

The Economic Impacts of Allowing Access to the Pacific OCS for Oil and Natural Gas Exploration and Development

Prepared For:

The American Petroleum Institute (API)

Prepared By:



CALASH



Executive Summary

Executive Summary

The offshore oil and natural gas industry is a significant contributor to the U.S.' domestic energy production and the national economy including employment and government revenues. New offshore oil and gas exploration and development in the U.S. is currently limited primarily to the Central and Western Gulf of Mexico, with limited legacy production off California and Alaska. In total, approximately 94 percent¹ of the total acreage in federal offshore waters is inaccessible to offshore oil and natural gas development, either through lack of federal lease sales or outright moratoriums. The Pacific OCS is currently inaccessible to new activity due to the lack of any recent lease sales within the region – all current production and active leases were purchased prior to the last lease sale in 1984. In January 2018, the administration introduced a new draft proposed program (for 2019 to 2024) with substantially all areas of the federal OCS not under specific moratorium to be offered for lease including the Southern, Central and Northern California and Washington and Oregon OCS areas.² Under this proposed plan leasing is scheduled to begin in the Southern California in 2020, and Northern California, Central California, Washington and Oregon in 2021.

This report constructs a scenario of oil and natural gas development in the Pacific OCS, based on the resource potential of the area, geologic analogs, and the full value chain of oil and natural gas development and production. This report attempts to construct a scenario based on the currently proposed leasing program. The report quantifies the capital and other investments projected to be undertaken by the oil and natural gas industry, identifies linkages to the oil and gas supply chain at both the state and national levels, estimates both job creation and contributions to economies associated with oil and natural gas development, as well as government revenues due to lease bids, rents, and production royalties. (Table 1)

¹ "2012-2017 OCS Oil and Gas Leasing Program", Bureau of Ocean Energy Management, August 22, 2012, September 1, 2017.

² "Secretary Zinke Announces Plan For Unleashing America's Offshore Oil and Gas Potential", Department of the Interior, January 4, 2018, January 23 2018

Table 1: Summary Table Potential Impacts from Pacific Oil and Natural Gas Development³⁴

Economic Impact	First Leasing + 3 Years	First Leasing + 10 Years	First Leasing + 20 Years	Cumulative 20 Years
Capital Investment and Spending (\$Billions)	\$0.4	\$6.4	\$19.8	\$160.9
Employment	8,436	91,855	300,789	N/A
Contributions to Economy - GDP (\$Billions)	\$0.8	\$7.6	\$25.0	\$205.2
Federal / State Government Revenue (\$Billions)	\$0.6	\$1.6	\$5.9	\$57.4
Natural Gas and Oil Production (MMBOED)	0.01	0.11	1.54	3.24 Billion BOE

Source: Calash

Leasing

This study assumes that leasing will begin in Southern California in 2020 which is denoted as “year one” in this study, to coincide with the currently proposed draft Bureau of Ocean Energy Management (BOEM) five-year plan. Leasing activity in the initial year of leasing is projected at over 200 leases sold. Leasing activity in the Central and Northern California as well as Washington and Oregon is projected to begin in year 2, which would coincide with 2021 under the draft proposed five-year plan.

Drilling

Drilling is the key activity both to discover oil and natural gas resources through exploration drilling as well as to bring them onto production by drilling development wells. With leasing starting in Year 1, Pacific drilling would be expected to begin shortly after in the following year, and continue at very low levels (2-6 wells a year) for around five years. Total exploratory and development wells drilled is projected to average about 40 wells per year across the forecast period of which around 65 percent of wells are projected to be drilled in deepwater and 35 percent are projected to be drilled in shallow water. Drilling in the Pacific OCS is projected to trend upwards as more infrastructure is developed and a higher percentage of development wells are drilled each year. In the last five years of the forecast an average of around 80 wells are projected to be drilled annually.

Projects

Offshore project development is the key factor in oil and natural gas production. It is also the main factor leading to capital and operational expenditures that drive increases in employment and economic activity. Offshore projects are complex, requiring a multitude of engineers, contractors, and equipment suppliers working over a number of years prior to oil and natural gas production. For the purposes of this study, offshore project development was generalized into six

³ BOED or barrel of oil equivalent per day is unit of combined oil and natural gas based on the energy equivalency of oil and natural gas. A MMBOE is a million barrels of oil equivalent.

⁴ Assumes 37.5 percent revenue sharing with state governments.

project types based on project size and water depth. This study estimates that over 30 major projects could begin oil and natural gas production in the Pacific OCS over the 20-year forecast period, of around 20 are projected to be deepwater projects and 10 are projected to be shallow water projects.

Oil and Natural Gas Production

Allowing new leasing in the Pacific OCS for offshore oil and natural gas production is projected to lead to a significant increase in Pacific OCS and domestic energy production, currently Pacific OCS oil and natural gas production is steadily declining due to a lack of new leasing in the area. In 2016 combined oil and natural gas production in the federal OCS fell to an average of around 19 thousand barrels of oil equivalent a day (BOED) due to a lack of new leasing. Within six years of initial leasing, oil and natural gas production is expected to exceed that level despite expected continued declines in existing production. Pacific OCS production is projected to increase to over 225 thousand BOED within ten years of leasing beginning. Production is projected to reach over 1.5 million BOED 20 years after leasing begins, with production expected to be around 79 percent oil and 21 percent natural gas.

Spending

Total cumulative domestic spending due to Pacific OCS oil and natural gas activity across the forecast period is projected to be around \$160 billion. Spending is projected to grow from an average of \$425 million per year during the first five years of initial leasing, seismic, and exploratory drilling to nearly \$20 billion per year 20 years after first leasing begins.

The largest amounts of expenditures are for drilling, operational expenditures, engineering, manufacturing and fabrication of platforms and equipment. Cumulative operational expenditures (OPEX), which occur after a well's initial production, are projected at nearly \$33 billion. Cumulative capital expenditures across the forecast period are projected to total around \$155 billion.

Domestic spending is expected to account for 85 percent of cumulative spending from Pacific coast offshore development, with the remaining taking place internationally. For domestic spending, nearly 70 percent of spending from Pacific oil and natural gas developments is expected to take place in the Pacific Coast states, with California projected to account for 49 percent of spending, Washington projected to account for 14 percent, and Oregon projected to account for eight percent of spending.

Employment

Pacific oil and natural gas development is expected to lead to significant employment gains, both in the Pacific Coast states and nationally. Employment impacts are expected to grow

throughout the forecast period, with total incremental U.S. employment supported projected to reach around 300 thousand jobs 20 years after initial lease sales. Total Pacific Coast region employment is projected to reach over 240 thousand jobs. States outside the region are projected to see employment gains of around 60 thousand jobs by the end of the forecast period. The largest employment impact of Pacific oil and natural gas activity is projected in California where over 165 thousand jobs will be created by the end of the forecast period. Washington and Oregon are projected to see employment gains of over 42 thousand and nearly 35 thousand jobs respectively by the end of the forecast period. The share of incremental employment within the Pacific Coast states is projected to steadily grow as the area is developed – allowing for additional goods and services to be sourced locally.

Contributions to the Economy and Government Revenues

Spending by the oil and gas industry is expected to lead to a significant increase of the nation's GDP. Total contributions to the economy are projected to be nearly \$26 billion per year by the end of the forecast period, with over \$21 billion of the impact in that year projected to occur in the Pacific Coast states.

Pacific oil and natural gas development has the potential to increase government revenue from royalties, bonus bids, and rents on leases by over \$57 billion cumulatively throughout the forecast period. Total government revenues are projected to reach over \$8.7 billion per year 20 years after initial lease sales. The majority of projected cumulative revenues are from royalties on produced oil and natural gas at around \$47 billion. Leasing bonus bids are projected to account for around \$8.1 billion while rental income from offshore blocks is expected to account for approximately \$2.3 billion.

This report assumes that associated government revenue is split 37.5 percent to the affected coastal states and 62.5 percent to the Federal government. This is similar to the arrangement in place with currently producing Gulf of Mexico States without an associated cap on state government revenue. Actual revenue proportion going to state governments, if any, would be determined by future legislation as there is currently no revenue sharing agreement in place between the federal government and the Pacific OCS states. Cumulative state revenues through the forecast period for the Pacific states could reach over \$21 billion. Any spending by state governments due to additional revenue has the potential to increase GDP.⁵

Allowing access to the Pacific OCS for oil and natural gas development is projected to increase employment, economic activity, and government revenues. The nation as a whole, but especially the Pacific coast states, are projected to see large employment gains, increased

⁵ Analysis assumes states spend 50 percent of additional revenue.

economic activity, and additional government revenue. In addition, the nation is projected to see increased domestic oil and natural gas production, increasing the nation’s energy security.

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Section 1 – Introduction

Oil and natural gas development contributes significantly to the U.S. economy both by providing a significant portion of primary energy consumption and by providing significant employment and other benefits. The impacts of oil and natural gas exploration and production are felt both throughout the nation and throughout all sectors of the economy. Despite the benefits of oil and natural gas development, a significant portion of the oil and natural gas resources of the United States is inaccessible, most notably 94 percent⁶ of the U.S. outer continental shelf's (OCS). These offshore areas are limited due to a lack of lease sales by the Federal government or outright moratoriums.

Despite the time that has surpassed between the last lease sales, offshore southern California continues to produce oil, while the estimated undiscovered technically recoverable resources (UTRR) within the region has grown from 7 billion BOE in 1987, to more than 13 billion BOE. The current 2017 to 2022 schedule of Federal offshore leasing does not include any proposed leases off of the U.S. Pacific coast. In January 2018, the administration introduced a new draft proposed program (for 2019 to 2024) with substantially all areas of the federal OCS not under specific moratorium to be offered for lease including all Pacific OCS areas.⁷ Under this proposed plan leasing is scheduled to begin in Southern California in 2020, in the remainder of Pacific OCS in 2021. The resources in the Pacific OCS suggests that providing companies with additional opportunities to conduct safe, well regulated, exploration and production in this area would further enhance the nation's energy security while providing significant employment and economic benefits both to the affected region as well as the country as a whole.

1.1 Purpose of the Report

Calash was commissioned by the American Petroleum Institute (API) to provide an independent evaluation of the potential impacts of the development of America's offshore oil and gas resources within the Pacific OCS if oil and natural gas development restrictions were lifted. In addition, Calash projected potential impacts on U.S. oil and natural gas production, supported employment, GDP, and government revenue. The conclusions set forth in this study are based solely upon government and other publicly-available data and Calash's own expertise and analysis.

The report assumes a favorable regulatory environment for development such as regular lease sales throughout the 20 year study period and a reasonable rate of permit approvals for projects and drilling. The report assumes that lease sales in the Pacific OCS would follow the

⁶ "2012-2017 OCS Oil and Gas Leasing Program", Bureau of Ocean Energy Management, August 22, 2012, September 1, 2017.

⁷ "Secretary Zinke Announces Plan For Unleashing America's Offshore Oil and Gas Potential", Department of the Interior, January 4, 2018, January 23 2018

proposed lease schedule for five years and continue on a regular basis throughout the forecast period. The provided analysis uses existing USGS and Bureau of Ocean Energy Management (BOEM) resource estimates.

The analysis tracks the full lifecycle of oil and natural gas development that is projected to take place following the opening of the Pacific OCS to new leasing. The report therefore projects spending from leasing and seismic imaging to exploration drilling, onto project development and through production. The associated ongoing spending needed to maintain and operate projects is also estimated.

The report assumes that the initial leasing activity will begin in year 1, which coincides with 2020 in the draft proposed program. The study projects activity, spending, employment, economic impacts, and government revenues associated with these activities for 20 years.

Economic and employment impacts calculated on expected industry spending are based on the report's forecasted timing of oil and natural gas exploration and production activity as well as projections for where the development activity and associated economic activity will take place. The report also projects estimated state and federal government revenues from sources such as bids, rents, and royalties, and projects the economic and employment effects of these where applicable. Assumptions on pricing, the location mix of spending, oil and natural gas prices, and economic multipliers are based on current conditions and are subject to change based on the timing of increased access to Pacific oil and natural gas reserves.

1.2 Report Structure

The report is structured as follows: preceding this introductory section is the Executive Summary outlining all principal results and findings of this report. Immediately following the section is the Data Development section, outlining Calash's methods for data aggregation and analysis, including a comprehensive overview of the project and model flow. Data Development may further be broken down into subsets based on: resource and production modeling, project spending inputs encompassing capital expenditures (CAPEX) and operational expenditures (OPEX), allocated spending into individual states, economic development representing job growth, and governmental revenues. Applications of the model and its results are presented in further detail within the Results section of the paper. Included within Results are the distributions of production, spending, economic, and governmental effects upon the national, regional, and states. The final Conclusions section provides further assessment and analysis. Additional essential information can be found within the appendix sections following the report.

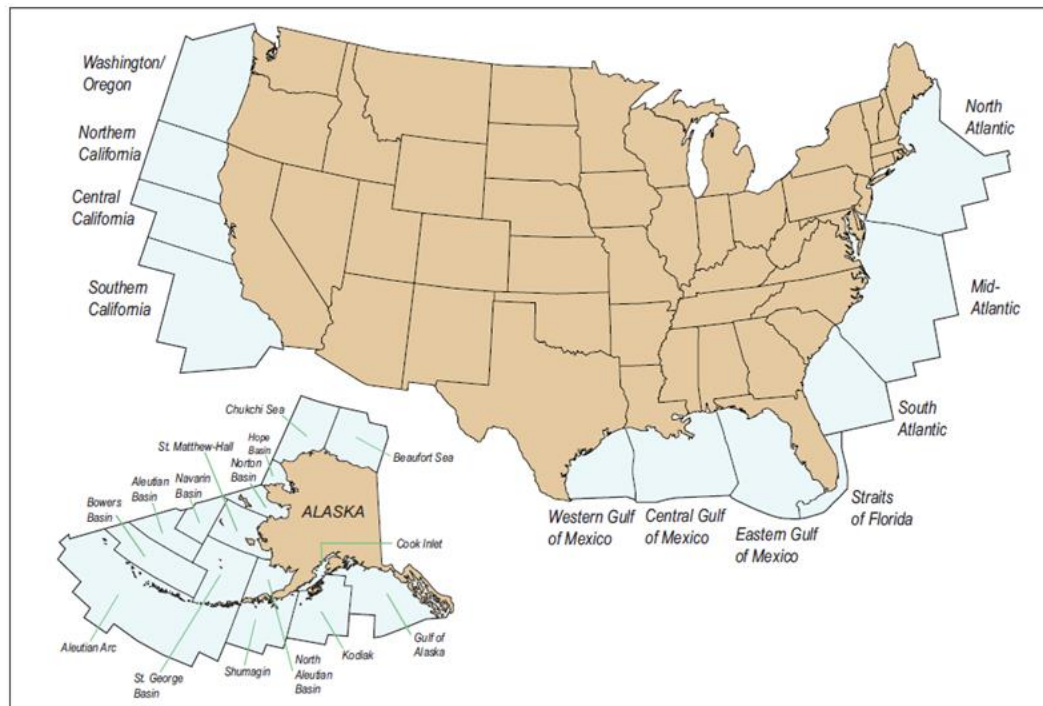
For the purpose of this report the directly affected states along the Pacific coast are defined as: California, Washington, and Oregon.

