



LAEDC

2019 REPORT

# Oil & Gas In California:

## The Industry, Its Economic Contribution and User Industries at Risk.

A look at the industry in 2017, the most  
recent year with complete data available.

Institute For Applied Economics  
Los Angeles County Economic Development Corporation

# OIL AND GAS IN CALIFORNIA:

## THE INDUSTRY, ITS ECONOMIC CONTRIBUTION AND USER INDUSTRIES AT RISK IN 2017

Los Angeles County Economic Development Corporation  
444 S. Flower Street, 37<sup>th</sup> Floor ♦ Los Angeles, CA 90071  
(888) 4-LAEDC-1 ♦ [www.LAEDC.org](http://www.LAEDC.org)



Shannon M. Sedgwick  
Tyler Laferriere  
Eric Hayes  
Somjita Mitra, Ph.D.

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The LAEDC Institute for Applied Economics provides objective economic and policy research for public agencies and private firms. The group focuses on economic impact studies, regional industry analyses, economic forecasts and issue studies, particularly in workforce development, transportation, infrastructure and environmental policy.

Every reasonable effort has been made to ensure that the data contained herein reflect the most accurate and timely information possible and they are believed to be reliable.

The report is provided solely for informational purposes and is not to be construed as providing advice, recommendations, endorsements, representations or warranties of any kind whatsoever.

## Executive Summary

The oil and gas industry makes a significant contribution to the California economy. Extraction, production, refining and petroleum products manufacturing result in highly tradable products both consumed domestically and exported, producing high revenues, high wage jobs and significant fiscal revenues for all levels of government.

The oil and gas industry is facing a number of challenges that include: price volatility; regulatory issues; changes in economic growth impacting demand; environmental activism; community support; geopolitical unrest; and emerging alternative intermittent sources of energy.

In this report, the Institute for Applied Economics of the Los Angeles County Economic Development Corporation (LAEDC) conducts an industry contribution analysis of the oil and gas industry in California in 2017, looks at the workforce in the industry and concludes with forward industry linkages for oil and gas industries in California in 2017. The findings are set forth below:

## Oil and Gas Industry

### *Total Economic Contribution*

The total economic contribution of the oil and gas industry in California, which includes indirect and induced activity, is presented in Exhibit ES-1.

These estimates include all segments of the industry; upstream, midstream, downstream and industries which market the products to end users. Direct employment estimates in this report represent activity which would be lost to the economy without the presence of the oil and gas industry in California.

The oil and gas industry in California:

- ▶ Directly employed 152,100 workers statewide, which supported an additional 213,860 jobs though indirect and induced effects, for a total of 365,970 jobs in 2017.
- ▶ Generated \$152.3 billion in total economic output, making up 2.1 percent of California's overall gross state product in 2017.



#### Exhibit ES-1

#### Total Economic Contribution of Oil and Gas Industry California 2017

<b>Employment (jobs):</b>			
Direct	152,100		
<b>TOTAL</b>			<b>365,970</b>
<i>Percent of California Total Employment</i>			<i>1.6%</i>
<b>Labor income (\$ millions):</b>			
Direct	\$ 12,059		
<b>TOTAL</b>			<b>\$ 26,148</b>
<i>Percent of California Total Labor Income</i>			<i>1.6%</i>
<b>Value added (\$ millions):</b>			
Direct	\$ 35,885		
<b>TOTAL</b>			<b>\$ 59,332</b>
<i>Percent of California Total GDP</i>			<i>2.1%</i>
<b>Output (\$ millions):</b>			
Direct	\$114,881		
<b>TOTAL</b>			<b>\$152,300</b>
<i>Percent of California Total Output</i>			<i>3.4%</i>

Source: Estimates by LAEDC

- Generated approximately \$21.5 billion in state and local taxes, including \$11 billion in sales tax, \$7 billion in property taxes, \$96 million in DOGGR assessments, and \$1 billion in income taxes.

Employment in the oil and gas industry in California has grown in 2016 and 2017, employment in the industry is 6 percent higher than its prerecession peak. Jobs are forecast to increase an additional 1.6 percent over the next five years, although the outlook for employment will be affected if oil prices drop again/remain low.

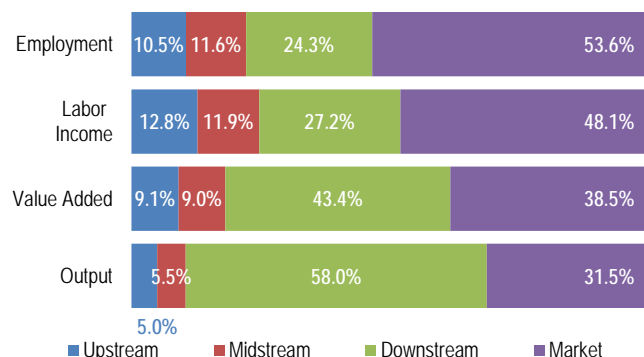
In 2017, 174.1 million barrels (bbl.) of crude and 209.3 billion cubic feet (Bcf.) of natural gas was produced in the state.

### Total Economic Contribution by Industry Segment

Each segment of the oil and gas industry is associated with its own distinct set of activities, which ripple through the California economy with different magnitudes. Exhibit ES-2 shows the distribution of the total economic contribution of the oil and gas industry by industry segment.

#### Exhibit ES-2

Distribution of Total Impacts by Industry Segment  
California 2017



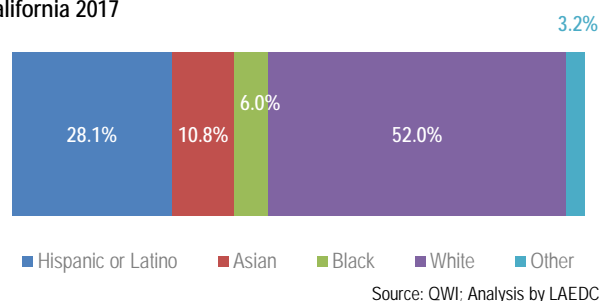
## Characteristics of the Workforce

The industry employs individuals with a broad range of characteristics exhibiting notable diversity as shown in Exhibits ES-3 and ES-4:

- The workforce is ethnically and racially diverse, with 28.1 percent of Hispanic origin, 10.8 percent Asian, and 6.0 percent black.
- Men in the workforce outnumber women by more than two to one.
- Almost three-quarters (73 percent) of the industry's workforce is in its prime working age—between 22 years and 54 years of age, although workers aged 55 years and older accounted for 26.2 percent, a significant share of the industry workforce.
- A diversity of employment opportunities is available across the educational spectrum:
  - Approximately 35 percent of workers have a bachelor's degree or higher;
  - Just over 32 percent have some college, post-secondary certification or an associate degree; and
  - About 31 percent of all workers have high school credentials or less.
  - Across all levels of education, earnings are higher in oil and gas industries compared to the all industry average. ❖

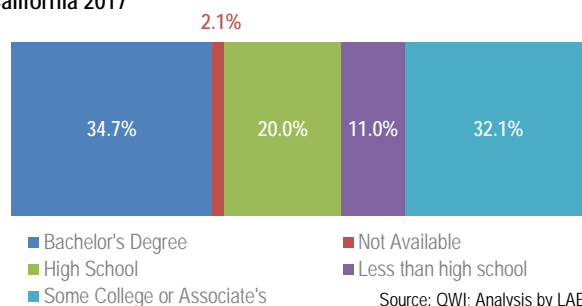
#### Exhibit ES-3

Employment Distribution by Race and Ethnicity  
California 2017



#### Exhibit ES-4

Industry Employment Distribution by Education  
California 2017



## Changes in Worker Characteristics over Time

A comparison of worker characteristics in the oil and gas industry in California between this report (2017) and the two previous industry reports (2013 and 2015) revealed the following:

- ▶ The share of workers who are women fluctuate between a quarter and a third of the industry's workforce;
- ▶ The share of older workers, 35 years and above, has increased in the industry;
- ▶ The racial and ethnic composition of the industry's workforce has remained relatively constant; and
- ▶ The share of workers with a community college level education or above has increased.

## Future Workforce Needs

Industry employment is expected to grow moderately, by close to 2 percent between 2017 and 2022, with mixed performance across the various component industries. Overall, it is expected that close to 2,500 payroll jobs will be created in the industry in California over the next five years.

Educational institutions at the secondary (high school) and post-secondary level (community colleges and four-year universities, vocational-technical schools and apprenticeships) educate individuals to work in the oil and gas industry across all skill-levels.

## Oil and Gas Occupations

Workforce characteristics, including demographics, employment and wage data, are presented in occupational profiles covering ten detailed occupations identified as unique to the oil and gas industry.

## User Industries: Forward Linkages

Many industries are directly dependent on oil and gas products in their production processes and will be exposed to the risk of cost increases, relocation or closure should there be a reduction in the availability or increase in the prices of these products. *Forward linkages* are the industries that purchase these oil and gas products as inputs. These primary user industries represent significant economic activity which is at risk, as shown in Exhibit ES-5.

- ▶ 3.9 million jobs (16.5 percent of state total)
- ▶ \$1.0 trillion in labor income
- ▶ \$610 billion in value added annually, accounting for 22.0 percent of state GDP.

In addition to the oil and gas industry itself, California's utilities, mining, manufacturing and transportation industries are vulnerable and will be most at risk. ❖

### Exhibit ES-5

Economic Activity At Risk from Oil and Gas Industry Changes:  
At Risk User Industries Across All Segments in California 2017

<b>Employment (jobs):</b>	
Primary Industries	3,897,320
Percent of California Total Employment	16.5%
<b>Labor income (\$ billions):</b>	
Primary Industries	\$ 1,038.4
Percent of California Total Labor Income	23.4%
<b>Value added (\$ billions):</b>	
Primary Industries	\$ 610.6
Percent of California Total GDP	22.0%

Source: Estimates by LAEDC





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# 1 Introduction

The U.S. economy is incredibly dependent on the oil and gas industry. Operating in a global market, demand, supply and prices are influenced by what takes place worldwide, not just nationally. Extraction, production, refining and related manufacturing result in highly tradable products consumed domestically and exported to satiate California and global demand. As a result, the oil and gas industry is associated with high revenues and high wage jobs.

As finite natural resources, the extraction, production, and refining of oil and natural gas are heavily regulated and heavily taxed, resulting in public revenues that are larger than those collected from other industries.

The industry continues to face strict regulatory mandates adopted by the state of California to meet their aggressive emissions goals, these mandates are changing the market faced by the industry. The ability of in-state oil production and refinery operations to continue and the available supply of petroleum products will continue to be affected.

## Report Organization

In this report, the Institute for Applied Economics of the Los Angeles County Economic Development Corporation (LAEDC) estimates the economic and fiscal contribution of the oil and gas industry in California, explores the industry's workforce in the state, and conducts a regional dependency study of the four industry segments, which evaluates the ripple effect of potential changes in the oil and gas industry and how that may impact user industries in California. The report is presented in eight parts.

This introductory section provides a short description of the industry definition and sub-regions used in the contribution analysis. Additional details and methodology can be found in the appendix.

Section 2 provides a brief overview of the oil and gas industry in California, including upstream, midstream, downstream market segment activity. Section 3 examines the state's oil and gas industry's workforce.

Section 4 provides an analysis of the oil and gas industry's total economic and fiscal contribution to the state of California and a discussion of the public revenues



Photo: US Department of Energy

attributed to the industry and the consumption of its products.

Section 5 provides analysis at the sub-regional and county levels and provides contributions for most counties in California.

Section 6 traces oil and gas industry products through the industry user chain for each segment of the industry. A *vulnerability index* is constructed to evaluate each industry's exposure to these products. The top primary user industries most vulnerable to potential supply disruptions are quantified for each oil and gas industry segment, providing an order of magnitude estimate of the economic activity that is at risk from reduction of supply of refined petroleum products based on the *forward linkages* of the oil and gas industry in California.

Section 7 provides an analysis of the top sixteen most vulnerable primary user industries of oil and gas products. Employment, labor income, output and direct contribution to GDP are estimated to provide orders of magnitude of the economic activity that is at risk from potential price changes and reduction of supply for these products.

Section 8 identifies employment in industries at risk, user industries that rely upon oil and gas products in their supply chain, or who are users of the dependent industry's output. Jobs at risk are identified at the county level and the senate and congressional district level.

Section 9 includes detailed sheets for each county in California for the economic contribution of the oil and gas industry, and the number of jobs in industries identified

as most at risk from potential refinery supply disruptions. For context, the economic base for each county is provided to illustrate how the oil and gas industry relates to the county economy.

Detailed tables as referenced in the text can be found in the Appendix. ❖

## Oil and Gas Industry Definition

The North American Industry Classification System (NAICS) was created to track economic activity for businesses at the establishment level. Each establishment is grouped according to its primary activity. The thirteen NAICS codes included in the definition of the oil and gas industry used in this report are listed in Exhibit 1-1. These are described in detail in the Appendix.

Throughout this report, the thirteen industry codes included in the oil and gas industry definition have been grouped into the following categories: upstream, midstream, downstream and market.

The oil and gas industry is commonly categorized into three major segments, upstream, midstream and downstream. Upstream operations are related to oil and gas production including the separation of oil, natural gas, and water. Downstream operations include the refining of crude and the processing and purifying of natural gas for distribution and sale to users. Midstream operations work in the “in-between” and are related to the processing and separation of gas and condensate and the use of heaters and scrubbers to produce pipeline quality

gas, and the transportation (includes pipeline), storage and wholesale of crude oil, natural gas, NGLs (natural gas liquids) and other hydrocarbon products. While the retail and distribution of oil and gas products can be included in the downstream segment, for the purposes of this report, industries involved in marketing oil and gas products to the end user have been separated into their own “market” category. ❖

**Exhibit 1-1**  
**Oil and Gas Industry Definition**

NAICS	Industry
<b>Upstream Industries</b>	
211	Oil and gas extraction
213111	Drilling oil and gas wells
213112	Support activities for oil and gas operations
333132	Oil and gas field machinery and equipment manufacturing
<b>Midstream Industries</b>	
23712	Oil and gas pipeline and related structures construction
4247	Petroleum and petroleum products merchant wholesalers
486	Pipeline transportation
<b>Downstream Industries</b>	
32411	Petroleum refineries
324191	Petroleum lubricating oil and grease manufacturing
32511	Petrochemical manufacturing
<b>Market Industries</b>	
2212	Natural gas distribution
447	Gasoline stations
45431	Fuel dealers

Source: LAEDC

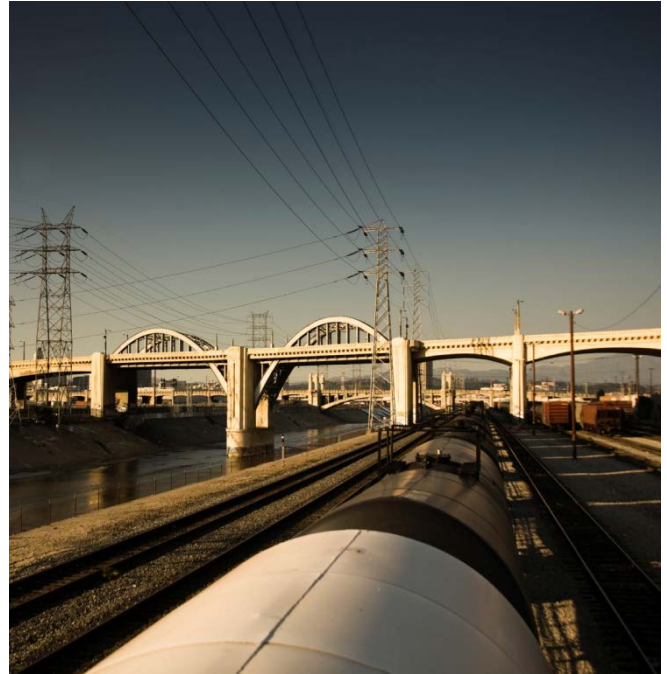
## 2 The Oil and Gas Industry in California

California's oil and gas industry continues to produce energy for its residents and businesses, as well as for those in the rest of the nation. The oil and gas industry remains a high-wage industry in the state that provides economic mobility. However, the oil and gas industry is facing a number of challenges that include: price volatility; regulatory issues; changes in economic growth impacting demand; environmental activism; community support; geopolitical unrest; and emerging alternative intermittent sources of energy.

### The Oil and Gas Industry Today

This report looks at oil and gas industry activity in 2017, due to data availability, but much has happened in the industry between 2015 (the period covered in the last report) and the first half of 2019.

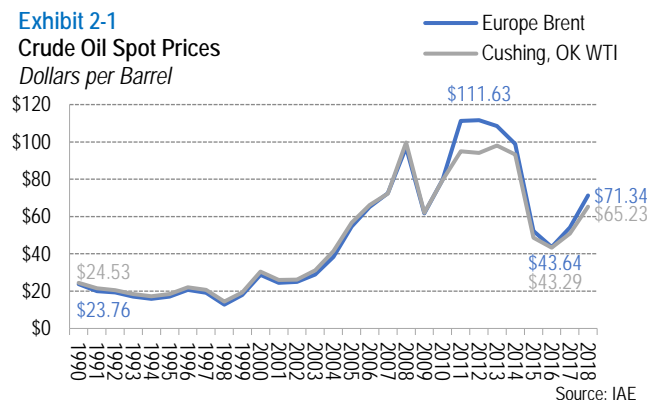
The first half of 2018 marked one of the most substantial oil price recoveries as of late, when the Brent Crude spot price (Exhibit 2-1) climbed from an annual average of \$43 per barrel in 2016 to \$54 in 2017 and up to close to \$80 a barrel by the third quarter of 2018. A number of factors contributed to the rebound, including: stronger demand related to global economic growth, especially in emerging markets experiencing population growth, industrialization, and urbanization; the production restraint agreement between OPEC and non-OPEC countries; and reduced oil production from countries like Venezuela, Libya and Iran; all of which led to much needed withdrawals from high global inventories of crude. But price volatility struck again; oil prices fell in the 4th quarter in 2018, down to the high \$50s by December, causing the Brent annual average price to settle at \$71 per barrel for 2018.



The production restraint agreement was implemented in 2017 between 12 OPEC and 10 non-OPEC countries (including Russia), where producers agreed to cut output from 2016 baselines by 1.2 million barrels a day for OPEC countries and by 600,000 barrels a day by non-OPEC exporters. However, initial speculation over whether the cuts would be made, and their efficacy in stabilizing the market, led to price volatility the second half of 2018 with a drop-in price late in the year (November and December). Despite price volatility, 2018 saw record setting levels of oil and gas production at shale formations including the Permian Basin and Bakken. This coupled with the disbandment of the ban on most U.S. crude oil exports, in effect since the 1970s, led to net oil exports in 2018 in the U.S. for the first time, and lots of discussions about bottlenecks related to inadequate infrastructure.

Natural gas prices in the U.S. have remained limited due to the massive amount of reserves, a pattern that will continue despite growing demand related to electricity generation and the manufacture of products that use natural gas as a feedstock. Exports of liquefied natural gas (LNG) and natural gas liquids (NGLs) from mid-continent states through the Gulf of Mexico will help ease some downward pressure related to the glut of supply, but only

**Exhibit 2-1**  
Crude Oil Spot Prices  
Dollars per Barrel



slightly. In 2017, the U.S. became a net exporter of natural gas for the first time in almost 60 years.

California has remained largely isolated from the benefits of U.S. energy independence and associated investments. California is effectively an energy island, since it has no interstate crude oil or refined products pipelines from other states. All crude oil and refined products entering the state travel almost exclusively by supertanker, with limited crude oil rail imports from Canada and other states. As a result, Californians compete with China, India, Japan and European economies for oil exports from the Middle East, Latin America, and Alaska. Therefore, California businesses and consumers are tied to Brent international waterborne crude oil prices, which have historically been higher than West Texas Intermediate crude oil that supplies most of the lower 48 states.

Sustainability is a key objective across all segments of the oil and gas industry. For upstream operations, large oil companies are investing in renewable energy and gas producers are looking to mitigate emissions of methane. Refineries and petrochemical manufacturers, main players in the downstream segment, have long been steering through environmental mandates and reporting requirements.

Infrastructure, part of the midstream segment, has been a concern for the industry as production levels in the U.S. increase; a lack of pipelines, port terminals, plants and processing and storage facilities depresses the industry's ability to move product and negatively impacts producers. Unfortunately, getting oil and gas infrastructure projects off the ground is difficult, requiring delicate navigation through the planning, permitting and building of these projects, which often face litigation by activist organizations.

During the downturn, oil and gas companies had to simultaneously contain costs and increase efficiency and productivity. Major players in the oil and gas industry are looking to diversify their portfolios to help insulate themselves from impacts related to future downturns and decreased demand for carbon-based fuels through investment and mergers and acquisitions activity; BP, Shell and Chevron all acquired or invested in EV charging companies, and California Resources Corporation and Exxon are designing carbon capture and sequestration projects.

The beginning of 2019 has seen more withdrawals from crude inventories as estimated production in the U.S. and Organization of Petroleum Exporting Countries (OPEC) are declining. The Energy Information Administration



(EIA) predicts the joint OPEC/non-OPEC production cuts in crude are here to stay throughout 2019. Potential increases in the price of oil back to levels of \$70 per barrel may be limited, due to the impact of tariffs and concerns about slowing growth in China and elsewhere. In California, increased fuel taxes, low carbon fuel standard, greenhouse gas cap-and-trade programs and renewable portfolio standards have increased prices of energy and goods for consumers, magnifying the impact of any increase in underlying commodity prices.

Looking towards the rest of 2019, price volatility, the LNG market, interest rates, tariffs and the waning benefits of the tax stimulus will be key issues nationally, as will addressing midstream bottlenecks (i.e. infrastructure) and the adoption of new digital technologies, especially the use of data and automation, to increase productivity. These national issues affecting oil production have less effect in California, because the state is effectively an energy island, with no interstate crude oil or refined products pipelines from other states. California depended in 2018 on waterborne imports for 73 percent of its crude oil demand, mostly from foreign countries.

## Upstream Activity

Upstream industries are those that are involved in the exploration and extraction of oil and gas. These industries include production, which includes the drilling of wells and pumping of crude oil and natural gas, and oilfield services. Oilfield services include the manufacture of oil and gas field machinery used in production and



support activities for oil and gas operations, such as exploration (except geophysical surveying and mapping); excavating well cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; well maintenance activities; and cleaning out, bailing, and swabbing wells. The upstream industry is capital-intensive and highly regulated.

### *Industrywide Trends*

Upstream companies remain cautious, as they are still recovering from the post-2014 downturn in oil prices (that bottomed out in 2016), which put them into cost-cutting survival mode, where some payrolls were cut, and development projects may have been cancelled or deferred. Even though prices increased in 2018, they were volatile and dipped at the end of the year, again giving rise to uncertainty. Cutbacks in resource development projects during the downturn may constrain future supply as demand increases. Looking forward, investment in new growth will resume, as long as prices can remain relatively stable and land use and permitting processes can remain predictable.

California producers have unique concerns. The oil found here has higher gravity which makes production and transportation more expensive compared to lighter oil reserves. High costs are also in part due to California's stringent and frequently changing environmental standards.

Upstream operations in California navigate through the toughest regulatory environment in the nation.

Underground injection wells are intended to safely dispose of wastewater (salt and fresh water) produced with oil and gas in the oil production process. After oil and gas are separated from the produced water, the wastewater is piped or trucked to Class II injection wells, where it is injected into petroleum reservoirs, increasing oil yields. It is estimated that seventy-five percent of oil produced daily in California uses these enhancement methods.<sup>1</sup> The Division of Oil, Gas, and Geothermal Resources (DOGGR) decided to revise and strengthen its permit approval policies through new underground injection control regulations which took effect April 1st, 2019.

Under these new regulations, approval for underground injection well permits require a series of complicated



Photo: AP, Reed Saxon

steps, an application must include: a detailed engineering study with planned drilling, plugging, and abandonment programs; a geologic study with structural and cross-section maps of the well; an injection plan that maps all injection facilities, anticipated injection pressures and volumes; monitoring systems; and protection measures. The most stringent part of the application is the Area of Review, which requires engineering studies to provide evidence that plugged and abandoned wells in the surrounding area will not have an adverse effect on the project or public and environmental health. Production in California will be severely impacted by underground injection well permits not being issued.

Constantly changing land use permitting processes at the state and local level are negatively impacting investment in oil and gas production operations, which stunts future employment growth. Many of the jobs associated with this industry offer high wages and benefits for those with a high school education, hence withheld investment limits good job opportunities for those who need them most. Changing safety and environmental standards mean producers are constantly chasing compliance and investing their time and money into keeping operations open; this reduces the amount of resources available to invest in growth and new infrastructure.

Operations in the state face not only high regulatory costs, but also activist attempts to end production. In the summer of 2018, activist groups petitioned then Governor Brown to end oil and gas production through the withholding of permits and other measures. The

<sup>1</sup> According to the new DOGGR statement of reasons, about seventy-five percent of the roughly 600,000 barrels of oil produced

daily in California result from the use of enhanced oil recovery injection methods.

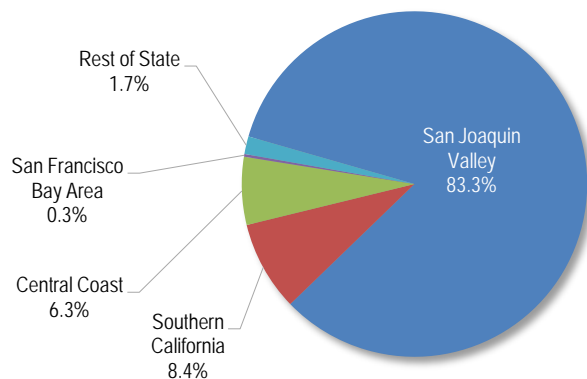
petition was initiated by a branch of a New York anti-oil organization and many of the California officials are from areas with little to no industry activity. This group is also proposing setback requirements of up to a half mile around oil and gas operations.

Finally, current legislation in consideration includes increased setback requirements for some local jurisdictions, at present the City of Los Angeles, and at the state level, an additional levy on oil production (SB 246). An assessment is already imposed on oil and gas production in the state to fund the California Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR), but a senate bill has been introduced that would establish an additional severance tax of 10 percent on the price per barrel of oil or per unit of natural gas produced. While other states have severance taxes, producers there don't face the same high regulatory costs and high income, sales and ad valorem property taxes on oil and gas reserves in the ground before they are produced.

### California's Active Oil and Gas Wells

There were 51,390 active oil and gas wells in California in 2017. Active wells are distributed across California, with the majority located in the Central Valley/Northern California sub-region, as shown in Exhibit 2-2.

**Exhibit 2-2**  
Active Wells in CA by Sub-Region 2017



Source: CA Dept of Conservation, DOGGR

A decrease in the number of new wells drilled between 2015 (1,016 wells drilled) and 2016 (759 wells drilled) turned around between 2016 and 2017 (996 wells drilled). Footage drilled followed the same down then up pattern, with footage drilled in 2017 (2,085,937 feet) exceeding footage drilled in 2015 (2,022,697 feet). Kern County has the most active oil and gas wells by far, numbering over 40,000 in 2017, while the second ranked

county, Los Angeles County, had 3,359 active oil and gas wells.

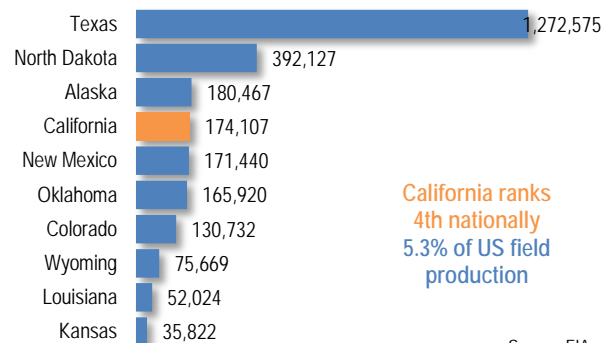
Active wells by county and California legislative district (upper and lower house) can be found in the Appendix.

### Crude Oil in California

According to the Energy Information Administration (EIA), global crude oil consumption in 2017 was close to 98 million barrels per day. California is the second highest U.S. state in energy consumption and the fourth largest globally (after the U.S., China, and Texas), yet is highly dependent on imported energy. In 2017, California imported 72 percent of its crude oil consumption, 91 percent of its natural gas consumption, and even 30 percent of its electricity consumption.

U.S. oil field production totaled just over 3.4 billion barrels in 2017. Exhibit 2-3 shows the highest oil producing states in the nation ranked according to their crude oil production in 2017. California produced 174 million barrels, representing 5.3 percent of total national production.

**Exhibit 2-3**  
Crude Oil Production 2017  
(Thousands of barrels)



Source: EIA

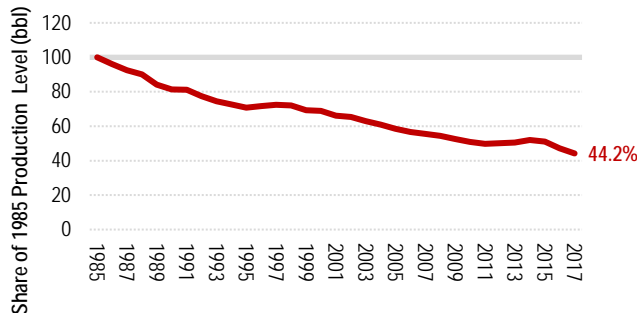
While the U.S. oil production has been increasing, oil production in California is moving in the opposite direction, with three consecutive years of decline, causing the state's ranking to slip from its usual spot (behind Texas and North Dakota) to the fourth highest state in oil production in 2017 and further to sixth in 2018 behind New Mexico and Oklahoma.

This is part of a long-term decline that has been occurring since the late 1980s when the number of barrels produced in 1985 was 394 million versus the 174 million barrels produced in 2017, that's a 56 percent decline in

production volume; production levels in 2017 were only 44 percent of what they were in 1985 (Exhibit 2-4).

Exhibit 2-4

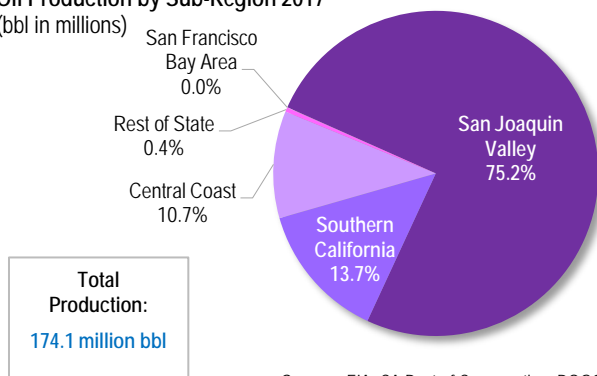
California Oilfield Production 1985 to 2017  
Indexed Growth (1985=100)



The distribution of California crude oil production in 2017 according to sub-region is shown in Exhibit 2-5.

Exhibit 2-5

Oil Production by Sub-Region 2017  
(bbl in millions)



Sources: EIA; CA Dept of Conservation, DOGGR

While crude oil production activity occurs throughout the state, the Central Valley/Northern California sub-region accounted for just over 75 percent of total California production. The second and third largest producing sub-regions were Southern California and the Central Coast, with 14 percent and 11 percent respectively. Crude oil reserves in California as of the end of 2017 were an estimated 2,209 million barrels.

Crude oil production by county and legislative district (upper and lower house) can be found in the appendix.

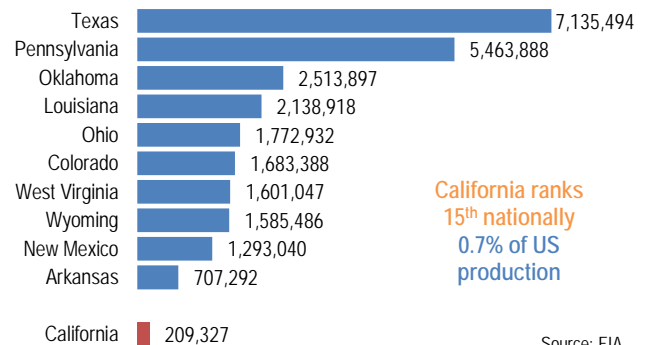
### Natural Gas in California

Natural gas production in the U.S. totaled 28.1 trillion cubic feet in 2017. California imported 91 percent of its natural gas needs in 2017. In-state production totaled 209.3 billion cubic feet, accounting for 0.7 percent of total U.S. production. The majority of natural gas production in

the state is produced onshore, close to 98 percent in 2017 with the remaining 2 percent produced offshore. Between 2016 and 2017, net gas production in the state increased by 3.6 percent. Out of the 34 natural gas producing states nationwide, California ranks fifteenth. Exhibit 2-6 displays the highest ten ranking states and California according to their total natural gas production in 2017.

Exhibit 2-6

Natural Gas Production 2017  
(Cubic feet in millions)

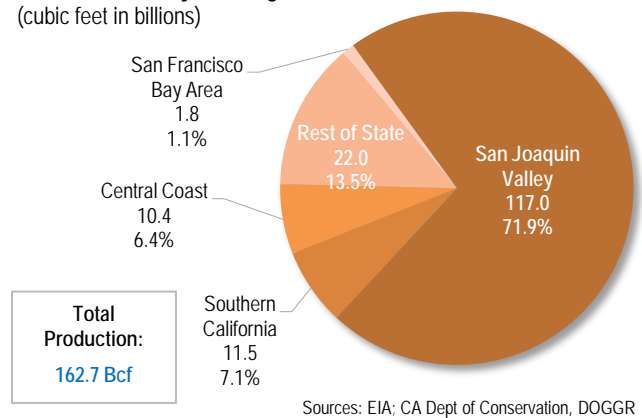


Similar to crude oil production, the Central Valley/Northern California sub-region accounted for just over 80 percent of total California natural gas production in 2017, followed by Southern California and the Central Coast, producing close to 12 percent and 10 percent respectively. Expected future production of dry natural gas as of the end of 2017 is estimated at 1,560 billion cubic feet.

The distribution of California natural gas production in 2017 by sub-region is shown in Exhibit 2-7.

Exhibit 2-7

Gas Production by Sub-Region 2017  
(cubic feet in billions)





Natural gas production by county and legislative district (upper and lower house) can be found in the Appendix.



## Midstream Activity

The midstream segment of the oil and gas industry is a highly integrated transmission and distribution system that exists across the U.S. to link upstream producers with downstream operations, their services are fee-based. Midstream operations move oil and gas from the wellhead in upstream operations to downstream refining and manufacturing operations and include processing, storage and logistics (pipeline, rail, truck, tanker, and export terminals). These same companies also move finished product from downstream operations to the market segment which includes gasoline stations and fuel dealers.

Exhibit 2-8 shows part of the midstream infrastructure that exists in California, including natural gas resource areas and interstate natural gas pipelines into California. As noted earlier, there are no interstate crude oil or refined products pipelines into California.

### Industrywide Trends

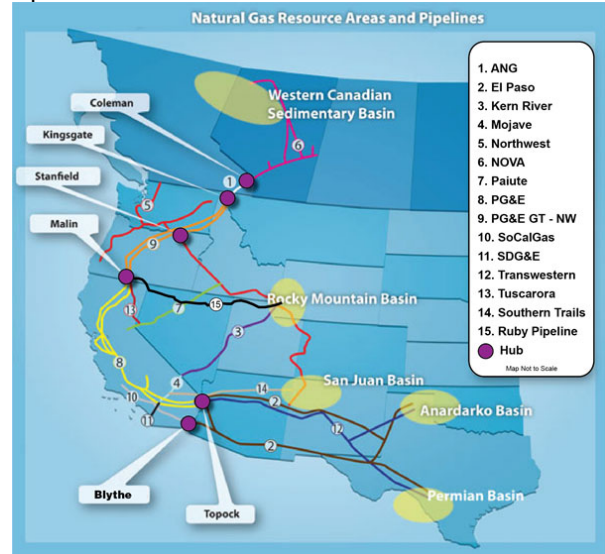
Midstream operations in 2017 were looking to lower capital costs in their operations to improve balance sheets which were affected by slowdowns in production by their upstream customers who were still trying to recover from the low oil prices and oversupply they faced in the post 2014 commodity price downfall. As upstream operations increase their production, midstream and other businesses that provide services to these producers will benefit. Looking ahead, in the near-term steel tariffs might be a cause for concern, but the continued long-term push towards renewable sources of energy will continue to drive demand for natural gas and LNG, which may translate to growth in midstream operations as they develop the requisite infrastructure, especially pipelines and storage tanks, to meet demand.

### California's Midstream Industry

The Midstream industry in California accounts for 14 percent of employment in the oil and gas industry in the state. Employment has been hovering around 21,000 since 2014. A selection of companies operating in the midstream segment in California is presented in Exhibit 2-9.

**Exhibit 2-8**

Natural Gas Resource Areas and Interstate Natural Gas Pipelines into CA



Source: California Energy Commission, Cartography Unit, 2014

**Exhibit 2-9**

Midstream Companies in California

- CALNEV Pipe Line, LLC
- Central Valley Gas Storage, LLC
- Crimson California Pipeline, L.P.
- Gill Ranch Storage, LLC
- Kern River Gas Transmission Company
- Lodi Gas Storage, LLC
- Mojave Pipeline Company, LLC
- North Baja Pipeline, LLC
- Pacific Pipeline System, LLC
- Phillips 66, Pipeline LLC
- Plains West Coast Terminals, LLC
- San Ardo Pipeline Company
- San Pablo Bay Pipeline Company, LLC
- Torrance Pipeline Company, LLC
- Torrance Valley Pipeline Company
- Wild Goose Storage, LLC

## Downstream Activity

Downstream operations include refineries, petrochemicals and the manufacture of petroleum lubricating oil and grease.

The refining of crude oil produces highly tradable products consumed domestically almost entirely in California and exported to global markets. Refined petroleum products include gasoline and diesel, liquefied petroleum gas (LPG), kerosene, jet fuel and fuel oils. Other products of the refining process include petrochemicals, which are used to manufacture a wide variety of different goods, including medical and personal products, fuel and lubricants, chemical products (adhesives, detergents, solvents) synthetic fabrics and materials, plastics and resins and more (see Exhibit 2-10 for a more comprehensive listing).

### Industry Trends

Increased oil demand has been benefiting refinery and petrochemical plants across the U.S. Outside of California, new refineries and petrochemical plants are being built to process the supply of shale oil produced in other states. But California is missing out on this boom, no pipelines exist to transport crude from other states, and crude-by-rail isn't a meaningful alternative.

Refineries in California focus on meeting California's high demand, not in expanding their operations as seen elsewhere in the country. Conversely, many crude oil energy companies are looking outside of the Golden State for new opportunities. For example, Meridian Energy Group is currently building a refinery in North Dakota and is looking to build another 60,000 barrel per day refinery, with a price tag of \$1 billion, in Texas (Kermit) to refine crude from the Permian Basin.

Market conditions for refined petroleum products and byproducts produced in-state continue to change as a result of regulatory mandates issued to meet increasingly more ambitious emissions goals. As part of California's climate change program, the state cap and trade program, low carbon fuel standard and other climate programs collectively cost the industry hundreds of millions of dollars annually. A Rand Corporation report estimated the costs to refiners associated with compliance with the California process safety management (PSM) and California Accidental Release Prevention regulations would reach an estimated \$58 million annually.

### Exhibit 2-10 Petroleum-Based Consumer Products

#### Medical and Personal

antihistamines	inhalers	makeup
anesthetics	band aids	perfume
aspirin	latex gloves	contact lenses
cough syrup	syringes	lotion
vitamins	artificial limbs	diapers

#### Fuel and Lubricant

gasoline	heating fuel	motor oil
diesel fuel	propane	electricity generation

#### Chemical Products

pesticides	fabric softeners	brake fluid
fertilizers	cleaning chemicals	coolant
preservatives	solvents	antifreeze
Teflon	paint	

#### Synthetic Fabrics and Materials

polyester	elastic	carpeting
nylon, rayon	shoes	vinyl
	upholstery	Styrofoam

#### Other Products

PVC pipe	electronics	toys
shingles	plastic containers	helmets
tires	plastic bags	guitar strings
asphalt/ tar	sponges	sports equipment

Compiled by LAEDC

Refining operations heavily rely upon the supply of reliable electricity and recycled water in their production process; California refiners need to ensure the future supply of each. Like producers in the upstream segment, downstream operations in California are encountering constantly changing regulatory standards. The high-cost regulatory environment and uncertainty for future operations in the state reduces the amount of investment put towards growth and new infrastructure.

In order to meet demand, California refineries operate at or near maximum capacity. When refineries in the state experience unplanned outages, the price of gas jumps in response to the reduced supply, and gasoline imports increase. Production issues also directly translate into price increases due to the high in-state demand for refined products and the lack of interstate pipelines into California.

### California's Refineries

The petroleum refining industry has a large presence in California. In 2017, annual operable atmospheric crude oil distillation capacity in California was just over 1.9 million barrels per calendar day (bpcd.), maintaining its rank as third among states and representing just over 10 percent of total U.S. capacity (Exhibit 2-11).

From 2015 to 2017, crude oil distillation capacity in California increased slightly by 0.2 percent, adding 3,700 bpcd., a much slower rate of increase than the U.S. with a distillation capacity increase of 3.1 percent over the period.

Despite the prominence of the state in terms of the national industry, the number of refineries in California has been decreasing over the years due to emissions related regulations, which would otherwise require refineries to make large expenditures on equipment, modifications and upgrades. Operations that are unable to merge or consolidate to fund these investments have ceased operations. This has resulted in the closure of older and smaller refining operations that found compliance with the state's strict environmental regulations to be cost prohibitive. This is also limiting the permitting of new facilities, and therefore, any potential increase in oil refining capacity in the future to meet upcoming needs in California appears highly unlikely.

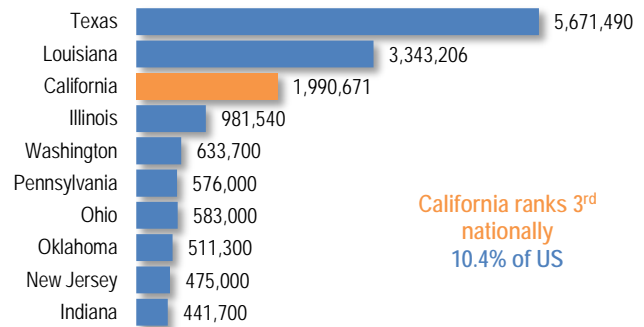
There number of refineries in California has stayed constant at 18 since 2012, less than half the number of operable refineries in 1987 (Exhibit 2-12). These refineries are located largely within two sub-regions: Southern California (primarily Los Angeles County) and the San Francisco Bay Area.

Exhibit 2-13 displays crude oil refining capacity in California by sub-region in 2017. The three largest refineries in the state are located in El Segundo, Richmond and Carson. Total statewide refining capacity was approximately 1.9 million barrels per calendar day. Southern California accounts for more than half, and the San Francisco Bay Area accounts for another 44 percent of total refining capacity.

Although the number of refineries has been declining in both California and the nation as a whole, expansions of existing operations and increases in efficiencies have resulted in increased capacity nationwide (Exhibit 2-14).

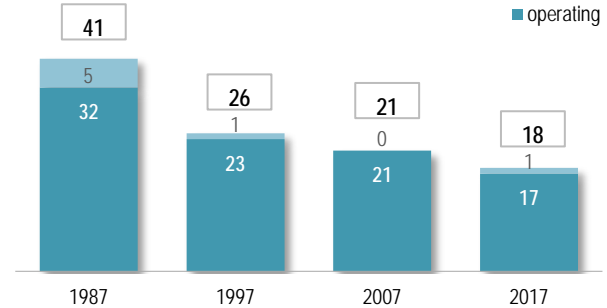
However, unlike the national experience, overall operating capacity in California has not seen a consistent upward trend. Despite an increase in refinery capacity of 0.2 percent in 2017 over that in 2015, there remains an overall loss of 312,629 bpcd capacity (a decline of 14.1 percent) since 1987 (Exhibit 2-15).

**Exhibit 2-11**  
**Crude Oil Distillation Capacity 2017**  
Annual Operable Atmospheric (BPCD)



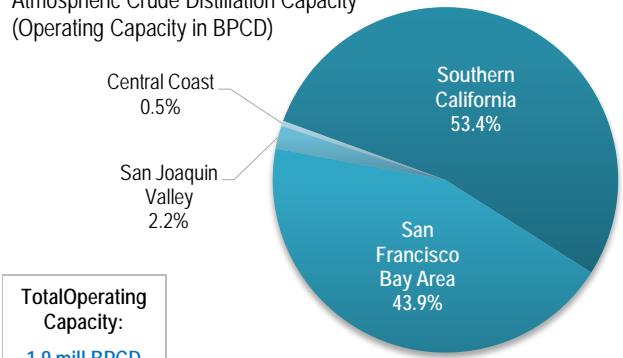
Source: FIA

**Exhibit 2-12**  
**Number of Refineries in CA**



Source: FIA

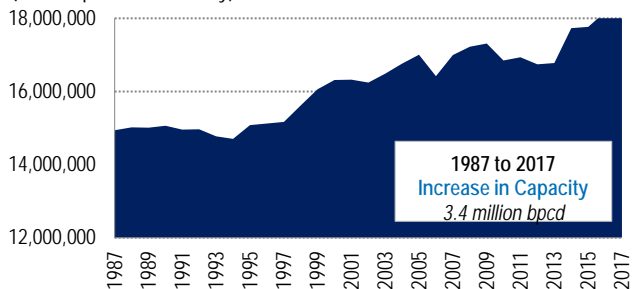
**Exhibit 2-13**  
**Refining Capacity in CA by Sub-Region 2017**  
Atmospheric Crude Distillation Capacity  
(Operating Capacity in BPCD)



Total Operating Capacity:  
1.9 mill BPCD

Source: CA Energy Commission

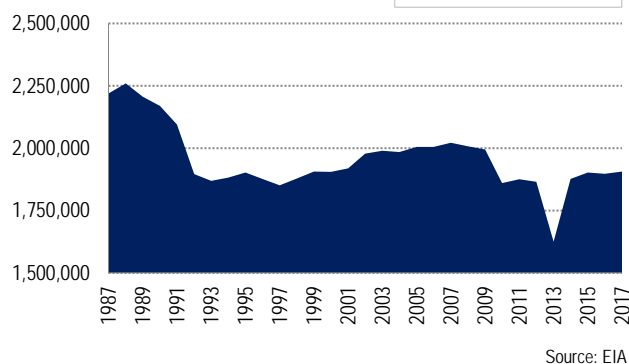
**Exhibit 2-14**  
**Annual Operating Refinery Capacity in U.S.**  
(barrels per calendar day)



Source: EIA

**Exhibit 2-15**

**Annual Operating Capacity in CA**  
(barrels per calendar day)



The potential for further reductions of the in-state supply of crude oil and refined petroleum products and byproducts will impact thousands of businesses that depend on these products in their production processes, impacting production costs and leading to higher prices of end products—which themselves may be used in other industries as inputs into production.

### Oil Supply Sources

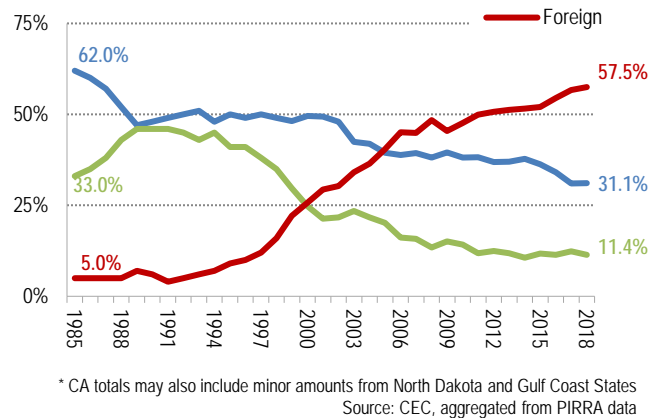
The requirements for fuel consumed in California are highly specific. Due to limits placed on in-state production, refineries import over 70 percent of California's crude oil needs from Alaska and outside the U.S. California has no interstate oil pipelines. Production volumes from Californian and Alaskan sources have been declining over the years, leading to increasing amounts of foreign crude being delivered to marine terminals in the San Pedro and San Francisco ports to augment the supply of crude which is constrained locally.

Exhibit 2-16 shows the total supply of crude oil to petroleum refineries in California by source from 1985 through 2018. In 2017, crude oil from foreign sources represented more than half the oil supplied to refineries in the state. Foreign sources and out-of-state domestic sources combined account for 70 percent of the total supply of crude oil to petroleum refineries in California; only 30 percent of what is refined in the state is locally sourced.

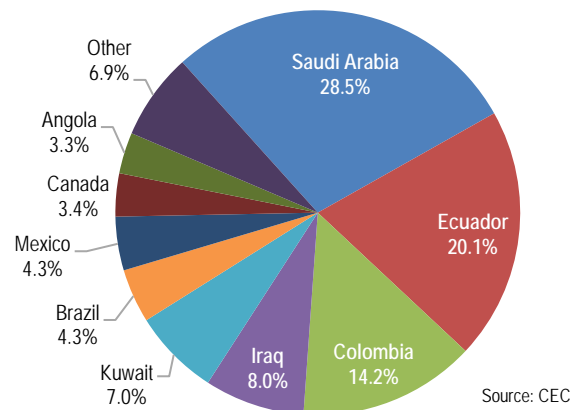
The specificity of the requirements for fuel and the growing reliance upon foreign crude oil sources (Exhibit 2-17) leave consumers at the pump in California vulnerable to short-term fluctuations in oil prices and supply shocks resulting from unplanned disruptions during refinery outages.

**Exhibit 2-16**

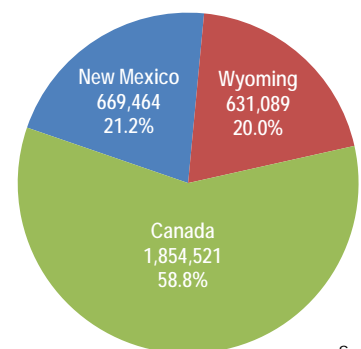
**Oil Supply Sources to CA Refineries**

**Exhibit 2-17**

**California's Sources of Foreign Crude in 2017**

**Exhibit 2-18**

**2017 Crude Imports to California by Rail**  
(barrels)



California imports a small portion (less than 1 percent) of its crude oil by rail. Crude-by-rail imports have been increasing, they have more than doubled since 2009. In 2017, close to 3.2 million barrels of crude was imported by rail from New Mexico, Wyoming and Canada (Exhibit 2-18).

## The Supply Shock

Each year, California transitions from winter-grade to spring-grade gasoline and from spring-grade to summer-grade gasoline. The cost to manufacture the warmer weather blends is higher than that to manufacture the winter-blend. Regardless of the blend, the cost of manufacturing gasoline to state specifications exceeds that of conventional gasoline used outside of California.

Blendstock transitions also reveal price volatility. Immediately preceding a transition from one seasonal gasoline blend to another, prices will either increase or decrease according to inventory levels; they will rise when inventory is low to delay a badly timed purchase or will drop to accelerate sales of the current blend if inventory is deemed high.

In the event that refining capacity is reduced further, and local production cannot meet local demand due to more aggressive restrictions, additional product must be imported into the area.

There are several refineries outside of the state that can produce California gasoline, they include the state of Washington and the U.S. Gulf Coast, and abroad sources include Eastern Canada, Finland, Germany, the U.S. Virgin Islands, the Middle East and Asia.

Costs for petroleum and petrochemical products produced out of state will be higher due to increased shipping costs and costs associated with out-of-state producers reconfiguring and refitting facilities, a costly and labor-intensive undertaking that will be required to accommodate California's specific blends of low sulfur gasoline and diesel.

Both industries and individual consumers will feel these additional costs. Dependent industries that use petroleum and petrochemical products as an input in production or are heavily reliant upon these products in the provision of a service, such as transportation industries, may not be able to absorb the increases. Consumers will feel cost increases that cannot be absorbed by the industry at the pump or when they purchase transportation services or petroleum-based end products. In addition, those other states and countries to not apply California's leading safety, labor and environmental standards. ❖

## Market Activity

The market segment of the oil and gas industry includes industries who bring petroleum and natural gas products to the end-user. This includes gasoline stations, natural gas distribution and fuel dealers, who retail liquefied petroleum gas (LPG). Industry trends in this segment are unique to each product sold; therefore, they are discussed separately.

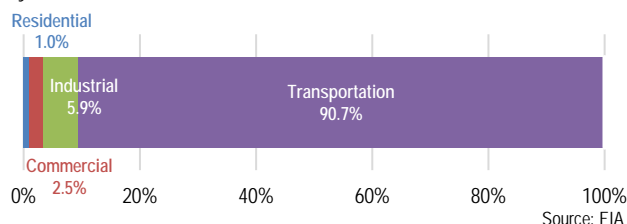
With a population pushing close to 40 million in the state of California, consumption and expenditures made on petroleum and natural gas in the state are substantial.

### Petroleum

Californians spent an estimated \$62.5 billion on 672 million barrels of petroleum (2016, the latest available). Most expenditures on petroleum go towards transportation (Exhibit 2-19).

Exhibit 2-19

California Expenditures on Petroleum  
by End-Use Sector



The state accounts for 11.4 percent of U.S. expenditures and 9.3 percent of U.S. consumption of petroleum. California is ranked the second highest state for barrels of total petroleum consumed (683 million barrels), behind Texas (1.4 trillion barrels), and is followed by Louisiana (399.4 million barrels) in third place with 272,510 less barrels consumed.

### Fuel Stations

There were an estimated 10,353 retail fuel stations in California in 2017. These retail outlets are estimated to have sold 15.6 billion gallons of gasoline and 3.1 billion gallons of diesel (Exhibit 2-20). The demand for gasoline and diesel fuel has increased in recent years, related to a strong performing economy. In 2017, vehicle miles travelled reached 343,862 million in the golden state.



Gasoline and diesel sales by county can be found in the Appendix.

Gasoline stations are affected by fluctuations in the price of oil and refined products; low oil prices during the downturn and volatile prices since have impacted industry revenues and profits. Regulatory compliance for gasoline stations includes tank testing, soil analysis and remediation.

Taxes levied on the purchase of fuels and natural gas in California are significant. Taxes that apply to the purchase of fuel include sales and use, state and federal excise and an Underground Storage Tank (UST) fee of 2 cents per gallon (cpg.). In 2017, California raised excise taxes on motor fuels; the tax on gasoline increased from 34.7 cpg to 46.7 cpg for gasoline and from 34 cpg to 67 cpg for diesel. According to the American Petroleum Institute, an estimated 72.76 cpg of gasoline and 109.33 cpg of diesel go towards taxes (Exhibit 2-21), ranking California 1<sup>st</sup> as the highest taxed state in the nation for diesel fuel and 2<sup>nd</sup> in the nation for gasoline.

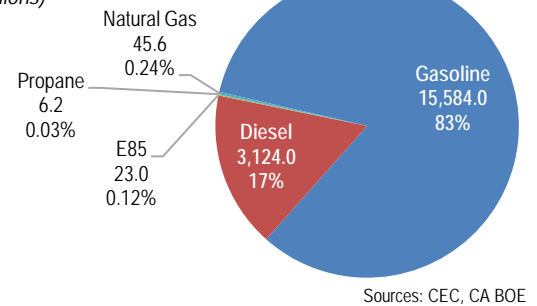
Additional regulatory costs also are at play in the state, increasing the cost of gasoline in California (i.e. reformulation, low carbon fuel standard, and the cap-and-trade program limiting GHG emissions which started to be applied to fuel producers in 2015). The result is an increase in the price spread of motor fuels between California and the national average (Exhibit 2-22). Finally, jet fuel constitutes a major refined product used in California.

### Natural Gas

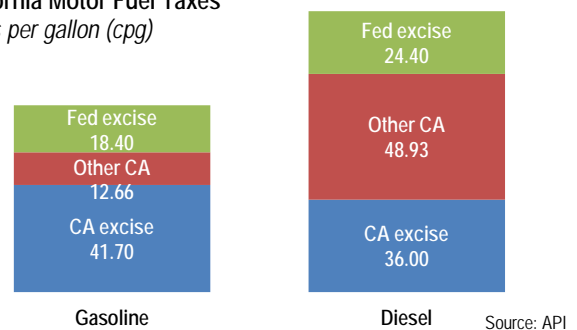
Natural gas distribution is included in the market segment of the industry as it markets natural gas to the end user. End-use sectors include not only residential users, but industrial and commercial users as well. Natural gas is also used in transportation and in electric power generation as the state completes its transition from coal to natural gas as a cleaner alternative. The EIA found that natural gas replacing the use of coal for electricity generation has resulted in significant reductions in sulfur dioxide (SO<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) emissions over the last decade.

Current natural gas utilities with service areas in California are listed in Exhibit 2-23.

