9	$2.3	$14.2	$13.3	$31.9
Texas	334.4	1,549.1	$82.9	$162.9	$122.5	$245.4
Utah	5.9	44.4	$0.4	$2.6	$0.8	$4.6
West Virginia	13.2	39.8	$1.1	$2.6	$3.3	$5.9
Wyoming	16.8	37.2	$1.5	$2.6	$3.3	$5.2
Subtotal	**690.5**	**3,231.9**	**$126.2**	**$297.2**	**$221.6**	**$493.1**

Source: PwC calculations based on the IMPLAN model and data from IHS Markit, Alaska's Department of Natural Resources, and the Energy Information Administration. Details may not add up to totals due to rounding.
(1) Employment is defined as the number of direct, indirect, and induced payroll and self-employed jobs, including part-time jobs.
(2) Labor income is defined as annual wages and salaries and benefits as well as proprietors' income.

These results were calculated using the IMPLAN model, an input-output model based on government data.

Economic Impacts of the Onshore Upstream Subsector of the Oil and Natural Gas Industry in Selected States in 2019

I. Introduction

The American Petroleum Institute engaged PwC to quantify the economic impacts of the onshore upstream subsector of the US oil and natural gas industry in 14 selected states in terms of employment, labor income, and value added.[2] This report presents PwC's economic impact estimates of this subsector for 2019.

In describing the economic impact of the onshore upstream subsector of the US oil and natural gas industry through its employment and purchases of goods and services, this report considers three separate channels -- the direct impact, the indirect impact, and the induced impact -- that in aggregate provide a measure of the total economic impact of the onshore upstream subsector in the 14 states.

- ***Direct impact*** is measured as the jobs, labor income, and value added *within* the onshore upstream subsector in each of the 14 states.
- ***Indirect impact*** is measured as the jobs, labor income, and value added occurring in each of the 14 states from *the supply chains* of the onshore upstream subsector attributable to its operating and capital expenditures in all states.[3]
- ***Induced impact*** is measured as the jobs, labor income, and value added in each of the 14 states resulting from *household spending* of labor and proprietor's income earned either directly or indirectly from the onshore upstream subsector's spending and from the personal spending by shareholders out of the dividends received from onshore upstream oil and natural gas companies.

For the indirect and induced impacts, this study separately quantifies the onshore upstream subsector's **operational impact** (due to purchases of intermediate inputs and payments of employee compensation and dividends) and **capital investment impact** (due to its investment in new structures and equipment).[4]

Together these effects result in the onshore upstream subsector having a significant economic impact throughout all sectors of the 14 states studied.

The main data source for the onshore upstream subsector's **direct** jobs, labor income and value added is the *State Annual Personal Income and Employment* data set published by the US Bureau of Economic Analysis ("BEA"). The BEA data are supplemented by data from IHS

[2] The 14 states are: Alaska, California, Colorado, Louisiana, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, and Wyoming.
[3] Operating expenditures are the costs on non-capital inputs (such as materials, rent, and utilities) for a company to run its business operations on a daily basis. Capital expenditures are the amounts that companies use to purchase major physical goods or services that will have a productive life of more than one year.
[4] These economic impacts represent all of the *backward linkages* of the onshore upstream subsector to its suppliers in the 14 states. They do not capture *forward linkages* (i.e., the economic impact on production in sectors that use oil and natural gas as an input).

Markit, Alaska's Department of Natural Resources, and the US Energy Information Administration.

For the subsector's **indirect** and **induced** economic impacts, we have developed the estimates using customized input-output models for each study area built based on the IMPLAN input-output modeling system.[5]

The rest of this report is organized as follows. **Section II** defines the onshore upstream subsector of the oil and natural gas industry for this study. **Section III** presents PwC's estimates of the economic impacts of the industry's onshore upstream subsector in 14 states in 2019.

[5] The IMPLAN input-output economic modeling system is supported by the IMPLAN Group LLC. Its users include academia, federal, state, and local governments, and the private sector.

II. Industry Definition

Table 1, below, shows the composition of the onshore upstream subsector of the US oil and natural gas industry as defined by PwC, followed by detailed descriptions based on the *North American Industry Classification System* ("NAICS").

Table 1.– Composition of the Onshore Upstream Subsector

NAICS	IMPLAN Sector	Description
211	20	Oil and gas extraction (including NGL extraction)
213111	35	Drilling oil and gas wells
213112	36	Support activities for oil and gas operations

NAICS 211. Oil and gas extraction. Establishments in this subsector operate and/or develop oil and gas field properties. Such activities may include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operating separators, emulsion breakers, desilting equipment, and field gathering lines for crude petroleum and natural gas; and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. This subsector includes the production of crude petroleum, the mining and extraction of oil from oil shale and oil sands, and the production of natural gas, sulfur recovery from natural gas, and recovery of hydrocarbon liquids. Establishments in this subsector include those that operate oil and gas wells on their own account or for others on a contract or fee basis.

NAICS 213111. Drilling oil and gas wells. This subsector comprises establishments primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding, drilling, redrilling, and directional drilling.

NAICS 213112. Support activities for oil and gas operations. This subsector comprises establishments primarily engaged in performing support activities on a contract or fee basis for oil and gas operations (except site preparation and related construction activities). Services included are exploration (except geophysical surveying and mapping); excavating slush pits and cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; acidizing and chemically treating wells; and cleaning out, bailing, and swabbing wells.

III. Economic Impact of the Onshore Upstream Subsector

This section presents the estimated economic impact of the onshore upstream subsector of US the oil and natural gas industry in 14 selected states: Alaska, California, Colorado, Louisiana, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, and Wyoming. Economic impacts to states other than these 14 selected states from the onshore upstream subsector's activities are excluded from the analysis.

The total economic impact we have measured includes the ***direct impact*** (the jobs, labor income, and value added *within* the onshore upstream subsector), the ***indirect impact*** (the jobs, labor income, and value added occurring *throughout the supply chain* of the onshore upstream subsector), and the ***induced impact*** (the jobs, labor income, and value added resulting from *household spending* of labor and proprietor's income earned either directly or indirectly from the onshore upstream subsector's spending and from dividends received from onshore upstream oil and natural gas companies).