1.3 About Calash

Since Calash's creation it has evolved from an oil and natural gas commercial and operational due diligence provider into an award-winning energy advisory firm providing strategy, business advisory, economic analysis, and mergers and acquisitions support services. As a function of Calash's core business, the company is engaged daily in the collection and analysis of data as it relates to the oil and natural gas industry. Calash serves the global community of operating oil and natural gas companies, their suppliers, financial firms, and many others by providing detailed analysis on projects, investments, capital investment and operational spending undertaken by the onshore and offshore industries. Calash analyzes market data from a variety of sources at the project level for projects throughout the world.

1.4 The Pacific OCS

The Pacific OCS is the third largest OCS area comprising 248 million acres of federal waters. Covering the entirety of the Pacific Coast, it is inclusive of Washington, Oregon, and California. Currently all leases, excluding 43 historic leases, remain inaccessible under the most recent 5-year leasing plan. Within the Pacific OCS, delineation is made to subdivide the region into four planning areas: Washington/Oregon, Northern California, Central California, and Southern California. Historically the majority of activity within in the regions has focused on Southern California, with 41 of 43 active leases as well as all federal production within the OCS taking place here, although additional leases and exploration efforts were undertaken throughout the regions prior to 1990.

Figure 1: Federal OCS Planning Area Map

Source: Bureau of Ocean Energy Management

1.5 Lease History

Federal lease sales within the Pacific OCS took place between the years of 1961-1984, with only Central and Southern California being offered after 1964. Overall, twelve lease sales have been completed within federal waters, while four additional sales were canceled between 1986 and 1989.

Presently there are 38 outstanding leases within federal waters that encompass 241 thousand acres of offshore waters - all within California regions. All of these 38 leases are currently producing.

1.6 Seismic

According to the BOEM's seismic inventory, oil and gas related seismic within the Pacific OCS is dated and limited in scope in comparison to developed regions - approximately 315 thousand miles of geophysical data has been acquired through all acquisition types. Within this data set, 132 thousand miles are 2-D, 110 thousand miles are gravitational/magnetic, 42 thousand miles are interpretations, and 30 thousand miles are HRD. Dates of seismic acquisitions all precede 1989 with the exception of 52 blocks of 3-D seismic and 484 miles of 2-D being acquired in the 1990's.

1.7 Drilling & Production

The most recent drilling within the area, in 2011, has been restricted to additional platform drilling on installed infrastructure, while new activity relating to undeveloped projects, inclusive of the last installation of a new structure as well as the last exploration well within the region, has been halted since 1989.

Since 1963, the BOEM reports a total of around 1150 wells have been drilled along the Pacific Coast. The distribution of wells is heavily weighted towards Southern California, where all development has taken place, although several wells have been drilled further north into Oregon and Washington – as well as additional Canadian wells nearby in Vancouver Island. Due to the technological limitations at the time, the majority of wells were drilled in shallow waters and to limited vertical depths by today's standards - the greatest water depth and deepest total vertical depth (TVD) within the region are presently 1,911 feet and 18,318 respectively.

Development and production within the region has focused on a select number of historical opportunities in the shallow waters of California particularly along the Santa Barbara coast. These projects have represented the area for numerous decades, the first being installed in 1967. Production today still continues—presently providing just under 20,000 boed of production from the region.

1.8 Pacific Resources

For this report, Calash has assumed the amount and general location of oil and natural gas resources based on the combination of historical BOEM reports. While multiple sources were identified, the 1995 and 1999 National Assessment of United States Oil and Gas Resources Assessment of the Pacific Outer Continental Shelf Region (Dunkel and Piper, 1997) provides a framework for play delineation, and the Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf as of 2011, provides a framework for UTRR presently available.

Throughout the region, potential mixture of oil and gas bearing geologies vary as one moves along the coast line and into deeper water depths. The report projects that the northern area of Oregon-Washington is likely to contain more gas rich prospects in shallower waters, while as one moves south, the mixture of oil-to-gas is likely to increase, as well as the reserves contained in deeper water depths. More detailed maps of the individual plays can be found from section 7.2 within the appendix section.

The play by play reserve assessments presented in the study by the BOEM are the basis for both the resource and production models used to formulate this study as further discussed in the data development section and resource sections. (Table 2)

Table 2: BOEM Resource Estimates by Play and Resource Type

UTRR by Play	Oil (Bbbl)	Gas (Tcf)	Oil %	Gas %	BOE (Bbbl)
Pacific Northwest Province	0.41	3.91	37%	63%	1.10
Central California Province	4.81	4.86	85%	15%	5.65
Santa Barbara - Ventura Basin Province	1.53	2.31	77%	23%	1.98
Los Angeles Basin Province	0.26	0.16	93%	7%	0.27
Inner Borderland Province	1.79	2.07	83%	17%	2.16
Outer Borderland Province	1.40	2.79	74%	26%	1.90
Total Pacific OCS	10.20	16.10	57%	43%	13.06

Source: Bureau of Ocean Energy Management

1.9 Excluded from This Study

This paper has been limited in scope to the assessment of the development of oil and natural gas resources from known Pacific formations in Federal waters identified in BOEM reports. Any potential benefits from the development of onshore downstream infrastructure are not included. In addition, the calculated government revenue potential does not include personal income taxes, corporate income taxes or local property taxes. The development of additional oil and natural gas resources not identified in the BOEM report are not included even though new formations will likely be found as the area is developed.

Section 2 – Data Development

2.1 Data Development

Calash's data development scenario focused on constructing a tiered "bottom-up" model that separates the complete life cycle of offshore operations and subsequent effects into three main categories and five sub categories. The three main categories are as follows: an "Activity" model assessing potential reserve information under the expectation of estimating the possible number of projects based on the resources within the Pacific OCS, a "Spending" model based on the requirements to develop projects within the "Activity Forecast", and an "Economic" model focused on the economic impact on employment and government revenue from the "Spending" model. Individual subsections of each of the three major models were further examined under six additional criteria that create an individual "Project" model. These categories include: reserves, seismic, leasing activity, drilling, infrastructure & project development, and production & operation. (Table 3)

Table 3: Oil and Gas Project Development Model

	Activity Forecast	Spending Model	Economic Model
Reserves	• Total Pacific OCS Gulf Reserves • Reserves by Play • Reserves by Field • Fields into Projects	N/A	N/A
Seismic	• Pre-Lease Seismic • Leased Block Seismic • Shoot Type	• Cost per Acre	• Economic Activity due to Seismic Spending within States
Leasing	• Yearly Lease Sales	• Bonus Bid Prices • Rental Rates	• Federal and State Revenues Created through Lease Sales • Economic Activity due to Increased State/Personal Spending
Exploration Drilling	• Number of Wells Drilled • Water Depth of Wells Drilled • Number of Drilling Rigs Required	• Cost per Well	• Economic Activity due to Exploration Drilling within States
Project Development & Operation	• Project Size • Project Development Timeline	• Spending per Project • Per Project Spending Timeline	• Division of State Spending • Economic Activity due to Project Development within States Vicinity
Production	• Production Type and Amount	• Oil and Gas Price Forecast	• Federal and State Revenues Created through Royalty Sharing • Economic Activity due to Increased State/Personal Spending

Source: Calash

2.2 Resources

Methodology used in the calculation of resources was derived from previous reports of the Bureau of Ocean Energy Management (BOEM) and its predecessor agencies on estimated resources in place. Given the predictive nature of these reports, Calash deemed it reasonable to

extrapolate from BOEM estimates to closer reflect undiscovered technically recoverable reserves (UTRR) growth patterns within developed regions. This important step was principally modeled through analysis on historical reserve assessment growth within the developed areas of the Gulf of Mexico, Alaska, and the North Sea. A resulting multiplier of 2.06 and UTRR alternative case of 18.42 MMboe were calculated using this methodology.

After recalculating UTRR play resources, further subdivision was assigned based on USGS field size distributions within similar geological plays. The combination of field sizing and number of fields allows for the distribution estimation of possible discoveries within each play, while the potential reserves within each discovery were then further discounted based on a recovery factor of similar geological plays. Calash's assessments of potential field developments led to the creation of multiple project development scenarios dependent on the field sizing, with the assumption that large fields are more likely to be discovered first. Through the allocation of field discoveries into project categories based on individual play reserve expectations, Calash concluded a forecast of the number of projects expected within each play. It is important to note the uncertainty around the location of fields and projects within each play, and thereby placing them within the associated vicinity of states becomes a challenge. In order to account for this, Calash drew a 200-mile buffer around each individual state's border, reweighting reserves and spending for each project based on the reserves in proximity to a state's border.

Projects were developed under two major criteria that allowed for six development scenarios. These criteria were separated between deepwater and shallow water projects and furthermore between small, medium, and large projects. This allowed for further delineation between projections, as each individual scenario has defined characteristics behind timing, spending, and production that drive later modeling. These delineations allowed for smaller projects to be developed under a shorter time-frame, require less hardware and engineering, as well as produce lower volumes for fewer years, while the opposites hold true for larger projects.

Project timing was developed based on offshore sector data, as each project was given an individual timeline representing the required time for a generic project of that size and scope. Assumptions were made for development scenarios given the minimal infrastructure currently in place within the Pacific OCS. Timelines and infrastructure requirements were adjusted as infrastructure grew within certain areas, allowing for increased subsea tie-backs for deepwater projects and increased project numbers given decreasing infrastructure requirements and increasing project economics. Once in place, projects are expected to produce based on a set production curve based on historical ramp-up and peak production data for existing fields, while declines were expected to follow an Arps equation.⁸

⁸ Arps represents the hyperbolic shaped decline curve of an oil and gas field after peak production. Arps, J.J. "Analysis of Decline Curves" Trans. AIME (1944) 160, 228-47.

2.3 Project Spending

This spending analysis accounts for all capital investment and operational spending through the entire “life cycle” of operations. Every offshore oil or natural gas project must go through a series of steps in order to be developed. Initial expenditures necessary to identify targets and estimate the potential recoverable resources in place include seismic surveys (G&G) and the drilling and evaluation of exploration & appraisal (E&A) wells. For projects that are commercially viable, the full range of above surface and below water (subsea) equipment must be designed and purchased. Offshore equipment includes production platforms and potentially on-site processing facilities as well as below water equipment generally referred to as SURF (Subsea, Umbilicals, Risers and Flowlines). Finally, the equipment must be installed and additional development wells must be drilled. Once under production, further operational expenditures (OPEX) are required to perform ongoing maintenance, production operations and other life extension activities as necessary for continued field production and optimization.

Spending for individual projects was subdivided into sixteen categories covering the complete life cycle of a single offshore project, excluding decommissioning, as well as two additional groups for natural gas processing and operation. Timing and cost for individual categories were assigned based on the previously mentioned project types where prices scale given the complexity and size of the project. (Table 4)

Table 4: Oil and Gas Project Spending Model

	Activity Model	Spending Model	Economic Model
Seismic (G&G)	• Number of Leases • 2D vs. 3D	• Cost per Acre	• Operation Requirements
SURF	• Trees, Manifolds, and Other Subsea Equipment • Umbilicals • Pipelines, Flowlines, and Risers	• Cost per Item • Cost per Mile	• Fabrication Locations
Platforms	• Fixed Platforms • Floating Production Systems	• Unit Size	• Fabrication Locations
Installation	• Surf Installation • Platform Installation	• Number of Vessels • Type of Vessels • Vessel Dayrate	• Operation Requirements • Shorebase Locations
Drilling	• Exploration Drilling • Development Drilling	• Rig Type • Rig Dayrate	• Operating Requirements • Shorebase Locations
Engineering	• FEED	• CAPEX • OPEX	• Technological Centers
Operating Expenditures (OPEX)	• Supply and Personnel Requirements • Project Maintenance • Project Reconfiguration	• Type of Project	• Shorebase Locations

Source: Calash

Upon compiling the scenario of overall spending estimates, Calash deconstructed the “local content” of oil and gas operations within the studied region. Individual tasks were analyzed on a component by component basis to provide an estimate of the percentage of regional, national, and international construction required by offshore operations. Once compiled, further

modeling was prepared to forecast changing distributions as oil and gas development activity increases within the Pacific states. Additionally, delineations were made at the regional level in order to project spending for individual states. Considerations were based on the proximity to reserves and production, strategic locations such as shore bases and ports, as well as Bureau of Economic Analysis (BEA) data pertaining to each state's present economic distribution.

2.4 Economic Data Development

Development of GDP and job data were calculated using the BEA's RIMs II Model providing an input-output multiplier on spending at the industry and state levels for each defined category. Model outputs considered from spending effects include number of jobs and GDP multiplier effects. Further delineation is presented in the form of direct and indirect and induced job numbers, which encompass the number of jobs relating to the spending in that category versus indirect and induced jobs that are created from pass-through spending.

