March 9, 2018

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Submitted via regulations.gov

Subject: Comments for the 2019–2024 Draft Proposed National Oil and Gas Leasing Program and Notice of Intent to Prepare a Programmatic Environmental Impact Statement

Docket ID: BOEM-2017-0074

The American Petroleum Institute ("API") offers the following comments on the Bureau of Ocean Energy Management's ("BOEM") request for comments on the 2019–2024 Draft Proposed National Oil and Gas Leasing Program ("DPP") and Notice of Intent to Prepare a Programmatic Environmental Impact Statement that were published in the Federal Register on January 28, 2018. Our members have significant interest in ensuring that there are future opportunities for offshore oil and natural gas exploration and development in the United States ("U.S.") so that the nation can capitalize on industry expertise that has been garnered through years of successful and beneficial exploration, development and production of domestic OCS oil and natural gas resources. We fully support keeping the DPP as is with no additional areas being removed from future leasing consideration. The decisions made regarding what areas are available for leasing will have long-term implications for our nation's energy security, prospects for job creation, and government revenue generation. API joined a number of our industry partners in submitting comments on the DPP under separate cover, and we offer these additional items for your consideration.

I. Introduction

API is a national trade association representing over 640 member companies involved in all aspects of the oil and natural gas industry. API's members include producers, refiners, suppliers, pipeline operators, marine transporters, and service and supply companies that support all segments of the industry. API and its members are dedicated to meeting environmental requirements, while economically and safely developing and supplying energy resources for consumers. API is a longstanding supporter of offshore exploration and development and the process laid out in the Outer Continental Shelf Lands Act as a means of balancing and rationalizing responsible oil and gas activities and the associated energy security and economic benefits with the protection of the environment.

The U.S. oil and natural gas industry is a central element of our nation's economy – supporting over 10.3 million U.S. jobs and $1.3 trillion of the nation's economy. The U.S. is also the world's leading oil and natural gas producer – due to advanced technologies that allow us to safely explore across the U.S. – which has enabled America's recent energy renaissance. Our ability to explore and develop our own resources has allowed us to strengthen both our economy, energy self-sufficiency, and our national security – all key aspects of America's global standing. This is especially important as other countries – such as China and Russia – race to pursue these same energy opportunities.

The U.S. energy renaissance that has put millions of Americans to work, generated billions of dollars in revenue for Federal and State governments, and increased our ability to adjust to energy market shocks has undoubtedly improved the nation's economic and security outlook. However, for this to continue U.S. energy policy must include a lasting commitment to expanding offshore oil and natural gas development to new areas as the DPP has done. By including all of the areas for proposed leasing, the U.S. will create an opportunity for our nation and the industry to move forward with exploratory activity using state-of-the-art technology to further define offshore geologic features and to assess the associated potential oil and natural resources that may be available to fuel our economy for decades to come. The Administration continues to promote the need for U.S. energy dominance. Whether it is energy dominance or continued efforts to drive forward our energy security, we cannot advance the objective without expanding access to our federal offshore resources.

II. Updated Economic Studies

The API recently commissioned updates to economic studies that detail the potential impacts of allowing additional access to areas offshore the Atlantic, Eastern Gulf of Mexico, Pacific and Alaska. The updated studies conclude that additional OCS exploration, drilling and production could spur spending on goods and services used to develop oil and natural gas resources, and this is expected to lead to a significant increase of the nation's gross domestic product.

The updated studies also conclude that additional OCS exploration, drilling and production could lead to large employment gains both nationally and regionally and is expected to benefit a diverse mix of industries. These include manufacturing; professional, scientific, and technical services (engineering); and construction. In addition, as a result of greater income in the economy, many employment sectors outside of traditional oil and gas development and its direct supply chain are also projected to see employment gains.

Finally, if legislation were passed to authorize a 37.5% state / federal revenue sharing agreement, states could see significant gains to their budgets. The projected state revenue increases could lead to further increases in economic activity and employment.

In the following sections we have highlighted the potential spending, employment, and revenue impacts resulting from additional access for four OCS regions. The full studies are included with these comments and can be found on API's website at www.api.org.

A. Atlantic OCS

Allowing oil and gas operators increased access to the Atlantic OCS and its resources would be expected to benefit oil and natural gas production, employment, the national economy, and government revenue. If leasing in the Atlantic OCS were allowed:

- Annual capital investment and other spending 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 $260 billion.
- Nearly 200,000 jobs could be created within 10 years of the beginning of leasing activity, the vast majority of which are likely to be in the Atlantic coast states.
- Approximately 1.5 million barrels of oil equivalent per day production could be realized within 20 years after initial lease sales.
- Nearly $16 billion per year could be added to the national economy within 10 years of leasing activity.
- Combined state and federal revenues from bonuses, rents and royalties are projected to reach $1.8 billion per year within ten years of leasing activity and grow to nearly $5.9 billion per year by the end of the 20-year forecast period.
    - With a 37.5% sharing agreement, state revenues are projected to be nearly $600 million per year within 10 years of leasing activity, with revenues expected to grow to over $2.2 billion per year by the end of the forecast period

B. Eastern Gulf of Mexico OCS

Allowing oil and gas operators increased access to the Eastern Gulf of Mexico and its resources would be expected to benefit oil and natural gas production, employment, the national economy, and government revenue. If leasing in the Eastern Gulf of Mexico were allowed:

- Annual capital investment and other spending could grow to over $11.5 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 $120 billion.
- Nearly 85,000 jobs could be created within 10 years of the beginning of leasing activity, the vast majority of which are likely to be in the Gulf coast states.
- Approximately 1.0 million barrels of oil equivalent per day production could be realized within 20 years after initial lease sales.
- Nearly $10.5 billion per year could be added to the national economy within 10 years of leasing activity.
- Combined state and federal revenues from bonuses, rents and royalties are projected to reach over $1.8 billion per year within ten years of leasing activity and grow to nearly $5 billion per year by the end of the 20-year forecast period.
    - With a 37.5% sharing agreement, state revenues are projected to be nearly $685 million per year within 10 years of leasing activity, with revenues expected to grow to over $1.8 billion per year by the end of the forecast period.

C. Pacific OCS

Allowing oil and gas operators increased access to the Pacific OCS and its resources would be expected to benefit oil and natural gas production, employment, the national economy, and government revenue. If leasing in the Pacific were allowed:

- Annual capital investment and other spending 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.
- Over 100,000 jobs could be created within 10 years of the beginning of leasing activity, the vast majority of which are likely to be in the Pacific coast states.
- Approximately 1.5 million barrels of oil equivalent per day production could be realized within 20 years after initial lease sales.
- Over $9.0 billion per year could be added to the national economy within 10 years of leasing activity.
- Combined state and federal revenues from bonuses, rents and royalties are projected to reach over $1.7 billion per year within ten years of leasing activity and grow to nearly $8.7 billion per year by the end of the 20-year forecast period.
    - With a 37.5% sharing agreement, state revenues are projected to be nearly $635 million per year within 10 years of leasing activity, with revenues expected to grow to over $3.2 billion per year by the end of the forecast period.

D. Alaska OCS

Allowing oil and gas operators increased access to the Alaska OCS and its resources would be expected to benefit oil and natural gas production, employment, and government revenue. If leasing in the Alaska OCS were allowed:

- Cumulative direct industry spending over the 20 year forecast period is projected at over $53 billion.
- An average of about 13,500 jobs per year could be created over the 20 year forecast period; over half of the jobs are likely to be in Alaska.
- Approximately 3 billion barrels of oil could be produced in the 20 years after initial lease sales in the four Alaska OCS areas examined.
- Combined state and federal revenues from bonuses, rents, royalties and taxes are projected to average about $2.7 billion per year and total about $37.5 billion by the end of the 20-year forecast period.

III. Conclusion

API appreciates the opportunity to comment on the 2019–2024 Draft Proposed National Oil and Gas Leasing Program. The information provided in the studies referenced above should help BOEM quantify the potential socioeconomic benefits that could accrue with expanded OCS access. Interior follows a robust process for taking into consideration these socioeconomic factors and other factors, and the potential impacts of OCS oil and natural gas development. The DPP provides detailed consideration of the values and impacts and further development of the National Leasing Program will provide opportunities for additional consideration. Ultimately, API believes that these factors, along with statutory, economic and national security

considerations, are fully aligned in support of a robust oil and natural gas leasing program that expands exploration and production opportunities to new areas, and API fully supports all the areas proposed for leasing in the DPP. We look forward to working with BOEM on development of the 2019-2024 National OCS Leasing Program. Should you have any questions please contact Andy Radford at 202-682-8584 or radforda@api.org.

Erik Milito, American Petroleum Institute

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

Prepared For:

The American Petroleum Institute (API)

Prepared By:

CALASH

Executive Summary

Executive Summary

The U.S. offshore oil and natural gas industry is a significant contributor to domestic energy production, the national economy, 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 percent[1] 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. Oil and gas development off the Atlantic coast has been restricted since the 1980's. Only 51 exploratory wells were drilled in the 1970s and 1980s, mainly in shallow water. A lease sale off the coast of Virginia was planned for 2011, but was subsequently canceled. Atlantic areas were subsequently removed from the 2017-2022 OCS Oil and Gas Leasing Program (five-year plan). 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 Northern, Mid, and South Atlantic OCS areas.[2] Under this proposed plan leasing is scheduled to begin in the South and Mid-Atlantic in 2020, and the North Atlantic in 2022.

This report constructs a scenario of oil and natural gas development in the Atlantic, 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, but excludes the Straits of Florida due to a lack of information on potential commercial oil and gas reserves. 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 Atlantic Oil and Natural Gas Development[3][4]

Economic Impact	First Leasing + 3 Years	First Leasing + 10 Years	First Leasing + 20 Years	Cumulative 20 Years
Capital Investment and Spending ($Billions)	$1.7	$16.0	$20.4	$259.6
Employment	21,045	195,371	264,298	N/A
Contributions to Economy - GDP ($Billions)	$1.8	$15.5	$21.8	$260.7
Federal / State Government Revenue ($Billions)	$0.6	$1.6	$5.9	$52.5
Natural Gas and Oil Production (MMBOED)	0	0.25	1.46	4 Billion BOE

Source: Calash

Leasing

This study assumes that leasing will begin in the South and Mid-Atlantic 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 300 leases sold. Leasing activity in the North Atlantic 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 prepare them for production by drilling development wells. With leasing starting in Year 1, Atlantic drilling would be expected to begin shortly after in the following year, and continue at very low levels (1-2 wells a year) for around five years. Total exploratory and development wells drilled is projected to average about 35 wells across the forecast period of which around 80 percent of wells are projected to be in deepwater. Drilling in the Atlantic OCS is projected to trend upwards as 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 65 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 in the capital and operational expenditures that lead to 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 project types based on project size and water depth. This study estimates that nearly 40 major projects could begin oil and natural gas production in the Atlantic OCS over the 20-year forecast

[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.

period, of which 30 are projected to be deepwater projects and 7 are projected to be shallow water projects.

Oil and Natural Gas Production

Allowing access to the Atlantic OCS for offshore oil and natural gas production is projected to lead to an increase in domestic energy production, the first oil and natural gas production from the Atlantic is projected to start within seven years. Within three years of initial production, Atlantic production is projected to increase to over 250 thousand barrels of oil equivalent per day (BOED). Production is projected to reach nearly 1.5 million BOED 20 years after leasing begins, with production expected to be around 36 percent oil and 64 percent natural gas.

Spending

Total cumulative domestic spending across the forecast period is projected to be nearly $225 billion. Domestic spending is projected to grow from an average of nearly $2.1 billion during the first five years of initial leasing, seismic, and exploratory drilling to nearly $18 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 total operational expenditures (OPEX), which occur after a well's initial production, are projected at over $38 billion. Cumulative capital expenditures during the 20 year forecast period are projected at just over $205 billion.

Domestic spending is expected to account for 86 percent of cumulative spending from Atlantic offshore development, with the remaining taking place internationally. For domestic spending, nearly 57 percent of spending from Atlantic oil and natural gas developments is expected to take place in the mid-Atlantic[5] states, with North Carolina (16 percent), South Carolina (9 percent), and Virginia (8 percent) accounting for the largest share. States in the North Atlantic are projected to account for around 25 percent of spending and states in the South Atlantic are expected to account for 4 percent of total spending.

Employment

Atlantic oil and natural gas development is expected to lead to significant employment gains, both in the Atlantic Coast region and nationally. Employment impacts are expected to grow throughout the forecast period, with total incremental U.S. employment supported projected to reach nearly 265 thousand jobs 20 years after initial lease sales. Total Atlantic Coast region

[5] The North Atlantic states include Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New York, and New Jersey. The Mid-Atlantic states include Delaware, Maryland, Virginia, North Carolina, and South Carolina. The South Atlantic states include Georgia and Florida.

employment is projected to reach over 205 thousand jobs. States outside the region are projected to see employment gains of nearly 59 thousand jobs by the end of the forecast period. The largest employment impact of Atlantic oil and natural gas activity is projected in North Carolina with over 55 thousand jobs supported by the end of the forecast period and South Carolina and Virginia which are projected to have employment gains of over 31 thousand and nearly 23 thousand jobs respectively by the end of the forecast period. The share of incremental employment within the Atlantic 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 $22 billion per year by the end of the forecast period, with nearly $17 billion of the impact in that year projected to occur in the Atlantic Coast states.

Atlantic oil and natural gas development has the potential to increase government revenue from royalties, bonus bids, and rents on leases by over $52 billion cumulatively throughout the forecast period. Total government revenues are projected to reach over $5.9 billion per year 20 years after initial lease sales. The majority of cumulative revenues are from royalties on produced oil and natural gas at around $39 billion. Leasing bonus bids are projected to account for around $11 billion while rental income from offshore blocks is expected to account for approximately $2.1 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. Cumulative state revenues through the forecast period for the Atlantic states could reach over $20 billion. Any spending by state governments due to additional revenue has the potential to increase GDP.[6]

Allowing access for Atlantic oil and natural gas development is projected to increase employment, economic activity, and government revenues with comparatively little additional spending required by federal and state governments. The nation as a whole, but especially the Atlantic coast states would likely see large employment gains, increased economic activity, and additional government revenue. In addition, the nation is projected to see increased domestic oil and natural gas production, thus increasing the nation's energy security.

[6] Analysis assumes states spend 50 percent of additional revenue.

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Section 1 – Introduction

Oil and natural gas development contributes significantly to the U.S. economy. 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 are inaccessible, most notably 94 percent[7] 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.

Drilling restrictions in the Atlantic OCS of the United States were lifted in 2008. However, since no Federal lease sales have occurred, the Atlantic OCS is still under a de facto drilling moratorium. A lease sale off of the coast of Virginia was scheduled for November 2011, but was subsequently canceled. The current 2017 to 2022 schedule of Federal offshore leasing does not include any proposed leases off of the U.S. Atlantic 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 the Northern, Mid, and South Atlantic OCS areas.[8] Under this proposed plan leasing is scheduled to begin in the South and Mid-Atlantic in 2020, and the North Atlantic in 2022.

The de facto ban on drilling in the Atlantic OCS prevents oil and gas operators from exploring and producing oil and gas from one of the key untapped energy resources in the country. Allowing safe, well-regulated exploration and production from this area would further enhance the nation's energy security, enhance America's trade balance, and provide 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 Atlantic 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

[7] "2012-2017 OCS Oil and Gas Leasing Program", Bureau of Ocean Energy Management, August 22, 2012, September 1, 2017.
[8] "Secretary Zinke Announces Plan For Unleashing America's Offshore Oil and Gas Potential", Department of the Interior, January 4, 2018, January 23 2018

projects and drilling. The report assumes that lease sales in the Atlantic OCS would follow the 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 Atlantic OCS to oil and natural gas activities. 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 Atlantic 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 Atlantic coast are defined as: North Carolina, Virginia, South Carolina, Georgia, Florida, Maryland, Massachusetts,

New Hampshire, New York, New Jersey, Connecticut, Maine, Pennsylvania, Rhode Island, and Delaware. For the purposes of this report the north Atlantic states are defined as Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New York, and New Jersey; the mid-Atlantic states are defined as Delaware, Maryland, Virginia, North Carolina, and South Carolina; and the south Atlantic state are defined as Georgia and Florida.

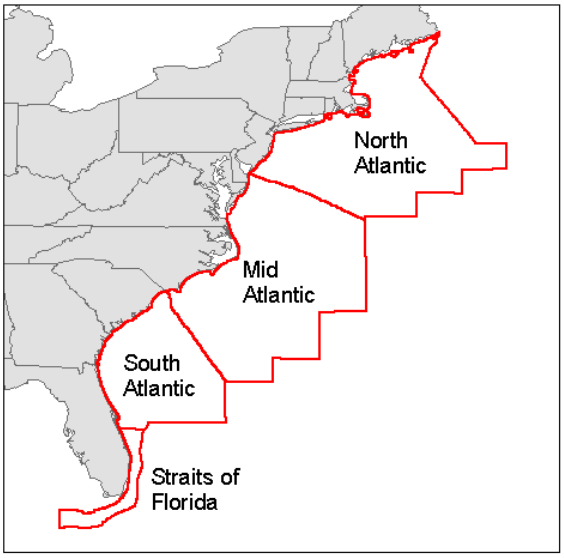
1.3 About Calash

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 Atlantic OCS

The Atlantic OCS stretches the coastlines of 14 U.S states, comprising federal waters from Nova Scotia, Canada in the North to the Bahamas in the South. Defined by four regions, the North Atlantic, Mid Atlantic, South Atlantic, and Straits of Florida, the Atlantic OCS is the second largest OCS, comprising 269 million acres or 49,252 individual blocks. (Figure 1)

Figure 1: Atlantic OCS Planning Areas Map



Source: Bureau of Ocean Energy Management

1.5 Lease History

Atlantic OCS lease activity has been inactive since the early 1980's. In the originally proposed 2007-2012 five-year plan[9] one lease sale in the Mid Atlantic during 2011 was proposed before government intervention caused the sale to be withdrawn. No Atlantic OCS leases were scheduled in the current 2017 to 2022 five-year plan even though there technically is no legal moratorium on Atlantic OCS lease sales.

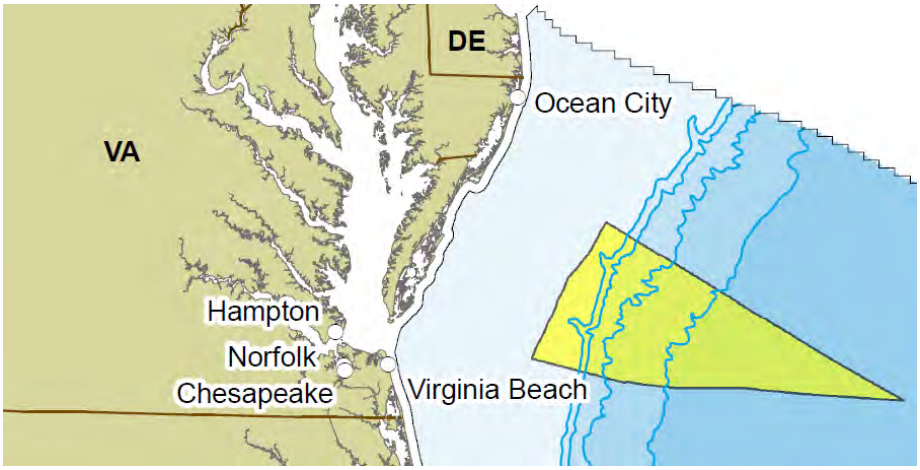
Historic lease sales within the Atlantic OCS took place between the years of 1976-1983, mainly focusing on the Mid Atlantic and South Atlantic regions. In the Mid Atlantic planning area, lease sales were executed in 1976, 1979, 1981 and 1983. In the South Atlantic planning area, lease sales were executed in 1978, 1981, and 1983. Only one lease sale has occurred in the North Atlantic planning area, this lease sale took place in 1979.

As originally proposed, the previous 2012 to 2017 five-year plan was scheduled to include the Beaufort Sea, Chukchi Sea, and Cook Inlet off the coast of Alaska; Western, Central, and Eastern GOM; and the Mid and South Atlantic.[10] The Northern Atlantic OCS was one of four areas excluded from this scoping. On the Atlantic Coast, the initial lease sale was planned for offshore

[9] "2012-2017 OCS Oil and Gas Leasing Program", Bureau of Ocean Energy Management, August 22, 2012, September 1, 2017.
[10] "Secretary Salazar Announces Comprehensive Strategy for Offshore Oil and Gas Development and Exploration." U.S. Department of the Interior, 31 Mar. 2010, accessed online on 11 Nov. 2013.

Virginia to be named Virginia Lease Sale 220, a portioned lease sale focused on 2.9 million acres over 50 miles offshore Virginia with the lease sale expected to take place in 2011.[11] (Figure 2)

Figure 2: Area of Proposed Virginia Lease Sale 220



Source: Bureau of Ocean Energy Management

Under increased industry scrutiny during 2010 in the wake of the Macondo incident, all leasing plans pertaining to the Atlantic OCS were removed from consideration. The Atlantic OCS region was not included in the 2017-2022 five-year plan developed by the Obama administration. Proposed mid and south Atlantic lease sales were removed from the draft proposed program during the proposed program stage of the development of the five-year plan.[12]

Subsequently on January 4th, 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 Northern, Mid, and South Atlantic OCS areas.[13] Under this proposed plan leasing is scheduled to begin in the South and Mid-Atlantic in 2020, and the North Atlantic in 2022.

1.6 Seismic

According to the BOEM estimates, some 240 thousand line miles of two-dimensional seismic imaging has been carried out in the Atlantic OCS, with data acquisition taking place from the late 1960's to the mid 1980's. Additionally a very limited amount of three dimensional seismic

[11] "Virginia Lease Sale 220 Information." *BOEM Homepage*. Bureau of Ocean Energy Management, 27 May 2010, accessed online on 11 Nov. 2013.

[12] "Secretary Jewell Announces Offshore Oil and Gas Leasing Plan for 2017-2022", Department of Interior Homepage, Department of Interior, November 18, 2016, accessed online on September 1, 2017.

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

was also carried out over a four block area in 1982. The lack of recent seismic imaging of the Atlantic OCS increases uncertainty as to the oil and natural gas resources of the area.

No seismic has been carried out since the 1980s. However, in 2011, BOEM began the process to open the Atlantic for seismic with the focus on the Mid and South-Atlantic regions only. Subsequently, the Obama administration blocked the issuance of new seismic permits in the region. As part of Secretary of the Interior Zinke's secretarial order to start formulating a new five-year plan, the Secretary also announced the restart of the permitting process which would allow new geophysical surveys of the Atlantic OCS.[14]

1.7 Drilling & Production

Drilling within the Atlantic OCS has been a limited and focused effort; only 51 wells were drilled between 1975 and 1984. Located predominately within the shallow waters of the South Atlantic and North Atlantic, all but four of the wells drilled were in less than 500 feet of water. Information regarding the Mid-Atlantic and deepwater, where a vast portion of the reserves are believed to exist, remains sparse. Shell conducted an ambitious drilling program focused on the Mesozoic shelf-edge during 1983 which represents the only deepwater exploration in the region. This established world records at the time, with water depths ranging between 5,838 to 6,952 feet, as well as the only well within the Mid-Atlantic region. Drilling success within the region was limited to one discovery by Tenneco and Texaco within HC598/599/642, although a later appraisal found the reserve to be non-commercial and the operator released the blocks in 1984.

1.8 Atlantic Resources

The Bureau of Ocean Energy Management produces analysis of the potential Atlantic OCS oil and natural gas resources in their "Assessment of Undiscovered Technically Recoverable Oil and Gas Resources off the Atlantic Outer Continental Shelf" series which is the basis for the reserve information in this report. This report identified ten unique plays, or oil and gas systems, on the Atlantic OCS. (Table 2)

[14] "Secretarial Order No. 3350, America-First Offshore Energy Strategy", Department of Interior Homepage, Department of Interior, 1 May 2017, September 1, 2017.

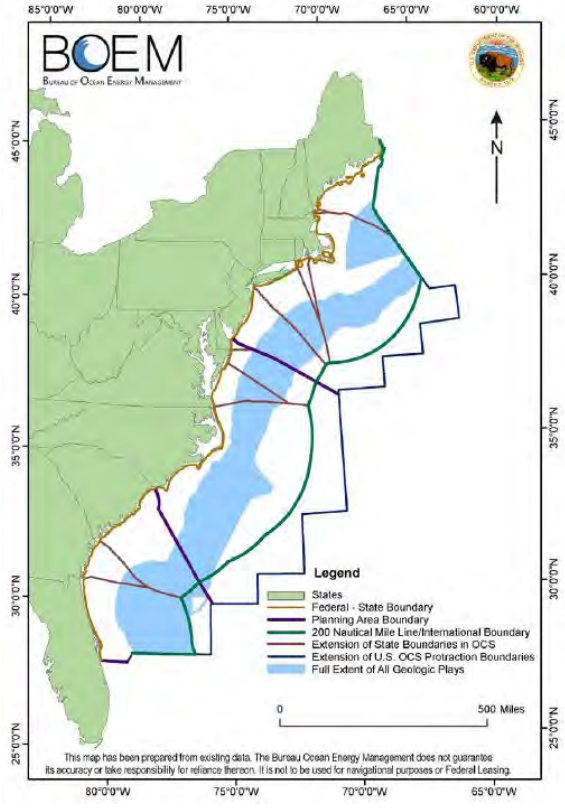
Table 2: Atlantic OCS Plays as Identified by BOEM Report

Play	Planning Area(s)
Late Jurassic-Early Cretaceous Carbonate Margin	North, Mid, South
Cretaceous & Jurassic Marginal Fault Belt	Mid
Cenozoic - Cretaceous & Jurassic Carolina Trough Salt Basin	Mid
Jurassic Shelf Stratigraphic	North, Mid
Cretaceous & Jurassic Interior Shelf Structure	North, Mid
Cretaceous & Jurassic Blake Plateau Basin	Mid, South
Triassic - Jurassic Rift Basin	North
Cretaceous & Jurassic Hydrothermal Dolomite	North
Cenozoic - Cretaceous & Jurassic Paleo-Slope Siliciclastic Core	North, Mid
Cenozoic - Cretaceous & Jurassic Paleo-Slope Siliciclastic Extension	North, Mid, South

Source: Bureau of Ocean Energy Management

The report recognized possible oil and gas bearing geologies through the Atlantic coast, with some plays being relatively localized in one region and others stretching throughout the Atlantic coast. In many places, the various plays overlap throughout different depths. (Figure 3)

Figure 3: Full Extent of All Geologic Plays for the Atlantic OCS



Source: Bureau of Ocean Energy Management

The play by play reserve assessments produced by the BOEM are the basis for both the resource and production models used to formulate this study as discussed in the data development section.

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 Atlantic 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. Additionally, the Straits of Florida planning area is excluded from this study.

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 Atlantic 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 Atlantic 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 holds 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 lack of existing infrastructure currently in place within the Atlantic 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.[15]

[15] 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 Atlantic 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 Gulf of Mexico where applicable due to a lack of existing structures in the Atlantic states. 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 this 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 Atlantic states under GOMESA. Calculations in this report were made to distinguish the potential State government revenue impacts among Atlantic 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 oil and natural gas prices 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

Allowing access to the Atlantic OCS for oil and natural gas production would likely provide large contributions to employment, gross domestic product, and state and federal government revenues. These benefits as projected would be felt throughout the Atlantic coast region as well as the US as a whole.

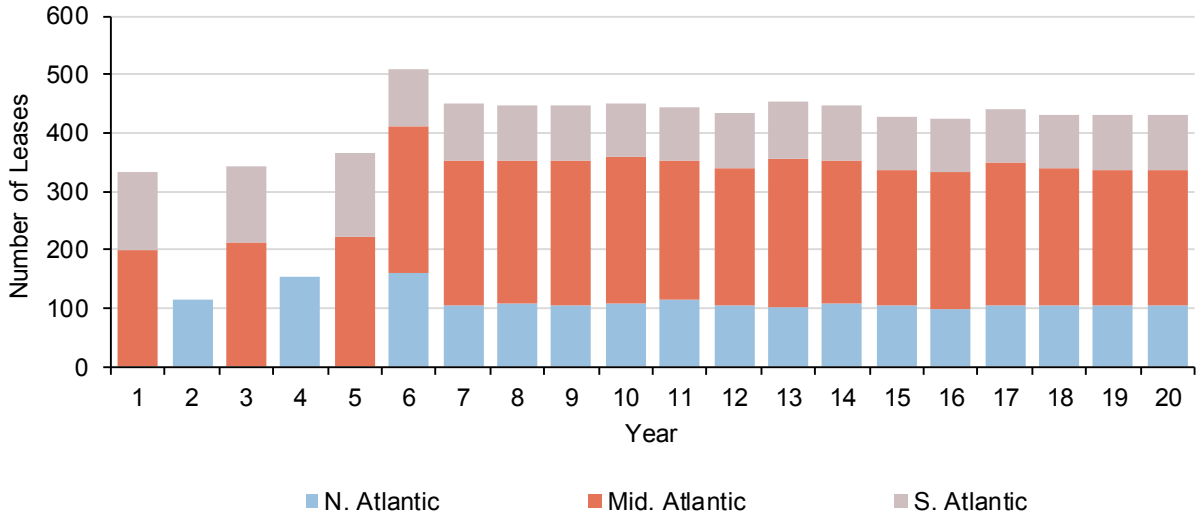
Offshore oil and natural gas exploration and production would require diverse activities such as: seismic imaging of reservoirs, drilling of wells, manufacturing equipment, and installing specialized equipment. The development of Atlantic oil and natural gas reserves would require capital and operational expenditures associated with these activities, as well as increase government revenues, which as projected would combine to lead to increased employment and economic activity.

3.1 Seismic and Leasing Activity

Seismic activity is normally the first step required for offshore exploration, both to enable oil and natural gas companies to make bids on lease blocks and to identify drilling targets after leasing. Due to the lack of recently acquired seismic data in the Atlantic OCS, some pre-leasing seismic activity is expected. Upon the beginning of wide spread sustained leasing in the Atlantic OCS, seismic and leasing activity would be expected to increase significantly. This study assumes that leasing begins in year 1, which would coincide with 2020 in the draft proposed program. New seismic activity is expected to begin within the year before initial lease sales (2019) at the latest, but significant seismic activity could begin as soon as seismic permits are issued for the Atlantic OCS.

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. Across the forecast period the number of leases sold is expected to range from 115 to 450 per year. (Figure 4)

Figure 4: Projected Leases Sold Atlantic OCS[16]



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 is most often used with drilling, processing, and production taking place from one or more platform or platforms that are fixed directly to the seafloor (fixed 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

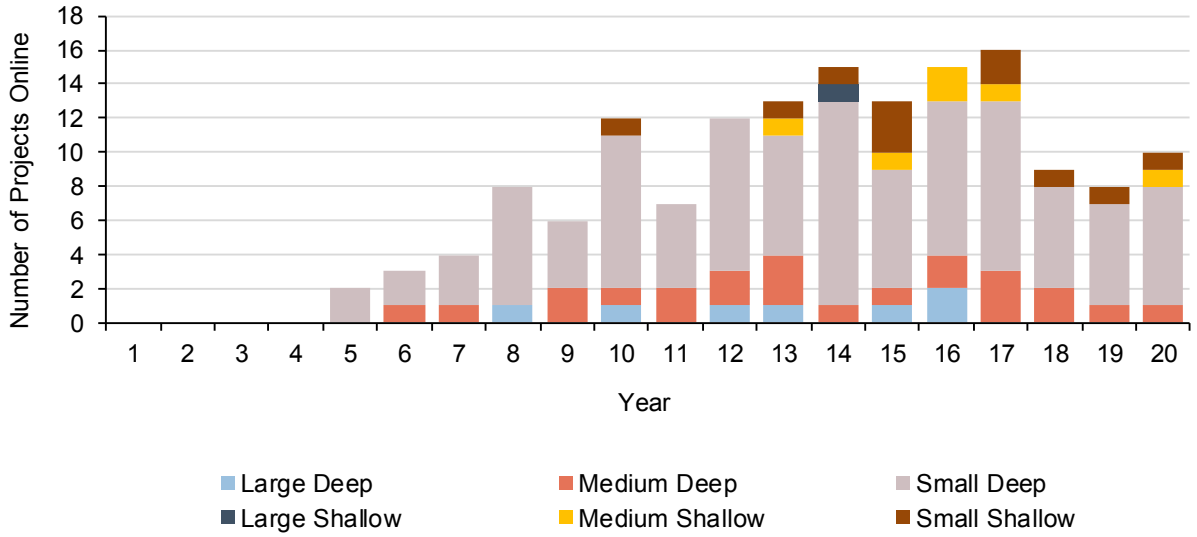
[16] Lease sales begin in year 1.

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 little to no infrastructure currently in place such as the Atlantic OCS until larger projects are in place or processing is available.

During the 20 year forecast period the study projects that that nearly 40 major projects could begin oil and natural gas production in the Atlantic OCS over the 20-year forecast period, of which 30 are projected to be deepwater projects and 7 are projected to be shallow water projects. (Figure 5)

Figure 5: Projected Number of Projects by Start-Up Year, Size and Water Depth



Source: Calash

Projects could begin producing oil and natural gas as soon as the fifth year of leasing in the Atlantic OCS. The number of projects anticipated to start up each year is expected to vary between two and 16 annually, dependent on variables such as discovery timing, water depth, available infrastructure already in place, and project development lead times.

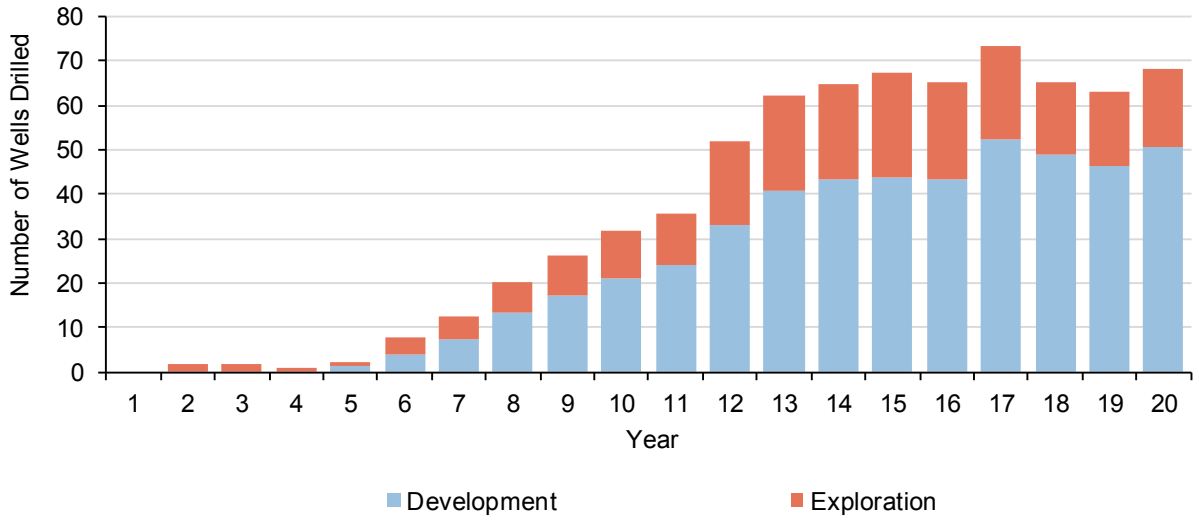
3.3 Drilling Activity

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 (mobile offshore drilling units – MODU's) must constantly be resupplied and crewed, and thus lead to high levels of activity in the areas and ports that support offshore drilling rigs.