To quantify these linkages, we rely on the IMPLAN model, an input-output (I-O) model based on government data. For this analysis, we have separately quantified the indirect and induced impacts of the onshore upstream subsector's **operational** and **capital spending**. Operating expenditures are the costs on non-capital inputs (such as materials, rent, and utilities) for a company to run its business operations on a daily basis. Capital expenditures are the amounts that companies use to invest in major physical goods or services that have a productive life of more than one year.

As shown in **Table 2**, below, the onshore upstream subsector of the oil and natural gas industry directly provided 690,500 jobs, paid out $126.2 billion in labor income, and generated $221.6 billion in value added in 2019 in the 14 states studied, with Texas receiving nearly half of the direct employment impact, 66 percent of the direct labor income impact, and 55 percent of the direct value added impact.

Including the indirect and induced impacts, the total impacts of the onshore upstream subsector of the oil and natural gas industry on the 14 states were 3.2 million jobs, $297.2 billion in labor income, and $493.1 billion in value added.

Table 2. The Economic Impact of the Onshore Upstream Subsector of the Oil and Natural Gas Industry in Selected States, 2019

(Thousands of jobs; Billions of dollars)

State	Employment[1]		Labor Income[2]		Value Added	
	Direct	Total	Direct	Total	Direct	Total
Alaska	9.3	28.6	$1.7	$2.9	$5.1	$7.3
California	29.1	399.4	$2.8	$34.1	$7.0	$58.0
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Louisiana	43.4	153.4	$6.0	$11.9	$8.8	$19.4
Montana	4.5	21.1	$0.5	$1.3	$0.5	$1.8
New Mexico	28.2	72.7	$2.4	$4.6	$9.3	$13.3
North Dakota	23.5	58.4	$2.6	$4.7	$5.8	$9.2
Ohio	17.5	146.0	$0.8	$9.2	$9.9	$23.9
Oklahoma	94.9	257.6	$8.7	$18.4	$21.3	$36.6
Pennsylvania	27.4	188.9	$2.3	$14.2	$13.3	$31.9
Texas	334.4	1,549.1	$82.9	$162.9	$122.5	$245.4
Utah	5.9	44.4	$0.4	$2.6	$0.8	$4.6
West Virginia	13.2	39.8	$1.1	$2.6	$3.3	$5.9
Wyoming	16.8	37.2	$1.5	$2.6	$3.3	$5.2
Subtotal	**690.5**	**3,231.9**	**$126.2**	**$297.2**	**$221.6**	**$493.1**

Source: PwC calculations based on the IMPLAN model and data from IHS Markit, Alaska's Department of Natural Resources, and the Energy Information Administration. Details may not add up to totals due to rounding.
(1) Employment is defined as the number of direct, indirect, and induced payroll and self-employed jobs, including part-time jobs.
(2) Labor income is defined as annual wages and salaries and benefits as well as proprietors' income.

Appendix A: Impact of the Onshore Upstream Subsector in Selected States

This Appendix provides the detailed results of the onshore upstream subsector of the US oil and natural gas industry in 14 states: Alaska, California, Colorado, Louisiana, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, and Wyoming.