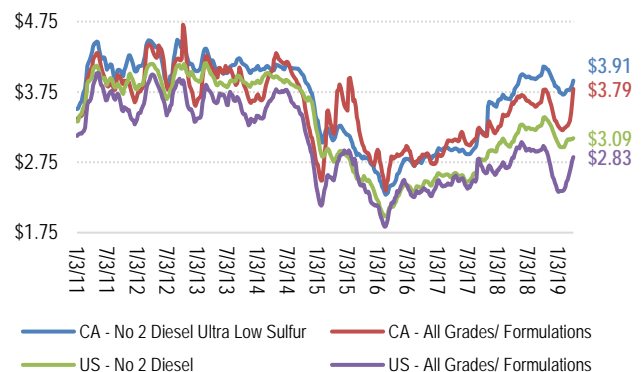
**Exhibit 2-20**  
Retail Sales Volumes in California 2017  
(Million gallons)



**Exhibit 2-21**  
California Motor Fuel Taxes  
Cents per gallon (cpg)



**Exhibit 2-22**  
Price of Gasoline and Diesel  
California versus U.S. average



**Exhibit 2-23**  
Natural Gas Utilities with Service Areas in California

- City of Long Beach Energy Resources Department
- City of Palo Alto Gas Department
- Pacific Gas and Electric Company (PG&E)
- San Diego Gas & Electric (SDG&E)
- Sierra Pacific - Nevada & California
- Southern California Gas Company (SoCalGas)
- Southwest Gas Corporation

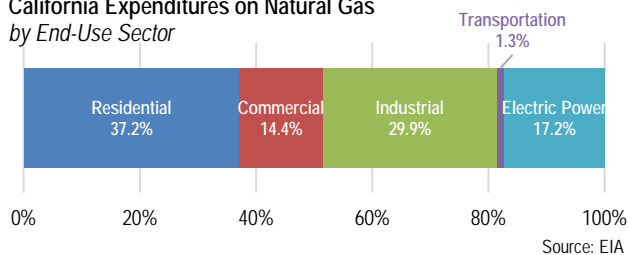
Looking ahead, changes in natural gas infrastructure and storage operations may impact the generation of electricity, especially in Southern California. Planned and unplanned pipeline outages (since October 2017) have reduced the ability to bring natural gas into Southern California and total capacity of the four natural gas storage facilities in the Southern California Gas Company service area declined by 92 Bcf (from 136 Bcf to 74 Bcf). Combined, the pipeline outages and reduced storage capacity (which changed the timing and extent of refilling storage fields) will present challenges meeting both demand for electricity over the summer while refilling gas storage fields to adequately prepare for winter heating demand.

Most of the reduction in natural gas storage capacity stems from the October 2015 leak at the Aliso Canyon storage field, previously the second-largest natural gas storage facility in the United States, which reduced capacity by about 61 Bcf (from 86 billion cubic feet (Bcf) to about 25 Bcf).

Californians spent an estimated \$14.5 billion on 2,115 billion cubic feet of natural gas (2017). The largest expenditures are made by the residential sector (Exhibit 2-24). Just over 64 percent of home heating in the state uses natural gas, and California has the 9th highest residential price for natural gas in 2017 with \$13.08 per thousand cubic feet.

Exhibit 2-24

California Expenditures on Natural Gas  
by End-Use Sector

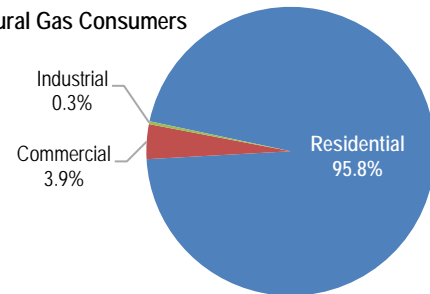


California accounts for 10.2 percent of U.S. expenditures on and 7.8 percent of U.S. consumption of natural gas.

The number of natural gas consumers in California in 2017 reached close to 11.5 million, with residential consumers accounting for nearly 96 percent of the total number of consumers in the state (Exhibit 2-25).

Exhibit 2-25

Number of Natural Gas Consumers  
California 2017



Residential consumption includes natural gas used in private households, for heating, air-conditioning, cooking, water heating, and other household uses. Commercial consumption includes establishments or agencies predominantly engaged in the sale of goods or services, such as hotels, restaurants, wholesale and retail stores and other service enterprises. This category also includes nonmanufacturing activities of government agencies (local, state and federal). Industrial consumption includes establishments that use natural gas for heat, power, or chemical feedstock in manufacturing, mining or other mineral extraction, agriculture, forestry, and fisheries. Operations with generators that produce electricity and/or thermal output in support of these listed industrial activities are also included in industrial consumption.

While the number of natural gas consumers trump the number of commercial and industrial consumers, the average annual consumption per consumer for commercial and industrial establishments exceed that of an average household; the average annual consumption per commercial consumer and per industrial consumer in California in 2017 was 531 Mcf and 20,652 Mcf respectively.

Taxes are imposed on the consumption of natural gas, through a natural gas surcharge paid by consumers to their utility service provider, the rate is determined by service territory and customer class (end-use)

In California, an excise tax applies to compressed natural gas (CNG), liquefied natural gas (LNG) and propane used to operate a vehicle. The tax can be paid either through a flat rate fee based on vehicle weight, or on a per gasoline gallon equivalent (GGE) for CNG or diesel gallon equivalent (DGE) for LNG and propane. ❖



## Regulatory Environment

California has long been heralded for its leading role in renewable energy and environmental issues. Existing environmental regulations, undertaken as a means for California to achieve its larger 2020, 2030 and 2050 climate change goals, are impacting all segments of the oil and natural gas industry, from upstream production to retail and distribution operations in the market segment.

Market conditions for refined petroleum products and byproducts produced in-state continue to change as a result of regulatory mandates issued to meet increasingly more ambitious emissions goals. Upstream and midstream development in California faces constantly changing regulations from multiple state and local agencies with overlapping jurisdiction that impede or delay permitting, investment, new infrastructure and growth in employment. California is highly dependent on intrastate natural gas pipelines to supply 91 percent of the natural gas consumed in the state, mostly by residential users (home heating and cooking). Communities rely on networks of pipelines to gather crude oil and natural gas and transport them to refineries and utilities, and in turn to distribute refined products and natural gas to end users. Timely and efficient permitting of upstream wells and facilities and midstream pipelines and processing plants is essential to maintain the quality of California's energy infrastructure and ensure that Californians benefit from a diverse mix of traditional and renewable energy supplies which increase affordability and reliability. Downstream development is stagnant due to the permitting of new petroleum refining facilities also being limited, making any potential increase in oil refining capacity in the future in California highly unlikely.

Greenhouse gas legislation (SB 32) was passed that extended AB32 goals out to 2030, with a new target of 40 percent below 1990 levels by 2030, building upon the momentum of the previous target of meeting 1990 levels by 2020. In addition, California Executive Order B-55-18 (signed by then Governor Jerry Brown in Sept 2018) set the objective of reaching statewide carbon neutrality by 2045.

Oil and gas producers are already highly regulated in California; the California Air Resources Board (CARB) and California's Air Quality Management Districts (AQMD)

have been tasked with improving air quality, resulting in the state having to abide by the most stringent emission control regulations in the U.S.<sup>2</sup> (Exhibit 2-26). CARB and SCAQMD are two of the 25 plus local, state and federal agencies that oversee the oil and gas production industry and its workforce.<sup>3</sup>

Existing regulations faced by California producers, not currently required in other states or countries, require air permits with emission controls that include: vapor recovery on tanks and vessels; vapor control on compressors; use of instrument air on pneumatic devices; and leak detection and repair on components not covered by federal regulations.<sup>4</sup> High costs are in part due to California's stringent environmental standards.

Activist groups have proposed increased setback requirements of up to 2,500 feet for oil and gas production both in the California Assembly and in Los Angeles. These proposals seek to shut down production around residential areas, schools and hospitals and would also limit future development around existing oil and gas production since setbacks are reciprocal. In a high-cost area such as Los Angeles, whose housing shortage contributes significantly to its high cost of living, restricting future residential development would exacerbate the housing crisis. A great deal of urban infill, including hospitals, schools and homes, would not have been built had expanded setbacks been in place in the past.

Currently, natural gas generates over a third of California's electricity, but natural gas plants are heavily relied upon to fill supply constraints due to the intermittent nature of renewable energy. California Senate Bill 100, enacted in 2018, increased California's mandate that renewables supply 50 percent of retail electricity to 60 percent by 2030 and thereby reduce the state's reliance on retail electricity from natural gas. The bill also set a state goal for renewables to supply all retail electricity by 2045, subject to ensuring affordability and reliability of the electricity grid. Eric Garcetti, the current mayor of the City of Los Angeles issued a statement in February that the LADWP will phase out use of natural gas units at its Scattergood, Haynes and Harbor plants, which represent about 38 percent of the city's current natural gas portfolio. However, the Mayor has acknowledged that the city will continue to rely for

<sup>2</sup> Technical Review of Current Emission Control Regulations by Jurisdiction, GSI Environmental, February 2018.

<sup>3</sup> Why Local Oil and Gas Production is important to Los Angeles, Californians for Energy Independence, January 2019.

<sup>4</sup> Los Angeles Oil and Gas Producers are Highly Regulated by California Air Resources Board and South Coast Air Quality Management District, Californians for Energy Independence, January 2019.

several years on imported electricity generated in other states from coal and natural gas. Statewide, it's expected that natural gas will continue to be required to fill supply constraints until the technology is developed and proven that may enable distributed energy resources (DER) to meet spikes in electricity demand in an affordable and reliable manner.

Finally, the market segment of the industry is selling their products to consumers who are facing ever increasing tax rates for gasoline and diesel at the point of purchase, which eats into their expendable income. In April 2017, then Governor Jerry Brown signed California Senate Bill 1, which, starting November 1, 2017, increased the state excise tax on gasoline and increased both the state excise tax and sales tax rate on diesel fuel.

The fuel tax burden is being shouldered disproportionately by lower income households who are increasingly forced into longer commutes due to increasing housing costs. Electric vehicles are typically purchased by households with higher incomes due to the cost differential between electric vehicles and internal combustion engine (ICE) vehicles; starting in 2020 electric vehicle owners (among the wealthiest demographic in California) will pay an annual fee of only \$100 in lieu of gas taxes.

Over time, the oil and gas industry has had to continuously innovate and adapt to major changes in the industry and shifting societal expectations. These new regulations and those that are in discussion currently will present challenges to the industry; however, consumers' need for oil and gas has helped the industry innovate many times, and it is continuing to do so.

Exhibit 2-26

## Emission Control Regulations in California Are the Most Stringent in the Nation

Jurisdiction	Vapor Recovery on Tanks and Vessels	Vapor Control on Compressors	Instrument Air on Pneumatic Devices	Leak Detection and Repair for Components beyond Federal Regs	Mandatory Tax on Greenhouse Gas Emissions	Community Air Monitoring
<b>Jurisdictions Regulated by CARB and Regional Air Districts</b>						
Kern County <sup>5</sup>	✓	✓	✓	✓	✓	✓
Los Angeles County	✓	✓	✓	✓	✓	✓
Orange County	✓	✓	✓	✓	✓	✓
Riverside County	✓	✓	✓	✓	✓	✓
San Bernardino County	✓	✓	✓	✓	✓	✓
City of Carson	✓	✓	✓	✓	✓	✓
<b>Other Jurisdictions with Setbacks</b>						
Colorado	✗	✗	✗	✗	✗	✗
Maryland	✗	✗	✗	✗	✗	✗
Santa Fe County, NM	✗	✗	✗	✗	✗	✓
City of Arlington, TX	✗	✗	✗	✗	✗	✓
City of Dallas, TX	✗	✗	✗	✗	✗	✓
City of Flower Mound, TX	✗	✗	✗	✗	✗	✓
City of Fort Worth, TX	✗	✗	✗	✗	✗	✓
Oklahoma City, OK	✗	✗	✗	✗	✗	✓

Source: Californians for Energy Independence

<sup>5</sup> Kern County is regulated by the San Joaquin Valley Air Pollution Control District applying rules similar to the SCAQMD.

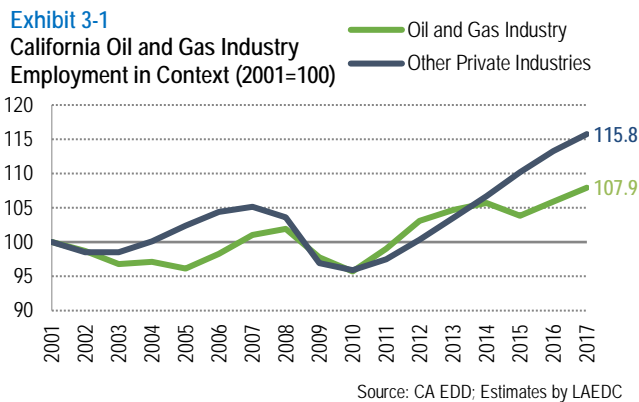
### 3 California's Oil and Gas Industry Workforce

The oil and gas industry employs a large number of people in California, providing a myriad of employment opportunities for a diverse group of individuals across the different component industries. As job duties vary, so do the required skills and education levels for job entry. Wages vary with occupations in the industry, with many associated with high wages.

#### Oil and Gas Industry Employment

The oil and gas industry has proven itself to be valuable to the state's economy. The industry provides jobs for individuals across the skills spectrum with relatively high wages and benefits. Employment in the industry was more resilient than other private industries as a whole and performed well in its post-recession recovery. While the industry does react to contractions in the economy, the magnitude of these reactions are milder than those experienced by other private industries.

Exhibit 3-1 displays private payroll employment in the oil and gas industry as a whole and for all other private industries in California, indexed to 2001 employment levels. Values of 100 mean that the employment level is equal to that seen in the base year (2001).



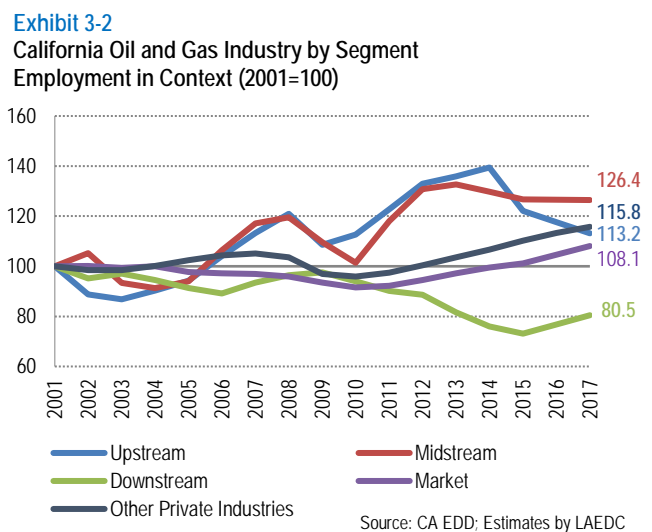
The Great Recession caused private employment levels to dip below that of the base year and has rebounded, posting a consistent gain from the lowest level in 2010, and exceeding the pre-recession peak by close to 16 percent in 2017.

In contrast, the oil and gas industry exhibited more post-recession buoyancy; the industry rebounded from the



lowest level, also in 2010, to base year levels a year earlier than other private industry and beating the prerecession peak starting in 2012. Oil and gas industry employment declined by nearly two percent in 2015 after four consecutive years of growth, as result of low crude prices and high inventories; however, employment growth in 2016 and 2017 rebounded with the current level exceeding the pre-recession peak by 6 percent. Employment in 2017 in the industry, was 8 percent higher in the state compared to the industry employment level in the base year of 2001.

Looking at the oil and gas industry by industry segment reveals several trends in employment (Exhibit 3-2).



The upstream and midstream industry segments show correlation with their employment trends. While payroll employment in both segments dipped as a result of the recession, employment in these segments was more resilient than the downstream and market segments and other private industries; neither fell below base year employment (2001). The upstream segment was impacted by the industry's downturn which began in 2014 and some payroll employment was lost between then and 2017, but midstream employment has remained relatively constant since 2012. In 2017, payroll employment in the upstream and midstream segments was higher than base year employment by 13.2 percent and 26.4 percent, respectively.

Industries that bring oil and gas products to the end-user (market segment) almost mirror the employment trend of the larger economy (other private industries). This comes as no surprise; consumer spending increases as unemployment decreases. In 2017, market industries were 8.1 percent higher than in the base year. Employment in downstream operations has not been so resilient; the refinery industry has been challenged by regulatory mandates and unplanned refinery outages. While there has been an uptick in the number of workers added to the payroll in the segment over the last two years, in 2017, employment was still 20 percent below that of the base year.

Another feature of the oil and gas industry is the higher annual wages paid in most component industries, as shown in Exhibit 3-3. With the exception of petrochemical manufacturing, fuel dealers and gasoline stations, **wages in each of the component industries listed exceed the average annual wage in the state.** These wages include benefits and compensation for overtime.

### *Opportunities for Upward Mobility*

Upward mobility is the ability for an individual to move to improve their economic status. Individuals with lower economic status face more challenges including poverty, affordability of housing and utilities, living in higher crime areas, difficulty meeting the expense of obtaining higher levels of education, challenges with child care and transportation issues, to name a few.

Industries with upward mobility opportunities help individuals with lower levels of education and skills to obtain jobs that provide a living wage or higher. A living wage is the wage one must earn in order to support their family at a minimum standard of living. According to the MIT living wage calculator, a resident in California alone must earn \$30,400, and if they are the sole provider for a

family of four (one other adult and two children) they must earn \$63,800 per year.

**Exhibit 3-3**  
**Oil and Gas Industry Wages**  
**California 2017**

NAICS	Industry	Ave Annual Wage
211	Oil and gas extraction	\$227,241
213111	Drilling oil and gas wells	116,824
213112	Support activities for oil and gas operations	75,589
2212	Natural gas distribution	133,596
23712	Oil and gas pipeline construction	80,343
32411	Petroleum refineries	156,762
324191	Petroleum lubricating oil and grease mfg.	80,626
32511	Petrochemical manufacturing	333,824
333132	Oil and gas field machinery and eqpmt mfg.	68,943
4247	Petroleum and petroleum prods wholesalers	79,092
447	Gasoline stations	25,435
45431	Fuel dealers	56,349
486	Pipeline transportation	109,284
<b>Oil and Gas Industry</b>		<b>80,374</b>
All other private industries		65,340
All private industries in CA		65,490

Note: Excludes non-employers and independent contractors  
Source: CA EDD; Estimates by LAEDC

In the past, manufacturing was a well-known industry for people with lower levels of education to earn a good living; however, manufacturing has been on a long-term sectoral decline in employment in California and does not offer the same opportunities as it did decades ago. The oil and gas industry is an industry that still offers stable employment opportunities with high wages and benefits to individuals with lower levels of education. Examples of occupations in the oil and gas industry that require a high school level education or below include gas plant operators (median wage of \$99,620), oil and gas derrick operators (median wage of \$51,800) and oil and gas service unit operators (median wage of \$56,010).

The oil and gas industry operates in close geographic proximity to wherever reserves are found—often in rural areas with limited industry. Without a diverse economic base, these rural areas typically have challenges in attracting and sustaining other industries. Oil and gas industries provide much needed employment opportunities with higher than average wages, translating into larger indirect and induced effects that expand throughout the economy. ❖



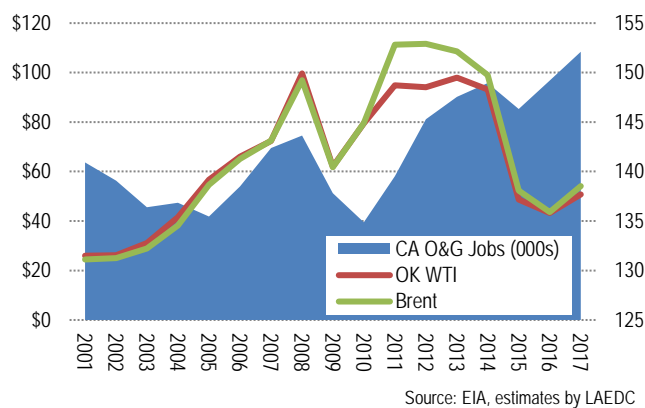
## The Employment and Price Relationship

Increased domestic oil production in mid-continent states resulting from horizontal drilling techniques and hydraulic fracturing combined with high levels of output by the Organization of Petroleum Exporting Countries (OPEC) led to a global supply glut that caused oil prices to plummet and sent the oil and gas industry into a significant downturn the second half of 2014. Extended periods of low commodity prices in the oil and gas industry have resulted in decreased activity in extraction and refinery operations and, consequently, job losses.

During downturns, such losses are not limited to those working in oil fields and refineries, as companies in oil and gas industries to decrease their payrolls in office admin roles, IT staff, workers in finance and legal, and in marketing. At lower prices, new drilling and other projects are put on hold, which impacts jobs in the energy supply chain such as equipment manufacturers, shippers and construction crews. This also results in declining in-state production and increases Californians' dependence on imported energy.

Exhibit 3-4 shows annual average payroll employment in the oil and gas industry in California from 2001 through 2017, overlaid with annual average spot prices for the West Texas Intermediate (WTI) and Brent benchmarks.

**Exhibit 3-4**  
Payroll Jobs and Spot Prices FOB (\$US per barrel)



Mid-2014 marked the beginning of a precipitous fall in the price of oil that bottomed out in 2016, with annual averages of spot prices for both WTI and Brent benchmarks experiencing their lowest annual averages since 2005. From 2014 to 2015, payroll employment in the oil and gas industry in California lost just over 2,600 jobs, the industry's first employment decline after four consecutive years of growth, but 2016 and 2017 saw the industry adding nearly 6,000 worker to its payrolls and

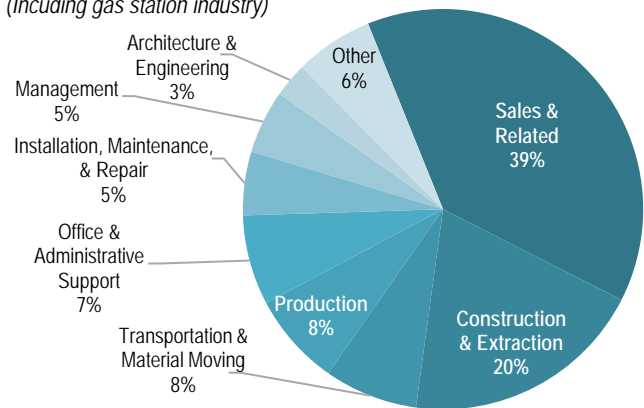
reaching 152,110 payroll jobs in 2017, job growth of 6 percent over the two-year period. ❖

## Industry Occupations

An occupation is classified according to the set of activities or tasks that an employee is paid to perform. Some occupations are specific to an industry, but others exist in a number of different industries, for example, customer service representatives, salespersons, accounting staff and receptionists.

Occupations are classified by the Standard Occupational Classification (SOC) System. Workers fall into one of 810 detailed occupations, which are combined into 23 major groups. Each occupation requires its own skill set and education levels. The distribution of employment by major occupational group specific to the oil and gas industry in California is displayed in Exhibit 3-5.

**Exhibit 3-5**  
Occupational Distribution of Oil and Gas Industry  
(Including gas station industry)



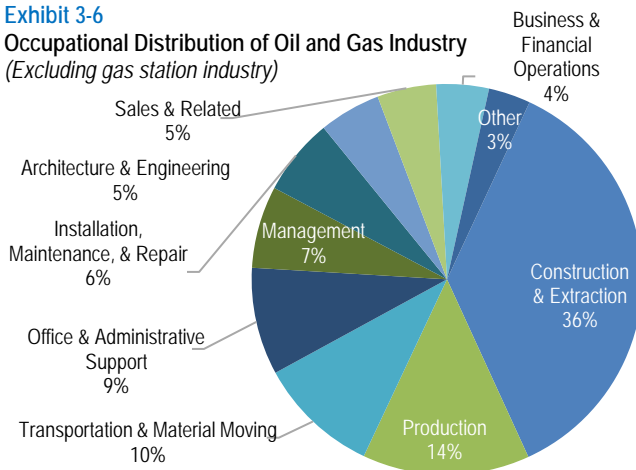
Just under 40 percent of workers in the industry are employed in sales occupations, another 15 percent in office and administrative, business and financial, and management occupations combined, and another 40 percent (combined) work in occupations in construction and extraction, production, installation and maintenance, and transportation and material moving.

It should be noted that this occupational distribution includes individuals employed at gas stations. Gas stations represent the retail side of the oil and gas industry and account for a large share of industry employment. Activities taking place at retail gas stations are dissimilar to activities taking place in other oil and gas industries, many of which involve production and distribution.

Including gasoline stations in an occupational analysis skews average annual wages of occupations in the oil and gas industry downward, and also affects the occupational composition of the oil and gas industry. Many gas station jobs require lower skill levels and are associated with average annual wages significantly lower than found in other oil and gas industries. This skewing is evident in the next exhibit as the oil and gas industry outside of gasoline stations is reviewed. (The gas station industry is shown separately in the following section). Exhibit 3-6 shows the distribution of employment in the California oil and gas industry by major occupational group excluding gasoline stations.

**Exhibit 3-6**

**Occupational Distribution of Oil and Gas Industry**  
(Excluding gas station industry)



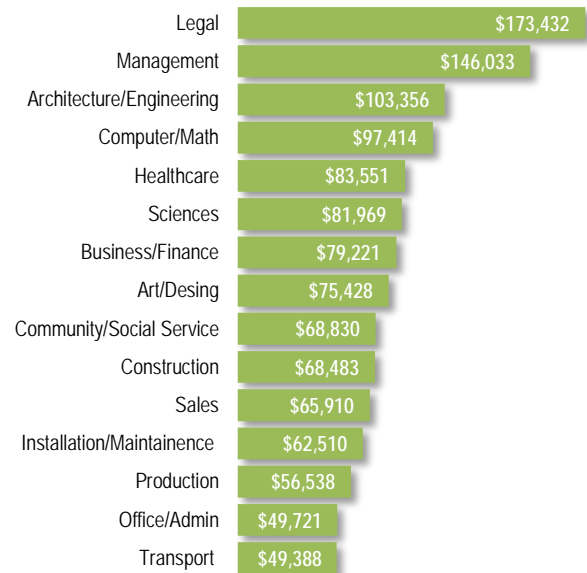
Excluding gasoline stations, the largest share of the oil and gas workforce is employed in construction and extraction occupations and in production (manufacturing) occupations, with employment shares of 36 percent and 14 percent, respectively. Transportation and material moving occupations account for 10 percent of industry employment and office and administrative occupations, which includes bookkeepers and accounting clerks, utility meter readers, office clerks, stock clerks and order fillers, dispatchers and customer service representatives, account for 9 percent.

The wages of occupations in the oil and gas industry vary widely. Exhibit 3-7 shows average annual wages in the oil

and gas industry in California for the different major occupational groups.

**Exhibit 3-7**

**Average Wages by Major Occupational Group**  
**California Industry in 2017**  
(Excluding gas station industry)



Source: OES

A wide variety of detailed occupations exist in each major occupational group. The top 20 detailed occupations by employment share in the oil and gas industry in California and their associated wages in 2017 are shown in Exhibit 3-8, followed by the top 20 by average annual wages in Exhibit 3-9.

The top twenty detailed occupations account for more than half of the industry's workforce. In contrast, the top twenty highest paid occupations account for just over 5 percent of the workforce. ❖

**Exhibit 3-8****Detailed Industry Occupations by Employment Share (Excluding Gas Station Industry)  
Largest Employment Share in California 2017**

SOC	Detailed Occupation	Emp Share (%)	Average Annual Wage
47-2061	Construction Laborers	9.4%	\$47,430
51-8093	Petroleum Pump System/Refinery Operators/Gaugers	6.3%	\$81,580
47-2073	Operating Engineers/Other Construction Equipment Operators	4.8%	\$61,720
47-1011	First-Line Sups-Construction Trades/Extraction Workers	4.7%	\$87,330
47-5013	Service Unit Operators, Oil/Gas/Mining	3.0%	\$56,330
47-2151	Pipelayers	2.8%	\$54,780
11-1021	General and Operations Managers	2.7%	\$31,380
53-3032	Heavy and Tractor-Trailer Truck Drivers	2.7%	\$47,390
49-9012	Control/ Valve Installers/ Repairers, Except Mechanical Door	2.5%	\$65,640
53-7062	Laborers/Freight/Stock/Material Movers, Hand	2.3%	\$34,480
41-4012	Sales Reps, Wholesale/Mfg., Except Tech/Scientific Products	2.0%	\$85,170
43-9061	Office Clerks, General	1.9%	\$39,470
47-5012	Rotary Drill Operators, Oil and Gas	1.9%	\$62,580
51-4121	Welders, Cutters, Solderers, and Brazers	1.9%	\$48,300
17-2171	Petroleum Engineers	1.8%	\$139,330
47-5021	Earth Drillers, Except Oil and Gas	1.8%	\$59,580
47-5071	Roustabouts, Oil and Gas	1.6%	\$38,420
11-9021	Construction Managers	1.5%	\$152,490
43-3031	Bookkeeping/Accounting/Auditing Clerks	1.4%	\$51,460
47-5081	Helpers--Extraction Workers	1.3%	\$41,060
	<i>Other Occupations</i>	41.5%	

Source: OES

**Exhibit 3-9****Detailed Industry Occupations by Average Annual Wages (Excluding Gas Station Industry)  
Highest Annual Wage in California 2017**

SOC	Detailed Occupation	Emp Share (%)	Average Annual Wage
11-1011	Chief Executives	0.03%	\$224,900
23-1011	Lawyers	0.01%	\$213,490
11-9121	Natural Sciences Managers	0.01%	\$185,400
11-3021	Computer and Information Systems Managers	0.02%	\$185,040
11-9041	Architectural and Engineering Managers	0.18%	\$156,230
11-9021	Construction Managers	1.54%	\$152,490
11-3031	Financial Managers	0.44%	\$147,960
11-2021	Marketing Managers	0.02%	\$143,150
11-3061	Purchasing Managers	0.01%	\$140,430
11-3051	Industrial Production Managers	0.19%	\$139,620
17-2171	Petroleum Engineers	1.83%	\$139,330
11-3121	Human Resources Managers	0.01%	\$134,170
11-3011	Administrative Services Managers	0.38%	\$133,180
17-2061	Computer Hardware Engineers	0.00%	\$131,850
15-1133	Software Developers, Systems Software	0.02%	\$130,340
15-1152	Computer Network Support Specialists	0.05%	\$126,030
15-1143	Computer Network Architects	0.32%	\$125,320
15-1132	Software Developers, Applications	0.02%	\$122,030
17-2141	Mechanical Engineers	0.22%	\$114,230
13-1111	Management Analysts	0.10%	\$113,960
	<i>Other Occupations</i>	94.60%	

Source: OES



## Gas Station Industry

Gasoline stations represent the retail side of the oil and gas industry, with products being sold to the end user.

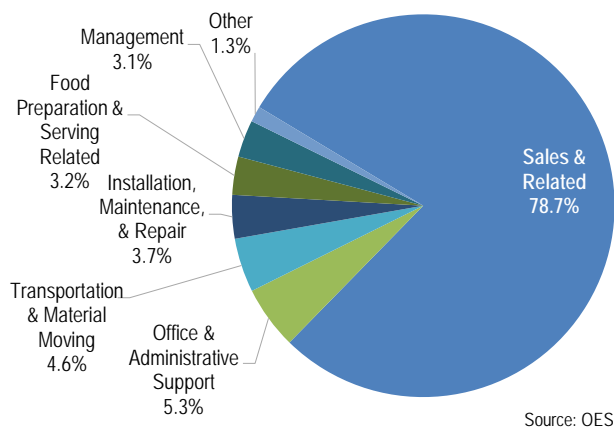
The distribution of employment by major occupational group specific to gas stations in California is shown in Exhibit 3-10. The majority of individuals in this industry segment work in sales occupations, close to 80 percent. Most of these workers are cashiers. Workers in office and administrative occupations and transportation and material moving occupations rank second and third, each with employment shares of 5.3 percent and 4.6 percent respectively. The fourth largest group in terms of employment is installation, maintenance and repair occupations, with 3.7 percent of workers.

The wages of these occupations also vary substantially. Exhibit 3-11 shows the average wages in the gas station industry in California for the different major occupational groups.

As expected, the highest average annual wages are paid to those in management occupations. Sales occupations, which account for close to 80 percent of gas station industry employment, have a median wage of \$27,230 per year. Overall, the industry median is \$30,080 annually. ❖

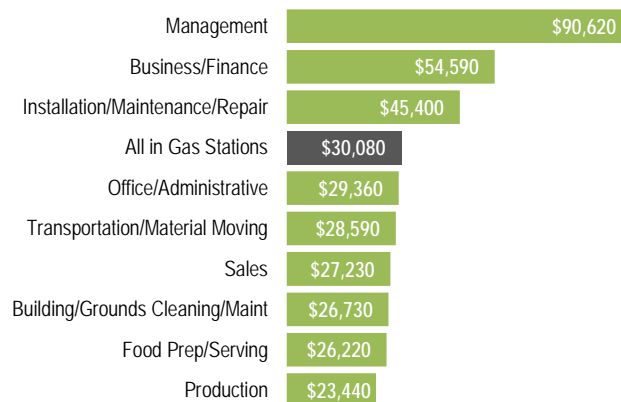
**Exhibit 3-10**

Occupational Distribution of Gas Station Industry



**Exhibit 3-11**

Annual Median Wages of Gas Station Industry  
California 2017



Source: OES

## Future Scan of Workforce Needs

The oil and gas industry employed over 152,000 payroll employees in California in 2017. Industry employment is expected to grow moderately, by close to 2 percent between 2017 and 2022, with mixed performance across the various component industries. Overall, it is expected that close to 2,500 payroll jobs will be created in the industry in California over the next five years. It is important to note that this projection assumes flat commodity prices for crude oil, natural gas, and refined products through 2022.<sup>6</sup>

California's position as an energy island that is highly dependent on waterborne imported crude oil from the Middle East and Latin America (and natural gas pipelines from Canada and other states) exposes its residents and businesses to risks of significant supply shortages and price spikes from international turmoil, competition from other large energy consumers like China and India, and transportation disruptions. Sustained increases in commodity prices would be expected to increase these employment projections significantly.

The highest number of openings will be found in the market segment, those marketing oil and gas products to the end user; these industries are expected to add an estimated 3,000 net new jobs over the next five years, with most of that growth led by gasoline stations. Gasoline stations are a local-serving industry, meaning it is highly correlated with population, as population growth takes place in more affordable areas, the number of gasoline stations will increase to support the area's increased transportation needs.

Midstream industries will provide the second highest number of openings, with just over 1,300 jobs forecast to be added over the period. Payroll employment growth in the midstream segment is expected to be led by the construction of oil and gas pipelines and related structures within California, which includes construction of oil and gas lines, mains, gas and petrochemical plants, oil refineries, and storage tanks. The work performed may include new work, reconstruction, upgrades, repairs and maintenance. Job growth in this segment may also stem from resumption of capital projects deferred during the downturn.

<sup>6</sup> California's position as an energy island that is highly dependent on waterborne imported crude oil from the Middle East and Latin America (and natural gas pipelines from Canada and other states) exposes its residents and businesses to risks of significant supply shortages and price spikes from international turmoil, competition

**Exhibit 3-12**

### 5-Year Oil and Gas Industry Workforce Needs California 2017 to 2022

	2017 Payroll Jobs	2022f Payroll Jobs	2017-22f Change (%)
<b>Upstream Segment</b>			
Oil and gas extraction	9,877	9,200	-6.8
Drilling oil and gas wells	3,050	2,930	-3.9
Support activities for oil and gas operations	6,437	6,030	-6.3
Oil and gas field machinery/ equipment mfg.	1,359	1,040	-23.4
<b>Midstream Segment</b>			
Oil and gas pipeline and related construction	10,668	11,760	10.2
Petroleum and petroleum products wholesale	7,958	8,500	6.8
Pipeline transportation	2,091	1,780	-14.9
<b>Downstream Segment</b>			
Petroleum refineries	11,270	10,890	-3.4
Petroleum lubricating oil and grease mfg.	818	840	3.0
Petrochemical manufacturing	13	20	34.8
<b>Market Segment</b>			
Natural gas distribution	33,371	32,890	-1.4
Gasoline stations	62,004	65,230	5.2
Fuel dealers	3,178	3,470	9.1
<b>Total Oil and Gas Industry</b>	<b>152,095</b>	<b>154,590</b>	<b>1.6</b>

Source: QCEW, estimates by LAEDC

Over the next five years, California's upstream segment of the oil and gas industry is expected to experience a decline in payroll employment of just about 7 percent, approximately 1,500 jobs. Producers are still rebounding from the industry downturn and remain cautious. Manufacturers of oil and gas field machinery will be feeling the effects of producers operating conservatively; their employment situation will improve once producers feel more optimistic and capital projects pick up again.

Downstream industries in California are forecast to have relatively stagnant job growth between 2017 and 2022. Manufacturing of petrochemicals and petroleum lubricating oil and grease are expected to add jobs, but the

from other large energy consumers like China and India, and transportation disruptions. Sustained increases in commodity prices would be expected to increase these employment projections significantly.

declines expected in the refinery industry (close to 400 jobs) negate job growth in the segment overall.

Additional job openings over the next five years will arise related to job churn, replacement openings that result from workers switching jobs, the retirement of existing workers, or workers separating from the industry. Additional job opportunities will exist for independent contractors as well, many of which are high-paying union construction jobs with benefits. ❖

## The Talent Pipeline

The oil and gas industry is characterized by a bimodal distribution of education. At one end of the distribution lie high-skilled, educated petroleum and geophysical engineers and finance and business managers. At the other end of the educational distribution are construction, extraction, and transportation workers — who are often highly-skilled but who typically have less educational attainment.

### *Current Training Programs*

Entry-level and lower-skilled jobs associated with the oil and gas industry traditionally have two tiers of training, both of which are primarily on-the-job. For example, positions such as derrick operators and roustabouts require as little as a few days or a few months of training, whereas other positions, such as unit operators or rotary drill operators, may require up to a year of working alongside an experienced employee, or completion of a recognized apprenticeship program. To ensure that their production facilities or refineries are constructed and maintained by a highly qualified workforce several California oil and gas companies have Project Labor Agreements with the California Building and Construction Trades Council, whose 300 locals throughout the state have about 450,000 members and are currently training about 20,000 apprentices in skilled crafts.

For positions such as these, educational attainment has little to do with job preparedness. Rather, most jobs call for candidates with a high school diploma (or equivalent), consistent with a majority of oil workers. Employers are more likely to value transferable skills and experience than educational attainment for many oil and gas industry positions.

In recent years, trade school and technical programs have started to form in and around areas of extraction or refinery operations. These programs aim to reduce the

time spent training on-the-job and create an occupation-ready workforce. We briefly discuss some of the training options that exist in California for individuals interested in working in the oil and gas industry.

It is important to note that entry-level oil and gas occupations often do not require post-high school education. Hence applicable programs that exist in high school bring the potential workforce up to minimum qualifications by allowing students to earn their high school diploma while giving them a competitive edge with entry-level training and opportunities to grow their skills on the job through more advanced training. Several programs exist in California including:

- ▶ Taft Union High School Oil Technology Academy (Taft, CA)
- ▶ Independence High School Energy and Utilities Career Academy (Bakersfield, CA)
- ▶ Edison High School Green Energy Technology Academy (Fresno, CA)
- ▶ Venture Academy New Energy Academy (Stockton, CA)

Community colleges and vocational schools across the state offer associate degrees, certificates and courses in manufacturing and industrial technology fields. Manufacturing and industrial operations programs may not be directly applicable to the oil industry, but they may give prospective employees transferable skills and experience with heavy machinery, which may better prepare prospective employees for a job in the industry.

Programs that train individuals for specific roles in the oil and gas industry also exist at the community college level.

### **Coastline Community College (Fountain Valley, CA)**

- ▶ Process Technology Certificate
  - Don Knabe Energy Pathway Program (DKEPP) is a partnership with Coastline Community College, Phillips66, Torrance Refining Company, Chevron, Andeavor, USW Local 675, World Oil Refining, World Oil Recycling, General Mills, Los Angeles Sanitation Districts, and the United Way of Greater Los Angeles. It provides entry level education and training in process systems, technology and safety (with emphasis in petrochemical and wastewater treatment).

### **Laney College (Oakland, CA)**

- ▶ Continuing education and professional development programs:
  - Gas Transmission Pipe Welding
- ▶ Certificate programs:

- Industrial Maintenance
- ▶ Programs with Certificate or associate degree options:
  - Commercial HVAC, Residential and Light Commercial HVAC/R,
  - Building Automation Systems, and
  - Welding Technology.
- ▶ Associate degree programs:
  - Machine Technology

#### **Los Angeles Trade Technical College (Los Angeles, CA)**

- ▶ Process Technology Certificate (PTEC)
  - The PTEC program prepares students to work as process operators in the oil and gas, power generating, wastewater treatment, pharmaceutical, and other industries.

At the university level, multiple Cal State and University of California schools, Stanford and the University of Southern California (USC) offer degree programs that train individuals for the industry. While Cal State University in Bakersfield, Long Beach, and Cal State Polytechnic in San Luis Obispo are perhaps best known for educating energy workers, other campuses like Cal State Dominguez Hills (featured below) also provide excellent industrial education and training to help students succeed in California's oil and gas industry.

#### **California State University Dominguez Hills (Dominguez Hills, CA)**

- ▶ Refinery Safety Technician Certificate
  - Participants will be prepared with a solid foundation to assist refinery safety managers

in facilitating OSHA regulations and meeting performance expectations of employers.

#### **University of Southern California (Los Angeles, CA)**

- ▶ Certificate programs:
  - Smart Oilfield Technologies,
  - Systems Architecting and Engineering, and Engineering Technology Commercialization.
- ▶ Bachelor's degree programs:
  - Chemical, Civil, Electrical, Industrial & Systems, and Mechanical Engineering.
- ▶ Postgraduate degree programs:
  - Petroleum Engineering,
  - Industrial and Systems Engineering,
  - Engineering Management,
  - Product Development Engineering,
  - Systems Architecting and Engineering,
  - Chemical Engineering, and
  - Materials Engineering.

#### **Stanford University (Palo Alto, CA)**

- ▶ Certificate programs:
  - Management Science and Engineering,
  - Molecular Engineering of Energy Technologies, and
  - Energy Innovation and Emerging Technologies.
- ▶ Master's degree programs:
  - Chemical Engineering,
  - Civil and Environmental Engineering,
  - Electrical Engineering,
  - Management Science and Engineering,
  - Materials Science and Engineering, and
  - Mechanical Engineering.

## Characteristics of the Industry Workforce in California

The composition of the workforce in the oil and gas industry varies according to gender, age, race and ethnicity and educational attainment.

### *Sex of Workforce*

Workers in the oil and gas industry are predominantly male. In 2017, males represented 75.4 percent of the workforce (Exhibit 3-13).

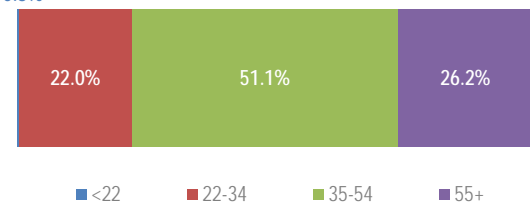
**Exhibit 3-13**  
Gender



### *Age of Workforce*

The majority of the workforce is in its prime working age—between 22 years and 54 years of age, with almost half being in the 35 to 54 years of age group (Exhibit 3-14). Still, workers aged 55 years and older accounted for 26.2 percent, a significant share of the industry workforce.

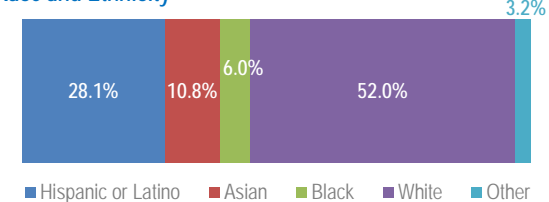
**Exhibit 3-14**  
Age



### *Race and Ethnicity in the Workforce*

The workforce in the oil and gas industry is diverse in both race and ethnicity (Exhibit 3-15). Workers reporting their race as white accounted for just over half of the workforce, with those reporting their ethnicity as Hispanic or Latino (all races) accounting for nearly 30 percent. 10.8 percent of industry workers reported as Asian and 6 percent identified as Black.

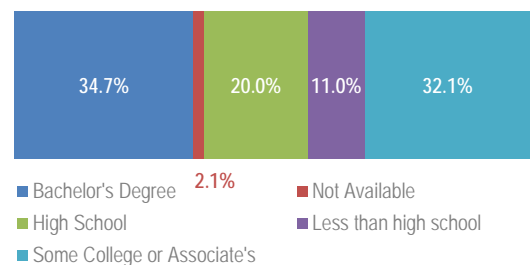
**Exhibit 3-15**  
Race and Ethnicity



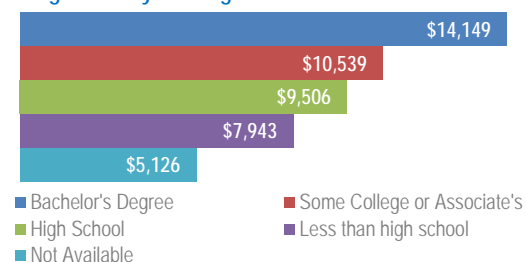
### *Educational Attainment of Workers*

The industry provides a wide range of jobs to individuals with different levels of education (Exhibit 3-16). Approximately 31 percent of the workforce has a high school education or less; 20 percent have a high school diploma and 11 percent have less than a high school education. Oil and gas workers with some college education accounted for 32 percent of the workforce, and 34.7 percent have earned a bachelor's degree or higher. While almost a third of the workforce has up to a high school education, these jobs in oil and gas industries are associated with higher earnings compared to those with the same levels of education across all industries in the state (Exhibit 3-17). ❖

**Exhibit 3-16**  
Educational Attainment



**Exhibit 3-17**  
Average Monthly Earnings 2017





## Changes in Workforce Characteristics in California Over Time

The composition of the workforce in the oil and gas industry changes over time. A comparison of worker characteristics in this report (2017) and the two previous industry reports (2013 and 2015) are presented.

### Sex of Workforce

While the oil and gas industry has been a predominantly male dominated industry, **women represented a quarter of workers in the oil and gas industry in California in 2017**. The share of women workers declined by almost 8 percentage points between 2015 and 2017 and was about 6 percentage points below their share in 2013. (Exhibit 3-18).

### Age of Workforce

The majority of the workforce in the state has been in its prime working age—between 22 years and 54 years of age across all three years reported; however, in 2017, there is an increased share of workers ages 35 to 54 years, up to 51 percent from 44 percent in 2015. Workers 55 years and above, increasing by 1 percentage point to 26 percent of the workforce from 2015, **Workers in younger cohorts declined between 2015 and 2017**.

### Race and Ethnicity in the Workforce

The workforce in the oil and gas industry is diverse in both race and ethnicity, though **there has not been much change in the racial and ethnic composition of the workforce over time at the state level** (Exhibit 3-20). Workers reporting their ethnicity as Hispanic or Latino (all races) have been hovering around 30 percent of the industry's workforce in California's across all three years reported. Workers reporting their race as Asian accounted for 13 percent in 2013 and 2015, with their share declining slightly to 11 percent in 2017. Finally, workers reporting their race as black accounted for approximately 6 percent of the workforce across all three years reported.

### Educational Attainment of Workers

Over the last five years reported, the number of workers with lower levels of education has declined, while those with a community college level education, or a bachelor's and above has increased (Exhibit 3-21). Workers with less than a high school education lost their share of the industry workforce by 6 percentage points and those with

Exhibit 3-18

Workforce in the California Oil and Gas Industry

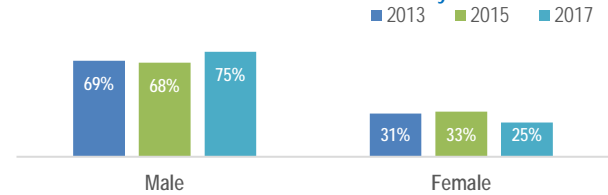


Exhibit 3-19

Workforce in the California Oil and Gas Industry

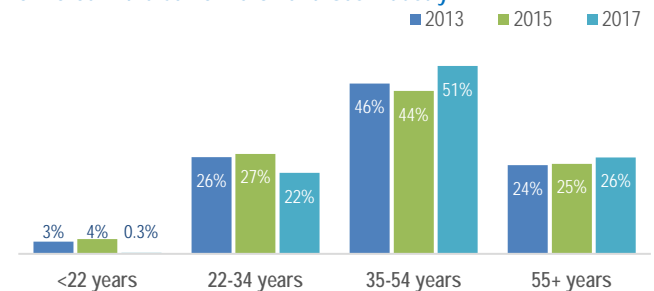


Exhibit 3-20

Workforce in the California Oil and Gas Industry

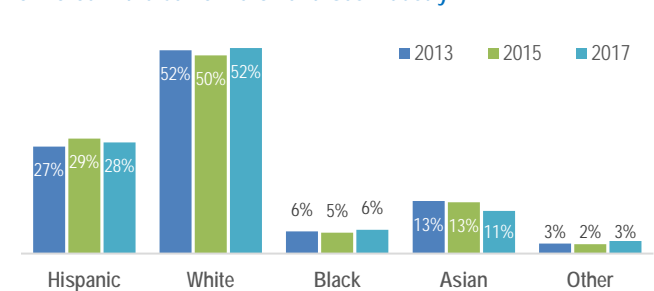
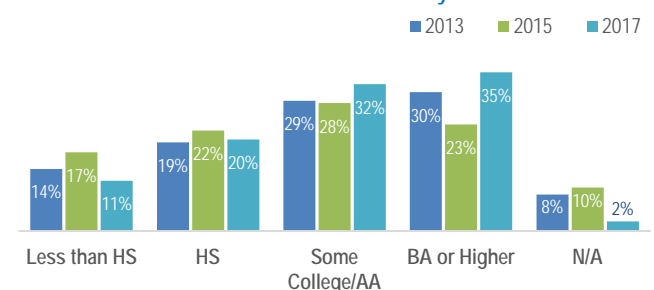


Exhibit 3-21

Workforce in the California Oil and Gas Industry



a high school level education lost 2 percentage points between 2015 and 2017. The N/A category, which includes workers ages 24 years and below, have also declined over the period. ❖

## Occupations Specific to the Oil and Gas Industry

While many occupations are required to successfully operate businesses in the oil and gas industry, there are some occupations that are uncommon or do not exist in other industries. These specialized occupations are unique to the oil and gas industry and, as such, we explore each of these identified occupations and look at the characteristics of the workers to provide insight into who is working in these jobs in the industry.

Ten detailed occupations have been identified as being unique to the oil and gas industry in California. These occupations exist across the skills spectrum, all with higher than average wages and many requiring less than a bachelor's degree for entry. We compiled detailed information for each occupation in California with wages and worker characteristics data for 2017.

The information on current and projected employment, wages and demographics can be used by employers or educational institutions to tailor workforce development programs for their specific needs and to guide outreach to potential workers and/or students to market promising career paths.



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Each California occupational profile sheet contains metrics for the occupation including:

- ▶ Number of current Jobs in 2017 and projected jobs in 2022
- ▶ Annual wages paid in 2017
- ▶ Worker characteristics, including:
  - Educational attainment;
  - Age distribution;
  - Race and ethnicity;
  - Gender;
  - Veteran status; and
  - A comparison of each with the average across all occupations in all industries (total workforce).

### ***Oil and Gas Specific Occupations:***

- ▶ Petroleum Engineers (SOC 17-2171)
- ▶ Geological and Petroleum Technicians (SOC 19-4041)
- ▶ Pipe layers (SOC 47-2151)
- ▶ Derrick, Rotary Drill, and Service Unit Operators, Oil, Gas, and Mining
  - Derrick Operators, Oil and Gas (SOC 47-5011)
  - Rotary Drill Operators, Oil and Gas (SOC 47-5012)
  - Service Unit Operators, Oil, Gas, and Mining (SOC 47-5013)
- ▶ Other Extraction Workers
  - Roustabouts, Oil and Gas (SOC 47-5071)
  - Helpers--Extraction Workers (SOC 47-5081)
- ▶ Miscellaneous Plant System Operators
  - Gas Plant Operators (SOC 51-8092)
  - Petroleum Pump System Operators, Refinery Operators, and Gaugers (SOC 51-8093)

## Petroleum Engineers

### Petroleum Engineers (SOC 17-2171)

Petroleum engineers devise methods to improve oil and gas extraction and production and determine the need for new or modified tool designs. They oversee drilling and offer technical advice.

**Petroleum Engineers**  
2,240 jobs in 2017

Entry-level education:  
*Bachelor's degree*

On-the-job training:  
*None*

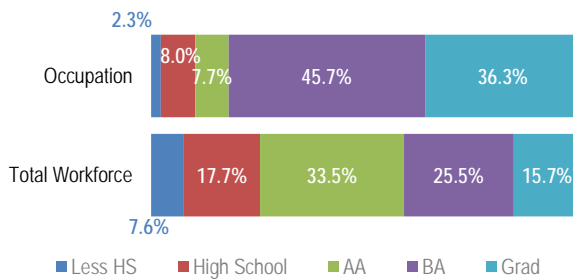
**Jobs in CA:**

**2,240**  
in 2017

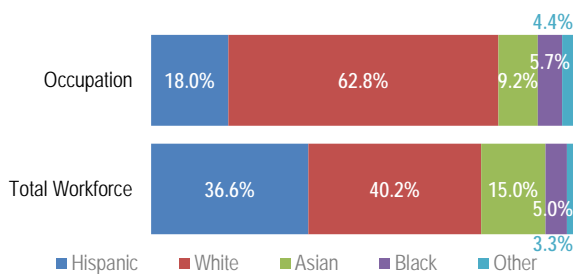
**2,300**  
Projected Jobs  
2017 to 2022

## Regional Worker Characteristics

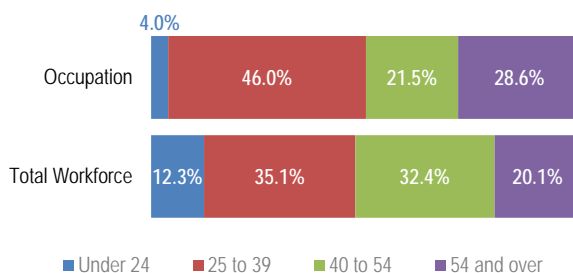
### Educational Attainment



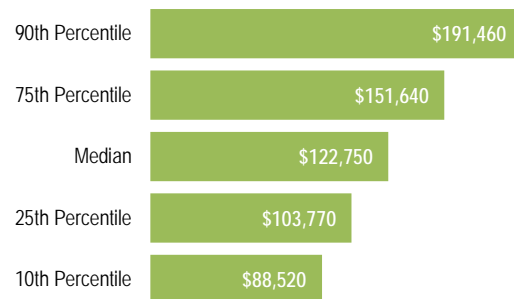
### Race and Ethnicity



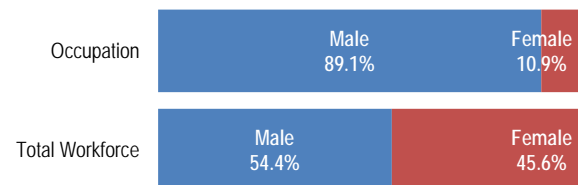
### Age



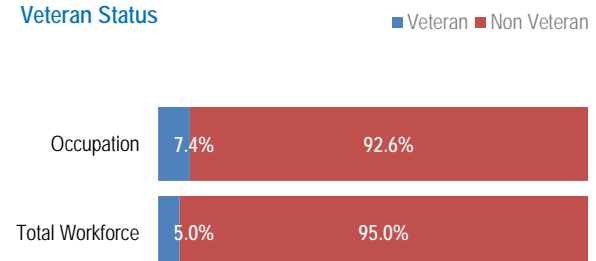
### Annual Wages in 2017 Petroleum Engineers



### Gender



### Veteran Status



## Geological and Petroleum Technicians

### Geological and Petroleum Technicians (SOC 19-4041)

Geological and petroleum technicians assist scientists or engineers in the use of electronic, sonic, or other measuring instruments in both laboratory and production activities to obtain data indicating potential resources such as minerals, natural gas, or crude oil. They analyze mud and drill cuttings and they chart pressure, temperature, and other characteristics of wells or bore holes. Geological and petroleum technicians investigate and collect information leading to the possible discovery of new minerals, gas, or petroleum deposits.

**Geological and Petroleum Technicians**  
1,590 jobs in 2017

Entry-level education:  
Associate degree

On-the-job training:  
None

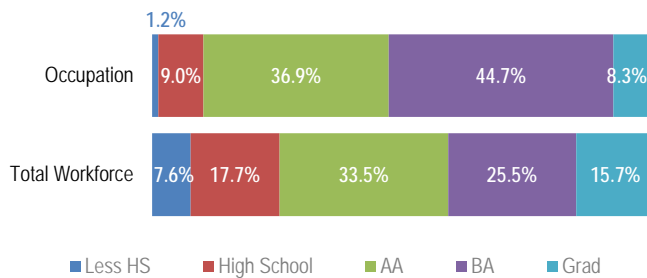
**Jobs in CA:**

**1,590**  
in 2017

**1,600**  
Projected jobs  
2017 to 2022

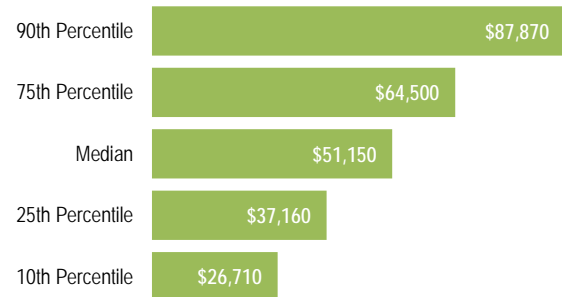
## Regional Worker Characteristics

### Educational Attainment

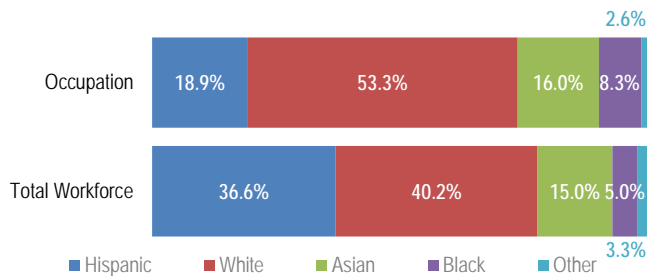


### Annual Wages in 2017

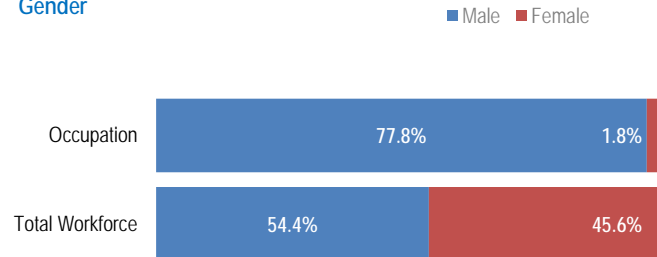
#### Geological and Petroleum Technicians



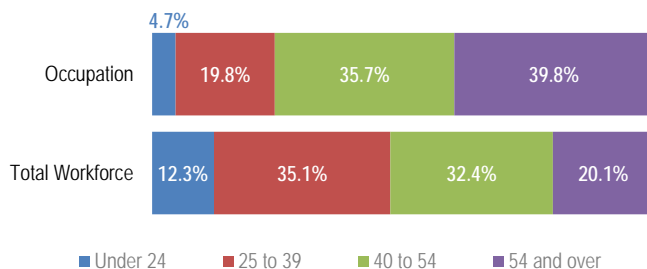
### Race and Ethnicity



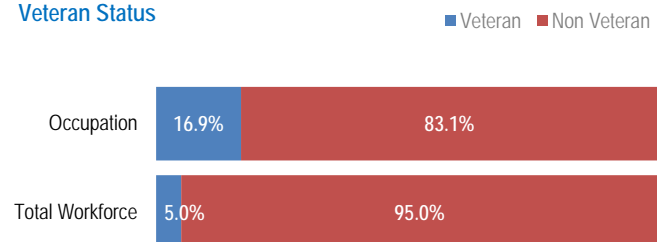
### Gender



### Age



### Veteran Status



## Pipelayers

### Pipelayers (47-2151)

Pipelayers lay pipe for oil and natural gas pipelines, utilities, storm or sanitation sewers, drains, and water mains. They perform any combination of the following tasks: grade trenches or culverts, position pipe, or seal joints.