Drilling activity in the Atlantic is expected to be highly robust upon the commencement of offshore oil and natural gas activity. Exploratory drilling is projected to begin within two years of the first lease sales. Only exploratory drilling is expected to take place for the first four years of potential Atlantic OCS development. Total drilling activity is projected to level off at around 65-70 wells per year 14 years after initial lease sales. (Figure 6)

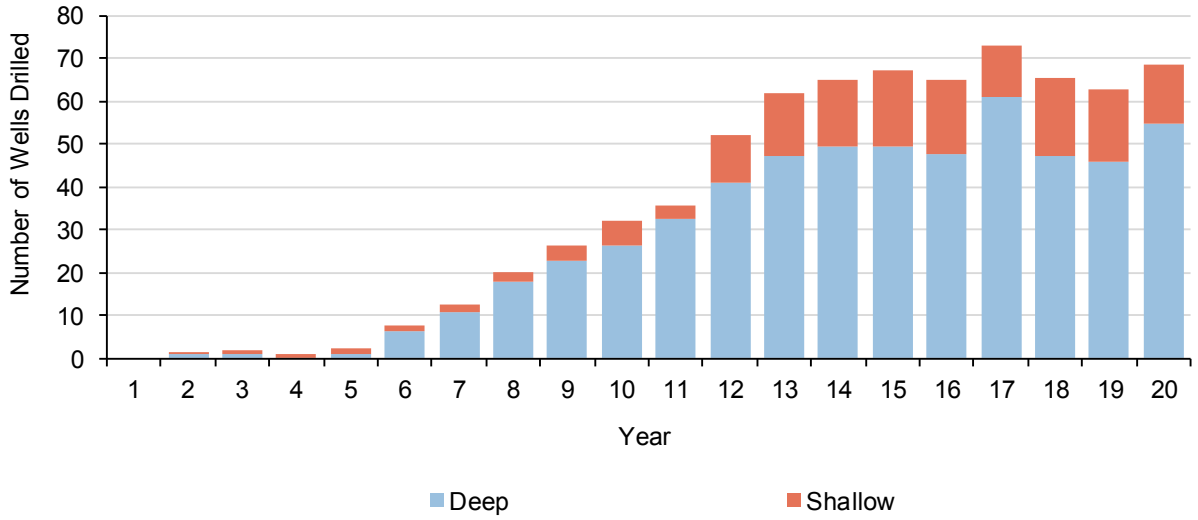
Figure 6: Projected Number of Wells Drilled by Well Type



Source: Calash

Due to the interconnected nature of exploration, drilling, and development, Atlantic 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 90 to 10 ratio of deepwater to shallow water wells. A total of around 370 wells are projected to be drilled across the forecast period. (Figure 7)

Figure 7: Projected Number of Wells Drilled by Water Depth and Year



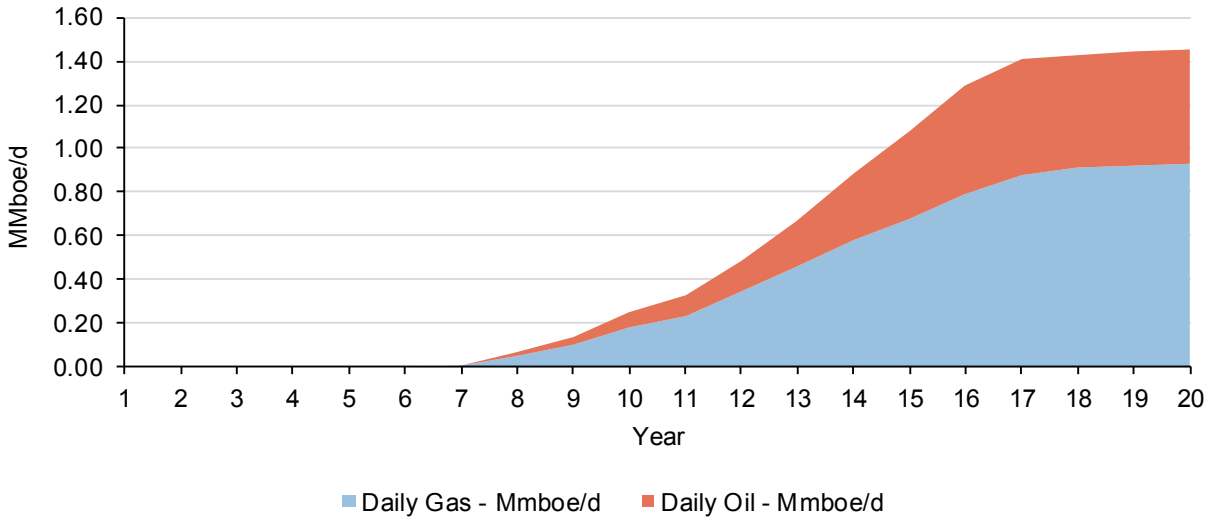
Source: Calash

3.4 Production Activity

The number of projects developed, coupled with reservoir size and reservoir productivity, is the main determinant of 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 all natural gas. Most reservoirs possess both oil and natural gas in varying ratios with oil sometimes expressed as condensate. All of the 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.

This study projects that first oil and natural gas production in the Atlantic OCS would take place six years after the beginning of leasing in the area. Annual production is projected to reach 140 thousand BOED by the third year of production. Production is projected to reach around 1.5 million BOED by the end of the forecast period, with approximately 36 percent of production oil (530 thousand BOED), and 64 percent of the production natural gas (930 thousand BOED or 5.4 billion cubic feet per day). (Figure 8)

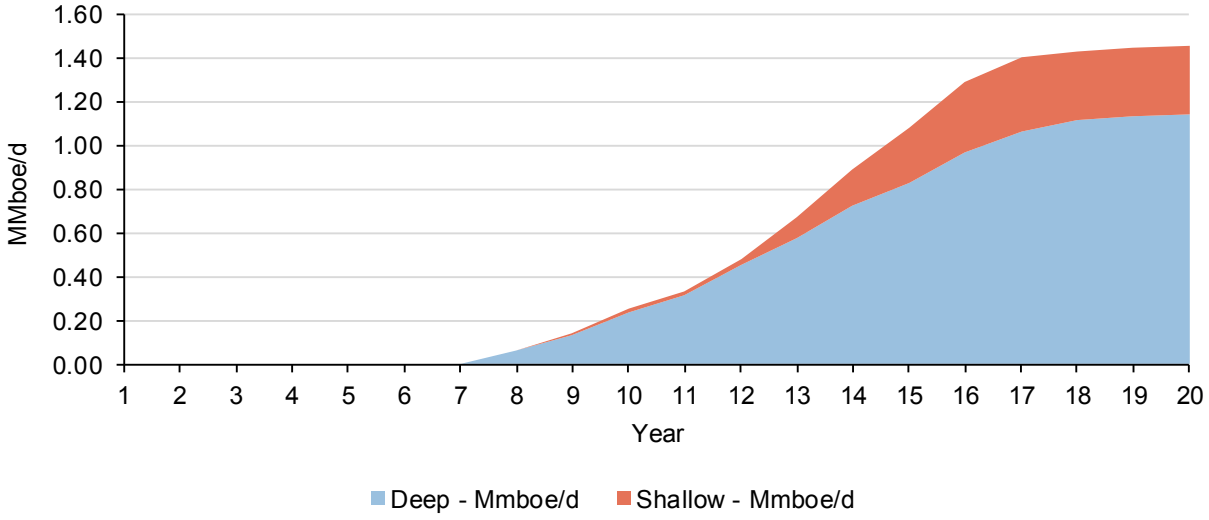
Figure 8: Projected Production by Type and Year



Source: Calash

Since project development and drilling is expected to be concentrated in deepwater, production is expected to outweigh shallow water production by a large margin. Deepwater production is expected to account for 79 percent of production by the end of the forecast period, compared to 21 percent of production from shallow water fields. (Figure 9)

Figure 9: Projected Production by Water Depth



Source: Calash

3.5 Spending Activity

Offshore oil and natural gas development is capital intensive. Offshore projects require 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 Atlantic OCS offshore oil and natural gas development is projected to be nearly $260 billion. Total spending in the first five years is projected to be around $2.1 billion per year; spending per year is expected to increase as projects are built and development drilling begins. Total drilling spending is projected to steadily increase throughout the forecast period, reaching around $3.9 billion by the end of the forecast period. Total spending is projected to remain relatively constant at about $20 billion per year for the last three 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.

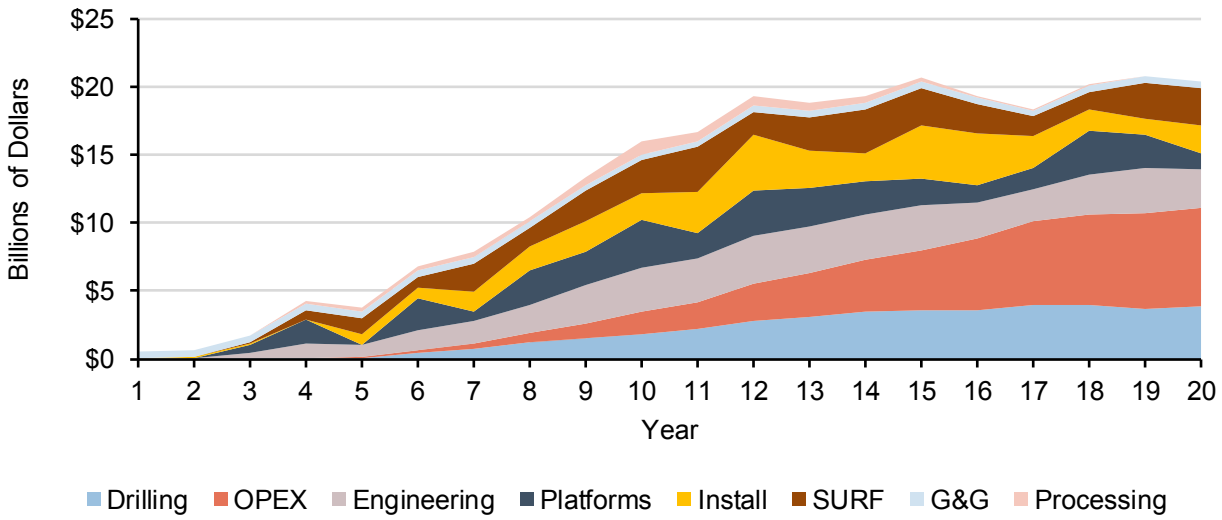
Although critically important, (G&G) spending including seismic is a relatively low percentage of overall spending at an average of nearly $450 million per year or just about four percent of overall spending across the forecast period. Seismic spending is one of the first categories of spending expected in the region, accounting for nearly 27 percent of spending in the first five years of the forecast period, as offshore prospects require a significant amount of time to identify.

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 $1.7 billion per year. Drilling expenditures are projected to increase throughout the forecast to nearly $4 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 $2 billion per year across the forecast period, increasing steadily as the Atlantic 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 $1.7 billion per year across the forecast period. SURF spending is projected to average around $1.5 billion per year. (Figure 10)

Figure 10: Projected Overall Spending by Category ($Billions per Year)



Source: Calash

Installation of platforms and SURF equipment is normally carried out by a number of different 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 $1.7 billion per year across the forecast period.

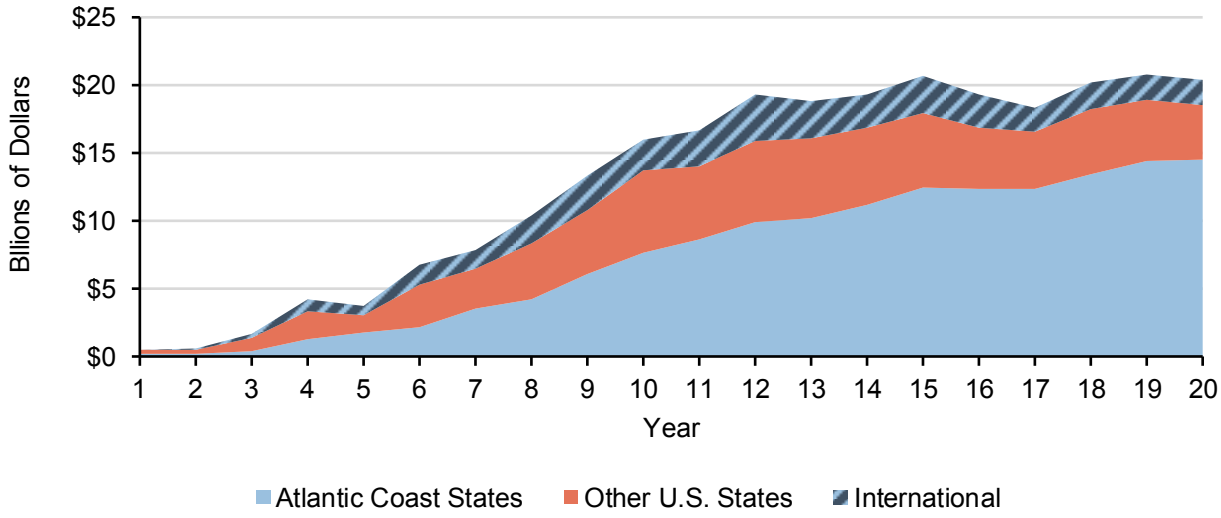
Once the initial production wells have been drilled and completed and the necessary equipment installed, a field can enter the operational phase. The operational phase requires manning and operating facilities and equipment, continuously supplying essential fluids and supplies, and constant general maintenance. 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 Atlantic OCS production, operational expenditures are expected to be over $1 billion per year, and with OPEX spending projected to continue to climb to over $6.7 billion per year by the end of the forecast period.

3.6 Spending Trends

The location of spending for Atlantic 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 in the early years of development in a new offshore oil and gas production region.

During the first five years of leasing in the Atlantic OCS, where activity is projected to consist mostly of seismic and exploration drilling, an average of 37 percent of total domestic Atlantic OCS oil and natural gas spending is projected to take place in the Atlantic coast states. However, as projects begin to be developed and spending on platforms and SURF equipment begins, they cause the Atlantic coast states' projected share of spending to dip to as low as 29 percent in some years. (Figure 11)

Figure 11: Projected Overall Spending Atlantic Coast States vs. Other U.S States vs. International ($Billions per Year)



Source: Calash

As the Atlantic OCS is developed, it is projected that suppliers of offshore oil and natural gas equipment will take advantage of the high-tech manufacturing capabilities of the Atlantic coast states, as well the extensive port infrastructure already in place. An increased amount of equipment and services is expected to originate from Atlantic 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, 71 percent of domestic spending on Atlantic OCS oil and natural gas developments is projected to accrue to the Atlantic coast states reaching over $14.5 billion per year. Other U.S. state spending in at the end of the forecast period is projected to be over $4 billion.

Over the full forecast period, the largest share of spending due to Atlantic OCS offshore oil and natural gas development occurs in the Atlantic coast states themselves, with nearly $150 billion spent cumulatively. Cumulative spending in other US states is projected at over $75 billion.

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 Atlantic coast states' economies as well as geography. States with strong manufacturing, fabrication, engineering and other relevant industries are thus projected to be more likely to undertake these activities for Atlantic OCS offshore oil and gas exploration and production. (Table 5).

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

State	1	2	3	4	5	6	7	8	9	10	11
North Carolina	$52	$62	$109	$340	$528	$551	$1,016	$1,054	$1,590	$1,967	$2,266
South Carolina	$40	$45	$73	$160	$211	$289	$450	$553	$772	$1,002	$1,140
Virginia	$25	$31	$62	$172	$234	$303	$479	$562	$815	$1,014	$1,144
Massachusetts	$16	$18	$39	$108	$127	$187	$272	$335	$470	$608	$659
New York	$13	$17	$39	$133	$187	$243	$378	$435	$630	$775	$869
Maine	$6	$8	$17	$33	$33	$64	$85	$129	$174	$227	$259
Florida	$6	$8	$16	$47	$72	$91	$144	$169	$245	$299	$341
New Jersey	$9	$11	$22	$59	$82	$104	$166	$195	$283	$353	$398
Pennsylvania	$7	$9	$18	$58	$74	$102	$154	$181	$255	$329	$357
Maryland	$8	$10	$18	$41	$61	$79	$125	$152	$219	$271	$313
Connecticut	$11	$12	$21	$48	$56	$86	$123	$160	$219	$290	$318
Rhode Island	$11	$12	$17	$21	$28	$43	$64	$93	$126	$167	$197
Georgia	$4	$5	$9	$24	$35	$42	$71	$80	$117	$146	$167
Delaware	$8	$9	$12	$15	$19	$29	$45	$64	$87	$115	$137
New Hampshire	$6	$7	$10	$15	$17	$28	$40	$57	$77	$103	$118
East Coast	$221	$263	$480	$1,273	$1,764	$2,242	$3,610	$4,219	$6,081	$7,665	$8,681
Other U.S. States	$280	$308	$892	$2,136	$1,361	$3,063	$2,902	$4,128	$4,759	$6,048	$5,339
International	$1	$30	$310	$848	$636	$1,470	$1,382	$2,057	$2,532	$2,279	$2,659
Totals	**$502**	**$601**	**$1,682**	**$4,257**	**$3,761**	**$6,775**	**$7,894**	**$10,404**	**$13,372**	**$15,992**	**$16,680**

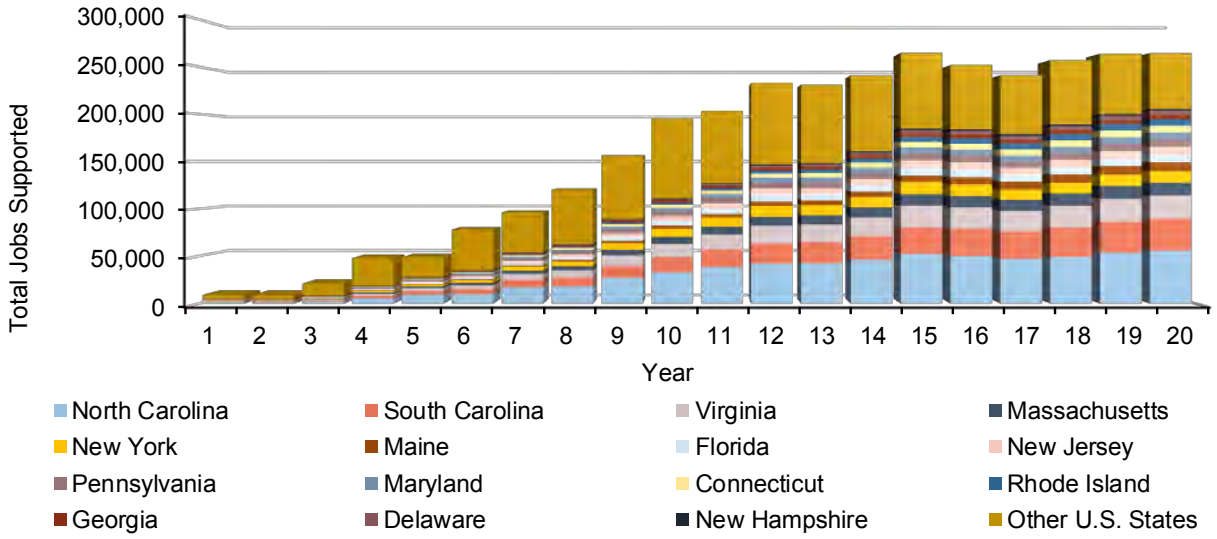
State	12	13	14	15	16	17	18	19	20	Total
North Carolina	$2,417	$2,539	$2,796	$3,052	$2,955	$2,858	$3,092	$3,447	$3,473	$36,165
South Carolina	$1,312	$1,405	$1,584	$1,748	$1,787	$1,875	$2,045	$2,151	$2,186	$20,828
Virginia	$1,327	$1,343	$1,442	$1,613	$1,577	$1,542	$1,687	$1,818	$1,821	$19,013
Massachusetts	$750	$781	$851	$922	$891	$895	$1,011	$1,076	$1,049	$11,063
New York	$995	$960	$998	$1,138	$1,066	$969	$1,047	$1,126	$1,135	$13,151
Maine	$338	$361	$405	$462	$514	$570	$625	$648	$660	$5,615
Florida	$411	$388	$399	$472	$459	$426	$447	$467	$486	$5,392
New Jersey	$467	$470	$502	$566	$557	$546	$595	$637	$640	$6,661
Pennsylvania	$394	$402	$434	$472	$444	$428	$480	$511	$501	$5,611
Maryland	$385	$381	$406	$471	$478	$477	$508	$532	$549	$5,485
Connecticut	$372	$399	$446	$485	$491	$521	$583	$607	$603	$5,852
Rhode Island	$258	$284	$328	$372	$413	$467	$504	$517	$535	$4,457
Georgia	$193	$195	$211	$238	$236	$231	$249	$267	$272	$2,791
Delaware	$179	$197	$228	$258	$287	$324	$350	$361	$373	$3,098
New Hampshire	$147	$163	$189	$209	$226	$254	$278	$286	$292	$2,520
East Coast	$9,945	$10,266	$11,220	$12,478	$12,382	$12,384	$13,501	$14,451	$14,575	$147,703
Other U.S. States	$5,997	$5,861	$5,700	$5,455	$4,543	$4,251	$4,776	$4,473	$4,026	$76,295
International	$3,420	$2,752	$2,376	$2,818	$2,395	$1,765	$1,943	$1,929	$1,809	$35,411
Totals	**$19,363**	**$18,879**	**$19,296**	**$20,751**	**$19,320**	**$18,400**	**$20,220**	**$20,853**	**$20,409**	**$259,410**

Source: Calash

3.7 Employment

Spending on goods and services to develop oil and natural gas in the Atlantic OCS is projected to provide large employment gains both nationally and regionally. Employment generally follows spending patterns. Employment effects are expected to steadily grow throughout the forecast period, reaching over 260 thousand jobs supported in the US 20 years after initial leasing begins. Total Atlantic coast state employment is projected to reach over 200 thousand jobs by the end of the forecast period. U.S. states outside the Atlantic region are projected to see additional employment of nearly 59 thousand jobs by the end of the forecast period. (Figure 12)

Figure 12: Projected Employment by State



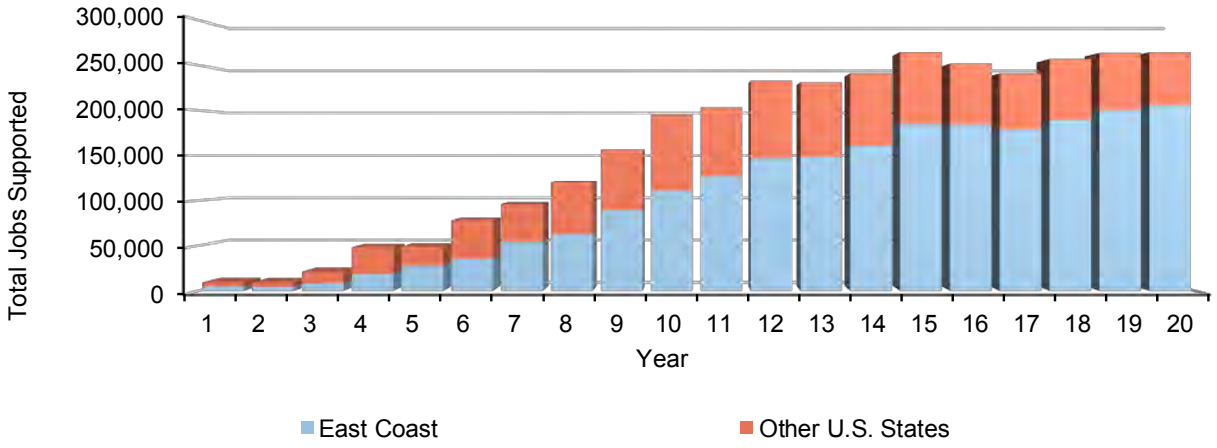
Source: Calash

The largest impact on employment by number of jobs is expected to be seen in the states of North and South Carolina, Virginia, Massachusetts, and New York with the five states projected to see employment gains of around 56 thousand, 34 thousand, 25 thousand, 14 thousand and 12 thousand jobs respectively by the end of the forecast period. Over 35 thousand jobs in Atlantic coast states are projected to be created within five years of the beginning of leasing.

As the Atlantic 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 Atlantic 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. In the first five years of the forecast period, prior to the beginning of significant project development, an average of 47 percent of employment benefits are expected to accrue to Atlantic coast states. As spending on items such as SURF equipment and platforms that will initially be produced outside the region increases, the percentage of overall employment effects in Atlantic coast states is expected to fall as low as 39, albeit with overall employment in the region still growing rapidly. By the end of the forecast period, the Atlantic coast states are projected to account for 78 percent of the employment effects of Atlantic OCS development. The opening of the Atlantic 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 economy. Direct employment by oil and natural gas companies and their suppliers is projected to reach over 101 thousand jobs by 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 163 thousand jobs. (Figure 13)

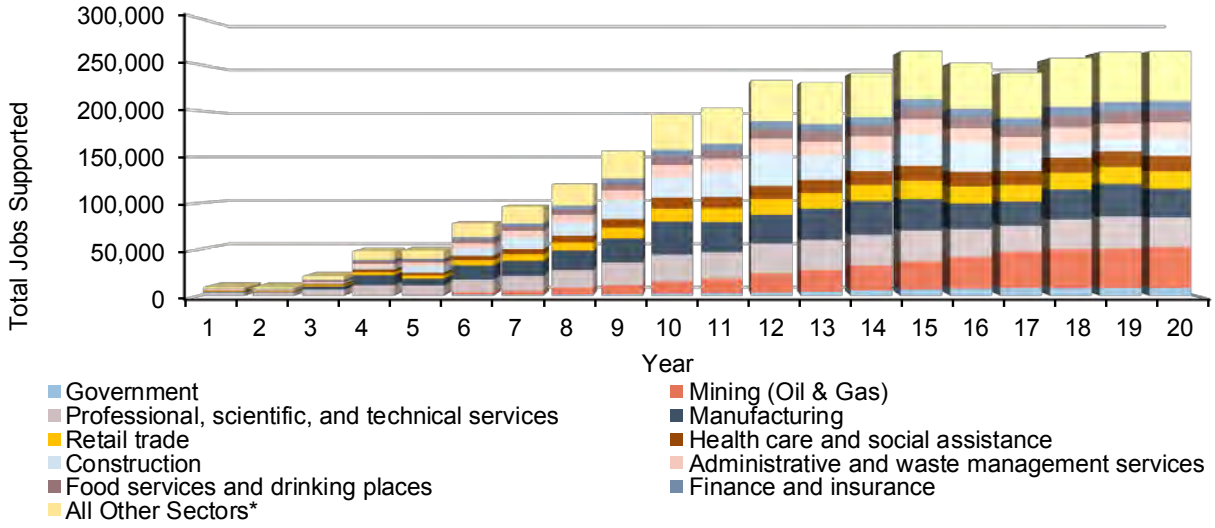
Figure 13: Projected Employment Direct vs. Indirect and Induced



Source: Calash

Offshore oil and natural gas development in the Atlantic OCS is expected to benefit a diverse spectrum of industries both nationally and in Atlantic coast states. Industry sectors which are directly involved in oil and natural gas activities such as mining, which includes the oil and gas industry, manufacturing, professional, scientific, and technical Services (engineering), and Construction (installation) are expected to see the largest employment impacts with a combined over 125 thousand jobs by the end of the forecast period. Additionally, employment impacts are expected to be significant for a variety of other industries outside oil and gas, with over 135 thousand jobs projected outside of these four categories at the end of the forecast period. (Figure 14)

Figure 14: Projected Employment by Industry Sector



Source: Calash

Many employment sectors of the economy outside oil and gas development or the direct supply chain will also 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 Atlantic Coast States and Other U.S. States

State	1	2	3	4	5	6	7	8	9	10
North Carolina	1,245	1,037	2,158	5,438	9,222	9,887	17,234	18,246	27,036	32,999
South Carolina	933	715	1,424	2,489	3,821	4,933	7,414	9,009	12,479	15,977
Virginia	503	421	983	2,224	3,368	4,382	6,646	7,889	11,308	13,940
Massachusetts	189	334	483	1,454	1,627	2,437	3,443	4,149	5,800	7,423
New York	150	256	453	1,564	2,146	2,902	4,304	4,973	7,117	8,684
Maine	88	156	252	558	507	994	1,240	1,811	2,413	3,145
Florida	357	179	528	787	1,543	1,800	2,652	3,063	4,310	5,136
New Jersey	188	178	362	803	1,165	1,538	2,286	2,682	3,821	4,711
Pennsylvania	131	151	305	939	1,256	1,672	2,519	2,884	4,090	5,186
Maryland	202	161	335	560	916	1,204	1,765	2,120	2,984	3,655
Connecticut	127	216	266	662	672	1,122	1,489	1,910	2,571	3,380
Rhode Island	135	239	225	409	373	657	845	1,149	1,519	2,034
Georgia	235	110	319	396	805	859	1,307	1,445	2,033	2,436
Delaware	156	113	213	188	305	457	599	808	1,071	1,407
New Hampshire	76	125	127	252	226	368	446	541	678	878
East Coast	4,714	4,389	8,433	18,725	27,952	35,211	54,191	62,679	89,231	110,992
Other U.S. States	4,411	4,563	12,613	29,402	20,930	42,923	42,082	57,721	67,405	84,379
Totals	**9,124**	**8,951**	**21,045**	**48,127**	**48,882**	**78,135**	**96,273**	**120,401**	**156,636**	**195,371**

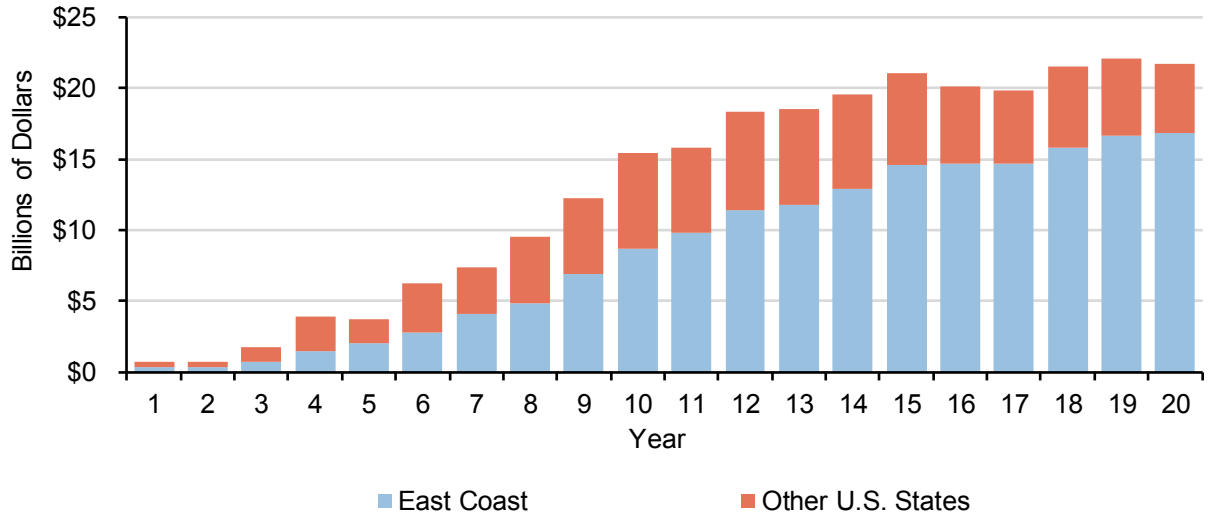
State	11	12	13	14	15	16	17	18	19	20
North Carolina	38,565	42,132	42,617	46,161	52,201	50,333	47,046	49,289	53,855	55,760
South Carolina	18,447	21,236	22,215	24,940	28,313	28,865	29,201	31,113	32,494	33,604
Virginia	15,929	18,898	18,604	19,721	22,765	22,283	21,360	22,788	24,061	24,664
Massachusetts	8,130	9,376	9,751	10,672	12,070	11,993	11,884	12,915	13,649	13,503
New York	9,777	11,450	10,734	10,958	12,990	12,261	10,864	11,338	11,931	12,277
Maine	3,543	4,610	5,012	5,709	6,805	7,664	8,299	8,850	9,148	9,311
Florida	5,868	7,176	6,499	6,659	8,211	8,220	7,405	7,470	7,615	8,102
New Jersey	5,335	6,390	6,270	6,597	7,607	7,504	7,303	7,810	8,237	8,418
Pennsylvania	5,692	6,325	6,305	6,682	7,424	6,962	6,539	7,167	7,615	7,580
Maryland	4,212	5,231	5,098	5,365	6,314	6,373	6,326	6,643	6,873	7,173
Connecticut	3,704	4,412	4,737	5,312	6,014	6,193	6,455	6,950	7,137	7,143
Rhode Island	2,377	3,096	3,551	4,208	5,026	5,742	6,348	6,618	6,787	6,999
Georgia	2,777	3,238	3,110	3,346	3,949	4,027	3,776	3,875	4,059	4,218
Delaware	1,652	2,154	2,389	2,749	3,124	3,486	3,987	4,302	4,447	4,592
New Hampshire	955	1,116	1,337	1,618	1,998	2,145	2,166	2,098	2,097	2,115
East Coast	126,963	146,840	148,228	160,698	184,810	184,051	178,961	189,225	200,006	205,460
Other U.S. States	76,273	86,039	82,704	80,127	79,684	67,732	61,926	67,670	63,622	58,838
Totals	**203,235**	**232,879**	**230,932**	**240,824**	**264,495**	**251,783**	**240,887**	**256,895**	**263,628**	**264,298**

Source: Calash

3.8 State Income Impacts

Along with employment benefits, significant contributions to state and national gross domestic product are also expected due to Atlantic coast oil and natural gas development. Total contributions to state economies are projected at over $21.7 billion per year by the end of the forecast period, with around 77 percent expected to occur in the Atlantic coast states and 23 percent in the rest of the U.S. (Figure 15)

Figure 15: Projected Contributions to State Economies Atlantic Coast States and Other U.S. States ($Billions Per Year)



Source: Calash

Presented below are the projected economic effects of Atlantic OCS exploration and production. The largest contributions are expected to mimic spending at the state level. Under this projection, the states of North Carolina, Virginia, South Carolina, Massachusetts, and New York receive the majority of contributions to their states' economies. (Table 7)

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

State GDP	1	2	3	4	5	6	7	8	9	10	11
North Carolina	$96	$76	$165	$372	$591	$665	$1,115	$1,222	$1,790	$2,225	$2,554
South Carolina	$74	$56	$113	$179	$264	$347	$511	$638	$879	$1,138	$1,294
Virginia	$46	$39	$91	$197	$272	$370	$544	$661	$940	$1,171	$1,316
Massachusetts	$19	$31	$48	$135	$141	$226	$306	$383	$527	$682	$737
New York	$16	$25	$47	$152	$193	$273	$396	$469	$668	$824	$916
Maine	$7	$12	$20	$42	$37	$77	$95	$142	$188	$246	$278
Florida	$29	$14	$42	$56	$107	$126	$181	$211	$294	$354	$399
New Jersey	$18	$17	$35	$76	$103	$141	$205	$246	$347	$432	$483
Pennsylvania	$11	$13	$26	$75	$94	$135	$194	$231	$322	$415	$450
Maryland	$19	$15	$31	$52	$78	$105	$151	$183	$256	$316	$359
Connecticut	$13	$20	$26	$61	$60	$103	$135	$176	$236	$315	$342
Rhode Island	$12	$21	$21	$35	$32	$58	$75	$104	$138	$185	$216
Georgia	$19	$9	$26	$30	$58	$64	$94	$108	$149	$182	$205
Delaware	$15	$12	$21	$20	$30	$45	$59	$80	$106	$139	$163
New Hampshire	$7	$11	$12	$22	$19	$32	$38	$48	$59	$78	$84
East Coast	$401	$371	$723	$1,504	$2,078	$2,764	$4,097	$4,901	$6,900	$8,702	$9,797
Other U.S. States	$375	$383	$1,062	$2,397	$1,619	$3,454	$3,306	$4,638	$5,380	$6,779	$6,045
Totals	**$776**	**$754**	**$1,785**	**$3,901**	**$3,697**	**$6,218**	**$7,403**	**$9,539**	**$12,280**	**$15,481**	**$15,842**