RIMs Categories used:

- Architectural, Engineering, and Related Services
- Construction
- Drilling Oil and Gas Wells
- Fabricated Metal Product Manufacturing
- Mining and Oil and Gas Field Machinery Manufacturing
- Natural Gas Distribution
- Oil and Gas Extraction
- Steel Product Manufacturing from Purchased Steel
- Support Activities for Oil and Gas Operations

2.5 Governmental Revenue Development

Governmental revenue data is presented in three categories: bonus bids from lease sales, rents from purchased but not yet developed leases, and royalty payments from producing leases. The projected revenue was calculated using the current operating structure of the Pacific OCS where applicable and the Gulf of Mexico where a lack of existing structures exists. Lease sales and rental rates were calculated through the simulation of lease sales within each individual area, while the number of leases acquired has been modeled on historical rates and based on the estimated amount of reserves in the region. Calash has modeled lease sales for the first five years on the draft proposed program, after which the report assumes yearly area wide sales within each

region - thus contrasting the current sales which have included a sale approximately every other year.

The federal / state government revenue split of leases, rents and royalties were modeled assuming a similar percentage split as in GOMESA (Gulf of Mexico Energy Security Act). Under GOMESA 37.5 percent of OCS bonus bid, rent, and royalty income is distributed to the appropriate states. GOMESA has an annual revenue cap per state. No such cap was assumed in this analysis.

Currently there is no legislated federal / state revenue sharing agreement applicable to the Pacific states under GOMESA. Calculations in this report were made to distinguish the potential State government revenue impacts among Pacific coast states. These revenue estimates will need to be adjusted based on future legislated sharing arrangements if and when they occur.

Production pricing was calculated using the EIA estimates for both West Texas Intermediate crude spot and Henry Hub natural gas prices from the 2017 Annual Energy Outlook. Due to the steadily increasing trend in the near to medium term of the EIA price forecast, this forecast should be considered conservative and actual revenues could potentially be higher. Additional governmental revenues such as income and corporate taxes were considered outside of the scope of this study and are likely to provide additional government revenues throughout the studied period.

Section 3 – National Results

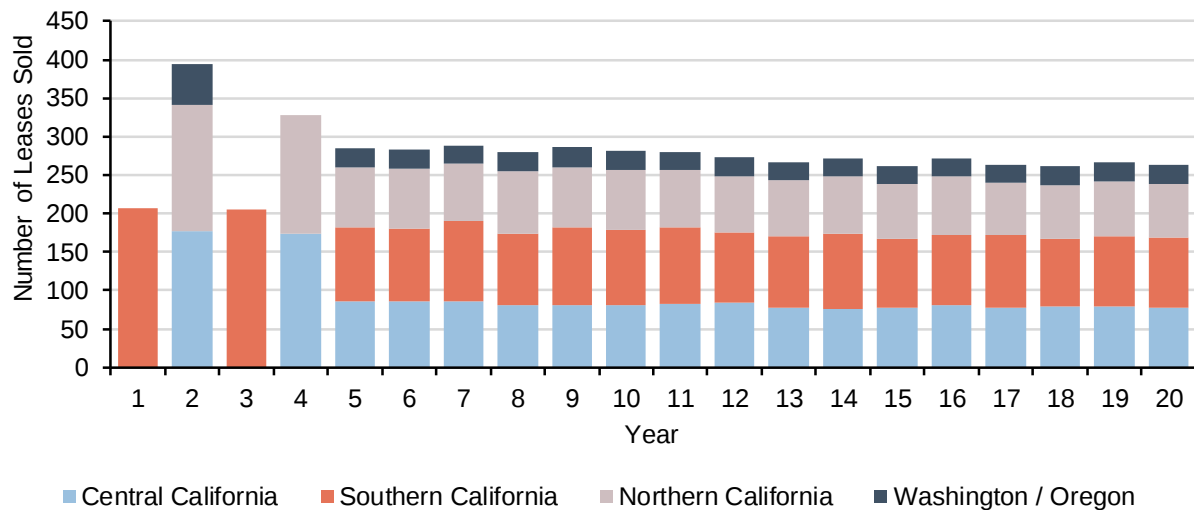
Opening the Pacific OCS to new oil and natural gas activity would be expected to provide large contributions to employment, gross domestic product, and state and federal government revenues. These benefits as projected would be felt throughout the Pacific Coast states as well as the country as a whole. This study examines the total activities and impacts expected to result from resumed Pacific OCS oil and gas development. Offshore oil and natural gas exploration and production requires diverse activities such as seismic imaging of reservoirs, drilling of wells, manufacturing equipment, and installing specialized equipment, all of which require large capital and operational expenditures. Together with increased government revenues from royalties and other payments, these activities are projected to lead to increased employment and economic activity nationwide.

3.1 Seismic and Leasing Activity

In contrast with other OCS areas that are inaccessible for offshore oil and natural gas production, the Pacific OCS has some limited production off the southern California coast. Currently, 38 leases are held and active in the Southern California planning area, with these leases acquired between 1967 and 1982 when the last lease sale took place. These historical sales and associated seismic, as well as production, activities mean that the geology of certain parts of the Southern California planning area are reasonably well known. However, in other portions of the Pacific OCS, seismic surveys have either been sparse, or have never been carried out, so the geology is less understood.

Given that seismic activity is normally the first step required for offshore exploration, both to enable oil companies to make bids on lease blocks and to identify drilling targets after leasing, some pre-leasing seismic activity is expected in the region. Upon the beginning of wide-spread sustained leasing in the Pacific OCS, seismic and leasing activity would be expected to increase. This study assumes that widespread leasing begins in Year 1 coinciding with 2020 in the draft proposed program.

Given the level of knowledge on the area's geology, leasing is assumed to be most active initially in the Southern and Central Pacific regions. The number of leases sold each year in the study's scenario is the estimated amount necessary to develop the projected number of projects, given historical leasing trends in other areas. In Year 1, with leasing taking place only in Southern California, just over 200 leases are projected to be sold. (Figure 2)

Figure 2: Projected Leases Sold Pacific OCS⁹

Source: Calash

3.2 Projects

Offshore project development is the key determinant of oil and natural gas production, industry spending, and economic impacts. Developing offshore projects is a complex process, requiring time, detailed engineering and large amounts of capital. An offshore oil and natural gas project is typically based on one or more discoveries of oil and natural gas fields. Although seismic and other surveys can identify possible oil and natural gas deposits, only drilling can confirm the existence of oil and natural gas in a given location. After confirmation of a viable oil and natural gas field that meets the operators' technical and economic constraints, project development may begin.

Although no two offshore oil and natural gas projects are exactly alike, for the purposes of this study, offshore project developments were generalized into six generic project types based on project size and water depth. Water depth range is one of the key determinants of project development, as field development scenarios vary greatly from shallow to deepwater fields. In shallow water fields so called "fixed" infrastructure which is physically attached to the sea bed is most often used with drilling, processing, and production taking place from one or more platform or platforms.

Deepwater projects are typically more complex and thus more capital intensive. Most deepwater projects utilize floating production units and subsea oil production infrastructure. Due

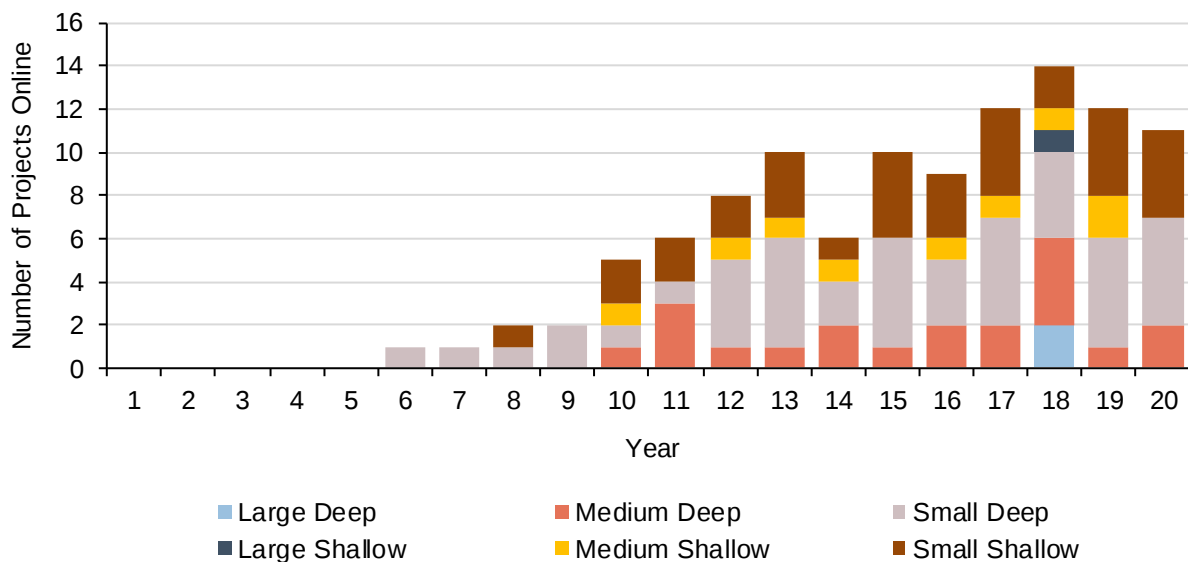
⁹ Lease sales begin in year 1.

to their increased complexity, deep water projects typically have longer development timeframes, as well as larger capital requirements.

Apart from water depth, project size is typically defined by reservoir characteristics, hydrocarbon volumes, and most importantly expected production, all which define the timeline and capital investment required to develop the project. Larger projects typically require more wells, longer development periods, and larger upfront capital requirements. Smaller projects, on the other hand, often rely on larger projects for infrastructure such as pipelines or processing facilities. Thus, smaller projects are normally delayed, especially in undeveloped areas with limited infrastructure currently in place such as the Pacific OCS, until larger projects are in place or processing is available. However, some new projects could potentially utilize the existing infrastructure available in the Pacific OCS region.

During the 20 year forecast period the study projects that that over 30 major projects could begin oil and natural gas production in the Pacific OCS over the 20-year forecast period, of which 20 are projected to be deepwater projects and 10 are projected to be shallow water projects. (Figure 3)

Figure 3: Projected Number of Projects by Start-Up Year, Size and Water Depth



Source: Calash

New projects could begin producing oil and natural gas as soon as the fifth year after leasing commenced in the Pacific OCS. The number of projects anticipated to come online each year is expected to vary between one and 14 annually. Project startups are dependent on variables including discovery timing, water depth, available infrastructure already in place, and project development lead times. The existing shallow water production infrastructure including

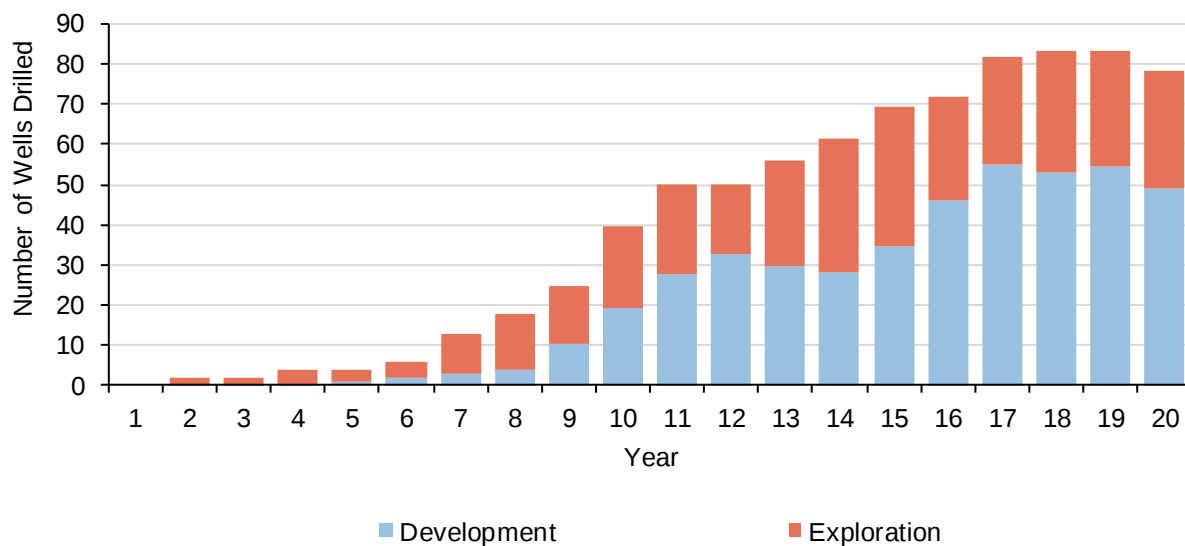
platforms and pipelines in the Southern California OCS could be used to develop new offshore projects.

3.3 Drilling Activity

Drilling, including exploration and production drilling, is used to identify, confirm, delineate, and produce oil and natural gas, making it one of the most important offshore oil and natural gas activities. Drilling is a very capital-intensive process employing drilling rigs that require large crews as well as significant quantities of consumables ranging from food and fuel to drill pipe and drilling fluids. Drilling rigs (including mobile offshore drilling units – MODU's) must constantly be resupplied and crewed, and thus require high levels of support activity in the areas and ports near offshore drilling rigs.