#### Pipelayers (47-2151)

3,260 jobs in 2017

Entry-level education:

No formal educational credential

On-the-job training:

Short-term on-the-job training

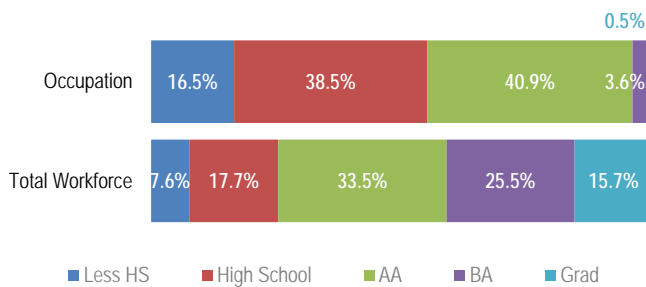
Jobs in CA:

**3,260**  
in 2017

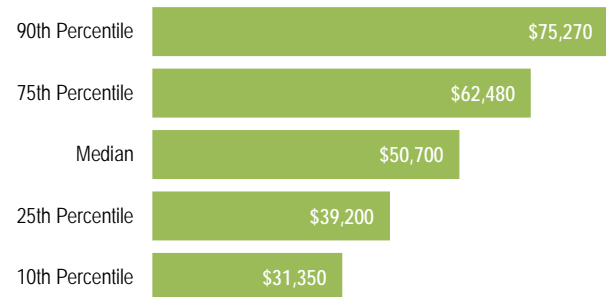
**3,400**  
Projected Jobs  
2017 to 2022

## Regional Worker Characteristics

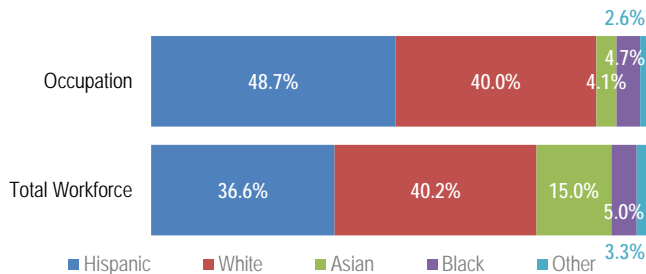
### Educational Attainment



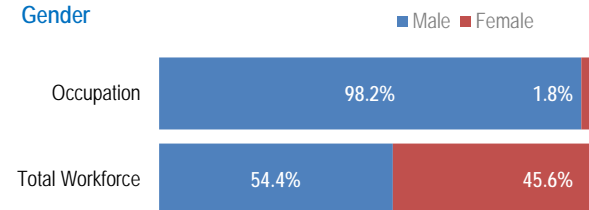
### Annual Wages in 2017 Pipelayers



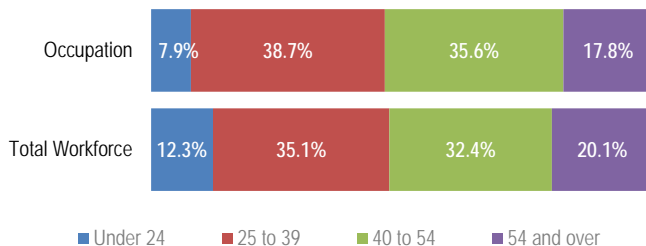
### Race and Ethnicity



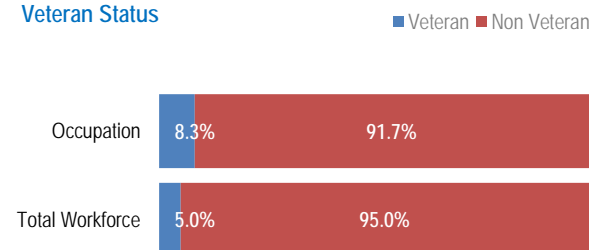
### Gender



### Age



### Veteran Status





## Derrick, Rotary Drill and Service Unit Operators, Oil, Gas, and Mining

### Derrick Operators, Oil and Gas (47-5011)

Oil and gas derrick operators rig derrick equipment and operate pumps to circulate mud or fluid through drill hole.

### Rotary Drill Operators, Oil and Gas (47-5012)

Oil and gas rotary drill operators set up or operate a variety of drills to remove underground oil and gas or remove core samples for testing during oil and gas exploration.

### Service Unit Operators, Oil, Gas and Mining (47-5013)

Oil, gas and mining service unit operators operate equipment to increase oil flow from producing wells or to remove stuck pipe, casing, tools, or other obstructions from drilling wells.

### Derrick Operators, Oil and Gas (47-5011)

560 jobs in 2017

Entry-level education:

No formal educational credential

On-the-job training: Short-term on-the-job training

### Rotary Drill Operators, Oil and Gas (47-5012)

1,090 jobs in 2017

Entry-level education: No formal educational credential

On-the-job training: Moderate-term on-the-job training

### Service Unit Operators, Oil, Gas and Mining (47-5013)

2,080 jobs in 2017

Entry-level education: No formal educational credential

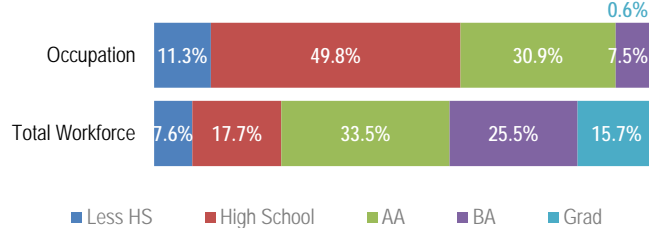
On-the-job training: Moderate-term on-the-job training

Jobs in  
CA:  
**5,600**  
in 2017

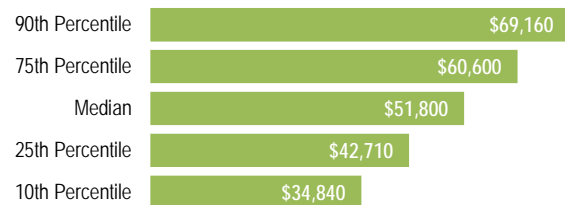
**5,700**

## Regional Worker Characteristics

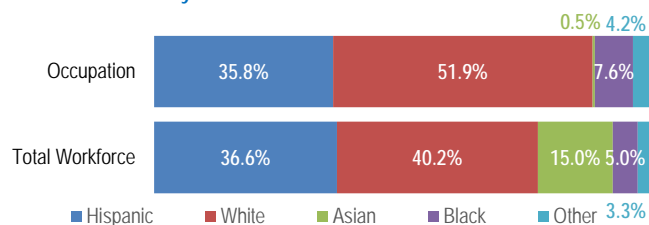
### Educational Attainment



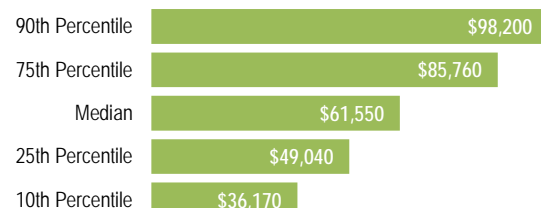
### Annual Wages in 2017 Derrick Operators



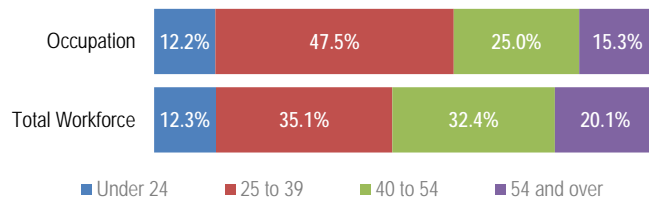
### Race and Ethnicity



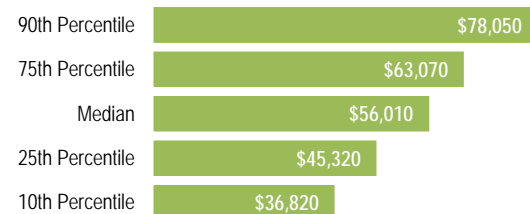
### Rotary Drill Operators



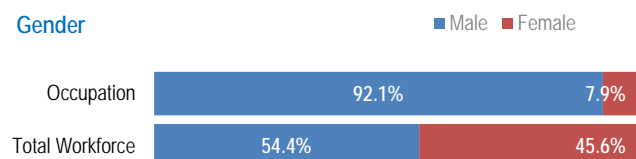
### Age



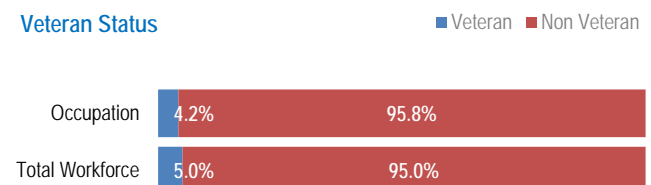
### Service Units Operators



### Gender



### Veteran Status



## Other Extraction Workers

### Roustabouts, Oil and Gas (47-5071)

Oil and gas roustabouts assemble or repair oil field equipment using hand and power tools. Perform other tasks as needed.

### Helpers—Extraction Workers (47-5081)

Extraction worker helpers assist extraction craft workers, such as drillers, derrick operators, and machine operators, by performing duties including supplying equipment or preparing and cleaning work areas.

#### Roustabouts, Oil and Gas

1,750 jobs in 2017

Entry-level education:

No formal educational credential

On-the-job training:

Moderate-term on-the-job training

#### Helpers—Extraction Workers

890 jobs in 2017

Entry-level education:

High school diploma or equivalent

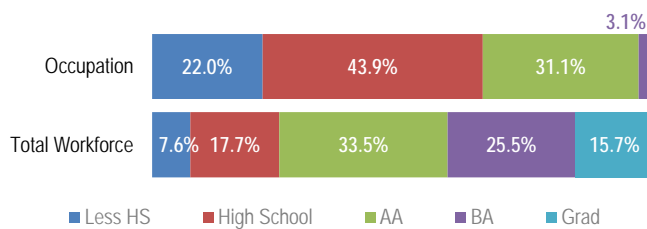
On-the-job training: Moderate-term on-the-job training

**Jobs in  
CA:**  
**2,640**  
in 2017

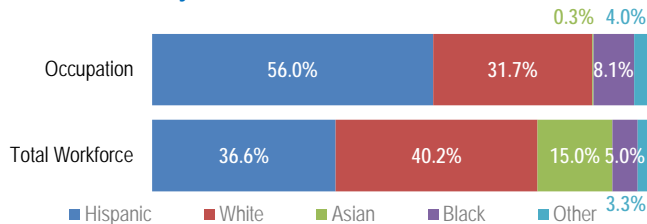
**2,700**  
Projected  
Jobs

## Regional Worker Characteristics

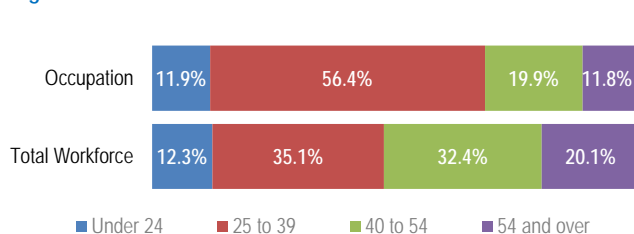
### Educational Attainment



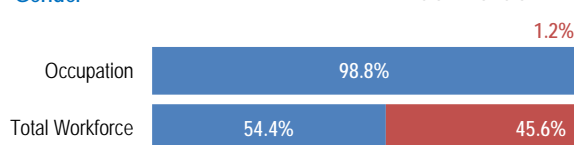
### Race and Ethnicity



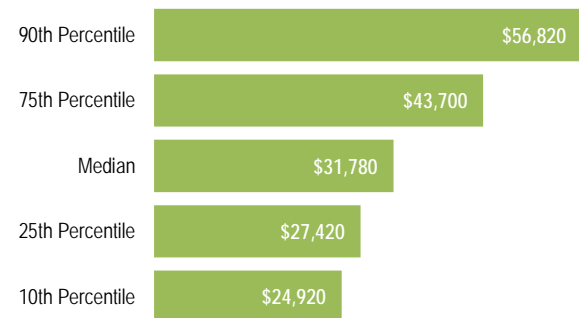
### Age



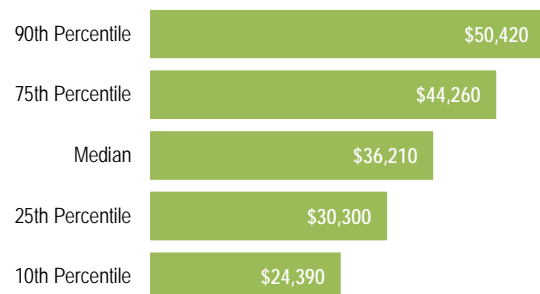
### Gender



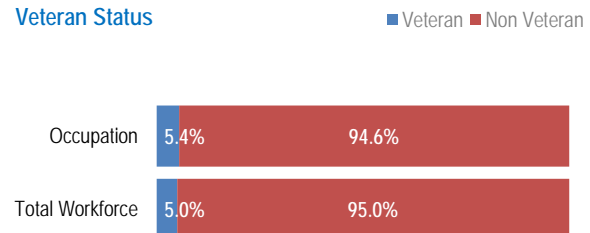
### Annual Wages in 2017 Roustabouts



### Helpers - Extraction Workers



### Veteran Status



## Miscellaneous Plant System Operators

### Gas Plant Operators (SOC 51-8092)

Gas plant operators distribute or process gas for midstream or utility companies and others by controlling compressors to maintain specified pressures on main pipelines.

### Petroleum Pump System Operators, Refinery Operators, and Gaugers (SOC 51-8093)

Petroleum pump system and refinery operators and gaugers operate or control petroleum refining or processing units. May specialize in controlling manifold and pumping systems, gauging or testing oil in storage tanks, or regulating the flow of oil into pipelines.

### Gas Plant Operators (51-8092)

1,070 jobs in 2017

Entry-level education:

High school diploma or equivalent

On-the-job training:

Long-term on-the-job training

### Petroleum Pump System Operators, Refinery Operators, and Gaugers

4,530 jobs in 2017

Entry-level education: High school diploma or equivalent

On-the-job training: Moderate-term on-the-job training

Jobs in CA:

5,600

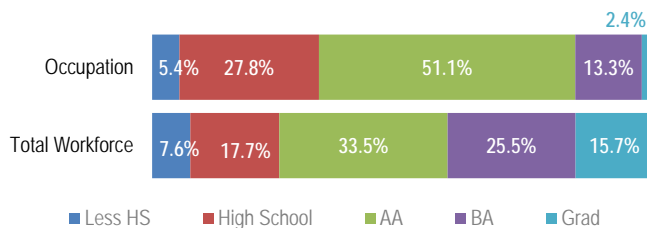
in 2017

5,700

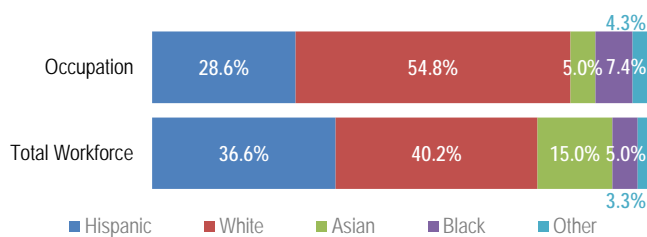
Total Openings

## Regional Worker Characteristics

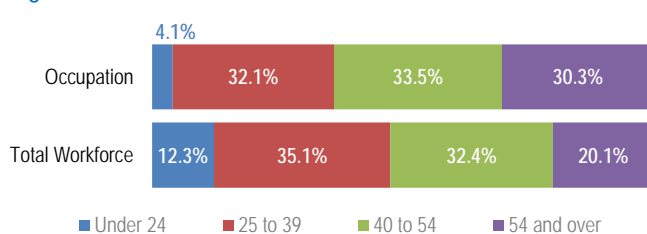
### Educational Attainment



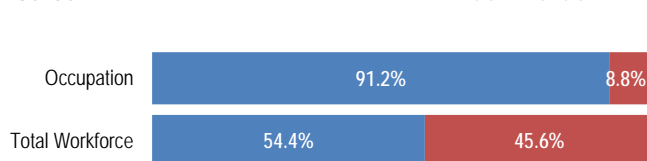
### Race and Ethnicity



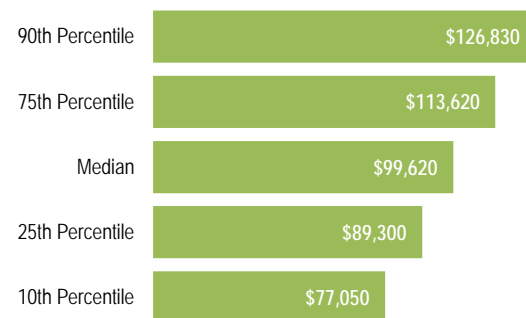
### Age



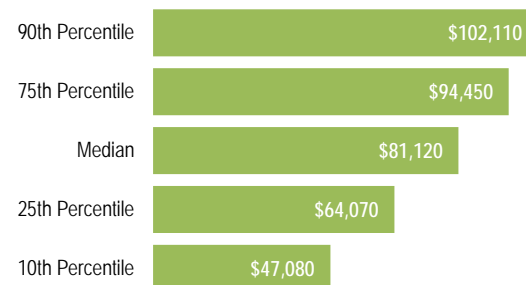
### Gender



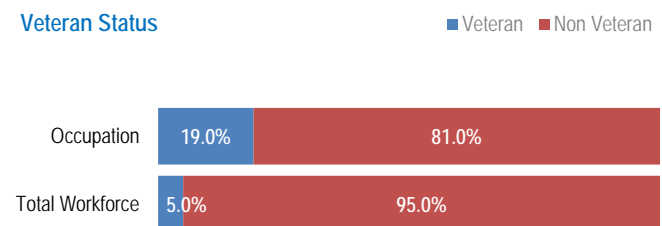
### Annual Wages in 2017 Gas Plant Operators



### Operators and Gaugers



### Veteran Status



## 4 Economic Contribution of Oil and Gas in California

Extraction, production, refining and petroleum products manufacturing result in highly tradable products both consumed domestically and exported, producing high revenues, high wage careers with benefits and significant fiscal revenues for all levels of government.

As part of this study, a customized input-output model was developed for the state to estimate the economic contribution of the oil and gas industry in California. The models measure economic benefits through jobs, labor income, economic output, Gross State Product (or Gross Regional Product), and fiscal revenues paid to state and local governments. Additional details on the methodology used in this report can be found in the Appendix.

### Direct Economic Activity

Direct activity associated with the oil and gas industry is the direct contribution to the economy of the industry in terms of employment, labor income and value added.

Direct employment of the oil and gas industry includes all individuals whose employment is directly related to business establishments with activities that fall within the NAICS codes included in the industry definition. Measured on a job-count basis regardless of the number of hours worked, it includes full-time, part-time, permanent and seasonal employees and the self-employed.<sup>7</sup>

Exhibit 4-1 displays the estimated direct employment associated with each component industry in the oil and gas industry in California in 2017. Direct employment estimates in this report represent activity which would be lost to the economy without the presence of the oil and gas industry in California.

The oil and gas industry in California provided over 152,100 jobs in 2017, including independent contractors and payroll employees. Just over 40 percent work in support gas stations, about 22 percent in gas distribution

and about 7 percent each in oil and gas extraction, oil and gas pipeline construction and petroleum refineries.

Exhibit 4-2 shows the distribution of estimated direct oil and gas industry employment by sub-region in 2017.

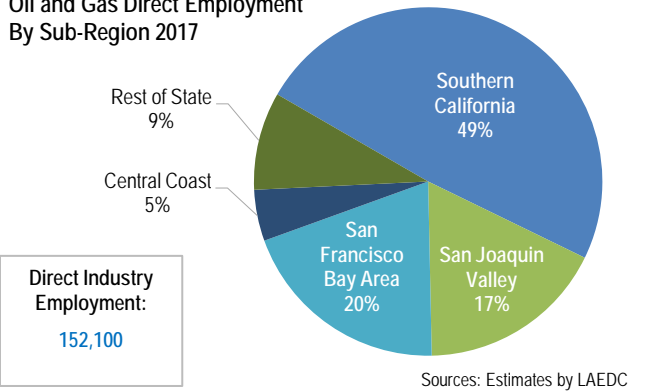
While the number of wells, and both oil and gas production levels are highest in the Central Valley/Northern California region, almost half of all industry employment is in Southern California.

Exhibit 4-1  
Oil and Gas Industry Employment  
California 2017

NAICS	Industry	Direct Employment
	Upstream	20,730
	Midstream	20,720
	Downstream	12,100
	Market	98,550
	<b>Oil and Gas Industry Employment</b>	<b>152,100</b>
	<i>Percent of California Total Employment</i>	<i>0.9%</i>

Note: Includes non-employers and independent contractors  
Source: Estimates by LAEDC

Exhibit 4-2  
Oil and Gas Direct Employment  
By Sub-Region 2017



<sup>7</sup> The size of workforce in the oil and gas industry is hard to quantify, as there are a significant number of temporary and contingent, or contract, workers. These workers may live outside the area where they are performing their work duties. Data reported according to these workers' mailing address, such as nonemployer data, will attribute these workers not by where their work is taking place, but

by their associated address, which leads to potential overcounting and undercounting of contingent workers at the county-level and sub-regions. A small labor leakage may take place in state-level data as well, due to work contracted with companies from outside of California.

Labor income in the oil and gas industry is the value of all earnings received by both payroll employees and the self-employed, including benefits such as health insurance and pension plan contributions. Total labor payments by industry are presented in Exhibit 4-3.

**Exhibit 4-3****Oil and Gas Industry Labor Income  
California 2017**

NAICS	Industry	Direct Labor Income (\$ millions)
	Upstream	2,234
	Midstream	1,730
	Downstream	1,831
	Market	6,265
<b>Oil and Gas Industry Employment</b>		<b>12,059</b>
<i>Percent of California Total Labor Income</i>		<i>0.7%</i>

Note: Includes non-employers and independent contractors  
Source: Estimates by LAEDC

Close to 40 percent of the labor income in the industry was earned by natural gas distribution workers, nearly fifteen percent by refineries workers and just under fourteen percent by workers at gas stations. The total labor income paid by the oil and gas industry accounted for 1.6 percent of all labor income in California. ❖

## Total Economic Contribution

The total economic contribution of the oil and gas industry in California includes indirect and induced activity in addition to the direct activity already identified. *Direct activity* includes the materials purchased and the employees hired by the industry itself. *Indirect effects* are those which stem from the employment and business revenues motivated by the purchases made by the industry and any of its suppliers. *Induced effects* are those generated by the spending of employees whose wages are sustained by both direct and indirect spending. These direct, indirect and induced effects combined result in a considerable contribution to the California economy, which is presented in Exhibit 4-4.

It is estimated that the activities related to the oil and gas industry in California in 2017 generated value added equaling \$59.3 billion in California, approximately 2.1 percent of the state's GDP of \$2.8 trillion. The industry contributed 365,970 jobs, or 1.6 percent of the state total,

with labor income of just over \$26 billion, accounting for 1.6 percent of all labor income earned in the state.

### Industry Distribution

The total economic contribution is achieved through activity occurring across a wide range of industry sectors via indirect and induced effects. These effects capture the economic activity created in other sectors through purchases of goods and services made in the industry's supply chain and through the purchases of goods and services made by employees.

**Exhibit 4-4****Total Economic Contribution of Oil and Gas Industry  
California 2017\***

<b>Employment (jobs):</b>		
Direct	152,100	
Indirect	106,590	
Induced	107,270	
<b>TOTAL</b>		<b>365,970</b>
<i>Percent of California Total Employment</i>		<i>1.6%</i>
<b>Labor income (\$ millions):</b>		
Direct	12,059	
Indirect	7,985	
Induced	6,104	
<b>TOTAL</b>		<b>26,148</b>
<i>Percent of California Total Labor Income</i>		<i>1.6%</i>
<b>Value added (\$ millions):</b>		
Direct	35,885	
Indirect	12,399	
Induced	11,048	
<b>TOTAL</b>		<b>59,332</b>
<i>Percent of California Total GDP</i>		<i>2.1%</i>
<b>Output (\$ millions):</b>		
Direct	114,881	
Indirect	19,610	
Induced	17,809	
<b>TOTAL</b>		<b>152,300</b>
<i>Percent of California Total Output</i>		<i>3.4%</i>

\* Results are not directly comparable to the previous reports due to a change in methodology  
Source: Estimates by LAEDC

The distribution of the total employment, labor income and value-added contribution among industry sectors is presented in Exhibit 4-5.

Of the 365,970 jobs supported, close to a quarter were in retail trade (which includes gas stations and fuel dealers), just over 9 percent were in the utilities sector (which includes natural gas distribution and electric power



generation and transmission), and 7 percent were in the wholesale sector (which includes petroleum bulk stations and terminals). However, virtually all industry sectors receive a positive economic impact from the oil and gas industry, including professional, scientific and technical services, transportation and warehousing, administrative and waste services, construction, health and social services, mining and accommodation and food services.

#### Exhibit 4-5

##### Total Economic Contribution of Oil and Gas Industry By Sector California 2017

	Jobs	Labor Income (\$ millions)	Value Added (\$ millions)
Ag, forestry, fish & hunting	720	40	59
Mining	19,470	2,149	3,397
Utilities	33,530	4,444	9,101
Construction	21,580	1,655	2,191
Manufacturing	18,820	2,347	17,954
Wholesale trade	25,190	2,131	4,340
Retail trade	82,060	2,541	4,496
Transportation and warehousing	22,970	1,559	2,161
Information	3,500	750	1,325
Finance and insurance	13,930	1,240	2,096
Real estate and rental	11,200	536	4,063
Professional, scientific technical	23,570	2,088	2,398
Management of companies	4,250	586	680
Administrative and waste services	21,800	940	1,193
Educational services	4,410	207	218
Health and social services	19,690	1,252	1,393
Arts, entertainment and recreation	4,310	182	266
Accommodation and food services	19,030	575	838
Other services	14,530	759	905
Government	1,240	136	214
<b>Total</b>	<b>365,970</b>	<b>\$ 26,148</b>	<b>\$ 59,332</b>

Source: Estimates by LAEDC

A description of the industry sectors is provided in the Appendix. ❖

## Public Revenues

The oil and gas industry faces a high tax burden, incurred by both businesses operating within the industry and by consumers. The production, refining, distribution, retail and consumption of oil and gas all face taxes levied by local, state and federal governments.

#### Ad Valorem:

In California, ad valorem taxes are locally assessed and administered by each county. The State of California dictates that ad valorem taxes have a one percent maximum; however, individual counties have the option

to add to this rate to satisfy local voter-approved debt. In the case of oil and gas industry, the market value of the mineral property interest is assessed by estimating the market value of proved reserves volumes. This results in oil and gas reserves in California actually being taxed in the ground, irrespective of what is being produced, unlike most other oil-producing states. In addition, local governments in California receive these tax revenues to fund needed public services like education and public safety.

#### Production:

The state of California imposes an assessment on oil and gas production in order to support the Department of Conservation's Division of Oil, Gas, and Geothermal Resources (DOGGR). The amount per barrel/10,000 cubic feet produced changes yearly.

#### State and Local Excise Taxes:

Excise taxes are levied on the purchase of certain goods and are paid by the end user at the time of sale. California imposes an excise tax on both natural gas and oil sales. The state excise tax levied on natural gas consumption in California varies among the different private utility gas distributors in the state and with the type of customer (residential, commercial, industrial, etc.), while excise taxes levied on the purchase of fuel varies by fuel type.

#### Federal Excise Tax:

The federal government levies an excise tax on fuel consumption in addition to those levied by the State of California. The federal excise tax applied to the purchase of fuel (from point of sale, terminal, refinery or from outside of the U.S.) also varies by fuel type, including gasoline, aviation gasoline, diesel and jet fuel. Compressed natural gas used as a fuel for motor vehicles is also subject to a federal excise tax.

#### Sales Tax:

Sales tax is levied on the sale of gasoline by both state and local governments; the purchaser incurs the tax burden at the point of sale. State and local (county and city) sales tax rates are usually bundled together. The total rate varies from county to county (and even different areas within the same county), based upon voter approved measures specific to that geography. Diesel fuel sales in California are subject to an additional sales tax levied by the state.

#### Lease and Royalty Payments:

Oil and gas operations involved in extraction may enter into a mineral lease with the federal government to obtain the right to explore, drill, extract, remove, and dispose of oil and gas deposits on federally owned lands. Leases are purchased, bonus lease payments are paid,

rental rates apply and once production is underway the lessees are subject to royalty fees.

The State Lands Commission's Mineral Resources Management Division is charged with the management and administration of oil and gas, geothermal and other mineral resources on state-owned public lands in California. In addition to initial bonus lease payments, lease rent and royalties apply. They have 21 state tidelands oil and gas leases, only seven of which are not producing. Average production associated with the 14 producing developed leases was 7,027 barrels per day. Royalty payments on their leases are determined by several methods: price based sliding scale on oil royalty, sliding rate scale, net profits share and fixed royalty rates. State Lands Commission oil revenues routinely exceed \$100 million per year from production on state tidelands, chiefly in Long Beach.

Private individuals also receive royalty payments for production activity taking place on their lands.

#### Other State and Local Taxes and Fees:

Additional taxes and fees relevant to the oil and gas industry in California include the following:

*International Fuel Tax Agreement (IFTA)* tax rates in California on diesel fuel at the close of 2017 were \$0.5700 per gallon purchased, to be redistributed among jurisdictions according to miles travelled in each. Miles travelled are reported by the commercial carrier in quarterly reports.

The *Underground Storage Tank Fee* funds programs to replace underground petroleum storage tanks in California that have reached or exceeded their regulated age limit.

The *Oil Spill Prevention and Administration Fee* funds prevention and response programs in California. The fee of 6.5 cents per barrel is collected by terminal and refinery operators from producers of crude or petroleum products upon receipt and then remitted to the state.

The *Oil Spill Response Fee* applies to crude oil and petroleum products received at marine terminals, moving through marine pipelines, or received at California refineries. The fund has reached its \$50 million maximum in 1991, so the state would resume collecting this fee in the event that this fund is accessed. ❖

## Total Fiscal Contribution

Given this background, the economic activity associated with the oil and gas industry in California in 2017 is estimated to have generated \$21.6 billion in state and local taxes. The disaggregation of taxes by type is shown in Exhibit 4-6.

In 2017, DOGGR receipts account for \$96 million (1 percent) of all associated state and local tax payments in California.

Of state and local government revenues, over \$11 billion was received from sales and excise taxes (including those paid on the consumption of oil and gas products), about \$7 billion was received from property taxes paid by households and businesses and ad valorem taxes about \$1.1 billion was received from personal and corporate income taxes.

#### Exhibit 4-6

#### Fiscal Contribution of Oil and Gas Industry California 2017

##### State and Local Taxes (\$ millions):

Sales and excise taxes	11,454
Property taxes	7,490
Personal income taxes	794
Corporate profits taxes	345
Social insurance	125
DOGGR Assessment	96
Other taxes	666
Fees, fines and permits	583
<b>Total State and Local Taxes</b>	<b>\$ 21,553</b>

Source: Estimates by LAEDC

## Contribution to California's Urban Society

Beyond the oil and gas industry's substantial economic and fiscal contributions to California detailed in this report, it is important to recognize the industry helps sustain California's growing urban population. Metropolitan areas particularly depend on petroleum and refined products to supply massive quantities of food, water, energy and products every day that sustain the health, well-being and quality of life of millions of Californians.

## Federal Revenues

Oil and gas production of federal land in California totaled 9,255,753 barrels of oil and 12,906,610 Mcf of natural gas

in 2017. The extraction of natural resources on federal land results in both tax and non-tax revenue. Non-tax revenue, which includes royalties, rents, bonuses and other fees, is reported by the Office of Natural Resources Revenue (ONRR). Bonuses are the amounts those offered by the highest bidder, annual rent is \$1.50 per acre for a 5-year period and \$2.00 per acre thereafter, and royalties are 12.5 percent of production value.

In 2017, \$57.8 million in revenue was collected by the federal government as a result of oil and gas production in California; with oil production accounting for the lion's share of revenue with \$53.1 million and natural gas and NGL accounting for close to \$3.2 million and just over \$0.9 million, respectively. The remaining revenue was associated with federal fees and costs for pre-production and other activities, coming in at just under \$0.6 million.

Additional federal tax revenues are collected by corporations that pay corporate income taxes to the IRS. C-corporations can pay up to 21 percent on their income. Federal funds collected from oil and gas extraction on federal land by the ONRR are then disbursed to agencies, national funds and state and local governments for public use. The State of California received federal disbursements from onshore (\$35.6 million) and offshore (\$0.6 million) production totaling just over \$36.2 million in 2017. ❖

## Economic Contribution by Segment

The total economic impact of the oil and gas industry in California in 2017 was just presented; however, each segment of the industry, upstream, midstream, downstream and market, industry is associated with its own distinct set of activities. These direct activities extend throughout the California economy with different magnitudes.

Exhibit 4-7 identifies the total economic contribution (direct, indirect and induced) of each segment of the industry as defined in the first section of this report. The industry segment with the largest impacts for employment and labor income is the market segment, which includes natural gas distribution and gasoline stations. The downstream industry segment has the largest impacts for value added and output, this segment includes refineries and petrochemical manufacturing.

Exhibit 4-8 shows the distribution of the total economic impact of each segment of the industry, allowing for the comparison of each segment's share of the larger oil and gas industry's total economic contribution.

In terms of employment and associated labor income, market activity (retail and distribution) contributes a larger share compared to other segments, contributing 54 percent and 48 percent each. When it comes to total value added and total output, downstream activity (refineries and petrochemicals) contributes a larger share, accounting for 43 percent and 58 percent respectively. ❖

**Exhibit 4-7**

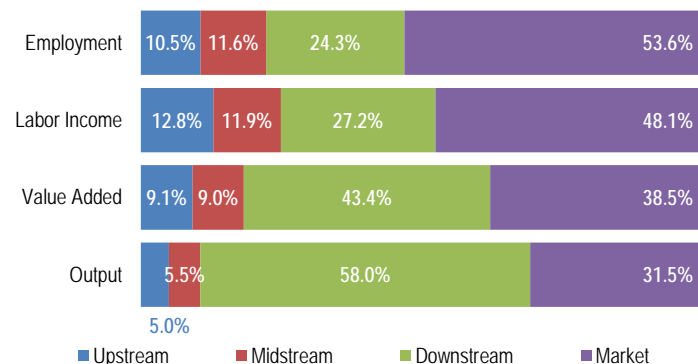
### Total Economic Contribution by Industry in California 2017

<b>Total Employment Impact (jobs):</b>		
Upstream	38,500	
Midstream	42,340	
Downstream	89,000	
Market	196,080	
<b>TOTAL</b>		<b>365,910</b>
<b>Total Labor Income (\$ billions):</b>		
Upstream	3.3	
Midstream	3.1	
Downstream	7.1	
Market	12.6	
<b>TOTAL</b>		<b>\$ 26.1</b>
<b>Total Value Added (\$ billions):</b>		
Upstream	5.4	
Midstream	5.3	
Downstream	25.6	
Market	22.8	
<b>TOTAL</b>		<b>\$ 59.1</b>
<b>Total Output (\$ billions):</b>		
Upstream	7.5	
Midstream	8.4	
Downstream	88.3	
Market	47.8	
<b>TOTAL</b>		<b>\$152.1</b>

Source: Estimates by LAEDC

**Exhibit 4-8**

### Distribution of Total Impacts by Industry Segment California 2017



## 5 Economic Contribution by Sub-Region and County

For purposes of exposition, California is divided into four sub-regions, which are shown in Exhibit 5-1 and defined below.

### Southern California

This sub-region includes the following six counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino and San Diego.

### San Francisco Bay Area

This sub-region includes the following nine counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma.

### Central Coast

This sub-region includes the following four counties: Monterey, San Luis Obispo, Santa Barbara and Ventura.

### San Joaquin Valley

This sub-region includes the following eight counties: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus and Tulare.

The oil and gas industry is widespread across the state. However, concentrations of activity are evident.

These four sub-regions account for 27 counties and more than eighty percent of the direct employment in the industry. The remaining 31 counties are summarized in a Rest of State sub-region.

According to the Division of Oil, Gas and Geothermal Resources of the California Department of Conservation (DOGGR), well activity is similarly distributed among the sub-regions.

Active wells are distributed across the state, but the majority of them are located in Kern County in the San Joaquin Valley sub-region, as shown in Exhibit 5-2.

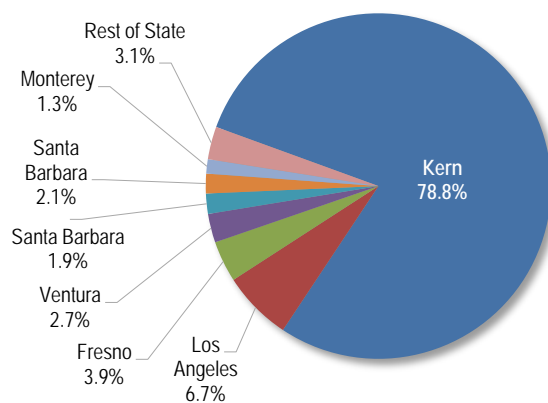
Direct activity and economic and fiscal contributions of each sub-region are presented in the following pages. Data specific to the South Coast Air Quality Management District (SCAQMD) can be found in the Appendix. ❖

**Exhibit 5-1**  
California Sub-Regions



Source: ESRI

**Exhibit 5-2**  
Active Wells in CA by County 2017



Source: CA Dept of Conservation, DOGGR



## Southern California Sub-Region

The Southern California sub-region consists of the six counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino and San Diego.

**Exhibit 5-3**

### Southern California Sub-Region



Source: ESRI

**Exhibit 5-4**

### Direct Employment of Oil and Gas Industry Southern California Sub-Region 2017\*

	Employment
211 Oil and gas extraction	1,995
213111 Drilling oil and gas wells	499
213112 Support activities for oil and gas operations	1,444
2212 Natural gas distribution	12,405
23712 Oil and gas pipeline construction	6,131
32411 Petroleum refineries	4,933
324191 Petroleum lubricating oil and grease mfg.	616
32511 Petrochemical manufacturing	4
333132 Oil and gas field machinery and eqpmt mfg.	617
4247 Petroleum and petroleum prods wholesalers	3,417
447 Gasoline stations	31,612
45431 Fuel dealers	908
486 Pipeline transportation	1,263

### TOTAL DIRECT EMPLOYMENT

65,844

43.3%

### Percent of California Industry Employment

\* Estimates may differ from reports whose methodology includes royalty owners as proprietors in direct employment.

**Exhibit 5-5**

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Southern California Sub-Region 2017\*

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	65,844	\$ 4,297	\$ 13,951	\$ 48,064
Indirect	46,270	3,194	5,094	8,200
Induced	41,710	2,213	4,041	6,571
<b>TOTAL CONTRIBUTION</b>	<b>153,827</b>	<b>\$ 9,703</b>	<b>\$ 23,086</b>	<b>\$ 62,835</b>
<i>Percent of Total CA Contribution</i>	42.0%	37.1%	38.9%	41.3%
<i>Percent of Sub-Region Total</i>	1.2%	1.2%	1.6%	2.8%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	5,950
Property taxes	1,088
Personal income taxes	257
Corporate profits taxes	127
Social insurance taxes	42
DOGGR Assessment	13
Other taxes	232
Fees, fines and permits	268

### TOTAL TAX REVENUES

7,975

\* Estimates may differ from reports whose methodology includes royalty owners as proprietors.



## Characteristics of the Industry Workforce in Southern California

The composition of the workforce in the oil and gas industry varies according to gender, age, race and ethnicity and educational attainment.

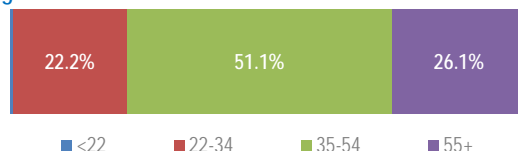
### *Gender of Workforce*

Workers in Southern California's oil and gas industry are predominantly male. In 2017, males represented 76 percent of the workforce (Exhibit 5-6).

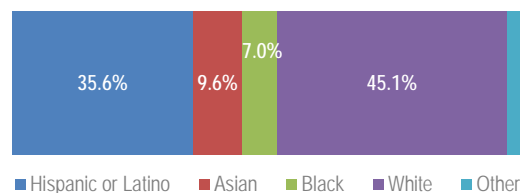
**Exhibit 5-6**  
Gender



**Exhibit 5-7**  
Age



**Exhibit 5-8**  
Race and Ethnicity



### *Age of Workforce*

The majority of the workforce is in its prime working age—between 22 years and 54 years of age, with roughly half being in the 35 to 54 years of age group (Exhibit 5-7). Workers aged 55 years and older accounted for 26.1 percent, a significant share of the industry workforce.

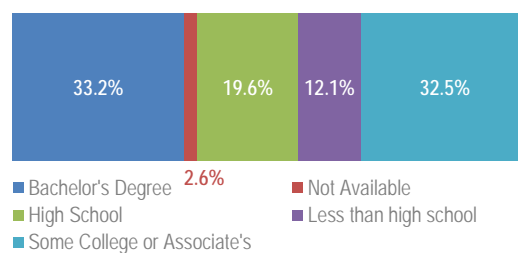
### *Race and Ethnicity in the Workforce*

The workforce in the oil and gas industry is diverse in both race and ethnicity (Exhibit 5-8). Workers reporting their race as white accounted for 45 percent of the workforce, with those reporting their ethnicity as Hispanic or Latino (all races) accounting for about 35 percent. Just under 10 percent of industry workers reported as Asian and 7 percent identified as Black.

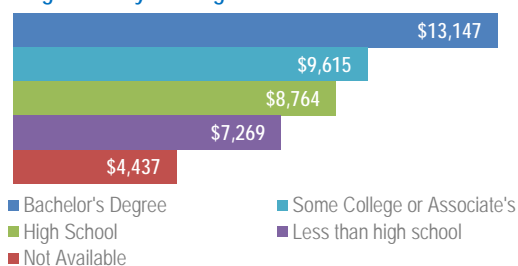
### *Educational Attainment of Workers*

The industry provides a wide range of jobs to individuals with different levels of education (Exhibit 5-9). Approximately 32 percent of the workforce has a high school education or less; 19.6 percent have a high school diploma and 12.1 percent have less than a high school education. Oil and gas workers with some college education accounted for 32.5 percent of the workforce, and 33 percent have earned a bachelor's degree or higher. While nearly a third of the workforce has attained up to a high school education, these jobs in oil and gas industries are associated with higher earnings compared to those with the same levels of education across all industries in the sub-region (Exhibit 5-10). ❖

**Exhibit 5-9**  
Educational Attainment



**Exhibit 5-10**  
Average Monthly Earnings 2017



## San Joaquin Valley Sub-Region

The San Joaquin Valley sub-region consists of the eight counties of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus and Tulare. Kern County is the fifth most prolific oil producing county in the continental United States.

Exhibit 5-11

San Joaquin Valley Sub-Region



Source: ESRI

Exhibit 5-12

Direct Employment of Oil and Gas Industry  
San Joaquin Valley Sub-Region 2017

	Employment
211 Oil and gas extraction	1,782
213111 Drilling oil and gas wells	1,781
213112 Support activities for oil and gas operations	3,828
2212 Natural gas distribution	1,803
23712 Oil and gas pipeline construction	2,240
32411 Petroleum refineries	865
324191 Petroleum lubricating oil and grease mfg.	7
32511 Petrochemical manufacturing	0
333132 Oil and gas field machinery and eqpmt mfg.	251
4247 Petroleum and petroleum prods wholesalers	1,578
447 Gasoline stations	8,551
45431 Fuel dealers	425
486 Pipeline transportation	415

**TOTAL DIRECT EMPLOYMENT** 23,520  
*Percent of California Industry Employment* 15.5%

Exhibit 5-13

Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
San Joaquin Valley Sub-Region 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	23,520	\$ 1,599	\$ 3,793	\$ 10,337
Indirect	7,270	403	616	1,048
Induced	8,150	353	671	1,115
<b>TOTAL CONTRIBUTION</b>	<b>38,940</b>	<b>\$ 2,355</b>	<b>\$ 5,079</b>	<b>\$ 12,500</b>
<i>Percent of Total CA Contribution</i>	<i>10.6%</i>	<i>9.0%</i>	<i>8.6%</i>	<i>8.2%</i>
<i>Percent of Sub-Region Total</i>	<i>2.0%</i>	<i>2.2%</i>	<i>3.0%</i>	<i>4.1%</i>

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	\$ 1,177
Property taxes	444
Personal income taxes	69
Corporate profits taxes	28
Social insurance taxes	12
DOGGR Assessment	72
Other taxes	49
Fees, fines and permits	73
<b>TOTAL TAX REVENUES</b>	<b>\$ 1,923</b>

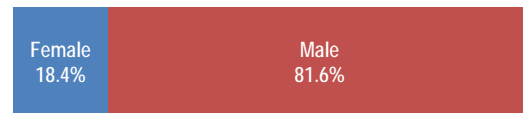
## Characteristics of the Industry Workforce in San Joaquin Valley

The composition of the workforce in the oil and gas industry varies according to gender, age, race and ethnicity and educational attainment.

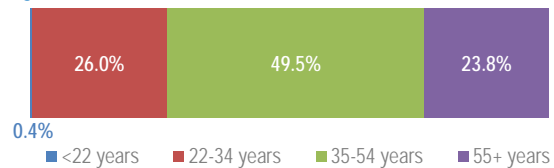
### *Gender of Workforce*

Workers in the oil and gas industry in the San Joaquin Valley are predominantly male. In 2017, females represented just over 18 percent of the workforce (Exhibit 5-14).

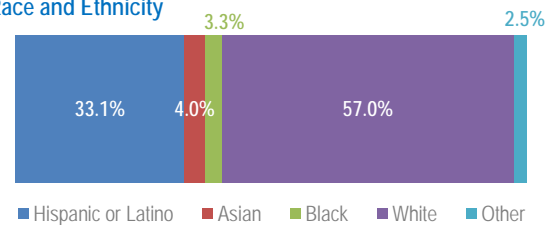
**Exhibit 5-14**  
Gender



**Exhibit 5-15**  
Age



**Exhibit 5-16**  
Race and Ethnicity



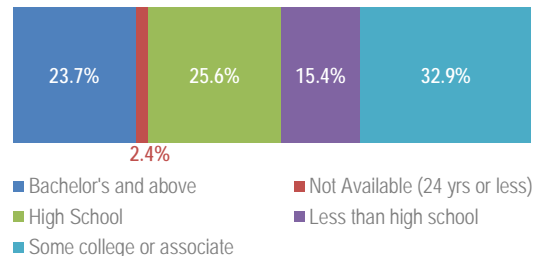
### *Age of Workforce*

The majority of the workforce is in its prime working age—between 22 years and 54 years of age, with close to half being in the 35 to 54 years of age group (Exhibit 5-15). Workers aged 55 years and older accounted for 23.8 percent, a significant share of the industry workforce.

### *Race and Ethnicity in the Workforce*

The workforce in the oil and gas industry is diverse in both race and ethnicity (Exhibit 5-16). Workers reporting their ethnicity as Hispanic or Latino (all races) accounted for just over 33 percent. Workers reporting their race as Asian accounted for 4 percent of the workforce and just over 3 percent identified as Black.

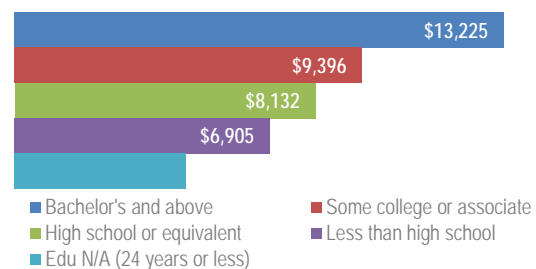
**Exhibit 5-17**  
Educational Attainment



### *Educational Attainment of Workers*

The industry provides a wide range of jobs to individuals with different levels of education (Exhibit 5-17). Approximately 41 percent of the workforce has a high school education or less; 25.6 percent have a high school diploma and 15.4 percent have less than a high school education. Oil and gas workers with some college education accounted for about 33 percent of the workforce, and 23.7 percent have earned a bachelor's degree or higher. While over 40 percent of the workforce has attained up to a high school education, these jobs in oil and gas industries are associated with higher earnings compared to those with the same levels of education across all industries in the sub-region (Exhibit 5-18). ❖

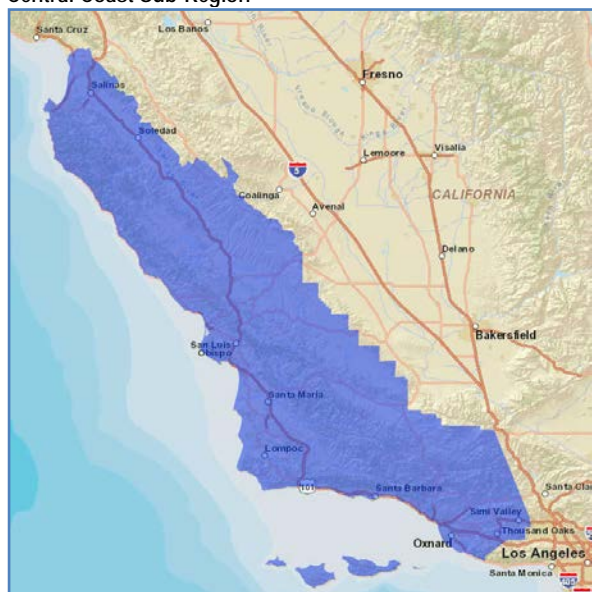
**Exhibit 5-18**  
Average Monthly Earnings 2017



## Central Coast Sub-Region

The Central Coast sub-region consists of the four counties of Monterey, San Luis Obispo, Santa Barbara and Ventura.

**Exhibit 5-19**  
Central Coast Sub-Region



Source: ESRI

**Exhibit 5-20**  
Direct Employment of Oil and Gas Industry  
Central Coast Sub-Region 2017

	Employment
211 Oil and gas extraction	968
213111 Drilling oil and gas wells	193
213112 Support activities for oil and gas operations	552
2212 Natural gas distribution	427
23712 Oil and gas pipeline construction	171
32411 Petroleum refineries	80
324191 Petroleum lubricating oil and grease mfg.	3
32511 Petrochemical manufacturing	-
333132 Oil and gas field machinery and eqpmt mfg.	437
4247 Petroleum and petroleum prods wholesalers	374
447 Gasoline stations	2,921
45431 Fuel dealers	232
486 Pipeline transportation	51
<b>TOTAL DIRECT EMPLOYMENT</b>	<b>6,410</b>
<i>Percent of California Industry Employment</i>	<i>4.2%</i>

**Exhibit 5-21**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Central Coast Sub-Region 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	6,410	\$ 376	\$ 896	\$ 2,153
Indirect	2,520	173	310	469
Induced	2,560	124	229	372
<b>TOTAL CONTRIBUTION</b>	<b>11,490</b>	<b>\$ 673</b>	<b>\$ 1,435</b>	<b>\$ 2,993</b>
<i>Percent of Total CA Contribution</i>	<i>3.1%</i>	<i>2.6%</i>	<i>2.4%</i>	<i>2.0%</i>
<i>Percent of Sub-Region Total</i>	<i>1.0%</i>	<i>1.0%</i>	<i>1.3%</i>	<i>1.7%</i>

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	419
Property taxes	123
Personal income taxes	17
Corporate profits taxes	6
Social insurance taxes	3
DOGGR Assessment	10
Other taxes	13
Fees, fines and permits	19
<b>TOTAL TAX REVENUES</b>	<b>609</b>

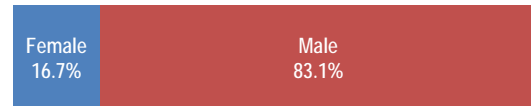
## Characteristics of the Industry Workforce in Central Coast

The composition of the workforce in the oil and gas industry varies according to gender, age, race and ethnicity and educational attainment.

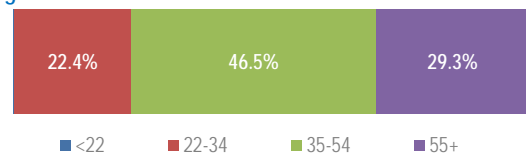
### *Gender of Workforce*

Workers in the Central Coast's oil and gas industry are predominantly male. In 2017, males represented 83.1 percent of the workforce (Exhibit 5-22).

**Exhibit 5-22**  
Gender



**Exhibit 5-23**  
Age



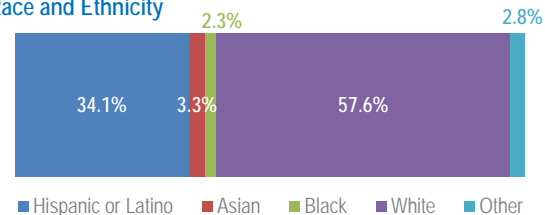
### *Age of Workforce*

The majority of the workforce is in its prime working age—between 22 years and 54 years of age, with almost half being in the 35 to 54 years of age group (Exhibit 5-23). Still, workers aged 55 years and older accounted for 29.3 percent, a significant share of the industry workforce.

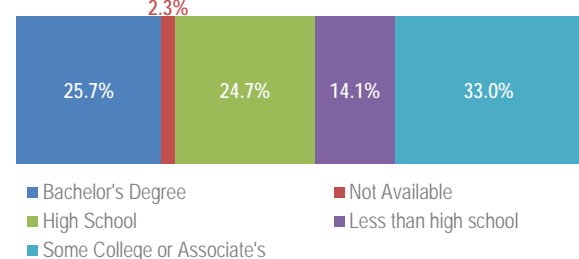
### *Race and Ethnicity in the Workforce*

The workforce in the oil and gas industry is diverse in both race and ethnicity (Exhibit 5-24). Workers reporting their race as white accounted for less than 58 percent of the workforce, with those reporting their ethnicity as Hispanic or Latino (all races) accounting for about 34 percent. 3.3 percent of industry workers reported as Asian and 2.3 percent identified as Black.

**Exhibit 5-24**  
Race and Ethnicity



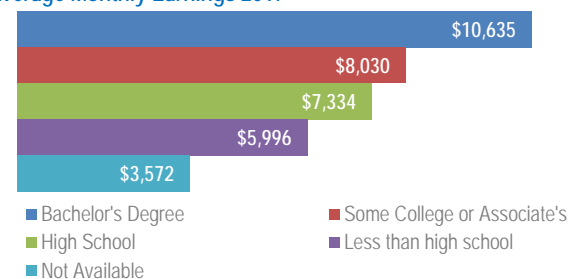
**Exhibit 5-25**  
Educational Attainment



### *Educational Attainment of Workers*

The industry provides a wide range of jobs to individuals with different levels of education (Exhibit 5-25). Approximately 39 percent of the workforce has a high school education or less; 24.7 percent have a high school diploma and 14.1 percent have less than a high school education. Oil and gas workers with some college education accounted for 33 percent of the workforce, and 25.7 percent have earned a bachelor's degree or higher. While more than a third of the workforce has attained up to a high school education, these jobs in oil and gas industries are associated with higher earnings compared to those with the same levels of education across all industries in the sub-region (Exhibit 5-26). ❖

**Exhibit 5-26**  
Average Monthly Earnings 2017



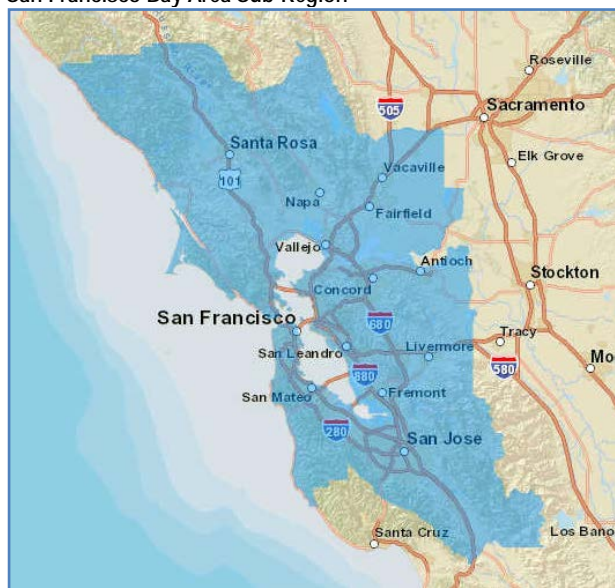


## San Francisco Bay Area Sub-Region

The San Francisco Bay Area sub-region consists of the nine counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma.