The Economic Impact of the Onshore Upstream Subsector in Alaska, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**9,310**			**9,310**	**2.0%**
Indirect/Induced Impacts on Other Industries					
Services		3,140	7,870	**11,010**	
Finance, insurance, real estate, rental and leasing		1,310	1,390	**2,700**	
Wholesale and retail trade		390	2,280	**2,670**	
Transportation and warehousing		300	490	**790**	
Construction		450	110	**560**	
Government		120	330	**450**	
Manufacturing		90	250	**340**	
Information		120	190	**310**	
Agriculture		10	150	**160**	
Mining		120	30	**150**	
Utilities		70	70	**140**	
Total Impact on Employment	**9,310**	**6,130**	**13,160**	**28,600**	**6.2%**
Labor Income** ($ Millions)					
Industry Direct Impact	**$1,714**			$1,714	**5.2%**
Indirect/Induced Impacts on Other Industries					
Services		$225	$441	$666	
Finance, insurance, real estate, rental and leasing		$75	$62	$137	
Wholesale and retail trade		$29	$94	$123	
Transportation and warehousing		$24	$29	$53	
Construction		$39	$9	$48	
Government		$12	$33	$45	
Information		$10	$17	$27	
Manufacturing		$7	$16	$22	
Utilities		$10	$9	$19	
Mining		$9	$2	$11	
Agriculture		$1	$6	$6	
Total Impact on Labor Income	**$1,714**	**$440**	**$716**	**$2,871**	**8.8%**
Value Added ($ Millions)					
Industry Direct Impact	**$5,100**			$5,100	**9.4%**
Indirect/Induced Impacts on Other Industries					
Services		$263	$516	$779	
Finance, insurance, real estate, rental and leasing		$195	$371	$566	
Transportation and warehousing		$293	$66	$359	
Wholesale and retail trade		$70	$152	$221	
Manufacturing		$37	$30	$67	
Government		$15	$42	$56	
Utilities		$27	$25	$52	
Information		$20	$32	$51	
Construction		$38	$10	$49	
Mining		$32	$8	$39	
Agriculture		$1	$8	$8	
Total Impact on Value Added	**$5,100**	**$990**	**$1,259**	**$7,348**	**13.5%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in California, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**29,110**			**29,110**	**0.1%**
Indirect/Induced Impacts on Other Industries					
Services		76,930	127,610	**204,540**	
Finance, insurance, real estate, rental and leasing		20,270	25,230	**45,500**	
Wholesale and retail trade		8,240	28,700	**36,940**	
Manufacturing		14,900	11,200	**26,100**	
Transportation and warehousing		8,760	13,580	**22,340**	
Construction		12,340	1,570	**13,910**	
Information		3,440	6,130	**9,570**	
Agriculture		770	5,640	**6,410**	
Government		980	2,370	**3,350**	
Utilities		620	790	**1,410**	
Mining		190	50	**240**	
Total Impact on Employment	**29,110**	**147,440**	**222,880**	**399,430**	**1.6%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$2,846**			**$2,846**	**0.2%**
Indirect/Induced Impacts on Other Industries					
Services		$8,378	$7,533	**$15,911**	
Finance, insurance, real estate, rental and leasing		$2,125	$2,026	**$4,151**	
Manufacturing		$1,652	$1,003	**$2,655**	
Wholesale and retail trade		$771	$1,694	**$2,465**	
Information		$928	$1,422	**$2,350**	
Transportation and warehousing		$681	$911	**$1,592**	
Construction		$952	$119	**$1,071**	
Government		$117	$276	**$393**	
Agriculture		$40	$319	**$359**	
Utilities		$146	$177	**$323**	
Mining		$13	$3	**$16**	
Total Impact on Labor Income	**$2,846**	**$15,803**	**$15,482**	**$34,131**	**1.8%**
Value Added ($ Millions)					
Industry Direct Impact	**$7,013**			**$7,013**	**0.2%**
Indirect/Induced Impacts on Other Industries					
Services		$9,325	$9,215	**$18,540**	
Finance, insurance, real estate, rental and leasing		$4,297	$7,783	**$12,079**	
Wholesale and retail trade		$1,772	$3,262	**$5,034**	
Manufacturing		$2,875	$2,127	**$5,002**	
Information		$1,799	$2,783	**$4,582**	
Transportation and warehousing		$1,152	$1,402	**$2,554**	
Construction		$1,051	$171	**$1,222**	
Utilities		$418	$495	**$913**	
Government		$151	$371	**$521**	
Agriculture		$53	$444	**$497**	
Mining		$32	$8	**$40**	
Total Impact on Value Added	**$7,013**	**$22,924**	**$28,061**	**$57,997**	**1.9%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Colorado, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**42,180**			**42,180**	**1.1%**
Indirect/Induced Impacts on Other Industries					
Services		39,320	70,270	**109,590**	
Finance, insurance, real estate, rental and leasing		11,990	19,520	**31,510**	
Wholesale and retail trade		3,550	19,450	**23,000**	
Transportation and warehousing		2,890	5,980	**8,870**	
Manufacturing		2,930	2,370	**5,300**	
Construction		3,550	1,260	**4,810**	
Information		1,530	2,810	**4,340**	
Government		850	2,400	**3,250**	
Agriculture		90	1,330	**1,420**	
Utilities		400	390	**790**	
Mining		240	60	**300**	
Total Impact on Employment	**42,180**	**67,350**	**125,840**	**235,370**	**6.0%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$12,521**			**$12,521**	**4.9%**
Indirect/Induced Impacts on Other Industries					
Services		$3,627	$3,596	**$7,223**	
Finance, insurance, real estate, rental and leasing		$793	$943	**$1,737**	
Wholesale and retail trade		$332	$908	**$1,240**	
Transportation and warehousing		$576	$301	**$877**	
Manufacturing		$267	$163	**$430**	
Information		$139	$232	**$371**	
Construction		$239	$84	**$323**	
Government		$67	$186	**$253**	
Utilities		$61	$59	**$121**	
Mining		$38	$5	**$43**	
Agriculture		$2	$31	**$33**	
Total Impact on Labor Income	**$12,521**	**$6,141**	**$6,509**	**$25,171**	**9.9%**
Value Added ($ Millions)					
Industry Direct Impact	**$10,689**			**$10,689**	**2.7%**
Indirect/Induced Impacts on Other Industries					
Services		$4,155	$4,441	**$8,597**	
Finance, insurance, real estate, rental and leasing		$1,590	$3,502	**$5,092**	
Wholesale and retail trade		$627	$1,580	**$2,207**	
Transportation and warehousing		$770	$454	**$1,224**	
Information		$322	$560	**$882**	
Manufacturing		$476	$319	**$795**	
Construction		$275	$114	**$389**	
Utilities		$186	$177	**$363**	
Government		$84	$236	**$320**	
Agriculture		$4	$64	**$68**	
Mining		$45	$10	**$55**	
Total Impact on Value Added	**$10,689**	**$8,533**	**$11,457**	**$30,679**	**7.8%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Louisiana, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**43,420**			**43,420**	**1.6%**
Indirect/Induced Impacts on Other Industries					
Services		23,320	37,900	**61,220**	
Finance, insurance, real estate, rental and leasing		9,590	7,810	**17,400**	
Wholesale and retail trade		2,900	10,370	**13,270**	
Transportation and warehousing		2,450	2,540	**4,990**	
Manufacturing		3,080	1,390	**4,470**	
Construction		3,170	640	**3,810**	
Information		770	880	**1,650**	