Drilling activity in the Pacific is expected to be highly robust upon the commencement of offshore oil and natural gas activity. Exploratory drilling is projected to begin within a year of the first lease sales. Only exploratory drilling is expected to take place for the first four years of potential Pacific OCS development. Development drilling is expected to begin with an initial focus on projects close to existing infrastructure, but eventually taking place throughout the whole Pacific OCS. Total drilling activity is projected to level off at around 70-80 wells per year. (Figure 4)

Figure 4: Projected Number of Wells Drilled by Well Type

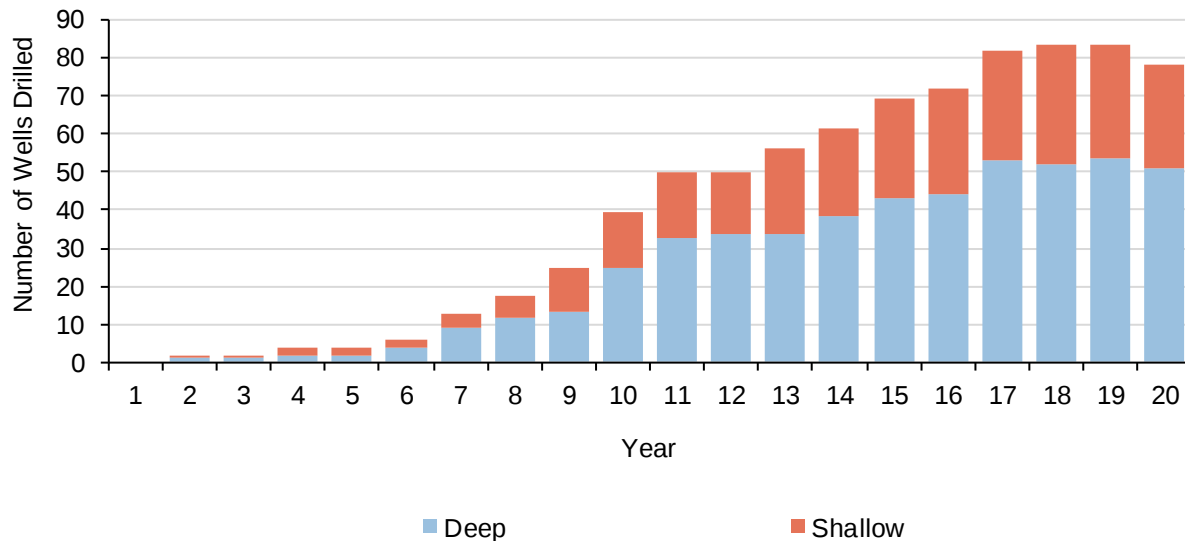


Source: Calash

Due to the interconnected nature of exploration, drilling, and development, Pacific OCS drilling is projected to follow a trend similar to project development regarding water depths of wells. As the basin matures, drilling is projected to trend to an approximately 65 to 35 ratio of

deepwater to shallow water wells. A total of around 800 wells are projected to be drilled across the forecast period. (Figure 5)

Figure 5: Projected Number of Wells Drilled by Water Depth and Year

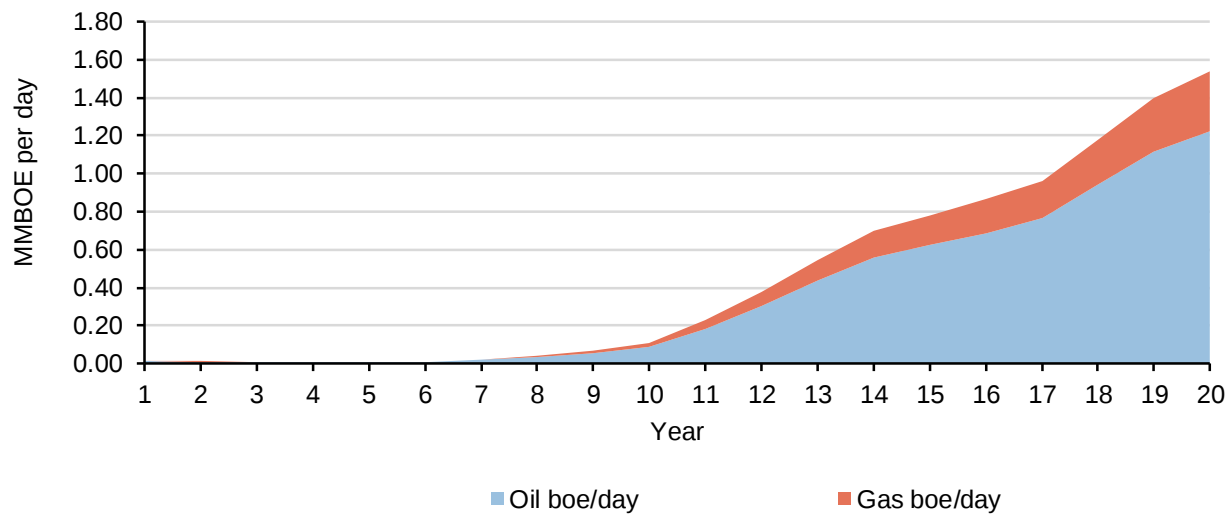


Source: Calash

3.4 Production Activity

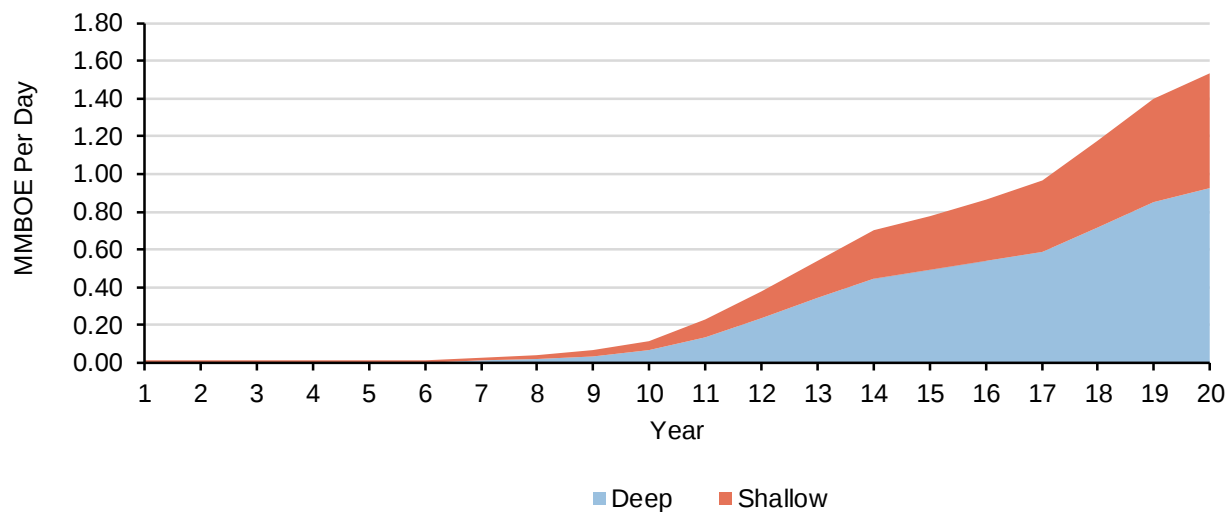
The number of projects developed, coupled with reservoir sizes and reservoir productivity, determine oil and natural gas production levels. Most oil and natural gas reservoirs contain a combination of oil, natural gas, water, and many other substances. Some reservoirs may contain nearly all oil or natural gas. Most reservoirs possess both oil and natural gas in varying ratios with oil sometimes expressed as condensate (in fields that primarily produce natural gas). All of the Pacific OCS resource plays defined by BOEM studies are constructed under the expectation that both oil and natural gas are present, with the relative ratios defined on a play by play basis. Oil and gas ratios for individual fields across plays are likely to vary, though for the purpose of this study they were modeled as consistent within each play. Production for each project was modeled based on standard production curves taking into account the start-up, ramp-up, peak, and decline timing, as well as the expected hydrocarbon mix. Pacific OCS oil and natural gas production from currently producing wells was projected to continue to decline throughout the forecast period.

This study projects that first new oil and natural gas production in the Pacific OCS would take place five years after the beginning of leasing in the area. Annual production is projected to reach 225 thousand BOED by the fifth year of new production. Production is projected to reach over 1.5 million BOED by the end of the forecast period, with approximately 80 percent of production oil (1.2 million BOED), and 20 percent of the production natural gas (315 thousand BOED or 1.8 billion cubic feet per day). (Figure 6)

Figure 6: Projected Production by Type and Year

Source: Calash

The Pacific OCS is projected to see significant new production in both shallow and deepwater areas. Deepwater production is expected to account for 60 percent of production by the end of the forecast period, compared to 40 percent of production from shallow water fields. (Figure 7)

Figure 7: Projected Production by Water Depth

Source: Calash

3.5 Spending Activity

Offshore oil and natural gas exploration and development is a capital-intensive process. Offshore projects require a variety of activities, goods and services ranging from exploratory seismic surveys and drilling, production equipment, services such as engineering, operational

expenditures including the ongoing supply of consumables, and maintenance. The combined effects of one individual project flow through the entire economy driving employment and economic growth. Total cumulative spending for the 20 year forecast period on Pacific OCS offshore oil and natural gas development is projected to be over \$188 billion. Average spending in the first five years is projected to be around \$445 million per year; spending per year is expected to increase as projects are developed and development drilling begins. Total drilling spending is projected to steadily increase throughout the forecast period, reaching around \$4.6 billion by the end of the forecast period. Total spending is projected to remain relatively constant at about \$20-\$22 billion per year for the last four years of the forecast period.

For the purposes of this report, spending is divided into eight main categories, with each category encompassing a major type of exploration and production activity. For example, geological and geophysical (G&G) spending is normally associated with imaging of possible reservoirs prior to exploration drilling and thus takes place primarily at the early stages of a project's lifecycle.

Although critically important, G&G spending including seismic is a relatively low percentage of overall spending averaging only around \$250 million per year across the forecast period.

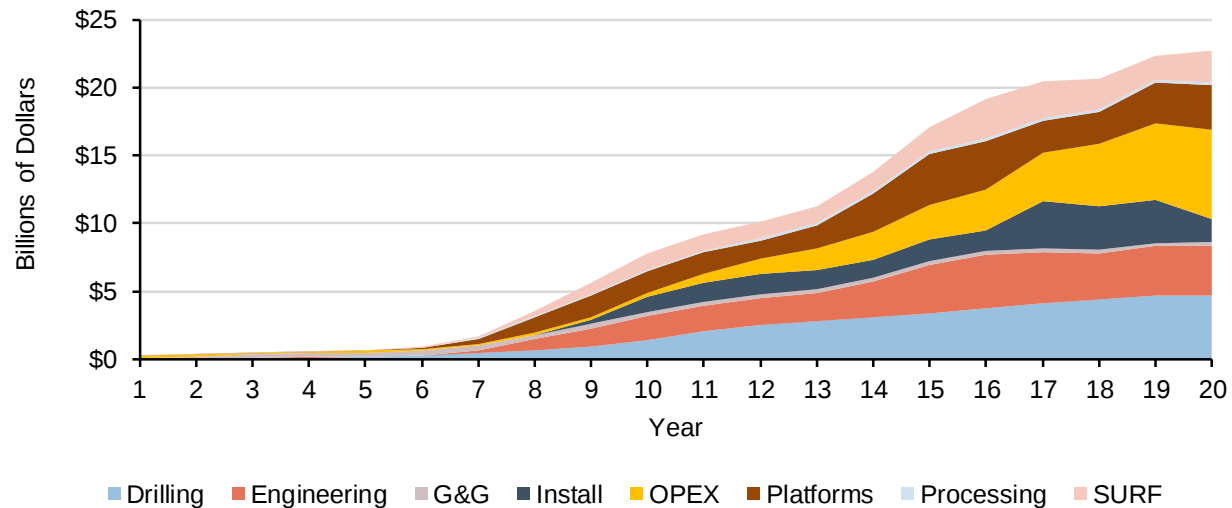
Given the expense and logistics requirements of offshore drilling, where rigs command large day rates in conjunction with high operational supply costs, drilling expenditures represent one of the largest sources of spending for any offshore project. Drilling expenditures across the forecast period, including both exploration and development drilling, are projected to average over \$1.9 billion per year. Drilling expenditures are projected to increase throughout the forecast to over \$4.6 billion per year by the end of the forecast period.

Engineering spending takes place at all stages of an offshore projects lifecycle, from exploration to project development as well as during a projects operational phase. Engineering activities vary from overall project-focused engineering to the engineering of very specific equipment and components. Engineering spending is projected to average over \$1.8 billion per year across the forecast period, increasing steadily as the Pacific OCS is developed.

Most of the equipment utilized in developing offshore oil and natural gas fields falls into either the platform (both fixed and floating) or SURF (subsea equipment, umbilicals, risers and flowlines) categories. This equipment is traditionally purchased and constructed prior to production of oil and natural gas. The types of equipment include complicated structures like floating platforms that weigh tens of thousands of tons, complex subsea trees that control wells at the ocean floor, and miles of pipeline that transport production back to shore. Some of the equipment required is less complex, such as nonstructural steel and unpressurized tanks. Due to

the different timelines for procurement of equipment, spending for platforms and SURF equipment is more variable year to year than most other project development spending. Platform spending is expected to average around \$1.5 billion per year across the forecast period. SURF spending is projected to average around \$1 billion per year. (Figure 8)

Figure 8: Projected Overall Spending by Category (\$ Billions)



Source: Calash

Installation of platforms and SURF equipment is normally carried out by specialized construction vessels, each with specialized functions such as pipe-lay or heavy-lift. Some vessels might lay large diameter pipelines (14 inch+), while other vessels reel-lay smaller diameter (2-10 inches) pipelines connecting wells to platforms, or lift heavy equipment or install smaller hardware. Additional specialized supply vessels supply drill-pipe, fuel and other fluids, and food to offshore vessels and platforms. Nearly everything installed offshore must first be prepared onshore at specialized shore bases located near projects prior to execution. Sometimes, equipment is transported to the field on the installation vessels themselves, and other times it is transferred to the field in specialized barges or heavy-lift transport vessels. Installing offshore equipment often requires complex connection or integration operations that require specialized vessels that can command day rates of over \$1 million. The combination of these operations is projected to lead to annual installation spending of nearly \$1.1 billion per year across the forecast period.