**Exhibit 5-27**

**San Francisco Bay Area Sub-Region**



Source: ESRI

**Exhibit 5-28**

**Direct Employment of Oil and Gas Industry  
San Francisco Bay Area Sub-Region 2017**

	Employment
211 Oil and gas extraction	457
213111 Drilling oil and gas wells	252
213112 Support activities for oil and gas operations	118
2212 Natural gas distribution	7,530
23712 Oil and gas pipeline construction	1,363
32411 Petroleum refineries	5,021
324191 Petroleum lubricating oil and grease mfg.	67
32511 Petrochemical manufacturing	4
333132 Oil and gas field machinery and eqpmt mfg.	48
4247 Petroleum and petroleum prods wholesalers	1,102
447 Gasoline stations	10,322
45431 Fuel dealers	236
486 Pipeline transportation	166
<b>TOTAL DIRECT EMPLOYMENT</b>	<b>26,686</b>
<i>Percent of California Industry Employment</i>	<i>17.5%</i>

**Exhibit 5-29**

**Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
San Francisco Bay Area Sub-Region 2017**

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	26,686	\$ 2,564	\$ 11,151	\$ 41,178
Indirect	29,370	2,673	4,327	7,138
Induced	18,200	1,261	2,243	3,379
<b>TOTAL CONTRIBUTION</b>	<b>81,510</b>	<b>\$ 6,498</b>	<b>\$ 17,721</b>	<b>\$ 51,696</b>
<i>Percent of Total CA Contribution</i>	<i>20.3%</i>	<i>24.8%</i>	<i>29.9%</i>	<i>33.9%</i>
<i>Percent of Sub-Region Total</i>	<i>1.4%</i>	<i>1.2%</i>	<i>2.0%</i>	<i>3.9%</i>

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	2,124
Property taxes	705
Personal income taxes	162
Corporate profits taxes	105
Social insurance taxes	24
DOGGR Assessment	0.1
Other taxes	194
Fees, fines and permits	111
<b>TOTAL TAX REVENUES</b>	<b>3,424</b>

## Characteristics of the Industry Workforce in San Francisco Bay Area

The composition of the workforce in the oil and gas industry varies according to gender, age, race and ethnicity and educational attainment.

### *Gender of Workforce*

Workers in the San Francisco Bay Area's oil and gas industry are predominantly male. In 2017, males represented 70.7 percent of the workforce (Exhibit 5-30).

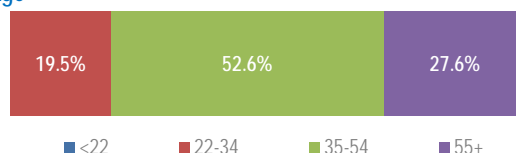
**Exhibit 5-30**  
Gender



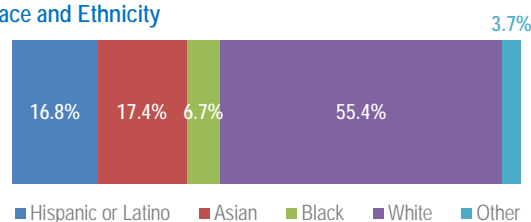
### *Age of Workforce*

The majority of the workforce is in its prime working age—between 22 years and 54 years of age, with 52.6 percent being in the 35 to 54 years of age group (Exhibit 5-31). Workers aged 55 years and older accounted for 27.6 percent, a significant share of the industry workforce.

**Exhibit 5-31**  
Age



**Exhibit 5-32**  
Race and Ethnicity



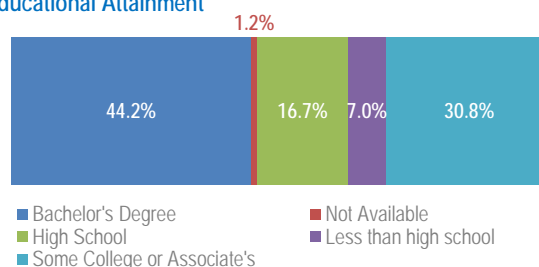
### *Race and Ethnicity in the Workforce*

The workforce in the oil and gas industry is diverse in both race and ethnicity (Exhibit 5-32). Workers reporting their race as white accounted for 55 percent of the workforce, with those reporting their ethnicity as Hispanic or Latino (all races) accounting for about 17 percent. About 17 percent of industry workers reported as Asian and 6.7 percent identified as Black.

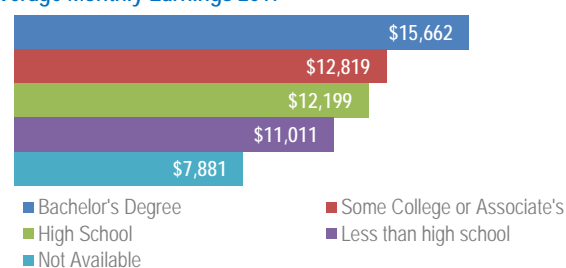
### *Educational Attainment of Workers*

The industry provides a wide range of jobs to individuals with different levels of education (Exhibit 5-33). Approximately 24 percent of the workforce has a high school education or less; 16.7 percent have a high school diploma and 7 percent have less than a high school education. Oil and gas workers with some college education accounted for 30.8 percent of the workforce, and 44.2 percent have earned a bachelor's degree or higher. While nearly a quarter of the workforce has attained up to a high school education, these jobs in oil and gas industries are associated with higher earnings compared to those with the same levels of education across all industries in the sub-region (Exhibit 5-34). ❖

**Exhibit 5-33**  
Educational Attainment



**Exhibit 5-34**  
Average Monthly Earnings 2017



## Rest of State

The Rest of State consists of the remaining thirty-one counties that have not been included in the four sub-regions above.

**Exhibit 5-35**  
Rest of State



Source: ESR

**Exhibit 5-36**  
Direct Employment of Oil and Gas Industry  
Rest of State 2017

	Employment
211 Oil and gas extraction	182
213111 Drilling oil and gas wells	161
213112 Support activities for oil and gas operations	119
2212 Natural gas distribution	903
23712 Oil and gas pipeline construction	460
32411 Petroleum refineries	185
324191 Petroleum lubricating oil and grease mfg.	1
32511 Petrochemical manufacturing	3
333132 Oil and gas field machinery and eqpmt mfg.	4
4247 Petroleum and petroleum prods wholesalers	1,239
447 Gasoline stations	7,906
45431 Fuel dealers	1,036
486 Pipeline transportation	47
<b>TOTAL DIRECT EMPLOYMENT</b>	<b>12,247</b>
<i>Percent of California Industry Employment</i>	<i>8.1%</i>

**Exhibit 5-37**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Rest of State 2017

	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	12,247	\$ 561	\$ 1,173	\$ 3,275
Indirect	4,370	205	355	643
Induced	1,700	82	155	251
<b>TOTAL CONTRIBUTION</b>	<b>18,310</b>	<b>\$ 848</b>	<b>\$ 1,683</b>	<b>\$ 4,168</b>
<i>Percent of Total CA Contribution</i>	<i>5.0%</i>	<i>3.2%</i>	<i>2.8%</i>	<i>2.7%</i>
<i>Percent of Sub-Region Total</i>	<i>0.8%</i>	<i>0.7%</i>	<i>0.8%</i>	<i>1.3%</i>

	State and Local (\$ millions)
<b>FISCAL CONTRIBUTION</b>	
Sales and excise taxes	\$ 1,465
Property taxes	135
Personal income taxes	25
Corporate profits taxes	8
Social insurance taxes	4
DOGGR Assessment	2
Other taxes	27
Fees, fines and permits	64
<b>TOTAL TAX REVENUES</b>	<b>\$ 1,730</b>

## California's Oil and Gas Industry by County

California is comprised of 58 individual counties. Oil and gas industry activity varies from county to county. This section identifies the direct activity of the oil and gas industry in each county and then estimates the industry's economic and fiscal contribution.

Exhibit 5-38 identifies the direct industry employment, the total economic contribution and the total fiscal contribution of each county. Counties asterisked (\*) are detailed in Section 8, in alphabetical order. ❖

### Exhibit 5-38

#### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution by County\* California 2017

County	Direct Employment	Total Employment	----- Total Economic Contribution* -----		Total Fiscal Contribution** (\$ millions)
			Total Labor Income (\$ millions)	Total Value Added (\$ millions)	
Alameda County	3,007	5,340	341.6	662.1	1,658.0
Alpine County	-	-	-	-	-
Amador County	131	160	4.3	8.0	11.1
Butte County	404	570	21.8	45.2	61.9
Calaveras County	196	260	9.1	17.5	14.0
Colusa County	196	250	13.5	27.7	14.6
Contra Costa County	12,233	38,110	3,213.1	11,237.1	1,346.8
Del Norte County	108	130	3.8	7.7	6.7
El Dorado County	561	1,020	52.5	165.2	68.7
Fresno County	2,969	5,990	372.8	727.6	373.6
Glenn County	139	190	9.9	19.1	25.7
Humboldt County	565	790	29.8	55.3	47.2
Imperial County	614	800	24.5	55.5	67.7
Inyo County	203	250	12.0	21.6	16.1
Kern County	14,213	23,900	1,605.7	3,606.6	925.0
Kings County	299	370	15.2	28.7	42.8
Lake County	238	330	13.3	26.8	20.2
Lassen County	94	120	4.1	8.2	6.1
Los Angeles County	31,077	77,550	5,325.8	15,183.8	3,915.7
Madera County	515	670	22.6	47.4	65.2
Marin County	398	560	35.1	67.1	65.4
Mariposa County	48	60	2.2	4.6	5.2
Mendocino County	629	1,030	55.9	109.1	50.1
Merced County	847	1,070	33.8	61.0	100.2
Modoc County	59	70	2.5	5.2	1.6
Mono County	96	120	5.5	10.0	5.2
Monterey County	984	1,360	62.0	117.9	132.2
Napa County	387	620	40.4	71.0	45.1
Nevada County	332	460	18.0	32.7	32.3
Orange County	11,050	18,790	1,151.5	2,072.3	1,044.7
Placer County	1,137	1,910	98.6	193.4	150.9
Plumas County	129	180	7.5	15.1	8.5
Riverside County	6,009	9,100	368.3	747.2	779.2
Sacramento County	3,306	5,840	315.6	655.5	447.0
San Benito County	60	80	3.4	6.7	13.1
San Bernardino County	6,993	10,390	425.5	845.8	867.5
San Diego County	10,097	20,900	1,345.5	2,571.0	1,300.2
San Francisco County	1,589	2,600	314.0	546.1	341.1

Exhibit 5-38 (cont'd)

County	Direct Employment	Total Employment	----- Total Economic Contribution* -----		Total Fiscal Contribution** (\$ millions)
			Total Labor Income (\$ millions)	Total Value Added (\$ millions)	
San Joaquin County	1,981	2,920	133.1	252.6	311.4
San Luis Obispo County	1,298	2,240	113.5	256.9	124.5
San Mateo County	1,417	2,190	136.6	416.5	221.9
Santa Barbara County	1,622	2,670	174.4	392.0	150.6
Santa Clara County	4,177	6,170	438.1	813.7	536.6
Santa Cruz County	498	700	27.7	48.5	62.4
Shasta County	779	1,070	35.2	66.0	78.4
Sierra County	8	10	0.5	0.7	27.2
Siskiyou County	293	380	14.0	27.0	134.0
Solano County	2,387	4,490	300.0	1,107.9	231.2
Sonoma County	1,019	1,520	64.3	121.5	182.3
Stanislaus County	1,349	2,100	89.1	198.4	61.8
Sutter County	427	600	29.0	58.5	44.7
Tehama County	461	620	27.9	53.1	16.6
Trinity County	78	90	2.4	4.7	111.4
Tulare County	1,347	1,930	82.8	157.1	55.4
Tuolumne County	279	400	16.4	29.9	201.9
Ventura County	2,505	4,010	226.2	502.6	201.9
Yolo County	538	720	31.3	55.4	34.8
Yuba County	240	310	11.5	21.9	8.9

\* Estimates may differ from reports whose methodology includes royalty owners as proprietors.

\*\* State and local taxes

Source: Estimates by LAEDC

State-level and sub-regional and county-level impacts were estimated separately. This analysis used individual county data for estimation of sub-regional and county-level contributions of the oil and gas industry, using an industry-change analysis based on known employment numbers.

Statewide direct employment may be larger than the sum of all counties, as some jobs could not be attributed to specific counties and because unavailable and nondisclosed data was estimated conservatively.

Fiscal contributions may not sum to the aggregate state level fiscal contribution since some tax revenues cannot

be estimated at the county level with precision. The estimates provided at the county level are therefore likely to be conservative.

Additionally, county-level economic contributions may not add to sub-regional contributions because estimates are produced at defined geographic levels, which do not account for spill-over benefits between counties. Such spill-over effects are captured in state level impacts and in the sub-regional impacts.

Additional details on the methodology used in this report can be found in the Appendix. ❖



## 6 User Industries at Risk in California

This section focuses on industries that use oil and gas products as an input in their production of goods and provision of services. We identify which industries are most at risk to potential price fluctuations, supply disruptions and other changes in the oil and gas industry that could impact their operations.

Both end-user consumers and user chain industries will be vulnerable to reductions of the supply of petroleum-based products. Response strategies may include: relocation; input substitution; operational shut-down; price increases; and more. Each of these options will have its own impact on the state's economic activity. The overall potential impact is demonstrated in the sections that follow. ❖

### Backward and Forward Linkages

In his seminal work, *The Strategy of Economic Development* (1958), Albert O. Hirschman introduced the concept of backward and forward linkages to industries.

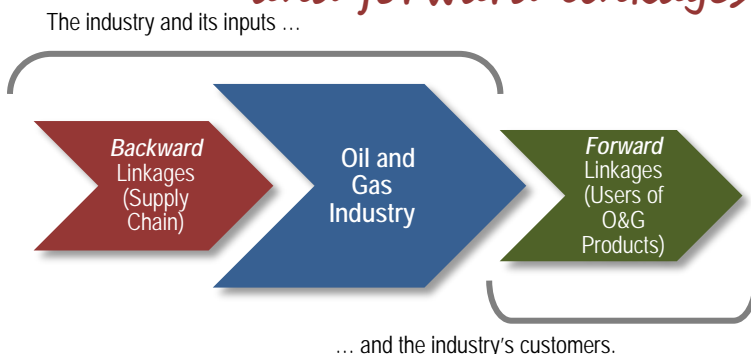
#### Backward Linkages

Backward linkages are the industries in the supply chain of a given industry, providing the inputs needed for its output. These are estimated for the oil and gas industry in the previous section using economic contribution analysis. Economic contribution quantifies the portion of a region's economy that can be attributed to an existing industry by tracing its purchases of goods and services in its supply chain, its payment of labor income to regional workers, and the tax revenues generated on its operations and their multiplier impacts. This analysis models what would happen if the industry did not exist in terms of those whose economic activity depends on supplying the industry. A detailed description of our methodology can be found in the Appendix.

#### Identifying Forward Linkages

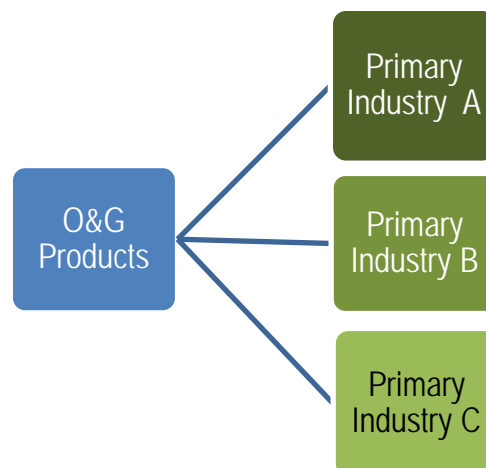
Hirschman also introduced the concept of forward linkages to industries. *Forward linkages* are those industries that use the output of a given industry in their

### Backward Linkages and forward linkages



own production. For example, air transportation uses petroleum products in order to provide its services. The air transportation industry is a major user of refinery products and is thus a forward linkage of the refinery industry. In this report, we refer to these first-tier user industries, as well as the first-tier users of the upstream, midstream and market segments, as *primary users*.

This network of linkages is depicted in the diagram. Oil and gas products are used as inputs into production of primary industries A, B and C. The dependence of these primary industries is estimated using information about their business model and the market for their goods and services. These are direct forward linkages of the oil and gas industry.



In this report, we look at a variety of measures that identify the primary tier of forward linkages of the oil and gas industry in California. ❖

## Forward Linkages by Industry Segment

We look at identifying forward linkages to the oil and gas industry by segment.

### Upstream Industries

Upstream industries are related to oil and gas production and include the industries of oil and gas extraction (NAICS 211), drilling oil and gas wells (NAICS 213111), support activities for oil and gas operations (NAICS 213112) and oil and gas field machinery and equipment manufacturing (NAICS 333132).

The extent of purchases of upstream products by other industries illustrates the broad reach that these products have throughout their user industries (see Exhibit 6-1). The top five industries purchased close to \$1.0 billion worth of products from California's upstream industries in 2017.

**Exhibit 6-1**

#### Top 5 User Industries of California Upstream Products\*

NAICS	Industry Description	Purchases From Upstream Industries (\$ millions)
55	Mgmt. of Companies and Enterprises	\$ 239.7
23	Construction	225.1
325	Chemical manufacturing	209.7
486	Pipeline transportation	157.1
541	Professional and technical services	130.9
	<i>Top 5</i>	<i>\$ 962.4</i>
	<i>All Other Industries</i>	<i>942.5</i>
	Purchases from Upstream Products	\$1,904.9

\* Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

### Midstream Industries

Midstream operations are related to the transportation (includes pipeline), storage and wholesale of crude oil, natural gas, NGLs (natural gas liquids) and other hydrocarbon products. Industries included in this segment include oil and gas pipeline and related facilities construction (NAICS 23712), petroleum and petroleum products merchant wholesalers (NAICS 4247) and pipeline transportation (NAICS 486).

Data on purchases specific to oil and gas pipeline and related facilities construction (NAICS 23712) and petroleum and petroleum products merchant wholesalers (NAICS 4247) are not available; these industries are included in broader industry classifications of construction (NAICS 23) and wholesale trade (NAICS 42) respectively. These larger industry groups include significant activity not related to the oil and gas industry and, as such, these midstream industries were excluded from this analysis; purchases made from midstream industries refers to pipeline transportation only.

The extent of purchases of midstream products by other industries illustrates the broad reach that these products have throughout their user industries (see Exhibit 6-2). The top five industries purchased more than \$1.0 billion worth of products from California's pipeline transportation industry in 2017.

**Exhibit 6-2**

#### Top 5 User Industries of California Midstream Products\*

NAICS	Industry Description	Purchases From Midstream Industries (\$ millions)
541	Prof'l, Scientific and Tech'l Services	\$ 30.3
211	Oil and Gas Extraction	27.4
23	Construction	22.5
332	Fabricated Metal Product Manufacturing	13.6
324	Petroleum and Coal Products Manufacturing	12.4
	<i>Top 5</i>	<i>\$ 106.2</i>
	<i>All Other Industries</i>	<i>58.6</i>
	Purchases from Midstream Products	\$ 164.9

\* Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

### Downstream Industries

Downstream operations include the refining of crude into refined petroleum and petrochemicals.

Additionally, both refined petroleum and petrochemicals are used as an input for a wide variety of consumer products including plastics, cosmetics, pharmaceuticals, wax-based products like packaging or crayons, paints, solvents, asphalt, pesticides and fertilizers.

The extent of purchases of downstream products made by other industries illustrates the broad reach that these products have throughout its user industries (see Exhibit 6-4). The top ten industries purchased just over to \$59.2 billion worth of products from California's downstream industries in 2017.

## Market Industries

Market industries are industries that are involved in bringing oil and gas products to the end user. These industries include natural gas distribution (NAICS 2212), fuel dealers (NAICS 45431) and gasoline stores (NAICS 447).

Data on purchases specific to fuel dealers (NAICS 45431) is not available; this industry is included in broader industry classifications non-store retailers (NAICS 454). This larger industry group includes significant activity not related to the oil and gas industry and, as such, it has been excluded from this analysis; purchases made from market industries refers to natural gas distribution and gasoline stores only.

The extent of purchases of market products by other industries illustrates the broad reach that these products have throughout their user industries (see Exhibit 6-5). The top five industries purchased more than \$10.3 billion worth of products from California's market industries in 2017.

The full list of purchases of inputs from the oil and gas industry by industry segment is provided in the Appendix. ❖

## Constructing a Vulnerability Index

Primary users would be immediately impacted by reductions in the availability or increase in the price of products from the oil and gas industry if they were particularly dependent on them. To measure this dependence, we construct an index of vulnerability.

Hirschman's metric for quantifying a forward link was the share of an industry's output that is allocated to an intermediate input. Supplementing the original indicator suggested by Hirschman, we use three metrics to construct a composite index of vulnerability to input disruptions: (1) intensity of use; (2) trade exposure; and (3) gross operating surplus.

### Intensity of Use

Products from the oil and gas industry as an input of production are traced through the industry user chain to

**Exhibit 6-4**

#### Top 10 User Industries of California Downstream Products\*

NAICS	Industry Description	Purchases From Downstream Industries (\$ millions)
211	Oil and Gas Extraction	\$ 43,011.0
42	Wholesale Trade	2,675.2
486	Pipeline Transportation	1,751.4
23	Construction	1,452.7
484	Truck Transportation	1,054.9
325*	Chemical Manufacturing	636.7
221	Utilities	492.2
55	Mgmt. of Companies and Enterprises	468.7
541	Prof'l, Scientific and Tech'l Services	253.1
561	Administrative and Support Services	147.0
	<i>Top 10</i>	<i>\$ 51,942.7</i>
	<i>All Other Industries</i>	<i>903.9</i>
	Purchases from Downstream Products	\$ 52,846.6

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

**Exhibit 6-5**

#### Top 5 User Industries of California Market Products\*

NAICS	Industry Description	Purchases From Market Industries (\$ millions)
211	Oil and Gas Extraction	\$ 4,772.5
486	Pipeline Transportation	1,809.4
541	Professional, Scientific and Technical Services	1,798.8
521, 522	Monetary auth, credit intermediation and related	1,104.5
531	Real Estate	848.6
	<i>Top 5</i>	<i>\$ 10,333.7</i>
	<i>All Other Industries</i>	<i>3,116.9</i>
	Purchases from California Refineries	\$ 13,450.7

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

measure each user industry's *intensity of use* compared to its revenues (gross output). This is a measure of how dependent the user industry is on petroleum and refined products. Understanding interactions between producers of these products across the different industries that use them as an intermediate good in their own production is valuable for understanding how these user industries stand to be affected by changes in the price and supply of these goods.

User industries with larger shares of these products as inputs to total industry revenues (gross output) have a larger dependency on them as an input in their production. As such, changes in the supply of these inputs will affect them disproportionately more compared to industries whose usage is a smaller share of their gross output.

Exhibit 6-6 lists the top industries that use products from each segment of the oil and gas industry in their production in California, with dependency ranked by the share of input value to gross output in 2017.

Several industries are combined because they are individually very small but are also quite vulnerable. These include agricultural industries, forestry and hunting, and mining and mining support.

Many of the industries with the largest intensity of use measure across all segments are in the transportation and warehousing sector: air, rail, water, truck and passenger ground transportation industries and the postal service. Industries within these subsectors rely heavily on transportation fuels (jet fuel, diesel, gasoline, etc.), which are requisite to the provision of their services.

Manufacturing industries often use refined petroleum and petrochemicals to produce other end products; therefore, these industries also show up prominently when looking at their intensity of use.

Equipment used in forestry, hunting and fishing industries, such as timber harvesters, bunchers and skidders, power generators and ocean vessels require fuel for operation as well.

Materials used in the construction industry, such as asphalt, roofing materials and PVC piping, are produced using refined petroleum and petrochemical products. Additionally, petroleum fuels are used to operate heavy machinery including cranes, water trucks, bulldozers, excavators, loaders and graders.

The full list of oil and gas product inputs as a share of output for all industries is provided in the Appendix.

Linkages of user industries of products from the oil and gas industry are next evaluated in regards to trade sensitivity.

### Trade Sensitivity

Trade sensitivity or trade exposure provides an indication of an industry's ability to pass potentially higher costs of inputs through to its customers. Commodities traded in the global market must operate within the limitations presented by trade exposure. For example, if production costs increase for firms in California and necessitate price increases, in-state producers will face competition from producers in other states or nations and be unable to protect their market share.

For the composite vulnerability index, *trade sensitivity* is measured by the sum of an industry's domestic and foreign exports as a percentage of its total output. Exhibit 6-7 identifies the top twenty industries in California by their trade sensitivity in 2017.

Industries that export the majority of their output outside the state of California and therefore depend on larger markets for their sales revenue will be particularly vulnerable to changes in input prices. Their ability to increase prices to recover cost increases will be limited given the international competition they face.

**Exhibit 6-6**  
Top Industries by Industry Segment Inputs  
As a Share of Gross Output

NAICS	Industry	Share of Output (%)
<b>Upstream Industries</b>		
486	Pipeline transportation	18.6%
331	Primary Metal Manufacturing	1.0%
212-213*	Mining and Mining Support	0.7%
532	Rental and leasing services	0.5%
333*	Machinery manufacturing	0.4%
<b>Midstream Industries</b>		
211	Oil and Gas Extraction	0.38%
332	Fabricated Metal Product Manufacturing	0.04%
483	Water Transportation	0.03%
491	Postal Service	0.02%
487-488	Transportation Support & Sightseeing	0.02%
<b>Downstream Industries</b>		
211	Oil and Gas Extraction	592.1%
486	Pipeline transportation	207.1%
482	Rail transportation	3.5%
484	Truck transportation	2.8%
324*	Petroleum and coal products manufacturing	1.5%
42	Wholesale Trade	1.2%
221	Utilities	0.9%
212-213	Mining and Mining Support	0.8%
55	Management of Companies and Enterprises	0.7%
23	Construction	0.7%
<b>Market Industries</b>		
486	Pipeline Transportation	214.0%
211	Oil and gas Extraction	65.7%
482	Rail Transportation	1.4%
521 & 522	Monetary auth, credit intermediation and related	1.3%
493	Warehousing and Storage	1.0%

Source: IMPLAN Data for California; Analysis by LAEDC

California's manufacturing industries are particularly vulnerable to trade exposure. Seven of the top ten industries with the highest trade intensities are manufacturing industries, including machinery, apparel and computer and electronic equipment.

**Exhibit 6-7****Top 20 Industries by Trade Exposure**

NAICS	Industry	Exposure (%)
316	Leather and Allied Product Manufacturing	96.5%
313	Textile Mills	77.9
333	Machinery Manufacturing	75.6
721	Accommodation	75.3
315	Apparel Manufacturing	74.2
512	Motion Picture and Sound Recording	71.9
221	Utilities	70.9
334	Computer and Electronic Product Manufacturing	69.5
339	Miscellaneous Manufacturing	64.6
325	Chemical Manufacturing	60.4
113-114	Forestry, Fishing, Hunting	59.8
111-112,115	Agriculture	59.0
331	Primary Metal Manufacturing	56.1
336	Transportation Equipment Manufacturing	55.9
335	Electrical Equipment and Component Mfg.	54.4
314	Textile Product Mills	53.7
	Lessors-Nonfinancial Intangible Assets (except copyrighted works)	53.3
533	Beverage/Tobacco Product Manufacturing	53.3
483	Water Transportation	51.7
337	Furniture and Related Product Manufacturing	46.5
Average of all industries		28.2%

Source: IMPLAN Data for California; Analysis by LAEDC

The list of trade sensitivities for all industries is provided in the Appendix.

### Gross Operating Surplus

As an alternative to raising prices of their goods and services, firms in industries that experience increased input costs may instead absorb cost increases through reduction in profits. This capability is necessarily dependent on an industry's typical profit experience. Many industries have extremely thin profit margins and will not be able to absorb cost increases without price increases—which, if they are exposed to trade, may also not be a viable option. Other industries have a significant margin cushion and are less vulnerable to increases in input prices.

Exhibit 6-8 ranks industries by their gross operating surplus as a percentage of total output (essentially, profit margins). The higher this margin, the more likely the user industry will be able to absorb higher input costs. Industries with smaller or even negative gross surplus as a share of total output have no capability to absorb cost increases. If they are also unable to increase the prices of their goods and services, they will face an existential risk.

Industries in California, on average, operate close to the margin, with a gross operating surplus of 18 percent of total output. Industries that are especially significant and operating at a break-even point include nursing and residential care facilities, private educational services and the postal service. Still, the exhibit lists many industries that experience very small profit margins. These leave very little room for firms to absorb cost increases.

**Exhibit 6-8****Top 20 Industries by Smallest Gross Operating Surplus**

NAICS	Industry	Gross Operating Surplus (As % Total Output)
443	Electronics and appliance stores	-36.7%
812	Personal and laundry services	-12.8%
316	Leather and allied product manufacturing	-2.6%
712	Museums, historical sites, zoos, and parks	-1.0%
523	Securities, commodity contracts, investments	-0.5%
453	Miscellaneous store retailers	0.0%
491	Postal service	0.2%
623	Nursing and residential care facilities	0.3%
611	Educational services	0.7%
518	Data processing, hosting and related services	1.3%
451	Sporting goods, hobby, book and music stores	2.8%
813	Membership associations and organizations	3.2%
811	Repair and maintenance	3.4%
331	Primary metal manufacturing	3.5%
447	Gasoline stations	4.0%
484	Truck transportation	4.3%
624	Social assistance	4.4%
315	Apparel manufacturing	4.8%
337	Furniture and related product manufacturing	5.0%
446	Health and personal care stores	5.3%
Average of all industries		18.0%

Source: IMPLAN Data for California; Analysis by LAEDC

The list of gross operating surplus as a share of total output for all industries is provided in the Appendix.

### Composite Index of Vulnerability

The three indicators (intensity of use, trade sensitivity and gross operating surplus) are used to construct an overall composite *vulnerability index* for each segment of the oil and gas industry.

As the individual indicators that contribute to this index may be more or less important in determining vulnerability to supply disruptions in the refinery industry, their values are weighted accordingly.

The share of output that must be allocated to the given input product is clearly the most important factor in



judging vulnerability. An industry that does not significantly use petroleum products, for example, is not vulnerable to disruptions in its availability or price. This component is given a 55 percent weight in the composite vulnerability index.

Trade sensitivity is also relatively important as the ability for firms to compete in the global marketplace will determine their viability. This factor is allocated a 30 percent weight in the vulnerability index.

Finally, the share of output captured by gross operating surplus (or profits) is important, but is given a smaller weight of 15 percent in the vulnerability index, reflective of the variability in the indicator across firms within industries and the elasticity of this indicator with respect to revenues. ❖

## Primary User Industries

Exhibit 6-9 on the next page lists the top vulnerable industries, split out by industry segment, ranked by their corresponding composite index scores along with their



Source: SoCal Gas

direct economic activity in California. These industries are at immediate risk of disruptions in the availability and price of oil and gas industry products.

A listing of the vulnerability index for all industries is provided in the Appendix. ❖

## Exhibit 6-9

Most Vulnerable Primary User Industries  
California 2017

Rank	NAICS	Industry Description	Vulnerability Index	Employment	Labor Income (\$ millions)	Output (\$ millions)	Value-Added (\$ millions)
<b>Upstream Industries</b>							
1	325	Chemical Manufacturing	9.7	78,490	11,480.7	97,770.5	49,966.3
2	333	Machinery Manufacturing	9.4	77,790	8,840.6	31,074.1	12,625.4
3	221	Utilities	9.3	62,310	11,415.9	55,672.5	30,380.6
4	533	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	8.9	21,790	1,366.1	27,408.0	13,930.4
5	212-213	Mining and Mining Support	8.7	23,430	1,799.0	5,129.4	3,268.7
		<b>TOTAL OF TOP 5</b>		<b>263,810</b>	<b>34,902.3</b>	<b>217,054.5</b>	<b>110,171.4</b>
		<i>Percent of California Total</i>		<i>1.1%</i>	<i>2.1%</i>	<i>4.9%</i>	<i>4.0%</i>
<b>Midstream Industries</b>							
1	333	Machinery Manufacturing	9.4	77,790	8,840.6	31,074.1	12,625.4
2	221	Utilities	9.3	62,310	11,415.9	55,672.5	30,380.6
3	483	Water Transportation	9.1	7,370	819.9	5,937.6	2,088.3
4	332	Fabricated Metal Product Manufacturing	8.9	139,070	9,992.5	33,670.4	14,160.8
5	324	Petroleum and Coal Products Manufacturing	8.9	13,720	3,169.6	76,823.6	18,850.9
		<b>TOTAL OF TOP 5</b>		<b>300,260</b>	<b>34,238.5</b>	<b>203,178.2</b>	<b>78,106.0</b>
		<i>Percent of California Total</i>		<i>1.3%</i>	<i>2.0%</i>	<i>4.6%</i>	<i>2.8%</i>
<b>Downstream Industries</b>							
1	221	Utilities	9.9	62,310	11,415.9	55,672.5	30,380.6
2	325	Chemical Manufacturing	9.1	78,490	11,480.7	97,770.5	49,966.3
3	42	Wholesale Trade	8.9	867,900	75,064.0	217,380.6	151,066.2
6	533	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	8.9	21,790	1,366.1	27,408.0	13,930.4
3	483	Water Transportation	8.6	7,370	819.9	5,937.6	2,088.3
5	211	Oil and Gas Extraction	8.4	32,360	1,853.3	7,268.6	4,588.7
8	212-213	Mining and Mining Support	8.1	23,430	1,799.0	5,129.4	3,268.7
10	316	Leather and Allied Product Manufacturing	8.1	3,740	151.2	530.8	139.4
9	721	Accommodation	8.1	179,840	7,682.6	20,503.3	13,492.5
10	113-114	Forestry, Hunting and Fishing	8.0	9,497	426.5	969.6	842.4
		<b>TOTAL OF TOP 10</b>		<b>1,370,450</b>	<b>119,841.7</b>	<b>478,289.3</b>	<b>283,067.4</b>
		<i>Percent of California Total</i>		<i>5.8%</i>	<i>7.1%</i>	<i>10.8%</i>	<i>10.2%</i>
<b>Market Industries</b>							
1	721	Accommodation	9.3	179,840	7,682.6	20,503.3	13,492.5
2	211	Oil and gas Extraction	8.4	32,360	1,853.3	7,268.6	4,588.7
3	487-488	Transportation Support and Sightseeing	8.4	119,010	9,424.3	20,738.4	11,655.7
4	541	Professional, Scientific, and Technical Services	8.4	2,169,910	226,808.5	391,849.3	268,107.2
5	332	Fabricated Metal Product Manufacturing	8.3	139,070	9,992.5	33,670.4	14,160.8
		<b>TOTAL OF TOP 5</b>		<b>2,640,190</b>	<b>255,761.2</b>	<b>474,030.0</b>	<b>312,004.9</b>
		<i>Percent of California Total</i>		<i>11.2%</i>	<i>15.2%</i>	<i>10.7%</i>	<i>11.3%</i>

Source: IMPLAN Data for California; Analysis by LAEDC

## 7 Detailed Industry Sheets

The following pages provide detailed data for each vulnerable primary and secondary user industry.

### Primary Industries

For each of the top twenty-five vulnerable industries, we provide an industry description as detailed in the North American Industry Classification System (NAICS) in its sourcebook, *North American Industry Classification System*, published by the U.S. Office of Management and Budget (2017).

We quantify the industry in terms of employment, labor income, industry output and its contribution to state GDP. These metrics are an indication of the activity that is at risk from disruptions in each segment of the oil and gas industry.

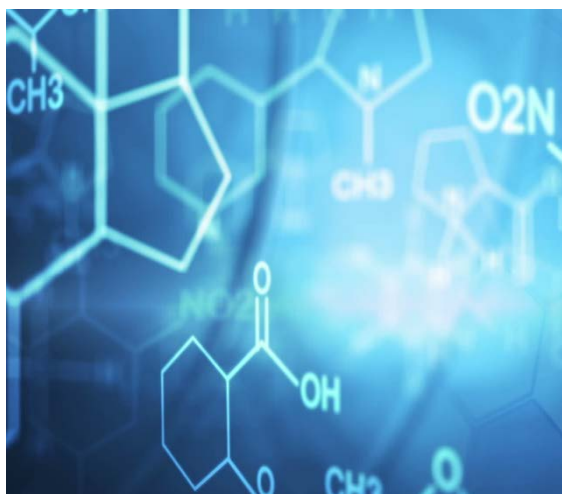
We outline the products that each industry produces and sells in California, and list the industries that purchase its products. This provides an indication of the breadth and width the primary industry through its own user chain.

Industries are shown in the following sequence:

<b>Primary Industries</b>	<b>Page</b>
Chemical Manufacturing	59
Utilities	60
Water Transportation	61
Accommodation	62
Mining and Support Activities	63
Machinery Manufacturing	64
Fabricated Metal Products	65
Petroleum and Coal Products Mfg.	66
Support Activities for Transportation	67
Forestry, Hunting and Fishing	68
Oil and Gas Extraction	69
Wholesale Trade	70
Leather and Allied Product Mfg.	71
Prof'l, Scientific and Technical Services	72
Lessors of Intangible Assets	73

**Primary Industry:**

CHEMICAL MANUFACTURING (NAICS 325\*)

**Size of Industry:**

78,490 jobs  
 \$ 11.5 billion Labor Income  
 \$ 97.7 billion Industry Output  
 \$ 50.0 billion Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-1.

**Which Industries Use this Industry's Products?**

Exhibit 7-2 lists the user industries in California of this industry's goods and services.

**Vulnerability Index:** 9.7 Upstream  
 9.1 Downstream

**Industry Description**

*This subsector is based on the transformation of organic and inorganic raw materials by a chemical process and the formulation of products. This subsector distinguishes the production of basic chemicals that comprise the first industry group from the production of intermediate and end products produced by further processing of basic chemicals that make up the remaining industry groups.*

*\* For the purposes of this report, this industry has been modified to remove Petrochemical Manufacturing (NAICS 32511) to avoid double-counting.*

**Exhibit 7-1****Top 5 Products of the Chemical Manufacturing Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Pharmaceuticals	56,610.2	57.9%
Toilet preparations	7,455.5	7.6%
Medicines and botanicals	3,540.4	3.6%
Plastics materials and resins	3,133.4	3.2%
Other basic organic chemicals	2,855.0	2.9%
Total Industry Sales in California	97,790.9	

**Exhibit 7-2****Top 10 User Industries of Chemical Manufacturing**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
42	Wholesale Trade	5,077.4
541	Professional, Scientific and Technical Services	2,626.0
326	Plastics and Rubber Products Manufacturing	1,424.8
221	Utilities	1,199.9
324	Petroleum and Coal Products Manufacturing	1,027.8
322	Paper Manufacturing	788.3
332	Fabricated metal product manufacturing	748.6
311	Food Manufacturing	667.5
484	Truck Transportation	570.0
561	Administrative and Support Services	427.8
Top 10		14,558.0
All Other Industries		33,206.45
Total Industry Sales in California		47,764.4

Source: IMPLAN Data for California; Analysis by LAEDC

**Primary Industry:**

UTILITIES (NAICS 221)

**Size of Industry:**

62,310 jobs

\$ 34.9 billion  
Labor Income\$ 217.1 billion  
Industry Output\$ 110.2 billion  
Contribution to GDP**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-3.

**Which Industries Use this Industry's Products?**

Exhibit 7-4 lists the user industries in California of this industry's goods and services.

**9.3 Upstream**  
**Vulnerability Index: 9.3 Midstream**  
**9.9 Downstream**

**Industry Description**

*Industries in the Utilities subsector provide electric power, natural gas, steam supply, water supply, and sewage removal through a permanent infrastructure of lines, mains, and pipes. Establishments are grouped together based on the utility service provided and the particular system or facilities required to perform the service.*

**Exhibit 7-3****Top 5 Products of the Utilities Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Electricity	25,795.7	46.3%
Natural gas distribution	22,185.4	39.8%
Electricity transmission and distribution	5,023.4	9.0%
Water, sewage and other systems	2,350.2	4.2%
Other products and services of Local Govt enterprises	305.3	0.5%
Total Industry Sales in California	55,675.8	100.0

**Exhibit 7-4****Top 10 User Industries of Utilities**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
211	Oil and Gas Extraction	7,133.7
541	Professional, Scientific, and Technical Service	2,459.7
486	Pipeline Transportation	2,237.7
212 & 213	Mining (except Oil and Gas)	2,172.1
519	Other Information Services	1,312.3
324	Petroleum and Coal Products Manufacturing	938.7
23	Construction	755.0
561	Administrative and Support Services	695.6
487 & 488	Other Transportation	648.2
325	Chemical Manufacturing	604.0
Top 10		18,956.9
All Other Industries		6,330.6
Total Industry Sales in California		25,287.5

Source: IMPLAN Data for California; Analysis by LAEDC



**Primary Industry:****WATER TRANSPORTATION (NAICS 483)****Vulnerability  
Index:****9.1 Midstream  
8.6 Downstream****Industry Description**

Industries in this subsector provide water transportation of passengers and cargo using watercraft, such as ships, barges and boats. The subsector is organized into two groups: (1) one for deep sea, coastal and Great Lakes; and (2) one for inland water transportation. This split typically reflects the difference in equipment used.

**Size of Industry:****7,370 jobs****\$ 819 million**  
Labor Income**\$ 5.9 billion**  
Industry Output**\$ 2.0 billion**  
Contribution to GDP**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-5.

**Which Industries Use this Industry's Products?**

Exhibit 7-6 lists the user industries in California of this industry's goods and services.

**Exhibit 7-5****Top 5 Products of the Water Transportation Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Water transportation service	5,937.8	100.0

**Exhibit 7-6****Top 10 User Industries of Water Transportation**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
324	Petroleum and Coal Products Manufacturing	697.2
487 & 488	Other Transportation	442.1
562	Waste Management and Remediation Services	356.5
42	Wholesale Trade	308.4
541	Professional, Scientific, and Technical Services	286.7
523	Securities, Commodity Contracts, and Other	214.5
336	Transportation Equipment Manufacturing	190.4
561	Administrative and Support Services	177.5
531	Real Estate	160.4
332	Fabricated Metal Product Manufacturing	120.9
<b>Top 10</b>		<b>2,954.5</b>
<b>All Other Industries</b>		<b>973.9</b>
<b>Total Industry Sales in California</b>		<b>3,928.4</b>

Source: IMPLAN Data for California; Analysis by LAEDC

## Primary Industry: ACCOMMODATION (NAICS 721)

### Industry Description

Industries in the Accommodation subsector provide lodging or short-term accommodations for travelers, vacationers, and others. There is a wide range of establishments in these industries. Some provide lodging only; while others provide meals, laundry services, and recreational facilities, as well as lodging.

The subsector is organized into three groups: (1) traveler accommodation, (2) recreational accommodation, and (3) rooming and boarding houses. Traveler Accommodation includes establishments that primarily provide traditional types of lodging services, hotels, motels, and bed-and-breakfast inns. RV (Recreational Vehicle) Parks and Recreational Camps includes establishments that operate lodging facilities to accommodate outdoor enthusiasts, travel trailer campsites, recreational vehicle parks, and outdoor adventure retreats. Rooming and Boarding Houses includes establishments providing temporary or longer-term accommodations that for the period of occupancy, may serve as the principal residence.

### Size of Industry:

179,840 jobs  
\$ 7.7 billion Labor Income  
\$ 20.5 billion Industry Output  
\$ 13.9 billion Contribution to GDP

### Which Industries Use this Industry's Products?

Exhibit 7-8 lists the user industries in California of this industry's goods and services.

### What This Primary Industry Sells

The products and services that are sold by this industry in California are shown in Exhibit 7-7.

Vulnerability Index: 8.1 Downstream  
9.3 Market



Exhibit 7-7

#### Top 5 Products of the Accommodation Industry

Commodity	Sales in California (\$ millions)	% of Industry Sales
Real estate buying and selling, leasing, managing, and related services	1,340.3	6.5%
Hotels and motel services, including casino hotels	18,398.4	89.7%
Total Industry Sales in California	20,502.9 \$	100.0

Exhibit 7-8

#### Top 10 User Industries of Accommodation

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
541	Professional, Scientific, and Technical Services	1,235.1
221	Utilities	580.7
561	Administrative and Support Services	427.5
525	Funds, Trusts, and Other Financial Vehicles	397.7
311	Food Manufacturing	281.2
722	Food Services and Drinking Places	273.1
523	Securities, Commodity Contracts, and Other	246.7
322	Paper Manufacturing	239.4
23	Construction	238.2
334	Computer and Electronic Product Manufacturing	231.2
Top 10		4,150.8
All Other Industries		2,861.1
Total Industry Sales in California		7,011.9

Source: IMPLAN Data for California; Analysis by LAEDC

## Primary Industry:

### MINING AND MINING SUPPORT (NAICS 212, 213)

#### Industry Description

Mining and mining support includes two subsectors, (1) Mining (except oil and gas) and (2) support activities for mining. Industries in the mining (except Oil and Gas) subsector primarily engage in mining, mine site development, and beneficiating (i.e., preparing) metallic minerals and nonmetallic minerals, including coal. It includes ore extraction, quarrying, and beneficiating (e.g., crushing, screening, washing, sizing, concentrating, and flotation), customarily done at the mine site. Industries in the Support Activities for Mining subsector group establishments primarily providing support services, on a contract or fee basis, required for the mining and quarrying of minerals and for the extraction of oil and gas. Establishments performing exploration (except geophysical surveying and mapping) for minerals, on a contract or fee basis, are included in this subsector. Exploration includes traditional prospecting methods, such as taking core samples and making geological observations at prospective sites.

#### Size of Industry:

23,430 jobs  
\$1.8 billion Labor Income  
\$5.1 billion Industry Output  
\$3.3 billion Contribution to GDP

#### What This Primary Industry Sells

The products and services that are sold by this industry in California are shown in Exhibit 7-9.

#### Which Industries Use this Industry's Products?

Exhibit 7-10 lists the user industries in California of this industry's goods and services.

Vulnerability Index: 8.7 Upstream  
8.1 Downstream



Exhibit 7-9

#### Top 5 Products of the Mining and Mining Support Industry

Commodity	Sales in California (\$ millions)	% of Industry Sales
Oil and gas wells	1,403.8	27.4%
Sand and gravel	987.8	19.3%
Support activities for oil and gas operations	964.3	18.8%
Stone	427.0	8.3%
Potash, soda, and borate mineral	333.1	6.5%
Total Industry Sales in California	5,126.6 \$	100.0

Exhibit 7-10

#### Top 10 User Industries of Mining and Mining Support

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
333	Machinery Manufacturing	242.2
541	Professional, Scientific, and Technical Services	177.6
324	Petroleum and Coal Products Manufacturing	148.7
42	Wholesale Trade	106.0
221	Utilities	86.9
23	Construction	83.0
325	Chemical Manufacturing	74.7
523	Securities, Commodity Contracts, and Other	62.8
532	Rental and Leasing Services	58.7
482	Rail Transportation	28.7
Top 10		1,069.4
All Other Industries		788.90
Total Industry Sales in California		1,858.2

Source: IMPLAN Data for California; Analysis by LAEDC

**Primary Industry:****MACHINERY MANUFACTURING (NAICS 333)**

**Vulnerability Index:** 9.4 Upstream  
9.4 Midstream

**Size of Industry:**

77,790 jobs  
\$ 8.8 billion Labor Income  
\$ 31.1 billion Industry Output  
\$ 12.6 billion Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-11.

**Which Industries Use this Industry's Products?**

Exhibit 7-12 lists the user industries in California of this industry's goods and services.

**Industry Description**

Industries in this subsector create end products that apply mechanical force, for example, the application of gears and levers, to perform work. Some important processes for the manufacture of machinery are forging, stamping, bending, forming, and machining that are used to shape individual pieces of metal. Processes such as welding and assembling are used to join separate parts together. Although these processes are similar to those used in metal fabricating establishments, machinery manufacturing is different because it typically employs multiple metal forming processes in manufacturing the various parts of the machine. Moreover, complex assembly operations are an inherent part of the production process.

**Exhibit 7-11****Top 5 Products of the Machinery Manufacturing Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Semiconductor machinery	6,402.4	20.6%
Other commercial service industry machinery	2,473.7	8.0%
Optical instruments and lenses	2,136.8	6.9%
Turbine and turbine generator set units	2,056.6	6.6%
Farm machinery and equipment	1,688.1	5.4%
Total Industry Sales in California	31,074.7 \$	100.0

**Exhibit 7-12****Top 10 User Industries of Machinery Manufacturing**

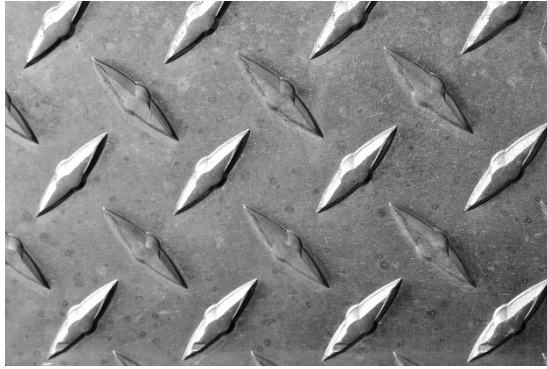
NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
332	Fabricated Metal Product Manufacturing	2,056.7
331	Primary Metal Manufacturing	2,032.9
42	Wholesale Trade	1,861.3
541	Professional, Scientific, and Technical Services	1,087.2
335	Electrical Equipment, Appliance, and Component Manufacturing	919.2
334	Computer and Electronic Product Manufacturing	892.8
326	Plastics and Rubber Products Manufacturing	573.9
336	Transportation Equipment Manufacturing	433.4
325	Chemical Manufacturing	393.4
484	Truck Transportation	286.4
	<b>Top 10</b>	<b>10,537.2</b>
	<i>All Other Industries</i>	<i>7,917.71</i>
	<b>Total Industry Sales in California</b>	<b>18,454.9</b>

Source: IMPLAN Data for California; Analysis by LAEDC



**Primary Industry:**

**FABRICATED METAL PRODUCTS  
MANUFACTURING (NAICS 332)**

**Size of Industry:**

139,070 jobs  
\$ 9.9 billion Labor Income  
\$ 33.7 billion Industry Output  
\$ 14.2 billion Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-13.

**Which Industries Use this Industry's Products?**

Exhibit 7-14 lists the user industries in California of this industry's goods and services.

**Vulnerability Index: 8.9 Midstream  
8.3 Market**

**Industry Description**

*Industries in this subsector transform metal into intermediate or end products, other than machinery, computers and electronics, and metal furniture, or treat metals and metal formed products fabricated elsewhere. Important fabricated metal processes are forging, stamping, bending, forming, and machining, used to shape individual pieces of metal; and other processes, such as welding and assembling, used to join separate parts together.*

**Exhibit 7-13****Top 5 Products of the Fabricated Metal Products Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Machined products	5,153.1	26.4%
Turned products and screws, nuts, and bolts	3,103.1	15.9%
Sheet metal work (except stampings)	2,942.9	15.1%
Valve and fittings, other than plumbing	2,355.7	12.1%
Fabricated structural metal products	1,832.8	9.4%
Total Industry Sales in California	19,515.6	100.0

**Exhibit 7-14****Top 10 User Industries of Fabricated Metal Products**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
42	Construction	1,507.3
541	Food manufacturing	1,016.9
325	Computer and electronic product manufacturing	1,006.3
561	Chemical manufacturing	575.5
334	Beverage and tobacco product manufacturing	537.2
221	Transportation equipment manufacturing	460.0
333	Wholesale Trade	434.8
484	Food services and drinking places	318.9
326	Miscellaneous manufacturing	291.2
522	Furniture and related product manufacturing	272.2
	<b>Top 10</b>	<b>12,689.3</b>
	<i>All Other Industries</i>	<i>6,826.24</i>
	<b>Total Industry Sales in California</b>	<b>19,515.6</b>

Source: IMPLAN Data for California; Analysis by LAEDC



## Primary Industry:

PETROLEUM & COAL PRODUCTS  
MANUFACTURING (NAICS 324\*)

Midstream  
Vulnerability  
Index: 8.9



### Industry Description

The Petroleum and Coal Products Manufacturing subsector is based on the transformation of crude petroleum and coal into usable products. The dominant process is petroleum refining that involves the separation of crude petroleum into component products through such techniques as cracking and distillation.

In addition, this subsector includes establishments that primarily further process refined petroleum and coal products and produce products, such as asphalt coatings and petroleum lubricating oils. However, establishments that manufacture petrochemicals from refined petroleum are classified in Industry 32511, Petrochemical Manufacturing.

### Size of Industry:

13,720 jobs  
\$ 3.2 billion Labor Income  
\$ 76.8 billion Industry Output  
\$ 18.5 billion Contribution to GDP

### What This Primary Industry Sells

The products and services that are sold by this industry in California are shown in Exhibit 7-15.

### Which Industries Use this Industry's Products?

Exhibit 7-16 lists the user industries in California of this industry's goods and services.

Exhibit 7-15

#### Top 5 Products of the Petroleum & Coal Products Mfg. Industry

Commodity	Sales in California (\$ millions)	% of Industry Sales
Refined petroleum products	70,398.6	91.6%
Petrochemicals	3,708.7	4.8%
Petroleum lubricating oil and grease	1,406.7	1.8%
Asphalt shingles and coating materials	714.2	0.9%
Asphalt paving mixtures and blocks	502.9	0.7%
Total Industry Sales in California	76,823.2	100.0

Exhibit 7-16

#### Top 10 User Industries of Petroleum Products

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
211	Oil and Gas Extraction	43,012.4
42	Wholesale Trade	2,728.0
325	Chemical Manufacturing	2,103.0
486	Pipeline Transportation	1,754.1
23	Construction	1,458.1
484	Truck Transportation	1,075.5
221	Utilities	513.2
541	Professional, Scientific, and Technical Services	273.3
561	Administrative and Support Services	153.5
482	Rail Transportation	107.8
	Top 10	53,179.0
	All Other Industries	4,766.78
	Total Industry Sales in California	57,945.8

Source: IMPLAN Data for California; Analysis by LAEDC

**Primary Industry:****SUPPORT ACTIVITIES FOR TRANSPORTATION  
(NAICS 487, 488)****Market  
Vulnerability  
Index: 8.4****Industry Description**

*This industry is comprised of two subsectors: (1) scenic and sightseeing transportation; and (2) support activities for transportation—the latter being by far the largest contributor. Industries in Scenic and Sightseeing Transportation utilize transportation equipment to provide recreation and entertainment. These activities have a production process distinct from passenger transportation carried out for the purpose of other types of for-hire transportation.*

*Industries in the Support Activities for Transportation subsector provide services which support transportation. These services may be provided to transportation carrier establishments or to the general public and includes a wide array of establishments, including air traffic control services, marine cargo handling, and motor vehicle towing. The subsector also includes freight transportation arrangement and packing and crating services.*

**Size of Industry:**

119,010 jobs  
\$ 9.4 billion Labor Income  
\$ 20.7 billion Industry Output  
\$ 11.7 billion Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-17.

**Which Industries Use this Industry's Products?**

Exhibit 7-18 lists the user industries in California of this industry's goods and services.

**Exhibit 7-17****Top 5 Products of the Support Activities for Transportation Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Support activities for transportation, and scenic and sightseeing transportation	20,737.5	100.0

**Exhibit 7-18****Top 10 User Industries of Support Activities for Transportation**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
492	Construction	1,457.0
491	Food manufacturing	1,416.1
561	Computer and electronic product manufacturing	448.9
212213	Chemical manufacturing	434.1
493	Beverage and tobacco product manufacturing	424.4
23	Transportation equipment manufacturing	336.8
333	Wholesale Trade	300.4
531	Food services and drinking places	282.1
541	Miscellaneous manufacturing	278.6
324	Furniture and related product manufacturing	240.0
	Top 10	5,618.2
	All Other Industries	3,471.52
	Total Industry Sales in California	9,089.7

Source: IMPLAN Data for California; Analysis by LAEDC

**Primary Industry:**

FORESTRY, HUNTING AND FISHING  
(NAICS 113, 114)

Downstream  
Vulnerability  
Index:

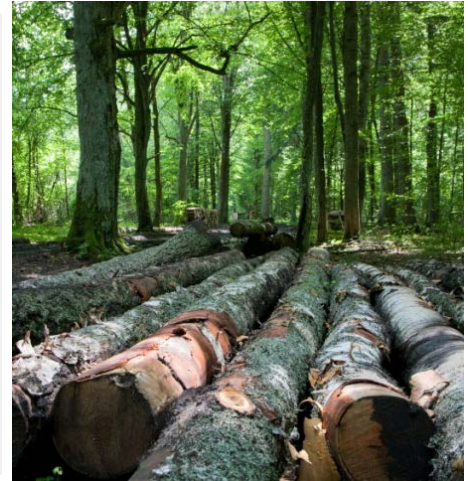
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**Industry Description**

Forestry, hunting and fishing include two subsectors: (1) forestry and logging and (2) fishing, hunting and trapping. Industries in the forestry and logging subsector grow and harvest timber on a long production cycle (i.e., of 10 years or more). Long production cycles use different production processes than short production cycles.