Government		550	1,030	**1,580**	
Agriculture		110	810	**920**	
Utilities		320	210	**530**	
Mining		140	20	**160**	
Total Impact on Employment	**43,420**	**46,400**	**63,580**	**153,400**	**5.6%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$6,043**			**$6,043**	**4.1%**
Indirect/Induced Impacts on Other Industries					
Services		$1,414	$1,645	**$3,059**	
Finance, insurance, real estate, rental and leasing		$541	$306	**$847**	
Wholesale and retail trade		$230	$400	**$630**	
Manufacturing		$341	$112	**$452**	
Transportation and warehousing		$172	$117	**$288**	
Construction		$191	$38	**$229**	
Government		$40	$75	**$115**	
Information		$53	$60	**$114**	
Utilities		$42	$27	**$70**	
Agriculture		$3	$21	**$24**	
Mining		$13	$1	**$14**	
Total Impact on Labor Income	**$6,043**	**$3,041**	**$2,801**	**$11,884**	**8.0%**
Value Added ($ Millions)					
Industry Direct Impact	**$8,803**			**$8,803**	**3.4%**
Indirect/Induced Impacts on Other Industries					
Services		$1,617	$1,989	**$3,606**	
Finance, insurance, real estate, rental and leasing		$1,347	$1,445	**$2,792**	
Manufacturing		$1,148	$386	**$1,534**	
Wholesale and retail trade		$483	$741	**$1,224**	
Transportation and warehousing		$264	$149	**$413**	
Utilities		$179	$115	**$294**	
Information		$120	$138	**$258**	
Construction		$196	$45	**$241**	
Government		$49	$92	**$141**	
Agriculture		$4	$28	**$31**	
Mining		$26	$3	**$28**	
Total Impact on Value Added	**$8,803**	**$5,432**	**$5,132**	**$19,367**	**7.5%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Montana, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**4,510**			**4,510**	**0.6%**
Indirect/Induced Impacts on Other Industries					
Services		3,520	5,440	**8,960**	
Finance, insurance, real estate, rental and leasing		1,210	1,260	**2,470**	
Wholesale and retail trade		460	1,600	**2,060**	
Construction		600	100	**700**	
Transportation and warehousing		340	340	**680**	
Manufacturing		280	250	**530**	
Agriculture		50	450	**500**	
Information		100	120	**220**	
Government		80	140	**220**	
Mining		100	30	**130**	
Utilities		60	40	**100**	
Total Impact on Employment	**4,510**	**6,800**	**9,780**	**21,100**	**3.0%**
Labor Income** ($ Millions)					
Industry Direct Impact	**$460**			**$460**	**1.4%**
Indirect/Induced Impacts on Other Industries					
Services		$202	$237	**$439**	
Finance, insurance, real estate, rental and leasing		$66	$48	**$115**	
Wholesale and retail trade		$31	$63	**$95**	
Transportation and warehousing		$25	$17	**$43**	
Construction		$33	$6	**$38**	
Manufacturing		$20	$13	**$32**	
Information		$8	$9	**$17**	
Government		$5	$10	**$15**	
Utilities		$8	$6	**$13**	
Agriculture		$2	$11	**$13**	
Mining		$9	$3	**$12**	
Total Impact on Labor Income	**$460**	**$409**	**$423**	**$1,292**	**3.9%**
Value Added ($ Millions)					
Industry Direct Impact	**$459**			**$459**	**0.9%**
Indirect/Induced Impacts on Other Industries					
Services		$223	$283	**$505**	
Finance, insurance, real estate, rental and leasing		$140	$205	**$345**	
Wholesale and retail trade		$63	$93	**$156**	
Transportation and warehousing		$51	$26	**$78**	
Manufacturing		$46	$28	**$75**	
Construction		$34	$7	**$41**	
Utilities		$23	$16	**$40**	
Mining		$25	$8	**$33**	
Information		$14	$17	**$32**	
Agriculture		$3	$25	**$28**	
Government		$7	$13	**$20**	
Total Impact on Value Added	**$459**	**$630**	**$721**	**$1,810**	**3.4%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in New Mexico, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**28,230**			**28,230**	**2.5%**
Indirect/Induced Impacts on Other Industries					
Services		8,930	15,700	**24,630**	
Finance, insurance, real estate, rental and leasing		4,330	2,870	**7,200**	
Wholesale and retail trade		1,380	4,350	**5,730**	
Transportation and warehousing		1,000	800	**1,800**	
Construction		1,420	250	**1,670**	
Manufacturing		550	410	**960**	
Government		310	530	**840**	
Information		320	310	**630**	
Agriculture		50	510	**560**	
Utilities		180	120	**300**	
Mining		120	20	**140**	
Total Impact on Employment	**28,230**	**18,590**	**25,860**	**72,680**	**6.4%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$2,441**			**$2,441**	**4.1%**
Indirect/Induced Impacts on Other Industries					
Services		$517	$653	**$1,171**	
Finance, insurance, real estate, rental and leasing		$227	$109	**$336**	
Wholesale and retail trade		$85	$151	**$236**	
Transportation and warehousing		$68	$36	**$105**	
Construction		$75	$13	**$88**	
Government		$23	$40	**$63**	
Manufacturing		$30	$20	**$50**	
Information		$21	$22	**$43**	
Utilities		$20	$13	**$33**	
Agriculture		$1	$15	**$16**	
Mining		$10	$2	**$12**	
Total Impact on Labor Income	**$2,441**	**$1,080**	**$1,074**	**$4,594**	**7.8%**
Value Added ($ Millions)					
Industry Direct Impact	**$9,299**			**$9,299**	**8.8%**
Indirect/Induced Impacts on Other Industries					
Services		$676	$829	**$1,505**	
Finance, insurance, real estate, rental and leasing		$552	$634	**$1,186**	
Wholesale and retail trade		$194	$261	**$455**	
Transportation and warehousing		$117	$51	**$169**	
Manufacturing		$93	$48	**$141**	
Government		$46	$82	**$128**	
Utilities		$66	$41	**$107**	
Construction		$87	$17	**$104**	
Information		$43	$48	**$91**	
Mining		$44	$7	**$51**	
Agriculture		$2	$22	**$24**	
Total Impact on Value Added	**$9,299**	**$1,921**	**$2,041**	**$13,260**	**12.6%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in North Dakota, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**23,530**			**23,530**	**4.0%**
Indirect/Induced Impacts on Other Industries					
Services		6,610	11,180	**17,790**	
Finance, insurance, real estate, rental and leasing		3,660	2,670	**6,330**	
Wholesale and retail trade		1,240	3,840	**5,080**	
Transportation and warehousing		1,010	810	**1,820**	
Construction		960	170	**1,130**	
Manufacturing		500	290	**790**	
Government		190	410	**600**	
Information		270	260	**530**	
Agriculture		40	430	**470**	
Utilities		150	100	**250**	
Mining		90	10	**100**	
Total Impact on Employment	**23,530**	**14,730**	**20,190**	**58,440**	**10.0%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$2,613**			**$2,613**	**7.6%**
Indirect/Induced Impacts on Other Industries					
Services		$435	$532	**$967**	
Finance, insurance, real estate, rental and leasing		$243	$128	**$371**	
Wholesale and retail trade		$109	$152	**$261**	
Transportation and warehousing		$101	$53	**$154**	
Construction		$69	$12	**$81**	
Manufacturing		$38	$20	**$58**	
Information		$24	$22	**$46**	
Government		$13	$28	**$41**	