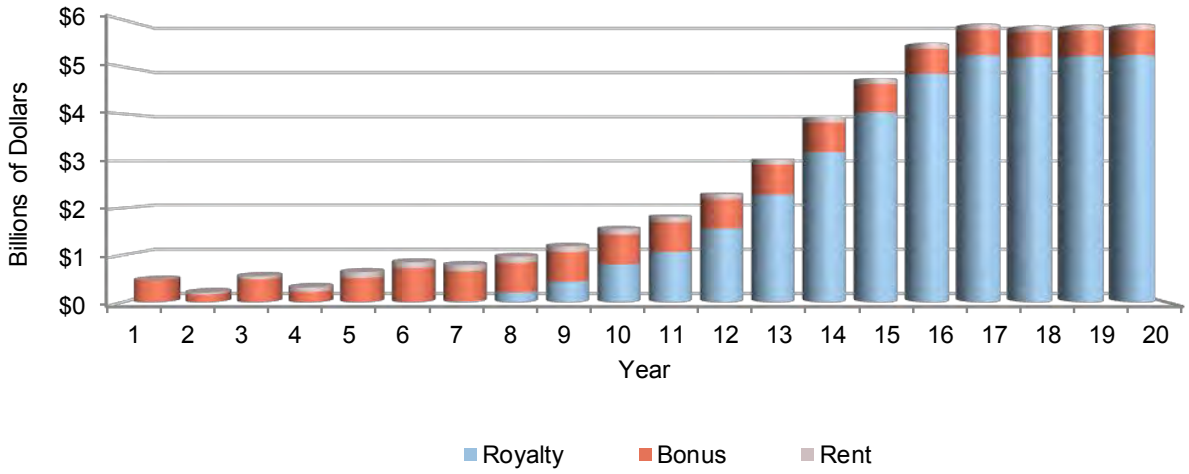
State GDP	12	13	14	15	16	17	18	19	20	Total
North Carolina	$2,825	$2,935	$3,222	$3,575	$3,482	$3,382	$3,636	$3,948	$4,003	$41,878
South Carolina	$1,517	$1,624	$1,839	$2,049	$2,100	$2,180	$2,358	$2,454	$2,497	$24,110
Virginia	$1,564	$1,576	$1,688	$1,903	$1,863	$1,829	$1,997	$2,119	$2,125	$22,308
Massachusetts	$856	$899	$988	$1,102	$1,092	$1,100	$1,214	$1,277	$1,250	$13,014
New York	$1,072	$1,035	$1,075	$1,239	$1,175	$1,080	$1,164	$1,236	$1,239	$14,293
Maine	$364	$400	$459	$545	$615	$671	$716	$739	$751	$6,402
Florida	$484	$452	$473	$569	$575	$534	$551	$568	$590	$6,609
New Jersey	$579	$578	$614	$695	$685	$679	$738	$780	$785	$8,236
Pennsylvania	$505	$513	$550	$604	$571	$554	$615	$649	$640	$7,167
Maryland	$445	$440	$467	$540	$544	$546	$582	$607	$624	$6,361
Connecticut	$409	$445	$503	$564	$586	$622	$680	$702	$698	$6,696
Rhode Island	$283	$326	$387	$458	$522	$582	$610	$625	$644	$5,335
Georgia	$241	$239	$264	$306	$318	$312	$328	$343	$351	$3,646
Delaware	$212	$236	$272	$306	$339	$388	$419	$431	$445	$3,739
New Hampshire	$100	$120	$145	$176	$189	$194	$191	$190	$191	$1,907
East Coast	$11,456	$11,819	$12,947	$14,631	$14,658	$14,653	$15,798	$16,670	$16,831	$171,700
Other U.S. States	$6,878	$6,729	$6,581	$6,442	$5,515	$5,184	$5,721	$5,385	$4,923	$88,796
Totals	**$18,334**	**$18,548**	**$19,528**	**$21,073**	**$20,172**	**$19,837**	**$21,519**	**$22,055**	**$21,754**	**$260,496**

Source: Calash

3.9 Government Revenue Impacts

In addition to economic and employment growth, oil and gas production in the Atlantic OCS would increase government revenue. Extrapolating from the current Gulf of Mexico regulatory environment due to a lack of similar structures in the Atlantic OCS, total government revenues are projected to reach over $5.9 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 $5.2 billion. At the end of the forecast period, leasing bonus bids are projected to account for nearly $540 million per year in government revenue, while rental income from offshore blocks is expected to account for over $120 million. Across the forecast period, royalties on oil and natural gas production are expected to total over $39 billion and cumulative government revenues are projected to reach over $52 billion. (Figure 16)

Figure 16: Projected Government Revenues – Rentals, Royalties, and Bonus Bids ($Billions per Year)[17]

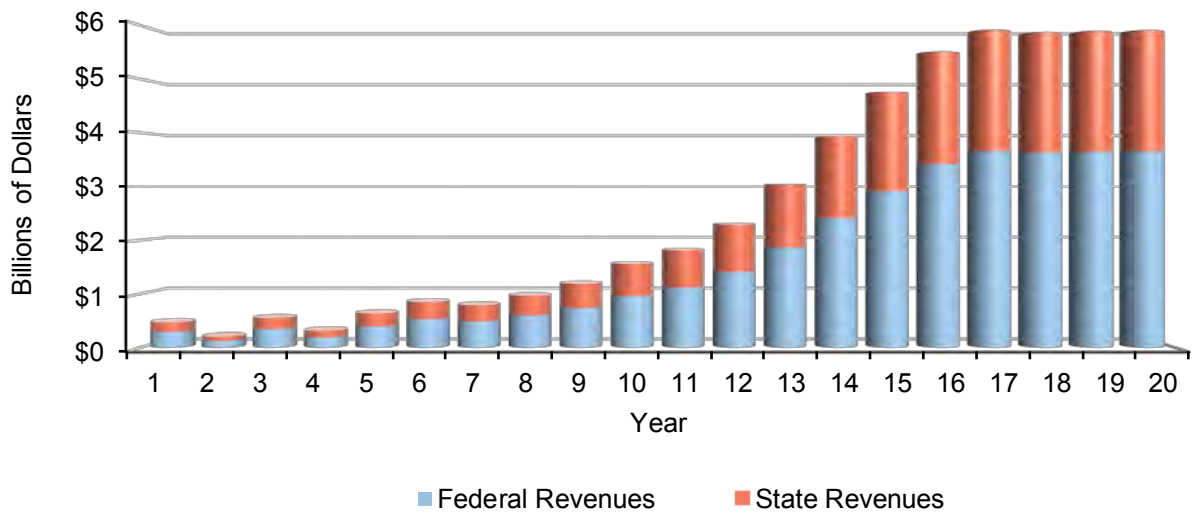


Source: Calash

There is a possibility that revenue generated from Atlantic OCS oil and natural gas development will be shared between the Federal government and the various state governments, although there currently is no revenue sharing agreement in place that covers the Atlantic OCS. 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 Atlantic 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 Atlantic coast states, federal government revenues from Atlantic OCS offshore oil and natural gas production are projected to reach over $3.6 billion per year at the end of the forecast period. Combined state revenues for the Atlantic coast states are projected at about $2.3 billion per year by the end of the forecast period. (Figure 17)

[17] Assumes 37.5 percent revenue sharing with state governments.

Figure 17: Projected Government Revenues from Rentals, Royalties, and Bonus Bids, State and Federal ($Billions per Year)[18]



Source: Calash

Due to the projected location of the potential oil and natural gas production based on the play data, North Carolina, South Carolina, Virginia, and Massachusetts are most likely to receive significant returns from any revenue sharing agreement. At a 37.5 percent share for state governments, these states are projected to receive a cumulative $4.4, $3.8, $2.1 and 1.4 billion respectively across the forecast period. Each of the Atlantic coast states would receive at least $375 million cumulatively of new government revenue over the forecast period. (Table 8)

[18] Assumes 37.5 percent revenue sharing with state governments.

Table 8: Projected Government Revenues from Rentals, Royalties, and Bonus Bids by State[19] and Federal ($Millions per Year)

State	1	2	3	4	5	6	7	8	9	10	11
North Carolina	$0	$1	$46	$4	$51	$54	$57	$83	$113	$151	$184
South Carolina	$0	$3	$39	$3	$43	$40	$42	$65	$88	$121	$147
Virginia	$0	$3	$23	$5	$25	$31	$31	$43	$57	$75	$91
Massachusetts	$0	$12	$3	$20	$5	$22	$16	$18	$20	$29	$33
New York	$0	$8	$4	$14	$5	$17	$13	$15	$17	$24	$27
Maine	$0	$5	$1	$8	$2	$9	$7	$7	$7	$12	$13
Florida	$0	$5	$29	$3	$33	$25	$25	$24	$24	$23	$24
New Jersey	$0	$4	$10	$8	$12	$19	$17	$18	$20	$25	$27
Pennsylvania	$0	$3	$4	$5	$5	$9	$8	$9	$10	$14	$16
Maryland	$0	$4	$13	$5	$14	$20	$18	$19	$22	$26	$29
Connecticut	$0	$8	$2	$13	$4	$15	$11	$12	$15	$21	$24
Rhode Island	$0	$10	$2	$16	$4	$18	$13	$15	$17	$25	$28
Georgia	$0	$3	$19	$2	$22	$17	$17	$16	$16	$16	$16
Delaware	$0	$4	$11	$5	$13	$18	$17	$18	$20	$25	$27
New Hampshire	$0	$5	$1	$8	$2	$9	$7	$7	$7	$12	$13
East Coast	$0	$76	$208	$118	$241	$321	$299	$368	$455	$599	$698
Federal	$0	$126	$343	$193	$397	$530	$493	$600	$735	$962	$1,116
Totals	**$0**	**$202**	**$551**	**$312**	**$637**	**$851**	**$792**	**$969**	**$1,190**	**$1,561**	**$1,814**

State	12	13	14	15	16	17	18	19	20	Total
North Carolina	$238	$298	$368	$411	$427	$461	$491	$493	$495	$4,427
South Carolina	$193	$245	$316	$359	$395	$419	$442	$444	$445	$3,849
Virginia	$117	$145	$176	$195	$199	$220	$234	$235	$236	$2,141
Massachusetts	$42	$69	$98	$138	$169	$179	$163	$163	$163	$1,362
New York	$35	$49	$63	$82	$97	$105	$100	$100	$100	$874
Maine	$16	$37	$59	$93	$117	$119	$103	$103	$103	$822
Florida	$23	$26	$48	$60	$91	$93	$87	$87	$87	$818
New Jersey	$34	$39	$44	$48	$48	$58	$60	$60	$61	$612
Pennsylvania	$21	$24	$27	$30	$33	$39	$40	$40	$40	$375
Maryland	$35	$41	$46	$49	$48	$58	$60	$60	$60	$627
Connecticut	$32	$49	$66	$90	$109	$116	$107	$108	$108	$909
Rhode Island	$36	$60	$84	$118	$145	$152	$138	$139	$139	$1,157
Georgia	$16	$18	$32	$40	$60	$62	$58	$58	$58	$544
Delaware	$33	$38	$43	$46	$46	$55	$57	$57	$57	$590
New Hampshire	$16	$36	$57	$89	$112	$114	$99	$100	$100	$794
East Coast	$886	$1,175	$1,526	$1,846	$2,095	$2,252	$2,239	$2,246	$2,252	$19,900
Federal	$1,409	$1,863	$2,410	$2,911	$3,412	$3,662	$3,633	$3,646	$3,654	$32,096
Totals	**$2,295**	**$3,038**	**$3,936**	**$4,758**	**$5,508**	**$5,913**	**$5,872**	**$5,892**	**$5,906**	**$51,996**

Source: Calash

[19] Assumes 37.5 percent revenue sharing with state governments.

Section 4 – Conclusions

The offshore oil and natural gas industry is a key component of the nation's energy mix, and a significant source of employment, economic activity, and government revenue nationally. However, large portions of the nations' federal waters are currently inaccessible to oil and gas operators, including the Atlantic OCS due to a lack of lease sales. Allowing oil and gas operators increased access to the Atlantic OCS and its resources would be expected to benefit oil and natural gas production, employment, the national economy, and government revenue.

- If leasing in the Atlantic OCS is allowed, 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 $260 billion.
- Atlantic OCS oil and gas activities could create nearly 200 thousand jobs within ten years of the beginning of leasing activity, the vast majority of which are likely to be in the Atlantic coast states.
- By the end of the forecast period, total national employment due to Atlantic OCS oil and gas exploration and production could reach nearly 265 thousand jobs, with over 205 thousand of these jobs in the Atlantic coast states.
- Development of the Atlantic OCS' offshore oil and natural gas resources could lead to production of approximately 1.5 million barrels of oil equivalent per day within 20 years after initial lease sales.
- Atlantic OCS oil and natural gas activity could contribute nearly $16 billion per year to the national economy within ten years of leasing activity, with Atlantic coast states receiving contributions of nearly $10 billion per year.
- At the end of the forecast period total national contributions to the economy could reach over $21.7 billion per year, with Atlantic Coast states receiving combined contributions of over $16.8 billion per year.
- Combined state and federal revenues from bonuses, rents and royalties are projected to reach $1.8 billion per year within ten years of leasing activity, with these revenues projected to grow to over $5.9 billion per year by the end of the 20 year forecast period.
- If a legislated state / federal revenue sharing agreement is enacted, Atlantic coast states could see significant gains to their state budgets. With a 37.5 percent

sharing agreement, state revenues are projected to be nearly $600 million per year within ten years of leasing activity, with revenues expected to grow to over $2.2 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, allowing oil and natural gas development in the Atlantic OCS shows significant potential to grow the American economy across numerous industries and areas. Allowing access to these areas 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 resource areas. This spending would likely lead to large increases in employment and economic activity both in the Atlantic Coast states and nationally. Additionally, this activity is projected to lead to a large increase in domestic energy production and the royalties plus other revenues received are expected to lead to healthy increases in revenues to state and federal governments.

Section 5 – State Results Appendix

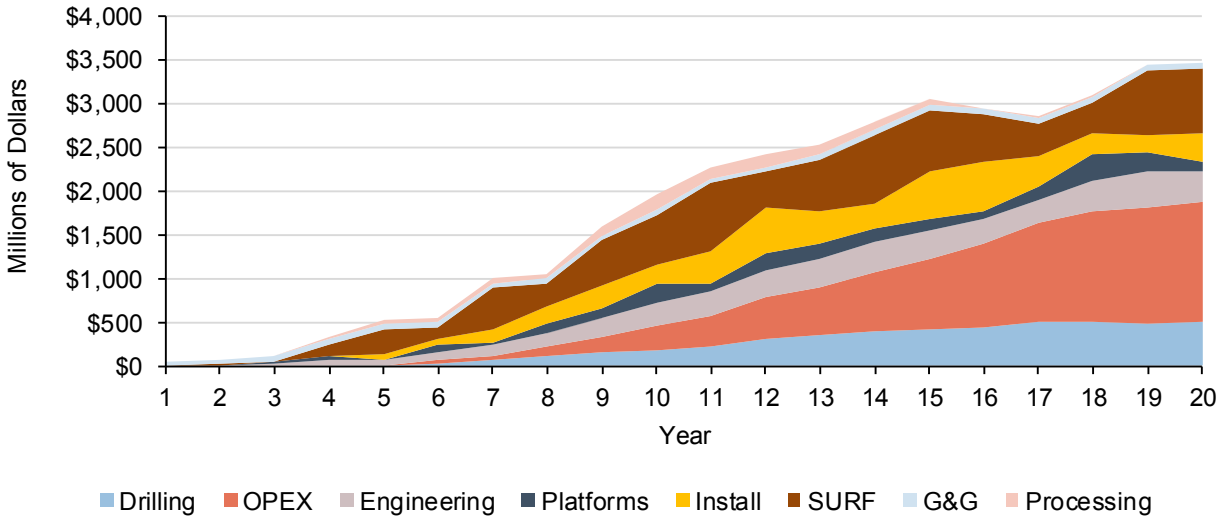
6.1 States Results

While the opening of the Atlantic OCS for oil and natural gas production activities is expected to benefit both the states that border the Atlantic 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 Atlantic coast region. If exploration and production of oil and natural gas in U.S. Atlantic waters 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. Within the region, the distribution of the benefits is also expected to be diverse with certain states expected to accrue greater benefits due to factors such as the state's coastline's proximity to modeled reserves, the relative density of oil and natural gas reserves in the waters off a state's coast, and the size and makeup of the states' economy.

6.2 North Carolina

North Carolina is projected to see the highest levels of spending, employment and contributions to its economy if Atlantic OCS oil and natural gas resources are developed. Annual spending on Atlantic OCS oil and gas in North Carolina could reach nearly $3.5 billion by the end of the forecast period. Under this projection, North Carolina benefits from the large amount of project activity expected off the state due to the large reserves in nearby waters and a relatively long coastline. Spending driven primarily through North Carolina's location is projected to include high operational expenditures (projected to be over $1.3 billion at the end of the forecast period), SURF spending (nearly $740 million at the end of the forecast period), and drilling spending ($515 million). North Carolina's extensive port infrastructure at Morehead City and Wilmington is expected to be heavily involved in offshore oil and natural gas activities. (Figure 18)

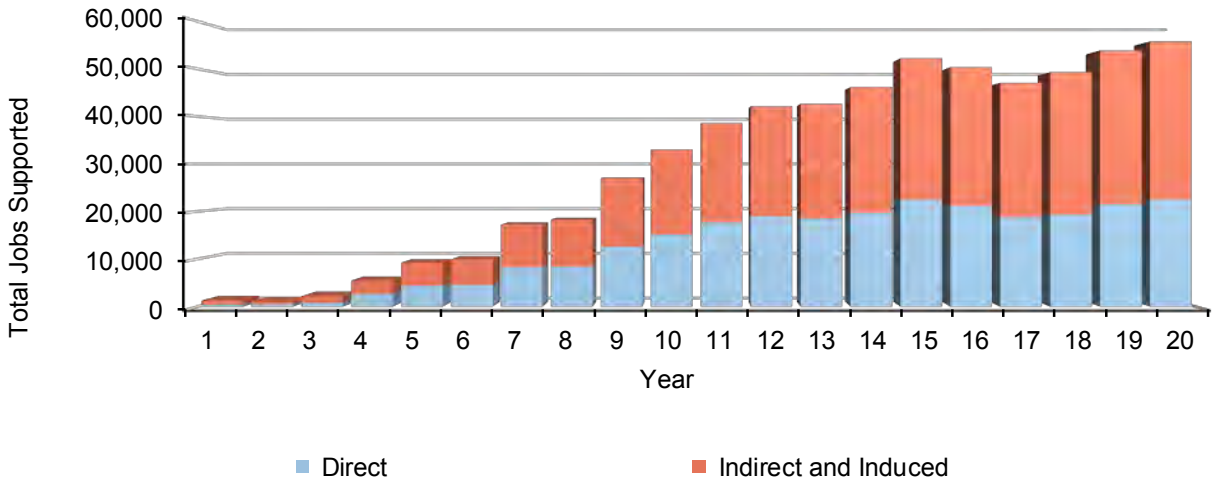
Figure 18: North Carolina Projected Spending by Sector ($Millions per Year)



Source: Calash

Employment due to offshore oil and gas development in North Carolina is expected to reach nearly 56 thousand jobs at the end of the forecast period, with direct employment of nearly 23 thousand jobs and indirect and induced employment of over 33 thousand jobs. North Carolina's workforce is well placed to take advantage of the high-tech nature of oil and gas manufacturing and other activities, drawing on the same workforce that has led companies such as Caterpillar, John Deere and Volvo to place significant manufacturing operations in the state, especially in and around the Raleigh, Durham, and Chapel Hill triangle. (Figure 19)

Figure 19: North Carolina Projected Employment Direct vs. Indirect and Induced

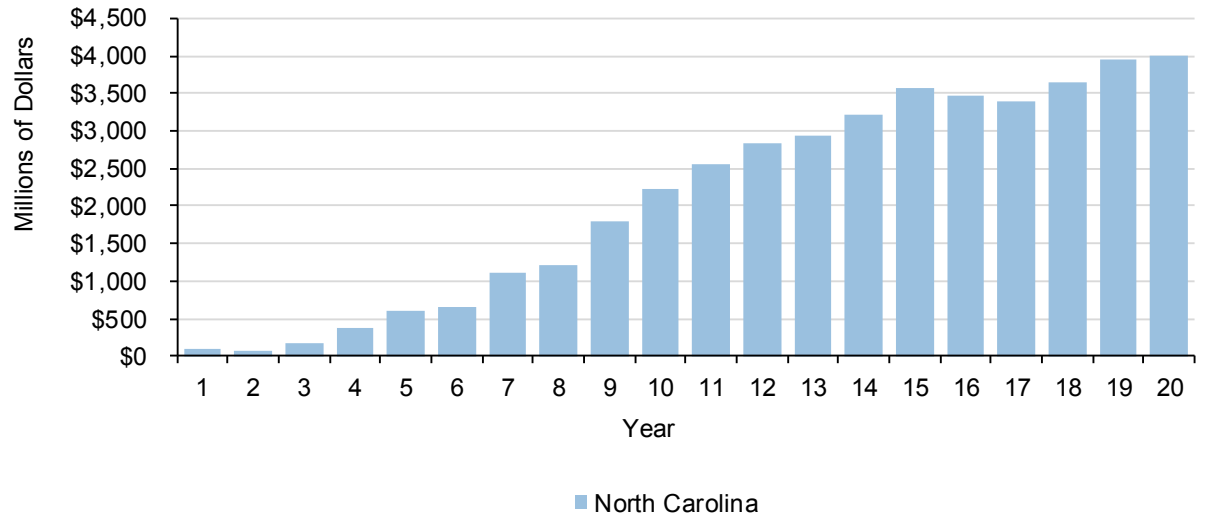


Source: Calash

Employment gains are not expected to be limited to those industries directly tied to oil and natural gas production, with a broad spectrum of businesses expected to benefit. Some of the industries expected to benefit most (in number of projected jobs at the end of the forecast period) include retail with 3,750, administrative and waste management services with around 3,300 jobs, healthcare and social assistance with nearly 3,400 jobs, and food services with over 2,600 jobs.

Atlantic OCS oil and natural gas exploration and production is also expected to cause a significant increase in North Carolina's gross state product with contributions to the state economy expected to reach over $4 billion by the end of the forecast period. (Figure 20)

Figure 20: North Carolina Projected Contributions to the State Economy ($Millions per Year)



Source: Calash

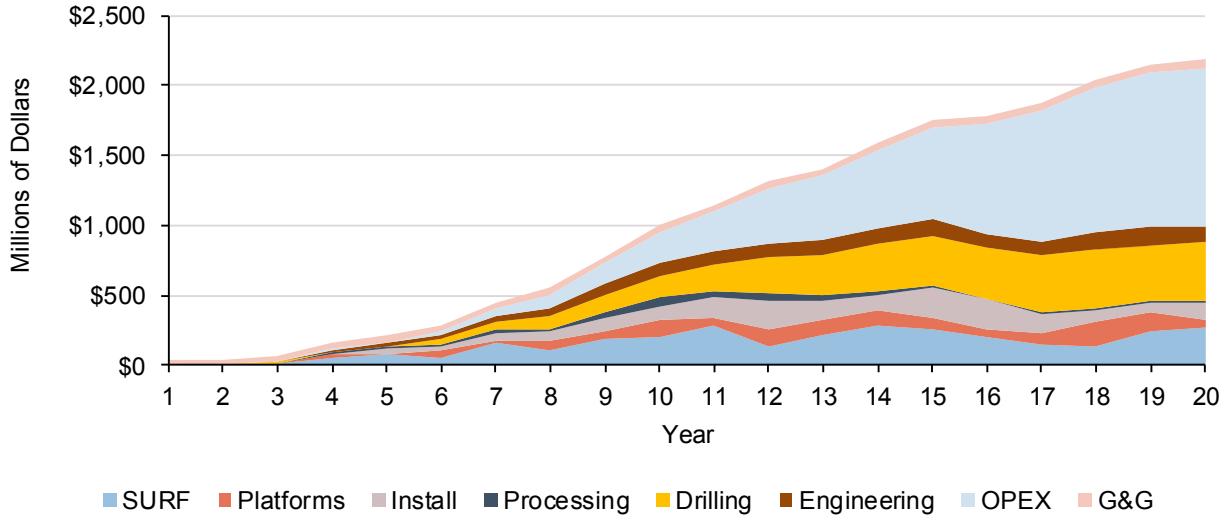
Additionally, if state / federal revenue sharing legislation is enacted North Carolina could see significant incremental government revenues. Under 37.5 percent state revenue sharing, North Carolina state government revenues from bonuses, rents and royalties are projected to reach nearly $500 million per year by the end of the forecast period and the cumulative effects on the state budget during the forecast period are projected to be nearly $2.8 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.3 South Carolina

South Carolina is projected to see the second highest levels of spending, employment and gross domestic product if Atlantic offshore oil and natural gas resources are developed. Annual spending due to Atlantic coast offshore oil and natural gas activity in South Carolina is expected to reach nearly $2.2 billion at the end of the study period. South Carolina is expected to benefit from the high levels of oil and gas development activity expected off the state due to the large

reserves in the waters in nearby waters. Spending driven primarily through these reserves and the expected projects off South Carolina's coast is projected to include high levels of operational expenditures (projected to be just over $1.1 billion at the end of the forecast period), drilling spending (over $425 million at the end of the forecast period), and installation spending ($260 million). (Figure 21)

Figure 21: South Carolina Projected Spending by Sector ($Millions per Year)

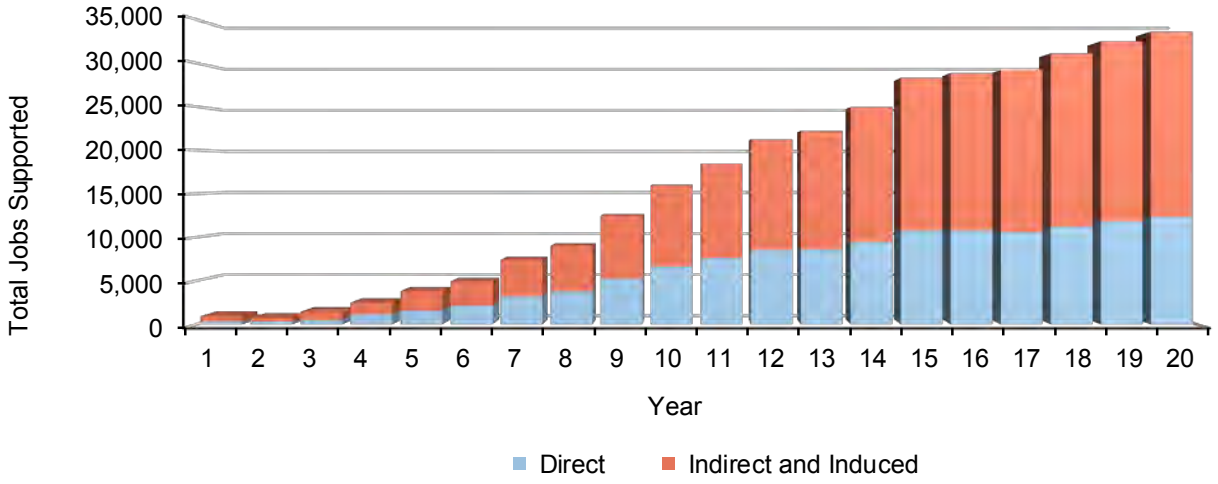


Source: Calash

South Carolina's economy, coupled with the high level of development activity off its coast, is projected to lead to high levels of oilfield equipment manufacturing activity, with spending projected to reach over $260 million dollars a year at the end of the forecast period. South Carolina possesses a strong high-tech manufacturing sector, extensive automobile manufacturing related activity, and manufacturing for suppliers to the energy industry.

Employment due to offshore oil and gas development activities on the Atlantic Coast in South Carolina is expected to reach nearly 34 thousand jobs at the end of the forecast period, with direct employment due to development activity at over 12 thousand jobs and an indirect and induced employment increase of over 21 thousand jobs. (Figure 22)

Figure 22: South Carolina Projected Employment Direct vs. Indirect and Induced

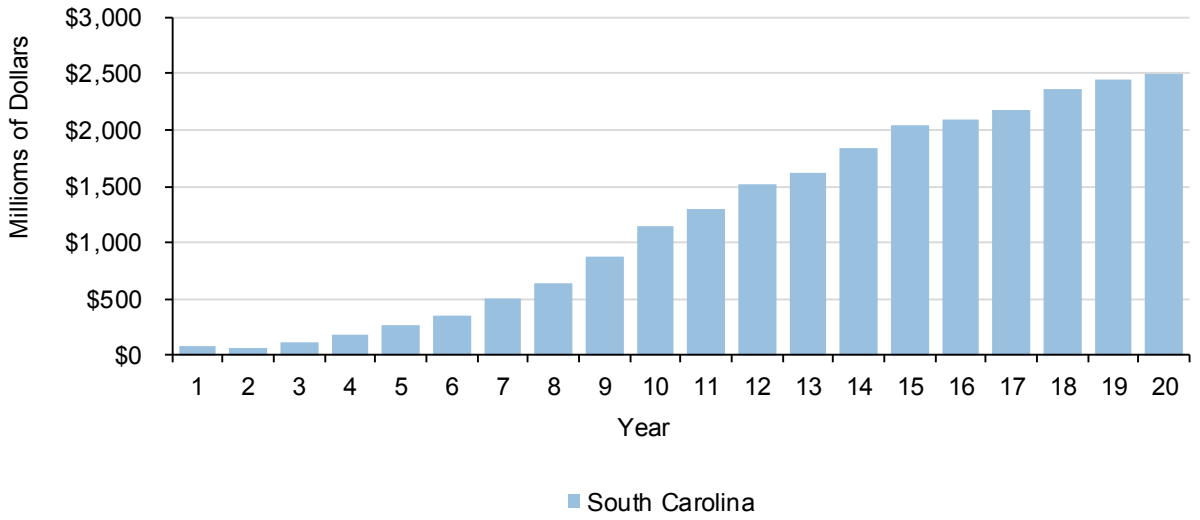


Source: Calash

A diverse spectrum of industries in South Carolina is expected to benefit from Atlantic OCS oil and natural gas production. Industries projected to see the greatest gains (in number of projected jobs at the end of the forecast period) include retail with nearly 2,200 jobs, administrative and waste management services (over 1,950 jobs), and healthcare and social assistance with over 1,930 jobs, and real estate and food services with around 1,520 jobs.

Offshore oil and natural gas production in the Atlantic OCS is also projected to contribute significantly to South Carolina's gross domestic product; contributions to the state economy are expected to reach nearly $2.5 billion by the end of the forecast period. (Figure 23)

Figure 23: South Carolina Projected Contributions to the State Economy ($Millions per Year)



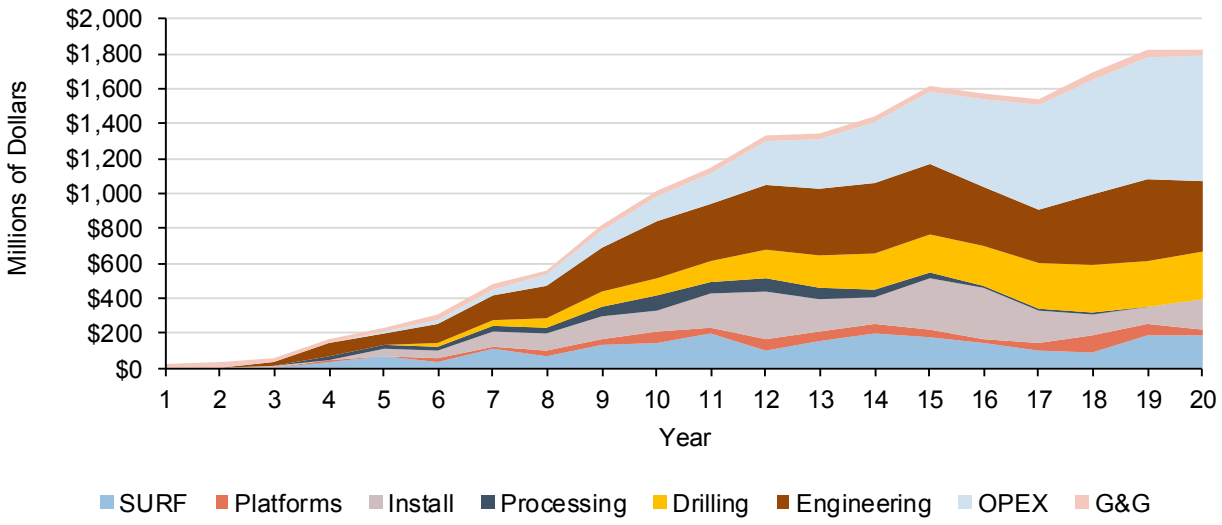
Source: Calash

Potential state government revenue from offshore development would be dependent on any future legislated revenue sharing agreements. At a 37.5 percent share of bonuses, rents, and royalties, South Carolina's state government revenues are projected to reach nearly $445 million by the end of the forecast period, with the cumulative effects on the state budget across the forecast period projected to be over $3.8 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.4 Virginia

Virginia is projected to receive the third highest levels of spending, employment and gross domestic product due to Atlantic offshore oil and natural gas development. Annual spending from Atlantic OCS oil and natural gas activity in Virginia is projected to reach over $1.8 billion at the end of the study period. Virginia is expected to see high spending levels due to significant oil and gas development activity in the resource rich waters near the state. Spending driven by projects, and mainly due to the state's large estimated resource base, is projected to include operational expenditures (projected at nearly $720 million at the end of the forecast period), and drilling (nearly $270 million). (Figure 24)

Figure 24: Virginia Projected Spending by Sector ($Millions per Year)



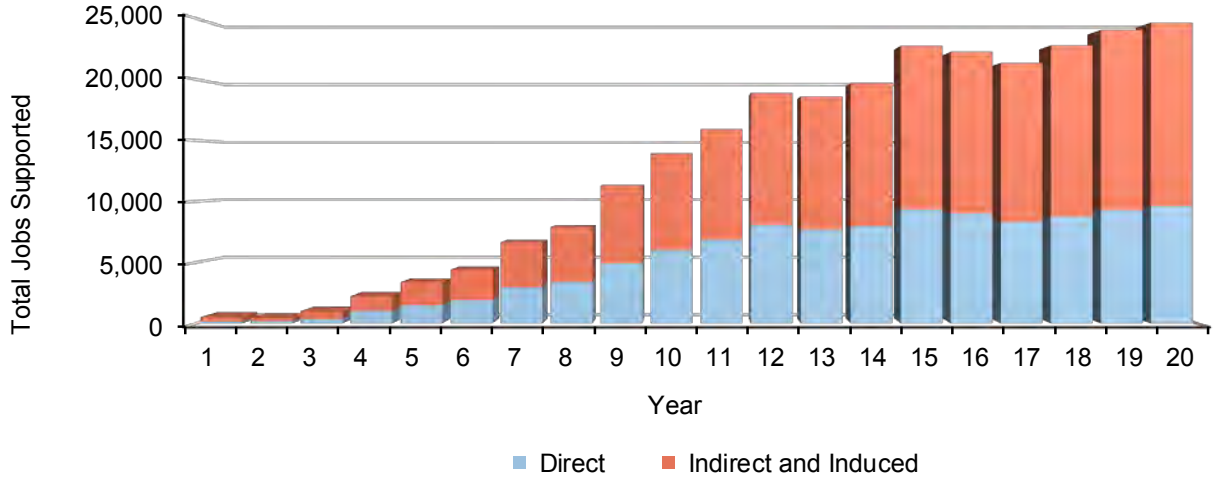
Source: Calash

The makeup of Virginia's economy, as well as the large amount of development activity projected off its coast is expected to lead to high levels of engineering activity in the state, with spending projected to reach over $400 million dollars a year at the end of the forecast period. Virginia possesses a strong marine background, hosting a major offshore industry supplier in Chesapeake and one of the largest dry docks in the US at Newport News. Other existing industry suppliers include suppliers of compression equipment for use on offshore platforms, cargo

handling equipment for offshore vessels and platforms, and high-tech building materials used in the construction of floating production units.