Industries in the fishing, hunting and trapping subsector harvest fish and other wild animals from their natural habitats and are dependent upon a continued supply of the natural resource.

The harvesting of fish is the predominant economic activity of this subsector and it usually requires specialized vessels that, by the nature of their size, configuration and equipment, are not suitable for any other type of production, such as transportation.

**Size of Industry:**

9,500 jobs  
\$ 427 million Labor Income  
\$ 970 million Industry Output  
\$ 842 million Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-19.

**Which Industries Use this Industry's Products?**

Exhibit 20 lists the user industries in California of this industry's goods and services.

**Exhibit 7-19****Top 5 Products of the Forestry, Hunting and Fishing Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Logs and roundwood	443.8	45.8%
Fish	344.9	35.6%
Forest, timber, and forest nursery products	126.3	13.0%
Wild game products, pelts, and furs	54.6	5.6%
Total Industry Sales in California	969.6	100.0

**Exhibit 7-20****Top 10 User Industries of Forestry, Hunting and Fishing**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
111,112,115	Agriculture	56.2
324	Petroleum and Coal Products Manufacturing	6.2
484	Truck Transportation	4.6
321	Wood Product Manufacturing	4.3
811	Repair and Maintenance	2.9
541	Professional, Scientific, and Technical Services	1.8
487 & 488	Transportation	1.6
532	Rental and Leasing Services	1.3
333	Machinery Manufacturing	0.8
525	Funds, Trusts, and Other Financial Vehicles	0.7
	Top 10	80.4
	All Other Industries	46.72
	Total Industry Sales in California	127.1

Source: IMPLAN Data for California; Analysis by LAEDC

## Primary Industry:

### OIL AND GAS EXTRACTION (NAICS 211)



## Size of Industry:

32,360 jobs  
 \$1.9 billion Labor Income  
 \$7.3 billion Industry Output  
 \$4.6 billion Contribution to GDP

## What This Primary Industry Sells

The products and services that are sold by this industry in California are shown in Exhibit 7-23.

## Which Industries Use this Industry's Products?

Exhibit 7-24 lists the user industries in California of this industry's goods and services.

**Vulnerability Index:** 8.4 Downstream  
 8.4 Market

### Industry Description

*Industries in the Oil and Gas Extraction 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 production of natural gas, sulfur recovery from natural gas, and recovery of hydrocarbon liquids.*

### Exhibit 7-23

#### Top 5 Products of the Oil and Gas Extraction Industry

Commodity	Sales in California (\$ millions)	% of Industry Sales
Natural gas and crude petroleum	6,735.9	92.7%
Refined petroleum products	528.2	7.3%
Total Industry Sales in California	969.6	100.0

### Exhibit 7-24

#### Top 10 User Industries of Oil and Gas Extraction

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
212-213	Mining	902.8
23	Construction	205.5
325	Chemical Manufacturing	184.5
486	Pipeline Transportation	156.8
333	Machinery Manufacturing	107.0
532	Rental and Leasing Services	76.7
541	Professional, Scientific, and Technical Services	71.1
221	Utilities	61.3
324	Petroleum and Coal Products Manufacturing	40.6
42	Wholesale Trade	40.2
	Top 10	1,846.5
	All Other Industries	826.82
	Total Industry Sales in California	2673.3

Source: IMPLAN Data for California; Analysis by LAEDC

## Primary Industry:

### WHOLESALE TRADE (NAICS 42)



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**Size of Industry:**

867,900 jobs

\$ 75.1 billion

\$ 217.4 billion Labor Income

\$ 151.1 billion Industry Output

Contribution to GDP

### What This Primary Industry Sells

The products and services that are sold by this industry in California are shown in Exhibit 7-25.

### Which Industries Use this Industry's Products?

Exhibit 7-26 lists the user industries in California of this industry's goods and services.

Downstream  
Vulnerability  
Index: **8.9**

#### Industry Description

*Establishments in this industry sector are engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing.*

*The wholesaling process is an intermediate step in the distribution of merchandise. Wholesalers are organized to sell or arrange the purchase or sale of (a) goods for resale (i.e., goods sold to other wholesalers or retailers), (b) capital or durable nonconsumer goods, and (c) raw and intermediate materials and supplies used in production.*

#### Exhibit 7-25

##### Top 5 Products of the Wholesale Trade Industry

Commodity	Sales in California (\$ millions)	% of Industry Sales
Wholesale trade distribution services	217,364.9	100.0

#### Exhibit 7-26

##### Top 10 User Industries of Wholesale Trade

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
541	Professional, Scientific, and Technical Services	12,620.4
531	Real Estate	7,292.4
55	Management of Companies and Enterprises	6,694.0
561	Administrative and Support Services	4,743.5
524	Insurance Carriers and Related Activities	2,699.3
491	Postal Service	2,581.0
492	Couriers and Messengers	2,513.9
493	Warehousing and Storage	2,259.3
487 & 488	Other Transportation	2,099.2
517	Telecommunications	1,954.6
Top 10		47,333.2
All Other Industries		18,997.09
Total Industry Sales in California		66,330.3

Source: IMPLAN Data for California; Analysis by LAEDC



**Primary Industry:**LEATHER AND ALLIED PRODUCT  
MANUFACTURING (NAICS 316)**Downstream  
Vulnerability  
Index:****8.1****Industry Description**

Establishments in this industry subsector transform hides into leather by tanning or curing and fabricating the leather into products for final consumption. It also includes the manufacture of similar products from other materials, including products (except apparel) made from "leather substitutes," such as rubber, plastics, or textiles. Rubber footwear, textile luggage, and plastics purses or wallets are examples of "leather substitute" products included in this group. The products made from leather substitutes are included in this subsector because they are made in similar ways leather products are made (e.g., luggage). They are made in the same establishments, so it is not practical to separate them.

**Size of Industry:**

3,740 jobs

\$ 151 million

\$ 531 million Labor Income

\$ 139 million Industry Output

Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-27.

**Which Industries Use this Industry's Products?**

Exhibit 7-28 lists the user industries in California of this industry's goods and services.

**Exhibit 7-27****Top 5 Products of the Leather & Allied Product Mfg. Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Other leather and allied products	349.7	65.9%
Footwear	111.4	21.0%
Tanned and finished leather and hides	69.4	13.1%
Other cut and sew apparel	0.4	0.1%
Total Industry Sales in California	969.6	100.0

**Exhibit 7-28****Top 10 User Industries of Oil and Gas Extraction**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
42	Wholesale Trade	58.6
311	Food manufacturing	45.0
541	Professional, Scientific, and Technical Services	36.8
313	Textile Mills	22.5
339	Miscellaneous Manufacturing	21.7
325	Chemical Manufacturing	18.4
523	Securities, Commodity Contracts, and Other	18.3
326	Plastics and Rubber Products Manufacturing	15.6
332	Fabricated Metal Product Manufacturing	14.8
561	Administrative and Support Services	6.3
Top 10		257.9
All Other Industries		133.69
Total Industry Sales in California		391.6

Source: IMPLAN Data for California; Analysis by LAEDC

**Primary Industry:**  
PROFESSIONAL BUSINESS SERVICES  
(NAICS 541)

**Market  
Vulnerability  
Index:** **8.4**

**Industry Description**

The Professional Business Services sector comprises establishments that specialize in performing professional, scientific, and technical activities for others. These activities require a high degree of expertise and training. The establishments in this sector specialize according to expertise and provide these services to clients in a variety of industries and, in some cases, to households. Activities performed include: legal advice and representation; accounting, bookkeeping, and payroll services; architectural, engineering, and specialized design services; computer services; consulting services; research services; advertising services; photographic services; translation and interpretation services; veterinary services; and other professional business services.



**Size of Industry:**

2,168,910 jobs

\$ 2.0 billion  
Labor Income

\$ 11.1 billion  
Industry Output

\$ 2.7 billion  
Contribution to GDP

**What This Primary Industry Sells**

The products and services that are sold by this industry in California are shown in Exhibit 7-29.

**Which Industries Use this Industry's Products?**

Exhibit 7-30 lists the user industries in California of this industry's goods and services.

**Exhibit 7-29**

**Top 5 Products of the Professional Business Services Industry**

Commodity	Sales in California (\$ millions)	% of Industry Sales
Custom computer programming services	60,783.1	15.5%
Legal services	47,419.4	12.1%
Architectural, engineering, and related services	38,310.6	9.8%
Accounting, tax preparation, bookkeeping, and payroll services	23,919.4	6.1%
Specialized design services	7,582.1	1.9%
Total Industry Sales in California	391,828.3	100.0

Source: IMPLAN Data for California; Analysis by LAEDC

**Exhibit 7-30**

**Top 10 User Industries of Professional Business Services**

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
531	Real Estate	18,293.6
561	Administrative and Support Services	17,021.3
521 & 522	Credit Intermediation and Related Activities	3,624.4
517	Telecommunications	3,575.2
55	Management of Companies and Enterprises	3,498.0
722	Food Services and Drinking Places	2,992.9
524	Insurance Carriers and Related Activities	2,668.5
334	Computer and Electronic Product Manufacturing	1,972.4
533	Lessors of Nonfinancial Intangible Assets	1,525.4
42	Wholesale Trade	1,475.0
	Top 10	56,646.9
	All Other Industries	67,246.61

Total Industry Sales in California

123,893.5

Source: IMPLAN Data for California; Analysis by LAEDC

## Primary Industry:

LESSORS OF NONFINANCIAL  
INTANGIBLE ASSETS (except Copyrighted  
Works) (NAICS 533)



## Size of Industry:

21,790 jobs  
 \$1.4 billion Labor Income  
 \$27.4 billion Industry Output  
 \$13.9 billion Contribution to GDP

## What This Primary Industry Sells

The products and services that are sold by this industry in California are shown in Exhibit 7-31.

## Which Industries Use this Industry's Products?

Exhibit 7-32 lists the user industries in California of this industry's goods and services.

**Vulnerability Index:** 8.9 Upstream  
8.9 Downstream

### Industry Description

*Establishments in this industry subsector include establishments that are primarily engaged in assigning rights to assets, such as patents, trademarks, brand names, and/or franchise agreements for which a royalty payment or licensing fee is paid to the asset holder. Establishments in this subsector own the patents, trademarks, and/or franchise agreements that they allow others to use or reproduce for a fee and may or may not have created those assets.*

### Exhibit 7-31

#### Top 5 Products of the Lessors of Nonfinancial Intangible Assets

Commodity	Sales in California (\$ millions)	% of Industry Sales
Leasing of nonfinancial intangible assets	27,408.8	100.0

Source: IMPLAN Data for California; Analysis by LAEDC

### Exhibit 7-32

#### Top 10 User Industries of Lessors of Nonfinancial Intangible Assets

NAICS	Industry Description	Purchases From This CA Industry (\$ millions)
541	Professional, Scientific, and Technical Services	4,239.5
561	Administrative and Support Services	2,738.4
519	Other Information Services	935.8
531	Real Estate	399.4
522	Credit Intermediation and Related Activities	393.4
517	Telecommunications	384.8
524	Insurance Carriers and Related Activities	384.7
523	Securities, Commodity Contracts, and Other	338.5
813	Religious, Grantmaking, Civic, Professional, and Similar Organizations	226.1
532	Rental and Leasing Services	141.6
Top 10		10,182.1
All Other Industries		3,271.7
Total Industry Sales in California		13,453.8

Source: IMPLAN Data for California; Analysis by LAEDC

## 8 Geography of the Jobs at Risk

Changes that occur in the direct activity associated with each segment of the oil and gas industry, upstream, midstream, downstream and market, will not only affect employment in the industries themselves, but will also extend across user industries that rely upon the use of products from the oil and gas industry in their supply chain, or who are users of the dependent industry's output. Individuals employed in these industries have jobs at risk.

In California, the oil and gas industry directly employs 152,100 and industry sectors identified to be the most at risk due to their interconnectedness with the oil and gas industry (manufacturing, transportation and agriculture), provide close to 2.3 million jobs statewide (Exhibit 8-1).



### Exhibit 8-1

#### Jobs at Risk Due to Industry Interconnectedness California 2017

	Payroll Jobs	CA Ave Annual Wage
Agriculture	421,749	\$33,299
Manufacturing	1,303,550	92,246
Transportation and Warehousing	551,752	54,446
Total Jobs in At-Risk Sectors	2,277,051	
Share of Total Jobs	13.4%	
Total Covered	17,019,703	

Source: Estimates by LAEDC

These jobs are dispersed across different geo-political boundaries in the state, with each area boasting unique mixes and concentrations of the respective industries. This section identifies both (mix and concentrations) for industries most at risk across the different counties and across different congressional districts located in California.

## County Level

California is comprised of 58 counties, each with a distinctive mix of industries. Counties in the state vary significantly in land area, population size, total employment, demographics, industry mix and more.

Employment and wage data is available at the county level from the California Employment Development Department (EDD) Labor Market Information Division,

Quarterly Census of Employment & Wages (QCEW). Data is obtained from the Unemployment Insurance program and represents approximately 99.7 percent of all private payroll employment in the nation (excluding the self-employed). The most current annual data available is for 2017. These are job counts and may be full- or part-time.

### Exhibit 8-2

#### Oil and Gas Industry Disruptions: Jobs Most At-Risk by County California 2017

County	Total Jobs in At-Risk Industries	Jobs in At-Risk Industry Sectors			Share of Total Jobs in County (Percent)
		Agriculture	Manufacturing	Transportation	
Alameda County	107,002	597	79,447	26,958	18.1%
Alpine County *	33	-	33	-	7.6%
Amador County	1,275	412	728	135	23.2%
Butte County	8,398	3,167	4,251	980	10.2%
Calaveras County	721	263	307	151	7.7%
Colusa County	4,242	2,825	1,266	151	47.1%
Contra Costa County *	22,929	780	15,616	6,533	6.3%
Del Norte County	520	339	117	64	6.4%
El Dorado County	3,349	382	2,549	418	5.9%
Fresno County	81,905	45,982	25,428	10,495	21.4%
Glenn County	3,331	2,195	660	476	37.3%
Humboldt County *	4,177	1,232	2,041	904	8.5%
Imperial County	14,940	11,389	1,391	2,160	23.8%
Inyo County	374	40	292	42	5.0%
Kern County	83,791	61,715	13,294	8,782	26.5%
Kings County	13,900	7,766	4,838	1,296	29.7%
Lake County	1,527	1,029	325	173	9.3%
Lassen County	858	709	6	143	8.5%
Los Angeles County	524,392	5,815	346,364	172,213	12.0%
Madera County	16,056	11,945	3,412	699	32.8%
Marin County *	6,212	351	4,801	1,059	5.4%
Mariposa County	154	32	91	31	2.8%
Mendocino County	4,638	1,653	2,443	542	14.4%
Merced County	26,524	14,204	9,521	2,799	33.4%
Modoc County *	402	365	13	24	18.7%
Mono County	152	64	60	28	2.1%
Monterey County	61,773	53,071	5,478	3,224	32.4%
Napa County	19,368	5,011	12,569	1,788	25.2%
Nevada County	1,969	173	1,402	394	6.3%
Orange County	184,267	2,141	157,659	24,467	11.6%
Placer County *	8,381	335	5,789	2,257	5.2%
Plumas County	666	85	485	96	10.7%
Riverside County	95,029	12,282	42,853	39,894	13.3%
Sacramento County	36,093	3,115	20,790	12,188	5.6%
San Benito County	6,006	2,217	3,328	461	35.4%
San Bernardino County	128,165	2,030	55,328	70,807	17.6%
San Diego County	142,913	8,582	107,952	26,379	10.0%
San Francisco County *	26,403	184	12,902	13,317	3.7%



Exhibit 8-2 (cont'd)

County	Total Jobs in At-Risk Industries	Jobs in At-Risk Industry Sectors			Share of Total Jobs in County (Percent)
		Agriculture	Manufacturing	Transportation	
San Joaquin County	60,045	16,321	19,017	24,707	24.2%
San Luis Obispo County	14,191	5,173	7,170	1,848	12.1%
San Mateo County	58,282	1,678	25,977	30,627	14.6%
Santa Barbara County	37,462	21,630	12,923	2,909	19.0%
Santa Clara County	177,522	3,543	161,648	12,331	16.6%
Santa Cruz County *	16,272	8,052	6,818	1,402	15.6%
Shasta County	5,057	1,158	2,573	1,326	7.7%
Sierra County *	37	15	11	11	7.5%
Siskiyou County	2,101	1,046	880	175	15.1%
Solano County	17,631	1,716	12,223	3,692	12.7%
Sonoma County	32,098	6,093	22,720	3,285	15.6%
Stanislaus County	42,780	14,294	21,300	7,186	22.9%
Sutter County	6,917	4,494	1,466	957	22.6%
Tehama County	5,480	2,103	1,808	1,569	29.8%
Trinity County	254	23	219	12	9.3%
Tulare County	57,545	38,493	12,728	6,324	35.5%
Tuolumne County	1,020	135	783	102	5.9%
Ventura County	58,854	23,689	30,055	5,110	18.3%
Yolo County	18,498	5,679	6,256	6,563	18.2%
Yuba County	1,753	747	712	294	10.1%

Source: CA EDD, LMID, QCEW; \* nondisclosed estimates by IMPLAN

## California State Senate Districts

The California State Senate is the upper house of the California State Legislature. The state is split into 40 senate districts according to population size, with approximately 931,300 residents in each district.

Employment data at the industry sector level by California Senate District is available through the U.S. Census Bureau, the most recent available is for 2017.

For more data by senate district, refer to the Appendix.

### Exhibit 8-3

#### Oil and Gas Industry: Jobs Most At-Risk by California Senate District California 2017

District	Total Jobs in At-Risk Industries	Jobs in At-Risk Industry Sectors			Share of Total Jobs in SD (Percent)
		Agriculture	Manufacturing	Transportation	
Senate District 1	39,588	7,861	28,042	3,685	9.0%
Senate District 2	44,608	13,304	27,579	3,725	10.7%
Senate District 3	64,774	14,852	42,976	6,946	11.6%
Senate District 4	48,207	15,045	28,621	4,541	9.7%
Senate District 5	63,204	16,857	39,748	6,599	15.1%
Senate District 6	29,957	3,292	21,933	4,732	6.7%
Senate District 7	49,314	3,903	40,223	5,188	10.2%
Senate District 8	69,428	25,733	37,907	5,788	13.2%
Senate District 9	38,918	1,692	29,978	7,248	8.1%
Senate District 10	79,732	1,437	72,677	5,618	17.4%
Senate District 11	35,487	1,024	27,515	6,948	6.6%
Senate District 12	102,961	61,655	36,528	4,778	22.4%
Senate District 13	61,900	1,928	54,046	5,926	12.9%
Senate District 14	122,325	80,210	31,201	10,914	24.5%
Senate District 15	81,763	2,660	74,811	4,292	17.9%
Senate District 16	93,198	47,766	28,958	16,474	19.2%
Senate District 17	65,691	23,334	38,154	4,203	14.2%
Senate District 18	41,225	2,128	34,510	4,587	9.6%
Senate District 19	66,806	29,350	32,988	4,468	15.6%
Senate District 20	72,334	3,138	56,002	13,194	13.6%
Senate District 21	44,316	2,892	34,983	6,441	11.6%
Senate District 22	57,589	2,340	47,981	7,268	12.8%
Senate District 23	53,455	3,481	41,000	8,974	10.1%
Senate District 24	46,161	2,014	39,386	4,761	10.7%
Senate District 25	44,146	2,087	36,601	5,458	8.4%
Senate District 26	48,092	1,383	39,683	7,026	8.2%
Senate District 27	43,803	3,439	36,470	3,894	10.0%
Senate District 28	43,960	8,004	30,960	4,996	9.7%
Senate District 29	71,184	2,448	62,144	6,592	14.2%
Senate District 30	54,089	1,933	42,833	9,323	10.8%
Senate District 31	65,703	3,309	51,546	10,848	13.1%
Senate District 32	72,664	2,184	61,168	9,312	14.7%
Senate District 33	79,214	2,235	65,665	11,314	16.7%
Senate District 34	72,977	3,119	64,661	5,197	15.7%
Senate District 35	75,836	2,293	58,366	15,177	14.7%
Senate District 36	56,465	4,062	48,357	4,046	12.5%
Senate District 37	63,999	1,998	57,761	4,240	12.7%
Senate District 38	59,774	6,977	47,905	4,892	11.7%
Senate District 40	50,147	1,752	44,638	3,757	9.9%

Source: U.S. Census Bureau

## California State Assembly Districts

The California State Legislature is split into 53 assembly districts according to population size, with each member representing at least 465,000 residents in each district.

Employment data at the industry sector level by assembly district in California is available through the U.S. Census Bureau, the most recent available is for 2017.

### Exhibit 8-4

#### Oil and Gas Industries: Jobs Most At-Risk by California State Assembly District California 2017

District	Total Jobs in At-Risk Industries	Jobs in At-Risk Industry Sectors			Share of Total Jobs in AD (Percent)
		Agriculture	Manufacturing	Transportation	
Assembly District 1	21,690	5,936	10,362	5,392	11.8%
Assembly District 2	30,245	8,862	16,591	4,792	14.4%
Assembly District 3	33,105	13,372	13,512	6,221	17.3%
Assembly District 4	39,217	12,570	19,987	6,660	17.5%
Assembly District 5	31,174	12,649	12,642	5,883	17.1%
Assembly District 6	25,361	1293	18,095	5,973	11.0%
Assembly District 7	22,583	1467	11,501	9,615	10.2%
Assembly District 8	20,945	947	10,555	9,443	9.5%
Assembly District 9	28,202	4,568	13,320	10,314	13.2%
Assembly District 10	25,956	3,460	16,335	6,161	10.7%
Assembly District 11	31,569	2458	18,491	10,620	14.1%
Assembly District 12	45,658	10462	24,004	11,192	22.0%
Assembly District 13	40,271	7693	18,384	14,194	20.7%
Assembly District 14	27,309	1157	16,595	9,557	11.4%
Assembly District 15	24,404	791	13,787	9,826	9.5%
Assembly District 16	31,369	767	24,714	5,888	12.6%
Assembly District 17	25,186	525	15,544	9,117	8.6%
Assembly District 18	33,460	1,015	18,450	13,995	13.4%
Assembly District 19	30,017	588	14,833	14,596	10.5%
Assembly District 20	44,942	890	30,235	13,817	18.3%
Assembly District 21	48,421	17,590	21,368	9,463	26.8%
Assembly District 22	35,052	902	21,930	12,220	13.3%
Assembly District 23	26,903	4,467	14,024	8,412	12.2%
Assembly District 24	41,245	1,355	35,898	3,992	16.3%
Assembly District 25	63,221	438	55,272	7,511	24.1%
Assembly District 26	53,430	32,551	14,447	6,432	29.0%
Assembly District 27	49,486	1655	39,173	8,658	19.9%
Assembly District 28	45,663	656	40,457	4,550	18.7%
Assembly District 29	32,712	6436	21,071	5,205	13.9%
Assembly District 30	61,864	36678	19,362	5,824	28.8%
Assembly District 31	55,804	32716	15,490	7,598	32.2%
Assembly District 32	58,115	41402	10,154	6,559	35.5%
Assembly District 33	26,702	890	11,413	14,399	16.0%
Assembly District 34	28,566	8498	11,246	8,822	13.9%
Assembly District 35	41,192	19,521	15,612	6,059	18.7%
Assembly District 36	28,272	1,607	18,612	8,053	16.1%
Assembly District 37	32,871	8474	18,601	5,796	13.6%
Assembly District 38	32,522	905	24,232	7,385	13.6%

## Exhibit 8- 4(cont'd)

District	Total Jobs in At-Risk Industries	Jobs in At-Risk Industry Sectors			Share of Total Jobs in AD (Percent)
		Agriculture	Manufacturing	Transportation	
Assembly District 39	35,409	1599	23,740	10,070	15.9%
Assembly District 40	32,667	1127	16,284	15,256	15.6%
Assembly District 41	24,393	641	15,752	8,000	10.3%
Assembly District 42	19,874	1,943	10,321	7,610	10.7%
Assembly District 43	23,348	574	14,654	8,120	9.4%
Assembly District 44	46,272	15774	25,648	4,850	20.4%
Assembly District 45	25,887	860	18,231	6,796	10.2%
Assembly District 46	27,468	839	18,233	8,396	10.6%
Assembly District 47	45,092	922	21,689	22,481	22.0%
Assembly District 48	38,847	1414	26,128	11,305	17.6%
Assembly District 49	32,699	628	21,830	10,241	15.1%
Assembly District 50	17,950	597	12,344	5,009	6.5%
Assembly District 51	34,135	1,105	22,662	10,368	15.3%
Assembly District 52	45,116	1984	26,335	16,797	21.1%
Assembly District 53	40,225	1107	28,913	10,205	16.9%
Assembly District 54	22,006	543	11,706	9,757	9.0%
Assembly District 55	36,189	860	27,097	8,232	15.6%
Assembly District 56	24,583	12,412	7,366	4,805	14.0%
Assembly District 57	43,283	933	28,872	13,478	20.0%
Assembly District 58	43,489	647	27,304	15,538	20.1%
Assembly District 59	45,427	1,262	30,608	13,557	23.6%
Assembly District 60	44,992	1,647	29,097	14,248	19.7%
Assembly District 61	37,138	1,200	18,461	17,477	17.5%
Assembly District 62	35,982	958	18,546	16,478	15.0%
Assembly District 63	48,051	911	30,591	16,549	23.5%
Assembly District 64	48,070	1,440	28,547	18,083	24.0%
Assembly District 65	40,854	932	30,868	9,054	17.9%
Assembly District 66	42,078	366	29,657	12,055	18.0%
Assembly District 67	29,125	1,993	18,416	8,716	13.8%
Assembly District 68	39,358	1,016	32,156	6,186	15.3%
Assembly District 69	45,089	2,264	36,012	6,813	19.6%
Assembly District 70	40,008	566	21,455	17,987	17.2%
Assembly District 71	26,617	1,945	16,123	8,549	12.3%
Assembly District 72	43,925	913	35,061	7,951	18.9%
Assembly District 73	32,650	595	26,132	5,923	13.1%
Assembly District 74	32,260	957	25,947	5,356	12.9%
Assembly District 75	35,058	5,356	23,255	6,447	15.4%
Assembly District 76	34,807	2,991	26,345	5,471	15.7%
Assembly District 77	39,635	488	32,830	6,317	16.0%
Assembly District 78	24,936	766	17,736	6,434	9.7%
Assembly District 79	26,415	844	17,028	8,543	11.1%
Assembly District 80	25,407	1,037	15,318	9,052	12.7%

Source: U.S. Census Bureau

A description of the industry sectors is provided in the Appendix. ❖

## 9 Backward and Forward Linkages in California by County

### Alameda County

Exhibit 9-1

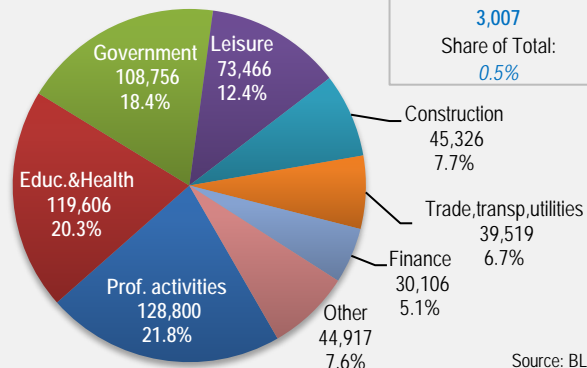
#### Direct Activity of Oil and Gas Industry Alameda County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	80	2.5
Mid-stream	196	16.0
Downstream	56	6.9
Market	2,676	160.0
<b>Total Direct Activity</b>	<b>3,007</b>	<b>185.5</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-2

#### Economic Base in Alameda County Payroll Jobs



Source: BLS

Exhibit 9-3

#### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Alameda County 2017

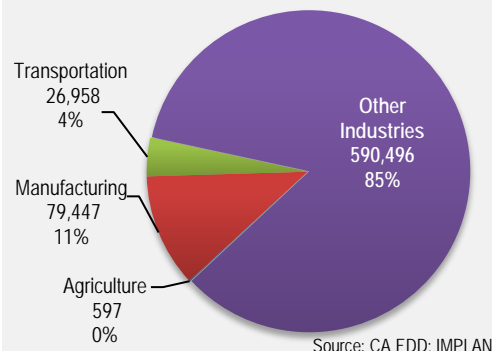
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	3,007	185.5	403.2	1,264.4
Indirect	1,160	87.5	135.1	202.3
Induced	1,180	68.6	123.8	191.3
<b>TOTAL CONTRIBUTION*</b>	<b>5,340</b>	<b>341.6</b>	<b>662.1</b>	<b>1,658</b>
Percent of County Total	0.5%	0.4%	0.5%	0.7%
Percent of Total CA Contribution	1.5%	1.3%	1.1%	1.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	366.5
Property taxes	43.4
Personal income taxes	10.3
Corporate profits taxes	2.8
Social insurance taxes	1.7
DOGGR Assessment	0.0
Other taxes	13.2
Fees, fines and permits	16.0
<b>TOTAL TAX REVENUES*</b>	<b>453.8</b>

\* May not sum due to rounding

Source: Estimates by LAEDC

Exhibit 9-4 (Alameda)  
Forward Linkages:  
Oil and Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



Source: CA FDD: IMPI AN



## Butte County

Exhibit 9-5

### Direct Activity of Oil and Gas Industry Butte County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	34	1.4
Mid-stream	48	2.9
Downstream	-	-
Market	323	10.2
<b>Total Direct Activity</b>	<b>404</b>	<b>14.52</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-6

### Economic Base Butte County Payroll Jobs

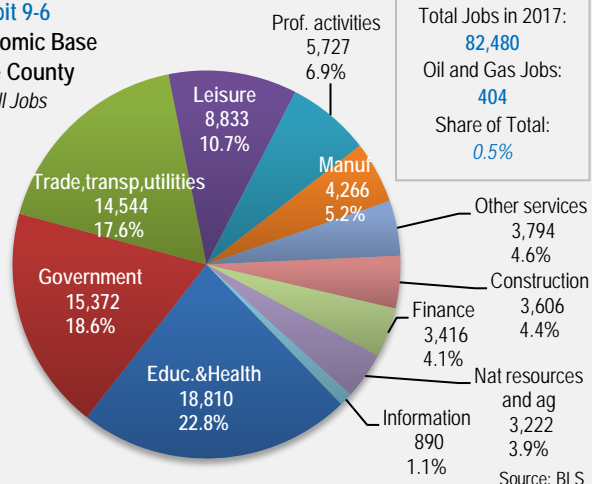


Exhibit 9-7

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Butte County 2017

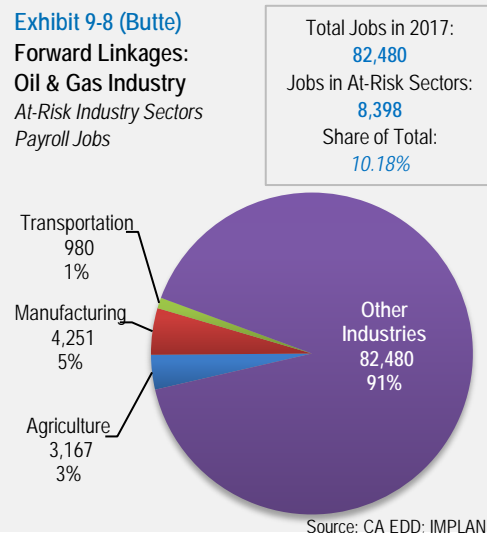
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	404	14.5	31.6	67.7
Indirect	80	3.5	6.4	11.5
Induced	90	3.8	7.2	12.0
<b>TOTAL CONTRIBUTION*</b>	<b>570</b>	<b>21.8</b>	<b>45.2</b>	<b>91.2</b>
Percent of County Total	0.5%	0.4%	0.5%	0.5%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	55.2
Property taxes	3.0
Personal income taxes	0.6
Corporate profits taxes	0.3
Social insurance taxes	0.1
DOGGR Assessment	-
Other taxes	0.5
Fees, fines and permits	2.1
<b>TOTAL TAX REVENUES*</b>	<b>61.9</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-8 (Butte)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs

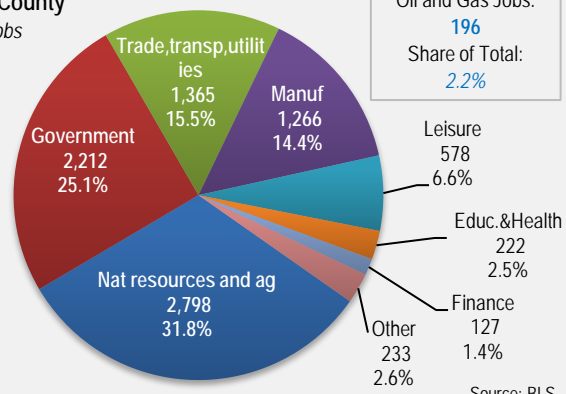


## Colusa County

**Exhibit 9-9****Direct Activity of Oil and Gas Industry  
Colusa County**

Industry Group	Employment	Labor Income (\$ millions)
Upstream	1	0.1
Mid-stream	23	1.5
Downstream	-	-
Market	173	9.1
<b>Total Direct Activity</b>	<b>196</b>	<b>10.7</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-10****Economic Base  
Colusa County  
Payroll Jobs**

Total Jobs in 2017:  
**9,009**  
Oil and Gas Jobs:  
**196**  
Share of Total:  
**2.2%**

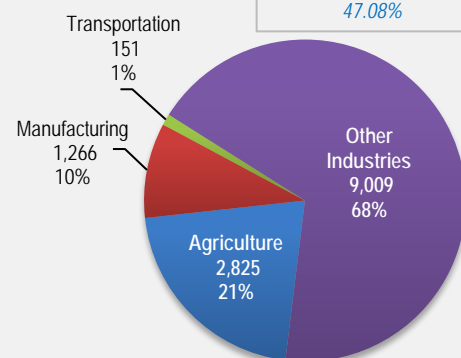
Source: BLS

**Exhibit 9-11****Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Colusa County 2017**

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	196	10.7	22.9	46.3
Indirect	30	1.7	2.9	4.7
Induced	20	1.0	2.3	3.7
<b>TOTAL CONTRIBUTION*</b>	<b>250</b>	<b>13.5</b>	<b>27.7</b>	<b>54.8</b>
Percent of County Total	2.0%	1.8%	2.7%	2.3%
Percent of Total CA Contribution	0.1%	0.1%	0.05%	0.04%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	9.9
Property taxes	3.0
Personal income taxes	0.4
Corporate profits taxes	0.1
Social insurance taxes	0.1
DOGGR Assessment	0.1
Other taxes	0.5
Fees, fines and permits	0.6
<b>TOTAL TAX REVENUES*</b>	<b>14.6</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-12 (Colusa)****Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs**

Total Jobs in 2017:  
**9,009**  
Jobs in At-Risk Sectors:  
**4,242**  
Share of Total:  
**47.08%**

Source: CA EDD; IMPLAN

## Contra Costa County

Exhibit 9-13

### Direct Activity of Oil and Gas Industry Contra Costa County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	160	8.4
Mid-stream	1,579	172.0
Downstream	4,480	669.0
Market	6,015	707.3
<b>Total Direct Activity</b>	<b>12,233</b>	<b>1,556.8</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-14

### Economic Base Contra Costa County Payroll Jobs

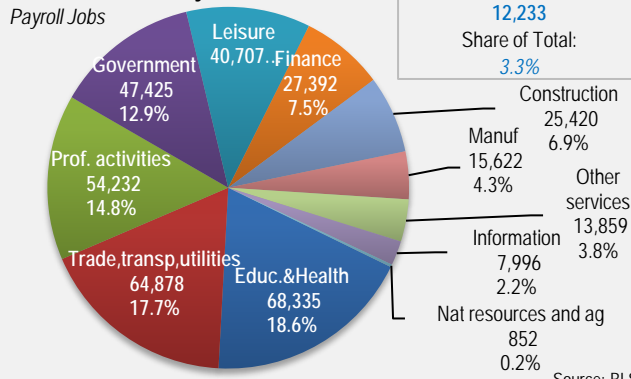


Exhibit 9-15

### Backward Linkages: Oil and Gas Total Economic and Fiscal Contribution Contra Costa County 2017

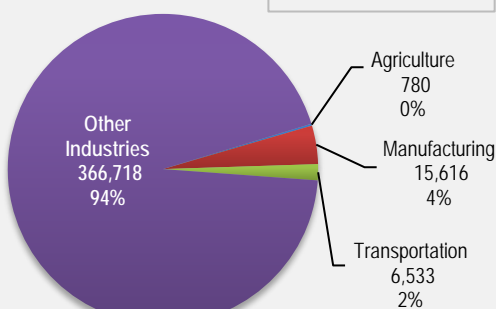
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	12,233	1,512.8	8,399.7	32,725.7
Indirect	15,980	1,175.4	1,818.0	2,851.0
Induced	9,900	525.0	1,019.4	1,578.7
<b>TOTAL CONTRIBUTION*</b>	<b>38,110</b>	<b>3,213.1</b>	<b>11,237.1</b>	<b>37,115.4</b>
Percent of County Total	6.7%	8.2%	15.4%	27.9%
Percent of Total CA Contribution	10.4%	12.3%	18.9%	24.4%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	563.6
Property taxes	439.7
Personal income taxes	100.7
Corporate profits taxes	82.3
Social insurance taxes	15.4
DOGGR Assessment	0.0
Other taxes	99.1
Fees, fines and permits	46.1
<b>TOTAL TAX REVENUES*</b>	<b>1,346.8</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-16 (Contra Costa)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## El Dorado County

Exhibit 9-17

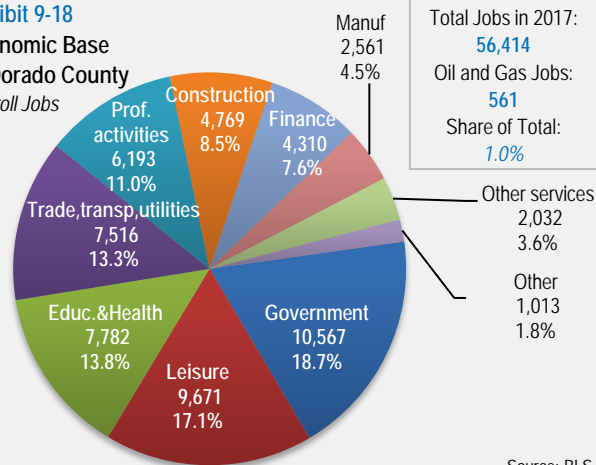
### Direct Activity of Oil and Gas Industry El Dorado County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	5	0.3
Mid-stream	15	1.7
Downstream	66	10.8
Market	475	17.8
<b>Total Direct Activity</b>	<b>561</b>	<b>30.6</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-18

### Economic Base El Dorado County Payroll Jobs



Source: RLS

Exhibit 9-19

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution El Dorado County 2017

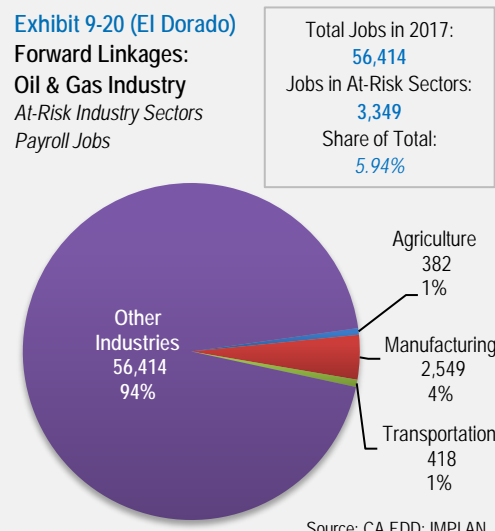
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	561	30.6	127.6	497.4
Indirect	300	15.4	24.3	43.8
Induced	160	6.5	13.3	22.4
<b>TOTAL CONTRIBUTION*</b>	<b>1,020</b>	<b>52.5</b>	<b>165.2</b>	<b>563.6</b>
Percent of County Total	1.1%	1.1%	2.2%	4.3%
Percent of Total CA Contribution	0.3%	0.23%	0.3%	0.4%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	52.7
Property taxes	9.1
Personal income taxes	1.5
Corporate profits taxes	0.8
Social insurance taxes	0.2
DOGGR Assessment	-
Other taxes	1.8
Fees, fines and permits	2.6
<b>TOTAL TAX REVENUES*</b>	<b>68.7</b>

\* May not sum due to rounding  
 Source: Estimates by LAEDC

Exhibit 9-20 (El Dorado)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA FDD: IMPIAN

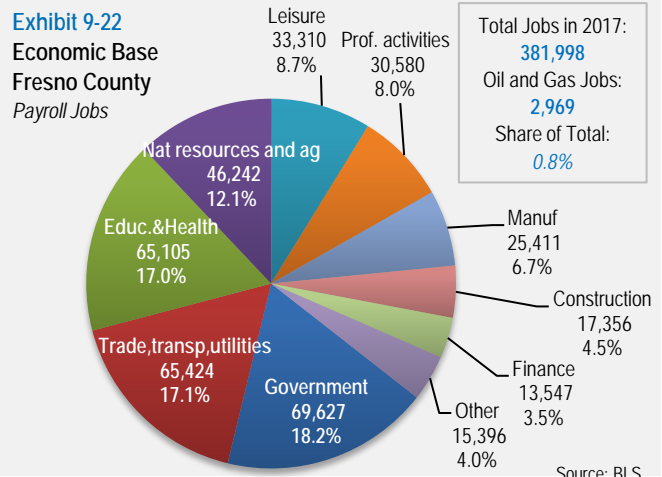
## Fresno County

**Exhibit 9-21**  
Direct Activity of Oil and Gas Industry  
Fresno County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	149	13.5
Mid-stream	263	20.5
Downstream	37	2.4
Market	2,522	190.8
<b>Total Direct Activity</b>	<b>2,969</b>	<b>227.2</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-22**  
Economic Base  
Fresno County  
Payroll Jobs



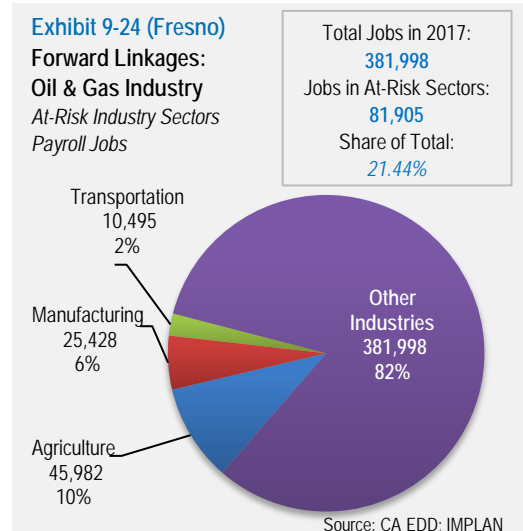
**Exhibit 9-23**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Fresno County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	2,969	227.2	478.5	1,257.4
Indirect	1,500	77.8	124.8	206.5
Induced	1,520	67.8	124.3	207.4
<b>TOTAL CONTRIBUTION*</b>	<b>5,990</b>	<b>372.8</b>	<b>727.6</b>	<b>1,671.3</b>
Percent of County Total	1.2%	1.4%	1.8%	2.3%
Percent of Total CA Contribution	1.6%	1.4%	1.2%	1.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	276.5
Property taxes	51.0
Personal income taxes	11.2
Corporate profits taxes	2.9
Social insurance taxes	1.8
DOGGR Assessment	3.6
Other taxes	11.7
Fees, fines and permits	14.8
<b>TOTAL TAX REVENUES*</b>	<b>373.6</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-24 (Fresno)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs





## Glenn County

Exhibit 9-25

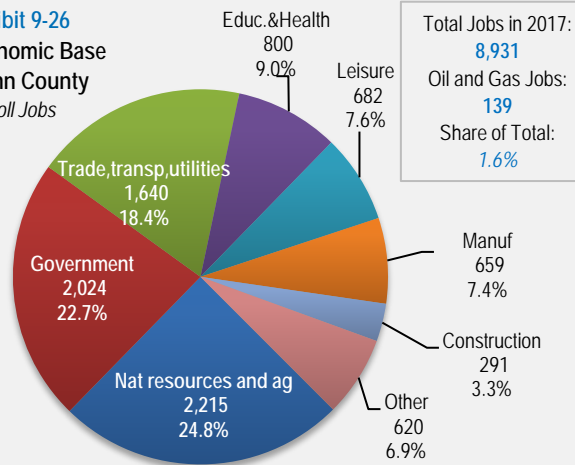
### Direct Activity of Oil and Gas Industry Glenn County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	10	1.0
Mid-stream	26	1.5
Downstream	-	-
Market	103	5.2
<b>Total Direct Activity</b>	<b>139</b>	<b>7.7</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-26

### Economic Base Glenn County Payroll Jobs



Total Jobs in 2017:  
**8,931**  
Oil and Gas Jobs:  
**139**  
Share of Total:  
**1.6%**

Source: BLS

Exhibit 9-27

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Glenn County 2017

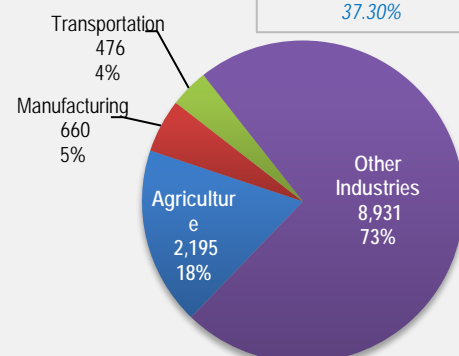
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	139	7.7	15.4	35.3
Indirect	30	1.3	1.8	3.1
Induced	30	1.0	1.9	3.2
<b>TOTAL CONTRIBUTION*</b>	<b>190</b>	<b>9.9</b>	<b>19.1</b>	<b>41.6</b>
Percent of County Total	1.4%	1.4%	1.6%	1.8%
Percent of Total CA Contribution	0.1%	0.04%	0.03%	0.03%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	21.3
Property taxes	2.2
Personal income taxes	0.3
Corporate profits taxes	0.0
Social insurance taxes	0.1
DOGGR Assessment	0.2
Other taxes	0.4
Fees, fines and permits	1.2
<b>TOTAL TAX REVENUES*</b>	<b>25.7</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-28 (Glenn)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Total Jobs in 2017:  
**8,931**  
Jobs in At-Risk Sectors:  
**3,331**  
Share of Total:  
**37.30%**

Source: CA EDD; IMPLAN

## Humboldt County

Exhibit 9-29

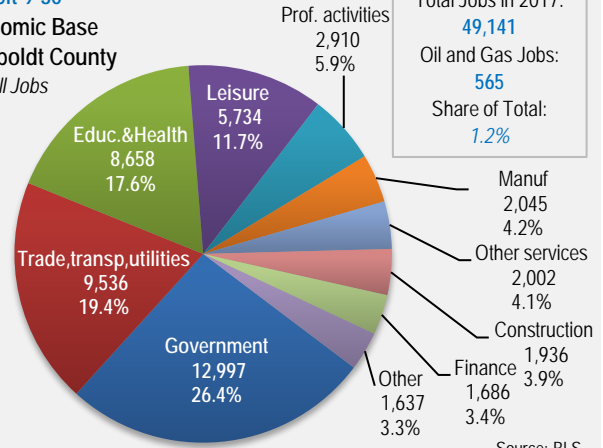
### Direct Activity of Oil and Gas Industry Humboldt County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	13	0.2
Mid-stream	42	2.2
Downstream	-	-
Market	511	17.6
<b>Total Direct Activity</b>	<b>565</b>	<b>20.0</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-30

### Economic Base Humboldt County Payroll Jobs



Source: BLS

Exhibit 9-31

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Humboldt County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	565	20.0	37.9	92.6
Indirect	120	5.1	8.6	15.6
Induced	110	4.7	8.8	14.9
<b>TOTAL CONTRIBUTION*</b>	<b>790</b>	<b>29.8</b>	<b>55.3</b>	<b>123.1</b>
Percent of County Total	1.1%	0.8%	1.0%	1.2%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

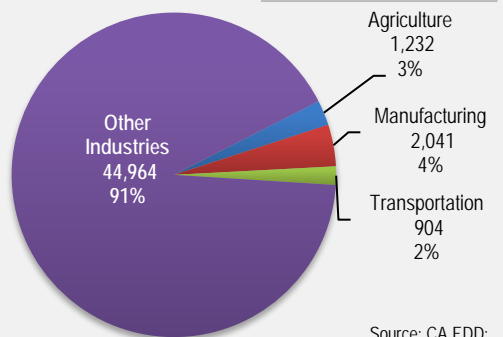
FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	39.0
Property taxes	4.5
Personal income taxes	0.8
Corporate profits taxes	0.3
Social insurance taxes	0.1
DOGGR Assessment	0.0
Other taxes	0.9
Fees, fines and permits	1.6
<b>TOTAL TAX REVENUES*</b>	<b>47.2</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-32 (Humboldt)

### Forward Linkages: Oil & Gas Industry

#### At-Risk Industry Sectors Payroll Jobs



Source: CA EDD;

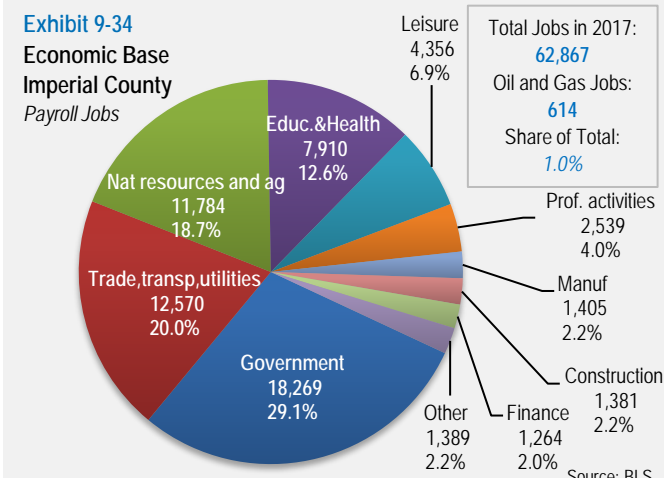
## Imperial County

**Exhibit 9-33**  
Direct Activity of Oil and Gas Industry  
Imperial County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	25	2.2
Mid-stream	84	5.5
Downstream	-	-
Market	505	15.5
<b>Total Direct Activity</b>	<b>614</b>	<b>23.1</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-34**  
Economic Base  
Imperial County  
Payroll Jobs



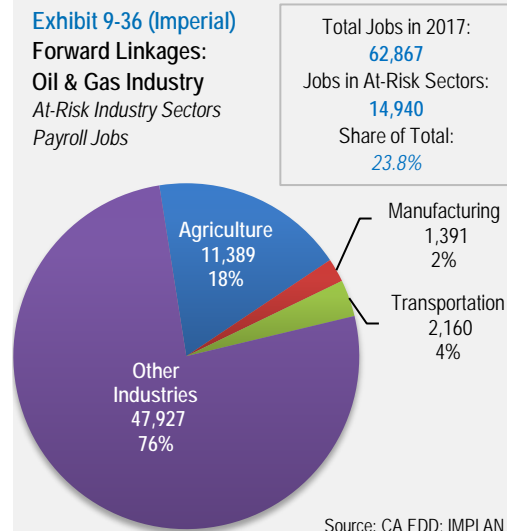
**Exhibit 9-35**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Imperial County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	614	16.9	42.0	118.3
Indirect	120	5.0	8.1	14.9
Induced	70	2.6	5.4	9.3
<b>TOTAL CONTRIBUTION*</b>	<b>800</b>	<b>24.5</b>	<b>55.5</b>	<b>142.5</b>
Percent of County Total	1.0%	0.6%	0.8%	1.2%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	57.2
Property taxes	6.2
Personal income taxes	0.7
Corporate profits taxes	0.2
Social insurance taxes	0.1
DOGGR Assessment	-
Other taxes	1.2
Fees, fines and permits	2.1
<b>TOTAL TAX REVENUES*</b>	<b>67.7</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-36 (Imperial)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



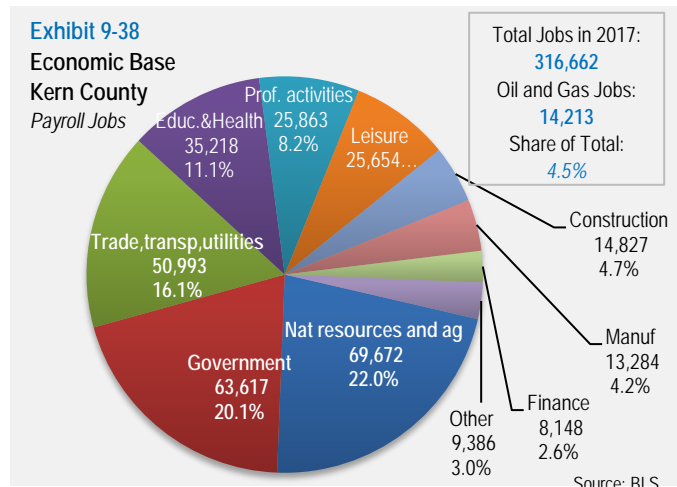
## Kern County

**Exhibit 9-37**  
Direct Activity of Oil and Gas Industry  
Kern County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	7,375	694.6
Mid-stream	3,012	188.2
Downstream	795	95.7
Market	3,031	105.2
<b>Total Direct Activity</b>	<b>14,213</b>	<b>1,083.7</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-38**  
Economic Base  
Kern County  
Payroll Jobs



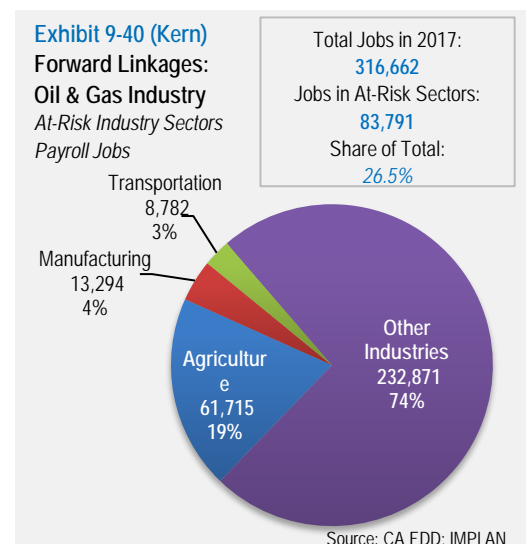
**Exhibit 9-39**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Kern County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	14,213	1,116.7	2,784.7	7,781.4
Indirect	4,280	255.5	376.5	645.2
Induced	5,400	233.4	445.3	740.2
<b>TOTAL CONTRIBUTION*</b>	<b>23,900</b>	<b>1,605.7</b>	<b>3,606.6</b>	<b>9,166.8</b>
Percent of County Total	5.9%	6.7%	9.5%	14.3%
Percent of Total CA Contribution	6.5%	6.1%	6.1%	6.0%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	391.8
Property taxes	331.3
Personal income taxes	46.1
Corporate profits taxes	22.3
Social insurance taxes	8.0
DOGGR Assessment	68.1
Other taxes	22.8
Fees, fines and permits	34.5
<b>TOTAL TAX REVENUES*</b>	<b>925.0</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-40 (Kern)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



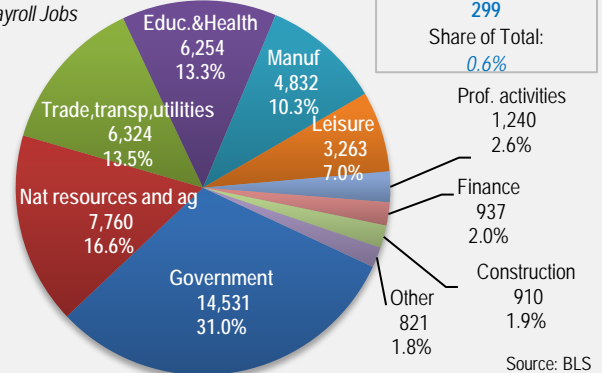
## Kings County

**Exhibit 9-41**  
Direct Activity of Oil and Gas Industry  
Kings County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	1	0.1
Mid-stream	27	1.6
Downstream	-	-
Market	272	10.3
<b>Total Direct Activity</b>	<b>299</b>	<b>12.0</b>

Source: OCEW; Estimates by LAEDC

**Exhibit 9-42**  
Economic Base  
Kings County  
Payroll Jobs



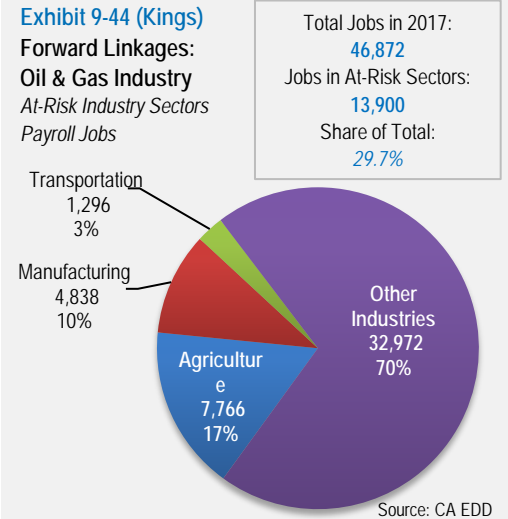
**Exhibit 9-43**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Kings County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	299	12.0	22.3	45.3
Indirect	40	1.6	2.9	4.9
Induced	40	1.6	3.4	5.9
<b>TOTAL CONTRIBUTION*</b>	<b>370</b>	<b>15.2</b>	<b>28.7</b>	<b>56.0</b>
Percent of County Total	0.6%	0.4%	0.4%	0.4%
Percent of Total CA Contribution	0.1%	0.1%	0.05%	0.04%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	36.7
Property taxes	3.1
Personal income taxes	0.4
Corporate profits taxes	0.2
Social insurance taxes	0.1
DOGGR Assessment	0.1
Other taxes	0.6
Fees, fines and permits	1.7
<b>TOTAL TAX REVENUES*</b>	<b>42.8</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-44 (Kings)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs





## Los Angeles County

Exhibit 9-45

### Direct Activity of Oil and Gas Industry Los Angeles County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	2,860	243.8
Mid-stream	4,384	417.1
Downstream	5,116	713.8
Market	18,718	959.6
<b>Total Direct Activity</b>	<b>31,077</b>	<b>2,334.3</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-46

### Economic Base Los Angeles County Payroll Jobs

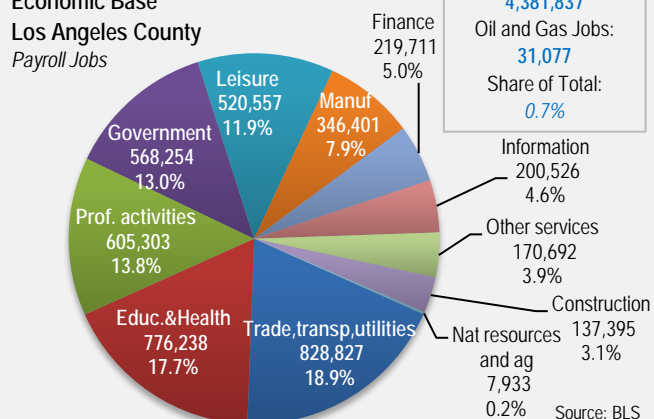


Exhibit 9-47

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Los Angeles County 2017

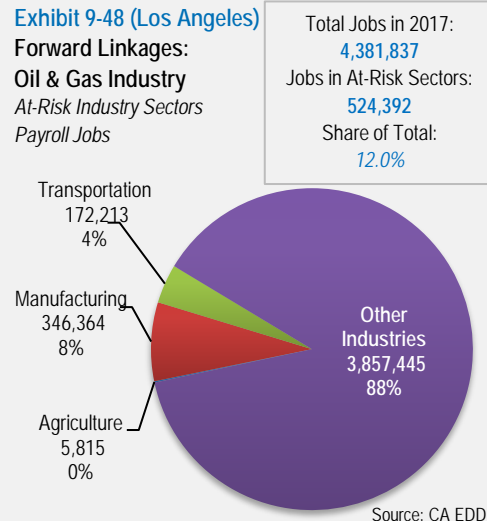
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	31,077	2,334.3	10,254.4	38,884.6
Indirect	27,250	1,942.6	3,042.9	4,872.6
Induced	19,220	1,048.9	1,886.5	2,980.6
<b>TOTAL CONTRIBUTION*</b>	<b>77,550</b>	<b>5,325.8</b>	<b>15,183.8</b>	<b>46,737.8</b>
Percent of County Total	1.2%	1.2%	2.0%	3.9%
Percent of Total CA Contribution	21.2%	20.4%	25.6%	30.7%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	2,718.4
Property taxes	623.2
Personal income taxes	159.2
Corporate profits taxes	101.1
Social insurance taxes	25.2
DOGGR Assessment	10.5
Other taxes	148.4
Fees, fines and permits	129.8
<b>TOTAL TAX REVENUES*</b>	<b>3,915.7</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-48 (Los Angeles)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## Madera County

Exhibit 9-49

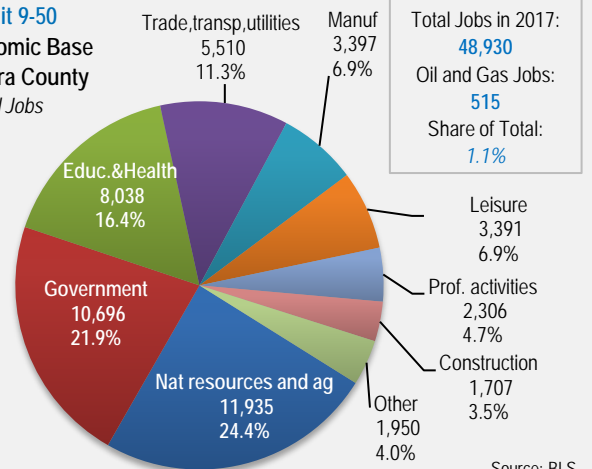
### Direct Activity of Oil and Gas Industry Madera County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	8	0.3
Mid-stream	69	6.0
Downstream	-	-
Market	438	14.7
<b>Total Direct Activity</b>	<b>515</b>	<b>21.0</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-50

### Economic Base Madera County Payroll Jobs



Source: BLS

Exhibit 9-51

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Madera County 2017

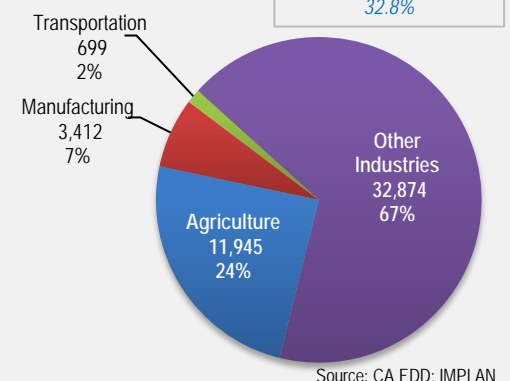
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	515	16.0	35.8	87.7
Indirect	90	3.7	6.1	11.4
Induced	60	2.8	5.4	9.4
<b>TOTAL CONTRIBUTION*</b>	<b>670</b>	<b>22.6</b>	<b>47.4</b>	<b>108.5</b>
Percent of County Total	1.0%	0.6%	0.8%	1.1%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	54.9
Property taxes	5.4
Personal income taxes	0.7
Corporate profits taxes	0.1
Social insurance taxes	0.1
DOGGR Assessment	0.0
Other taxes	1.4
Fees, fines and permits	2.6
<b>TOTAL TAX REVENUES*</b>	<b>65.2</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-52 (Madera)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



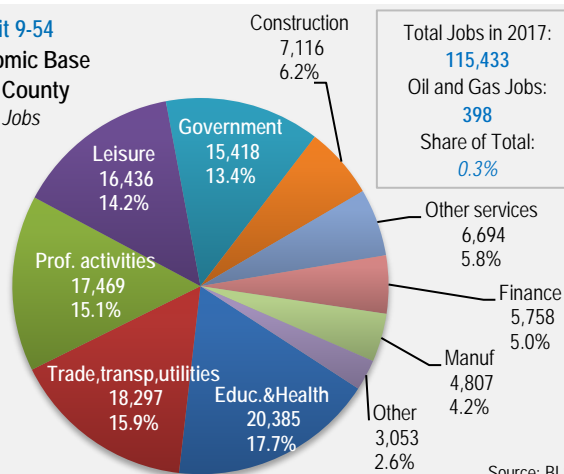
Source: CA FDD: IMPI AN

## Marin County

**Exhibit 9-53****Direct Activity of Oil and Gas Industry  
Marin County**

Industry Group	Employment	Labor Income (\$ millions)
Upstream	26	7.5
Mid-stream	10	1.0
Downstream	-	-
Market	362	15.9
<b>Total Direct Activity</b>	<b>398</b>	<b>24.4</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-54****Economic Base  
Marin County  
Payroll Jobs**

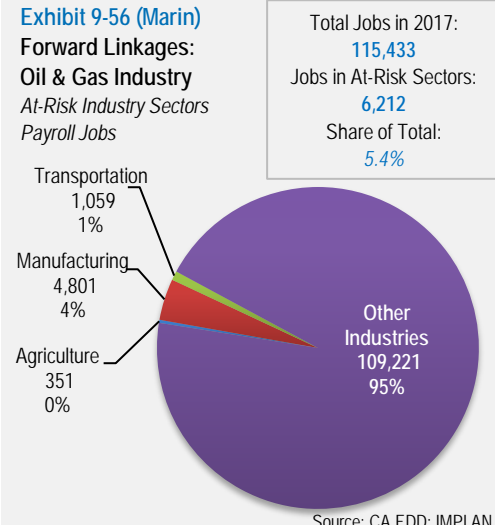
Source: BLS

**Exhibit 9-55****Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Marin County 2017**

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	398	24.4	49.2	122.4
Indirect	80	5.8	9.1	13.7
Induced	90	5.0	8.8	13.4
<b>TOTAL CONTRIBUTION*</b>	<b>560</b>	<b>35.1</b>	<b>67.1</b>	<b>149.5</b>
Percent of County Total	0.3%	0.2%	0.3%	0.4%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	55.8
Property taxes	4.3
Personal income taxes	1.1
Corporate profits taxes	0.2
Social insurance taxes	0.2
DOGGR Assessment	-
Other taxes	1.2
Fees, fines and permits	2.5
<b>TOTAL TAX REVENUES*</b>	<b>65.4</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-56 (Marin)****Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs**

Source: CA FDD: IMPIAN

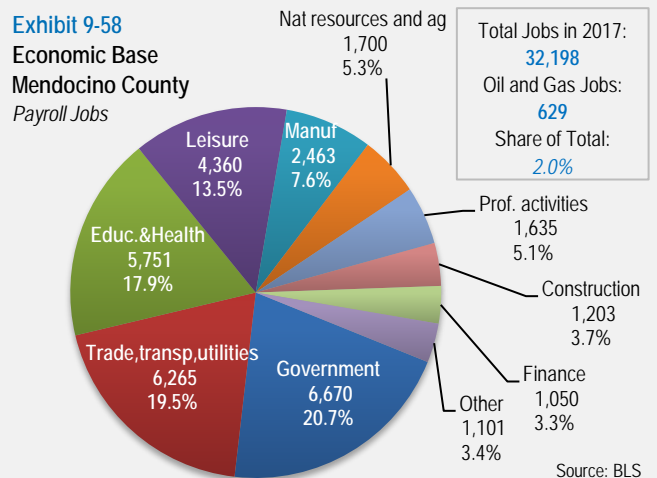
## Mendocino County

**Exhibit 9-57**  
Direct Activity of Oil and Gas Industry  
Mendocino County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	-	-
Mid-stream	203	11.1
Downstream	-	-
Market	427	27.6
<b>Total Direct Activity</b>	<b>629</b>	<b>38.7</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-58**  
Economic Base  
Mendocino County  
Payroll Jobs



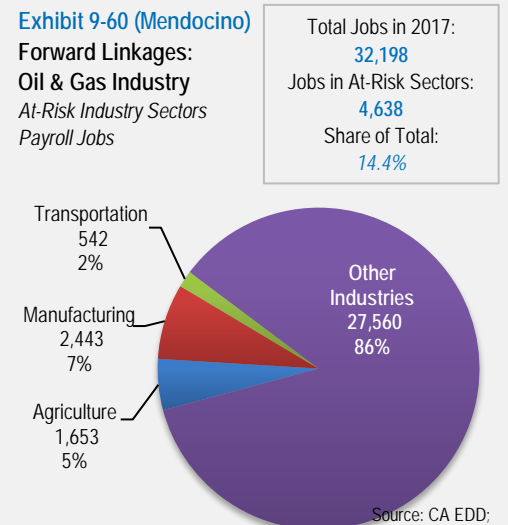
**Exhibit 9-59**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Mendocino County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	629	39.0	78.8	168.3
Indirect	210	9.1	14.9	26.6
Induced	190	7.8	15.4	26.0
<b>TOTAL CONTRIBUTION*</b>	<b>1,030</b>	<b>55.9</b>	<b>109.1</b>	<b>220.8</b>
Percent of County Total	2.1%	2.4%	3.0%	3.4%
Percent of Total CA Contribution	0.3%	0.2%	0.2%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	34.5
Property taxes	10.1
Personal income taxes	1.6
Corporate profits taxes	0.3
Social insurance taxes	0.3
DOGGR Assessment	-
Other taxes	1.7
Fees, fines and permits	1.6
<b>TOTAL TAX REVENUES*</b>	<b>50.1</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-60 (Mendocino)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



## Merced County

Exhibit 9-61

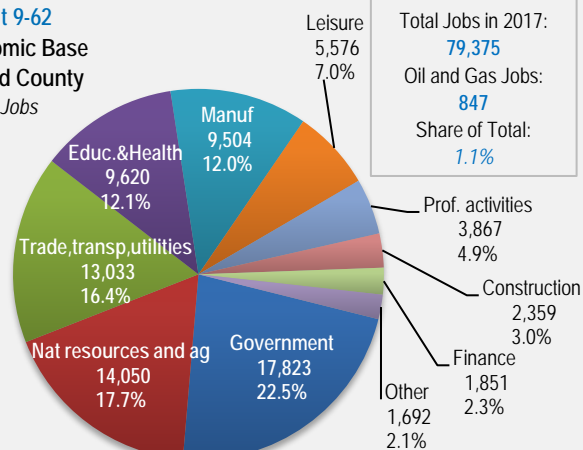
### Direct Activity of Oil and Gas Industry Merced County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	3	0.0
Mid-stream	34	2.0
Downstream	-	-
Market	810	22.0
<b>Total Direct Activity</b>	<b>847</b>	<b>24.1</b>

Source: OCEW; Estimates by LAEDC

Exhibit 9-62

### Economic Base Merced County Payroll Jobs



Source: BLS

Exhibit 9-63

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Merced County 2017

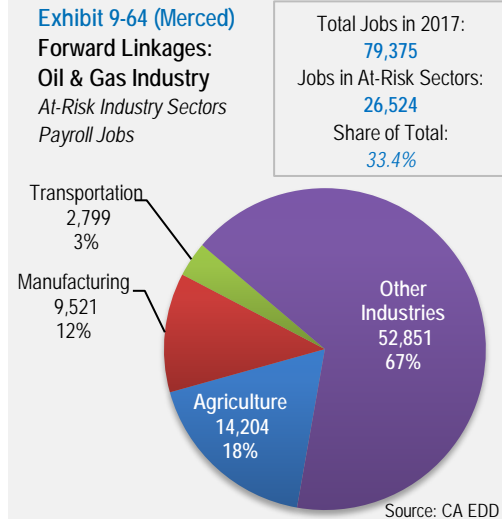
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	847	24.1	43.8	92.4
Indirect	120	5.8	9.2	16.8
Induced	100	4.0	8.0	13.5
<b>TOTAL CONTRIBUTION*</b>	<b>1,070</b>	<b>33.8</b>	<b>61.0</b>	<b>122.7</b>
Percent of County Total	1.0%	0.6%	0.7%	0.7%
Percent of Total CA Contribution	0.3%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	87.8
Property taxes	6.0
Personal income taxes	1.0
Corporate profits taxes	0.2
Social insurance taxes	0.2
DOGGR Assessment	-
Other taxes	1.3
Fees, fines and permits	3.8
<b>TOTAL TAX REVENUES*</b>	<b>100.2</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-64 (Merced)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA EDD



## Monterey County

Exhibit 9-65

### Direct Activity of Oil and Gas Industry Monterey County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	116	11.3
Mid-stream	102	8.2
Downstream	2	0.1
Market	763	22.0
<b>Total Direct Activity</b>	<b>984</b>	<b>41.6</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-66

### Economic Base Monterey County Payroll Jobs

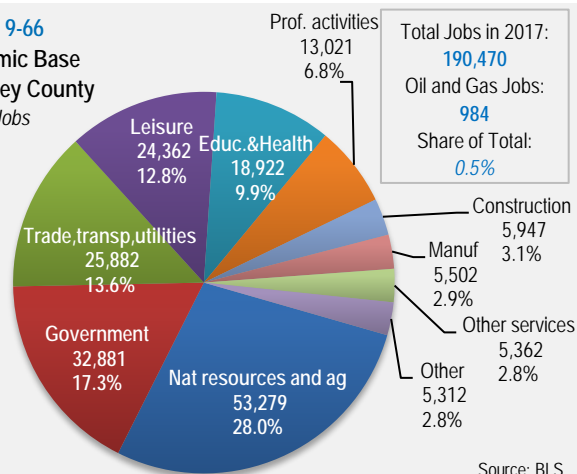


Exhibit 9-67

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Monterey County 2017

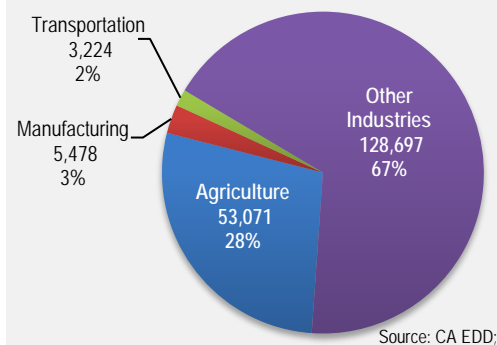
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	984	41.6	82.2	168.7
Indirect	180	10.4	17.2	27.9
Induced	200	10.0	18.5	29.4
<b>TOTAL CONTRIBUTION*</b>	<b>1,360</b>	<b>62.0</b>	<b>117.9</b>	<b>225.9</b>
Percent of County Total	0.5%	0.4%	0.5%	0.6%
Percent of Total CA Contribution	0.4%	0.2%	0.2%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	110.0
Property taxes	8.7
Personal income taxes	1.9
Corporate profits taxes	0.5
Social insurance taxes	0.3
DOGGR Assessment	3.8
Other taxes	1.8
Fees, fines and permits	5.1
<b>TOTAL TAX REVENUES*</b>	<b>132.2</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-68 (Monterey)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## Napa County

Exhibit 9-69

### Direct Activity of Oil and Gas Industry Napa County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	-	-
Mid-stream	65	6.5
Downstream	-	-
Market	322	21.1
<b>Total Direct Activity</b>	<b>387</b>	<b>27.6</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-70

### Economic Base Napa County Payroll Jobs

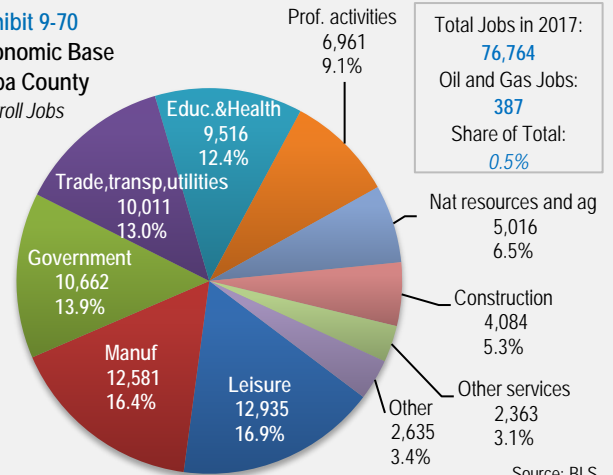


Exhibit 9-71

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Napa County 2017

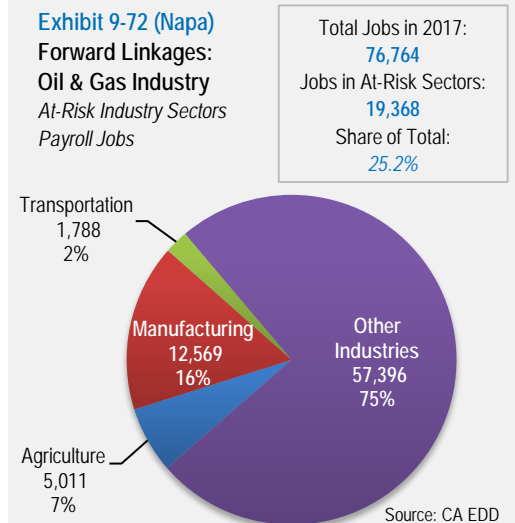
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	387	27.6	48.9	116.2
Indirect	120	6.9	11.1	16.7
Induced	120	5.8	11.1	17.0
<b>TOTAL CONTRIBUTION*</b>	<b>620</b>	<b>40.4</b>	<b>71.0</b>	<b>149.9</b>
Percent of County Total	0.6%	0.6%	0.7%	0.8%
Percent of Total CA Contribution	0.2%	0.2%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	34.5
Property taxes	6.5
Personal income taxes	1.2
Corporate profits taxes	0.2
Social insurance taxes	0.2
DOGGR Assessment	-
Other taxes	1.0
Fees, fines and permits	1.5
<b>TOTAL TAX REVENUES*</b>	<b>45.1</b>

\* May not sum due to rounding  
 Source: Estimates by LAEDC

Exhibit 9-72 (Napa)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## Orange County

Exhibit 9-73

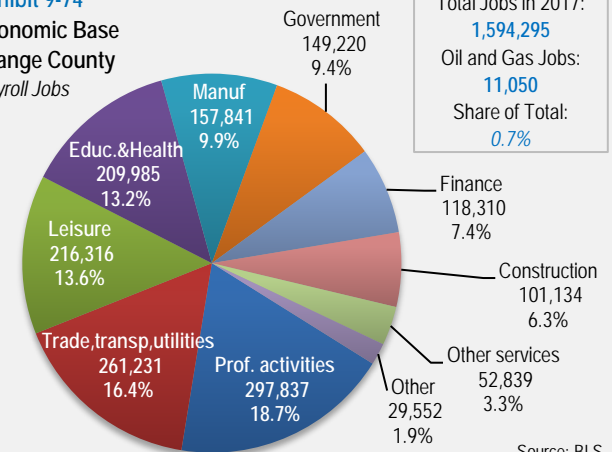
### Direct Activity of Oil and Gas Industry Orange County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	1,306	89.4
Mid-stream	3,963	363.2
Downstream	122	15.8
Market	5,660	211.2
<b>Total Direct Activity</b>	<b>11,050</b>	<b>679.6</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-74

### Economic Base Orange County Payroll Jobs



Total Jobs in 2017:  
**1,594,295**  
Oil and Gas Jobs:  
**11,050**  
Share of Total:  
**0.7%**

Source: BLS

Exhibit 9-75

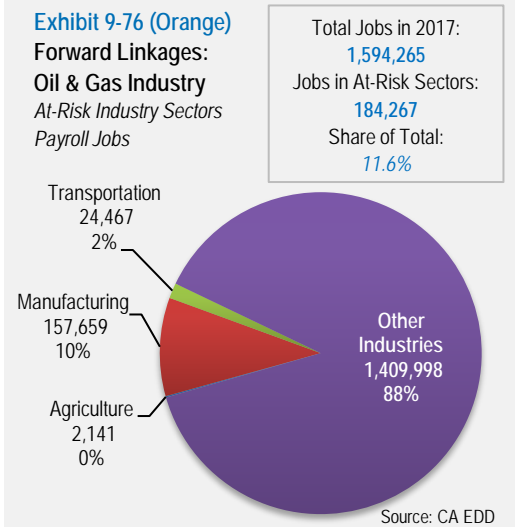
### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Orange County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	11,050	679.6	1,241.5	2,943.7
Indirect	3,310	233.5	389.3	592.8
Induced	4,430	238.4	441.5	692.1
<b>TOTAL CONTRIBUTION*</b>	<b>18,790</b>	<b>1,151.5</b>	<b>2,072.3</b>	<b>4,228.6</b>
Percent of County Total	0.8%	0.8%	0.8%	1.0%
Percent of Total CA Contribution	5.1%	4.4%	3.5%	2.8%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	832.2
Property taxes	103.9
Personal income taxes	34.5
Corporate profits taxes	10.0
Social insurance taxes	5.7
DOGGR Assessment	2.1
Other taxes	20.4
Fees, fines and permits	36.0
<b>TOTAL TAX REVENUES*</b>	<b>1,044.7</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-76 (Orange)  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



Total Jobs in 2017:  
**1,594,265**  
Jobs in At-Risk Sectors:  
**184,267**  
Share of Total:  
**11.6%**

Source: CA EDD

## Placer County

Exhibit 9-77

### Direct Activity of Oil and Gas Industry Placer County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	83	7.5
Mid-stream	187	12.7
Downstream	15	1.6
Market	852	35.4
<b>Total Direct Activity</b>	<b>1,137</b>	<b>57.3</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-78

### Economic Base Placer County Payroll Jobs

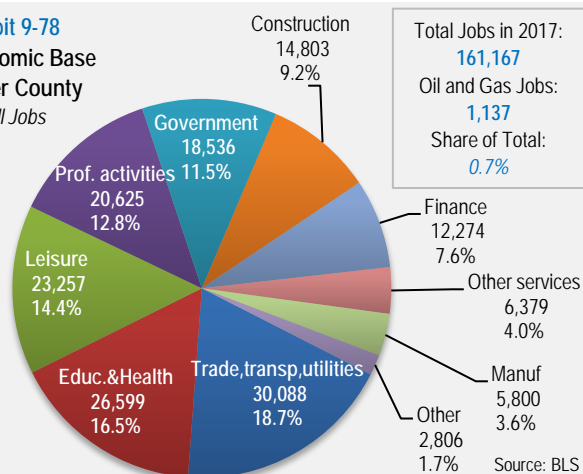


Exhibit 9-79

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Placer County 2017

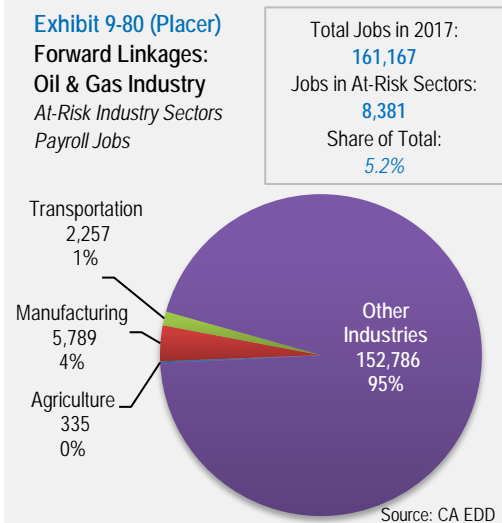
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,137	57.3	119.9	303.6
Indirect	380	22.1	37.1	59.6
Induced	400	19.2	36.5	58.9
<b>TOTAL CONTRIBUTION*</b>	<b>1,910</b>	<b>98.6</b>	<b>193.4</b>	<b>422.1</b>
Percent of County Total	0.8%	0.7%	0.9%	1.2%
Percent of Total CA Contribution	0.5%	0.4%	0.3%	0.3%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	123.8
Property taxes	14.8
Personal income taxes	2.9
Corporate profits taxes	0.8
Social insurance taxes	0.5
DOGGR Assessment	-
Other taxes	2.8
Fees, fines and permits	5.4
<b>TOTAL TAX REVENUES*</b>	<b>150.9</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-80 (Placer)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



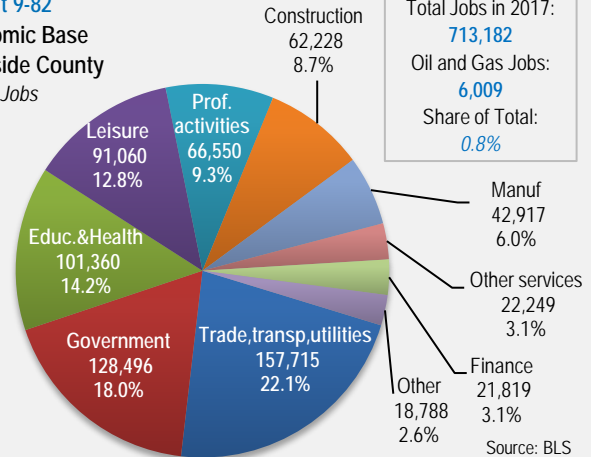
## Riverside County

**Exhibit 9-81**  
Direct Activity of Oil and Gas Industry  
Riverside County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	74	3.2
Mid-stream	932	69.2
Downstream	201	15.8
Market	4,803	152.0
<b>Total Direct Activity</b>	<b>6,009</b>	<b>240.2</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-82**  
Economic Base  
Riverside County  
Payroll Jobs



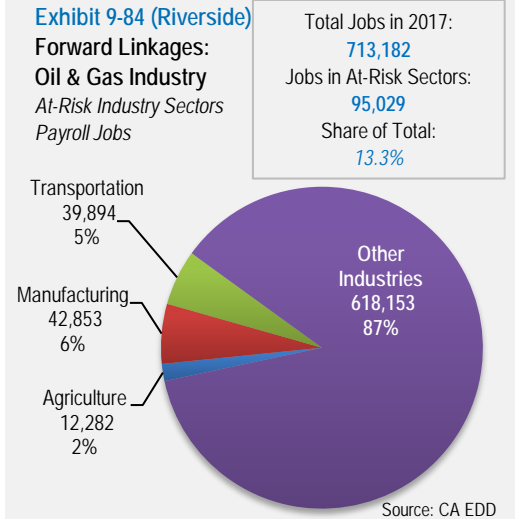
**Exhibit 9-83**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Riverside County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	6,009	240.2	513.2	1,192.7
Indirect	1,640	71.4	120.7	208.9
Induced	1,450	56.6	113.3	192.4
<b>TOTAL CONTRIBUTION*</b>	<b>9,100</b>	<b>368.3</b>	<b>747.2</b>	<b>1,594.0</b>
Percent of County Total	0.9%	0.7%	0.9%	1.1%
Percent of Total CA Contribution	2.5%	1.4%	1.3%	1.0%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	666.6
Property taxes	58.1
Personal income taxes	9.9
Corporate profits taxes	3.4
Social insurance taxes	1.8
DOGGR Assessment	-
Other taxes	9.3
Fees, fines and permits	30.1
<b>TOTAL TAX REVENUES*</b>	<b>779.2</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-84 (Riverside)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs





## Sacramento County

**Exhibit 9-85**

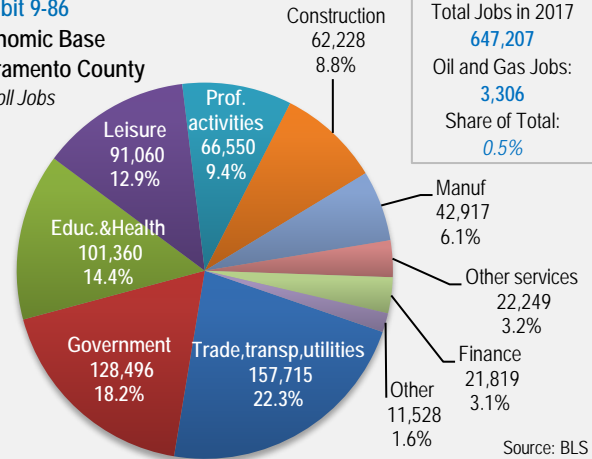
### Direct Activity of Oil and Gas Industry Sacramento County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	143	11.7
Mid-stream	559	51.7
Downstream	105	12.7
Market	2,499	96.4
<b>Total Direct Activity</b>	<b>3,306</b>	<b>172.4</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-86**

### Economic Base Sacramento County Payroll Jobs



Source: BLS

**Exhibit 9-87**

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Sacramento County 2017

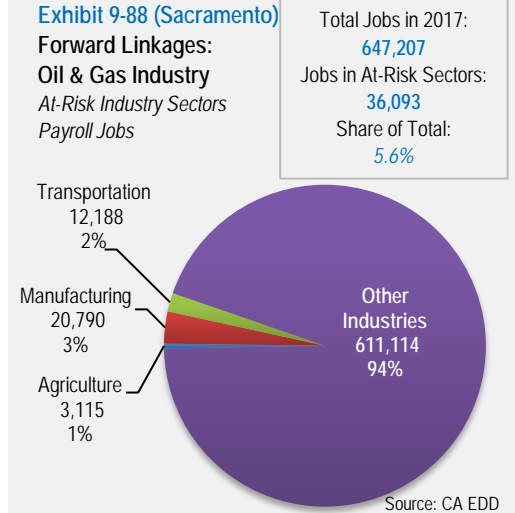
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	3,306	172.4	410.1	1,275.4
Indirect	1,340	82.6	132.2	216.7
Induced	1,200	60.5	113.3	182.4
<b>TOTAL CONTRIBUTION*</b>	<b>5,840</b>	<b>315.6</b>	<b>655.5</b>	<b>1,674.5</b>
Percent of County Total	0.7%	0.5%	0.8%	1.3%
Percent of Total CA Contribution	1.6%	1.2%	1.1%	1.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	370.7
Property taxes	36.2
Personal income taxes	9.0
Corporate profits taxes	3.5
Social insurance taxes	1.5
DOGGR Assessment	0.2
Other taxes	8.8
Fees, fines and permits	17.3
<b>TOTAL TAX REVENUES*</b>	<b>447.0</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-88 (Sacramento)**

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA EDD

## San Bernardino County

Exhibit 9-89

### Direct Activity of Oil and Gas Industry San Bernardino County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	243	10.9
Mid-stream	837	66.6
Downstream	32	3.7
Market	5,881	198.8
<b>Total Direct Activity</b>	<b>6,993</b>	<b>279.9</b>

Source: OCEW; Estimates by LAEDC

Exhibit 9-90

### Economic Base San Bernardino County Payroll Jobs

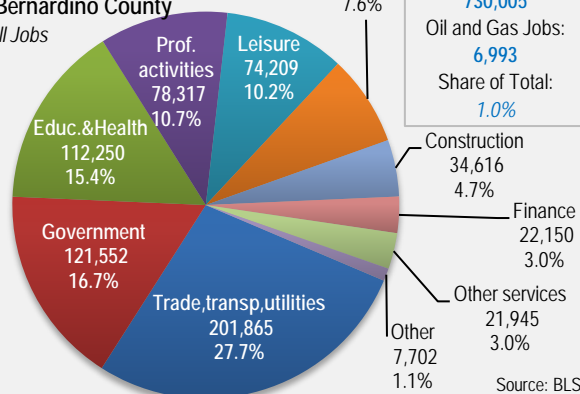


Exhibit 9-91

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution San Bernardino County 2017

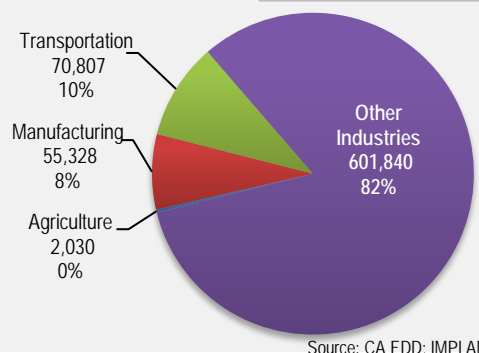
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	6,993	279.9	588.4	1,488.3
Indirect	1,790	79.8	132.3	222.2
Induced	1,610	65.8	125.1	208.7
<b>TOTAL CONTRIBUTION*</b>	<b>10,390</b>	<b>425.5</b>	<b>845.8</b>	<b>1,919.2</b>
Percent of County Total	1.0%	0.8%	1.0%	1.3%
Percent of Total CA Contribution	2.8%	1.6%	1.4%	1.3%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	728.8
Property taxes	77.5
Personal income taxes	12.2
Corporate profits taxes	3.3
Social insurance taxes	2.1
DOGGR Assessment	0.0
Other taxes	14.0
Fees, fines and permits	29.6
<b>TOTAL TAX REVENUES*</b>	<b>867.5</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-92 (San Bernardino)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## San Diego County

Exhibit 9-93

### Direct Activity of Oil and Gas Industry San Diego County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	47	3.3
Mid-stream	609	44.5
Downstream	82	7.2
Market	9,359	684.8
<b>Total Direct Activity</b>	<b>10,097</b>	<b>739.7</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-X

### Economic Base San Diego County Payroll Jobs

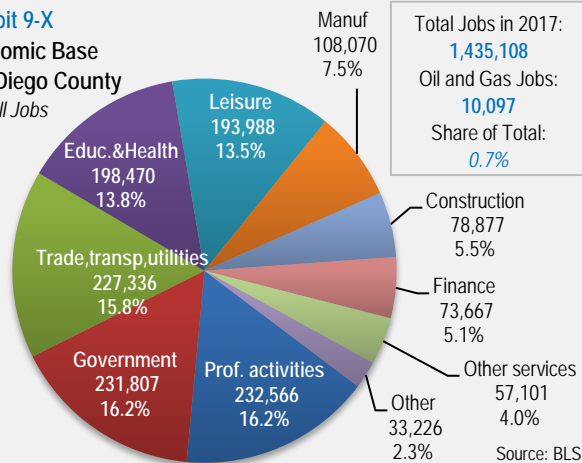


Exhibit 9-72

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution San Diego County 2017

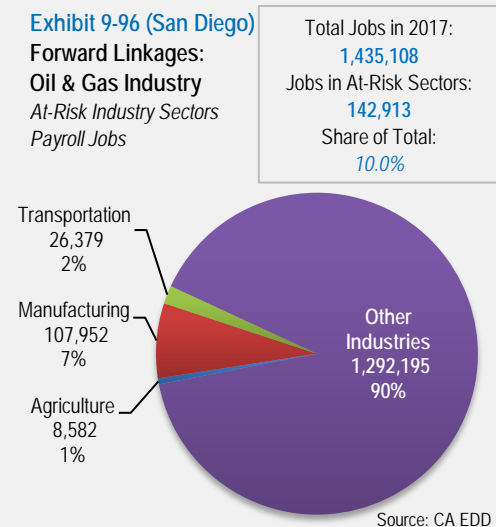
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	10,097	739.8	1,517.5	3,859.5
Indirect	5,260	333.5	540.3	834.8
Induced	5,550	272.2	513.3	825.6
<b>TOTAL CONTRIBUTION*</b>	<b>20,900</b>	<b>1,345.5</b>	<b>2,571.0</b>	<b>5,519.9</b>
Percent of County Total	1.0%	1.0%	1.1%	1.5%
Percent of Total CA Contribution	5.7%	5.1%	4.3%	3.6%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	946.7
Property taxes	219.5
Personal income taxes	40.2
Corporate profits taxes	8.9
Social insurance taxes	6.6
DOGGR Assessment	-
Other taxes	38.4
Fees, fines and permits	39.9
<b>TOTAL TAX REVENUES*</b>	<b>1,300.2</b>

\* May not sum due to rounding  
 Source: Estimates by LAEDC

Exhibit 9-96 (San Diego)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## San Francisco County

Exhibit 9-97

### Direct Activity of Oil and Gas Industry San Francisco County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	3	0.6
Mid-stream	12	0.5
Downstream	3	0.7
Market	1,570	202.2
<b>Total Direct Activity</b>	<b>1,589</b>	<b>203.9</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-98

### Economic Base San Francisco County Payroll Jobs

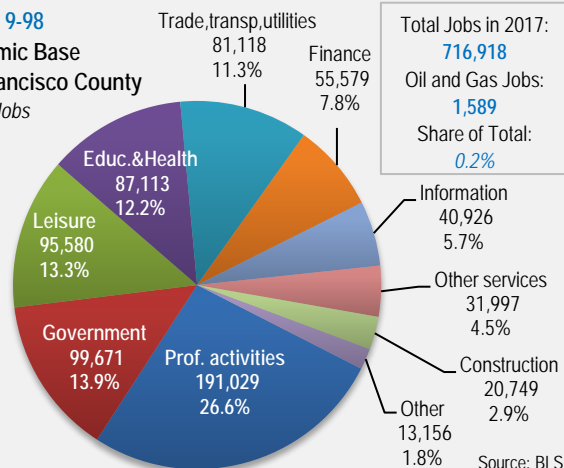


Exhibit 9-99

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution San Francisco County 2017

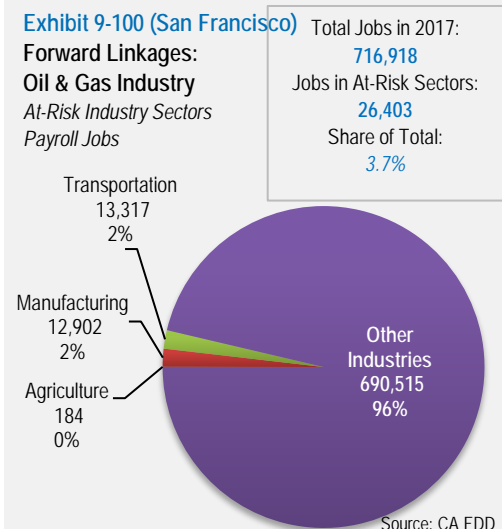
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,589	203.9	367.3	981.9
Indirect	550	73.3	114.3	146.8
Induced	460	36.8	64.5	91.1
<b>TOTAL CONTRIBUTION*</b>	<b>2,600</b>	<b>314.0</b>	<b>546.1</b>	<b>1,219.9</b>
Percent of County Total	0.3%	0.3%	0.3%	0.5%
Percent of Total CA Contribution	0.7%	1.2%	0.9%	0.8%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	180.8
Property taxes	75.6
Personal income taxes	22.8
Corporate profits taxes	4.4
Social insurance taxes	2.5
DOGGR Assessment	-
Other taxes	48.7
Fees, fines and permits	6.3
<b>TOTAL TAX REVENUES*</b>	<b>341.1</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-100 (San Francisco)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## San Joaquin County

Exhibit 9-101

### Direct Activity of Oil and Gas Industry San Joaquin County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	53	6.6
Mid-stream	311	24.2
Downstream	-	-
Market	1,618	59.7
<b>Total Direct Activity</b>	<b>1,981</b>	<b>90.5</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-102

### Economic Base San Joaquin County Payroll Jobs

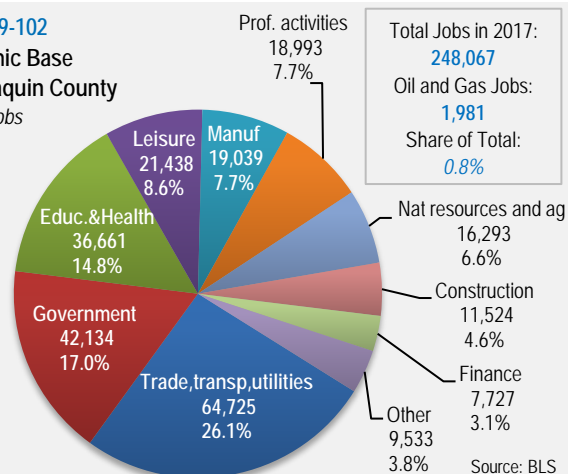


Exhibit 9-103

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution San Joaquin County 2017

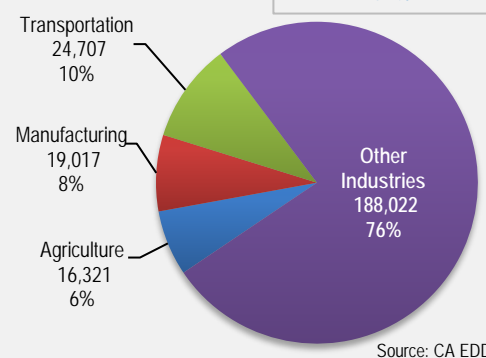
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,981	90.5	176.5	381.6
Indirect	490	22.9	38.3	64.1
Induced	450	19.6	37.8	61.3
<b>TOTAL CONTRIBUTION*</b>	<b>2,920</b>	<b>133.1</b>	<b>252.6</b>	<b>507.0</b>
Percent of County Total	0.9%	0.7%	0.9%	1.0%
Percent of Total CA Contribution	0.8%	0.5%	0.4%	0.3%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	267.6
Property taxes	21.2
Personal income taxes	3.9
Corporate profits taxes	1.1
Social insurance taxes	0.6
DOGGR Assessment	0.1
Other taxes	4.8
Fees, fines and permits	12.0
<b>TOTAL TAX REVENUES*</b>	<b>311.4</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-104 (San Joaquin)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs





## San Luis Obispo County

Exhibit 9-105

### Direct Activity of Oil and Gas Industry San Luis Obispo County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	379	23.1
Mid-stream	237	11.9
Downstream	46	7.9
Market	637	27.1
<b>Total Direct Activity</b>	<b>1,298</b>	<b>70.0</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-106

### Economic Base San Luis Obispo County Payroll Jobs

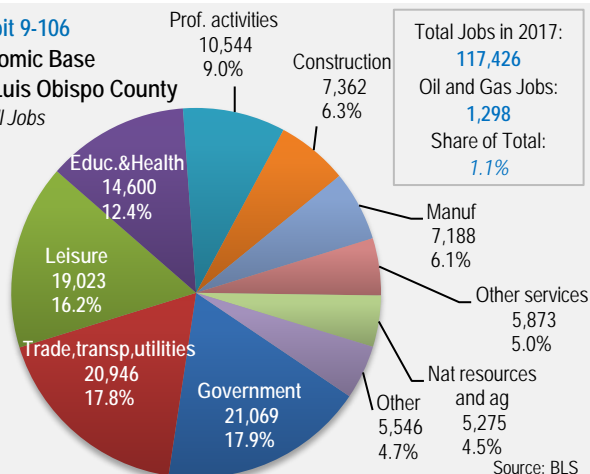


Exhibit 9-107

### Total Economic and Fiscal Contribution of Oil and Gas Industry San Luis Obispo County 2017

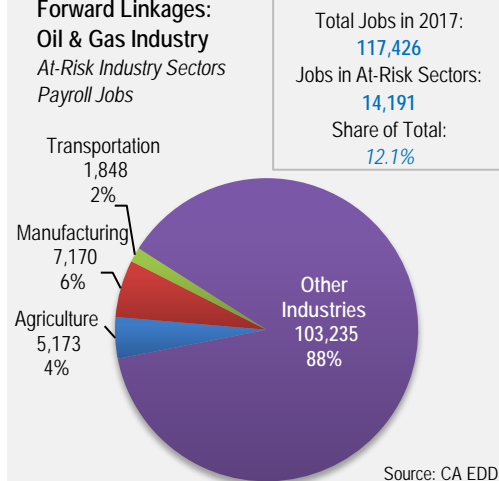
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,298	70.0	181.1	620.9
Indirect	520	25.8	41.3	72.7
Induced	420	17.7	34.4	56.8
<b>TOTAL CONTRIBUTION*</b>	<b>2,240</b>	<b>113.5</b>	<b>256.9</b>	<b>750.4</b>
Percent of County Total	1.3%	1.3%	1.7%	2.9%
Percent of Total CA Contribution	0.6%	0.4%	0.4%	0.5%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	97.5
Property taxes	15.9
Personal income taxes	3.0
Corporate profits taxes	1.2
Social insurance taxes	0.5
DOGGR Assessment	0.3
Other taxes	2.2
Fees, fines and permits	3.9
<b>TOTAL TAX REVENUES*</b>	<b>124.5</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-108 (San Luis Obispo)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## San Mateo County

Exhibit 9-109

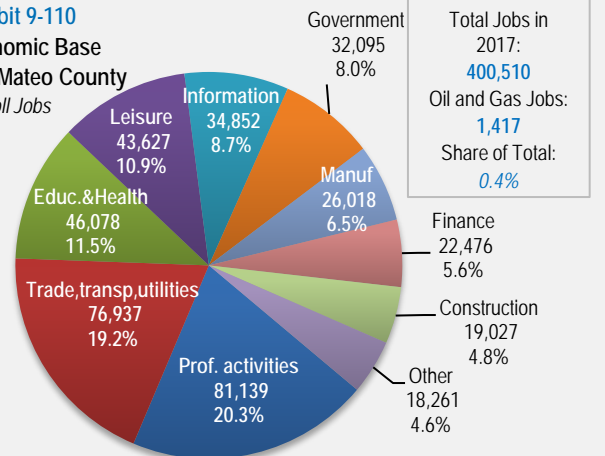
### Direct Activity of Oil and Gas Industry San Mateo County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	75	2.6
Mid-stream	28	3.1
Downstream	133	22.7
Market	1,253	41.2
<b>Total Direct Activity</b>	<b>1,417</b>	<b>69.5</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-110

### Economic Base San Mateo County Payroll Jobs



Source: BLS

Exhibit 9-111

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution San Mateo County 2017

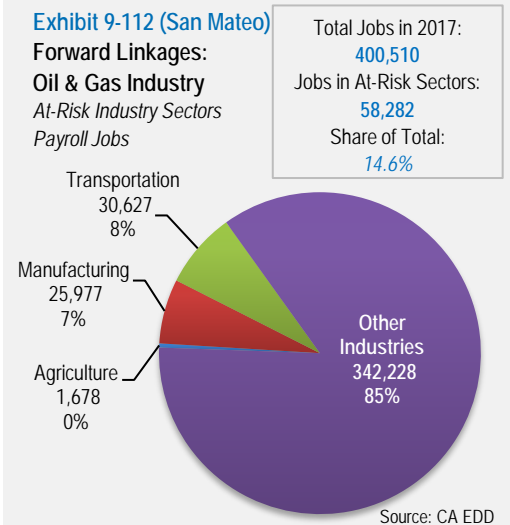
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,417	67.0	306.7	1,179.8
Indirect	520	51.8	78.4	112.4
Induced	250	17.7	31.4	45.7
<b>TOTAL CONTRIBUTION*</b>	<b>2,190</b>	<b>136.6</b>	<b>416.5</b>	<b>1,337.9</b>
Percent of County Total	0.4%	0.2%	0.4%	0.8%
Percent of Total CA Contribution	0.6%	0.5%	0.7%	0.9%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	185.3
Property taxes	17.2
Personal income taxes	4.0
Corporate profits taxes	3.2
Social insurance taxes	0.6
DOGGR Assessment	0.0
Other taxes	4.0
Fees, fines and permits	7.5
<b>TOTAL TAX REVENUES*</b>	<b>221.9</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-112 (San Mateo)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA EDD

## Santa Barbara County

Exhibit 9-113

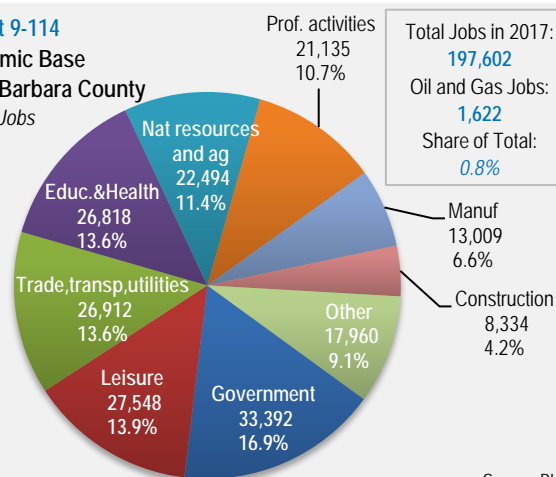
### Direct Activity of Oil and Gas Industry Santa Barbara County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	748	73.4
Mid-stream	66	5.7
Downstream	26	1.8
Market	781	34.4
<b>Total Direct Activity</b>	<b>1,622</b>	<b>115.3</b>

Source: OCEW; Estimates by LAEDC

Exhibit 9-114

### Economic Base Santa Barbara County Payroll Jobs



Source: BLS

Exhibit 9-115

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Santa Barbara County 2015

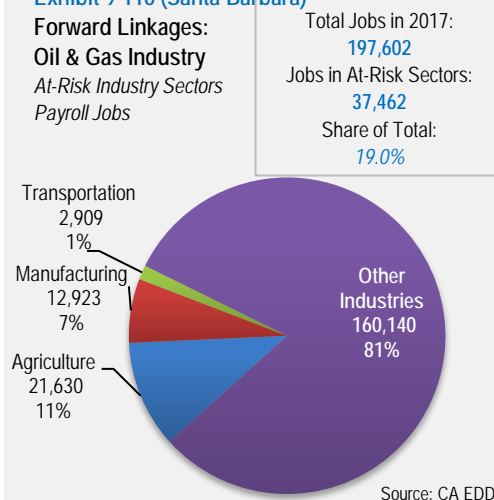
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,622	115.3	293.9	640.8
Indirect	430	27.6	42.2	69.2
Induced	610	31.5	56.0	89.4
<b>TOTAL CONTRIBUTION*</b>	<b>2,670</b>	<b>174.4</b>	<b>392.0</b>	<b>799.3</b>
Percent of County Total	1.0%	1.0%	1.5%	1.8%
Percent of Total CA Contribution	0.7%	0.7%	0.7%	0.5%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	112.5
Property taxes	19.6
Personal income taxes	5.1
Corporate profits taxes	1.9
Social insurance taxes	0.8
DOGGR Assessment	1.9
Other taxes	3.7
Fees, fines and permits	5.0
<b>TOTAL TAX REVENUES*</b>	<b>150.6</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-116 (Santa Barbara)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA EDD

## Santa Clara County

**Exhibit 9-117**

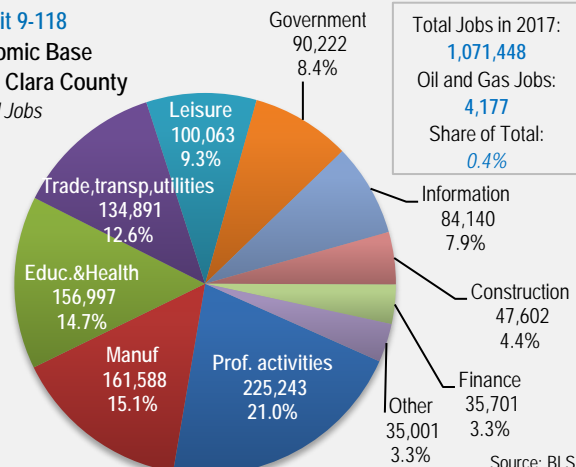
### Direct Activity of Oil and Gas Industry Santa Clara County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	268	16.2
Mid-stream	425	32.6
Downstream	4	0.1
Market	3,480	215.4
<b>Total Direct Activity</b>	<b>4,177</b>	<b>264.3</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-118**

### Economic Base Santa Clara County Payroll Jobs



Source: BLS

**Exhibit 9-119**

### Backward Linkages: Total Economic and Fiscal Contribution of Oil and Gas Industry Santa Clara County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	4,177	265.6	528.4	1,286.8
Indirect	1,160	115.7	182.4	250.0
Induced	830	56.7	102.9	149.6
<b>TOTAL CONTRIBUTION*</b>	<b>6,170</b>	<b>438.1</b>	<b>813.7</b>	<b>1,686.4</b>
Percent of County Total	0.4%	0.2%	0.3%	0.4%
Percent of Total CA Contribution	1.7%	1.7%	1.4%	1.1%

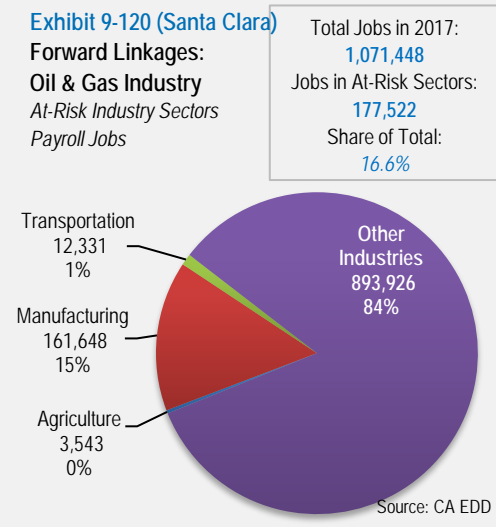
FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	421.6
Property taxes	66.4
Personal income taxes	11.3
Corporate profits taxes	3.0
Social insurance taxes	2.2
DOGGR Assessment	0.0
Other taxes	15.2
Fees, fines and permits	16.9
<b>TOTAL TAX REVENUES*</b>	<b>536.6</b>

\* May not sum due to rounding

Source: Estimates by LAEDC

**Exhibit 9-120 (Santa Clara)**

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## Shasta County

Exhibit 9-121

### Direct Activity of Oil and Gas Industry Shasta County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	4	1.0
Mid-stream	114	5.9
Downstream	-	-
Market	661	15.2
<b>Total Direct Activity</b>	<b>779</b>	<b>22.0</b>

Source: QCEW; Estimates by LAEDC

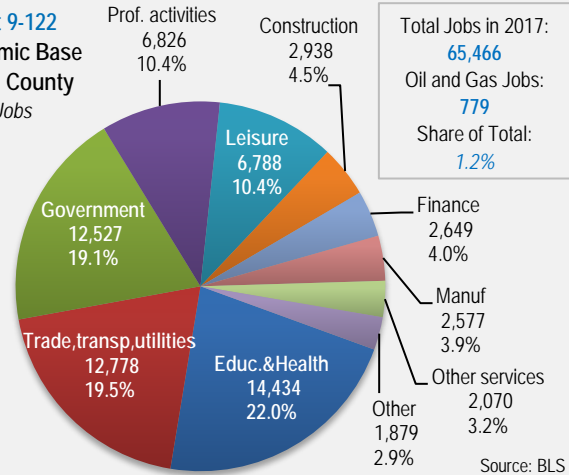
Exhibit 9-122  
Economic Base  
Shasta County  
Payroll Jobs

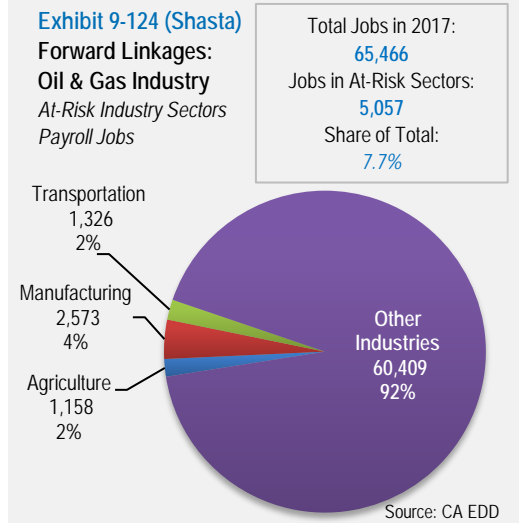
Exhibit 9-123

### Backward Linkages: Total Economic and Fiscal Contribution of Oil and Gas Industry Shasta County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	779	22.0	43.8	94.7
Indirect	150	6.8	10.8	19.0
Induced	150	6.4	11.4	19.1
<b>TOTAL CONTRIBUTION*</b>	<b>1,070</b>	<b>35.2</b>	<b>66.0</b>	<b>132.8</b>
Percent of County Total	1.2%	0.8%	0.9%	1.1%
Percent of Total CA Contribution	0.3%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	67.8
Property taxes	5.7
Personal income taxes	1.0
Corporate profits taxes	0.1
Social insurance taxes	0.2
DOGGR Assessment	-
Other taxes	1.1
Fees, fines and permits	2.5
<b>TOTAL TAX REVENUES*</b>	<b>78.4</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-124 (Shasta)  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs

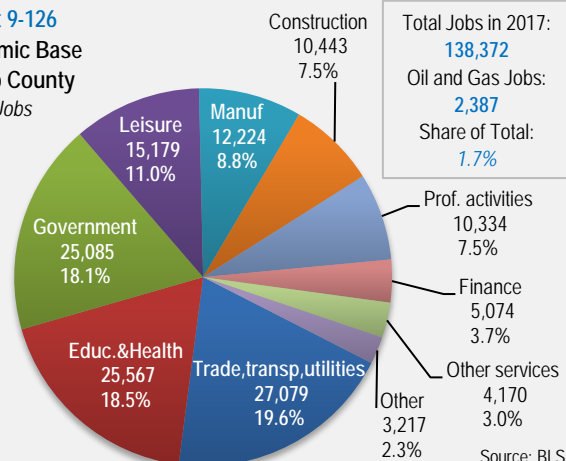
## Solano County

**Exhibit 9-125**  
Direct Activity of Oil and Gas Industry  
Solano County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	246	20.6
Mid-stream	261	21.4
Downstream	406	68.8
Market	1,474	82.4
<b>Total Direct Activity</b>	<b>2,387</b>	<b>193.3</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-126**  
Economic Base  
Solano County  
Payroll Jobs



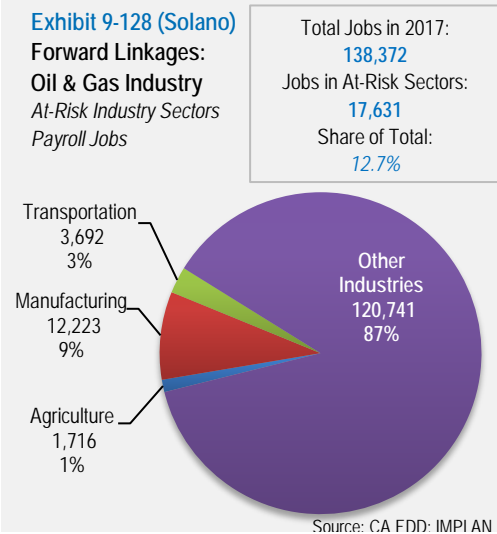
**Exhibit 9-127**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Solano County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	2,387	193.3	920.2	3,200.7
Indirect	1,200	69.0	109.6	182.3
Induced	900	37.6	78.1	124.8
<b>TOTAL CONTRIBUTION*</b>	<b>4,490</b>	<b>300.0</b>	<b>1,107.9</b>	<b>3,507.9</b>
Percent of County Total	2.3%	2.4%	4.5%	8.6%
Percent of Total CA Contribution	1.2%	1.1%	1.9%	2.3%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	157.1
Property taxes	39.8
Personal income taxes	8.4
Corporate profits taxes	8.3
Social insurance taxes	1.5
DOGGR Assessment	0.1
Other taxes	9.0
Fees, fines and permits	7.1
<b>TOTAL TAX REVENUES*</b>	<b>231.2</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

**Exhibit 9-128 (Solano)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs





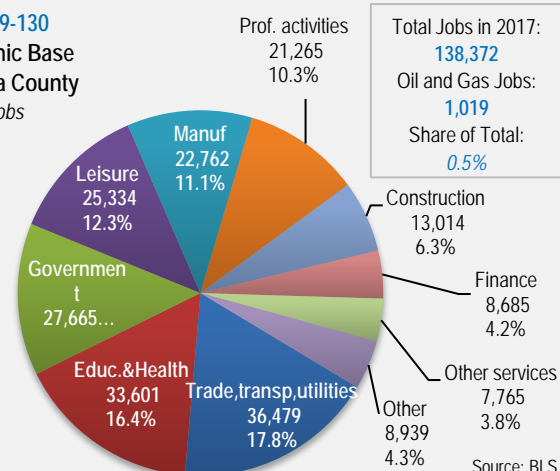
## Sonoma County

**Exhibit 9-129**  
Direct Activity of Oil and Gas Industry  
Sonoma County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	18	1.3
Mid-stream	55	3.7
Downstream	9	0.6
Market	937	32.6
<b>Total Direct Activity</b>	<b>1,019</b>	<b>38.2</b>

Source: QCEW; Estimates by LAEDC

**Exhibit 9-130**  
Economic Base  
Sonoma County  
Payroll Jobs



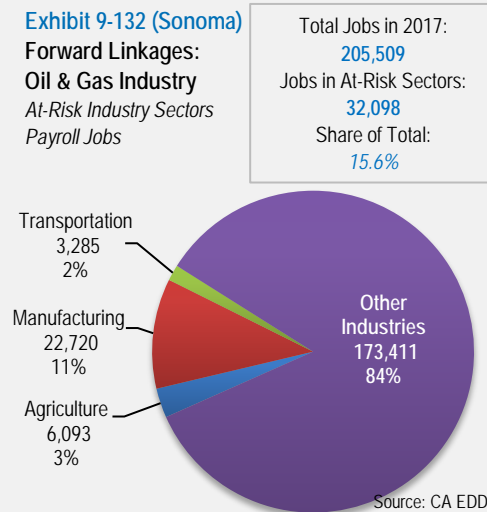
**Exhibit 9-131**  
Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Sonoma County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,019	37.7	74.4	223.9
Indirect	260	15.0	25.3	40.4
Induced	240	11.7	21.8	35.0
<b>TOTAL CONTRIBUTION*</b>	<b>1,520</b>	<b>64.3</b>	<b>121.5</b>	<b>299.3</b>
Percent of County Total	0.5%	0.4%	0.4%	0.6%
Percent of Total CA Contribution	0.4%	0.2%	0.2%	0.2%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	158.9
Property taxes	11.7
Personal income taxes	2.1
Corporate profits taxes	0.4
Social insurance taxes	0.2
DOGGR Assessment	-
Other taxes	2.4
Fees, fines and permits	6.7
<b>TOTAL TAX REVENUES*</b>	<b>182.3</b>

\* May not sum due to rounding  
 Source: Estimates by LAEDC

**Exhibit 9-132 (Sonoma)**  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



## Stanislaus County

Exhibit 9-133

### Direct Activity of Oil and Gas Industry Stanislaus County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	16	0.3
Mid-stream	274	15.7
Downstream	41	4.4
Market	1,019	33.9
<b>Total Direct Activity</b>	<b>1,349</b>	<b>54.3</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-134

### Economic Base Stanislaus County Payroll Jobs

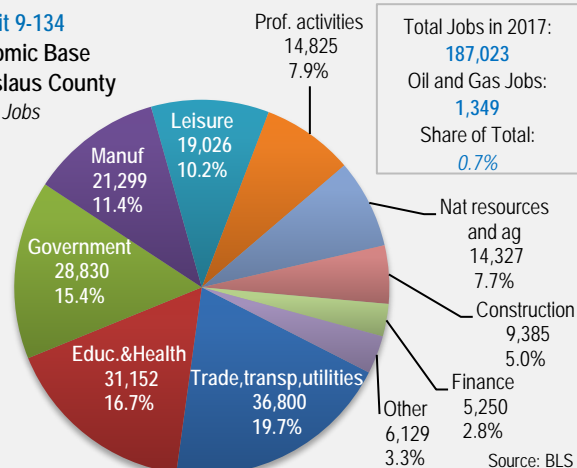


Exhibit 9-135

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Stanislaus County 2017

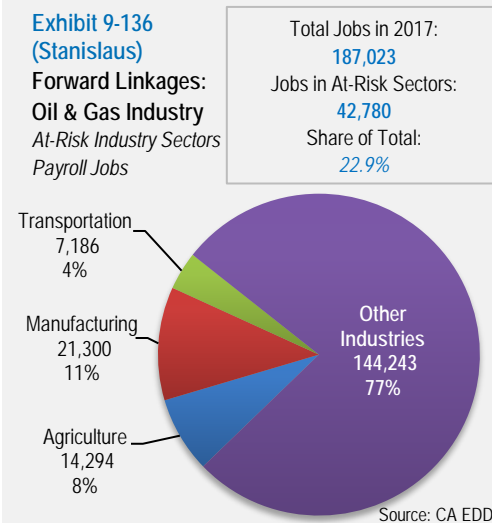
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,349	54.3	138.0	446.1
Indirect	420	20.3	33.8	58.1
Induced	330	14.5	26.6	43.5
<b>TOTAL CONTRIBUTION*</b>	<b>2,100</b>	<b>89.1</b>	<b>198.4</b>	<b>547.7</b>
Percent of County Total	0.8%	0.6%	0.9%	1.3%
Percent of Total CA Contribution	0.6%	0.3%	0.3%	0.4%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	39.8
Property taxes	12.3
Personal income taxes	2.7
Corporate profits taxes	1.0
Social insurance taxes	0.4
DOGGR Assessment	0.0
Other taxes	3.3
Fees, fines and permits	2.2
<b>TOTAL TAX REVENUES*</b>	<b>61.8</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-136  
(Stanislaus)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## Sutter County

Exhibit 9-137

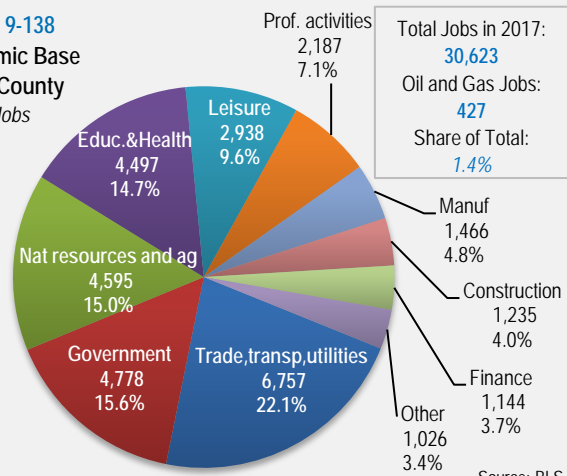
### Direct Activity of Oil and Gas Industry Sutter County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	79	7.3
Mid-stream	144	9.3
Downstream	-	-
Market	205	4.9
<b>Total Direct Activity</b>	<b>427</b>	<b>21.4</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-138

### Economic Base Sutter County Payroll Jobs



Source: BLS

Exhibit 9-139

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Sutter County 2017

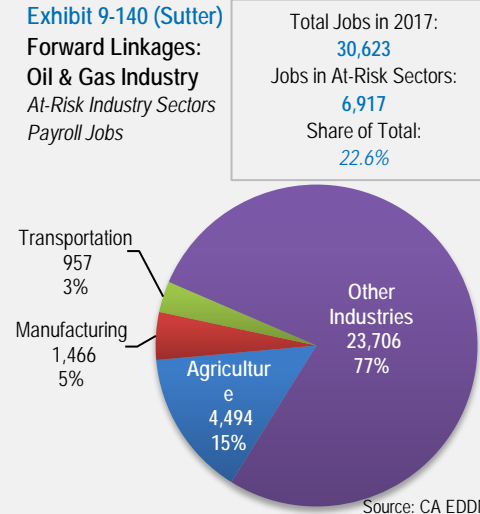
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	427	21.4	43.9	80.0
Indirect	70	3.3	6.0	10.3
Induced	100	4.3	8.6	14.1
<b>TOTAL CONTRIBUTION*</b>	<b>600</b>	<b>29.0</b>	<b>58.5</b>	<b>104.4</b>
Percent of County Total	1.4%	1.4%	1.7%	1.7%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	38.6
Property taxes	2.3
Personal income taxes	0.8
Corporate profits taxes	0.3
Social insurance taxes	0.1
DOGGR Assessment	0.2
Other taxes	0.7
Fees, fines and permits	1.6
<b>TOTAL TAX REVENUES*</b>	<b>44.7</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-140 (Sutter)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA EDDN

## Tehama County

Exhibit 9-141

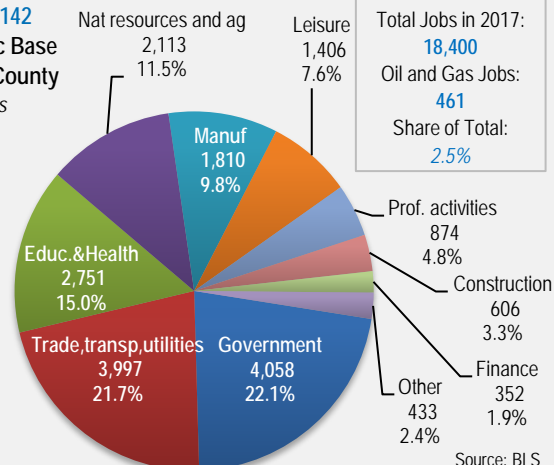
### Direct Activity of Oil and Gas Industry Tehama County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	4	0.3
Mid-stream	14	0.6
Downstream	-	-
Market	443	20.3
<b>Total Direct Activity</b>	<b>461</b>	<b>21.3</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-142

### Economic Base Tehama County Payroll Jobs



Source: BLS

Exhibit 9-143

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Tehama County 2017

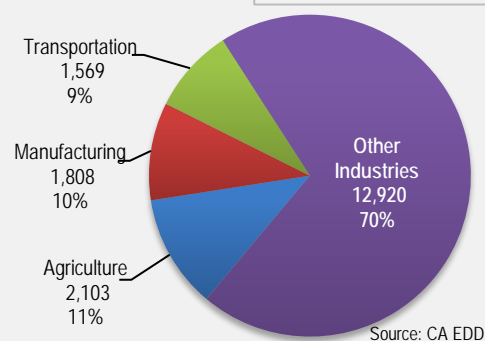
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	461	21.3	41.5	90.6
Indirect	90	3.7	5.6	10.2
Induced	70	2.9	6.0	10.1
<b>TOTAL CONTRIBUTION*</b>	<b>620</b>	<b>27.9</b>	<b>53.1</b>	<b>110.8</b>
Percent of County Total	2.5%	2.2%	2.8%	3.2%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	8.8
Property taxes	5.2
Personal income taxes	0.8
Corporate profits taxes	0.2
Social insurance taxes	0.1
DOGGR Assessment	0.0
Other taxes	1.1
Fees, fines and permits	0.3
<b>TOTAL TAX REVENUES*</b>	<b>16.6</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-144 (Tehama)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



Source: CA EDD

## Tulare County

Exhibit 9-145

### Direct Activity of Oil and Gas Industry Tulare County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	36	2.0
Mid-stream	243	19.9
Downstream	-	-
Market	1,068	34.8
<b>Total Direct Activity</b>	<b>1,347</b>	<b>56.6</b>

Source: QCEW; Estimates by LAEDC

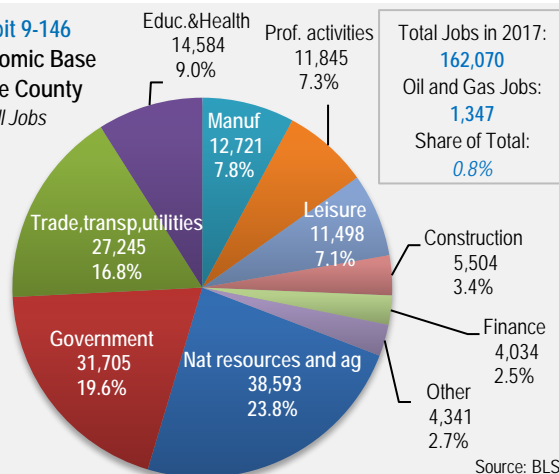
Exhibit 9-146  
Economic Base  
Tulare County  
Payroll Jobs

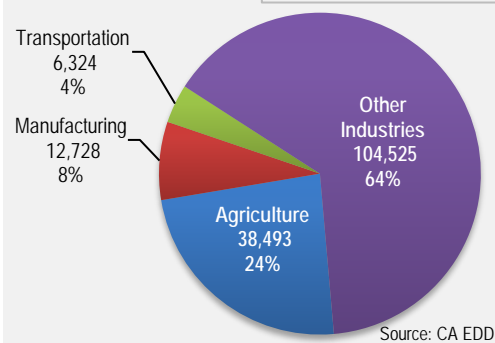
Exhibit 9-147

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Tulare County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	1,347	58.1	113.1	245.5
Indirect	330	14.9	24.2	41.5
Induced	250	9.8	19.7	33.5
<b>TOTAL CONTRIBUTION*</b>	<b>1,930</b>	<b>82.8</b>	<b>157.1</b>	<b>320.4</b>
Percent of County Total	0.9%	0.8%	0.9%	1.0%
Percent of Total CA Contribution	0.5%	0.3%	0.3%	0.2%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	33.2
Property taxes	13.6
Personal income taxes	2.5
Corporate profits taxes	0.6
Social insurance taxes	0.4
DOGGR Assessment	0.0
Other taxes	3.4
Fees, fines and permits	1.7
<b>TOTAL TAX REVENUES*</b>	<b>55.4</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-148 (Tulare)  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs

## Ventura County

Exhibit 9-149

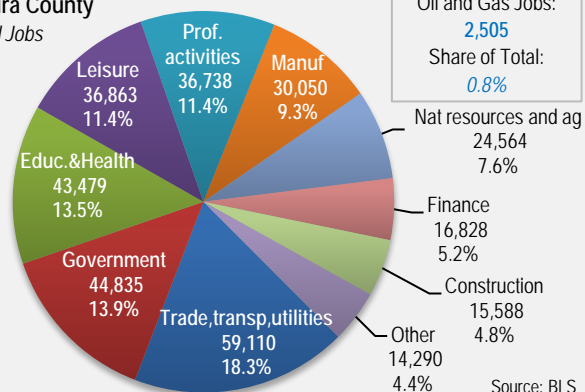
### Direct Activity of Oil and Gas Industry Ventura County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	906	81.9
Mid-stream	191	11.5
Downstream	9	0.8
Market	1,399	55.4
<b>Total Direct Activity</b>	<b>2,505</b>	<b>149.6</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-150

### Economic Base Ventura County Payroll Jobs



Total Jobs in 2017:  
**322,345**  
Oil and Gas Jobs:  
**2,505**  
Share of Total:  
**0.8%**

Source: BLS

Exhibit 9-152

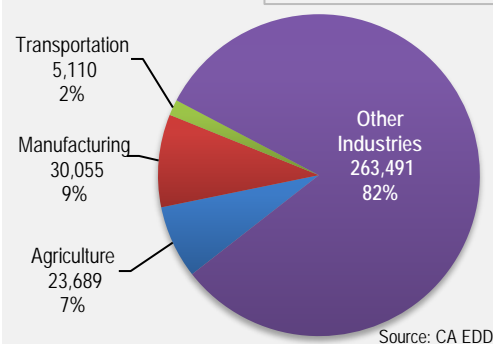
### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Ventura County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	2,505	149.6	367.1	760.2
Indirect	670	38.2	61.6	100.9
Induced	840	38.4	73.8	121.2
<b>TOTAL CONTRIBUTION*</b>	<b>4,010</b>	<b>226.2</b>	<b>502.6</b>	<b>982.4</b>
Percent of County Total	0.9%	0.8%	1.1%	1.3%
Percent of Total CA Contribution	1.1%	0.9%	0.8%	0.6%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	99.4
Property taxes	78.4
Personal income taxes	6.7
Corporate profits taxes	2.8
Social insurance taxes	1.1
DOGGR Assessment	3.8
Other taxes	5.0
Fees, fines and permits	4.7
<b>TOTAL TAX REVENUES*</b>	<b>201.9</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-152 (Ventura)  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



Total Jobs in 2017:  
**322,345**  
Jobs in At-Risk Sectors:  
**58,854**  
Share of Total:  
**18.3%**

Source: CA EDD



## Yolo County

Exhibit 9-153

### Direct Activity of Oil and Gas Industry Yolo County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	49	2.8
Mid-stream	90	7.5
Downstream	-	-
Market	400	11.7
<b>Total Direct Activity</b>	<b>538</b>	<b>22.0</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-154

### Economic Base Yolo County

Payroll Jobs

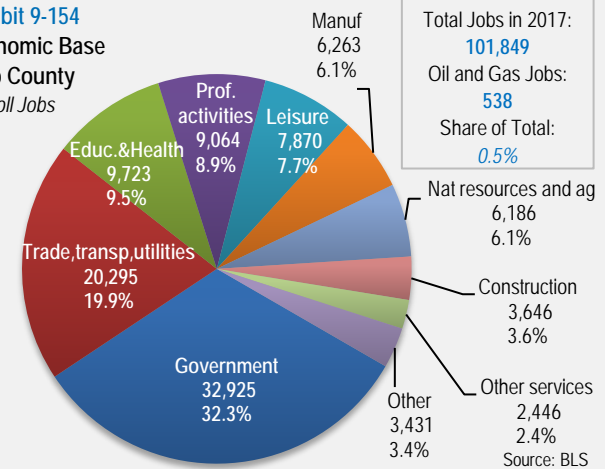


Exhibit 9-155

### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Yolo County 2015

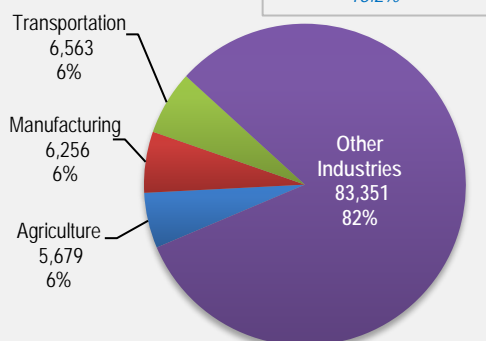
ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	538	22.0	38.7	80.8
Indirect	100	5.7	9.6	15.4
Induced	80	3.5	7.1	11.2
<b>TOTAL CONTRIBUTION*</b>	<b>720</b>	<b>31.3</b>	<b>55.4</b>	<b>107.5</b>
Percent of County Total	0.5%	0.3%	0.4%	0.5%
Percent of Total CA Contribution	0.2%	0.1%	0.1%	0.1%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	26.4
Property taxes	4.4
Personal income taxes	0.8
Corporate profits taxes	0.2
Social insurance taxes	0.2
DOGGR Assessment	0.0
Other taxes	1.4
Fees, fines and permits	1.5
<b>TOTAL TAX REVENUES*</b>	<b>34.8</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-156 (Yolo)

### Forward Linkages: Oil & Gas Industry At-Risk Industry Sectors Payroll Jobs



## Yuba County

Exhibit 9-157

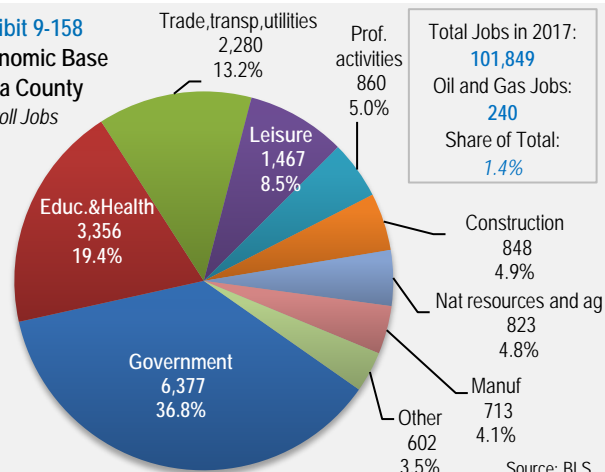
### Direct Activity of Oil and Gas Industry Yuba County

Industry Group	Employment	Labor Income (\$ millions)
Upstream	-	-
Mid-stream	39	1.9
Downstream	-	-
Market	201	6.8
<b>Total Direct Activity</b>	<b>240</b>	<b>8.7</b>

Source: QCEW; Estimates by LAEDC

Exhibit 9-158

### Economic Base Yuba County Payroll Jobs



Total Jobs in 2017:  
**101,849**  
Oil and Gas Jobs:  
**240**  
Share of Total:  
**1.4%**

Source: BLS

Exhibit 9-159

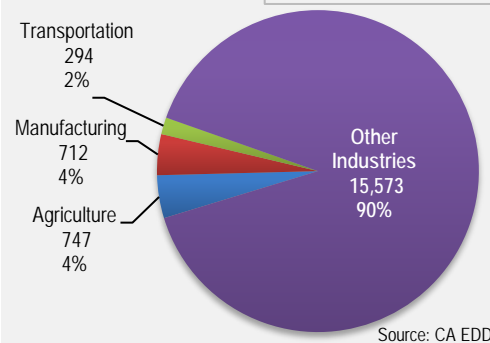
### Backward Linkages: Oil and Gas Industry Total Economic and Fiscal Contribution Yuba County 2017

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	240	8.8	17.1	32.6
Indirect	40	1.5	2.4	4.6
Induced	30	1.2	2.4	4.1
<b>TOTAL CONTRIBUTION*</b>	<b>310</b>	<b>11.5</b>	<b>21.9</b>	<b>41.3</b>
Percent of County Total	1.0%	0.6%	0.7%	0.9%
Percent of Total CA Contribution	0.1%	0.04%	0.04%	0.03%

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	4.5
Property taxes	2.8
Personal income taxes	0.3
Corporate profits taxes	0.1
Social insurance taxes	0.1
DOGGR Assessment	0.0
Other taxes	0.6
Fees, fines and permits	0.6
<b>TOTAL TAX REVENUES*</b>	<b>8.9</b>

\* May not sum due to rounding  
Source: Estimates by LAEDC

Exhibit 9-160 (Yolo)  
Forward Linkages:  
Oil & Gas Industry  
At-Risk Industry Sectors  
Payroll Jobs



Total Jobs in 2017:  
**17,326**  
Jobs in At-Risk Sectors:  
**1,753**  
Share of Total:  
**10.1%**

Source: CA EDD

# Appendix

## Detailed Tables

### *Oil and Gas Wells and Production by County*

The oil and gas production associated with the active wells in California in 2017 by county are displayed in Exhibit A-1 along with select estimated production-based revenues collected by the state.

**Exhibit A-1**

County Oil & Gas Production  
California

County	Total Wells	Active	Idle	Oil Production (BBL)	Gas Production (MCF)	Estimated Value (\$ millions)	Oil Spill Prevention and Administration Fee	DOGGR Assessment
<b>California</b>	<b>81,831</b>	<b>53,120</b>	<b>28,711</b>	<b>174,061,822</b>	<b>162,701,671</b>	<b>\$9,346.82</b>	<b>\$11,314,018</b>	<b>\$95,895,899</b>
Alameda County	8	6	2	8,715	644	\$0.44	\$566	\$4,423
Alpine County								
Amador County								
Butte County	27	16	11					
Calaveras County								
Colusa County	355	168	187		2,896,306	9.0		145,926
Contra Costa County	53	22	31	55	81,830	0.3	4	4,151
Del Norte County								
El Dorado County								
Fresno County	3,697	1,984	1,713	7,067,233	513,253	360.6	459,370	3,586,578
Glenn County	308	200	108		3,282,766	10.2		165,397
Humboldt County	55	26	29		417,445	1.3		21,032
Imperial County								
Inyo County								
Kern County	60,307	40,480	19,827	123,752,181	114,644,426	6,642.1	8,043,892	68,126,854
Kings County	346	145	201	116,331	94,504	6.2	7,562	63,373
Lake County								
Lassen County	6		6					
Los Angeles County	5,270	3,359	1,911	19,814,335	9,671,173	1,036.6	1,287,932	10,470,421
Madera County	32	18	14		407,416	1.3		20,527
Marin County								
Mariposa County								
Mendocino County								
Merced County	2		2					
Modoc County								
Mono County								
Monterey County	1,103	690	413	7,476,885	1,015,500	383.0	485,998	3,818,280
Napa County								
Nevada County								
Orange County	1,469	948	521	3,942,372	1,834,760	206.0	256,254	2,078,746
Placer County								
Plumas County								
Riverside County								
Sacramento County	209	90	119	9,543	3,783,160	12.2	620	195,417
San Benito County	47	19	28	749,700	6,743,776	59.0	48,731	717,500

## Exhibit A-1 (Cont'd)

County	Total Wells	Active	Idle	Oil Production (BBL)	Gas Production (MCF)	Estimated Value (\$ millions)	Oil Spill Prevention and Administration Fee	DOGGR Assessment
San Bernardino County	38	18	20	7,865	5,130	0.4	511	4,221
San Diego County								
San Francisco County								
San Joaquin County	230	134	96		1,341,882	4.2		67,609
San Luis Obispo County	347	216	131	604,308	490,570	32.2	39,280	329,188
San Mateo County	24	8	16	4			3	26
Santa Barbara County	2,216	1,026	1,190	2,363,390	6,180,580	183.7	225,540	1,868,574
Santa Clara County	18	13	5	17,911	16,261	1.2	1,538	11,970
Santa Cruz County								
Shasta County								
Sierra County								
Siskiyou County								
Solano County	230	100	130	2,163	12,154,200	5.4	130	86,744
Sonoma County								
Stanislaus County	2		2					1
Sutter County	415	213	202		3,021,630	12.6		204,187
Tehama County	152	92	60		388,085	2.3		37,659
Trinity County								
Tulare County	87	75	12	26,026		1.4	1,853	14,367
Tuolumne County						0.0		
Ventura County	3,029	1,236	1,793	6,951,220	4,596,710	375.2	454,230	3,848,556
Yolo County	78	18	60		1,098,080	0.3	5	4,125
Yuba County	1	1			31			44

Source: CA DOGGR, estimates by LAEDC

### Gasoline and Diesel Sales by County

The number of fuel stations and the estimated gasoline and diesel sales in California in 2017 by county are displayed in Exhibit A-2 along with select estimated retail-based fiscal revenues.

Exhibit A-2

#### County Gasoline and Diesel Sales and Related Taxes California

County	# of Fuel Stations	Gasoline Sales (million gallons)	Diesel Sales (million gallons)	Estimated Gasoline and Diesel Sales (\$ millions)	Estimated Sales Tax (\$ millions)	California Excise Tax (\$ millions)	Underground Storage Tank Fee (\$ millions)	Federal Excise Tax (\$ millions)
California	10,353	15,584	1,937	\$52,295	\$4,307.6	\$5,023.9	\$350.4	\$3,340.1
Alameda County	378	583	58	\$1,916	\$177.3	\$182.8	\$12.8	\$121.4
Alpine County		0	0	0	0.0	0.0	0.0	0.0
Amador County	25	15	2	51	3.9	4.9	0.3	3.2
Butte County	99	87	13	298	21.6	28.8	2.0	19.2
Calaveras County	28	15	3	53	3.9	5.2	0.4	3.5
Colusa County	20	12	3	44	3.4	4.4	0.3	2.9
Contra Costa County	281	430	28	1,373	113.2	129.5	9.2	86.0
Del Norte County	13	7	2	27	2.0	2.7	0.2	1.8
El Dorado County	78	82	10	275	19.9	26.4	1.8	17.5
Fresno County	341	367	45	1,230	98.1	118.1	8.2	78.5
Glenn County	23	18	19	107	7.7	11.8	0.7	7.9
Humboldt County	74	55	9	191	14.8	18.5	1.3	12.3
Imperial County	78	83	12	283	21.9	27.4	1.9	18.2
Inyo County	21	18	4	65	5.1	6.4	0.4	4.3
Kern County	356	390	121	1,509	109.4	151.6	10.2	101.3
Kings County	58	60	7	200	14.5	19.2	1.3	12.7
Lake County	38	21	3	72	5.2	6.9	0.5	4.6
Lassen County	20	6	1	21	1.5	2.0	0.1	1.3
Los Angeles County	2,076	3,659	301	11,853	1126.1	1124.7	79.2	746.7
Madera County	70	62	33	278	21.5	29.0	1.9	19.5
Marin County	61	101	4	315	26.0	29.5	2.1	19.6
Mariposa County	19	6	1	21	1.6	2.0	0.1	1.3
Mendocino County	51	38	6	131	10.3	12.7	0.9	8.5
Merced County	106	117	42	468	36.3	0.0	3.2	31.8
Modoc County		0	0	0	0.0	0.0	0.0	0.0
Mono County	18	5	1	18	1.3	1.7	0.1	1.2
Monterey County	140	174	27	599	46.4	58.0	4.0	38.6
Napa County	37	53	7	179	13.9	17.2	1.2	11.5
Nevada County	44	39	9	142	10.7	14.1	1.0	9.4
Orange County	674	1,382	61	4,331	335.7	406.0	28.9	269.2
Placer County	131	203	17	658	47.7	62.5	4.4	41.5
Plumas County	21	6	2	24	1.7	2.4	0.2	1.6
Riverside County	572	1,052	148	3,578	277.3	345.3	24.0	229.7
Sacramento County	384	599	48	1,937	150.1	183.7	12.9	121.9
San Benito County	16	20	0	60	5.0	5.6	0.4	3.7
San Bernardino County	613	993	265	3,723	288.6	370.7	25.2	247.4
San Diego County	779	1,377	103	4,432	343.5	419.6	29.6	278.5
San Francisco County	93	134	6	420	35.7	39.4	2.8	26.1
San Joaquin County	238	347	126	1,393	108.0	141.4	9.5	94.6
San Luis Obispo County	107	142	21	486	35.2	47.0	3.3	31.3
San Mateo County	196	326	17	1,029	90.0	96.7	6.9	64.1
Santa Barbara County	125	170	19	565	43.8	54.0	3.8	35.9
Santa Clara County	399	685	36	2,163	194.7	203.3	14.4	134.8
Santa Cruz County	81	94	6	300	25.5	28.3	2.0	18.8
Shasta County	140	92	25	346	25.1	34.5	2.3	23.0
Sierra County	45	29	21	145	10.5	15.6	1.0	10.5

## Exhibit A-2 (Cont'd)

County	# of Fuel Stations	Gasoline Sales (million gallons)	Diesel Sales (million gallons)	Estimated Gasoline and Diesel Sales (\$ millions)	Estimated Sales Tax (\$ millions)	California Excise Tax (\$ millions)	Underground Storage Tank Fee (\$ millions)	Federal Excise Tax (\$ millions)
Siskiyou County	152	217	24	720	52.2	68.9	4.8	45.8
Solano County	149	208	23	690	50.9	66.0	4.6	43.9
Sonoma County	187	253	34	856	70.6	82.5	5.7	54.8
Stanislaus County	41	39	4	129	10.1	12.3	0.9	8.2
Sutter County	42	29	38	192	13.9	21.6	1.3	14.6
Tehama County	18	5	0	15	1.1	1.4	0.1	0.9
Trinity County	219	167	41	616	44.7	61.1	4.2	40.7
Tulare County	35	25	3	84	6.5	8.0	0.6	5.3
Tuolumne County	207	338	36	1,118	81.0	106.8	7.5	71.0
Ventura County	82	113	30	423	30.7	42.1	2.9	28.1
Yolo County	40	34	9	127	9.2	12.7	0.9	8.5
Yuba County	14	2	3	14	1.0	1.6	0.1	1.1

Sources: EIA, CEC, estimates by LAEDC

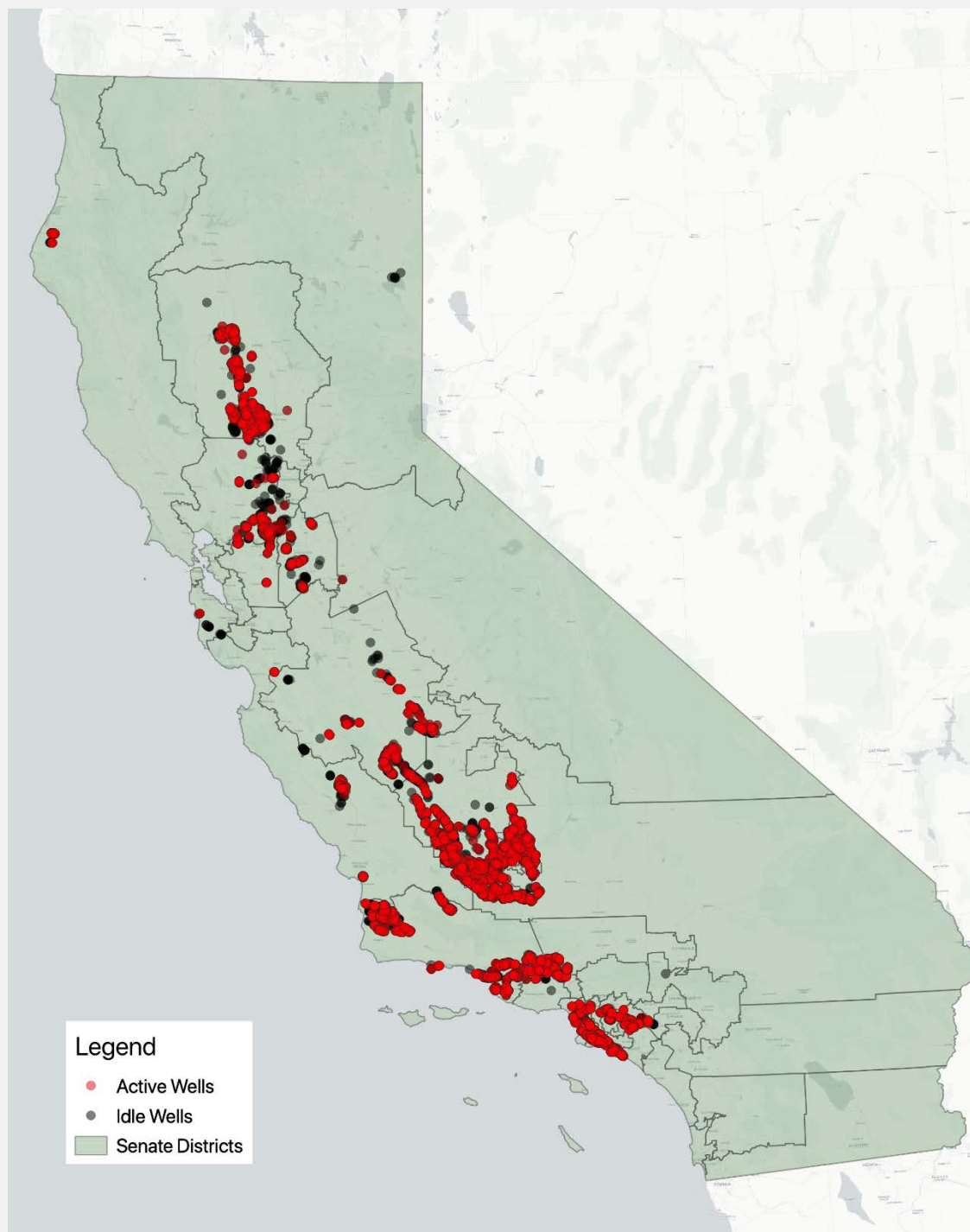


### California Senate Districts

In 2017, there were approximately 53,120 producing oil and gas wells, distributed across the senate districts in California, as illustrated in Exhibit A-3.

Exhibit A-3

Active Oil and Gas Wells in California by Senate District



Sources: DOGGR, LAEDC

Note: Idle wells do not appear separately in this map and may be co-located with active wells.

The oil and gas production associated with the active wells in California in 2017 by senate district are displayed in Exhibit A-4 along with select estimated production-based revenues collected by the state.

**Exhibit A-4****California State Senate Districts Oil & Gas Production**

	Total Wells	Active	Idle	Oil Production (BBL)	Gas Production (MCF)	Estimated Value (\$ millions)	Oil Spill Prevention and Administration Fee (\$)	DOGGR Assessment (\$)
Senate 1	6		6					16,845
Senate 2	52	24	28		334,329	1.0	723	826,123
Senate 3	509	201	308	11,120	16,285,500	51.1		2,441,851
Senate 4	1,259	677	582		48,465,300	150.3		2,017,395
Senate 5	247	107	140		40,040,800	124.2		
Senate 6	6		6				271	565,533
Senate 7	58	28	30	4,166	11,182,900	34.9		
Senate 8	2		2					
Senate 9								
Senate 10								
Senate 11							407,834	3,931,076
Senate 12	4,092	2,127	1,965	6,274,370	15,279,400	366.1		2
Senate 13	24	8	16	4			734,877	9,111,985
Senate 14	8,109	5,346	2,763	11,305,800	67,794,600	784.5		
Senate 15							5,361,649	47,782,694
Senate 16	55,139	36,872	18,267	82,486,900	123,511,000	4573.3	324,700	2,576,116
Senate 17	1,638	1,085	553	4,995,390	1,176,260	257.4	5,949	61,618
Senate 18	48	21	27	91,527	307,714	5.6	597,396	5,167,885
Senate 19	5,078	2,275	2,803	9,190,700	10,664,000	500.0		
Senate 20							40,890	1,232,133
Senate 21	628	201	427	629,080	18,164,300	88.3	242	1,874
Senate 22	8	3	5	3,720		0.2		
Senate 23	1		1				488	4,275
Senate 24	12	10	2	7,512	9,720	0.4		
Senate 25							11,042	176,803
Senate 26	152	71	81	169,875	1,810,390	14.2	16,686	165,985
Senate 27	329	108	221	256,706	727,378	15.3		
Senate 28							77,488	631,447
Senate 29	925	535	390	1,192,120	611,618	62.5	148,811	1,215,347
Senate 30	900	509	391	2,289,400	1,227,930	120.1		
Senate 31	4		4				61,503	513,558
Senate 32	548	331	217	946,203	730,954	50.3	99,497	792,273
Senate 33	1,356	1,062	294	1,530,720	417,645	79.1	23,625	191,662
Senate 34	307	187	120	363,458	169,484	19.0	85,032	675,882
Senate 35	637	440	197	1,308,180	332,957	67.5		
Senate 36							37,157	299,071
Senate 37	320	166	154	571,649	219,398	29.7		
Senate 38								
Senate 39								
Senate 40								16,845

Source: CA DOGGR, EIA, estimates by LAEDC

Individuals whose employment are in user industries that rely upon the use of oil and gas products in their supply chain, or who are users of the dependent industry's output, have jobs at risk. Employment in industry sectors identified to be the most at risk in California due to their interconnectedness with the oil and gas industry, manufacturing, transportation and agriculture, are provided by senate district in Exhibit A-5, along with the share of these industries to each district's total employment. The share of workers in these three interconnected industry sectors who are female is also provided.

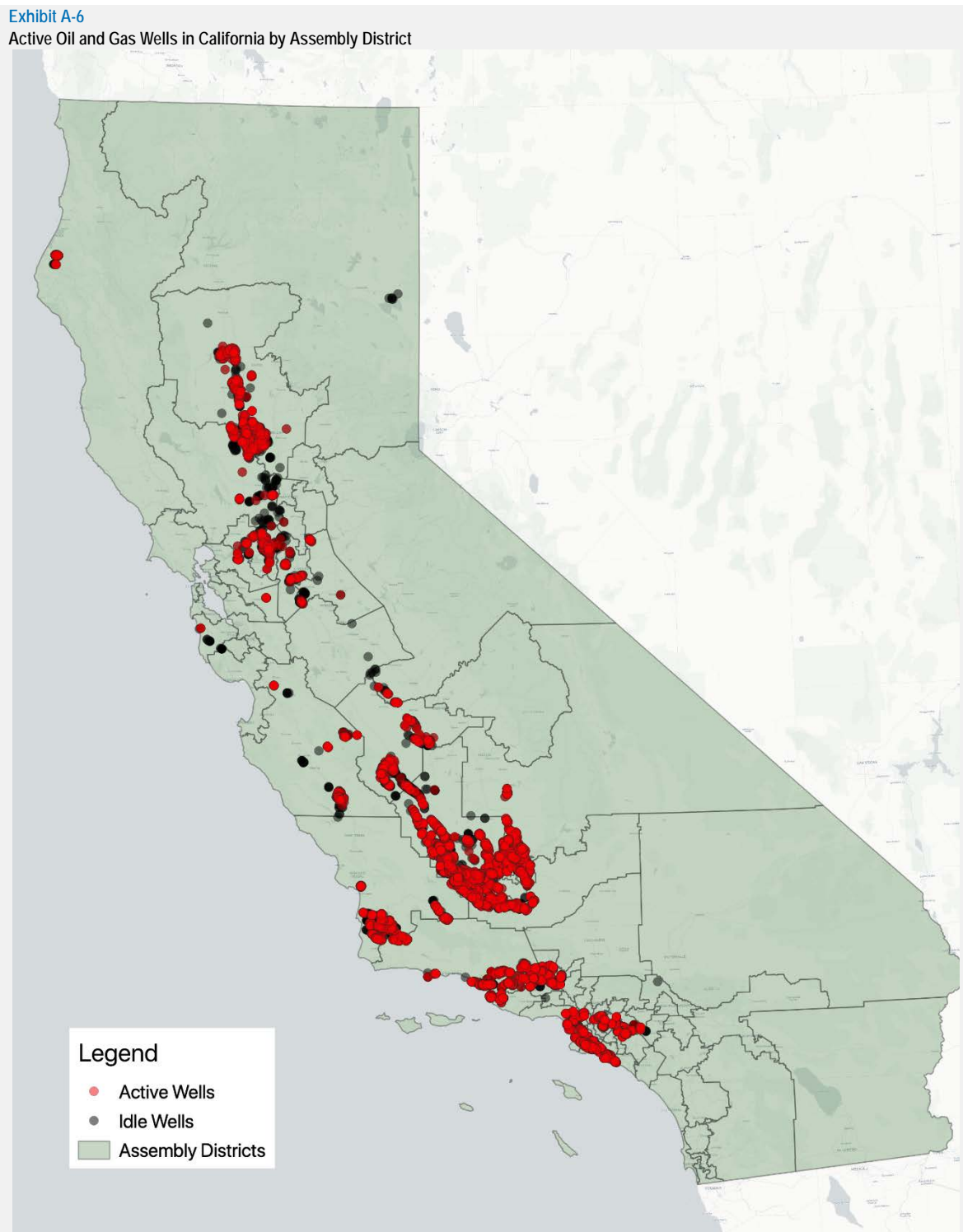
**Exhibit A-5****California Senate Districts Oil & Gas Related Industry Employment**

District	21 Mining, Quarrying and Oil & Gas Extraction	31-33 Manufacturing	48-49 Transportation & Warehousing	% of Total Employment	% Female in Industry
Senate 1	7,861	28,042	3,685	9.0%	26.0%
Senate 2	13,304	27,579	3,725	10.7%	29.1%
Senate 3	14,852	42,976	6,946	11.6%	30.4%
Senate 4	15,045	28,621	4,541	9.7%	24.2%
Senate 5	16,857	39,748	6,599	15.1%	26.8%
Senate 6	3,292	21,933	4,732	6.7%	36.1%
Senate 7	3,903	40,223	5,188	10.2%	32.1%
Senate 8	25,733	37,907	5,788	13.2%	24.2%
Senate 9	1,692	29,978	7,248	8.1%	43.8%
Senate 10	1,437	72,677	5,618	17.4%	36.3%
Senate 11	1,024	27,515	6,948	6.6%	46.6%
Senate 12	61,655	36,528	4,778	22.4%	16.5%
Senate 13	1,928	54,046	5,926	12.9%	35.7%
Senate 14	80,210	31,201	10,914	24.5%	13.0%
Senate 15	2,660	74,811	4,292	17.9%	33.0%
Senate 16	47,766	28,958	16,474	19.2%	14.5%
Senate 17	23,334	38,154	4,203	14.2%	23.8%
Senate 18	2,128	34,510	4,587	9.6%	39.1%
Senate 19	29,350	32,988	4,468	15.6%	23.0%
Senate 20	3,138	56,002	13,194	13.6%	40.6%
Senate 21	2,892	34,983	6,441	11.6%	33.7%
Senate 22	2,340	47,981	7,268	12.8%	40.2%
Senate 23	3,481	41,000	8,974	10.1%	35.0%
Senate 24	2,014	39,386	4,761	10.7%	42.0%
Senate 25	2,087	36,601	5,458	8.4%	38.8%
Senate 26	1,383	39,683	7,026	8.2%	41.0%
Senate 27	3,439	36,470	3,894	10.0%	37.1%
Senate 28	8,004	30,960	4,996	9.7%	30.8%
Senate 29	2,448	62,144	6,592	14.2%	35.9%
Senate 30	1,933	42,833	9,323	10.8%	45.8%
Senate 31	3,309	51,546	10,848	13.1%	36.9%
Senate 32	2,184	61,168	9,312	14.7%	36.5%
Senate 33	2,235	65,665	11,314	16.7%	39.5%
Senate 34	3,119	64,661	5,197	15.7%	35.1%
Senate 35	2,293	58,366	15,177	14.7%	45.0%
Senate 36	4,062	48,357	4,046	12.5%	33.5%
Senate 37	1,998	57,761	4,240	12.7%	34.5%
Senate 38	6,977	47,905	4,892	11.7%	30.6%
Senate 39	1,752	44,638	3,757	9.9%	33.5%
Senate 40	7,843	28,313	4,429	9.8%	31.3%

Source: 2017 ACS 5-year estimates

### California Assembly Districts

In 2017, there were approximately 53,120 producing oil and gas wells, distributed across the assembly districts in California, as illustrated in Exhibit A-6.



Sources: DOGGR, LAEDC

Note: Idle wells do not appear separately in this map and may be co-located with active wells.

California oil and gas production in 2017 associated with active wells by assembly district are displayed in Exhibit A-7 along with select estimated production-based revenues collected by the state.

**Exhibit A-7****California State Assembly Districts Oil & Gas Production**

District	Total Wells	Active	Idle	Oil Production (BBL)	Gas Production (MCF)	Estimated Value (\$ millions)	Oil Spill Prevention and Administration Fee (\$)	DOGGR Assessment (\$)
Assembly 1	6		6					
Assembly 2	52	24	28		334,329	1.0		16,845
Assembly 3	977	544	433		46,265,800	143.5		2,331,032
Assembly 4	374	154	220		3,297,590	10.2		166,144
Assembly 5	34	21	13		14,628,000	45.4		737,010
Assembly 6	0	0	0					
Assembly 7	6	0	6					
Assembly 8								
Assembly 9	2	1	1		848			43
Assembly 10								
Assembly 11	441	185	256	11,188	15,238,200	47.8	727	773,391
Assembly 12	44	22	22		8,622,440	26.7		434,429
Assembly 13	205	85	120		31,418,400	97.4		1,582,969
Assembly 14	24	16	8		11,130,900	34.5		560,814
Assembly 15								
Assembly 16	8	6	2	4,098	380	0.2	266	2,084
Assembly 17								
Assembly 18								
Assembly 19								
Assembly 20								
Assembly 21	2		2					
Assembly 22								
Assembly 23								
Assembly 24	24	8	16	4				2
Assembly 25								
Assembly 26	1,636	1,008	628	2,728,520	44,793	138.7	177,354	1,376,980
Assembly 27								
Assembly 28								
Assembly 29								
Assembly 30	1,348	910	438	4,443,910	630,927	227.7	288,854	2,270,785
Assembly 31	3,990	2,076	1,914	6,259,700	629,561	319.9	406,881	3,185,575
Assembly 32	8,570	5,569	3,001	12,314,300	7,260,960	648.1	800,430	6,570,207
Assembly 33								
Assembly 34	53,042	35,640	17,402	78,749,900	122,984,000	4381.8	5,118,744	45,873,311
Assembly 35	2,310	1,079	1,231	2,667,490	2,323,900	142.7	173,387	1,461,061
Assembly 36								
Assembly 37	3,042	1,395	1,647	6,778,650	8,979,330	372.2	440,612	3,867,730
Assembly 38	876	283	593	852,777	19,084,300	102.5	55,431	1,391,192
Assembly 39	29		29					
Assembly 40	1		1					
Assembly 41								
Assembly 42								
Assembly 43								
Assembly 44	181	52	129	435,250	42,894	22.2	28,291	221,455
Assembly 45	1		1					
Assembly 46								
Assembly 47								
Assembly 48								
Assembly 49	37	11	26	680	8,500	0.1	44	771
Assembly 50	190	66	124	274,506	314,118	14.9	17,843	154,132
Assembly 51	12	10	2	7,512	9,720	0.4	488	4,275
Assembly 52								
Assembly 53	18	9	9	41,778	28,142	2.2	2,716	22,467

## Exhibit A-7 (Cont'd)

District	Total Wells	Active	Idle	Oil Production (BBL)	Gas Production (MCF)	Estimated Value (\$ Millions)	Oil Spill Prevention and Administration Fee (\$)	DOGGR Assessment (\$)
Assembly 54	736	455	281	2,033,060	908,243	106.1	132,149	1,070,087
Assembly 55	871	488	383	1,513,200	596,135	78.7	98,358	792,438
Assembly 56								
Assembly 57	379	229	150	561,991	522,761	30.2	36,529	309,489
Assembly 58	144	94	50	387,252	199,693	20.3	25,171	205,172
Assembly 59	41	17	24	54,522	57,955	2.9	3,544	30,390
Assembly 60	4		4					
Assembly 61								
Assembly 62	63	29	34	54,806	1,740,060	8.2	3,562	115,283
Assembly 63								
Assembly 64	439	285	154	1,077,120	251,158	55.5	70,013	555,345
Assembly 65	54	47	7	40,798	15,483	2.1	2,652	21,336
Assembly 66	97	67	30	170,747	61,182	8.9	11,099	89,111
Assembly 67								
Assembly 68	14	6	8	47,867	7,737	2.5	3,111	24,507
Assembly 69								
Assembly 70	1,558	1,210	348	1,715,860	545,543	88.9	111,531	891,997
Assembly 71								
Assembly 72	224	145	79	243,154	62,010	12.5	15,805	125,634
Assembly 73								
Assembly 74	292	146	146	519,861	211,661	27.1	33,791	272,588
Assembly 75								
Assembly 76								
Assembly 77								
Assembly 78								
Assembly 79								
Assembly 80								

Source: CA DOGGR, estimates by LAEDC



Employment in industry sectors identified to be the most at risk in California due to their interconnectedness with the oil and gas industry, manufacturing, transportation and agriculture, are provided by assembly district in Exhibit A-8, along with the share of these industries to each district's total employment. The share of workers in these three interconnected industry sectors who are female is also provided.