Utilities		$22	$15	**$37**	
Agriculture		$2	$21	**$24**	
Mining		$7	$1	**$9**	
Total Impact on Labor Income	**$2,613**	**$1,063**	**$986**	**$4,663**	**13.6%**
Value Added ($ Millions)					
Industry Direct Impact	**$5,848**			**$5,848**	**10.2%**
Indirect/Induced Impacts on Other Industries					
Services		$500	$631	**$1,131**	
Finance, insurance, real estate, rental and leasing		$491	$457	**$948**	
Wholesale and retail trade		$218	$241	**$459**	
Transportation and warehousing		$170	$79	**$249**	
Manufacturing		$86	$40	**$125**	
Construction		$85	$17	**$102**	
Utilities		$60	$41	**$102**	
Information		$42	$39	**$81**	
Government		$16	$34	**$49**	
Agriculture		$4	$39	**$43**	
Mining		$21	$3	**$24**	
Total Impact on Value Added	**$5,848**	**$1,693**	**$1,620**	**$9,161**	**16.0%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Ohio, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**17,500**			**17,500**	**0.2%**
Indirect/Induced Impacts on Other Industries					
Services		28,510	41,050	**69,560**	
Finance, insurance, real estate, rental and leasing		6,790	7,890	**14,680**	
Manufacturing		9,550	4,990	**14,540**	
Wholesale and retail trade		3,560	10,120	**13,680**	
Transportation and warehousing		2,850	3,510	**6,360**	
Construction		3,880	530	**4,410**	
Information		810	1,130	**1,940**	
Agriculture		140	1,200	**1,340**	
Government		450	820	**1,270**	
Utilities		280	240	**520**	
Mining		110	30	**140**	
Total Impact on Employment	**17,500**	**56,940**	**71,510**	**145,950**	**2.0%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$771**			**$771**	**0.2%**
Indirect/Induced Impacts on Other Industries					
Services		$2,300	$2,094	**$4,393**	
Manufacturing		$806	$377	**$1,183**	
Finance, insurance, real estate, rental and leasing		$491	$426	**$917**	
Wholesale and retail trade		$294	$468	**$762**	
Transportation and warehousing		$306	$196	**$502**	
Construction		$248	$33	**$281**	
Information		$79	$104	**$183**	
Government		$37	$68	**$105**	
Utilities		$43	$35	**$78**	
Agriculture		$5	$27	**$32**	
Mining		$16	$5	**$21**	
Total Impact on Labor Income	**$771**	**$4,624**	**$3,833**	**$9,228**	**2.2%**
Value Added ($ Millions)					
Industry Direct Impact	**$9,882**			**$9,882**	**1.4%**
Indirect/Induced Impacts on Other Industries					
Services		$2,619	$2,544	**$5,163**	
Finance, insurance, real estate, rental and leasing		$1,370	$1,964	**$3,334**	
Manufacturing		$1,452	$771	**$2,222**	
Wholesale and retail trade		$581	$851	**$1,432**	
Transportation and warehousing		$439	$259	**$697**	
Information		$158	$214	**$372**	
Construction		$257	$44	**$301**	
Utilities		$164	$133	**$296**	
Government		$50	$95	**$144**	
Agriculture		$6	$40	**$46**	
Mining		$27	$5	**$32**	
Total Impact on Value Added	**$9,882**	**$7,123**	**$6,919**	**$23,923**	**3.4%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Oklahoma, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**94,930**			**94,930**	**4.1%**
Indirect/Induced Impacts on Other Industries					
Services		38,120	47,480	**85,600**	
Finance, insurance, real estate, rental and leasing		18,060	11,480	**29,540**	
Wholesale and retail trade		5,390	15,330	**20,720**	
Transportation and warehousing		3,950	3,100	**7,050**	
Manufacturing		3,650	1,460	**5,110**	
Construction		3,710	850	**4,560**	
Government		1,750	1,840	**3,590**	
Information		1,680	1,230	**2,910**	
Agriculture		110	1,480	**1,590**	
Utilities		1,170	410	**1,580**	
Mining		350	40	**390**	
Total Impact on Employment	**94,930**	**77,930**	**84,700**	**257,570**	**11.0%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$8,683**			**$8,683**	**6.7%**
Indirect/Induced Impacts on Other Industries					
Services		$2,307	$2,095	**$4,402**	
Transportation and warehousing		$1,360	$206	**$1,566**	
Finance, insurance, real estate, rental and leasing		$927	$419	**$1,346**	
Wholesale and retail trade		$395	$539	**$935**	
Manufacturing		$333	$104	**$437**	
Construction		$200	$46	**$246**	
Government		$119	$126	**$245**	
Information		$143	$95	**$238**	
Utilities		$159	$59	**$217**	
Mining		$50	$9	**$58**	
Agriculture		$2	$21	**$23**	
Total Impact on Labor Income	**$8,683**	**$5,994**	**$3,719**	**$18,395**	**14.2%**
Value Added ($ Millions)					
Industry Direct Impact	**$21,303**			**$21,303**	**10.5%**
Indirect/Induced Impacts on Other Industries					
Services		$2,775	$2,528	**$5,304**	
Finance, insurance, real estate, rental and leasing		$2,004	$1,799	**$3,803**	
Transportation and warehousing		$1,672	$279	**$1,952**	
Wholesale and retail trade		$840	$922	**$1,762**	
Manufacturing		$540	$184	**$724**	
Utilities		$408	$147	**$555**	
Information		$270	$198	**$468**	
Government		$163	$175	**$338**	
Construction		$209	$52	**$261**	
Mining		$63	$7	**$70**	
Agriculture		$3	$49	**$53**	
Total Impact on Value Added	**$21,303**	**$8,948**	**$6,341**	**$36,592**	**18.1%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Pennsylvania, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**27,420**			**27,420**	**0.3%**
Indirect/Induced Impacts on Other Industries					
Services		30,910	58,490	**89,400**	
Finance, insurance, real estate, rental and leasing		10,070	11,580	**21,650**	
Wholesale and retail trade		3,590	13,720	**17,310**	
Manufacturing		8,530	4,900	**13,430**	
Transportation and warehousing		3,400	5,180	**8,580**	
Construction		4,540	700	**5,240**	
Information		780	1,250	**2,030**	
Government		480	1,050	**1,530**	
Agriculture		140	1,090	**1,230**	
Utilities		360	340	**700**	
Mining		290	80	**370**	
Total Impact on Employment	**27,420**	**63,070**	**98,390**	**188,880**	**2.4%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$2,281**			**$2,281**	**0.4%**
Indirect/Induced Impacts on Other Industries					
Services		$2,841	$3,308	**$6,149**	
Finance, insurance, real estate, rental and leasing		$851	$733	**$1,584**	
Manufacturing		$754	$385	**$1,140**	
Wholesale and retail trade		$313	$641	**$954**	
Transportation and warehousing		$509	$315	**$825**	
Information		$290	$351	**$641**	
Construction		$322	$49	**$371**	
Government		$42	$92	**$135**	
Utilities		$61	$55	**$115**	
Agriculture		$6	$25	**$30**	
Mining		$17	$4	**$21**	
Total Impact on Labor Income	**$2,281**	**$6,006**	**$5,958**	**$14,244**	**2.8%**
Value Added ($ Millions)					
Industry Direct Impact	**$13,313**			**$13,313**	**1.6%**
Indirect/Induced Impacts on Other Industries					
Services		$3,208	$3,913	**$7,120**	
Finance, insurance, real estate, rental and leasing		$1,716	$2,588	**$4,303**	
Manufacturing		$1,273	$744	**$2,017**	