Virginia employment due to Atlantic OCS oil and gas exploration and development activities is projected to reach nearly 23 thousand jobs at the end of the forecast period, with a direct employment level due to development activity of nearly ten thousand jobs and an indirect and induced employment level of over 15 thousand jobs. (Figure 25)

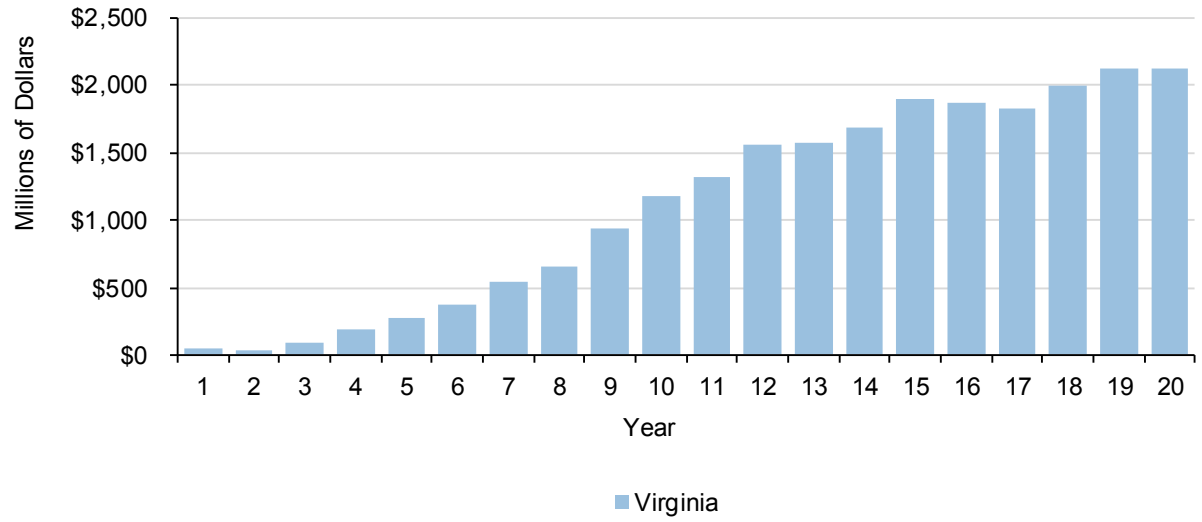
Figure 25: Virginia Projected Employment Direct vs. Indirect and Induced



Source: Calash

Atlantic OCS oil and natural gas production is also expected to contribute significant sums to the Virginia state economy. At the end of the forecast period, the contributions of this activity are projected to reach over $2.1 billion. (Figure 26)

Figure 26: Virginia Projected Contributions to the State Economy ($Millions per Year)



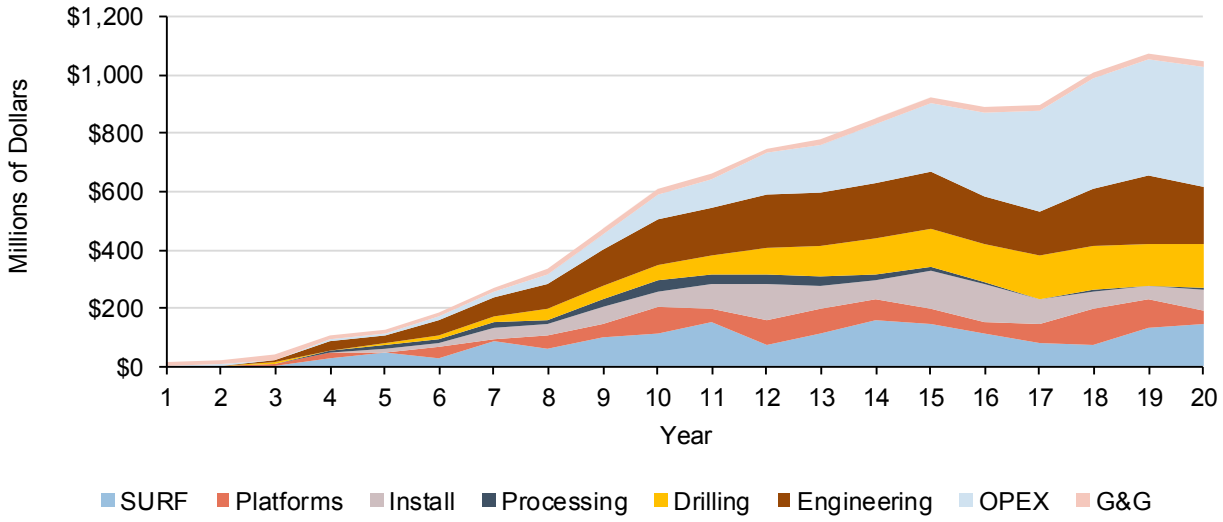
Source: Calash

Potential state government revenue from offshore development would be dependent on any future legislated revenue sharing agreements. Under a similar state percentage of revenue sharing as in the Gulf of Mexico at 37.5 percent, Virginia state revenues are projected to reach over $235 million per year by the end of the study period, with the cumulative effects on the state budget across the forecast period projected to reach over $2.1 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.5 Massachusetts

Massachusetts is expected to receive the fourth highest levels of spending, employment, and gross state product due to offshore oil and natural gas activity in the Atlantic OCS. Atlantic OCS oil and natural gas activity is expected to lead to spending of over $1 billion in at the end of the forecast period in Massachusetts. Spending driven by projects due to the state's large estimated resource base is projected to include operational expenditures (projected to be just over $400 million by the end of the forecast period), engineering spending ($195 million at the end of the forecast period), and drilling spending ($145 million at the end of the forecast period). (Figure 27)

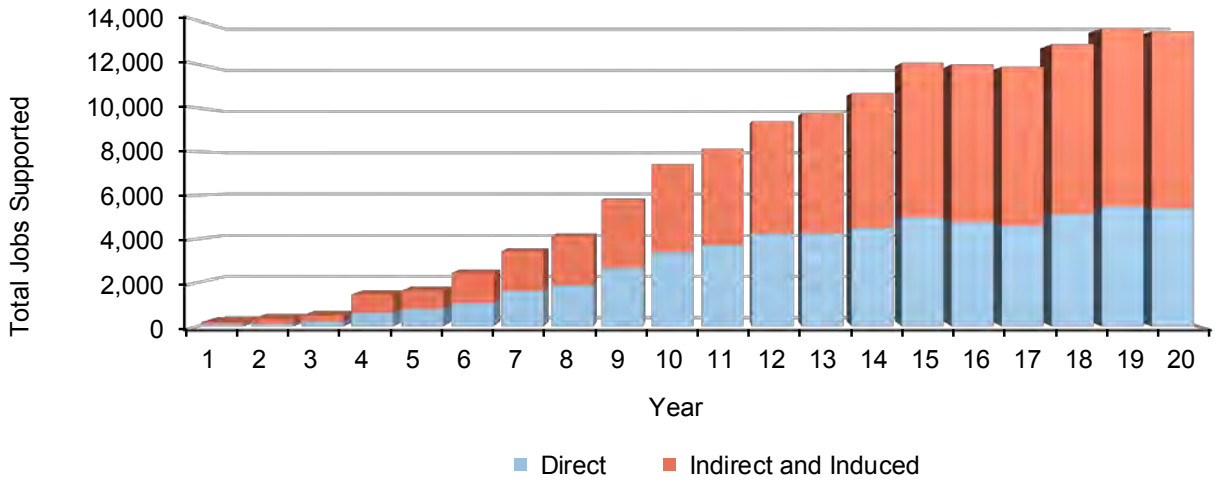
Figure 27: Massachusetts Projected Spending by Sector ($Millions per Year)



Source: Calash

Massachusetts is expected to see significant employment due to Atlantic OCS oil and gas exploration and development activities, with total employment reaching nearly 14 thousand jobs at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is projected to be over five thousand jobs at the end of the forecast period, with an indirect and induced employment level of nearly eight thousand jobs expected in the same year. (Figure 28)

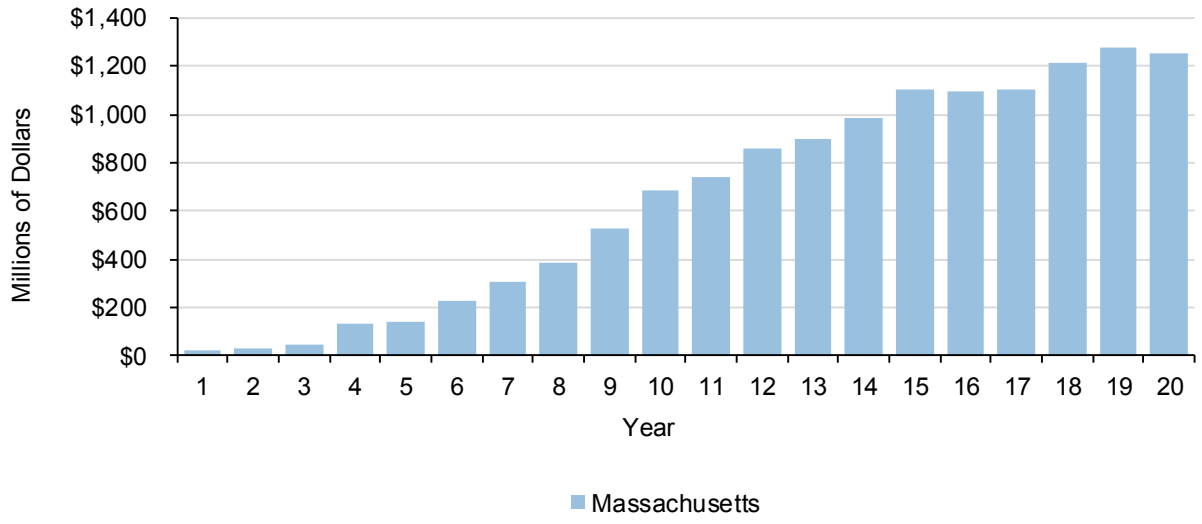
Figure 28: Massachusetts Projected Employment Direct vs. Indirect and Induced



Source: Calash

Offshore oil and natural gas exploration and production in the Atlantic OCS is also expected to provide large contributions to the Massachusetts state economy. At the end of the forecast period, contributions to the state economy from Atlantic offshore oil and natural gas exploration and production are projected to reach nearly $1.3 billion per year. (Figure 29)

Figure 29: Massachusetts Projected Contributions to the State Economy ($Millions per Year)



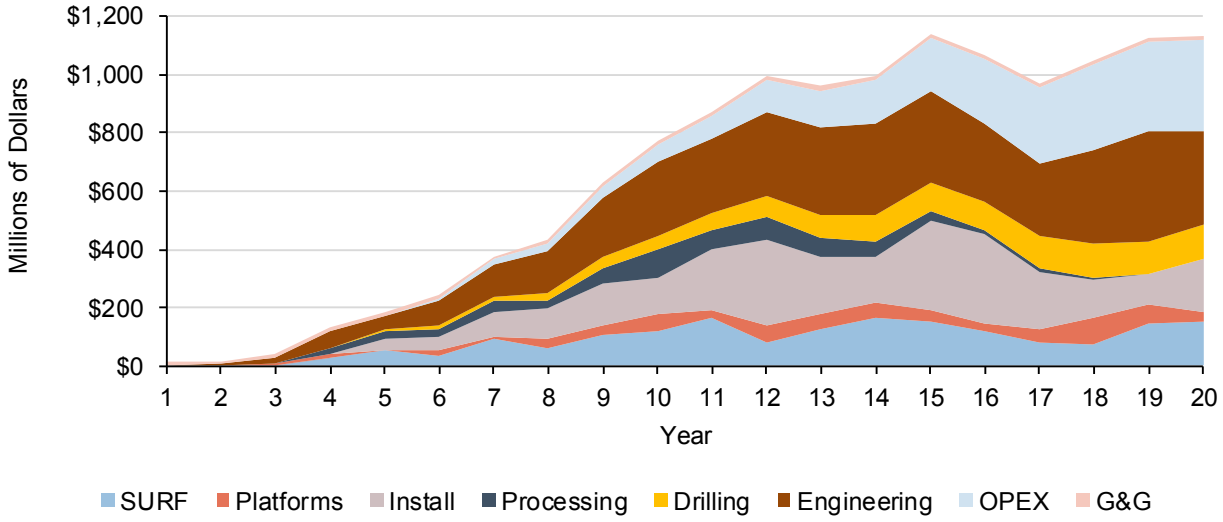
Source: Calash

Under a 37.5 percent revenue sharing agreement, state government revenues for Massachusetts from bonuses, rents, and royalties are projected to reach nearly $163 million in revenue by the end of the forecast period, with the cumulative effects on the state budget across the forecast period projected to be nearly $1.4 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.6 New York

New York is expected to receive the fifth highest levels of spending, employment and gross domestic product due to offshore oil and natural gas activity in the Atlantic OCS. Spending in the state is projected to reach just over $1.1 billion at the end of the forecast period, with spending especially focused on services to the offshore oil and gas industry. (Figure 30)

Figure 30: New York Projected Spending by Sector ($Millions per Year)

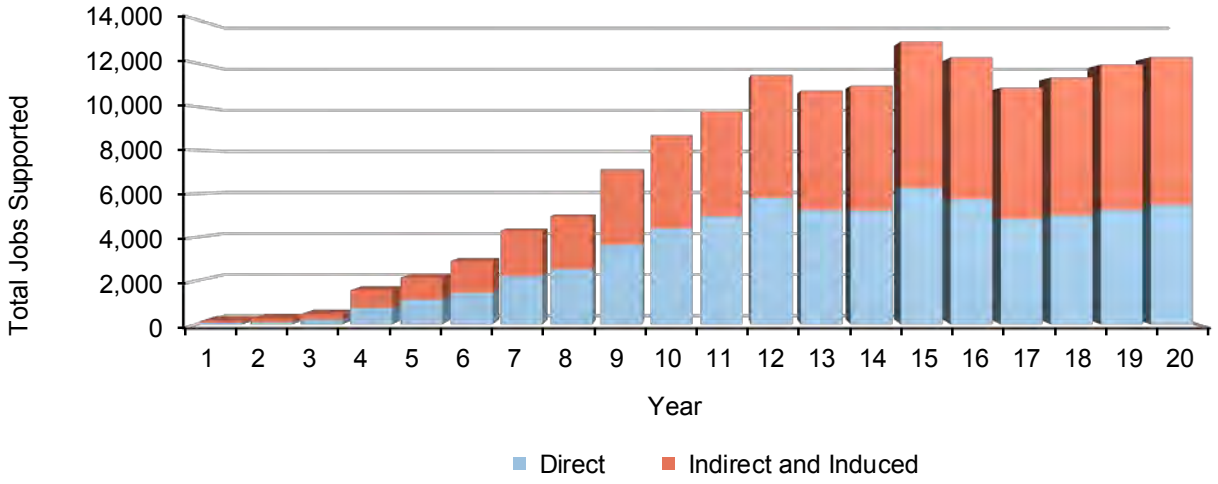


Source: Calash

Spending in New York is expected to be driven by engineering and operational expenditures, with these two categories projected to account for around $315 million of spending at the end of the forecast period.

Employment in New York due to Atlantic coast offshore oil and gas production is projected to reach over 12 thousand jobs by the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach over five thousand jobs by the end of the forecast period, with an indirect and induced employment level of nearly seven thousand jobs expected in the same year. (Figure 31)

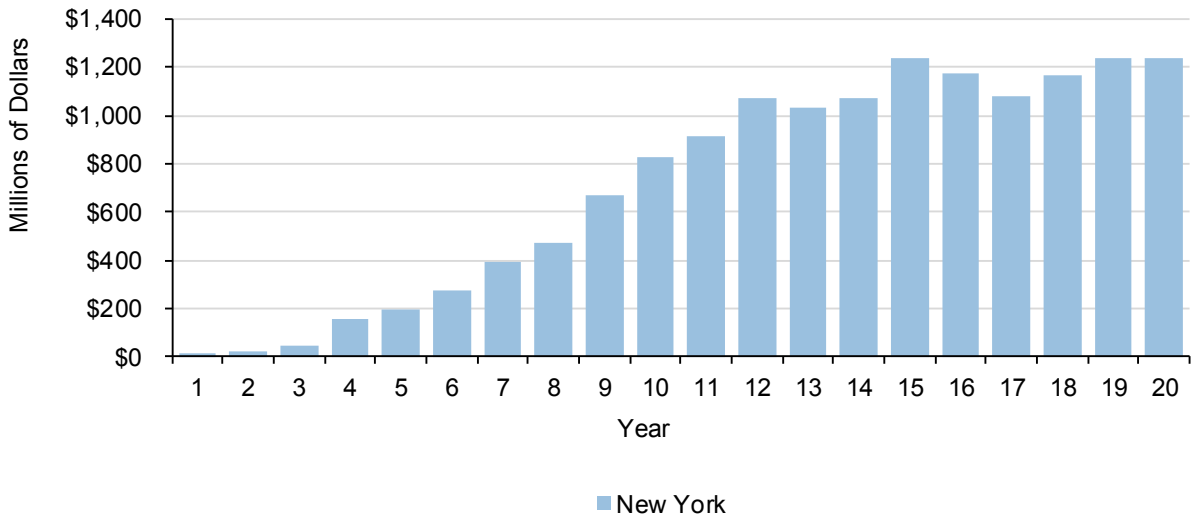
Figure 31: New York Projected Employment Direct vs. Indirect and Induced



Source: Calash

At the end of the forecast period, contributions to the state economy from Atlantic offshore oil and natural gas exploration and production in New York are projected to reach over $1.2 billion per year. (Figure 32)

Figure 32: New York Projected Contributions to the State Economy ($Millions per Year)



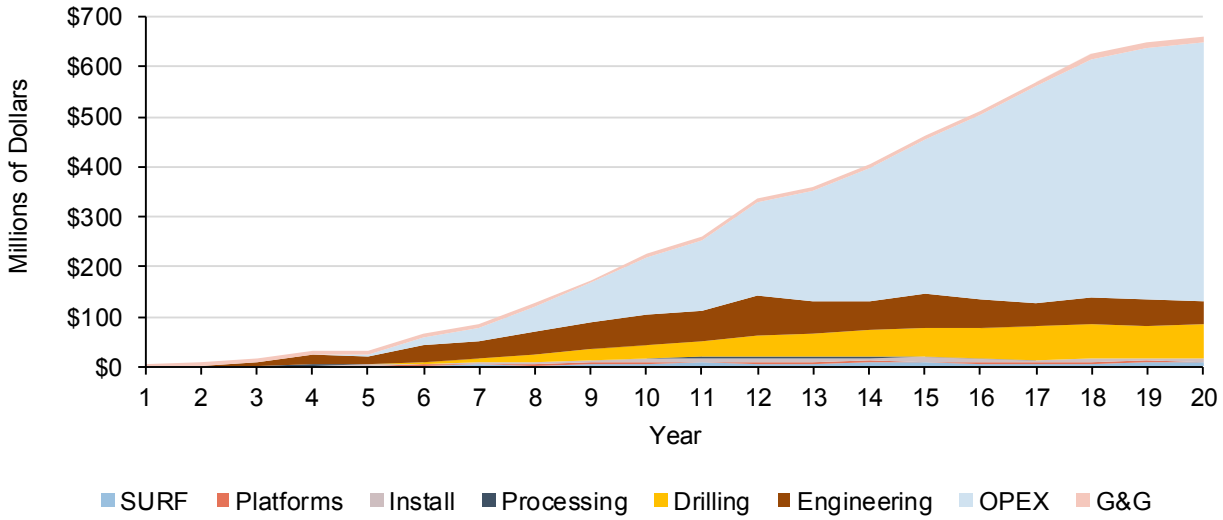
Source: Calash

Governmental revenues collected under a 37.5 percent state/federal revenue sharing agreement would be expected to create $100 million in new revenues for the state of New York at the end of the forecast period, with cumulative revenues across the forecast period projected to be over $875 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.7 Maine

Spending in Maine due to the offshore oil and natural gas industry is expected to reach around $660 million by the end of the forecast period, with spending primarily focused on operational expenditures. Maine is expected to be the main provider of ongoing services including marine services to producing oil and gas products in the North Atlantic planning area. (Figure 33)

Figure 33: Maine Projected Spending by Sector ($Millions per Year)

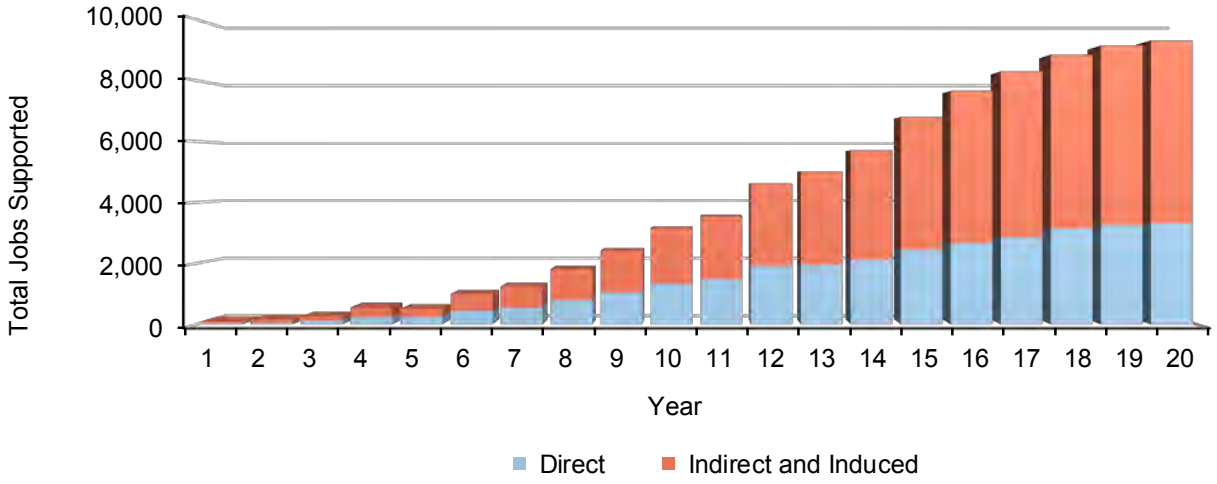


Source: Calash

Spending on operation expenditures is projected to reach nearly $520 million by the end of the forecast period. Maine has a large marine industry, including five seaports. The state is also host to many ship building and repair facilities.

Employment in Maine due to Atlantic coast offshore oil and gas production is projected to reach over 9 thousand jobs by the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach three thousand jobs by the end of the forecast period, with an indirect and induced employment level of over six thousand jobs expected in the same year. (Figure 34)

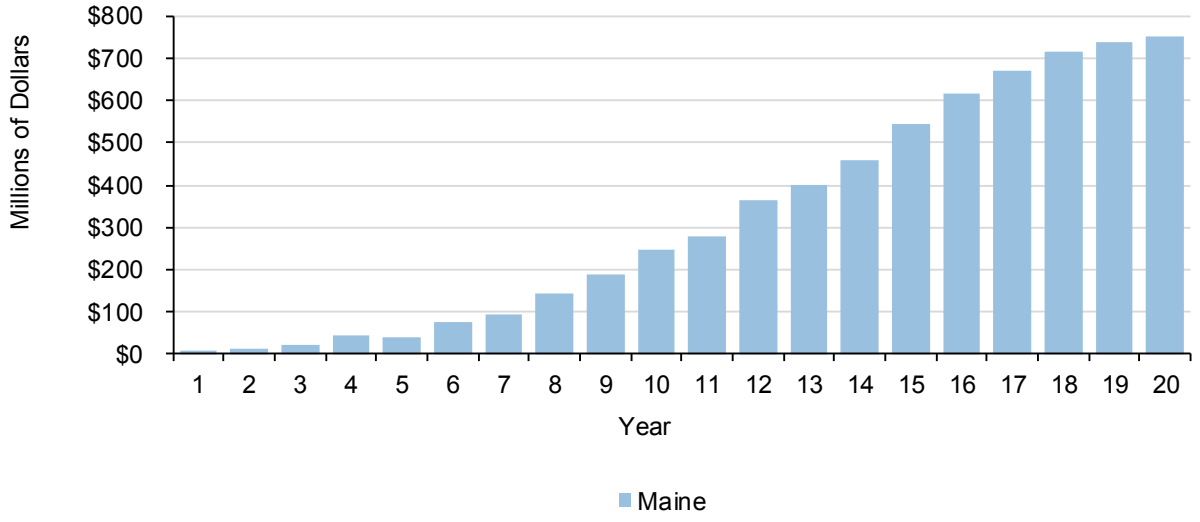
Figure 34: Maine Projected Employment Direct vs. Indirect and Induced



Source: Calash

Total contributions to the state economy due to spending on the Atlantic OCS oil and natural gas industry in Maine are projected to reach over $750 million by the end of the forecast period. (Figure 35)

Figure 35: Maine Projected Contributions to the State Economy ($Millions per Year)



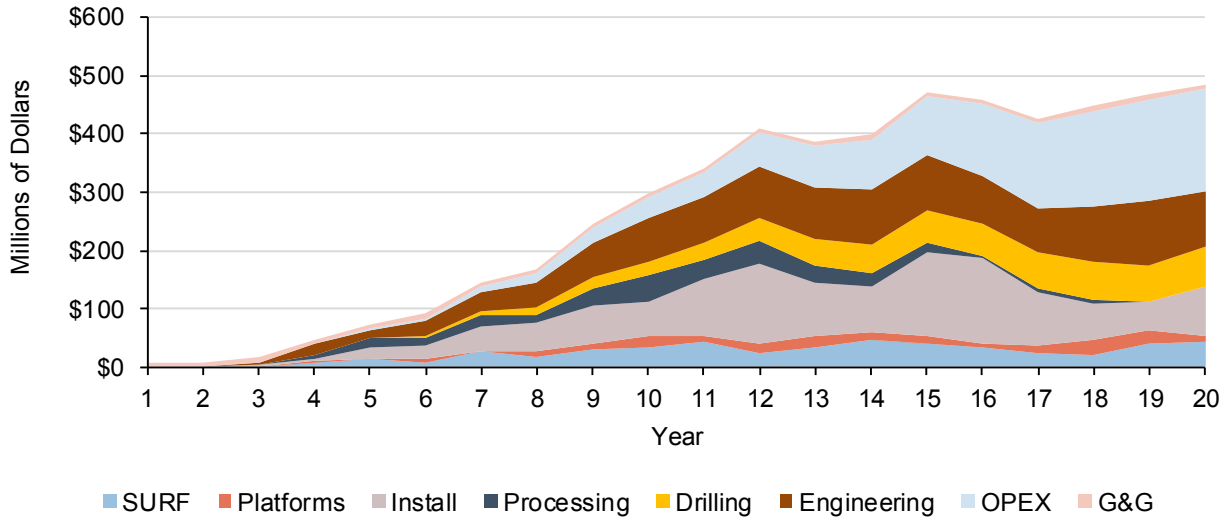
Source: Calash

Under the current development plan and an assumed revenue sharing plan of 37.5 percent, oil and natural gas activities are projected to contribute over $100 million to the state budget by the end of the forecast period, with cumulative contributions across the forecast period projected at nearly $825 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.8 Florida

Florida is projected to see annual spending of over $485 million due to the Atlantic offshore oil and natural gas industry by the end of the forecast period, with spending primarily focused on operational expenditures and engineering. (Figure 36)

Figure 36: Florida Projected Spending by Sector ($Millions per Year)

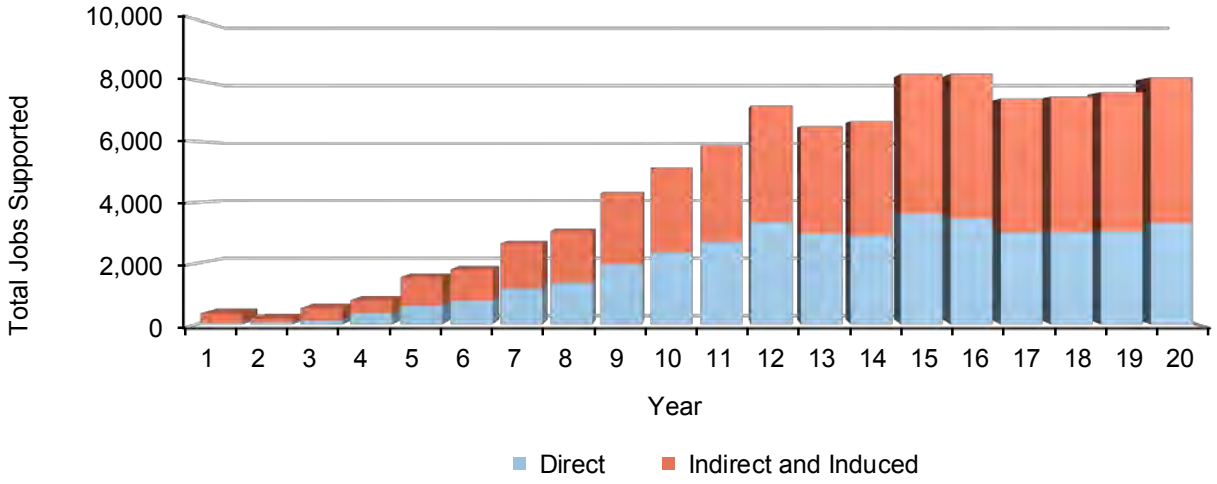


Source: Calash

Spending on operation expenditures is projected to reach $175 million by the end of the forecast period, with engineering spending at nearly $95 million. Florida is already host to major oil and natural gas industry suppliers, including one of the largest operators of large offshore tugs used for the transportation of drilling rigs and production units and one of the largest subsea umbilical plants in the world.

Employment in Florida due to spending supporting Atlantic offshore oil and natural gas development is projected to reach over eight thousand jobs by the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach nearly 3,500 jobs in at the end of the forecast period, with indirect and induced employment of over 4,500 jobs expected in the same year. (Figure 37)

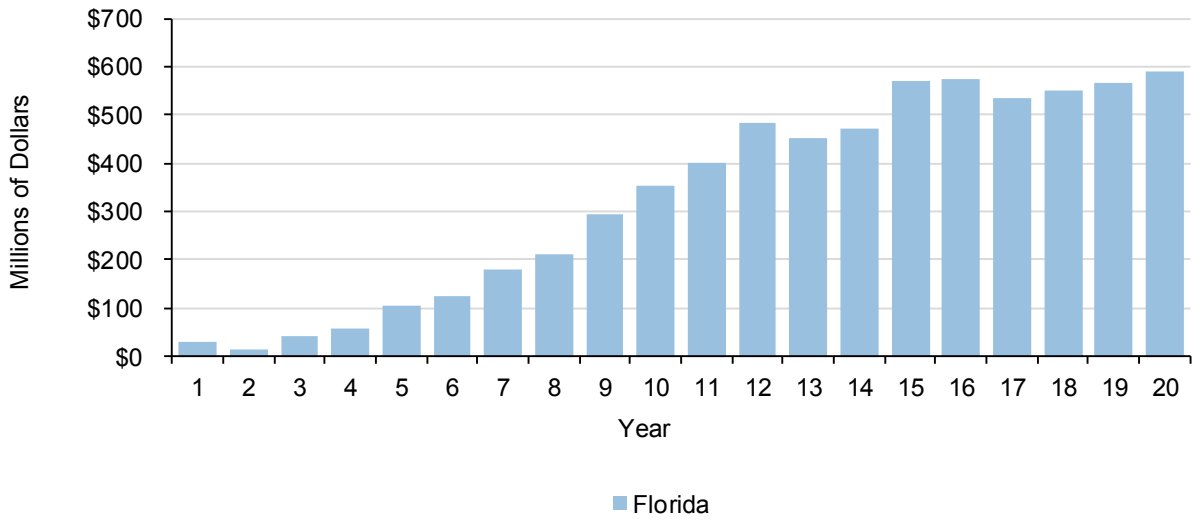
Figure 37: Florida Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Florida's state economy due to spending by the Atlantic OCS oil and natural gas industry are projected to be around $590 million at the end of the forecast period. (Figure 38)

Figure 38: Florida Projected Contributions to the State Economy ($Millions per Year)



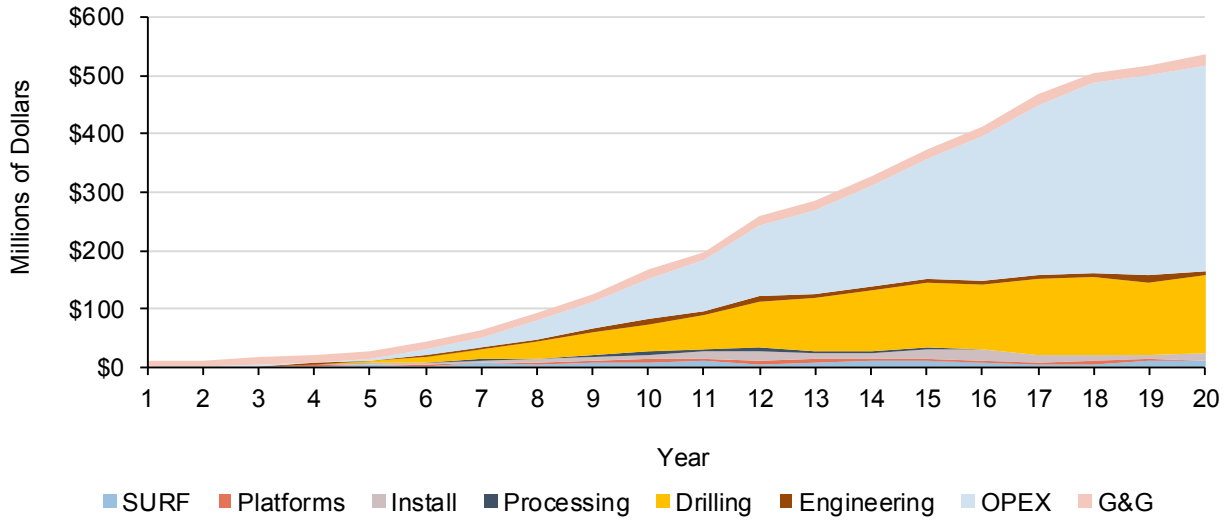
Source: Calash

With an assumed 37.5 percent revenue sharing agreement in place, Atlantic OCS oil and natural gas activities are projected to contribute nearly $90 million to Florida's budget at the end of the forecast period, with cumulative contributions across the forecast period projected to be nearly $820 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.9 Rhode Island

Spending due to Atlantic OCS oil and natural gas production in Rhode Island is expected to reach over $535 million by the end of the forecast period, with spending levels expected to be highest in operational expenditures, and drilling. (Figure 39)

Figure 39: Rhode Island Projected Spending by Sector ($Millions per Year)

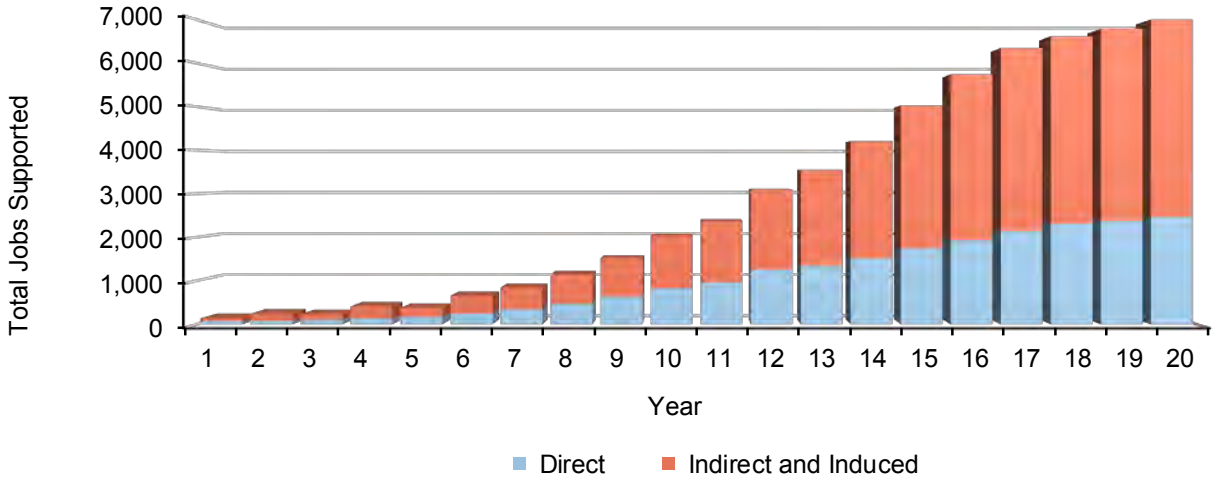


Source: Calash

Operational spending is projected to be over $350 million a year at the end of the forecast period, with spending on drilling at nearly $80 million. This operational spending should be supported by the state's marine industry. For example, Providence port is one of New England's premier deepwater ports and the center of the states' extensive maritime industry.