Once the initial production wells have been drilled and completed and the necessary equipment installed, a field can enter the operational phase. The operational phase requires manning and operating facilities and equipment, continuously supplying essential fluids and supplies, and constant general maintenance. These operational expenditures (OPEX) are a significant source of ongoing spending by oil and gas companies within the region and grow with the volume of oil and natural gas production. Five years after initial new Pacific OCS production,

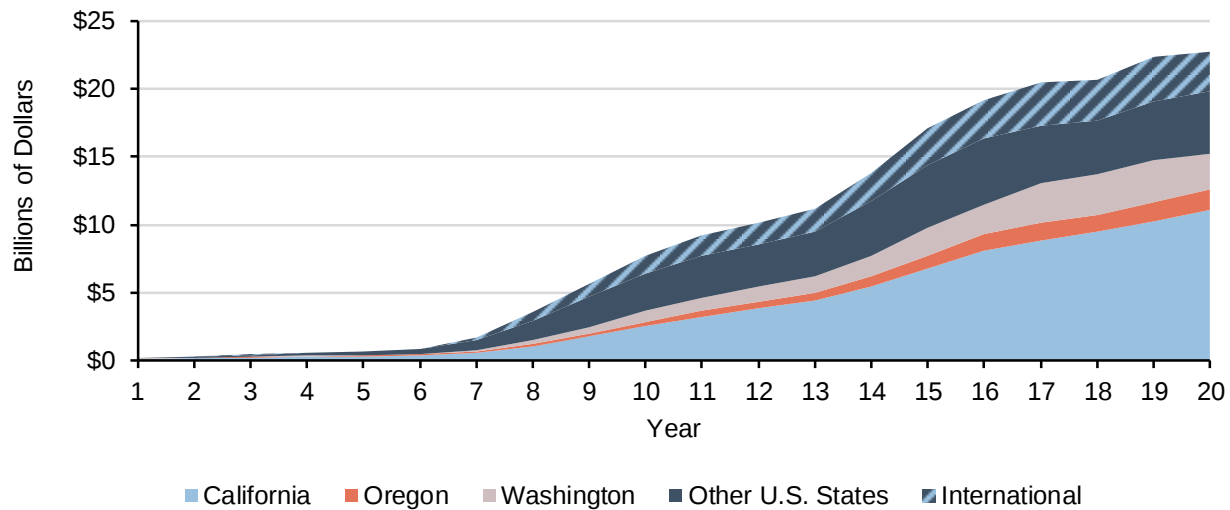
operational expenditures are expected to be nearly \$700 million per year, and with OPEX spending projected to continue to climb to over \$6.6 billion per year by the end of the forecast period.

3.6 Spending Trends

The location of spending for new Pacific OCS oil and natural gas development will be dependent on a variety of factors, including the type of equipment and services, the location of the projects being developed, and the time period in which the spending takes place. Developing an offshore oil and gas project requires a complex supply chain with suppliers located all over the country and often the world. Depending on the activity type, some spending can take place far from the activity area while other spending must be undertaken geographically close to projects. For instance, activity such as G&G seismic or drilling must take place in the waters of the affected region, with support required from nearby shorebases and ports to supply items such as fuel, food and other consumables. Specialized equipment may be manufactured in far off states or even foreign countries with more developed oil and natural gas supply chains, especially areas with minimal current offshore oil and natural gas production such as the Pacific OCS.

During the first five years of leasing in the Pacific OCS, where activity is projected to consist mostly of seismic and exploration drilling, an average of 65 percent of total domestic Pacific OCS oil and natural gas spending is projected to take place in the Pacific coast states. However, as projects begin to be developed and spending on platforms and SURF equipment begins, they cause the Pacific coast states' share of spending is projected to dip to as low as 52 percent in some years. (Figure 9)

Figure 9: Projected Overall Spending Pacific Coast States vs. Other U.S. States vs. International (\$ Billions)



Source: Calash

As the Pacific OCS is developed, it is assumed that suppliers of offshore oil and natural gas equipment will take advantage of the high-tech manufacturing capabilities of the Pacific coast states including the large existing California oil and natural gas supply chain, as well the extensive port infrastructure already in place. An increased amount of equipment and services is expected to originate from within the Pacific coast states. Production in the region is projected to lead to significantly lower transportation costs, as well as allowing suppliers to diversify their workforce nationally. By the end of the forecast period, 77 percent of domestic spending on Pacific OCS oil and natural gas developments is projected to accrue to the three Pacific coast states reaching over \$15 billion per year. Other U.S. state spending in at the end of the forecast period is projected to be over \$4.5 billion per year.

The location of spending for activities that require operations to be located in or near an oil and gas development are primarily driven by geographic factors, while spending on manufacturing equipment that can be more easily transported is driven by both the make-up of the Pacific coast states' economies including California existing oil and natural gas supply chain as well as geography. (Table 5).

Table 5: Projected Spending Pacific Coast States and Other U.S. States (\$Millions per Year)

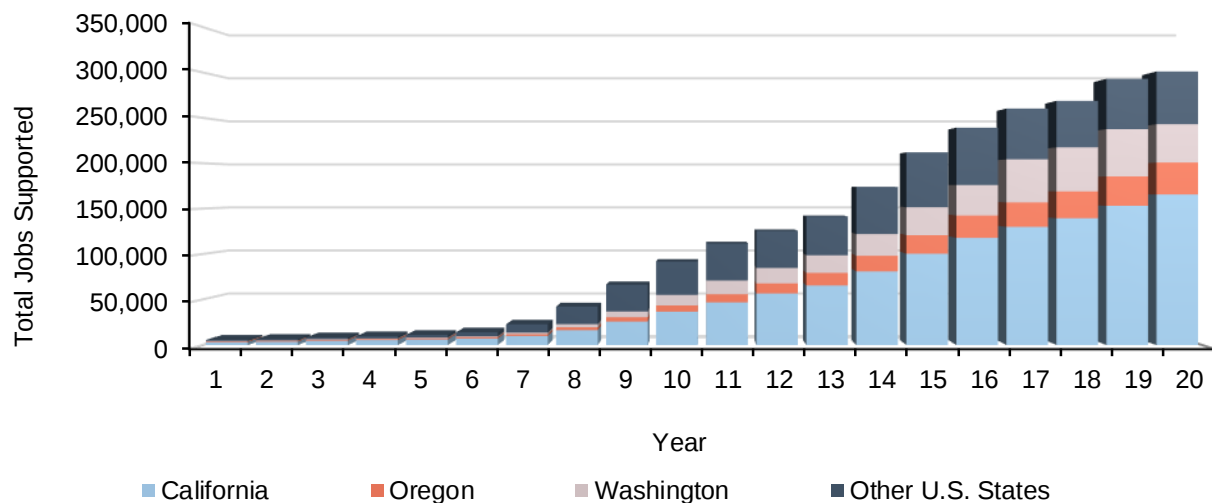
State	1	2	3	4	5	6	7	8	9	10
California	\$133	\$165	\$233	\$286	\$339	\$414	\$608	\$1,081	\$1,763	\$2,513
Oregon	\$12	\$15	\$23	\$28	\$35	\$46	\$76	\$148	\$247	\$362
Washington	\$11	\$14	\$22	\$27	\$32	\$48	\$104	\$242	\$440	\$758
Pacific Coast	\$155	\$194	\$278	\$342	\$406	\$508	\$788	\$1,471	\$2,450	\$3,634
Other U.S. States	\$81	\$108	\$149	\$189	\$224	\$330	\$707	\$1,498	\$2,257	\$2,778
Total	\$236	\$301	\$428	\$531	\$630	\$839	\$1,495	\$2,968	\$4,707	\$6,411

State	11	12	13	14	15	16	17	18	19	20
California	\$3,217	\$3,856	\$4,403	\$5,417	\$6,809	\$8,117	\$8,886	\$9,454	\$10,264	\$11,128
Oregon	\$449	\$522	\$612	\$760	\$936	\$1,179	\$1,254	\$1,312	\$1,373	\$1,487
Washington	\$951	\$1,060	\$1,198	\$1,522	\$1,990	\$2,191	\$2,894	\$2,927	\$3,161	\$2,647
Pacific Coast	\$4,617	\$5,437	\$6,213	\$7,699	\$9,735	\$11,487	\$13,034	\$13,692	\$14,798	\$15,263
Other U.S. States	\$3,108	\$3,143	\$3,321	\$4,044	\$4,694	\$4,914	\$4,305	\$3,979	\$4,327	\$4,575
Total	\$7,724	\$8,580	\$9,533	\$11,743	\$14,428	\$16,401	\$17,339	\$17,671	\$19,124	\$19,838

Source: Calash

3.7 Employment

Spending on goods and services to develop oil and natural gas in the Pacific OCS is projected to provide large employment gains within the Pacific coast region and nationally. Employment effects are expected to steadily grow throughout the forecast period, reaching over 300 thousand jobs supported in the US 20 years after initial leasing begins. Total Pacific coast state employment is projected to reach over 240 thousand jobs by the end of the forecast period. U.S. states outside the Pacific coast region are projected to see additional employment of nearly 58 thousand jobs by the end of the forecast period. (Figure 10)

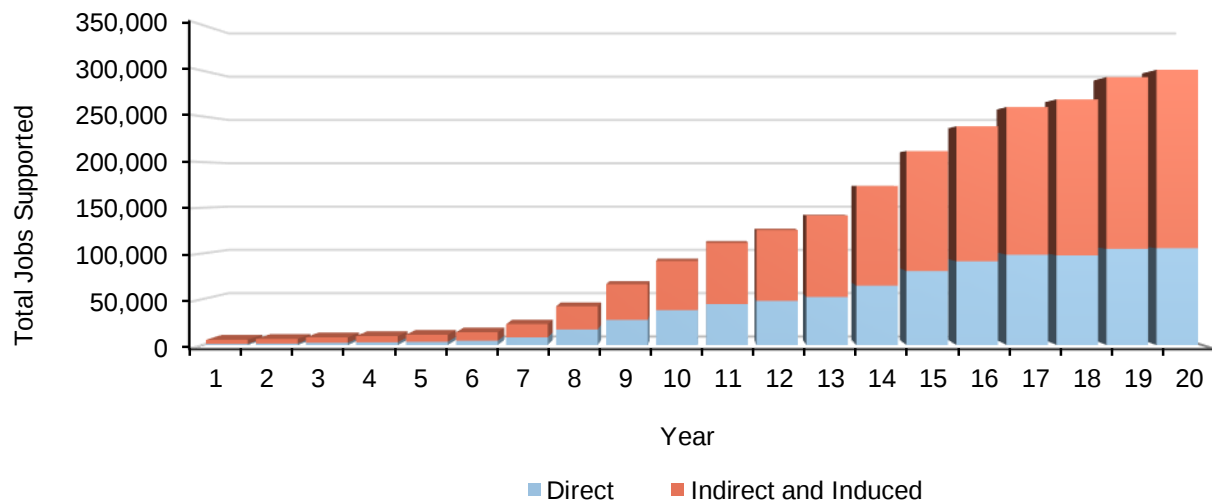
Figure 10: Projected Employment by State

Source: Calash

The largest employment impact at the end of the forecast period by number of jobs, at 165 thousand, is expected to be seen in California. Washington and Oregon are all also projected to see employment of 42 and 35 thousand jobs respectively at the end of the forecast period.

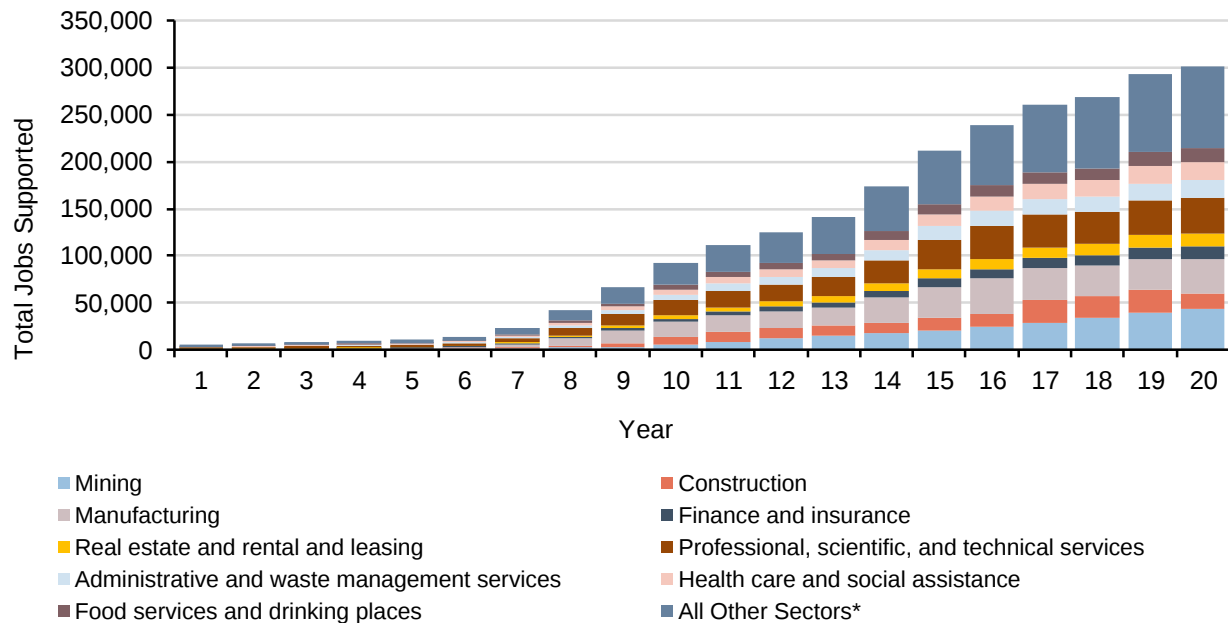
As the Pacific OCS is developed, the oil and gas industry is expected to take advantage of the skilled workforce and extensive infrastructure in place within the region. The mix between Pacific Coast and other U.S. state employment effects are projected to be highly dependent on the type of activity taking place in a given year, as well as the projected in-region supply chain shift over time. As initial project development within the region begins and large amounts of capital goods are imported from other states, the region's share of overall jobs is projected to fall to as low as 54 percent, but by the end of the forecast period the Pacific Coast states are projected to account for 81 percent of the employment effects of Pacific OCS development. (Figure 11)

Figure 11: Projected Employment Direct vs. Indirect and Induced



Source: Calash

The opening of the Pacific OCS to offshore oil and natural gas production is expected to increase employment not only through direct employment in the industry, but also indirectly. Indirect employment occurs through the purchases of needed goods and services and the induced employment impact of greater income in the overall economy. Direct employment by oil and natural gas companies and their suppliers is projected to reach around 105 thousand jobs at the end of the forecast period. Jobs generated through the purchase of goods and services coupled with the income effects of increased employment are expected to contribute a further 195 thousand jobs. (Figure 12)