**Exhibit A-8****California Assembly Districts Oil & Gas Related Industry Employment**

District	21 Mining, Quarrying and Oil & Gas Extraction	31-33 Manufacturing	48-49 Transportation & Warehousing	% of Total Employment	% Female in Industry
Assembly 1	6,547	12,431	1,734	9.4%	20.8%
Assembly 2	9,153	16,352	1,759	12.2%	25.8%
Assembly 3	13,150	13,629	1,937	13.3%	19.3%
Assembly 4	13,234	23,455	3,366	13.6%	26.8%
Assembly 5	16,193	15,961	2,231	13.9%	18.3%
Assembly 6	1,517	19,008	2,023	8.4%	29.6%
Assembly 7	1,943	13,592	2,599	6.6%	35.9%
Assembly 8	1,764	15,942	3,042	6.8%	31.9%
Assembly 9	4,581	14,671	2,842	9.1%	29.9%
Assembly 10	3,796	16,632	2,520	9.4%	35.0%
Assembly 11	3,535	18,259	3,479	10.6%	31.7%
Assembly 12	12,759	24,735	3,385	16.7%	26.2%
Assembly 13	8,588	20,098	3,741	14.6%	28.2%
Assembly 14	2,187	22,612	3,883	9.2%	35.4%
Assembly 15	789	13,952	3,163	6.8%	40.9%
Assembly 16	2,234	23,991	2,525	11.3%	30.5%
Assembly 17	576	15,226	2,782	6.3%	43.5%
Assembly 18	1,006	18,007	4,441	9.2%	46.0%
Assembly 19	671	18,447	5,481	6.8%	49.4%
Assembly 20	902	33,581	3,818	14.5%	37.9%
Assembly 21	17,732	23,667	2,972	19.5%	23.6%
Assembly 22	1,059	21,744	4,539	9.7%	42.6%
Assembly 23	12,801	17,343	2,951	12.1%	24.3%
Assembly 24	1,425	35,375	1,731	15.2%	32.2%
Assembly 25	1,111	55,435	2,585	20.5%	34.9%
Assembly 26	34,887	14,580	2,422	23.1%	13.2%
Assembly 27	1,556	38,092	2,748	17.5%	35.9%
Assembly 28	842	42,008	1,848	17.7%	30.0%
Assembly 29	8,440	24,444	1,846	13.1%	26.5%
Assembly 30	30,970	16,916	1,969	21.3%	16.2%
Assembly 31	32,633	16,206	2,409	22.6%	16.0%
Assembly 32	49,098	14,760	9,443	26.3%	10.6%
Assembly 33	1,960	13,803	4,120	9.6%	33.4%
Assembly 34	28,586	14,012	13,208	20.5%	13.1%
Assembly 35	17,325	12,956	2,935	15.7%	17.9%
Assembly 36	2,199	19,061	2,763	12.8%	29.7%
Assembly 37	10,524	21,316	2,722	12.6%	27.0%
Assembly 38	1,492	22,829	2,856	11.3%	36.8%
Assembly 39	1,642	22,977	3,141	11.4%	38.4%
Assembly 40	1,323	26,041	6,009	10.2%	35.8%
Assembly 41	1,125	21,992	3,348	8.6%	38.0%
Assembly 42	3,796	14,993	3,601	8.1%	33.9%
Assembly 43	850	14,125	2,072	6.9%	40.4%
Assembly 44	12,256	21,886	1,619	15.8%	27.5%
Assembly 45	1,034	16,780	2,023	8.1%	39.2%
Assembly 46	982	18,873	2,605	8.0%	38.9%
Assembly 47	1,268	29,268	8,114	13.7%	41.7%
Assembly 48	1,574	27,730	3,995	13.8%	39.0%
Assembly 49	872	23,038	3,585	11.4%	42.8%
Assembly 50	763	14,171	2,261	5.5%	41.3%

Exhibit A-8 (Cont'd)

District	21 Mining, Quarrying and Oil & Gas Extraction	31-33 Manufacturing	48-49 Transportation & Warehousing	% of Total Employment	% Female in Industry
Assembly 51	1,064	24,148	3,169	11.3%	42.2%
Assembly 52	2,078	30,897	6,335	13.5%	40.4%
Assembly 53	1,428	33,384	3,920	13.9%	40.1%
Assembly 54	631	15,435	4,328	6.3%	48.7%
Assembly 55	1,319	31,571	3,710	13.3%	36.6%
Assembly 56	9,250	7,589	1,652	9.3%	21.0%
Assembly 57	1,562	38,128	5,374	15.3%	36.6%
Assembly 58	1,207	36,410	5,986	14.9%	37.8%
Assembly 59	1,547	29,517	4,860	17.1%	41.6%
Assembly 60	1,759	31,629	5,374	14.5%	36.5%
Assembly 61	1,912	24,194	6,316	11.7%	37.0%
Assembly 62	1,096	23,422	6,765	10.3%	48.0%
Assembly 63	1,209	39,525	6,667	16.9%	38.8%
Assembly 64	1,433	35,273	8,135	17.1%	43.5%
Assembly 65	1,458	34,980	3,457	14.9%	35.2%
Assembly 66	690	30,128	5,683	14.5%	41.6%
Assembly 67	2,640	23,474	3,717	11.2%	33.0%
Assembly 68	1,256	34,742	2,270	13.6%	35.0%
Assembly 69	2,018	35,488	2,490	16.5%	36.0%
Assembly 70	1,180	25,980	7,068	12.5%	43.2%
Assembly 71	2,800	21,189	2,875	9.5%	31.6%
Assembly 72	1,341	36,162	2,790	16.1%	34.4%
Assembly 73	694	25,086	2,145	11.6%	34.0%
Assembly 74	976	27,443	1,971	11.8%	32.9%
Assembly 75	4,967	24,159	2,159	13.0%	30.3%
Assembly 76	3,481	24,827	1,959	13.4%	33.2%
Assembly 77	1,004	30,925	1,902	12.5%	32.1%
Assembly 78	888	19,736	2,250	8.1%	36.3%
Assembly 79	925	22,349	3,131	8.4%	34.9%
Assembly 80	982	19,369	2,909	8.8%	37.5%

Source: 2017 ACS 5-year estimates

## Oil and Gas User Industries

Exhibit A-9

### Purchases from California Upstream Operations by Industry

NAICS	Industry Description	\$ millions
55	Management of companies and enterprises	\$239.7
23	Construction	225.1
325*	Chemical manufacturing	209.7
486	Pipeline transportation	157.1
541	Professional and technical services	130.9
333*	Machinery manufacturing	114.5
532	Rental and leasing services	100.7
331	Primary metal manufacturing	92.0
42	Wholesale Trade	89.6
332	Fabricated metal product manufacturing	69.9
221	Utilities	67.7
324*	Petroleum and coal products manufacturing	66.2
533	Lessors of nonfinancial intangible assets	39.8
523	Securities, commodity contracts, investments	39.5
561	Administrative and support services	29.7
521-522	Monetary auth, credit intermediation & related	20.7
722	Food services and drinking places	20.5
212-213*	Mining and Mining Support	19.5
517	Telecommunications	17.9
334	Computer and electronic product manufacturing	16.8
484	Truck transportation	15.6
327	Nonmetallic mineral product manufacturing	15.5
562	Waste management and remediation services	13.9
336	Transportation equipment manufacturing	13.9
524	Insurance carriers and related activities	13.7
326	Plastics and rubber products manufacturing	8.0
483	Water transportation	6.7
481	Air transportation	6.5
482	Rail transportation	6.3
339	Miscellaneous manufacturing	6.0
531	Real estate	5.4
811	Repair and maintenance	4.0
322	Paper manufacturing	3.7
518	Data processing, hosting and related services	3.6
721	Accommodation	3.3
485	Transit and ground passenger transportation	2.5
441	Motor vehicle and parts dealers	1.8
813	Membership associations and organizations	1.6
515	Broadcasting, except internet	0.8
711	Performing arts and spectator sports	0.7
491	Postal service	0.6
713	Amusements, gambling, and recreation	0.6

493	Warehousing and storage	0.56
335	Electrical equipment and appliance mfg.	0.56
511	Publishing industries, except internet	0.49
519	Other information services	0.30
444	Building material and garden supply stores	0.17
452	General merchandise stores	0.12
323	Printing and related support activities	0.09
487-488	Transportation Support and Sightseeing	0.06
111-2 & 115	Agriculture	0.04
447	Gasoline stations	0.03
442	Furniture and home furnishings stores	0.03
454	Non-store retailers	0.02
446	Health and personal care stores	0.02
451	Sporting goods, hobby, book & music stores	0.01
448	Clothing and clothing accessories stores	0.01
453	Miscellaneous store retailers	0.01
443	Electronics and appliance stores	0.01
<b>Total Purchases</b>		<b>\$ 1,910.65</b>

\* Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

## Exhibit A-10

## Purchases from California Midstream Operations by Industry

NAICS	Industry Description	\$ millions
541	Professional and technical services	\$30.3
211	Oil and gas extraction	27.4
23	Construction	22.5
332	Fabricated metal product manufacturing	13.6
324	Petroleum and coal products manufacturing	12.4
561	Administrative and support services	11.0
42	Wholesale Trade	5.8
531	Real estate	4.7
333	Machinery manufacturing	4.6
487-488	Trans Support & Scenic/sightseeing trans	3.8
521-522	Monetary auth, credit intermediation and related	2.8
221	Utilities	2.8
517	Telecommunications	2.0
483	Water transportation	1.9
523	Securities, commodity contracts, investments	1.6
524	Insurance carriers and related activities	1.6
326	Plastics and rubber products manufacturing	1.5
491	Postal service	1.4
811	Repair and maintenance	1.3
484	Truck transportation	1.3
322	Paper manufacturing	1.2
562	Waste management and remediation services	1.2
518	Data processing, hosting and related services	0.7
492	Couriers and messengers	0.6
334	Computer and electronic product manufacturing	0.6
532	Rental and leasing services	0.3
813	Membership associations and organizations	0.2
335	Electrical equipment and appliance mfg.	0.2
323	Printing and related support activities	0.2
482	Rail transportation	0.2
722	Food services and drinking places	0.1
321	Wood product manufacturing	0.1
721	Accommodation	0.1
325	Chemical manufacturing	0.1
444	Building material and garden supply stores	0.1
452	General merchandise stores	0.1
446	Health and personal care stores	0.1
481	Air transportation	0.1
611	Educational services	0.1
448	Clothing and clothing accessories stores	0.1
493	Warehousing and storage	0.1
454	Non-store retailers	0.1

314	Textile product mills	0.1
453	Miscellaneous store retailers	0.0
447	Gasoline stations	0.0
443	Electronics and appliance stores	0.0
327	Nonmetallic mineral product manufacturing	0.0
442	Furniture and home furnishings stores	0.0
451	Sporting goods, hobby, book and music stores	0.0
339	Miscellaneous manufacturing	0.0
445	Food and beverage stores	0.0
485	Transit and ground passenger transportation	0.0
336	Transportation equipment manufacturing	0.0

**Total Purchases****\$161.1**

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

Exhibit A-11

## Purchases from California Downstream Operations by Industry

NAICS	Industry Description	\$ millions
211	Oil and gas extraction	\$43,011.0
42	Wholesale Trade	2,675.2
486	Pipeline transportation	1,751.4
23	Construction	1,452.7
484	Truck transportation	1,054.9
325	Chemical manufacturing	636.7
221	Utilities	492.2
55	Management of companies and enterprises	468.7
541	Professional and technical services	253.1
561	Administrative and support services	147.0
811	Repair and maintenance	102.0
482	Rail transportation	101.3
562	Waste management and remediation services	66.2
722	Food services and drinking places	62.2
521-522	Monetary auth, credit intermediation and related	59.0
533	Lessors of nonfinancial intangible assets	55.4
332	Fabricated metal product manufacturing	46.3
212-213	Mining and Mining Support	42.7
517	Telecommunications	33.8
311	Food manufacturing	30.6
326	Plastics and rubber products manufacturing	30.2
481	Air transportation	28.8
487-488	Trans Support & Scenic/sightseeing trans	23.3
532	Rental and leasing services	20.1
324	Petroleum and coal products manufacturing	19.7
483	Water transportation	19.1
813	Membership associations and organizations	15.2
523	Securities, commodity contracts, investments	13.5
334	Computer and electronic product manufacturing	13.0
491	Postal service	12.0
721	Accommodation	11.0
711	Performing arts and spectator sports	10.8
331	Primary metal manufacturing	9.9
524	Insurance carriers and related activities	9.3
322	Paper manufacturing	9.1
493	Warehousing and storage	8.1
485	Transit and ground passenger transportation	7.3
518	Data processing, hosting and related services	4.5
336	Transportation equipment manufacturing	4.4
444	Building material and garden supply stores	3.5
335	Electrical equipment and appliance mfg.	3.5

446	Health and personal care stores	3.2
316	Leather and allied product manufacturing	3.2
713	Amusements, gambling, and recreation	3.0
448	Clothing and clothing accessories stores	2.9
454	Non-store retailers	2.6
453	Miscellaneous store retailers	1.9
447	Gasoline stations	1.7
443	Electronics and appliance stores	1.6
442	Furniture and home furnishings stores	1.4
451	Sporting goods, hobby, book and music stores	1.0
611	Educational services	1.0
113-114	Forestry, Hunting and Fishing	0.8
333	Machinery manufacturing	0.8
323	Printing and related support activities	0.6
452	General merchandise stores	0.4
511	Publishing industries, except internet	0.4
812	Personal and laundry services	0.3
339	Miscellaneous manufacturing	0.2
445	Food and beverage stores	0.2
327	Nonmetallic mineral product manufacturing	0.1
531	Real estate	0.1
111-2 &	Agriculture	0.1
115		
441	Motor vehicle and parts dealers	0.0
<b>Total Purchases</b>		<b>\$52,846.6</b>

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC





## Exhibit A-13

## All Industries by Inputs of Upstream Products as a Percentage of Output

NAICS	Industry	Inputs as % of Output
486	Pipeline transportation	18.57%
331	Primary metal manufacturing	1.03%
212-213*	Mining and Mining Support	0.71%
532	Rental and leasing services	0.51%
333*	Machinery manufacturing	0.37%
55	Management of companies and enterprises	0.37%
482	Rail transportation	0.22%
325*	Chemical manufacturing	0.21%
332	Fabricated metal product manufacturing	0.21%
533	Lessors of nonfinancial intangible assets	0.15%
327	Nonmetallic mineral product manufacturing	0.13%
221	Utilities	0.12%
562	Waste management and remediation services	0.12%
483	Water transportation	0.11%
23	Construction	0.10%
324*	Petroleum and coal products manufacturing	0.09%
523	Securities, commodity contracts, investments	0.05%
326	Plastics and rubber products manufacturing	0.05%
484	Truck transportation	0.04%
42	Wholesale Trade	0.04%
541	Professional and technical services	0.03%
322	Paper manufacturing	0.03%
561	Administrative and support services	0.03%
481	Air transportation	0.03%
521-522	Monetary auth, credit intermediation and related	0.02%
485	Transit and ground passenger transportation	0.02%
339	Miscellaneous manufacturing	0.02%
517	Telecommunications	0.02%
524	Insurance carriers and related activities	0.02%
336	Transportation equipment manufacturing	0.02%
722	Food services and drinking places	0.02%
721	Accommodation	0.02%
518	Data processing, hosting and related services	0.02%
491	Postal service	0.01%
334	Computer and electronic product manufacturing	0.01%
811	Repair and maintenance	0.01%
441	Motor vehicle and parts dealers	0.01%
813	Membership associations and organizations	0.01%
335	Electrical equipment and appliance mfg.	0.00%
493	Warehousing and storage	0.00%
713	Amusements, gambling, and recreation	0.00%
711	Performing arts and spectator sports	0.00%
531	Real estate	0.00%
515	Broadcasting, except internet	0.00%
323	Printing and related support activities	0.00%
444	Building material and garden supply stores	0.00%
511	Publishing industries, except internet	0.00%
452	General merchandise stores	0.00%
519	Other information services	0.00%
447	Gasoline stations	0.00%
451	Sporting goods, hobby, book and music stores	0.00%
442	Furniture and home furnishings stores	0.00%
487-488	Trans Support & Scenic/sightseeing trans	0.00%
443	Electronics and appliance stores	0.00%
453	Miscellaneous store retailers	0.00%
446	Health and personal care stores	0.00%
111-112 & 115	Agriculture	0.00%
448	Clothing and clothing accessories stores	0.00%
454	Non-store retailers	0.00%
<b>Average of All Industries</b>		<b>0.05%</b>

Each industry segment excludes the industries within it to avoid double counting

Source: IMPLAN Data for California; Analysis by LAEDC

## Exhibit A-14

## All Industries by Inputs of Midstream Products as a Percentage of Output

NAICS	Industry	Inputs as % of Output
211	Oil and gas extraction	0.38%
486	Pipeline transportation	0.10%
332	Fabricated metal product manufacturing	0.04%
483	Water transportation	0.03%
491	Postal service	0.02%
487-488	Trans Support & Scenic/sightseeing trans	0.02%
324	Petroleum and coal products manufacturing	0.02%
333	Machinery manufacturing	0.01%
322	Paper manufacturing	0.01%
23	Construction	0.01%
562	Waste management and remediation services	0.01%
561	Administrative and support services	0.01%
326	Plastics and rubber products manufacturing	0.01%
541	Professional and technical services	0.01%
482	Rail transportation	0.01%
221	Utilities	0.01%
492	Couriers and messengers	0.00%
314	Textile product mills	0.00%
484	Truck transportation	0.00%
521-522	Monetary auth, credit intermediation and related	0.00%
518	Data processing, hosting and related services	0.00%
811	Repair and maintenance	0.00%
42	Wholesale Trade	0.00%
321	Wood product manufacturing	0.00%
323	Printing and related support activities	0.00%
517	Telecommunications	0.00%
524	Insurance carriers and related activities	0.00%
523	Securities, commodity contracts, investments	0.00%
531	Real estate	0.00%
335	Electrical equipment and appliance mfg.	0.00%
532	Rental and leasing services	0.00%
443	Electronics and appliance stores	0.00%
813	Membership associations and organizations	0.00%
451	Sporting goods, hobby, book and music stores	0.00%
446	Health and personal care stores	0.00%
444	Building material and garden supply stores	0.00%
493	Warehousing and storage	0.00%
721	Accommodation	0.00%
453	Miscellaneous store retailers	0.00%
447	Gasoline stations	0.00%
442	Furniture and home furnishings stores	0.00%

452	General merchandise stores	0.00%
448	Clothing and clothing accessories stores	0.00%
481	Air transportation	0.00%
327	Nonmetallic mineral product manufacturing	0.00%
334	Computer and electronic product manufacturing	0.00%
611	Educational services	0.00%
485	Transit and ground passenger transportation	0.00%
454	Non-store retailers	0.00%
722	Food services and drinking places	0.00%
325	Chemical manufacturing	0.00%
339	Miscellaneous manufacturing	0.00%
445	Food and beverage stores	0.00%
336	Transportation equipment manufacturing	0.00%

*Average of All Industries**0.73%*

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

**Exhibit A-15****All Industries by Inputs of Downstream Products as a Percentage of Output**

NAICS	Industry	Inputs as % of Output
211	Oil and gas extraction	592.11%
486	Pipeline transportation	207.11%
482	Rail transportation	3.50%
484	Truck transportation	2.82%
324	Petroleum and coal products manufacturing	1.54%
42	Wholesale Trade	1.23%
221	Utilities	0.88%
212-213	Mining and Mining Support	0.83%
55	Management of companies and enterprises	0.72%
23	Construction	0.67%
325	Chemical manufacturing	0.65%
316	Leather and allied product manufacturing	0.60%
562	Waste management and remediation services	0.55%
483	Water transportation	0.32%
811	Repair and maintenance	0.21%
533	Lessors of nonfinancial intangible assets	0.20%
326	Plastics and rubber products manufacturing	0.19%
491	Postal service	0.18%
332	Fabricated metal product manufacturing	0.14%
561	Administrative and support services	0.13%
481	Air transportation	0.11%
487-488	Trans Support & Scenic/sightseeing trans	0.11%
331	Primary metal manufacturing	0.11%
532	Rental and leasing services	0.10%
113-114	Forestry, Hunting and Fishing	0.08%
322	Paper manufacturing	0.08%
485	Transit and ground passenger transportation	0.07%
521-522	Monetary auth, credit intermediation and related	0.07%
541	Professional and technical services	0.06%
493	Warehousing and storage	0.06%
721	Accommodation	0.05%
813	Membership associations and organizations	0.05%
722	Food services and drinking places	0.05%
517	Telecommunications	0.04%
311	Food manufacturing	0.03%
443	Electronics and appliance stores	0.03%
711	Performing arts and spectator sports	0.03%
335	Electrical equipment and appliance mfg.	0.03%
451	Sporting goods, hobby, book and music stores	0.02%
446	Health and personal care stores	0.02%
444	Building material and garden supply stores	0.02%

518	Data processing, hosting and related services	0.02%
523	Securities, commodity contracts, investments	0.02%
453	Miscellaneous store retailers	0.02%
442	Furniture and home furnishings stores	0.02%
447	Gasoline stations	0.02%
713	Amusements, gambling, and recreation	0.01%
448	Clothing and clothing accessories stores	0.01%
524	Insurance carriers and related activities	0.01%
323	Printing and related support activities	0.01%
454	Non-store retailers	0.01%
334	Computer and electronic product manufacturing	0.01%
336	Transportation equipment manufacturing	0.01%
611	Educational services	0.00%
333	Machinery manufacturing	0.00%
452	General merchandise stores	0.00%
327	Nonmetallic mineral product manufacturing	0.00%
812	Personal and laundry services	0.00%
511	Publishing industries, except internet	0.00%
339	Miscellaneous manufacturing	0.00%
445	Food and beverage stores	0.00%
111-112 & 115	Agriculture	0.00%
531	Real estate	0.00%
441	Motor vehicle and parts dealers	0.00%
<b>Average of All Industries</b>		<b>0.73%</b>

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

## Exhibit A-16

## All Industries by Inputs of Market Products as a Percentage of Output\*

NAICS	Industry	Inputs as % of Output
486	Pipeline transportation	213.97%
211	Oil and gas extraction	65.70%
482	Rail transportation	1.40%
521-522	Monetary auth, credit intermediation and related	1.27%
493	Warehousing and storage	0.99%
487-488	Trans Support & Scenic/sightseeing trans	0.80%
491	Postal service	0.64%
562	Waste management and remediation services	0.49%
541	Professional and technical services	0.46%
561	Administrative and support services	0.41%
313	Textile mills	0.36%
811	Repair and maintenance	0.34%
332	Fabricated metal product manufacturing	0.29%
531	Real estate	0.28%
481	Air transportation	0.24%
813	Membership associations and organizations	0.23%
532	Rental and leasing services	0.23%
323	Printing and related support activities	0.23%
314	Textile product mills	0.23%
221	Utilities	0.22%
721	Accommodation	0.22%
492	Couriers and messengers	0.22%
42	Wholesale Trade	0.20%
485	Transit and ground passenger transportation	0.20%
523	Securities, commodity contracts, investments	0.19%
55	Management of companies and enterprises	0.18%
518	Data processing, hosting and related services	0.17%
533	Lessors of nonfinancial intangible assets	0.16%
326	Plastics and rubber products manufacturing	0.15%
484	Truck transportation	0.13%
611	Educational services	0.12%
23	Construction	0.11%
517	Telecommunications	0.10%
524	Insurance carriers and related activities	0.10%
322	Paper manufacturing	0.10%
722	Food services and drinking places	0.10%
321	Wood product manufacturing	0.08%
337	Furniture and related product manufacturing	0.05%
315	Apparel manufacturing	0.05%
713	Amusements, gambling, and recreation	0.05%
511	Publishing industries, except internet	0.05%

711	Performing arts and spectator sports	0.04%
221	Natural gas distribution	0.03%
335	Electrical equipment and appliance mfg.	0.03%
336	Transportation equipment manufacturing	0.02%
324	Petroleum and coal products manufacturing	0.02%
327	Nonmetallic mineral product manufacturing	0.02%
443	Electronics and appliance stores	0.02%
483	Water transportation	0.02%
316	Leather and allied product manufacturing	0.02%
333	Machinery manufacturing	0.02%
812	Personal and laundry services	0.01%
339	Miscellaneous manufacturing	0.01%
451	Sporting goods, hobby, book and music stores	0.01%
446	Health and personal care stores	0.01%
441	Motor vehicle and parts dealers	0.01%
444	Building material and garden supply stores	0.01%
519	Other information services	0.01%
453	Miscellaneous store retailers	0.01%
447	Retail - Gasoline stores	0.01%
442	Furniture and home furnishings stores	0.01%
325	Chemical manufacturing	0.01%
448	Clothing and clothing accessories stores	0.01%
454	Non-store retailers	0.00%
452	General merchandise stores	0.00%
334	Computer and electronic product manufacturing	0.00%
111-112 & 115	Agriculture	0.00%
445	Food and beverage stores	0.00%
331	Primary metal manufacturing	0.00%
212-213	Mining and Mining Support	0.00%
312	Beverage and tobacco product manufacturing	0.00%
512	Motion picture and sound recording industries	0.00%
311	Food manufacturing	0.00%
<b>Average of All Industries</b>		<b>0.73%</b>

Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

## Exhibit A-17

## All Industries by Trade Exposure as a Percentage of Output

NAICS	Industry	Trade Exposure as % of Output
316	Leather and allied product manufacturing	96.5%
313	Textile mills	77.9%
333	Machinery manufacturing	75.6%
721	Accommodation	75.3%
315	Apparel manufacturing	74.2%
512	Motion picture and sound recording industries	71.9%
221	Utilities	70.9%
334	Computer and electronic product manufacturing	69.5%
339	Miscellaneous manufacturing	64.6%
325	Chemical manufacturing	60.4%
113-114	Forestry, Hunting and Fishing	59.8%
111-112 & 115	Agriculture	59.0%
331	Primary metal manufacturing	56.1%
336	Transportation equipment manufacturing	55.9%
335	Electrical equipment and appliance mfg.	54.4%
314	Textile product mills	53.7%
533	Lessors of nonfinancial intangible assets	53.3%
312	Beverage and tobacco product manufacturing	53.3%
483	Water transportation	51.7%
337	Furniture and related product manufacturing	46.5%
332	Fabricated metal product manufacturing	43.2%
311	Food manufacturing	42.9%
326	Plastics and rubber products manufacturing	39.2%
511	Publishing industries, except internet	36.6%
711	Performing arts and spectator sports	36.4%
541	Professional and technical services	36.2%
324	Petroleum and coal products manufacturing	36.0%
487-488	Trans Support & Scenic/sightseeing trans	31.9%
624	Social assistance	31.8%
518	Data processing, hosting and related services	29.1%
519	Other information services	26.3%
448	Clothing and clothing accessories stores	25.6%
42	Wholesale Trade	25.5%
531	Real estate	25.4%
322	Paper manufacturing	24.9%
515	Broadcasting, except internet	24.0%
492	Couriers and messengers	23.1%
481	Air transportation	22.2%
621	Ambulatory health care services	19.5%
453	Miscellaneous store retailers	19.2%
713	Amusements, gambling, and recreation	19.0%
323	Printing and related support activities	16.2%
482	Rail transportation	15.9%

211	Oil and gas extraction	15.6%
445	Food and beverage stores	15.5%
812	Personal and laundry services	15.2%
611	Educational services	14.6%
321	Wood product manufacturing	14.5%
55	Management of companies and enterprises	14.0%
212-213	Mining and Mining Support	13.6%
493	Warehousing and storage	12.9%
327	Nonmetallic mineral product manufacturing	12.4%
484	Truck transportation	10.8%
517	Telecommunications	9.6%
454	Non-store retailers	9.6%
443	Electronics and appliance stores	8.6%
442	Furniture and home furnishings stores	7.6%
561	Administrative and support services	7.4%
811	Repair and maintenance	7.3%
813	Membership associations and organizations	7.1%
712	Museums, historical sites, zoos, and parks	6.6%
523	Securities, commodity contracts, investments	6.6%
446	Health and personal care stores	5.8%
521-522	Monetary auth, credit intermediation and related	5.2%
486	Pipeline transportation	5.0%
532	Rental and leasing services	4.7%
451	Sporting goods, hobby, book and music stores	3.1%
524	Insurance carriers and related activities	1.5%
491	Postal service	0.7%
562	Waste management and remediation services	0.5%
722	Food services and drinking places	0.3%
485	Transit and ground passenger transportation	0.3%
447	Gasoline stations	0.3%
622	Hospitals	0.2%
525	Funds, trusts, and other financial vehicles	0.1%
441	Motor vehicle and parts dealers	0.0%
23	Construction	0.0%
444	Building material and garden supply stores	0.0%
452	General merchandise stores	0.0%
623	Nursing and residential care facilities	0.0%
<b>Average of All Industries</b>		<b>28.2%</b>

Source: IMPLAN Data for California; Analysis by LAEDC

## Exhibit A-18

## All Industries by Gross Operating Surplus as a Percentage of Output

NAICS	Industry	Surplus as % of Output
443	Electronics and appliance stores	-36.7%
812	Personal and laundry services	-12.7%
316	Leather and allied product manufacturing	-2.6%
712	Museums, historical sites, zoos, and parks	-1.0%
523	Securities, commodity contracts, investments	-0.5%
453	Miscellaneous store retailers	0.0%
491	Postal service	0.2%
623	Nursing and residential care facilities	0.3%
611	Educational services	0.7%
518	Data processing, hosting and related services	1.3%
451	Sporting goods, hobby, book and music stores	2.8%
813	Membership associations and organizations	3.2%
811	Repair and maintenance	3.4%
331	Primary metal manufacturing	3.5%
447	Gasoline stations	4.0%
484	Truck transportation	4.3%
624	Social assistance	4.4%
315	Apparel manufacturing	4.8%
337	Furniture and related product manufacturing	5.0%
446	Health and personal care stores	5.3%
621	Ambulatory health care services	5.7%
452	General merchandise stores	5.8%
313	Textile mills	6.2%
314	Textile product mills	6.9%
622	Hospitals	7.0%
482	Rail transportation	7.4%
335	Electrical equipment and appliance mfg.	7.4%
321	Wood product manufacturing	7.6%
55	Management of companies and enterprises	7.6%
493	Warehousing and storage	7.8%
323	Printing and related support activities	7.8%
311	Food manufacturing	8.0%
322	Paper manufacturing	8.1%
445	Food and beverage stores	8.6%
312	Beverage and tobacco product manufacturing	9.1%
541	Professional and technical services	9.4%
487-488	Trans Support & Scenic/sightseeing trans	9.5%
519	Other information services	10.3%
444	Building material and garden supply stores	10.4%
524	Insurance carriers and related activities	10.8%
442	Furniture and home furnishings stores	10.8%
333	Machinery manufacturing	11.3%

336	Transportation equipment manufacturing	11.4%
326	Plastics and rubber products manufacturing	11.5%
332	Fabricated metal product manufacturing	11.6%
327	Nonmetallic mineral product manufacturing	12.0%
339	Miscellaneous manufacturing	12.3%
562	Waste management and remediation services	12.5%
722	Food services and drinking places	12.7%
561	Administrative and support services	13.5%
711	Performing arts and spectator sports	13.6%
441	Motor vehicle and parts dealers	15.3%
485	Transit and ground passenger transportation	15.3%
23	Construction	15.3%
515	Broadcasting, except internet	15.6%
448	Clothing and clothing accessories stores	15.9%
111-112 & 115	Agriculture	16.5%
42	Wholesale Trade	16.8%
492	Couriers and messengers	18.2%
481	Air transportation	18.7%
483	Water transportation	18.8%
324	Petroleum and coal products manufacturing	19.3%
486	Pipeline transportation	19.5%
334	Computer and electronic product manufacturing	19.9%
221	Utilities	20.6%
721	Accommodation	22.1%
212-213	Mining and Mining Support	23.1%
713	Amusements, gambling, and recreation	24.6%
525	Funds, trusts, and other financial vehicles	25.2%
454	Non-store retailers	27.9%
211	Oil and gas extraction	29.1%
521-522	Monetary auth, credit intermediation and related	30.8%
517	Telecommunications	34.0%
113-114	Forestry, Hunting and Fishing	35.0%
532	Rental and leasing services	36.7%
325	Chemical manufacturing	37.6%
511	Publishing industries, except internet	43.0%
533	Lessors of nonfinancial intangible assets	44.9%
512	Motion picture and sound recording industries	54.1%
531	Real estate	61.2%
<b>Average of All Industries</b>		<b>18.0%</b>

Source: IMPLAN Data for California; Analysis by LAEDC



**Exhibit A-19****Top 20 Industries by Vulnerability Index by Oil and Gas Industry Segment\***

NAICS	Industry Description	Index
<b>Upstream User Industries</b>		
325	Chemical manufacturing	9.7
333*	Machinery manufacturing	9.4
221	Utilities	9.3
533	Lessors of nonfinancial intangible assets	8.9
212-213*	Mining and Mining Support	8.7
331	Primary metal manufacturing	8.6
483	Water transportation	8.6
332	Fabricated metal product manufacturing	8.3
324	Petroleum and coal products manufacturing	8.3
721	Accommodation	8.1
532	Rental and leasing services	7.7
326	Plastics and rubber products manufacturing	7.7
482	Rail transportation	7.7
334	Computer and electronic product manufacturing	7.6
339	Miscellaneous manufacturing	7.6
55	Management of companies and enterprises	7.4
486	Pipeline transportation	7.4
42	Wholesale Trade	7.4
336	Transportation equipment manufacturing	7.4
481	Air transportation	7.4
<b>Midstream User Industries</b>		
333	Machinery manufacturing	9.4
221	Utilities	9.3
483	Water transportation	9.1
332	Fabricated metal product manufacturing	8.9
324	Petroleum and coal products manufacturing	8.9
487-488	Trans Support & Scenic/sightseeing trans	8.4
211	Oil and gas extraction	8.4
326	Plastics and rubber products manufacturing	8.3
541	Professional and technical services	7.9
314	Textile product mills	7.6
322	Paper manufacturing	7.6
721	Accommodation	7.6
42	Wholesale Trade	7.4
492	Couriers and messengers	7.4
482	Rail transportation	7.1
335	Electrical equipment and appliance mfg.	7.1
531	Real estate	7.1
561	Administrative and support services	7.0
518	Data processing, hosting and related services	6.9
334	Computer and electronic product manufacturing	6.9

**Downstream User Industries**

221	Utilities	9.9
325*	Chemical manufacturing	9.1
42	Wholesale Trade	8.9
533	Lessors of nonfinancial intangible assets	8.9
483	Water transportation	8.6
211	Oil and gas extraction	8.4
212-213	Mining and Mining Support	8.1
721	Accommodation	8.1
316	Leather and allied product manufacturing	8.1
113-114	Forestry, Hunting and Fishing	8.0
486	Pipeline transportation	7.7
482	Rail transportation	7.7
332	Fabricated metal product manufacturing	7.7
326	Plastics and rubber products manufacturing	7.7
481	Air transportation	7.4
324*	Petroleum and coal products manufacturing	7.4
331	Primary metal manufacturing	7.4
487-488	Trans Support & Scenic/sightseeing trans	7.3
484	Truck transportation	7.1
55	Management of companies and enterprises	7.1

**Market User Industries**

221*	Utilities	8.7
721	Accommodation	8.7
211	Oil and gas extraction	8.4
487-488	Trans Support & Scenic/sightseeing trans	8.4
313	Textile mills	8.4
531	Real estate	8.3
332	Fabricated metal product manufacturing	8.3
481	Air transportation	8.0
541	Professional and technical services	7.9
533	Lessors of nonfinancial intangible assets	7.7
482	Rail transportation	7.7
521-522	Monetary auth, credit intermediation and related	7.6
314	Textile product mills	7.6
486	Pipeline transportation	7.4
42	Wholesale Trade	7.4
493	Warehousing and storage	7.4
492	Couriers and messengers	7.4
562	Waste management and remediation services	7.1
326	Plastics and rubber products manufacturing	7.1
561	Administrative and support services	7.0

\* Each industry segment excludes the industries within it to avoid double counting  
Source: IMPLAN Data for California; Analysis by LAEDC

## South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD) consists of the four counties of Los Angeles, Orange, Riverside and San Bernardino.

**Exhibit A-20**

SCAQMD



Source: ESRI

**Exhibit A-21**

Direct Employment of Oil and Gas Industry  
SCAQMD 2017\*

	Employment
211 Oil and gas extraction	1,989
213111 Drilling oil and gas wells	487
213112 Support activities for oil and gas operations	1,392
2212 Natural gas distribution	8,267
23712 Oil and gas pipeline construction	6,013
32411 Petroleum refineries	4,870
324191 Petroleum lubricating oil and grease mfg.	597
32511 Petrochemical manufacturing	4
333132 Oil and gas field machinery and eqpmt mfg.	614
4247 Petroleum and petroleum prods wholesalers	2,892
447 Gasoline stations	26,060
45431 Fuel dealers	735
486 Pipeline transportation	1,212
<b>TOTAL DIRECT EMPLOYMENT</b>	<b>55,132</b>
<i>Percent of California Industry Employment</i>	<i>36.2%</i>

\* Estimates may differ from reports whose methodology includes royalty owners as sole proprietors in direct employment.

**Exhibit A-22**

Backward Linkages: Oil and Gas Industry  
Total Economic and Fiscal Contribution  
Southern California Sub-Region 2017\*

ECONOMIC CONTRIBUTION	Employment	Labor Income (\$ millions)	Value Added (\$ millions)	Output (\$ millions)
Direct	55,130	\$ 3,534	\$ 12,598	\$ 44,509
Indirect	33,990	2,327	3,685	5,896
Induced	26,710	1,410	2,566	4,074
<b>TOTAL CONTRIBUTION</b>	<b>115,830</b>	<b>\$ 7,271</b>	<b>\$ 18,849</b>	<b>\$ 54,480</b>
<i>Percent of Total CA Contribution</i>	<i>31.6%</i>	<i>27.8%</i>	<i>31.8%</i>	<i>35.8%</i>
<i>Percent of Sub-Region Total</i>	<i>1.1%</i>	<i>1.1%</i>	<i>1.6%</i>	<i>2.9%</i>

FISCAL CONTRIBUTION	State and Local (\$ millions)
Sales and excise taxes	\$ 4,946
Property taxes	863
Personal income taxes	216
Corporate profits taxes	118
Social insurance taxes	35
DOGGR Assessment	13
Other taxes	192
Fees, fines and permits	226
<b>TOTAL TAX REVENUES</b>	<b>\$ 6,607</b>

\* Estimates may differ from reports whose methodology includes royalty owners as sole proprietors.

## Characteristics of the Industry Workforce in South Coast Air Quality Management District

The composition of the workforce in the oil and gas industry varies according to gender, age, race and ethnicity and educational attainment.

### *Sex of Workforce*

Workers in the oil and gas industry are predominantly male. In 2017, females represented 22.2 percent of the workforce (Exhibit A-23).

### *Age of Workforce*

The majority of the workforce is in its prime working age—between 22 years and 54 years of age, with half being in the 35 to 54 years of age group (Exhibit A-24). Still, workers aged 55 years and older accounted for 26.0 percent, a significant share of the industry workforce.

### *Race and Ethnicity in the Workforce*

The workforce in the oil and gas industry is diverse in both race and ethnicity (Exhibit A-25). Workers reporting their ethnicity as Hispanic or Latino (all races) accounted for nearly 37 percent of the workforce. Workers reporting their race as Asian accounted for close to 10 percent of industry workers and just over 7 percent identified as Black.

### *Educational Attainment of Workers*

The industry provides a wide range of jobs to individuals with different levels of education (Exhibit A-26). Approximately 33 percent of the workforce has a high school education or less; 20 percent have a high school diploma and 13 percent have less than a high school education. Oil and gas workers with some college education accounted for just under 33 percent of the workforce, and 32 percent have earned a bachelor's degree or higher. While a third of the workforce has up to a high school education, these jobs in oil and gas industries are associated with higher earnings compared to those with the same levels of education across all industries in the SCAQMD (Exhibit A-27). ❖

Exhibit A-23  
Sex



Exhibit A-24  
Age

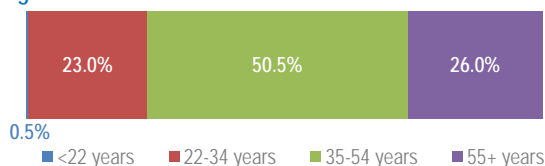


Exhibit A-25  
Race and Ethnicity

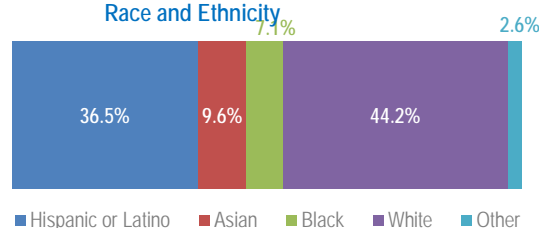


Exhibit A-26  
Educational Attainment

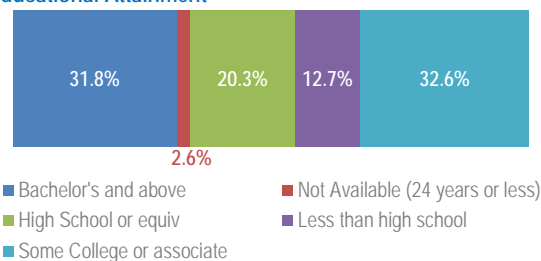
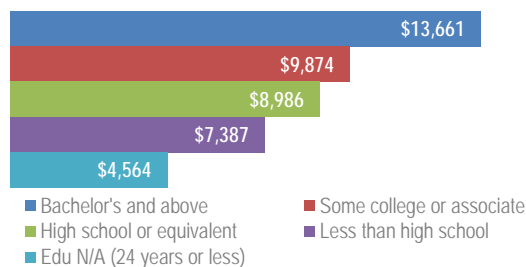


Exhibit A-27  
Average Monthly Earnings 2017



## Oil and Gas Industries

### **NAICS 211: Oil and gas extraction**

Establishments within this industry subsector operate and/or develop oil and gas field properties, either on their own account or for others on a contract or fee basis. Activities 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 production of natural gas, sulfur recovery from natural gas, and recovery of hydrocarbon liquids.

### **NAICS 213111: Drilling oil and gas wells**

Establishments in this U.S. industry are primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding in, drilling in, re-drilling, and directional drilling.

### **NAICS 213112: Support activities for oil and gas operations**

Establishments in this U.S. industry are 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 well cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; well maintenance activities; and cleaning out, bailing, and swabbing wells.

### **NAICS 2212: Natural gas distribution**

Establishments in this industry are: primarily engaged in: operating gas distribution systems (e.g., mains, meters); known as gas marketers that buy gas from the well and sell it to a distribution system; known as gas brokers or agents that arrange the sale of gas over gas distribution systems operated by others; and those primarily engaged in transmitting and distributing gas to final consumers. Only privately-owned establishments are included in this report.

### **NAICS 23712: Oil and gas pipeline and related structures construction**

Establishments in this industry include those primarily engaged in the construction of oil and gas lines, mains, refineries, and storage tanks. The work performed may include new work, reconstruction, upgrades, and repairs. Specialty trade contractors are included if they are engaged in activities primarily related to oil and gas pipeline and related structures construction. All structures (including buildings) that are integral parts of oil and gas networks (e.g., storage tanks, pumping stations, and refineries) are included in this industry.

### **NAICS 32411: Petroleum refineries**

Establishments in this industry are primarily engaged in refining crude petroleum into refined petroleum. Petroleum refining involves one or more of the following activities: (1) fractionation; (2) straight distillation of crude oil; and (3) cracking.

### **NAICS 324191: Petroleum lubricating oil and grease manufacturing**

Establishments in this U.S. industry are primarily engaged in blending or compounding refined petroleum to make lubricating oils and greases and/or re-refining used petroleum lubricating oils.

### **NAICS 32511: Petrochemical manufacturing**

Establishments in this industry are primarily engaged in manufacturing acyclic (i.e., aliphatic) hydrocarbons such as ethylene, propylene, and butylene made from refined petroleum or liquid hydrocarbons and/or manufacturing cyclic aromatic hydrocarbons such as benzene, toluene, styrene, xylene, ethyl benzene, and cumene made from refined petroleum or liquid hydrocarbons.

### **NAICS 333132: Oil and gas field machinery and equipment manufacturing**

This U.S. industry is comprised of establishments primarily engaged in (1) manufacturing oil and gas field machinery and equipment, such as oil and gas field drilling machinery and equipment; oil and gas field production machinery and equipment; and oil and gas field derricks and (2) manufacturing water well drilling machinery.

**NAICS 4247: Petroleum and petroleum products merchant wholesalers**

Establishments in this industry group are primarily engaged in the Petroleum Bulk Stations and Terminals industry, with bulk liquid storage facilities primarily engaged in the merchant wholesale distribution of crude, petroleum and petroleum products, including liquefied petroleum gas, or the Petroleum and Petroleum Products Merchant Wholesalers industry, the merchant wholesale distribution of petroleum and petroleum products (except from bulk liquid storage facilities).

**NAICS 447: Gasoline stations**

Establishments in this subsector retail automotive fuels (e.g., gasoline, diesel fuel, gasohol, alternative fuels) and automotive oils or retail these products in combination with convenience store items. These establishments have specialized equipment for the storage and dispensing of automotive fuels.

**NAICS 45431: Fuel dealers**

Establishments in this industry are primarily engaged in retailing heating oil, liquefied petroleum (LP) gas, and other fuels via direct selling.

**NAICS 486: Pipeline transportation**

Industries in this subsector use transmission pipelines to transport products, such as crude oil, natural gas, or refined petroleum products. Industries are identified based on the products transported (i.e., pipeline transportation of crude oil, natural gas, refined petroleum products, and other products). The Pipeline Transportation of Natural Gas industry includes the storage of natural gas because the storage is usually done by the pipeline establishment and because a pipeline is inherently a network in which all the nodes are interdependent. ❖

## Methodology

### *Backward Linkages*

Economic contribution analysis is used to describe that portion of a region's economy that can be attributed to an existing industry. Contribution analysis measures the value of the industry in terms of its *backward linkages* - its purchases of goods and services in its supply chain, its payment of labor income to regional workers, and the tax revenues generated on its operations and multiplier impacts. This analysis models what would happen if the industry did not exist in terms of those whose economic activity depends on supplying the industry.

The primary economic contribution to California's economy of the oil and gas industry is the expenditure of hundreds of millions of dollars towards goods and services from regional vendors. This injection of funds circulates from the initial recipients to the owners and employees of establishments that help supply the goods and services that the industry purchases.

The industry also spends billions of dollars every year for the wages and benefits of its employees and contract workers. These workers, as well as the employees of all the industry's suppliers, spend a portion of their incomes on groceries, rent, vehicle expenses, healthcare, entertainment, and so on. The recirculation of the original expenditures multiplies the initial spending through these indirect and induced effects.

The extent to which the initial expenditures multiply is estimated using economic models that depict the relationships between industries (such as oil production and its suppliers) and among different economic agents (such as industries and their employees).

These models are built upon actual data of expenditure patterns that are reported to the U.S. Bureau of Labor Statistics, the U.S. Census Bureau and the Bureau of Economic Analysis of the U.S. Department of Commerce. Data is regionalized so that it reflects and incorporates local conditions such as prevailing wages rates, expenditure patterns, and resource availability and costs. The model does not assess other factors related to the industry outside of these measures, such as environmental, governmental or social costs and benefits.

The magnitude of the multiplying effect differs from one region to another depending on the extent to which the local region can fill the demand for all rounds of supplying needs. For example, the automobile manufacturing industry has high multipliers in Detroit and Indiana since these regions have deep and wide supplier networks, while the same industry multiplier in Phoenix is quite small. In another example, the jobs multiplier for the construction industry is higher in, say, Arkansas, than in California because the same amount of spending will purchase fewer workers in Los Angeles than in Little Rock.



Multipliers can also differ from year to year as relative material and labor costs change and as the production “recipe” of industries change. For example, the IT revolution significantly reduced the job multiplier of many industries (such as manufacturing, accounting, architecture and publishing) as computers replaced administrative and production workers.

The metrics used to determine the value of the economic contribution are employment, labor income, value-added and the value of output. *Employment* includes full-time, part-time, permanent and seasonal employees and the self-employed, and is measured on a job-count basis regardless of the number of hours worked. *Labor income* includes all income received by both payroll employees and the self-employed, including wages and benefits such as health insurance and pension plan contributions. *Value-added* is the measure of the contribution to GDP made by the industry, and consists of compensation of employees, taxes on production and gross operating surplus. *Output* is the value of the goods and services produced. For most industries, this is simply the revenues generated through sales; for others, in particular retail industries, output is the value of the services supplied.

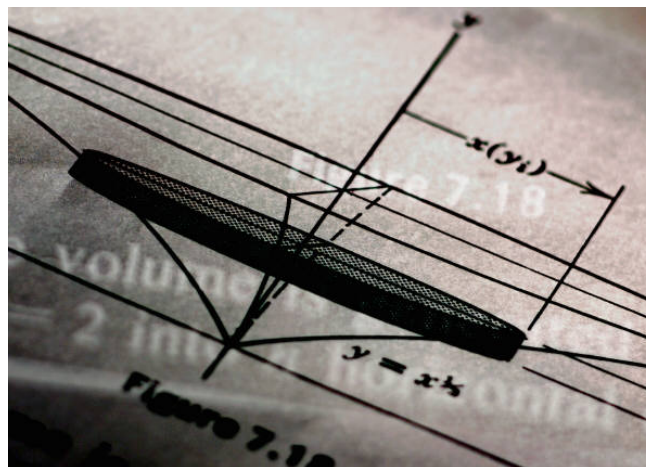
Estimates are developed using software and data from IMPLAN Group, LLC which traces inter-industry transactions resulting from an increase in demand in a given region. The economic region of interest is the State of California, and the activity is reported for 2017, the most recent year for which a complete set of data is available. Estimates for labor income, value added, and output are expressed in 2017 dollars to maintain consistency with the reported industry activity.

The total estimated economic contribution includes *direct*, *indirect* and *induced* effects.

### Forward Linkages

Another prism through which the industry can be viewed is its *forward linkages*—the extent to which its products are incorporated into the manufacturing and service delivery operations of the rest of the economy. In the case of the refinery industry, for example, those industries which are highly dependent on transportation fuels, such as trucking, aviation and construction industries, and manufacturing industries dependent on petroleum byproducts in the production of their own products, such as plastics manufacturers and medical device manufacturers.

Understanding these linkages is important in evaluating how cost increases in oil and gas industry products might



*Direct activity* includes the materials purchased and the employees hired by the industry itself. *Indirect effects* are those which stem from the employment and business revenues motivated by the purchases made by the industry and any of its suppliers. *Induced effects* are those generated by the spending of employees whose wages are sustained by both direct and indirect spending.

Contribution analysis differs from economic impact analysis in that linkages between the component industries as described below are removed so that indirect activity is not double-counted as also part of direct activity.

Direct activity related to the oil and gas industry was based on employment and wage data from the Quarterly Census of Employment and Wages and Nonemployer statistics from the U.S. Census Bureau with nondisclosed data estimated by the LAEDC. ❖

extend through the manufacturing and service delivery chains.

In this report, refinery and petrochemical products are traced through the industry user chain and each *primary* user industry's *intensity of use* compared to its use as a share of revenues, which represents a measure of the user industry's dependency on refined and petrochemical products. An industry that primarily depends on oil and gas inputs for production will be affected to a greater extent than other, less reliant industries.



This dependency is evaluated against the user industry's gross operating surplus, which points to the industry's ability to absorb higher costs of inputs.

Lastly, each user industry's *trade sensitivity* will be estimated to provide an indication of its ability to pass the higher costs of inputs through to its customers.

The combination of these measures provides the basis for a *vulnerability indicator*. The composite index is derived as discussed in the text.

For the top twenty user industries by vulnerability indicator, employment, labor income, output and direct contribution to GDP are estimated to provide orders of magnitude of the economic activity that is at immediate

risk from disruption of supply of refined petroleum products and byproducts.

The metrics used to determine orders of magnitude for primary user industries are employment, labor income, value-added and the value of output as described above.

The data used to conduct this analysis is the Industry Economic Accounts produced by the Bureau of Economic Analysis of the Department of Commerce (specifically, the Make and Use tables) as estimated and aggregated by the IMPLAN Group, LLC in its latest software release for the 2017 calendar year. The economic region of interest is the State of California. Estimates for labor income and output are expressed in 2017 dollars to maintain consistency with the reported industry activity. ❖

### Workforce Characteristics Methodology

Data for worker characteristics according to industry is not available at the same detailed level as it is for employment. As such, some modifications were made to the industry definition in reporting workers characteristics. Specifically, the following industries from Exhibit 1-1 were excluded from the workforce analysis: 23712, 32511, 333132 and 45431.

The Center for Economic Studies at the U.S. Census Bureau provides several public-use data products derived from existing census, survey, and administrative data. One of these products is the Quarterly Workforce Indicators (QWI), which provides workforce statistics by demography, geography and industry at the sector, subsector and 4-digit industry level.

The QWI is unique in that it reports data at the job-level, obtained from linked employer-employee microdata in the Longitudinal Employer-Household Dynamics (LEHD), a database covering more than 95 percent of U.S. private sector jobs. Additional sources include administrative records on employment by states, Social Security data, Federal tax records and other census and survey data.

Data available through the QWI allows for the analysis of the demographics of a particular labor market or specific industry, as is done in this report for the oil and gas industry. Estimates used to determine employment distributions of worker characteristics are stable full-quarter employment counts, the number of jobs held on both the first and last day of the quarter with the same employer. Quarterly data has been annualized. ❖

## Description of NAICS Industry Sectors

The industry sectors used in this report are established by the North American Industry Classification System (NAICS). NAICS divides the economy into twenty sectors, and groups industries within these sectors according to production criteria. Listed below is a short description of each sector as taken from the sourcebook, *North American Industry Classification System*, published by the U.S. Office of Management and Budget (2012).

*Agriculture, Forestry, Fishing and Hunting:* Activities of this sector are growing crops, raising animals, harvesting timber, and harvesting fish and other animals from farms, ranches, or the animals' natural habitats.

*Mining:* Activities of this sector are extracting naturally-occurring mineral solids, such as coal and ore; liquid minerals, such as crude petroleum; and gases, such as natural gas; and beneficiating (e.g., crushing, screening, washing and flotation) and other preparation at the mine site, or as part of mining activity.

*Utilities:* Activities of this sector are generating, transmitting, and/or distributing electricity, gas, steam, and water and removing sewage through a permanent infrastructure of lines, mains, and pipes.

*Construction:* Activities of this sector are erecting buildings and other structures (including additions); heavy construction other than buildings; and alterations, reconstruction, installation, and maintenance and repairs.

*Manufacturing:* Activities of this sector are the mechanical, physical, or chemical transformation of material, substances, or components into new products.

*Wholesale Trade:* Activities of this sector are selling or arranging for the purchase or sale of goods for resale; capital or durable non-consumer goods; and raw and intermediate materials and supplies used in production and providing services incidental to the sale of the merchandise.

*Retail Trade:* Activities of this sector are retailing merchandise generally in small quantities to the general public and providing services incidental to the sale of the merchandise.

*Transportation and Warehousing:* Activities of this sector are providing transportation of passengers and cargo, warehousing and storing goods, scenic and sightseeing transportation, and supporting these activities.

*Information:* Activities of this sector are distributing information and cultural products, providing the means to transmit or distribute these products as data or communications, and processing data.

*Finance and Insurance:* Activities of this sector involve the creation, liquidation, or change of ownership of financial assets (financial transactions) and/or facilitating financial transactions.

*Real Estate and Rental and Leasing:* Activities of this sector are renting, leasing, or otherwise allowing the use of tangible or intangible assets (except copyrighted works) and providing related services.

*Professional, Scientific, and Technical Services:* Activities of this sector are performing professional, scientific, and technical services for the operations of other organizations.

*Management of Companies and Enterprises:* Activities of this sector are the holding of securities of companies and enterprises, for the purpose of owning controlling interest or influencing their management decision, or administering, overseeing, and managing other establishments of the same company or enterprise and

normally undertaking the strategic or organizational planning and decision-making of the company or enterprise.

*Administrative and Support and Waste Management and Remediation Services:* Activities of this sector are performing routine support activities for the day-to-day operations of other organizations, such as: office administration, hiring and placing of personnel, document preparation and similar clerical services, solicitation, collection, security and surveillance services, cleaning, and waste disposal services.

*Educational Services:* Activities of this sector are providing instruction and training in a wide variety of subjects. Educational services are usually delivered by teachers or instructors that explain, tell, demonstrate, supervise, and direct learning. Instruction is imparted in diverse settings, such as educational institutions, the workplace, or the home through correspondence, television, or other means.

*Health Care and Social Assistance:* Activities of this sector are operating or providing health care and social assistance for individuals.

*Arts, Entertainment and Recreation:* Activities of this sector are operating facilities or providing services to meet varied cultural, entertainment, and recreational interests of their patrons, such as: (1) producing, promoting, or participating in live performances, events, or exhibits intended for public viewing; (2) preserving and exhibiting objects and sites of historical, cultural, or educational interest; and (3) operating facilities or providing services that enable patrons to participate in recreational activities or pursue amusement, hobby, and leisure-time interests.

*Accommodation and Food Services:* Activities of this sector are providing customers with lodging and/or preparing meals, snacks, and beverages for immediate consumption.

*Other Services (except Public Administration):* Activities of this sector are providing services not specifically provided for elsewhere in the classification system. Establishments in this sector are primarily engaged in activities such as equipment and machinery repairing, promoting or administering religious activities, grant-making, advocacy, and providing dry-cleaning and laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services. ❖

## Study Authors

### **Shannon M. Sedgwick**

*Senior Economist, Institute for Applied Economics*

In her current capacity as a Senior Economist at LAEDC, Ms. Sedgwick develops subject-specific information and data interpretation for economic impact, demographic, transportation, industry and issue studies. She is involved in the planning and design of projects and performs research, data collection and organization, analysis and report preparation. Her work focuses on workforce issues, demographics, industry clusters, and occupational and industry contribution analyses. Ms. Sedgwick is also proficient at conducting geospatial analysis and working with IMPLAN.

Ms. Sedgwick joined the LAEDC in June of 2008 as an Economic Research Assistant with the Kyser Center for Economic Research. In that role she assisted both Economic Research and the Consulting Practice of the LAEDC with data collection and research covering the State of California, Southern California and its counties.

Before joining the LAEDC, Ms. Sedgwick managed an industrial and steel supply company located in the Inland Empire. There she identified and targeted a diverse customer base and analyzed product and customer patterns in the local industrial market to successfully increase revenues.

A Southern California native, Ms. Sedgwick studied Economics at the University of Southern California (USC). She holds a minor in Architecture, is actively involved with local animal rescue organizations and volunteers annually as a mentor to undergraduate students selected for the USC Dornsife Gateway Internship Program.

### **Tyler Laferriere**

*Associate Economist, Institute for Applied Economics*

In his current capacity, Mr. Laferriere is an Associate Economist at the Institute for Applied Economics at LAEDC. His work portfolio at IAE includes data management and analysis; model building and forecasting; drafting economic reports; copy editing IAE drafts; and performing economic impact analyses. His research focuses include data management, economic forecasting, economic policy studies, labor and occupational research and economic impact studies. He joined LAEDC in December of 2017.

Before joining LAEDC, Mr. Laferriere was a graduate student at Washington State University pursuing joint degrees in applied economics and statistics. His graduate education also included internships with the Federal Reserve Board and USDA Economic Research Service in Washington, D.C., focusing in the former on consumer spending patterns and the latter on technological adoption models. His applied economics master's thesis involved a cross-sectional study on work-life policies aimed at improving gender balances in economics and applied economics. He also worked extensively in student affairs and as a copy editor and columnist for the WSU newspaper, the Daily Evergreen.

As mentioned above, Mr. Laferriere received his Master of Science degrees in Applied Economics and Statistics from Washington State University. He also holds a Bachelor of Science degree in Economics and Bachelor of Arts degree in Political Science from Gonzaga University. Originally a native of Phoenix, Arizona, he enjoys all manner of outdoor such as running, tennis, hiking and swimming in addition to the culinary arts and cinema. As might be inferred from his journalistic background, he is also politically active and jointly produces an economic development podcast with Mr. Eric Hayes.

### **Eric Hayes**

*Associate Economist, Institute for Applied Economics*

Eric Hayes joined the Los Angeles County Economic Development Corporation's Institute for Applied Economics as a Research Analyst in 2017. Since joining the LAEDC Eric has been heavily involved in the department's research agenda, including key roles on major recurring projects such as the annual Los Angeles County Economic Forecast, the San Gabriel Valley Economic Forecast and the SCAG Economic Update. In addition, Eric helps to develop and maintain many of the statistical and economic models used by the Institute for Applied Economics for analysis and forecasting. His personal research interests are related to urban and regional economics, with particular emphasis on the issues of housing, transportation and demography. He holds a BA in Economics from the University of California, Los Angeles and a MS in Statistics from San Diego State University. ❖

(888) 4-LAEDC-1



Los Angeles County Economic Development  
Corporation  
444 S. Flower Street, 37<sup>th</sup> Floor  
Los Angeles, CA 90071