Employment in Rhode Island due to spending by the offshore oil and natural gas industry is projected to reach seven thousand jobs by the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach nearly two thousand five hundred jobs at the end of the forecast period, with an indirect and induced employment level of over four five hundred thousand jobs expected in the same year. (Figure 40)

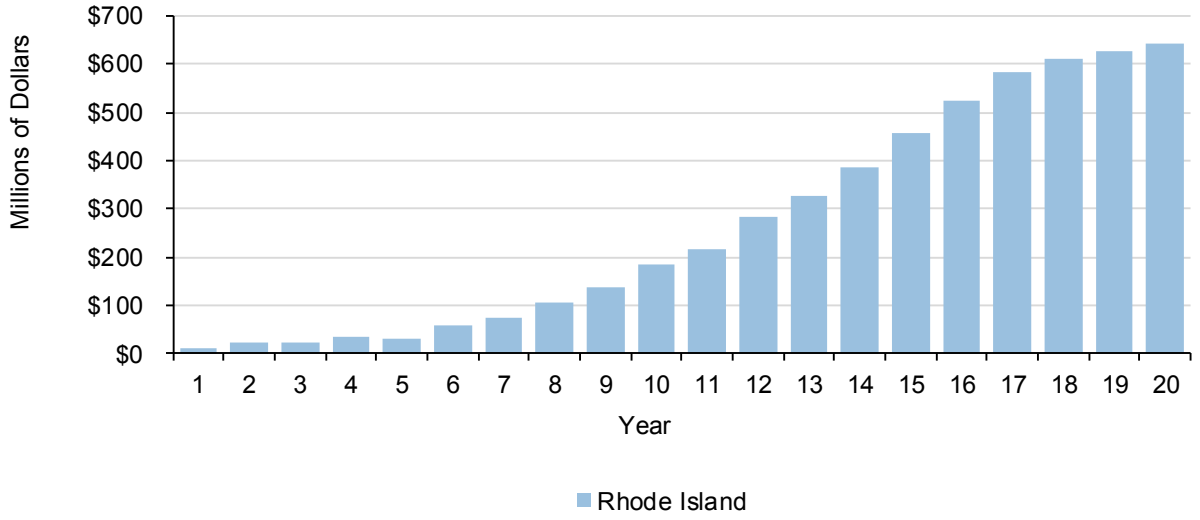
Figure 40: Rhode Island Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Rhode Island's state economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach nearly $645 million at the end of the forecast period. (Figure 41)

Figure 41: Rhode Island Projected Contributions to the State Economy ($Millions per Year)



Source: Calash

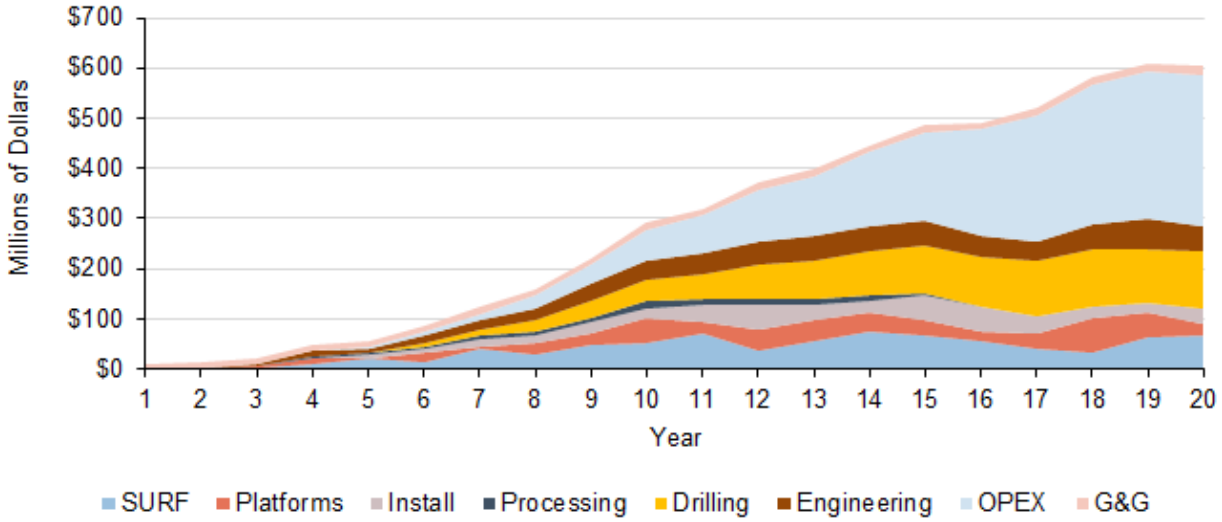
Rhode Island is expected to be one of the main benefactors of Atlantic OCS oil and natural gas activities on a per capita basis. If a 37.5 percent revenue sharing agreement were enacted, Rhode Island government revenues could contribute $140 million to the Rhode Island's budget at the end of the forecast period – contributing nearly $1.2 billion across the forecast period. If a

different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.10 Connecticut

Spending in Connecticut due to the Atlantic coast offshore oil and natural gas industry is projected to reach over $600 million by the end of the forecast period with spending focused on operational expenditures and drilling. (Figure 42)

Figure 42: Connecticut Projected Spending by Sector ($Millions per Year)

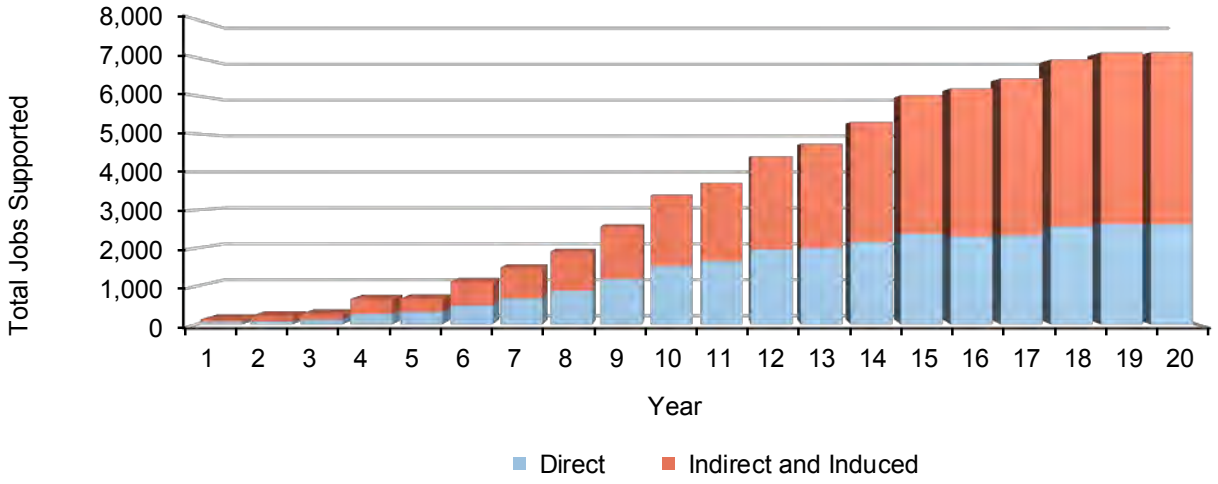


Source: Calash

Operational spending is expected to be over $300 million at the end of the forecast period, with drilling spending at nearly $115 million.

Employment in Connecticut due to spending by the offshore oil and natural gas industry is expected to reach over seven thousand jobs by the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach two thousand six hundred jobs at the end of the forecast period, with an indirect and induced employment level of over four thousand five hundred jobs expected in the same year. (Figure 43)

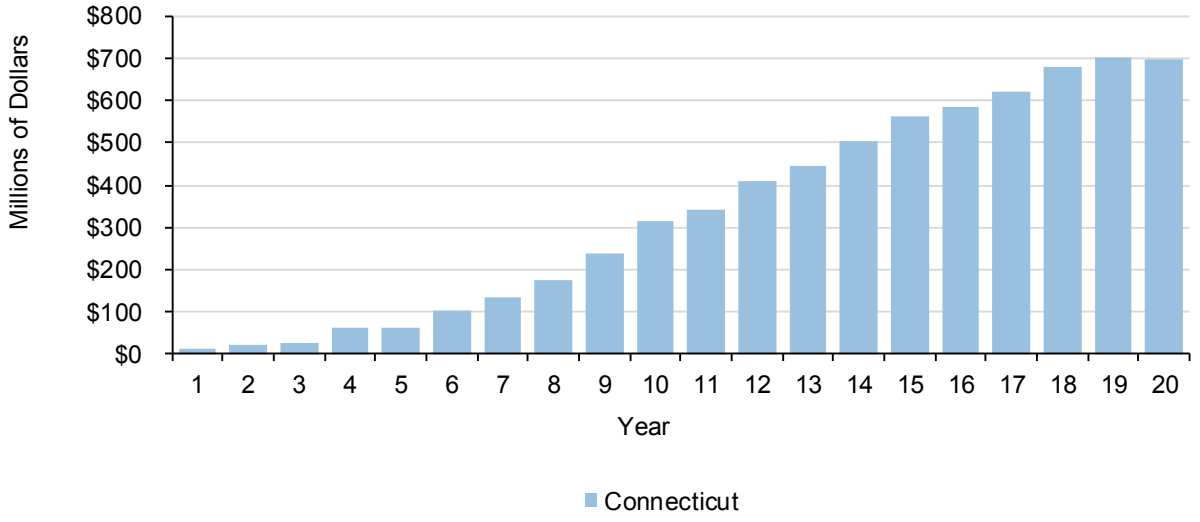
Figure 43: Connecticut Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Connecticut's state economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach $700 million at the end of the forecast period. (Figure 44)

Figure 44: Connecticut Projected Contributions to the State Economy ($Millions per Year)



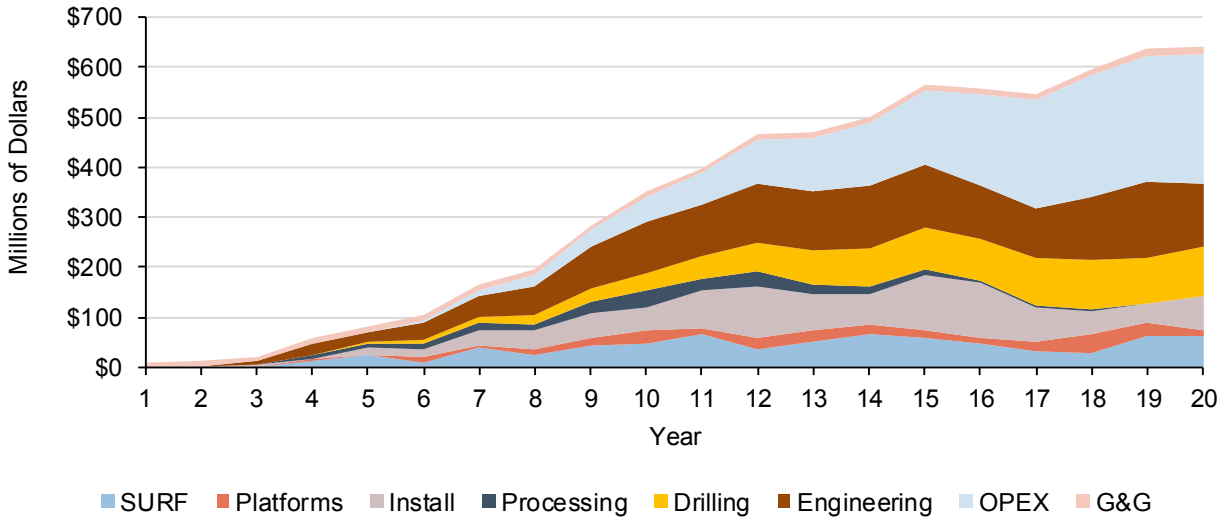
Source: Calash

If a 37.5 percent revenue sharing agreement were in place between federal and state governments for Atlantic OCS oil and natural gas development, it could contribute nearly $110 million to Connecticut's budget at the end of the forecast period, with cumulative contributions across the forecast period projected to be around $910 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.11 New Jersey

New Jersey is projected to see spending due to Atlantic OCS oil and natural gas exploration and production of $640 million at the end of the forecast period, with spending concentrated in operational expenditures and engineering. (Figure 45)

Figure 45: New Jersey Projected Spending by Sector ($Millions per Year)

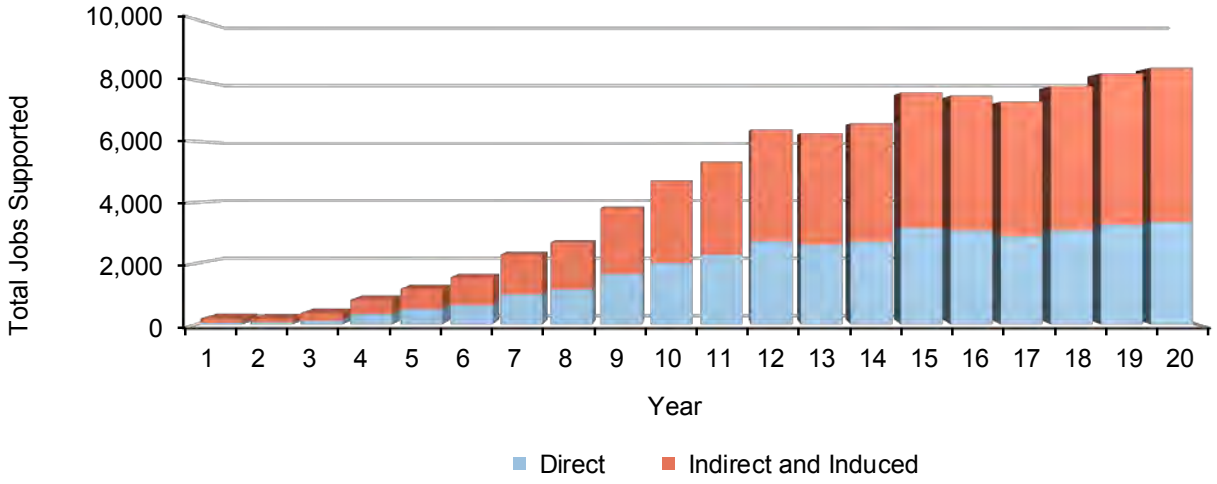


Source: Calash

Operational spending is expected to be over $260 million at the end of the forecast period and engineering spending of over $125 million. The state is home to major marine construction companies as well as major industrial companies that provide a wide array of equipment for the offshore oil and natural gas industry.

Employment in New Jersey due to spending by the offshore oil and natural gas industry is expected to be nearly eight thousand five hundred 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 three four hundred thousand jobs at the end of the forecast period, with an indirect and induced level employment of over five thousand jobs expected in the same year. (Figure 46)

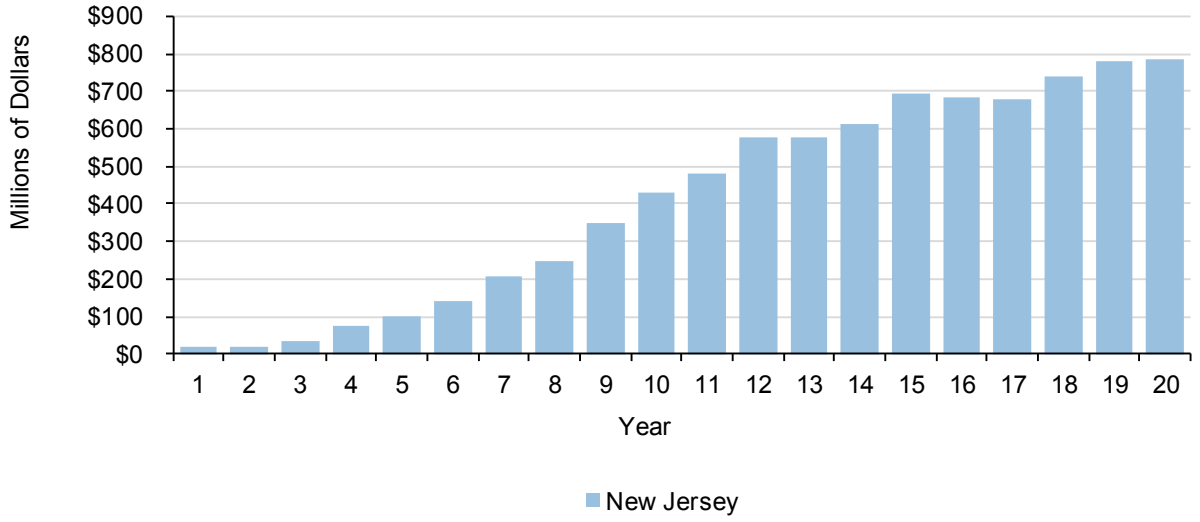
Figure 46: New Jersey Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to New Jersey's state economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach $785 million at the end of the forecast period. (Figure 47)

Figure 47: New Jersey Projected Contributions to the State Economy ($Millions per Year)



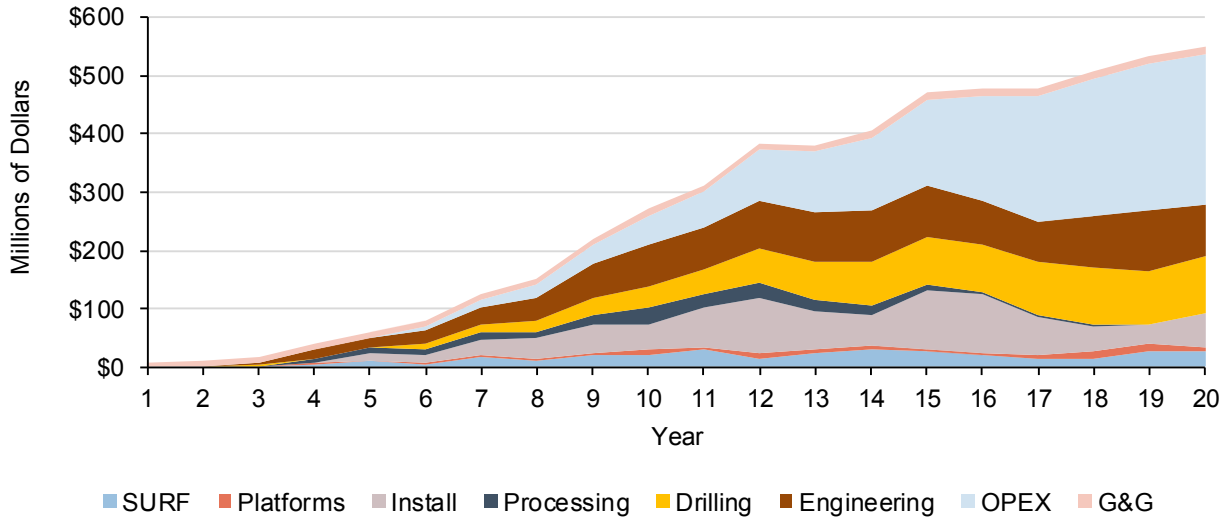
Source: Calash

Under the assumption of 37.5 percent revenue sharing in place between federal and state governments, Atlantic OCS oil and natural gas activities are projected to contribute $60 million to the New Jersey's budget at the end of the forecast period; cumulative contributions across the forecast period are projected at over $610 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.12 Maryland

Spending due to Atlantic OCS oil and natural gas exploration and production in Maryland is projected to reach nearly $550 million at the end of the forecast period, with spending concentrated toward operational expenditures and engineering. (Figure 48)

Figure 48: Maryland Projected Spending by Sector ($Millions per Year)

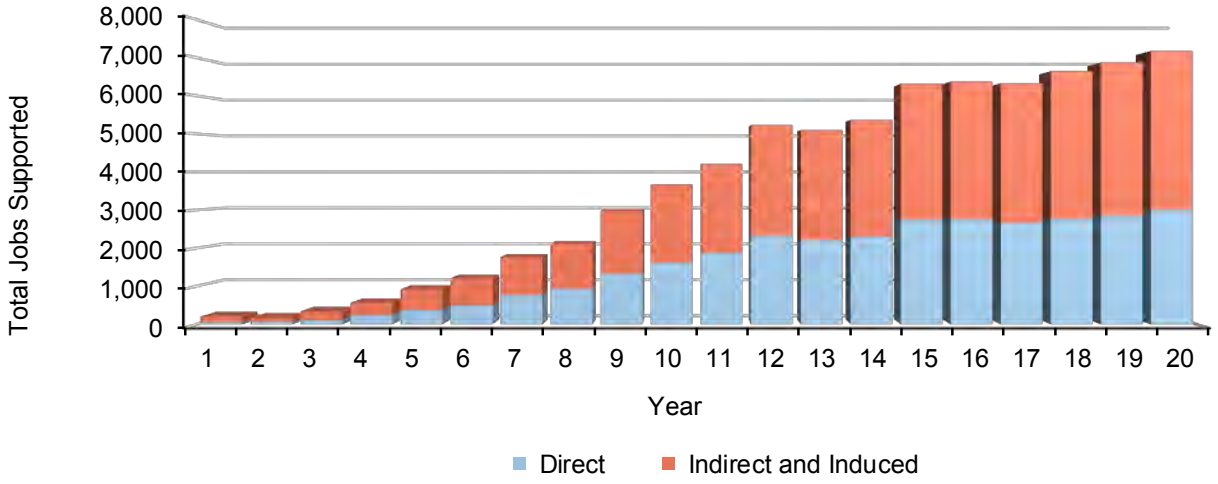


Source: Calash

Operational spending is expected to be nearly $260 million at the end of the forecast period, with drilling spending just over $95 million. Maryland is home to a provider of compression equipment for vessels, drilling rigs, and platforms and also is home to one of the largest ports on the east coast in Baltimore.

Employment in Maryland due to spending by the offshore oil and natural gas industry is expected to reach over seven thousand at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is expected to reach over three thousand jobs at the end of the forecast period, with an indirect and induced employment level of over four thousand jobs expected in the same year. (Figure 49)

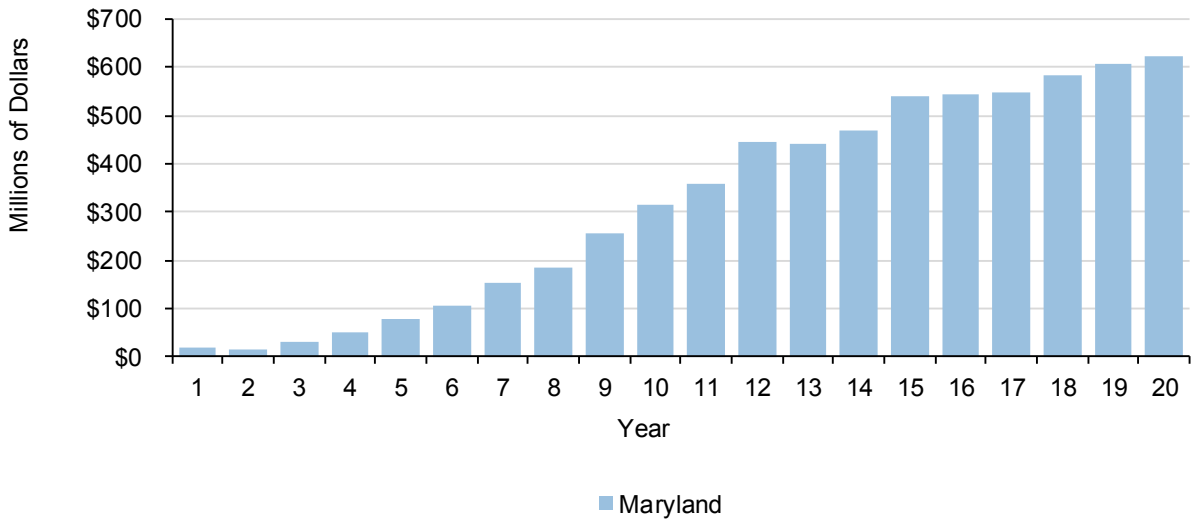
Figure 49: Maryland Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Maryland's state economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach nearly $625 million at the end of the forecast period. (Figure 50)

Figure 50: Maryland Projected Contributions to the State Economy ($Millions per Year)



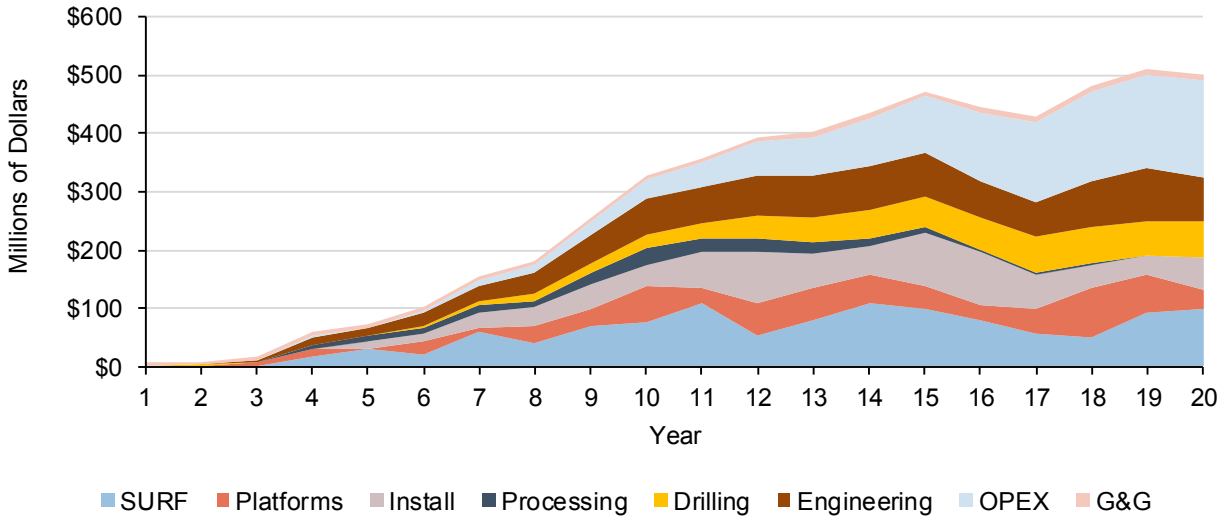
Source: Calash

Under the assumption of 37.5 percent revenue sharing in place between federal and state governments, Atlantic OCS oil and natural gas activities are projected to contribute $60 million to the Maryland budget at the end of the forecast period, cumulative contributions from across the forecast period are projected to be nearly $630 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.13 Pennsylvania

Pennsylvania is expected to see spending due to the Atlantic coast offshore oil and natural gas activity in excess of $500 million at the end of the forecast period, with spending focused on ongoing operational expenditures and the manufacturing and fabrication of offshore equipment. (Figure 51)

Figure 51: Pennsylvania Projected Spending by Sector ($Millions per Year)

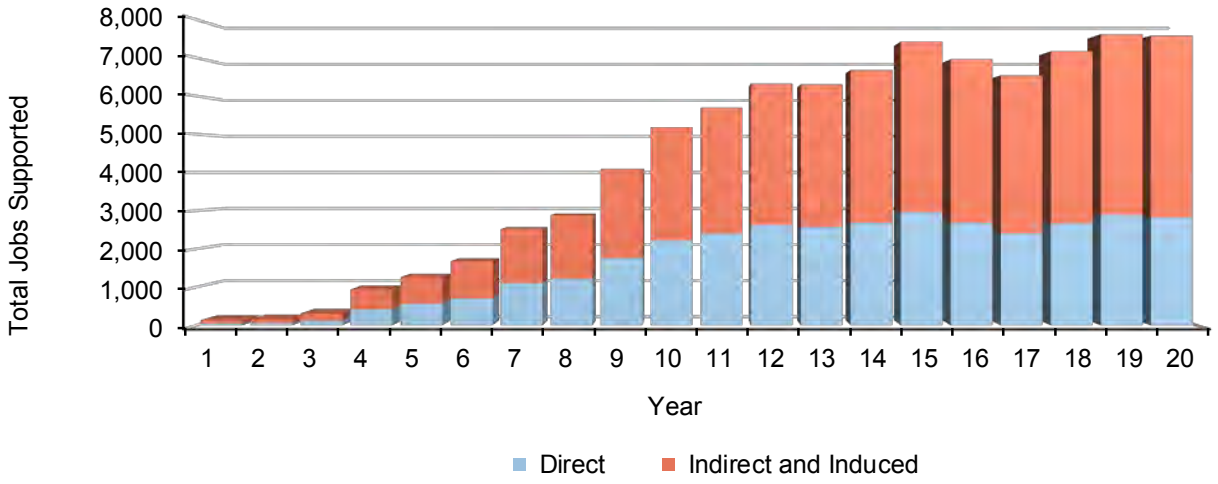


Source: Calash

Operational spending is expected to be nearly $170 million at the end of the forecast period, with combined spending on SURF equipment and platforms projected to be over $130 million. The state is home to suppliers to the industry such as shipyards and providers of specialized steel products to the industry.

Employment in Pennsylvania due to spending by the offshore oil and natural gas industry at the end of the forecast period is expected to reach nearly eight thousand jobs. Direct employment due to offshore oil and natural gas exploration and production is expected to reach nearly three thousand jobs at the end of the forecast period, with an indirect and induced employment level of nearly five thousand jobs expected in the same year. (Figure 52)

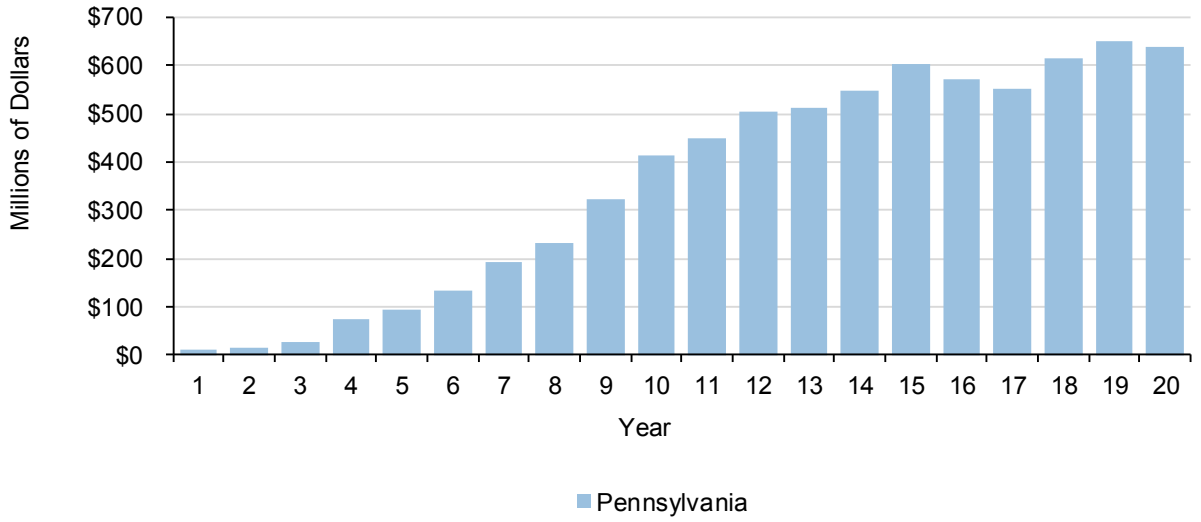
Figure 52: Pennsylvania Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Pennsylvania's state economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach $640 million at the end of the forecast period. (Figure 53)

Figure 53: Pennsylvania Projected Contributions to the State Economy ($Millions per Year)



Source: Calash

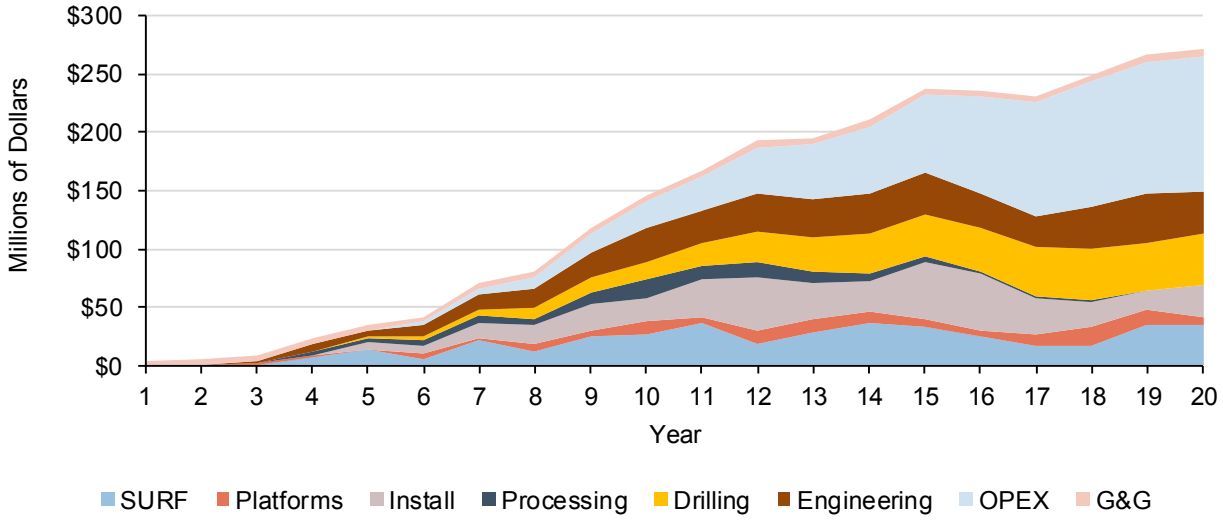
Even with a revenue sharing agreement of 37.5 percent is enacted, Pennsylvania's share of revenues would likely be diminished due to the state's short coast line and distance from reserves on the Atlantic OCS. However, revenues are still projected to reach $40 million at the end of the forecast period, with cumulative contributions across the forecast period projected at

around $365 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.14 Georgia

Spending in Georgia due to offshore oil and gas activity on the Atlantic coast is projected to reach over $270 million at the end of the forecast period, and is expected to be primarily focused on operational expenditures and drilling. (Figure 54)

Figure 54: Georgia Projected Spending by Sector ($Millions per Year)

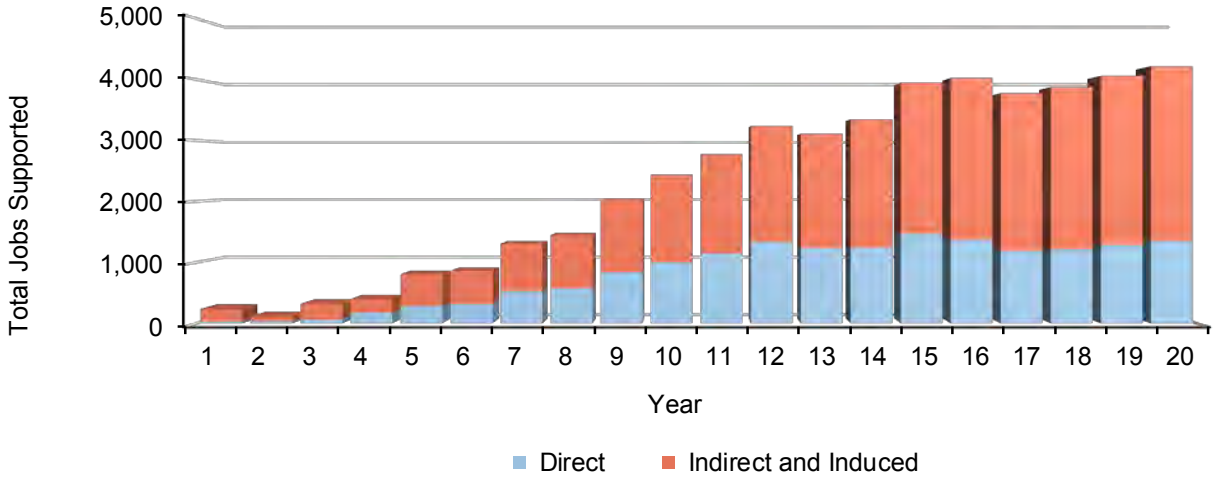


Source: Calash

Operational spending is expected to reach nearly $120 million at the end of the forecast period, with drilling spending projected to be nearly $45 million in the same year. Companies from Georgia currently supply equipment used in offshore oil and gas exploration and production, including pressure control equipment, industrial monitors, and industrial lighting.