Figure 12: Projected Employment by Industry Sector

Source: Calash

Many employment sectors outside oil and natural gas development or its direct supply chain are also projected to be impacted, mainly due to greater income in the economy. The summary table of projected total employment supported at the state level is provided below. (Table 6)

Table 6: Projected Employment Pacific Coast States and Other U.S. States

State	1	2	3	4	5	6	7	8	9	10
California	3,219	3,657	4,688	5,406	6,181	7,252	9,995	16,329	25,784	36,668
Oregon	914	967	1,125	1,202	1,308	1,510	2,041	3,127	4,750	6,825
Washington	483	525	645	708	783	1,008	1,758	3,491	6,388	11,653
Pacific Coast	4,616	5,149	6,457	7,316	8,272	9,769	13,794	22,948	36,922	55,146
Other U.S. States	1,094	1,420	1,979	2,460	2,918	4,282	9,093	19,371	29,500	36,709
Total	5,710	6,569	8,436	9,775	11,190	14,051	22,887	42,319	66,422	91,855

State	11	12	13	14	15	16	17	18	19	20
California	46,995	56,668	65,576	80,962	100,441	117,918	129,949	139,454	153,099	165,581
Oregon	8,963	11,128	13,779	17,183	20,450	24,555	26,836	29,555	32,375	35,097
Washington	15,016	17,095	19,332	23,883	30,644	33,456	47,426	48,418	52,028	42,160
Pacific Coast	70,974	84,892	98,687	122,028	151,535	175,929	204,212	217,427	237,502	242,838
Other U.S. States	40,690	40,697	42,626	51,911	60,433	63,167	55,860	51,054	55,310	57,952
Totals	111,664	125,588	141,313	173,940	211,968	239,096	260,071	268,481	292,812	300,789

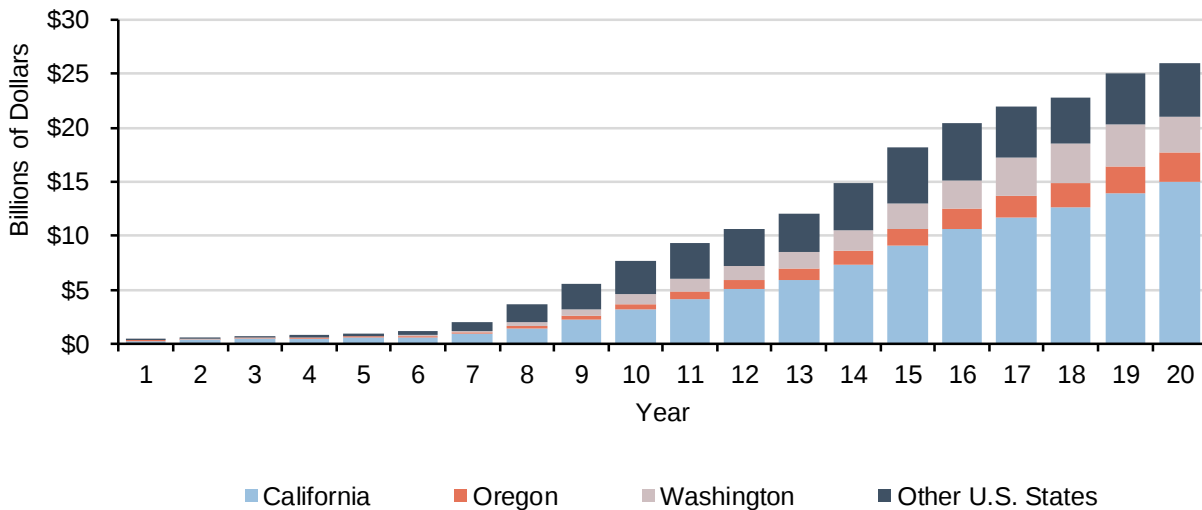
Source: Calash

3.8 State Income Impacts

Along with employment benefits, significant contributions to states' and the national gross domestic product are also expected due to new Pacific coast oil and natural gas development. Total contributions to state economies are projected at nearly \$26 billion per year by the end of

the forecast period, with around 81 percent expected to occur in the Pacific coast states and 19 percent in the rest of the U.S. (Figure 13)

Figure 13: Projected Contributions to State Economies Pacific Coast States vs. Other U.S. States (\$ Billions)



Source: Calash

The largest contributions are expected to mimic spending at the state level. California is expected to receive the largest share of contributions to the states' economies, with Washington and Oregon also projected to see significant gains. (Table 7)

Table 7: Projected Contributions to State Economies Pacific Coast States and Other U.S. States (\$Millions Per Year)

State	1	2	3	4	5	6	7	8	9	10
California	\$293	\$335	\$430	\$497	\$563	\$656	\$908	\$1,471	\$2,277	\$3,203
Oregon	\$78	\$82	\$94	\$100	\$108	\$123	\$165	\$250	\$374	\$528
Washington	\$43	\$47	\$57	\$63	\$69	\$87	\$149	\$292	\$512	\$894
Pacific Coast	\$413	\$464	\$581	\$660	\$740	\$866	\$1,222	\$2,013	\$3,163	\$4,624
Other U.S. States	\$94	\$124	\$174	\$218	\$255	\$369	\$776	\$1,631	\$2,447	\$3,023
Totals	\$508	\$588	\$755	\$878	\$995	\$1,235	\$1,998	\$3,644	\$5,611	\$7,648
State	11	12	13	14	15	16	17	18	19	20
California	\$4,157	\$5,072	\$5,929	\$7,334	\$9,059	\$10,581	\$11,643	\$12,637	\$13,931	\$15,053
Oregon	\$691	\$857	\$1,065	\$1,332	\$1,581	\$1,885	\$2,039	\$2,235	\$2,451	\$2,651
Washington	\$1,147	\$1,312	\$1,507	\$1,885	\$2,412	\$2,649	\$3,575	\$3,672	\$3,980	\$3,360
Pacific Coast	\$5,995	\$7,242	\$8,502	\$10,551	\$13,053	\$15,116	\$17,257	\$18,544	\$20,362	\$21,065
Other U.S. States	\$3,378	\$3,414	\$3,599	\$4,371	\$5,077	\$5,284	\$4,658	\$4,290	\$4,678	\$4,917
Totals	\$9,373	\$10,656	\$12,100	\$14,922	\$18,130	\$20,400	\$21,915	\$22,834	\$25,040	\$25,982

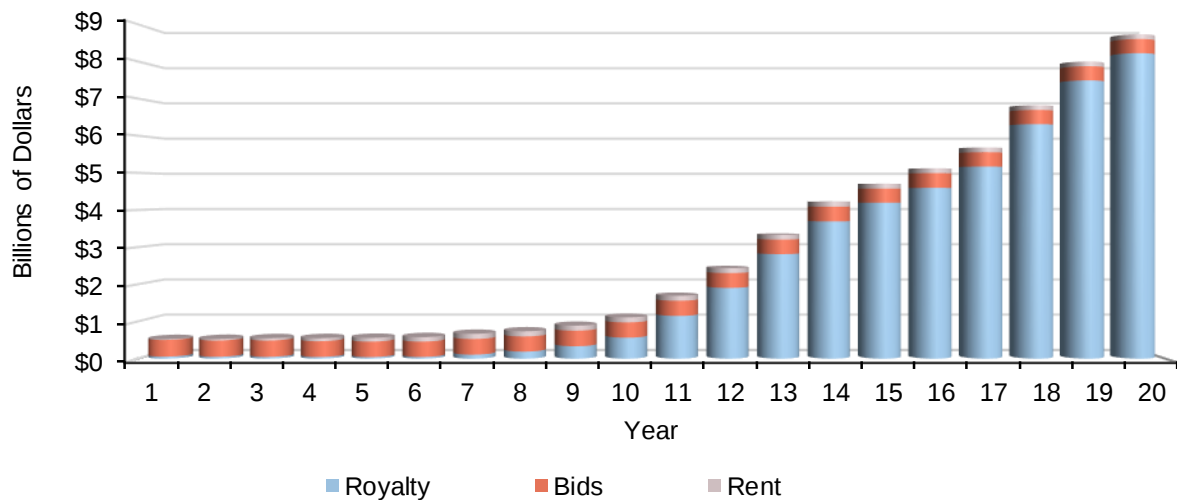
Source: Calash

3.9 Government Revenue Impacts

In addition to economic and employment growth, new oil and gas production in the Pacific OCS would increase government revenue. Total government revenues are projected to reach over \$8.7 billion dollars per year by the end of the forecast period, with the majority of revenues

from royalties on produced oil and natural gas at over \$8.2 billion. At the end of the forecast period, leasing bonus bids are projected to account for over \$380 million per year in government revenue, while rental income from offshore blocks is expected to account for over \$125 million. Across the forecast period, royalties on oil and natural gas production are expected to total over \$47 billion and cumulative government revenues are projected to reach over \$57 billion. (Figure 14)

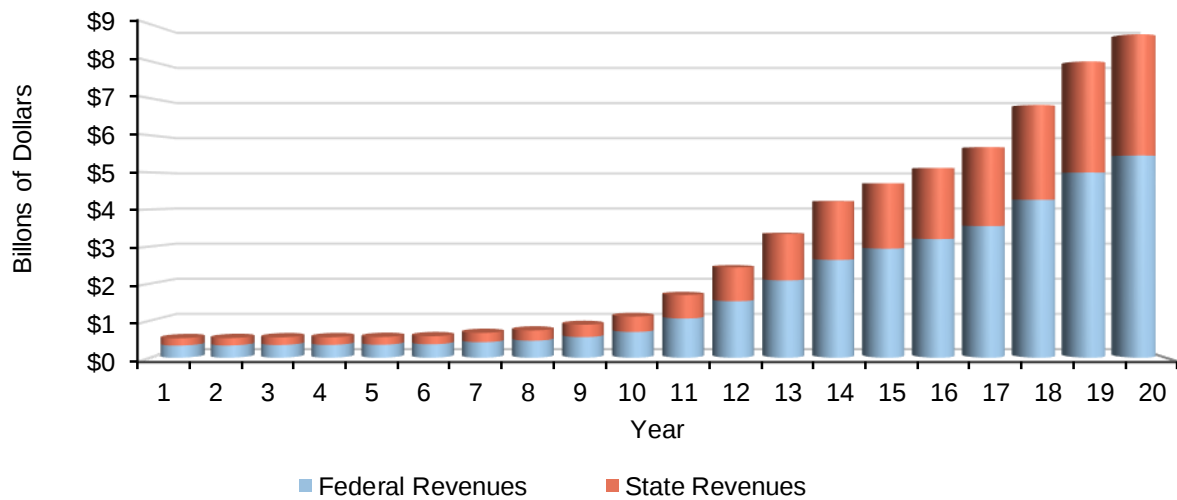
Figure 14: Projected Government Revenues – Rentals, Royalties, and Bonus Bid (\$ Billions)



Source: Calash

Although revenue sharing is currently not in place for the Pacific OCS there is a possibility that revenue generated from Pacific OCS oil and natural gas development could be shared between the Federal government and the Pacific coast state governments. However, an assumption that government revenues would be split on the basis of 62.5 percent for the Federal government and 37.5 percent for state governments was assumed for this analysis to compare potential revenue streams among the Pacific coast states. This is in-line with the percentage split currently in place with states in the Gulf of Mexico covered by GOMESA, but with no annual revenue cap. Such projected state government revenue streams will need to be adjusted proportionally when or if agreements are legislated. Given the assumed 37.5 percent revenue share to the Pacific coast states, federal government revenues from Pacific OCS offshore oil and natural gas production are projected to reach over \$5.4 billion per year at the end of the forecast period. Combined state revenues for the three Pacific coast states are projected at about \$3.2 billion per year by the end of the forecast period. (Figure 15)

Figure 15: Projected Government Revenues by Federal Government vs. State (\$ Billions)¹⁰



Source: Calash

Given the location of the potential oil and natural gas production, California is projected to receive the largest share of revenue under any sharing agreement with revenues of over \$1.8 billion at the end of the forecast period. Cumulatively across the forecast period the state is expected to receive over \$12.2 billion in revenue. Oregon is projected to receive the second highest share of state revenues with over \$963 million expected to be received at the end of the forecast period; cumulative revenue from across the forecast period is projected to be over \$6.3 billion. Washington is projected to receive over \$450 million in revenue at the end of the forecast period, with cumulative revenues across the forecast period projected at nearly \$3 billion. (Table 8)

¹⁰ Assumes 37.5 percent revenue sharing with state governments.

Table 8: Projected Government Revenues from Rentals, Royalties, and Bonus Bids by State and Federal (\$Millions Per Year)¹¹

State	1	2	3	4	5	6	7	8	9	10
California	\$112	\$112	\$117	\$117	\$119	\$123	\$142	\$157	\$189	\$237
Oregon	\$58	\$58	\$61	\$61	\$62	\$64	\$74	\$81	\$98	\$123
Washington	\$27	\$27	\$28	\$29	\$29	\$30	\$35	\$38	\$46	\$58
Pacific Coast	\$197	\$198	\$206	\$207	\$209	\$217	\$251	\$276	\$334	\$417
Federal	\$328	\$330	\$343	\$345	\$349	\$362	\$418	\$460	\$556	\$695
Total	\$525	\$528	\$549	\$552	\$559	\$580	\$669	\$737	\$890	\$1,112

State	11	12	13	14	15	16	17	18	19	20
California	\$360	\$519	\$710	\$898	\$1,001	\$1,090	\$1,209	\$1,451	\$1,701	\$1,701
Oregon	\$187	\$269	\$368	\$466	\$520	\$565	\$627	\$753	\$883	\$883
Washington	\$88	\$126	\$173	\$219	\$244	\$265	\$295	\$353	\$414	\$414
Pacific Coast	\$635	\$914	\$1,251	\$1,583	\$1,765	\$1,920	\$2,131	\$2,557	\$2,998	\$2,998
Federal	\$1,059	\$1,523	\$2,085	\$2,638	\$2,942	\$3,201	\$3,551	\$4,262	\$4,997	\$5,454
Total	\$1,694	\$2,437	\$3,336	\$4,221	\$4,707	\$5,121	\$5,682	\$6,819	\$7,995	\$8,452

Source: Calash

¹¹ Assumes 37.5 percent revenue sharing with state governments.