Wholesale and retail trade		$641	$1,100	**$1,741**	
Transportation and warehousing		$863	$396	**$1,259**	
Information		$440	$604	**$1,044**	
Construction		$349	$66	**$415**	
Utilities		$194	$173	**$367**	
Government		$56	$126	**$182**	
Mining		$68	$17	**$85**	
Agriculture		$7	$45	**$52**	
Total Impact on Value Added	**$13,313**	**$8,814**	**$9,771**	**$31,898**	**3.9%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Texas, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**334,410**			**334,410**	**1.9%**
Indirect/Induced Impacts on Other Industries					
Services		239,050	427,810	**666,860**	
Finance, insurance, real estate, rental and leasing		84,480	113,590	**198,070**	
Wholesale and retail trade		26,330	129,070	**155,400**	
Transportation and warehousing		26,530	36,650	**63,180**	
Manufacturing		25,840	16,420	**42,260**	
Construction		20,290	6,950	**27,240**	
Information		9,500	14,750	**24,250**	
Government		5,400	13,220	**18,620**	
Agriculture		670	10,110	**10,780**	
Utilities		3,610	2,760	**6,370**	
Mining		1,390	260	**1,650**	
Total Impact on Employment	**334,410**	**443,100**	**771,610**	**1,549,110**	**8.6%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$82,887**			**$82,887**	**7.2%**
Indirect/Induced Impacts on Other Industries					
Services		$19,279	$21,003	**$40,282**	
Finance, insurance, real estate, rental and leasing		$5,987	$6,298	**$12,286**	
Wholesale and retail trade		$2,446	$5,943	**$8,389**	
Transportation and warehousing		$5,951	$1,894	**$7,845**	
Manufacturing		$2,803	$1,262	**$4,065**	
Information		$952	$1,429	**$2,382**	
Construction		$1,391	$472	**$1,863**	
Government		$417	$1,015	**$1,432**	
Utilities		$659	$501	**$1,160**	
Mining		$197	$25	**$222**	
Agriculture		$12	$118	**$129**	
Total Impact on Labor Income	**$82,887**	**$40,094**	**$39,960**	**$162,942**	**14.1%**
Value Added ($ Millions)					
Industry Direct Impact	**$122,457**			**$122,457**	**6.6%**
Indirect/Induced Impacts on Other Industries					
Services		$21,846	$24,686	**$46,533**	
Finance, insurance, real estate, rental and leasing		$12,391	$19,913	**$32,304**	
Wholesale and retail trade		$5,177	$10,213	**$15,390**	
Manufacturing		$6,573	$2,888	**$9,461**	
Transportation and warehousing		$4,337	$2,315	**$6,652**	
Information		$1,777	$2,805	**$4,581**	
Utilities		$1,906	$1,436	**$3,343**	
Construction		$1,507	$583	**$2,090**	
Government		$523	$1,283	**$1,806**	
Mining		$391	$59	**$451**	
Agriculture		$19	$284	**$303**	
Total Impact on Value Added	**$122,457**	**$56,448**	**$66,466**	**$245,371**	**13.3%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Utah, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**5,920**			**5,920**	**0.3%**
Indirect/Induced Impacts on Other Industries					
Services		9,210	11,030	**20,240**	
Finance, insurance, real estate, rental and leasing		2,700	3,000	**5,700**	
Wholesale and retail trade		930	3,250	**4,180**	
Manufacturing		1,600	1,130	**2,730**	
Transportation and warehousing		830	1,060	**1,890**	
Construction		1,480	200	**1,680**	
Information		410	600	**1,010**	
Government		150	280	**430**	
Agriculture		30	300	**330**	
Mining		120	30	**150**	
Utilities		70	60	**130**	
Total Impact on Employment	**5,920**	**17,540**	**20,950**	**44,410**	**2.1%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$365**			**$365**	**0.3%**
Indirect/Induced Impacts on Other Industries					
Services		$638	$505	**$1,143**	
Finance, insurance, real estate, rental and leasing		$153	$127	**$281**	
Wholesale and retail trade		$78	$162	**$240**	
Manufacturing		$124	$74	**$199**	
Transportation and warehousing		$62	$68	**$130**	
Construction		$91	$12	**$103**	
Information		$39	$55	**$94**	
Government		$11	$21	**$32**	
Utilities		$12	$10	**$22**	
Mining		$7	$2	**$9**	
Agriculture		$1	$5	**$6**	
Total Impact on Labor Income	**$365**	**$1,217**	**$1,041**	**$2,623**	**2.3%**
Value Added ($ Millions)					
Industry Direct Impact	**$819**			**$819**	**0.4%**
Indirect/Induced Impacts on Other Industries					
Services		$725	$628	**$1,352**	
Finance, insurance, real estate, rental and leasing		$396	$547	**$943**	
Wholesale and retail trade		$147	$274	**$422**	
Manufacturing		$231	$133	**$364**	
Transportation and warehousing		$95	$102	**$198**	
Information		$76	$103	**$179**	
Construction		$112	$19	**$131**	
Utilities		$38	$33	**$71**	
Government		$16	$30	**$46**	
Mining		$26	$8	**$34**	
Agriculture		$1	$14	**$15**	
Total Impact on Value Added	**$819**	**$1,864**	**$1,892**	**$4,574**	**2.4%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in West Virginia, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**13,180**			**13,180**	**1.5%**
Indirect/Induced Impacts on Other Industries					
Services		6,190	8,620	**14,810**	
Finance, insurance, real estate, rental and leasing		2,330	1,290	**3,620**	
Wholesale and retail trade		840	2,330	**3,170**	
Transportation and warehousing		880	500	**1,380**	
Manufacturing		770	390	**1,160**	
Construction		760	110	**870**	
Agriculture		40	360	**400**	
Government		150	240	**390**	
Information		190	140	**330**	
Mining		240	70	**310**	
Utilities		110	70	**180**	
Total Impact on Employment	**13,180**	**12,500**	**14,100**	**39,790**	**4.4%**
***Labor Income** ($ Millions)*					
Industry Direct Impact	**$1,060**			**$1,060**	**2.3%**
Indirect/Induced Impacts on Other Industries					
Services		$423	$400	**$823**	
Finance, insurance, real estate, rental and leasing		$146	$57	**$203**	
Wholesale and retail trade		$57	$80	**$137**	
Transportation and warehousing		$86	$26	**$112**	
Manufacturing		$66	$28	**$94**	
Construction		$47	$7	**$54**	
Mining		$22	$7	**$29**	
Government		$10	$16	**$26**	
Utilities		$16	$9	**$25**	
Information		$14	$10	**$24**	
Agriculture		$1	$1	**$2**	
Total Impact on Labor Income	**$1,060**	**$889**	**$641**	**$2,590**	**5.5%**
Value Added ($ Millions)					
Industry Direct Impact	**$3,328**			**$3,328**	**4.2%**
Indirect/Induced Impacts on Other Industries					
Services		$452	$472	**$924**	
Finance, insurance, real estate, rental and leasing		$372	$296	**$669**	
Wholesale and retail trade		$134	$151	**$285**	
Manufacturing		$133	$59	**$192**	
Transportation and warehousing		$152	$35	**$187**	
Mining		$65	$19	**$85**	
Utilities		$48	$29	**$77**	
Construction		$60	$10	**$70**	
Information		$28	$21	**$49**	
Government		$13	$22	**$35**	
Agriculture		$1	$4	**$5**	
Total Impact on Value Added	**$3,328**	**$1,460**	**$1,118**	**$5,907**	**7.5%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