Employment in Georgia due to spending by the offshore oil and natural gas industry is projected to reach over four thousand jobs at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is projected to be over one thousand three hundred jobs at the end of the forecast period, with an indirect and induced employment level of nearly two thousand nine hundred jobs in the same year. (Figure 55)

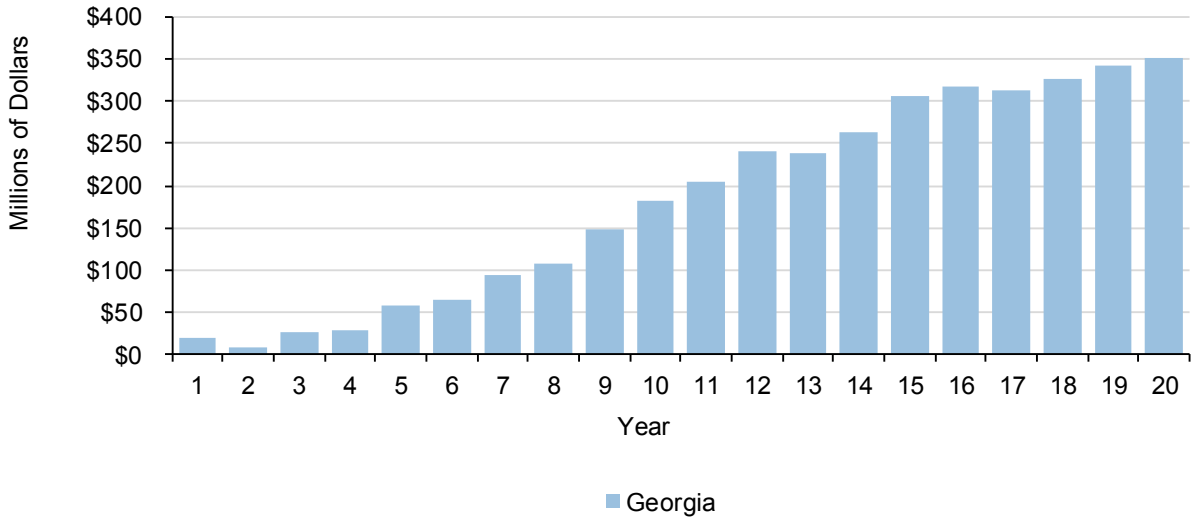
Figure 55: Georgia Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Georgia's economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach over $350 million at the end of the forecast period. (Figure 56)

Figure 56: Georgia Projected Contributions to the State Economy ($Millions per Year)



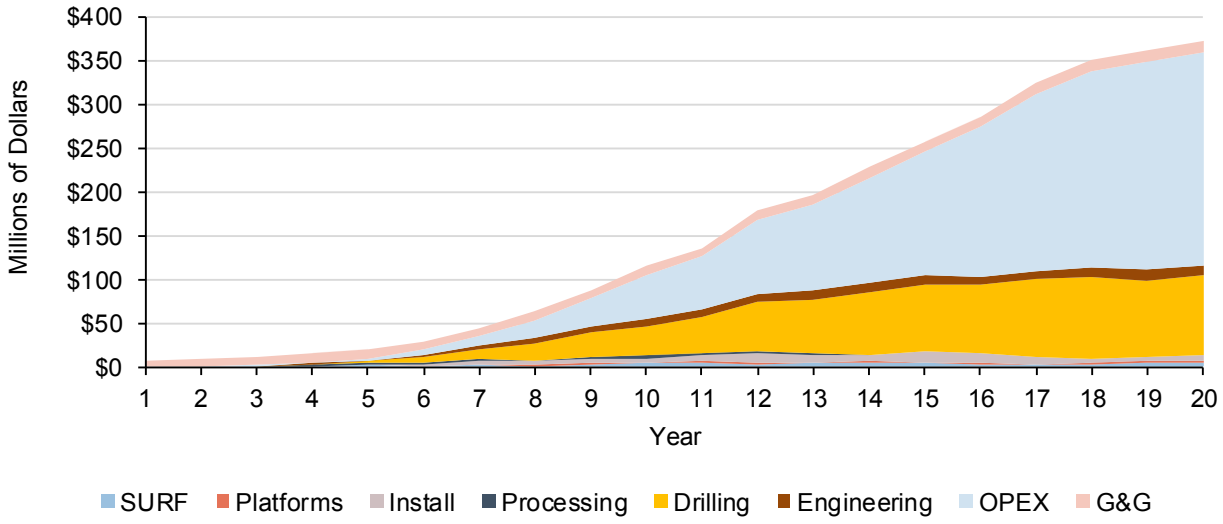
Source: Calash

Georgia's state revenue could see an increase of nearly $60 million at the end of the forecast period if a 37.5 percent revenue sharing agreement within the Atlantic OCS were enacted. Cumulative contributions across the forecast period are projected to be nearly $550 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.15 Delaware

Delaware is projected to see spending reach over $370 million at the end of the forecast period due to offshore oil and natural gas activity in the Atlantic OCS. Operational expenditures and drilling are expected to provide the majority of this spending. (Figure 57)

Figure 57: Delaware Projected Spending by Sector ($Millions per Year)

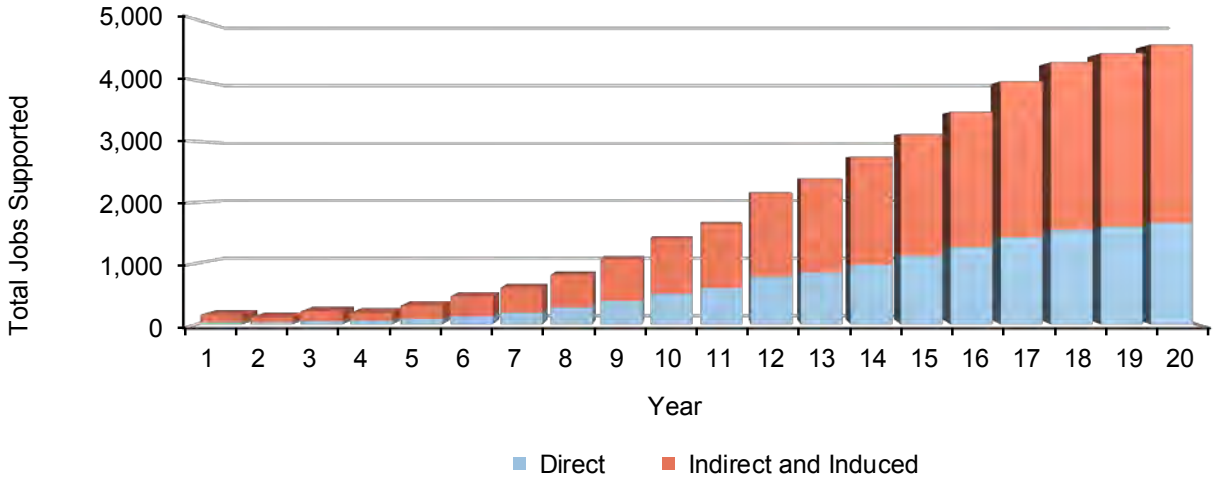


Source: Calash

Operational spending is expected to be nearly $245 million at the end of the forecast period, with drilling spending projected to be nearly $90 million in the same year. Companies in Delaware currently provide equipment and services to the offshore oil and natural gas industry, including fabrics that provide insulation for wiring used in offshore surveying and exploration and chemical precursors used in pipeline insulation.

Employment in Delaware due to spending by the offshore oil and natural gas industry is projected to reach over four thousand five hundred jobs at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is projected to be over one thousand six hundred jobs at the end of the forecast period, with an indirect and induced employment level of over two thousand nine hundred jobs in the same year. (Figure 58)

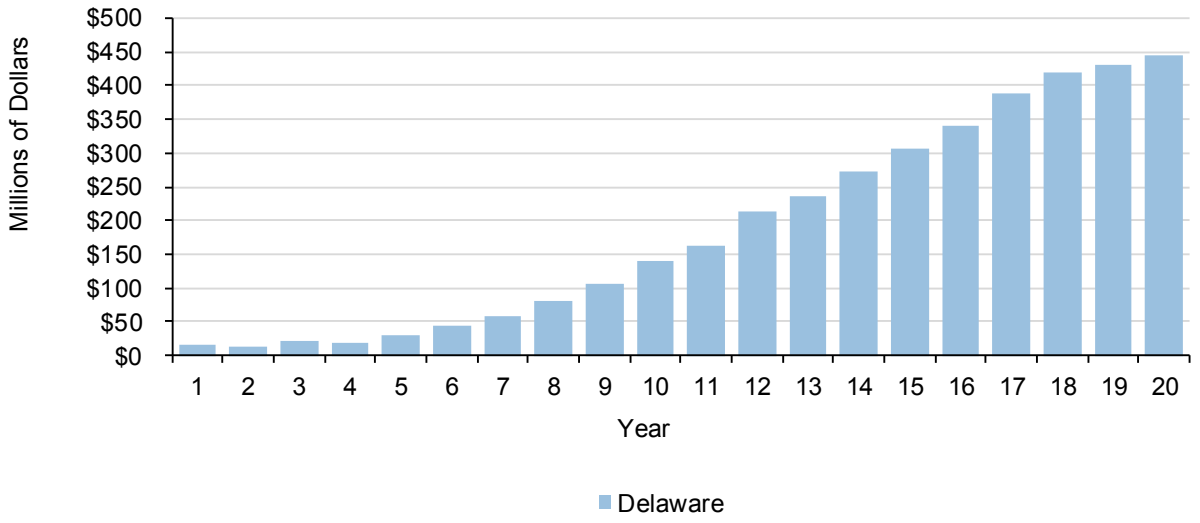
Figure 58: Delaware Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Delaware's economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach over $445 million at the end of the forecast period. (Figure 59)

Figure 59: Delaware Projected Contributions to the State Economy ($Millions per Year)



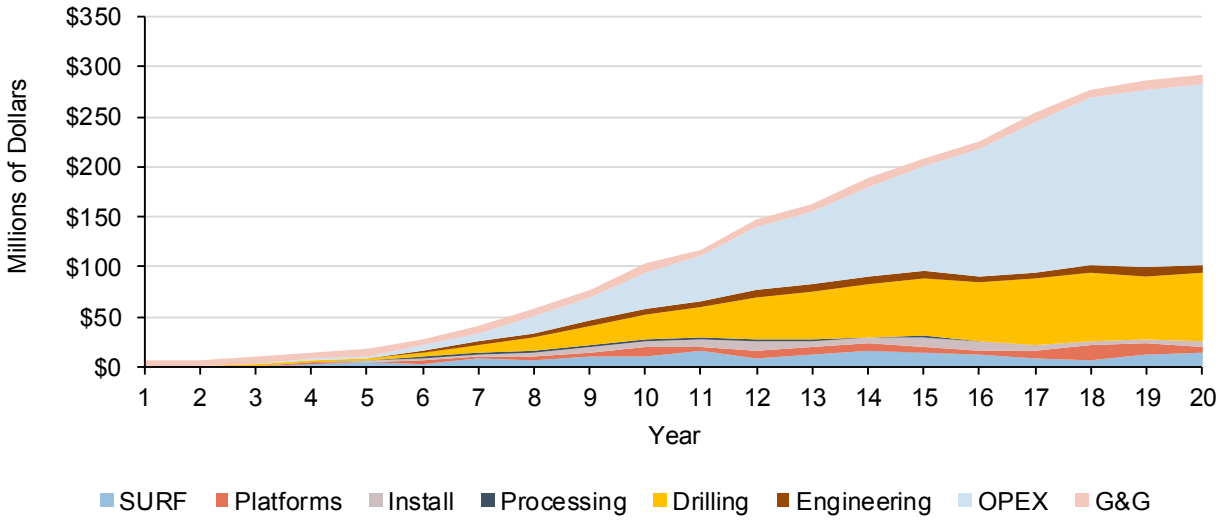
Source: Calash

With a 37.5 revenue sharing agreement in place between federal and state governments, Atlantic OCS oil and natural gas activities are projected to contribute nearly $60 million to the Delaware's state budget at the end of the forecast period; cumulative contributions from across the forecast period are projected to be around $390 million. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

6.17 New Hampshire

Spending by the oil and natural gas industry in New Hampshire as a result of Atlantic OCS oil and natural gas activities is projected to reach over $290 million at the end of the forecast period. Operational expenditures and drilling spending are expected to account for the majority of spending. (Figure 60)

Figure 60: New Hampshire Projected Spending by Sector ($Millions per Year)

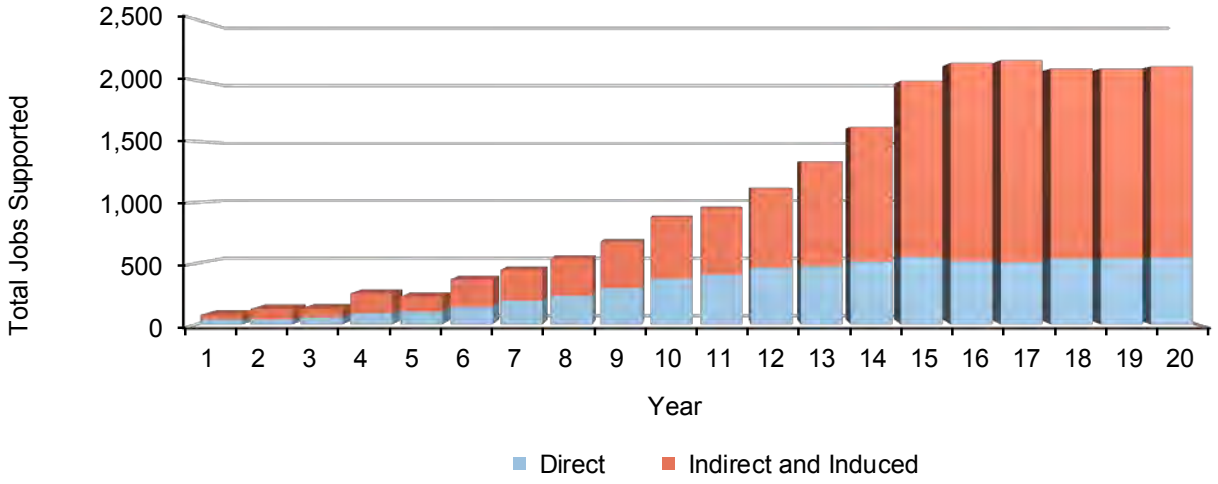


Source: Calash

Operational spending is projected to be over $180 million at the end of the forecast period, with drilling spending expected to reach nearly $70 million in the same year.

Employment in New Hampshire as a result of spending by the offshore oil and natural gas industry is projected to reach four thousand five hundred jobs at the end of the forecast period. Direct employment due to offshore oil and natural gas exploration and production is projected to be nearly five hundred fifty jobs at the end of the forecast period, with an indirect and induced employment level of over fifteen hundred jobs in the same year. (Figure 61)

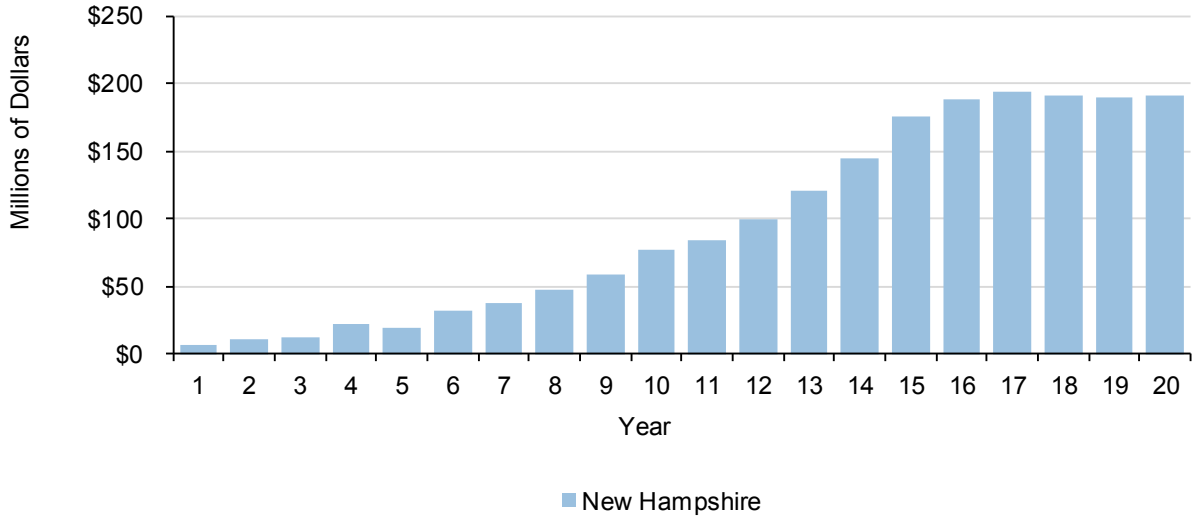
Figure 61: New Hampshire Projected Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to New Hampshire's economy due to spending by the Atlantic OCS oil and natural gas industry are projected to reach over $190 million at the end of the forecast period. (Figure 62)

Figure 62: New Hampshire Projected Contributions to the State Economy ($Millions per Year)



Source: Calash

Additional revenue could be collected by the New Hampshire state government if revenue sharing legislation is enacted. A 37.5 percent share of bonuses, rents, and royalties is projected to contribute over $100 million to the New Hampshire budget at the end of the forecast period, with cumulative contributions across the forecast period are projected at nearly $800 million. If a

different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

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CALASH

The Economic Impacts of Allowing Access to the Eastern Gulf of Mexico for Oil and Natural Gas Exploration and Development

Prepared For:

The American Petroleum Institute (API)

Prepared By:

CALASH

Executive Summary

Executive Summary

The U.S. offshore oil and natural gas industry is a significant contributor to domestic energy production, the national economy, 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 percent[1] 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 Eastern Gulf planning area is one such restricted area, with the vast majority of the area under a congressional drilling moratorium until 2022. 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 Eastern Gulf of Mexico.[2] Leasing in the Eastern Gulf of Mexico is proposed to begin in 2020, with leasing of areas currently under moratorium proposed to begin in 2023 after the expiration of the moratorium.

This report constructs a scenario of oil and natural gas development in the Eastern Gulf, based on the resource potential of the area, geologic analogs, and the full value chain of oil and natural gas development and production. It 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)

Table 1: Summary Table Potential Impacts from Eastern Gulf Oil and Natural Gas Development[3] [4]

Economic Impact	First Leasing + 3 Years	First Leasing + 10 Years	First Leasing + 20 Years	Cumulative 20 Years
Capital Investment and Spending ($Billions)	$0.3	$6.4	$11.6	$117.8
Employment	5,324	80,561	164,448	n/a
Contributions to Economy - GDP ($Billions)	$0.6	$8.1	$14.0	$149.2
Federal / State Government Revenue ($Billions)	$0.3	$1.3	$5.0	$44.0
Natural Gas and Oil Production (MMBOED)	0	0.18	1.01	2.86 Billion BOE

Source: Calash

[1] "2012-2017 OCS Oil and Gas Leasing Program", Bureau of Ocean Energy Management, August 22, 2012, accessed online on 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

[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.

[4] Assumes 37.5 percent revenue sharing with state governments.

Leasing

This study assumes that leasing will begin in Eastern Gulf of Mexico areas outside the congressional moratorium Eastern Gulf in Year 1, potentially coinciding with 2020 in the draft proposed Bureau of Ocean Energy Management (BOEM) five-year plan. Leasing activity in the initial year of leasing is projected at around 95 leases sold. Leasing in areas under congressional moratorium is projected to begin in Year 4, potentially coinciding with 2023 in the current draft proposed program. Leasing in this year, which would include Eastern Gulf of Mexico areas inside and outside the moratorium area is projected at around 285 leases. After the first five years of leasing annual lease sales are projected to be held every year covering the full Eastern Gulf OCS area. Lease sales are expected to fluctuate annually with overall lease sales trending down throughout the forecast period due to reduced lease availability.

Drilling

Drilling is the key activity both to discover oil and natural gas resources through exploration drilling as well as to prepare them for production by drilling development wells. With leasing starting in Year 1, Eastern Gulf drilling would be expected to begin years later. An average of around 28 wells per year are expected to be drilled across the forecast period. Around 70 percent of all wells are projected to be drilled in deepwater. Drilling in the area is projected to trend upwards as 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 45 wells is 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 driving capital and operational expenditures that lead to 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 project types based on project size and water depth. This study estimates that 40 major projects could begin oil and natural gas production in the Eastern Gulf between over the 20-year forecast period, of which 14 are projected to be deepwater projects and 26 are projected to be shallow water projects.

Oil and Natural Gas Production

Allowing access to the Eastern Gulf to offshore oil and natural gas production is projected to lead to an increase in domestic energy production. The first oil and natural gas production from the Eastern Gulf is projected to start within five years of the beginning of leasing. Within three

years of initial production, Eastern Gulf production is projected to increase to nearly 70 thousand barrels of oil equivalent per day (BOED). Production is projected to reach over 1 million BOED 20 years after leasing begins, with production expected to be around 65 percent oil and 35 percent natural gas.

Spending

Total cumulative spending across the forecast period is projected to be around $118 billion. Spending is projected to grow from an average of $315 million per year during the first five years of initial leasing, seismic, and exploratory drilling to over $11.5 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 $24 billion. Cumulative capital expenditures across the 20 year forecast period are projected at around $94 billion.

Domestic spending is expected to account for 85 percent of cumulative spending from Eastern Gulf of Mexico offshore development, with the remaining taking place internationally. For domestic spending over 90 percent of spending from Eastern Gulf oil and natural gas developments is expected to take place in the Gulf Coast states, with Texas (39 percent), Florida (22 percent) and Louisiana (17 percent) accounting for the largest shares. Alabama is expected to account for nine percent of total spending, with Mississippi accounting for five percent. States outside of the Gulf Coast are expected to account for nine percent of total spending.

Employment

Eastern Gulf oil and natural gas development is expected to lead to significant employment gains, both in the Gulf Coast region and nationally. Employment impacts are expected to grow throughout the forecast period, with total incremental U.S. employment supported reaching nearly 165 thousand jobs 20 years after initial lease sales. Total Gulf Coast employment is projected to reach over 152 thousand jobs. States outside the region are projected to see employment gains of nearly 12 thousand jobs by the end of the forecast period. The largest employment impact of Eastern Gulf oil and natural gas activity is projected in Florida and the traditional offshore oil and gas states of Texas and Louisiana. The share of incremental employment within the eastern states of Alabama, Mississippi, and Florida is anticipated 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 over $14 billion per year by the end of the forecast period, with nearly $13 billion of the total expected impact to occur in the Gulf Coast states. The largest contributions to states' economies are expected to be seen in Florida, Texas, and Louisiana.

Eastern Gulf oil and natural gas development has the potential to increase government revenue from royalties, bonus bids, and rents on leases by an estimated $41.5 billion cumulatively throughout the forecast period. Total government revenues are projected to reach nearly $5 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 $35 billion. Leasing bonus bids are projected to account for around $4.5 billion while rental income from offshore blocks is expected to account for approximately $2 billion.

This report assumes that associated government revenue is split 37.5 percent to the coastal states and 62.5 percent to the Federal government. This is similar to the arrangement in place with currently producing Gulf States but without an associated cap on state government revenue. Actual revenue proportion going to state governments, if any, would be determined by future legislation. Cumulative state revenues through the forecast period for the Gulf Coast states could reach over $16 billion. Any spending by state governments due to additional revenue has the potential to increase GDP.[5]

Allowing access for Eastern Gulf oil and natural gas development is projected to increase employment, economic activity, and government revenues with comparatively little additional spending required by federal and state governments. The nation as a whole, but especially the Gulf Coast states, would likely see large employment gains, increased economic activity, and additional government revenue. In addition, the nation is projected to see increased domestic oil and natural gas production, thus increasing the nation's energy security.

[5] Analysis assumes states spend 50 percent of additional revenue.

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Section 1 – Introduction

Oil and natural gas development contributes significantly to the U.S. economy. 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 percent[6] 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. The vast majority of the Eastern Gulf planning area is under Congressional leasing moratorium until at least 2022.

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 Eastern Gulf of Mexico.[7] Leasing in the Eastern Gulf of Mexico is proposed to begin in 2020, with leasing of areas currently under moratorium proposed to begin in 2023 after the expiration of the moratorium.

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 Eastern Gulf if oil and natural gas development restrictions for the Eastern Gulf were lifted. In addition, Calash projected potential impacts on Gulf of Mexico 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 throughout the forecast period such as regular lease sales and reasonable rate of permit approvals for projects and drilling within areas that are currently under moratorium. The provided analysis uses existing USGS and Bureau of Ocean Energy Management (BOEM) resource estimates.

This scenario in no way covers all previous or possible future proposals for the Eastern Gulf oil and natural gas activity. The analysis tracks the full lifecycle of oil and natural gas development that is projected to take place following the opening of the Eastern Gulf. The report therefore projects spending from leasing and seismic imaging to exploration drilling, onto project

[6] "2012-2017 OCS Oil and Gas Leasing Program", Bureau of Ocean Energy Management, August 22, 2012, accessed online on 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

development and through production. The associated ongoing spending needed to maintain and operate projects is also estimated.

The report assumes leasing will begin in Year 1, potentially coinciding with 2020 in the current draft proposed leasing 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 Eastern Gulf 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 Gulf of Mexico are defined as: Texas, Louisiana, Mississippi, Alabama, and Florida.

1.3 About Calash

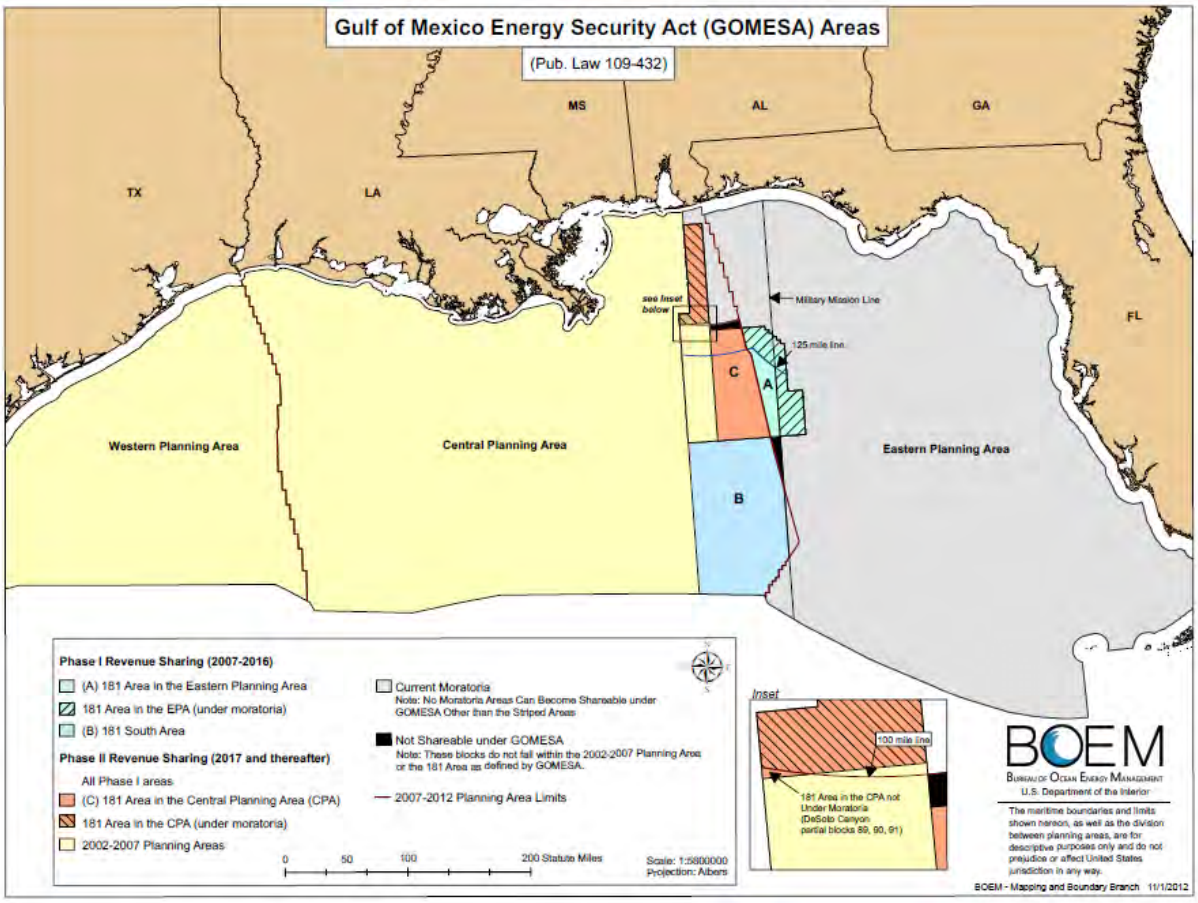
Since Calash's creation it has evolved from an oil and natural gas commercial and operational due diligence provider into an award-winning energy advisory firm providing strategy, business advisory, economic analysis, and mergers and acquisitions support services. As a function of Calash's core business, 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 Eastern Gulf

The Eastern Gulf is the second largest OCS area within the US Gulf of Mexico comprising 64.5 million acres of federal waters stretching southeast of the Florida and Alabama border. Currently 98% of the acreage, as well as the majority of potential oil and gas reserves, remains inaccessible under the most recent 5-year leasing plan. Within the unoffered acreage, the vast majority is subject to a moratorium under GOMESA until 2022. Since 2001 approximately 1.3 million acres or 233 lease blocks have been offered under the following lease sales. The most recent lease sale which took place in 2016, offered only 657,905 acres across 175 blocks. (Figure 1)

Figure 1: Eastern Gulf Planning Area Map



Source: Bureau of Ocean Energy Management

1.5 2006 GOMESA Moratorium

Eastern Gulf oil and gas development is prohibited under the 2006 Gulf of Mexico Energy Security Act (GOMESA). The GOMESA Moratorium covers a portion of the Central Gulf of Mexico Planning Area (CPA), and, until 2022, nearly all the Eastern Planning Area (EPA). The specific locations restricted from leasing activities include that portion of the Eastern Planning Area within 125 miles of Florida, all areas in the Gulf of Mexico east of the Military Mission Line (86 ° 41' west longitude), and the area within the Central Planning Area that is within 100 miles of Florida.

1.6 Lease History

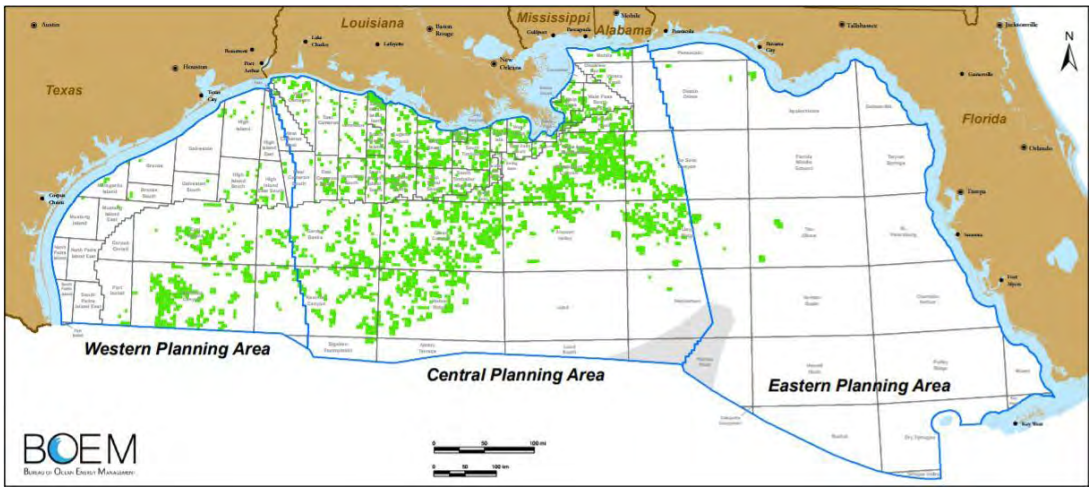
Federal lease sales within the Eastern Gulf took place between the years of 1959-2016, with the most recent sales taking place in a selected portion along the Central and Eastern Gulf border. Overall, ten lease sales have been completed within federal waters: 1959, 1973, 1984, 1985, 1988, 2001, 2003, 2005, 2008, 2014 and 2016.

Historically, sales in the area stretch back to the 1950's when the first lease comprising 80 blocks was offered in 1959. While federal lease sales were limited in the following years, offshore drilling continued through the period in shallow water areas upon the Florida shelf culminating in the late 1970's when additional lease sales in state waters were halted.

In the late 1980's, Florida and the Department of the Interior (DOI) began to outline a proposed ban on lease sales as well as drilling in the Eastern Gulf, including placing a 100-mile buffer zone along the Florida coast. These actions led to the repurchasing of leases from lessees throughout the period though several lessees have been permitted to hold leases for future exploration if the moratorium was lifted within the region.

In 2001, small concentrated lease sales returned to the Eastern Gulf under lease sale 181 which offered 233 lease blocks in a portioned section directly east of the Central Gulf of Mexico planning area border - incorporating sections of De Soto Canyon and Lloyd Ridge. Limited lease sales continued in recent years with five additional lease sales, the most recent in 2016, which has included an ever-decreasing number of acres and blocks on offer to operators as the leases on offer in the limited area along the western edge of the Eastern Gulf are leased. (Figure 2)

Figure 2: Eastern Gulf Active Leases



Source: Bureau of Ocean Energy Management

1.7 Seismic

Recent seismic studies have taken place throughout the Eastern Gulf, although in limited capacities depending on the location. Given the open leasing structure upon a portion of the Central and Eastern Gulf divide, this area has seen the most active 2D and 3D seismic in recent years. In the areas that are currently off-limits, 2D seismic studies have focused on the area west of the Florida escarpment in anticipation of increased lease offerings within the area, while shallow water seismic has been the most limited given the anticipated higher regulatory hurdles.

1.8 Drilling & Production

The history of offshore drilling in the Eastern Gulf has mainly been focused on a select number of historical opportunities in shallow water. Developed prospects include Alabama's Mobile Bay, Florida's Charlotte Harbor, Key West, as well as several prospects within the currently available deepwater region.

Throughout the 1960's and 1970's, exploration was limited but mainly focused on the Destin Dome region along the Alabama and Florida border. These exploration wells, while dry holes, helped delineate and define the sandstone and reservoir possibilities within the Norphlet play. Further exploration within deeper portions of the area led to discoveries and projects within Alabama state waters, particularly the Mobile Bay region, as well the Destin Dome project in block 56. Additional drilling has taken place in the majority of areas upon the Florida shelf as well as the southern Key West region, though the wells are dated and limited in number.

More recently, deepwater drilling has taken place within the available region within De Soto Canyon and Lloyd Ridge along the Central Gulf border. These wells have led to several discoveries within the Eastern Gulf, while additional resources and wells have been completed in

the nearby Central Gulf of Mexico. In particular, wells in the Norphlet play, which overlaps into the Eastern Gulf, have been successful in recent years. Projects such as Appomattox and Vicksburg are currently under development and represent some of the larger Gulf of Mexico discoveries in recent years. Additional discoveries in this trend continue to be made, including Chevron's Ballymore discovery of early 2017 which is located in Mississippi Canyon block 607.