Section 4 – Conclusions

The offshore U.S. oil and natural gas industry is a key component of the nation's energy supply, as well a significant source of employment, economic activity and government revenue throughout the nation. Despite the demonstrated impact of domestic offshore oil and gas development in the Gulf of Mexico and the Pacific Coast in the past, large portions of the nation's federal waters are currently inaccessible to oil and gas operators, including all but 38 previously purchased leases in the Pacific OCS. The last lease sale to take place in the region was more than 30 years ago in 1984. Allowing oil and gas operators increased access to the Pacific OCS and its resources would be expected to benefit employment, the national economy, government revenue, and domestic energy security through increased oil and natural gas production.

- If new leasing in the Pacific OCS were to begin, annual capital investment and other spending due to offshore oil and natural gas development could grow to over \$20 billion per year within 20 years after initial lease sales. Cumulative capital investments and other spending over the 20 year forecast period are projected at over \$160 billion.
- Pacific OCS oil and gas activities could create over 100 thousand jobs within ten years of the beginning of leasing activity, the vast majority of which are likely to be in the Pacific coast states.
- By the end of the forecast period, total national employment due to Pacific OCS oil and gas exploration and production could reach over 300 thousand jobs, with over 240 thousand of these jobs in the Pacific coast states.
- Development of the Pacific OCS' offshore oil and natural gas resources could lead to production of over 1.5 million barrels of oil equivalent per day within 20 years after initial lease sales.
- Pacific OCS oil and natural gas activity could contribute over \$9 billion per year to the national economy within ten years of leasing activity, with Pacific coast states receiving contributions of nearly \$6 billion per year.
- At the end of the forecast period total national contributions to the economy could reach over \$25 billion per year, with Pacific Coast states receiving combined contributions of over \$20 billion per year.
- Combined state¹² and federal revenues from bonuses, rents and royalties are projected to reach nearly \$1.7 billion per year within ten years of leasing activity,

¹² Assumes 37.5 percent revenue sharing with state governments.

with these revenues projected to grow to over \$8.7 billion per year by the end of the 20 year forecast period.

- If a legislated state / federal revenue sharing agreement is enacted, Pacific coast states could see significant gains to their state budgets. With a 37.5 percent sharing agreement and no cap, state revenues are projected to be over \$635 million per year within ten years of leasing activity, with revenues expected to grow to over \$3.2 billion per year by the end of the forecast period, leading to further increases in economic activity and employment. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

Under the development scenario put forth in this report, it is clear that the Pacific OCS displays significant potential to grow the American economy across numerous industries and areas. Allowing access to the entire Pacific OCS for oil and gas exploration and production activities is likely to lead to large capital investments and operational spending by oil and gas operators to develop key resources. This spending would likely lead to large increases in employment and economic activity both in Pacific Coast states and nationally. Additionally, this activity is projected to lead to a large increase in domestic energy production and the associated royalties and income, which are expected to lead to healthy increases in revenues to state and federal governments

Section 5 – State Results Appendix

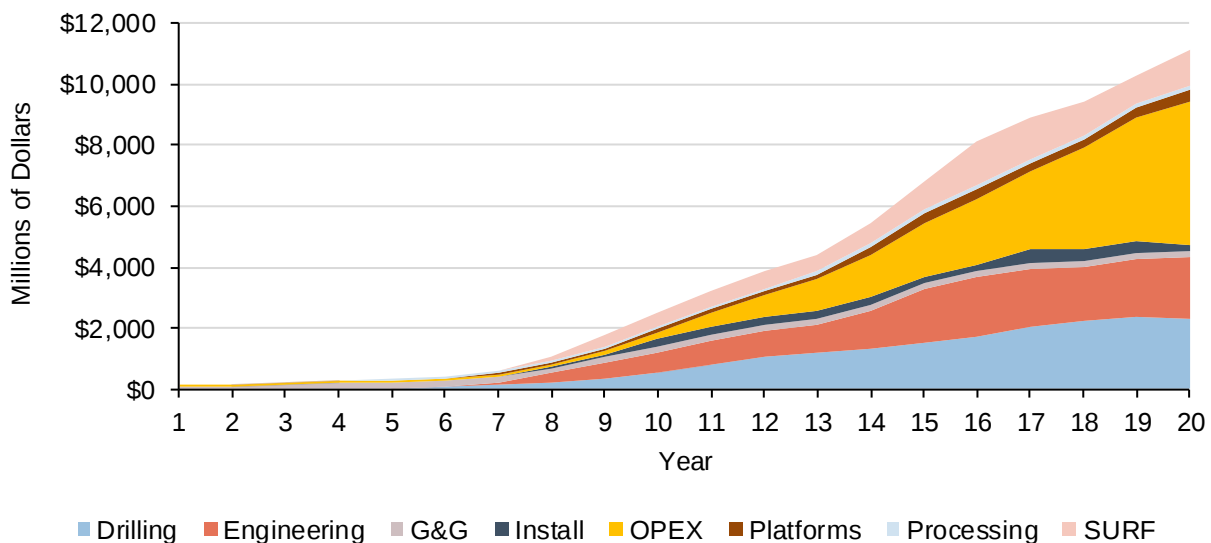
5.1 States Results

The opening of the Pacific OCS to new oil and natural gas production activities is expected to benefit both the Pacific Coast States as well other U.S. states. The benefits of projected exploration and development activity especially in later years are expected to accrue most significantly within the Pacific coast region. If new exploration and production of oil and natural gas in the Pacific OCS were to be allowed, each of the states on the coast are projected to see significant increases in employment, gross domestic product, and government revenue due to capital and operational spending from the oil and gas industry.

5.2 California

California is expected to receive the greatest benefits from the opening of the Pacific Coast to offshore oil and natural gas exploration and production activity. Annual spending at the end of the forecast period in the state is projected to be over \$11 billion per year with spending primarily focused on drilling, operational expenditures and engineering. (Figure 16)

Figure 16: Projected California Spending by Sector (\$Millions)



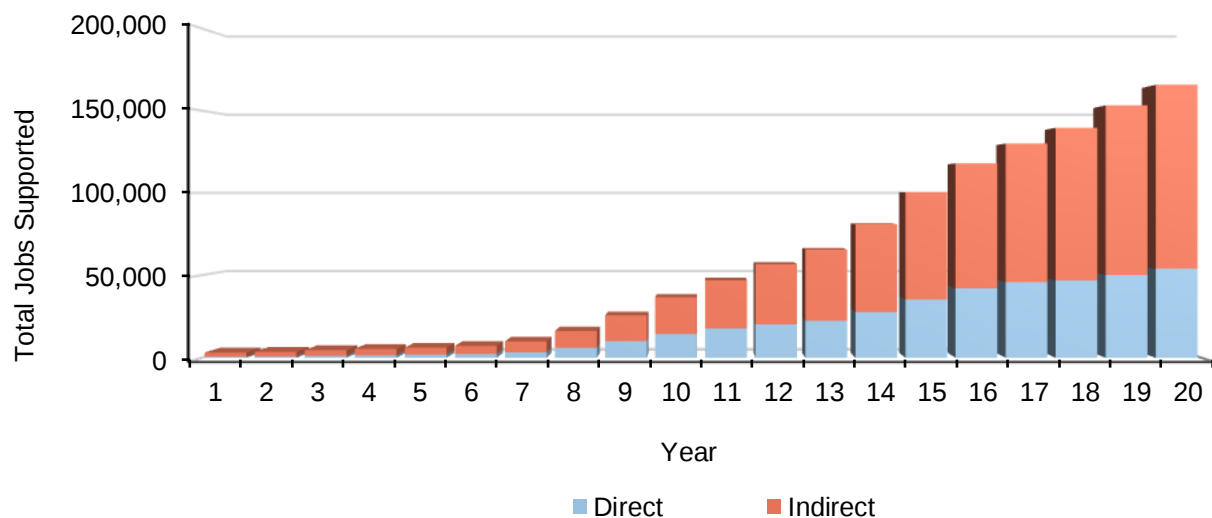
Source: Calash

At the end of the forecast period, spending on drilling is expected to reach over \$3.1 billion, operational expenditures are projected to reach over \$2.3 billion per year, and engineering spending near \$2 billion per year is projected. California is home to major oil and gas companies that are active in the Gulf of Mexico. In addition, California has had a long historical involvement in oil and natural gas production. Existing offshore oil and gas production means that California

is home to companies which provide supply and transportation services to offshore platforms from cities such as Huntington Beach and Santa Barbara. Its base of high tech industries supports a large number of equipment manufacturers and technology providers. Examples include companies that produce sophisticated electronics and instrumentation for the industry and that manufacture remotely operated vehicles used extensively in the offshore industry.

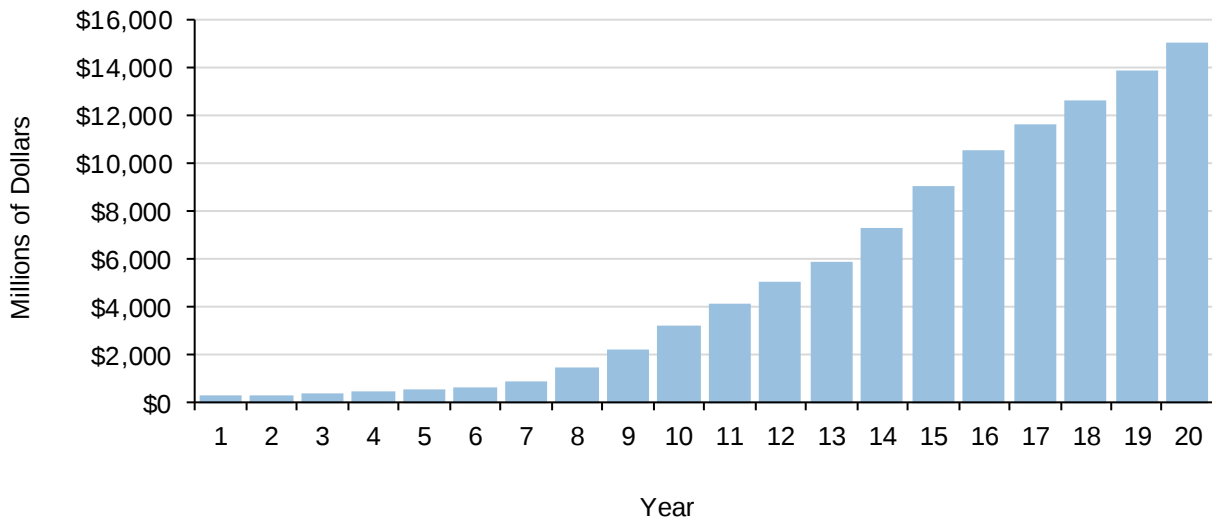
Employment in California due to spending on Pacific Coast oil and natural gas activity is projected to reach over 165 thousand jobs at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach nearly 55 thousand jobs at the end of the forecast period, with indirect and induced employment of over 111 thousand jobs expected in the same year. (Figure 17)

Figure 17: Projected California Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to California's state economy due to spending by the Pacific Coast oil and natural gas industry are projected to be over \$15 billion per year at the end of the forecast period. (Figure 18)

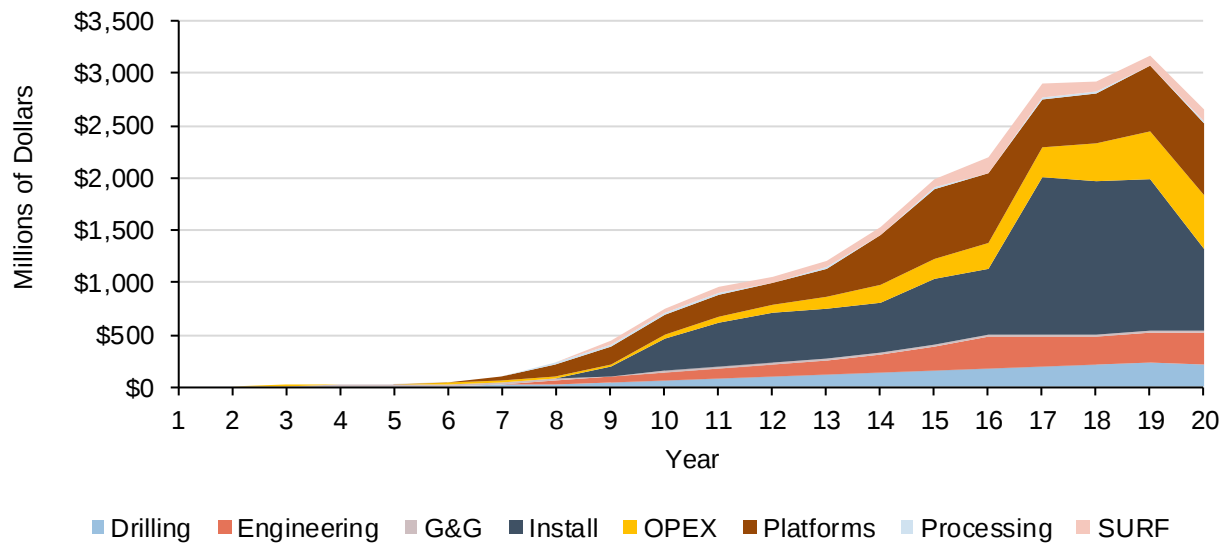
Figure 18: Projected California Contributions to the State Economy (\$Millions)

Source: Calash

With an assumed 37.5 percent revenue sharing agreement in place, Pacific Coast oil and natural gas activities are projected to contribute over \$3.8 billion per year to California's budget at the end of the forecast period; cumulative contributions across the forecast period are projected to be over \$12.2 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