The Economic Impact of the Onshore Upstream Subsector in Wyoming, 2019

Sector Description	Direct	Indirect	Induced	Total	As a % of State Total
Employment*					
Industry Direct Impact	**16,830**			**16,830**	**4.1%**
Indirect/Induced Impacts on Other Industries					
Services		4,420	5,120	**9,540**	
Finance, insurance, real estate, rental and leasing		3,130	1,810	**4,940**	
Wholesale and retail trade		800	1,730	**2,530**	
Transportation and warehousing		520	340	**860**	
Construction		720	120	**840**	
Manufacturing		280	120	**400**	
Government		150	220	**370**	
Agriculture		30	260	**290**	
Information		160	110	**270**	
Mining		160	40	**200**	
Utilities		90	50	**140**	
Total Impact on Employment	**16,830**	**10,460**	**9,920**	**37,210**	**9.0%**
Labor Income** ($ Millions)					
Industry Direct Impact	**$1,487**			**$1,487**	**6.3%**
Indirect/Induced Impacts on Other Industries					
Services		$233	$203	**$436**	
Finance, insurance, real estate, rental and leasing		$119	$52	**$171**	
Transportation and warehousing		$135	$27	**$162**	
Wholesale and retail trade		$63	$59	**$122**	
Construction		$43	$7	**$50**	
Manufacturing		$26	$8	**$34**	
Government		$11	$17	**$28**	
Mining		$21	$6	**$26**	
Utilities		$12	$7	**$19**	
Information		$11	$8	**$19**	
Agriculture		$1	$5	**$5**	
Total Impact on Labor Income	**$1,487**	**$673**	**$398**	**$2,558**	**10.9%**
Value Added ($ Millions)					
Industry Direct Impact	**$3,258**			**$3,258**	**8.1%**
Indirect/Induced Impacts on Other Industries					
Services		$285	$253	**$538**	
Finance, insurance, real estate, rental and leasing		$279	$248	**$527**	
Transportation and warehousing		$242	$45	**$287**	
Wholesale and retail trade		$119	$102	**$220**	
Mining		$61	$17	**$78**	
Manufacturing		$54	$18	**$72**	
Construction		$57	$11	**$68**	
Utilities		$37	$20	**$57**	
Information		$23	$16	**$39**	
Government		$14	$21	**$35**	
Agriculture		$1	$10	**$12**	
Total Impact on Value Added	**$3,258**	**$1,172**	**$760**	**$5,190**	**12.8%**

Source: PwC calculations based on the IMPLAN modeling system (2019 database). Details may not add up to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

Appendix B: Data Sources and Methodology

This Appendix describes the methodology used to derive the results for the study. It first discusses the data sources PwC utilized to develop estimates of the onshore upstream subsector's direct employment, labor income, and value-added impacts and its dividend and capital investment impacts. It then describes the development of the indirect and induced impact estimates.

Estimating the Direct Jobs, Labor Income and Value Added

PwC's employment estimates for the upstream subsector of the US oil and natural gas industry include both full-time and part-time workers as well as self-employed business owners. The *State Annual Personal Income and Employment* data set published by the US Bureau of Economic Analysis ("BEA") is the only source on total employment including self-employed individuals by industry. In cases where there is a one-to-one correspondence between the subsectors of the oil and natural gas industry as defined by PwC and the BEA sectors, we use the BEA data on employment, labor income and GDP without any further adjustment. This is the case for NAICS 211 (Oil and gas extraction).

The other two NAICS codes that define the upstream subsector of the US oil and natural gas industry are more disaggregated compared to the BEA data. PwC obtained each NAICS sector's paid employment from the US Bureau of Labor Statistics ("BLS"), and then estimated total self-employment for the more aggregated industry using the BEA data and allocated across the two NAICS sectors according to each NAICS sector's share of paid employment. Specifically, self-employment was estimated for NAICS sector 213 (Support Activities for Mining) and then allocated across five subsectors including 213111 (Drilling Oil and Gas Wells) and 213112 (Support Activities for Oil and Gas Operations).

Direct employment was separately estimated for each of the 14 states studied. A similar methodology was used to estimate labor income and GDP.

In nine of the 14 states studied, the upstream subsector of the oil and natural gas industry includes onshore operations only, while the other five states include both onshore and offshore operations. These states are Alaska, Alabama, California, Louisiana, and Texas. For Alabama, California, Louisiana, and Texas, we relied on each state's daily onshore production volume of crude oil and natural gas in 2019 from IHS Markit and the 2019 prices for crude oil and natural gas from the Energy Information Administration (EIA) to estimate the direct output value of the onshore upstream subsector in the respective states. Similar production data for Alaska were obtained from Alaska's Department of Natural Resources to estimate the direct output value of the onshore upstream subsector in Alaska. The direct output of the subsector in each of the 14 state is then used to estimate the corresponding direct employment, direct labor income, and direct value added of the subsector based on the IMPLAN model.