Recent production from the Eastern Gulf began in February 1999 with production growing from as little as 1,000 BOED until peaking in 2009, when it contributed 108,000 BOED to Gulf of Mexico production. Given the largely gaseous reservoirs within De Soto Canyon, economics for such projects have receded in the near-term due to lower natural gas prices. Since early 2014, the Eastern Gulf has ceased to produce any oil or gas as operators have delayed projects along with declining economics for Gulf of Mexico natural gas projects.

1.9 Eastern Gulf Resources

Numerous studies have estimated the oil and gas resources in the Gulf of Mexico including DOI's assessment on all OCS regions (Lore et.al, 1995), the Eastern Gulf and Florida's shelf (Gohrbandt, 2001), the conceptual Mesozoic Ultra-Deep plays (Post and Hunt, 2001), and the Assessment of Technically Recoverable Hydrocarbon Resources of the Gulf of Mexico OCS (Crawford et. al, 2008). While these studies provide a general framework and consistent estimation of recoverable resources within the Eastern Gulf, there is more ambiguity around defining plays within the sparsely explored area. For this analysis, Calash has assumed the amount and general location of oil and natural gas resources based on the BOEM's Assessment of Technically Recoverable Hydrocarbon Resources of the Gulf of Mexico Outer Continental Shelf as of January 1, 2009.

The report identified possible oil and gas bearing geologies throughout the Gulf of Mexico including the Eastern Gulf. The report projects that the northern portion of the Eastern Gulf is likely to be a little more gas rich, while oil reserves increase as you move south along the coastline as well as into the deepwater Buried Hill plays. In many places, the various plays overlap throughout different depths.

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 discussed in the data development section and resource appendix.

1.10 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 Eastern Gulf formations in Federal waters identified in BOEM reports. Any potential benefits from the development of onshore midstream and 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 Eastern Gulf, 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 2)

Table 2: Oil and Gas Project Development Model

	Activity Forecast	Spending Model	Economic Model
Reserves	• Total Eastern 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 2.07 and UTRR alternative case of 15.95 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 holds 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 different development scenarios given the infrastructure currently in place within the Eastern Gulf. 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 3)

Table 3: 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 new regions of the Gulf of Mexico. 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 assuming the current operating structure of the Gulf of Mexico where applicable. 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. Given the uncertainty around the form of lease sales that may be presented within the Eastern Gulf, Calash has modeled yearly area wide sales within each region - thus contrasting the current sales which have included a sale approximately every two to three years.

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 Florida under GOMESA. Calculations in this report were made to distinguish the potential State government revenue impacts among all Gulf 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 Brent crude spot and Henry Hub natural gas prices from the 2017 Annual Energy Outlook with 2018 prices used for the first year of leasing. Due to the steadily increasing trend in the near to medium term of the EIA price forecast, delaying the beginning of leasing likely could lead to higher realized prices for oil and natural gas. 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

Allowing access to the Eastern Gulf for oil and natural gas production would likely provide large contributions to employment, gross domestic product, and state and federal government revenues. These benefits as projected would be felt throughout the Gulf Coast region as well as the US as a whole.

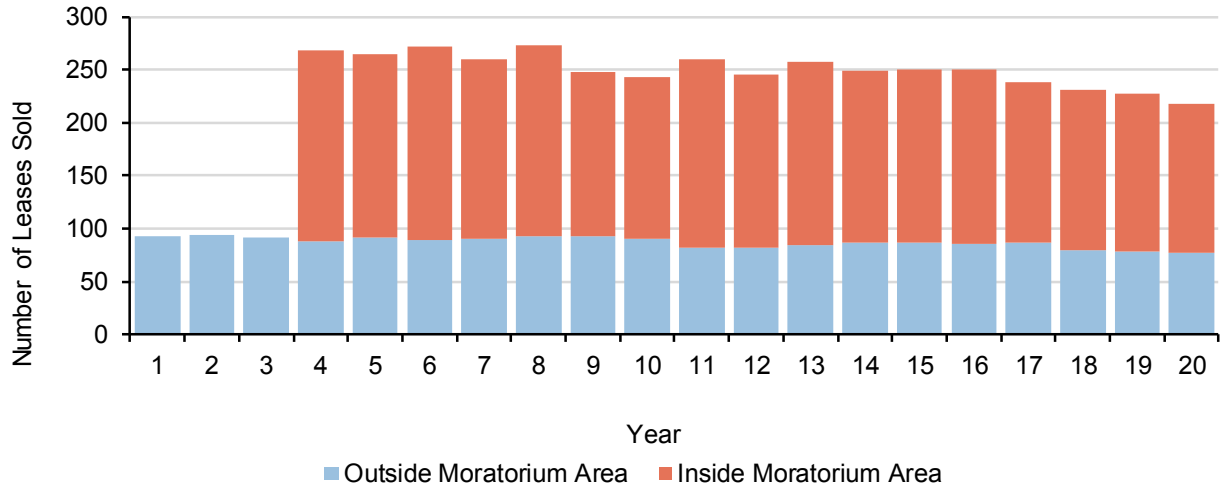
Offshore oil and natural gas exploration and production would require diverse activities such as: seismic imaging of reservoirs, drilling of wells, manufacturing equipment, and installing specialized equipment. The development of Eastern Gulf oil and natural gas reserves would require capital and operational expenditures associated with these activities, as well as increase government revenues, which as projected would combine to lead to increased employment and economic activity.

3.1 Seismic and Leasing Activity

Given that seismic activity is normally the first step required for offshore exploration, both to enable oil and natural gas companies to make bids on lease blocks and to identify drilling targets after leasing, some pre-leasing seismic activity is expected. Upon the beginning of wide spread sustained leasing in the Eastern Gulf, seismic and leasing activity would be expected to increase in relationship to present and historic levels. This study assumes that leasing outside the moratorium area begins in Year One, potentially coinciding with 2020 in the current Draft Proposed Program. Leasing within the moratorium area is assumed to begin in Year 4, potentially coinciding with 2023 in the current draft proposed program. New seismic activity is expected to begin within the first year of initial lease sales.

Additionally, despite some geologic differences to other parts of the Gulf, the level of understanding of the Eastern Gulf's geology is greater than other areas not currently subject to leasing - such as the Atlantic Coast. This is due in part to the significant development in the neighboring Central Gulf Region. The area's geology coupled with the accessibility of the area to existing exploration infrastructure should see lease sales draw significant interest from oil and gas operators. 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. Across the forecast period the number of leases sold is expected to range from around 90 to around 275 per year. (Figure 3)

Figure 3: Projected Leases Sold Eastern Gulf[9]



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 is most often used with drilling, processing, and production taking place from one or more platform or platforms that are fixed directly to the seafloor (fixed platforms).

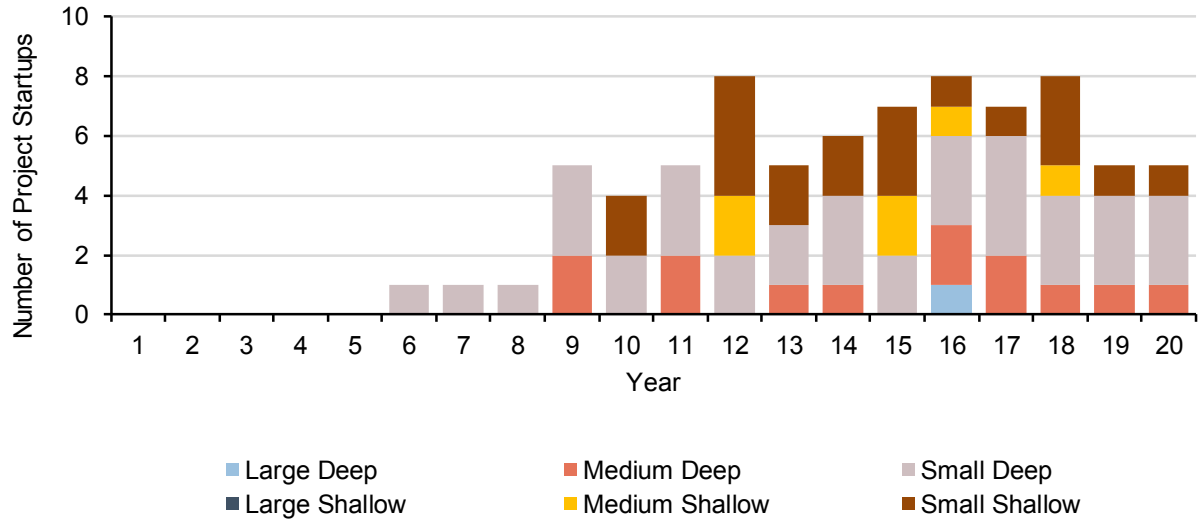
Deepwater projects are typically more complex and thus more capital intensive. Most deepwater projects utilize floating production units and subsea oil production infrastructure. Due to their increased complexity, deep water projects typically have longer development timeframes, as well as larger capital requirements.

[9] Lease sales begin in Year 1.

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 such as the Eastern Gulf until larger projects are in place or processing is available - though in the Eastern Gulf areas projects could tie into existing infrastructure such as platforms and pipelines in the central Gulf to speed development.

During the 20-year forecast period the study projects that around 20 major projects could begin oil and natural gas production in the Eastern Gulf planning area. Given the location of the resource potential, most of these projects would be expected to be deepwater projects, with around 14 major deepwater projects and 6 major shallow water projects projected. (Figure 4)

Figure 4: Projected Number of Projects by Start-Up Year, Size and Water Depth



Source: Calash

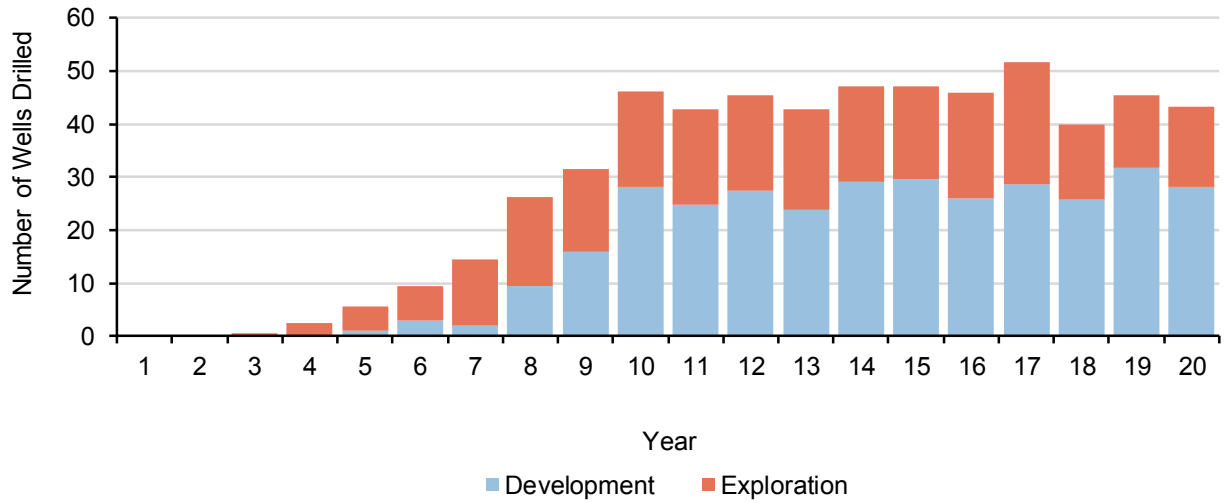
Projects could begin producing oil and natural gas as soon as five years after leasing begins in the Eastern Gulf.

3.3 Drilling Activity

Exploration and development drilling are used to identify, confirm, delineate, and produce oil and natural gas, making drilling 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 (mobile offshore drilling units – MODU's) must constantly be resupplied and crewed, and thus lead to high levels of activity in the areas and ports that support offshore drilling rigs.

Drilling activity in the Eastern Gulf is expected to be highly robust upon the commencement of offshore oil and natural gas activity. Exploratory drilling is projected to begin within two years after the first lease sales. Only exploratory drilling is expected to take place for the first four years of potential Eastern Gulf development. In the fifth year, development drilling is expected to begin and continue to accelerate. Total drilling activity is projected to level off at around 45-50 wells per year starting 11 years after initial lease sales. During this time, the proportion between development and exploratory wells is expected to shift to around 60 and 40 percent respectively, which is in line with other mature provinces. (Figure 5)

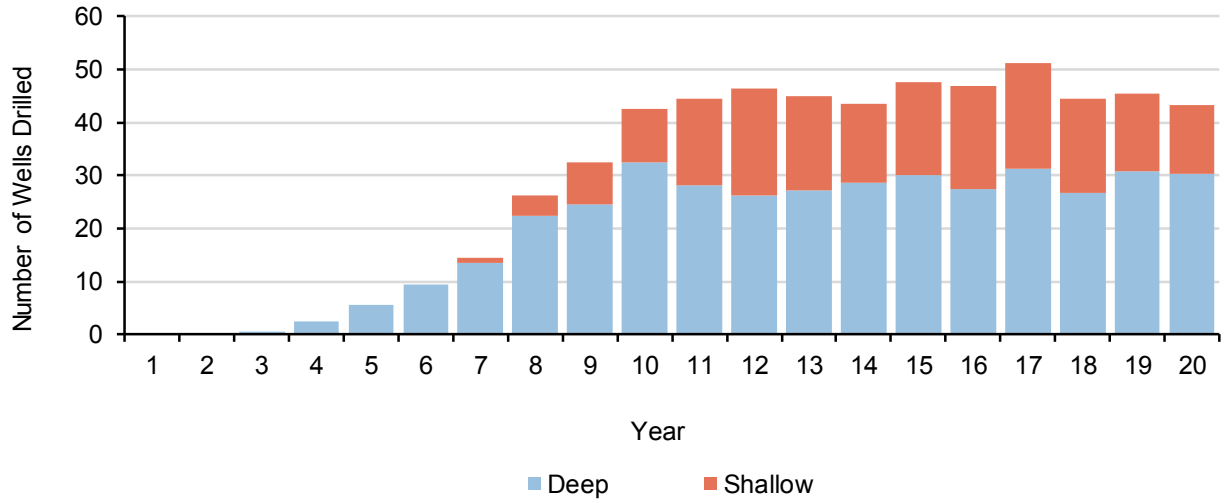
Figure 5: Projected Number of Wells Drilled by Well Type



Source: Calash

Due to the interconnected nature of exploration, drilling, and development, Eastern Gulf 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 a 65 to 35 ratio of deepwater to shallow water wells. A total of around 565 wells are projected to be drilled across the forecast period. (Figure 6)

Figure 6: Projected Number of Wells Drilled by Water Depth and Year



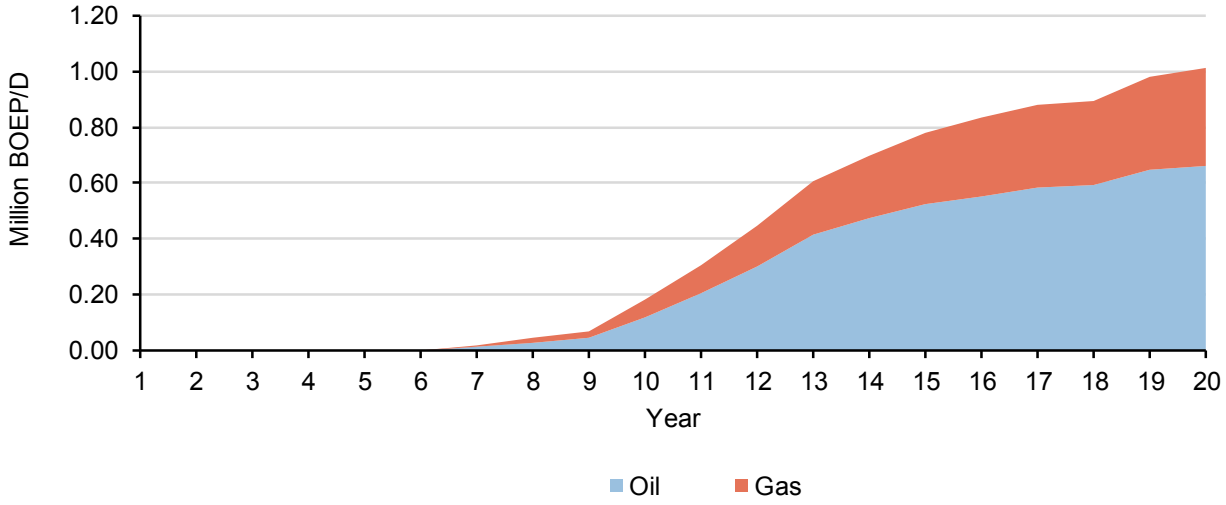
Source: Calash

3.4 Production Activity

The number of projects developed, coupled with reservoir size and reservoir productivity, is the main determinant of 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 all natural gas. Most reservoirs possess both oil and natural gas in varying ratios with oil sometimes expressed as condensate. All of the 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.

This study projects that first oil and natural gas production in the Eastern Gulf would take place five years after the beginning of leasing in the area. Initial production is expected to be in the deepwater, likely tying into existing oil and gas infrastructure in the Central Gulf. Due to the delay in leasing in areas under moratorium, annual production would be expected to reach only 45 thousand BOED by the third year of production. Production is projected to reach just over one million BOED by the end of the forecast period, with approximately 66 percent of production oil (650 thousand BOED), and 34 percent of the production natural gas (330 thousand BOED or 1.9 billion cubic feet per day). (Figure 7)

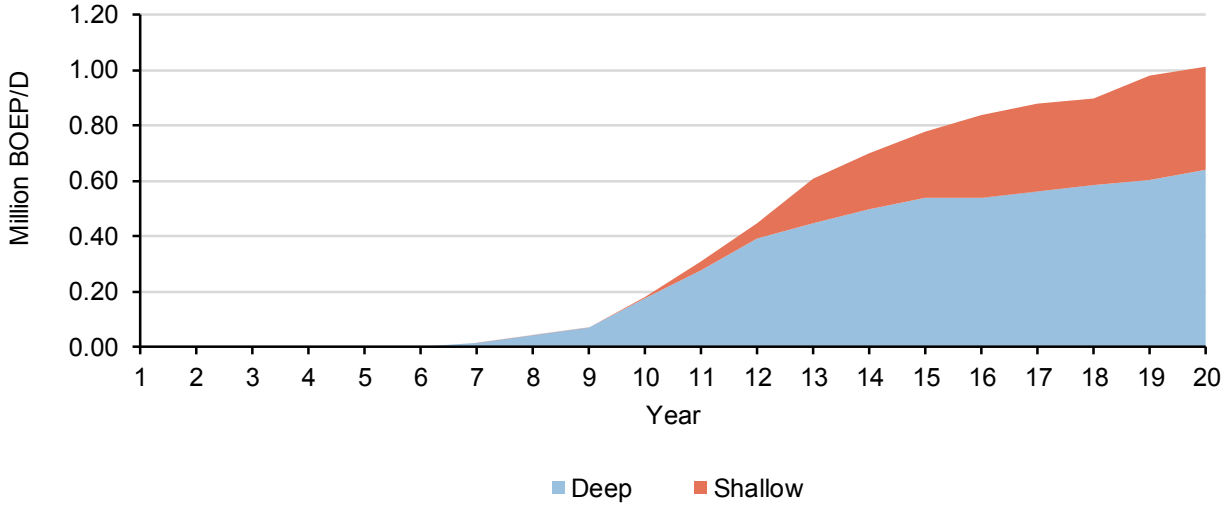
Figure 7: Projected Production by Type and Year



Source: Calash

Since project development and drilling is expected to be concentrated in deepwater, production is expected to outweigh shallow water production by a large margin. Deepwater production is expected to account for 63 percent of production by the end of the forecast period, compared to 37 percent of production from shallow water fields. (Figure 8)

Figure 8: Projected Production by Water Depth



Source: Calash

3.5 Spending Activity

Offshore oil and natural gas development is capital intensive. Offshore projects require 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 Eastern Gulf offshore oil and natural gas development is projected to be over $117 billion. Total spending in the first five years is projected to be around $315 million per year; spending per year is expected to increase as projects are built and development drilling begins. Total drilling spending is projected to steadily increase throughout the forecast period, reaching over $2.5 billion by the end of the forecast period. Total spending is projected to remain relatively constant at about $10-$11 billion per year for the last five 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 at an average of nearly $250 million per year or less than four percent of overall spending across the forecast period. Seismic spending is one of first categories of spending expected in the region, accounting for nearly 80 percent of spending in the first five years of the forecast period, as offshore prospects require a significant amount of time to identify.

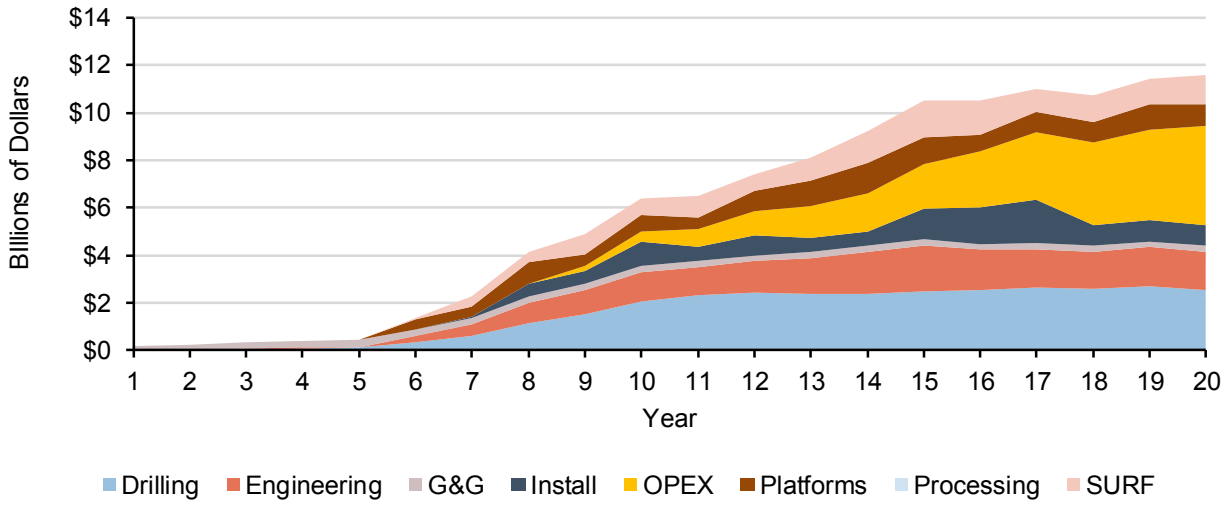
Given the expense and logistics requirements of offshore drilling, where rigs command large day rates in conjunction with high operational supply costs, drilling expenditures represent one of the largest sources of spending for any offshore project. Drilling expenditures across the forecast period, including both exploration and development drilling, are projected to average nearly $1.6 billion per year. Drilling expenditures are projected to increase throughout the forecast to over $2.5 billion per year for the last six years 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 nearly $990 million per year across the forecast period, increasing steadily as the Eastern Gulf 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 offshore accommodation modules as wells as

equipment such as mats, which are metal frames placed on the seafloor to hold other equipment. Due to the varying timelines for procurement of equipment, spending for platforms and SURF equipment is more variable year to year than most other offshore exploration and development spending. Platform spending is expected to average around $600 million per year across the forecast period. SURF spending is projected to average around $700 million per year. (Figure 9)

Figure 9: Projected Overall Spending by Category ($ Billions per Year)



Source: Calash

Installation of platforms and SURF equipment is normally carried out by multiple vessels, each with specialized functions such as pipe-lay or heavy-lift. Some vessels might lay large diameter pipelines (14 inch+), while other vessels lay smaller diameter infield pipelines (2-10 inches), or lift equipment and install hardware. Additional specialized vessels supply drill-pipe, fuel and other fluids, and food. Nearly everything installed offshore must first be prepared onshore at specialized bases in the region prior to execution. Equipment is sometimes transported to the field on the installation vessels themselves, and at other times is transferred to the field in specialized barges or transportation vessels. Installing offshore equipment often requires complex connection or integration operations and uses vessels that can command day rates of over $1 million. Overall, these variables are expected to drive annual installation spending of over $610 million per year across the forecast period.

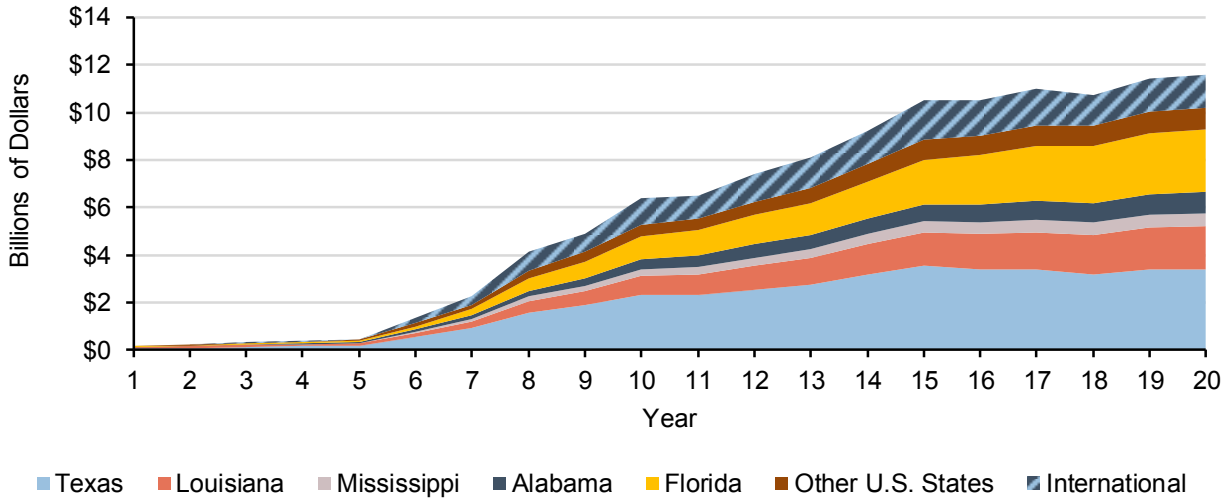
Once the initial wells have been drilled and the necessary equipment installed, a field can enter the operational phase. The operational phase requires manning and operating facilities and equipment, continuously supplying essential fluids, and constant general maintenance. These operational expenditures (OPEX) are a significant source of ongoing spending by oil and gas companies within the region. Once production has been underway for five years, operational expenditures are expected to be around $730 million per year and continue to climb to over $4.1 billion per year by the end of the forecast period.

3.6 Spending Trends

The location of spending for Eastern Gulf 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 in the early years of a basin's development. In contrast to most other undeveloped oil and natural gas areas in the United States, the Eastern Gulf has ready access to the Gulf regions' existing offshore oil and natural gas supply chain and infrastructure, which could lead to relatively faster development in the area.

During the initial five year seismic and exploratory drilling phase an average of 88 percent of total Eastern Gulf oil and natural gas spending is projected to take place in the Gulf Coast states. However, as projects begin to be developed and spending on platforms and SURF equipment begins, the Gulf Coast's share of spending is projected to dip to 73 percent across the forecast period, with some high value SURF equipment and platforms to be supplied by other countries. By the end of the forecast period around 80 percent of total spending is projected to take place in the Gulf Coast States. (Figure 10)

Figure 10: Projected Overall Spending Gulf Coast States vs. Other U.S States vs. International ($ Billions per Year)



Source: Calash

Spending among the Gulf Coast states is projected to vary based on the location of offshore oil and natural gas reserves, projects, and production as well as the makeup of the individual state's economies. The large existing offshore oil and gas supply chains in Texas and Louisiana are expected to result in these states capturing large shares of spending despite their relative distance from exploration and production in the Eastern Gulf. Initially, it is assumed that much of the Eastern Gulf development will be directly supplied through ports of Louisiana and Texas. However, as the region develops, suppliers of offshore oil and natural gas equipment are expected to take advantage of the high-tech manufacturing capabilities, as well the extensive port infrastructure in states such as Florida, Alabama, and Mississippi. This shift would therefore distribute spending from Texas and Louisiana towards the more eastern states in the Gulf. By the end of the forecast period, 40 percent of development expenditures are projected to be spent in Florida, Alabama, and Mississippi versus an average of only 20 percent in the first five years. In this scenario, total Gulf Coast spending from Eastern Gulf exploration and development activity is expected to reach over $9.2 billion per year by the end of the forecast period, of which over $4 billion is projected to be received by the three eastern most Gulf States. (Table 4).

Table 4: Projected Spending Gulf Coast States and Other U.S. States ($Millions per Year)

State	1	2	3	4	5	6	7	8	9	10
Florida	$13	$18	$29	$36	$48	$139	$271	$523	$699	$954
Texas	$76	$101	$138	$158	$189	$535	$925	$1,602	$1,881	$2,322
Louisiana	$52	$64	$86	$91	$99	$200	$292	$480	$595	$789
Mississippi	$6	$8	$12	$15	$19	$54	$95	$167	$211	$273
Alabama	$14	$19	$27	$32	$38	$83	$149	$260	$355	$457
Gulf Coast	$160	$210	$291	$332	$393	$1,011	$1,731	$3,031	$3,741	$4,795
Other U.S. States	$14	$18	$25	$28	$34	$115	$194	$332	$385	$475
Total	**$174**	**$228**	**$316**	**$360**	**$427**	**$1,126**	**$1,925**	**$3,363**	**$4,126**	**$5,270**

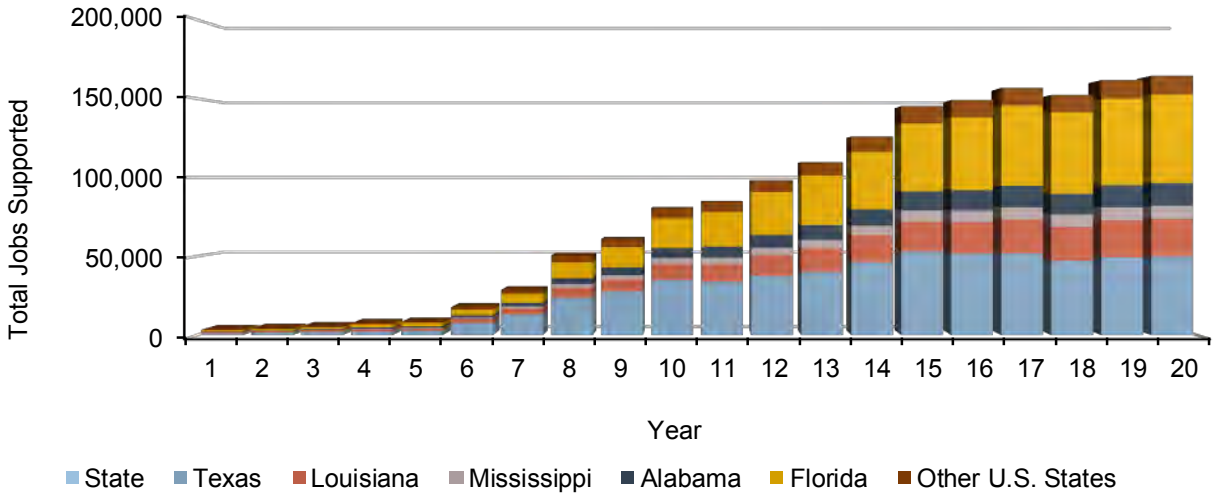
State	11	12	13	14	15	16	17	18	19	20
Florida	$1,054	$1,221	$1,348	$1,568	$1,880	$2,051	$2,298	$2,413	$2,566	$2,628
Texas	$2,329	$2,538	$2,744	$3,176	$3,536	$3,413	$3,397	$3,208	$3,379	$3,405
Louisiana	$861	$1,012	$1,146	$1,283	$1,410	$1,470	$1,581	$1,650	$1,769	$1,803
Mississippi	$319	$352	$376	$421	$464	$476	$502	$508	$541	$549
Alabama	$491	$566	$590	$654	$737	$791	$829	$827	$873	$887
Gulf Coast	$5,055	$5,688	$6,205	$7,102	$8,027	$8,200	$8,606	$8,606	$9,128	$9,272
Other U.S. States	$492	$562	$637	$751	$830	$811	$833	$844	$899	$908
Total	**$5,547**	**$6,250**	**$6,842**	**$7,853**	**$8,857**	**$9,012**	**$9,439**	**$9,449**	**$10,027**	**$10,180**

Source: Calash

3.7 Employment

Spending on goods and services to develop oil and natural gas in the Eastern Gulf is projected to provide large employment gains both nationally and regionally. Employment generally follows spending patterns. Employment effects are expected to steadily grow throughout the forecast period, reaching nearly 165 thousand jobs supported in the US 20 years after initial leasing begins. Total Gulf Coast employment is projected to reach over 152 thousand jobs by the end of the forecast period. U.S. states outside the Gulf Coast region are projected to see additional employment of nearly 12 thousand jobs by the end of the forecast period. (Figure 11)

Figure 11: Projected Employment by State



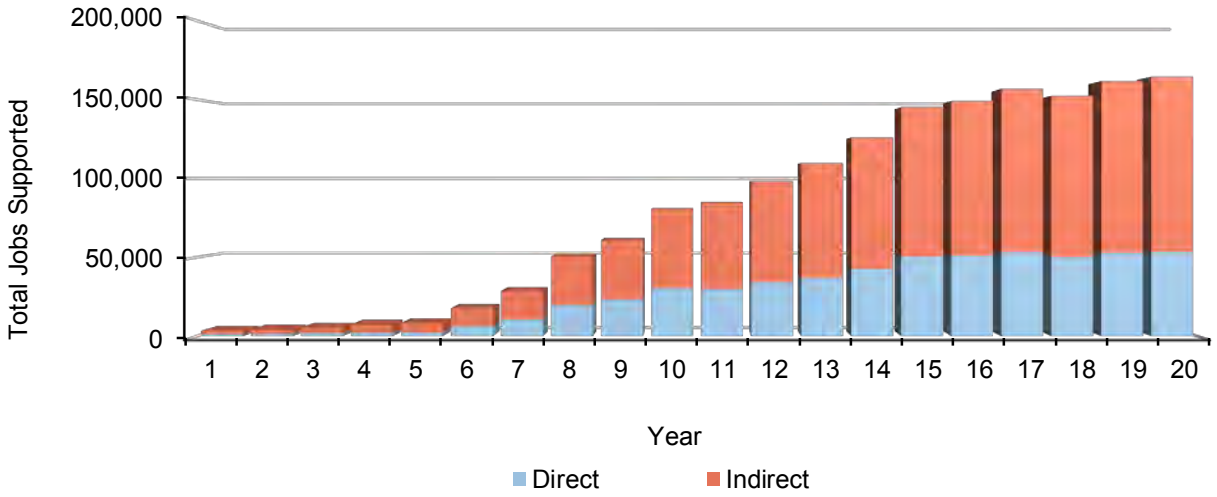
Source: Calash

The largest impact on employment by number of jobs is expected to be seen in the traditional offshore oil and natural gas production states of Texas and Louisiana as well as in

Florida. Total employment supported in Florida could reach over 56 thousand jobs by the end of the forecast period. Eastern Gulf of Mexico oil and natural gas development is projected to support employment gains of approximately 50 thousand and 24 thousand jobs in Texas and Louisiana respectively by the end of the forecast period. Alabama and Mississippi are also projected to see employment gains of over 14 thousand jobs and over 8 thousand jobs respectively by the end of the forecast period

The opening of the Eastern Gulf 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 economy. Direct employment by oil and natural gas companies and their direct suppliers are projected to reach over 53 thousand jobs by the end of the forecast period. Jobs generated through the secondary purchase of goods and services coupled with the income effects of increased employment are expected to contribute a further 111 thousand jobs. (Figure 12)