5.3 Washington

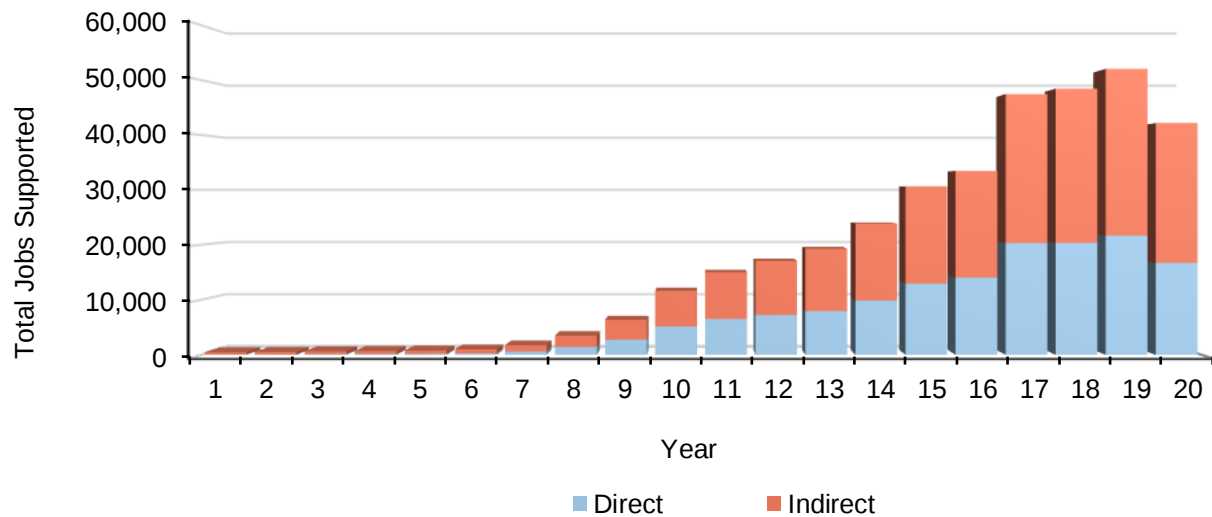
Washington is projected to see the second largest benefits from the opening of the Pacific Coast to offshore oil and natural gas exploration and production activity. Annual spending at the end of the forecast period in the state is projected at over \$2.6 billion per year. Spending is expected to primarily to be strongest from the installation, platform fabrication, and engineering segments. (Figure 19)

Figure 19: Projected Washington Spending by Sector (\$Millions)

Source: Calash

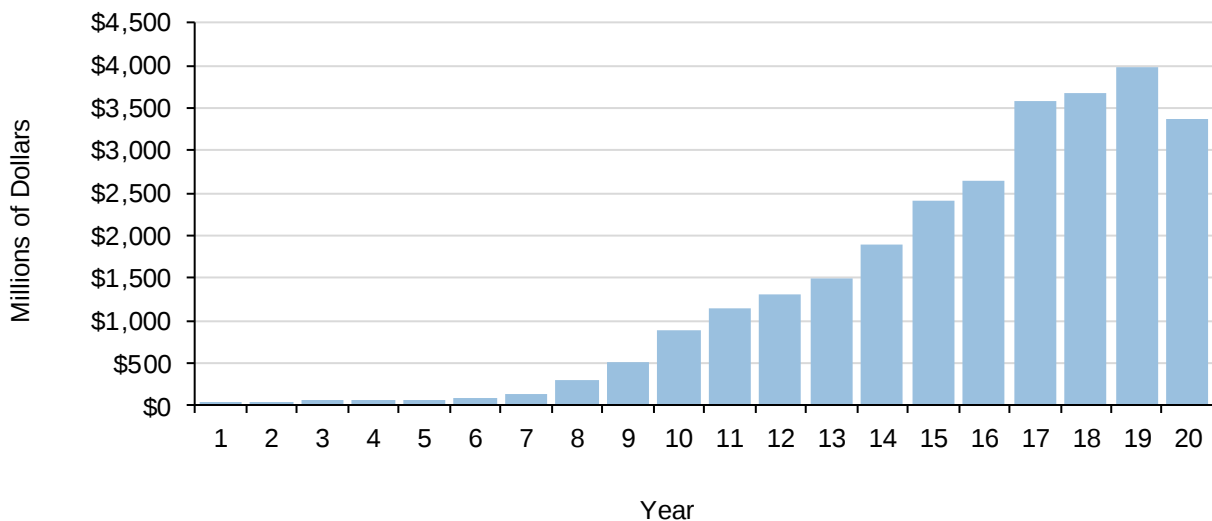
Spending on installation is expected to reach over \$1.4 billion per year, with platform spending at nearly \$780 million per year at the end of the forecast period, and engineering spending is projected to reach nearly \$300 million per year. Washington is already home to suppliers to the oil and natural gas industry and was especially involved in previous efforts to drill offshore Alaska. Companies have multiple facilities focused on offshore shipbuilding and repair, with facilities in Seattle and Tacoma which completed the repair and refitting of two drilling ships. The state is also home to companies which own offshore supply vessels, crew boats and anchor handlers. The state has dry dock facilities which could be utilized for offshore vessel and platform repair and fabrication. One of the largest suppliers of subsea production equipment has two facilities focused on measurement systems already located in the state. The state is also home to suppliers of vessel services to the oil and gas industry with construction, diving and survey vessels.

Employment in Washington due to spending on Pacific Coast offshore oil and natural gas development is projected to reach over 42 thousand jobs at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach nearly 17 thousand jobs at the end of the forecast period, with indirect and induced employment of nearly 25 thousand jobs expected in the same year. (Figure 20)

Figure 20: Projected Washington Employment Direct vs. Indirect and Induced

Source: Calash

Contributions to Washington's state economy due to spending on Pacific Coast oil and natural gas exploration and development industry are projected to be nearly \$3.4 billion per year at the end of the forecast period. (Figure 21)

Figure 21: Projected Washington Contributions to the State Economy (\$Millions)

Source: Calash

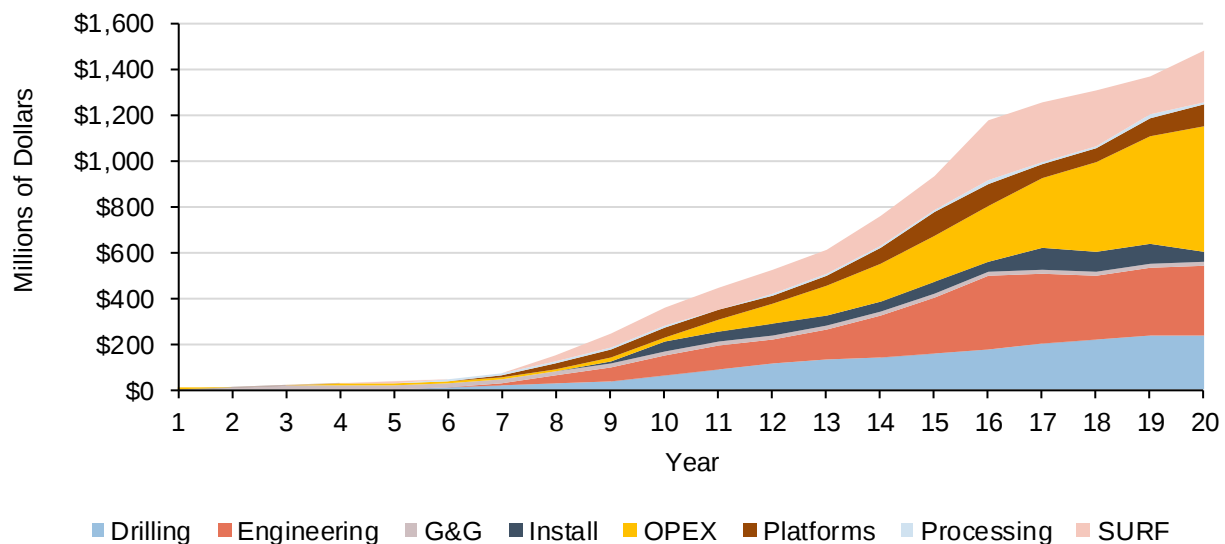
With an assumed 37.5 percent revenue sharing agreement in place, Pacific Coast oil and natural gas activities are projected to contribute nearly \$450 million per year to Washington's budget at the end of the forecast period; cumulative contributions across the forecast period are

projected to be nearly \$3 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

5.4 Oregon

Oregon is expected to receive the third highest levels of spending, employment and gross domestic product due to offshore oil and natural gas activity in the Pacific OCS. Spending in the state is projected to reach nearly \$1.5 billion per year at the end of the forecast period. (Figure 22)

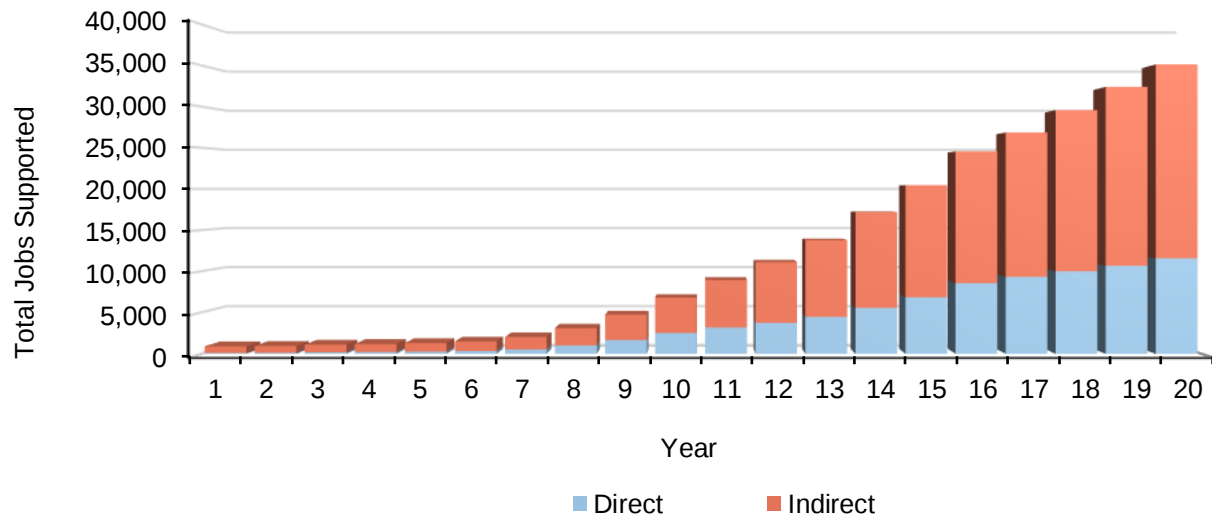
Figure 22: Projected Oregon Spending by Sector (\$Millions)



Source: Calash

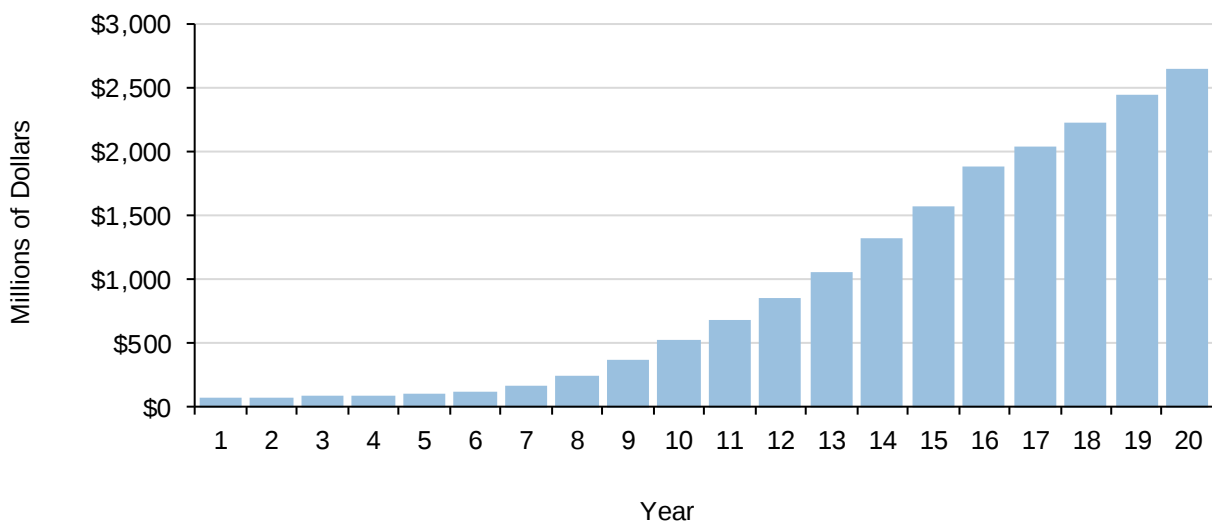
Spending in Oregon is expected to be driven by drilling, engineering and operational expenditures, with these categories accounting for around \$235 million, \$300 million, and \$550 million per year in spending at the end of the forecast period. Spending on fabrication of SURF equipment is also projected to reach nearly \$230 million in the same year. Oregon is already home to suppliers to the oil and natural gas industry including shipyards yard which construct workboats, tugs, barges and other vessels used offshore. Other companies in the state supply pumps used throughout the oil and natural gas production process.

Employment in Oregon due to Pacific OCS oil and gas production is projected to reach over 35 thousand jobs at the end of the forecast period, with direct employment expected to reach nearly 12 thousand jobs, and indirect and induced employment of over 23 thousand jobs expected in the same year. (Figure 23)

Figure 23: Projected Oregon Employment Direct vs. Indirect and Induced

Source: Calash

At the end of the forecast period, contributions to the state economy from Pacific Coast offshore oil and natural gas exploration and production in Oregon are projected to reach nearly \$2.7 billion per year. (Figure 24)

Figure 24: Projected Oregon Contributions to the State Economy (\$Millions)

Source: Calash

Governmental revenues collected under a 37.5 percent state/federal revenue sharing agreement would be expected to create over \$960 million per year in new revenues for the state of Oregon at the end of the forecast period, with cumulative revenues across the forecast period

projected to be over \$6.3 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.



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