Estimating Capital Investment Impact

To quantify the onshore upstream subsector's capital investment impact, PwC estimated its capital expenditures for 2019 based on data from the Census Bureau and the BEA. For the impact analysis, capital spending was then translated into purchases of capital assets by type through the use of the so-called "capital flow matrix" from the BEA.

Estimating Dividend Impact

PwC obtained data on common stock dividend payments by companies in the US oil and natural gas industry.[6] Dividend payments were allocated between households, foreign shareholders, retirement plans, governments, and other businesses using data from the Federal Reserve Board's *Financial Accounts of the United States*. Dividends paid to households by the oil and natural gas industry were allocated by income group and across the 50 states and the District of Columbia using tax return data published by the IRS's Statistics of Income Division.

Dividends paid to pension plans and other retirement accounts were allocated across income groups based on data on retirement assets by income quintile obtained from the 2019 *Survey of Consumer Finances*, conducted by the Federal Reserve. The data were then allocated across the 50 states and the District of Columbia using data on the distribution of assets in 401(k) and thrift savings accounts from the *Survey of Income and Program Participation* conducted by the US Census Bureau. These data were combined with the data on dividends paid directly to households by the oil and natural gas industry to derive our estimates of total dividends paid by the industry to residents in each state.

To quantify the economic impact resulting from the dividend payments of the onshore upstream subsector of the US oil and natural gas industry, PwC first converted the industry's dividend payments into additional household consumption expenditures. For dividends paid directly to households, after-tax dividend income was estimated by income class based on average tax rates on dividend income. The additional consumption from dividends paid directly to households was estimated using published estimates of the marginal propensity to consume out of dividend income.[7] Similarly, the additional consumption resulting from dividends paid to retirement accounts was estimated based on published estimates of the marginal propensity to consume out of wealth.[8] Finally, a portion of the industry's dividend payout impacts was allocated to each state based on the share of the onshore upstream subsector relative to the oil and natural gas industry as a whole in each state.

Estimating the Indirect and Induced Economic Impacts

The initial round of output, income, and employment generated by the operations of the onshore upstream subsector of the US oil and natural gas industry leads to successive rounds of re-spending in the chain of production and through the personal consumption spending of industry and supplier employees. Such indirect and induced economic impacts can be measured using various approaches. The most common is multiplier analysis. In broad terms, a multiplier is an index that indicates the overall change in the level of economic activity that results from a

[6] The measure of dividends used includes cash dividends from all classes of common stock out of income from US operations by US corporations in the oil and natural gas industry. It also includes dividends paid to US shareholders out of income from US operations by foreign corporations in the industry. It does not include the dollar value of stock dividends or dividends paid or accrued on preferred stock.

[7] The marginal propensity to consume out of dividend income is a measure of the additional consumption resulting from the last dollar of dividend income earned. The MPCs used for this study were based on Malcolm Baker, Stefan Nagel, and Jeffrey Wurgler, "The Effects of Dividends on Consumption" *Brookings Papers on Economic Activity*, 2007, pgs. 213-291. Using two micro data sets the authors estimated pre-tax MPCs ranging from 0.25 to 0.77. Using the authors' midpoint estimate of 0.4, PwC estimated the after-tax MPC for each income group as the pre-tax MPC divided by one minus the marginal effective tax rate on dividend income.

[8] A review of the literature suggests that each additional dollar of financial wealth increases consumption between two and six cents. To be conservative we have assumed an MPC out of wealth of 0.028 for all income groups (based on Gabriel Chodorow-Reich, Plamen T. Nenov, and Alp Simsek, "Stock Market Wealth and the Real Economy: A Local Labor Market Approach," working paper, June 7, 2019).

given initial change. It effectively adds up all the successive rounds of re-spending, based on a number of assumptions that are embedded in the method of estimation.

There are different methods available for calculating multipliers. The method used in this report is *input-output* analysis. It is the most commonly used approach in regional economic impact studies. The input-output model developed by IMPLAN is a well-known input-output model for regional economic studies in the United States and is widely used by government, academics and private-sector researchers.[9]

The IMPLAN model is built around an "input-output" table that relates the purchases that each industry has made from other industries to the value of the output of each industry. To meet the demand for goods and services from an industry, purchases are made in other industries according to the patterns recorded in the input-output table. These purchases in turn spark still more purchases by the industry's suppliers, and so on. Additionally, employees and business owners make personal purchases out of the additional income that is generated by this process, sending new demands rippling through the economy. Multipliers describe these iterations. The Type I multiplier measures the direct and indirect effects of a change in economic activity. It captures the inter-industry effects only, i.e., industries buying from local industries. The Type II (Social Accounting Matrix or SAM) multiplier captures the direct and indirect effects and, in addition, it also reflects induced effects (i.e., changes in spending from households as income increases or decreases due to the changes in production). The indirect and induced impacts by the oil and natural gas industry on other sectors of the economy in terms of employment, labor income (including wages and salaries and benefits as well as proprietors' income), and value added were calculated through the multiplier process built into the model.[10]

For this study, PwC built customized IMPLAN input-output models for the 14 states to calculate the onshore upstream subsector's *indirect* and *induced* economic impact on each study area in terms of employment, labor income, and value added. Cross-state spillover effects for each of the 14 states were also quantified. For example, if North Dakota's upstream subsector of the oil and natural gas industry buys intermediate inputs from a supplier located in a state outside of the selected 14 states (say Indiana), the indirect impact on Indiana is excluded from the current analysis, but if the said Indiana supplier then buys inputs from one of the 14 states (say California), then the indirect impact on California is included. Further, if the Indiana supplier's employees increase their purchase of gasoline, the effect on North Dakota is included.

[9] More information on IMPLAN is available at www.implan.com.

[10] Because the IMPLAN models are used for total impact analysis (as opposed to marginal impact analysis) in this study, necessary adjustments are made to the initial indirect and induced impact estimates to prevent double counting. For instance, any indirect or induced effects from the estimates that are mapped to the onshore upstream subsector are removed.