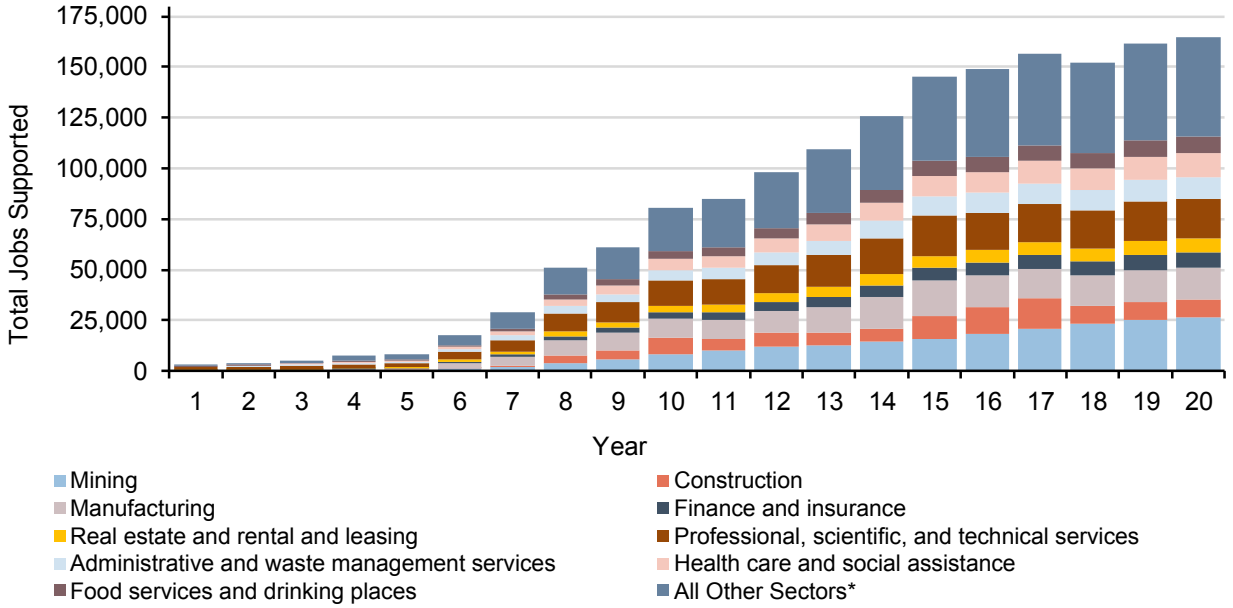
Figure 12: Projected Employment Direct vs. Indirect and Induced



Source: Calash

Offshore oil and natural gas development in the Eastern Gulf is expected to support a diverse spectrum of industries both nationally and along the Gulf Coast. Industry sectors which are directly involved in oil and natural gas activities such as mining, which includes the oil and gas industry, manufacturing, professional, scientific, and technical Services (engineering), and Construction (installation) are expected to see the largest employment impacts with a combined 70 thousand jobs created by the end of the forecast period. Additionally, employment impacts are expected to be significant for a variety of other industries outside oil and gas, with over 94 thousand jobs projected outside of these four categories by the end of the forecast period. (Figure 13)

Figure 13: Projected Employment by Industry Sector



Source: Calash

Many employment sectors of the economy outside oil and gas development or the direct supply chain will also 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 5)

Table 5: Projected Employment Gulf Coast States and Other U.S. States

State	1	2	3	4	5	6	7	8	9	10
Texas	1,168	1,518	2,057	2,308	2,734	7,575	13,149	23,779	27,776	34,892
Louisiana	742	898	1,184	1,386	1,477	2,660	3,718	6,208	7,502	10,200
Mississippi	100	131	173	367	420	834	1,313	2,267	2,776	3,656
Alabama	255	318	419	827	901	1,478	2,273	3,894	4,956	6,513
Florida	851	965	1,140	2,061	2,266	3,650	5,682	10,097	12,804	18,832
Gulf Coast	3,117	3,829	4,974	6,950	7,799	16,196	26,135	46,246	55,814	74,094
Other U.S. States	203	257	350	382	454	1,500	2,522	4,485	5,147	6,467
Total	**6,437**	**7,915**	**10,297**	**14,282**	**16,052**	**33,893**	**54,792**	**96,977**	**116,775**	**154,656**

State	11	12	13	14	15	16	17	18	19	20
Texas	33,920	37,397	39,927	46,218	53,069	51,706	51,793	47,068	49,388	49,840
Louisiana	11,009	13,146	15,050	16,889	18,971	19,917	21,440	21,754	23,343	23,824
Mississippi	4,207	4,790	5,440	6,156	6,974	7,279	7,722	7,617	8,220	8,415
Alabama	6,967	8,240	9,252	10,419	12,091	13,037	13,689	13,123	14,105	14,418
Florida	22,033	27,165	31,620	36,377	43,013	46,163	50,801	51,670	54,865	56,044
Gulf Coast	78,137	90,738	101,288	116,060	134,119	138,102	145,445	141,232	149,921	152,540
Other U.S. States	6,476	7,457	8,347	9,848	11,153	10,996	11,335	11,084	11,778	11,908
Total	**162,750**	**188,934**	**210,924**	**241,967**	**279,391**	**287,201**	**302,225**	**293,549**	**311,621**	**316,989**

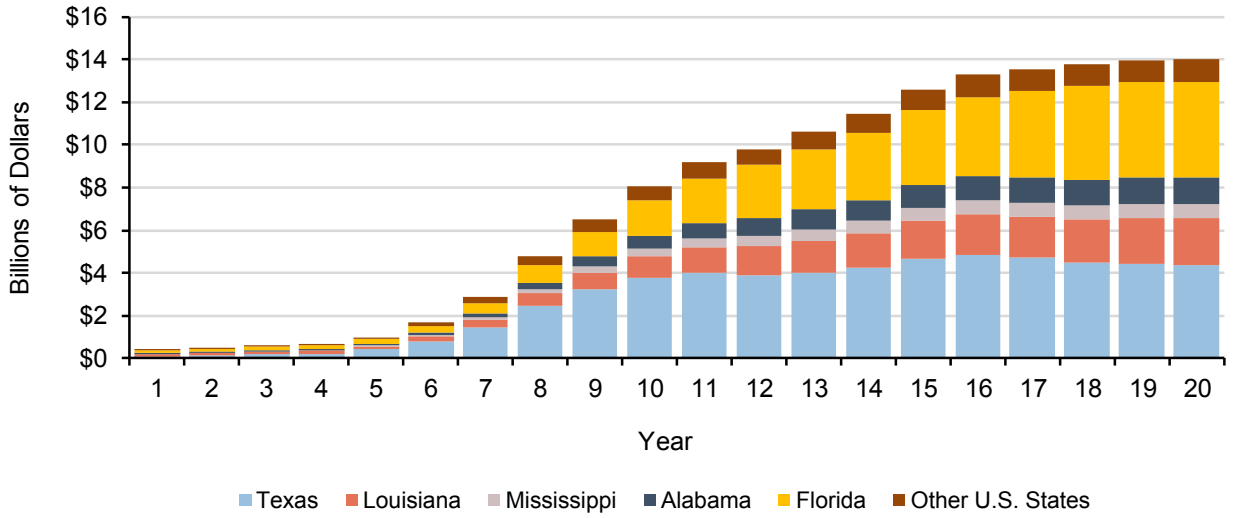
Source: Calash

3.8 State Income Impacts

Along with employment benefits, significant contributions to state and national gross domestic product are also expected due to Eastern Gulf of Mexico oil and natural gas development. Total contributions to state economies are projected at over $14 billion per year by

the end of the forecast period, with around 93 percent expected to occur in Gulf Coast states and seven percent in the rest of the U.S. (Figure 14)

Figure 14: Projected Contributions to State Economies Gulf Coast vs. Other U.S. States – Total ($ Billions per Year)



Source: Calash

Presented below are the projected economic effects of Eastern Gulf exploration and production. The largest contributions are expected to mimic spending at the state level. Under this projection, the states of Florida, Texas, and Louisiana receive the majority of contributions to their states' economies. (Table 6)

Table 6: Projected Contributions to State Economies Gulf Coast States and Other U.S. States ($ Millions per Year)

State	1	2	3	4	5	6	7	8	9	10
Texas	$105	$141	$193	$224	$409	$809	$1,454	$2,459	$3,230	$3,749
Louisiana	$74	$89	$116	$122	$164	$238	$360	$587	$801	$1,021
Mississippi	$16	$19	$23	$26	$40	$65	$109	$185	$265	$344
Alabama	$38	$45	$55	$61	$77	$114	$183	$307	$459	$616
Florida	$141	$151	$174	$180	$226	$301	$484	$803	$1,166	$1,659
Gulf Coast	$374	$444	$561	$614	$915	$1,527	$2,589	$4,340	$5,922	$7,390
Other U.S. States	$18	$23	$31	$35	$75	$155	$272	$466	$605	$694
Total	**$766**	**$911**	**$1,153**	**$1,264**	**$1,905**	**$3,209**	**$5,451**	**$9,147**	**$12,449**	**$15,474**

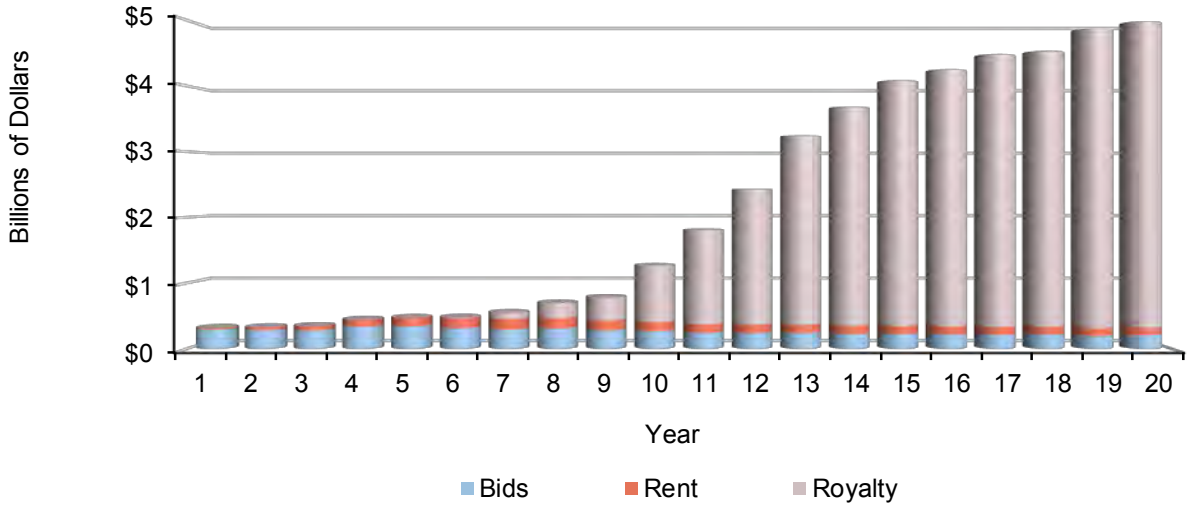
State	11	12	13	14	15	16	17	18	19	20
Texas	$3,995	$3,920	$4,008	$4,223	$4,657	$4,840	$4,715	$4,461	$4,421	$4,363
Louisiana	$1,177	$1,339	$1,519	$1,663	$1,808	$1,932	$1,934	$2,031	$2,126	$2,183
Mississippi	$421	$463	$511	$553	$590	$616	$633	$652	$670	$683
Alabama	$740	$848	$930	$987	$1,050	$1,131	$1,189	$1,229	$1,248	$1,262
Florida	$2,112	$2,476	$2,849	$3,145	$3,508	$3,716	$4,051	$4,379	$4,455	$4,484
Gulf Coast	$8,444	$9,046	$9,817	$10,571	$11,613	$12,235	$12,522	$12,751	$12,921	$12,975
Other U.S. States	$728	$744	$790	$876	$979	$1,043	$1,014	$1,012	$1,030	$1,042
Total	**$17,617**	**$18,836**	**$20,423**	**$22,018**	**$24,205**	**$25,513**	**$26,058**	**$26,513**	**$26,872**	**$26,991**

Source: Calash

3.9 Government Revenue Impacts

In addition to economic and employment growth, expanding current oil and gas production in the Eastern Gulf would increase government revenue. Extrapolating from the current Gulf of Mexico regulatory environment, total government revenues are projected to reach nearly $4.9 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 nearly $4.6 billion. At the end of the forecast period, leasing bonus bids are projected to account for nearly $205 million per year in government revenue, while rental income from offshore blocks is expected to account for nearly $110 million. Across the forecast period, cumulative government revenues are projected to total over $41 billion. (Figure 15)

Figure 15: Projected Government Revenues – Rentals, Royalties, and Bonus Bid ($ Billions per Year)[10]

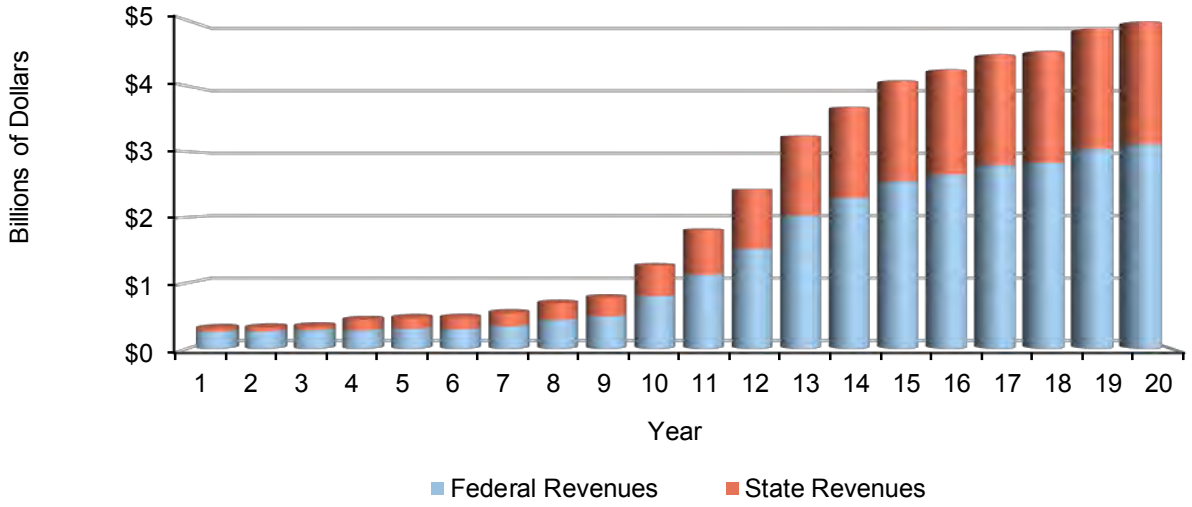


Source: Calash

There is a possibility that revenue generated from Eastern Gulf oil and natural gas revenues will be shared between the Federal government and the affected state governments, although there currently is no revenue sharing agreement in place that covers all of the Gulf of Mexico. 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 Gulf 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 and the addition of Florida. 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 Gulf of Mexico states, federal government revenues from Eastern Gulf offshore oil and natural gas production are projected to reach over $3.1 billion per year at the end of the forecast period. Combined state revenues for the Gulf Coast states are projected at about $1.8 billion per year by the end of the forecast period. (Figure 16)

[10] Assumes 37.5 percent revenue sharing with state governments.

Figure 16: Projected Government Revenues from Rentals, Royalties, and Bonus Bids, State and Federal ($ Billions per Year)[11]



Source: Calash

Due to the projected location of the potential oil and natural gas production based on the play data, Florida and Alabama are most likely to receive significant returns from any revenue sharing agreement. At a 37.5 percent share for state governments, these states are projected to receive a cumulative $11.7 billion and $2.2 billion across the forecast period. Most Gulf Coast states, with the exception of Texas, would receive at least $120 million per year by the end of the forecast period. At the end of the forecast period Florida is projected to receive the highest revenues, with revenues projected at over $1.6 billion in the final year of the forecast. (Table 7)

[11] Assumes 37.5 percent revenue sharing with state governments.

Table 7: Projected Government Revenues from Rentals, Royalties, and Bonus Bids by State and Federal ($ Millions per Year)[12]

State	1	2	3	4	5	6	7
Texas	$0	$0	$0	$0	$0	$0	$0
Louisiana	$4	$5	$5	$15	$15	$17	$18
Mississippi	$2	$2	$2	$13	$13	$14	$15
Alabama	$4	$4	$4	$29	$29	$32	$33
Florida	$44	$46	$47	$104	$108	$116	$136
Gulf Coast	$53	$56	$57	$161	$166	$179	$203
Federal	$261	$268	$285	$281	$305	$295	$344
Total	**$314**	**$324**	**$342**	**$442**	**$471**	**$474**	**$547**

State	8	9	10	11	12	13	14
Texas	$0	$0	$0	$0	$0	$0	$0
Louisiana	$23	$25	$40	$58	$77	$106	$121
Mississippi	$17	$18	$24	$35	$45	$70	$81
Alabama	$39	$39	$53	$78	$101	$157	$181
Florida	$177	$206	$352	$512	$687	$885	$1,001
Gulf Coast	$256	$288	$469	$684	$911	$1,219	$1,383
Federal	$438	$493	$798	$1,124	$1,517	$2,024	$2,295
Total	**$694**	**$781**	**$1,267**	**$1,808**	**$2,428**	**$3,242**	**$3,679**

State	15	16	17	18	19	20
Texas	$0	$0	$0	$0	$0	$0
Louisiana	$134	$141	$148	$149	$162	$166
Mississippi	$91	$98	$104	$103	$118	$122
Alabama	$202	$219	$231	$230	$262	$270
Florida	$1,109	$1,142	$1,202	$1,217	$1,291	$1,308
Gulf Coast	$1,535	$1,600	$1,685	$1,699	$1,833	$1,866
Federal	$2,547	$2,649	$2,795	$2,830	$3,039	$3,113
Total	**$4,082**	**$4,248**	**$4,479**	**$4,528**	**$4,872**	**$4,979**

Source: Calash

[12] 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. However, large portions of the nations' federal waters are currently inaccessible to oil and gas operators, including around 98 percent of the Eastern Gulf. Allowing oil and gas operators increased access to the Eastern Gulf and its resources would be expected to benefit oil and natural gas production, employment, the national economy, and government revenue.

- If leasing in the Eastern Gulf began, annual capital investment and other spending due to offshore oil and natural gas development could grow to over $11.5 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 nearly $120 billion.
- Eastern Gulf oil and gas activities could create nearly 85 thousand jobs within ten years of the beginning of leasing activity, the vast majority of which likely would be in the Gulf Coast states.
- By the end of the forecast period, total national employment due to Eastern Gulf oil and gas exploration and production could reach nearly 165 thousand jobs, with over 150 thousand of these jobs in Gulf Coast states.
- Development of the Eastern Gulf's offshore oil and natural gas resources could lead to production of approximately one million barrels of oil equivalent per day within 20 years after initial lease sales.
- Eastern Gulf activity could contribute over $10.5 billion per year to the national economy within ten years of leasing activity, with Gulf Coast states receiving contributions of nearly $9.5 billion per year.
- At the end of the forecast period total national contributions to the economy could reach nearly $14 billion per year, with Gulf Coast states receiving combined contributions of nearly $13 billion per year.
- Combined state and federal revenues from bonuses, rents and royalties are projected to reach over $1.8 billion per year within ten years of leasing activity, with these revenues projected to grow to nearly $5 billion per year by the end of the 20-year forecast period.
- If a legislated state / federal revenue sharing agreement is enacted, the Eastern Gulf coast states could see significant gains to their state budgets. With a 37.5 percent sharing agreement, state revenues are projected to be nearly $685 million per year within ten years of leasing activity, with revenues expected to grow to over

$1.8 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.

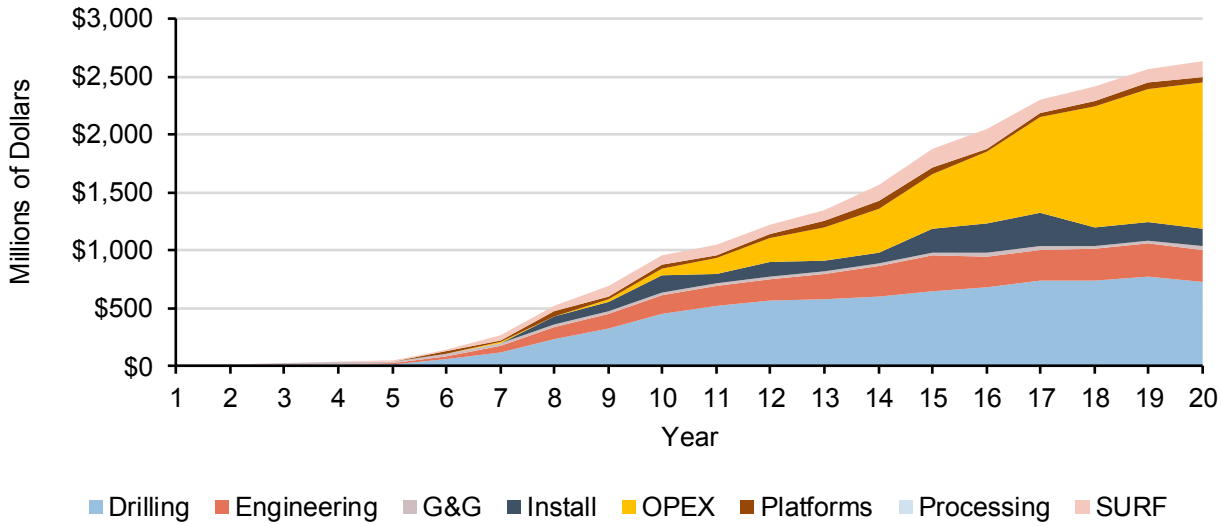
Under the development scenario put forth in this report, it is clear that the Eastern Gulf displays significant potential to grow the American economy across numerous industries and areas. Allowing access to the entire Eastern Gulf for oil and gas exploration and production activities is likely to lead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

Section 5 – State Results Appendix

5.1 Florida

Florida is expected to be one of the states to experience the largest benefit due to the opening of the Eastern Gulf 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 around $2.6 billion per year, with spending primarily focused on drilling, operational expenditures, and engineering. (Figure 17)

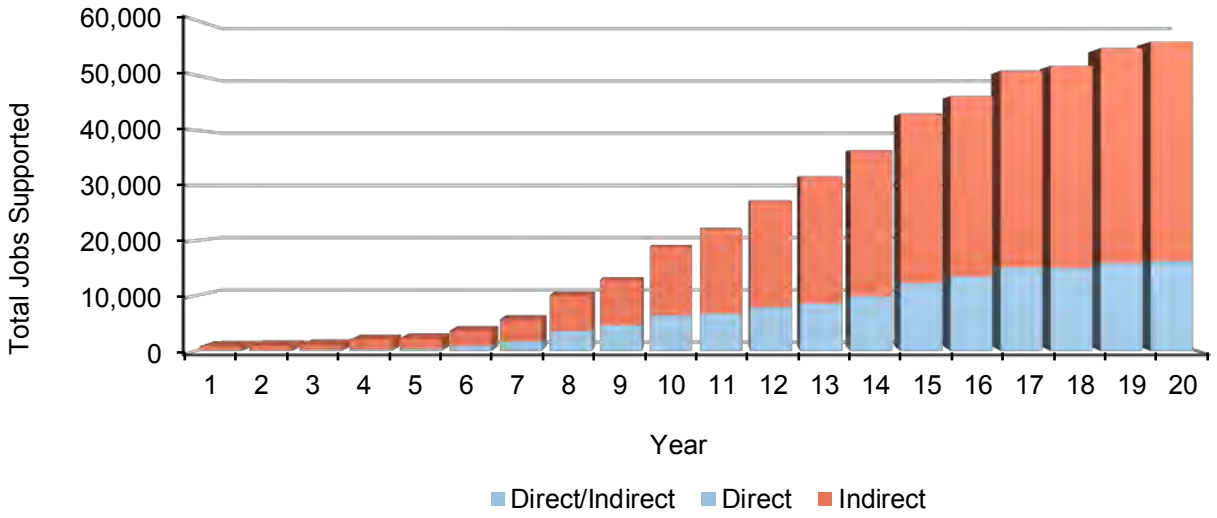
Figure 17: Projected Florida Spending by Sector ($ Millions per Year)



Source: Calash

Employment in Florida due to spending on Eastern Gulf oil and natural gas activity is projected to reach over 56 thousand jobs. Direct employment due to offshore oil and natural gas exploration and production is expected to reach over 16 thousand jobs by the end of the forecast period, with indirect and induced employment of nearly 40 thousand jobs projected in the same year. (Figure 18)

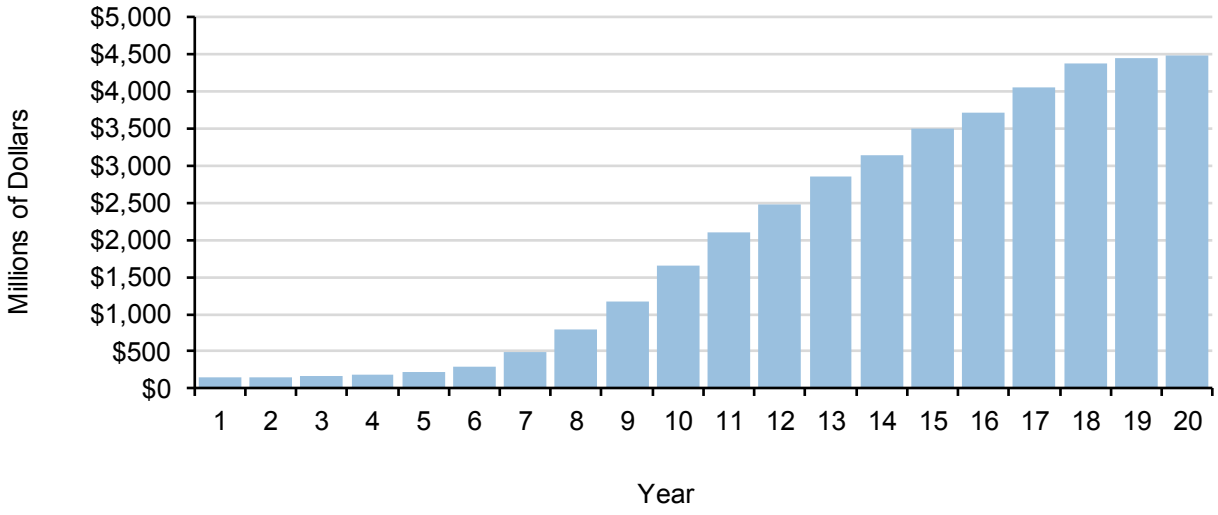
Figure 18: Projected Florida Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Florida's state economy due to spending by the Eastern Gulf oil and natural gas industry are projected to be nearly $4.5 billion per year by the end of the forecast period. (Figure 19)

Figure 19: Projected Florida Contributions to the State Economy ($ Millions per Year)



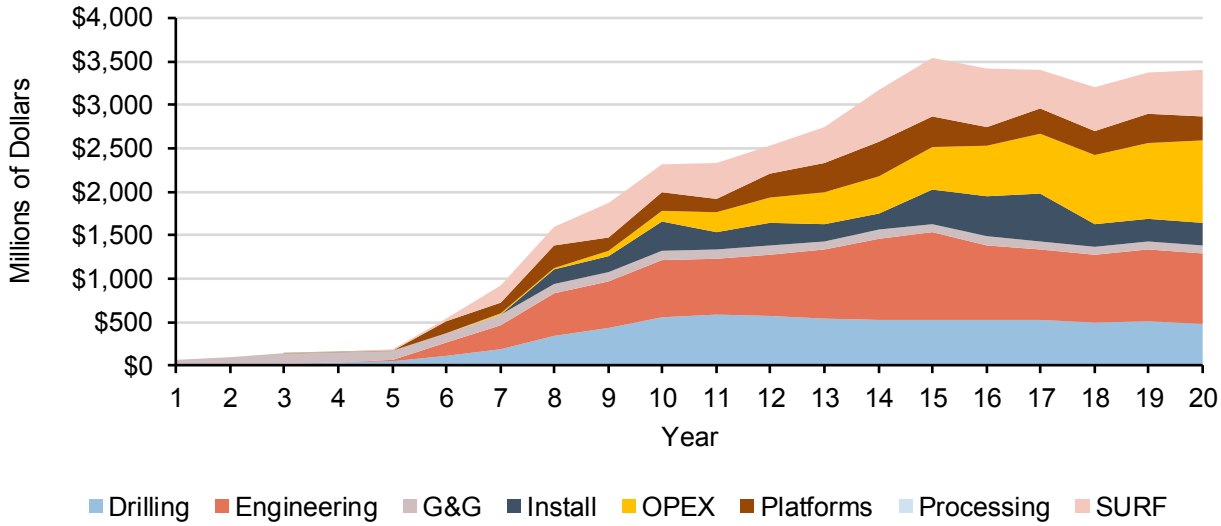
Source: Calash

With an assumed 37.5 percent revenue sharing agreement in place, Eastern Gulf oil and natural gas activities are projected to contribute over $1.3 billion per year to Florida's budget by the end of the forecast period; cumulative contributions across the forecast period are projected to be over $11.7 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

5.2 Texas

Texas is expected to be one of the states which will receive the greatest benefits from the opening of the Eastern Gulf 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 around $3.4 billion per year. Spending is expected to be strongest from the OPEX, engineering, SURF equipment, and platform construction segments. (Figure 20)

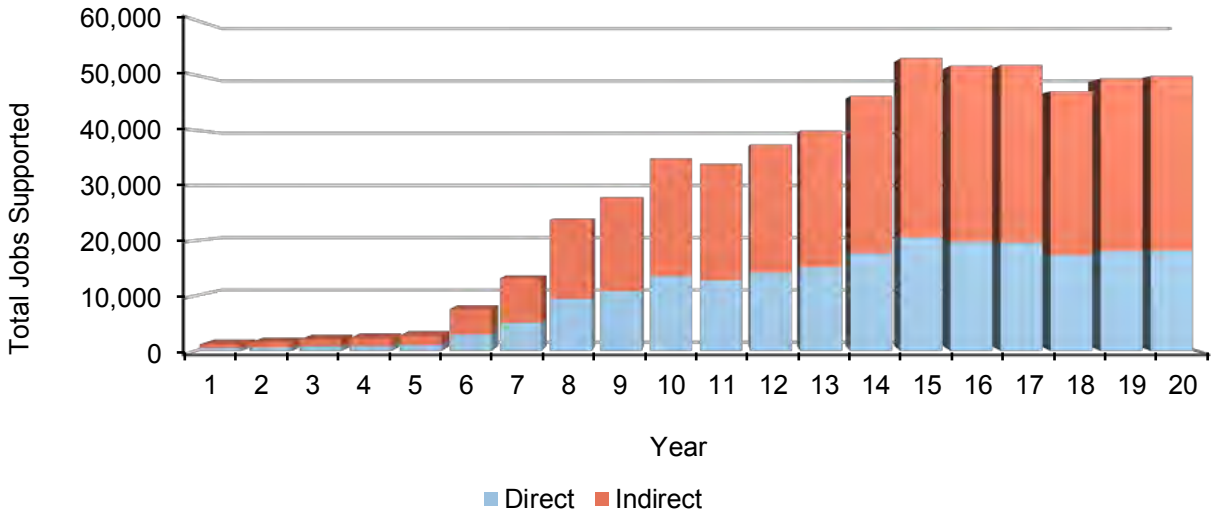
Figure 20: Projected Texas Spending by Sector ($ Millions per Year)



Source: Calash

Employment in Texas due to spending on Eastern Gulf offshore oil and natural gas development is projected to reach nearly 50 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 over 18 thousand jobs at the end of the forecast period, with indirect and induced employment of nearly 32 thousand jobs expected in the same year. (Figure 21)

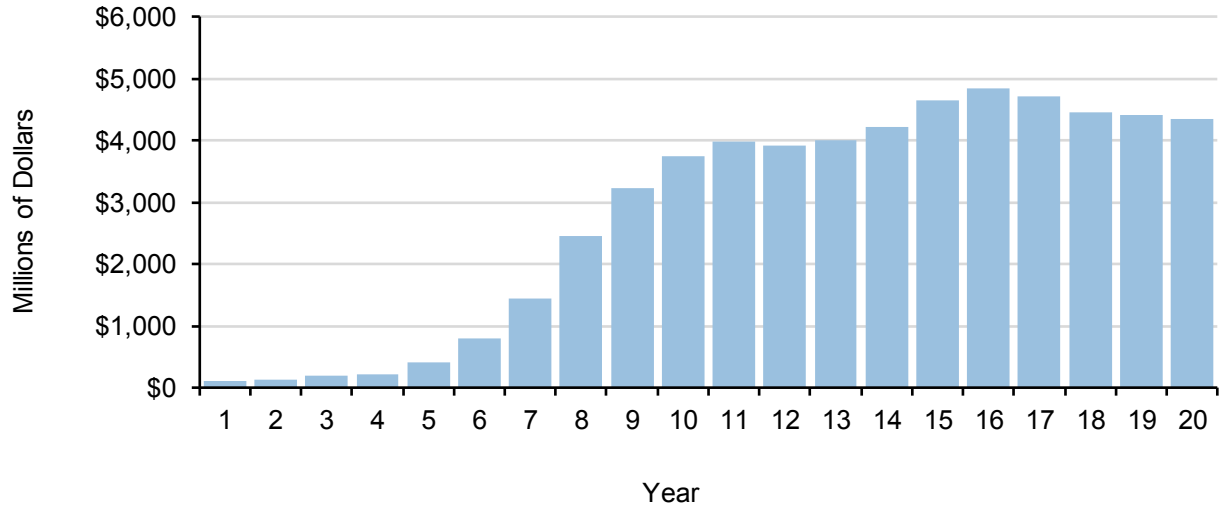
Figure 21: Projected Texas Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Texas' state economy due to spending on Eastern Gulf oil and natural gas exploration and development are projected to be nearly $4.4 billion per year at the end of the forecast period. (Figure 22)

Figure 22: Projected Texas Contributions to the State Economy ($ Millions per Year)



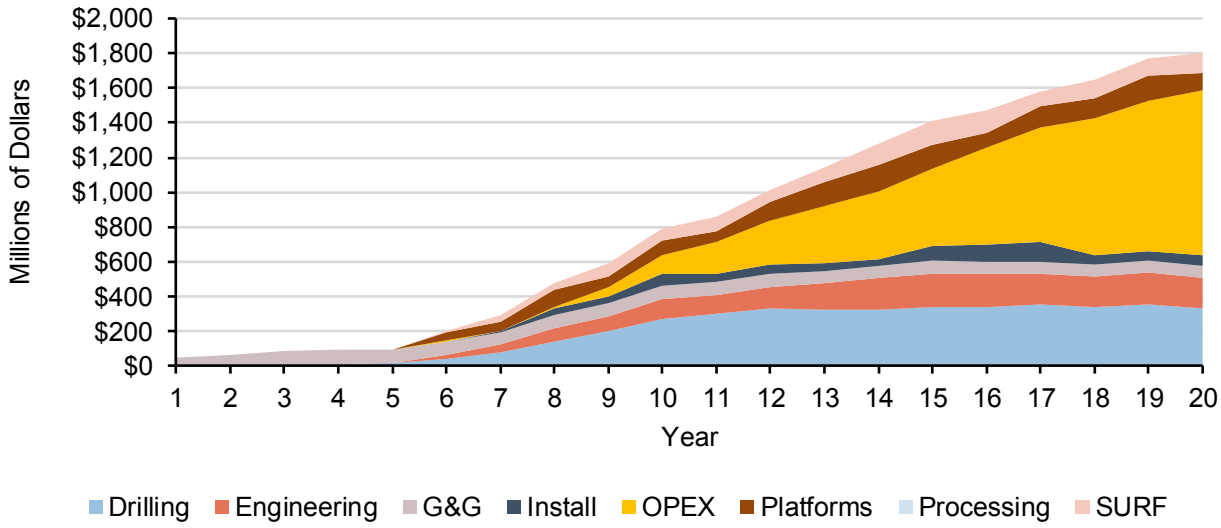
Source: Calash

Due to the distance of Texas from Eastern Gulf oil and natural gas exploration and production, under the scenario used in this report, Texas is not expected to see additional government revenues from Eastern Gulf activity.

5.3 Louisiana

Louisiana 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 Eastern Gulf. Spending in the state is projected to reach just over $1.8 billion per year at the end of the forecast period. Spending is expected to primarily be focused on drilling and operational expenditures. (Figure 23)

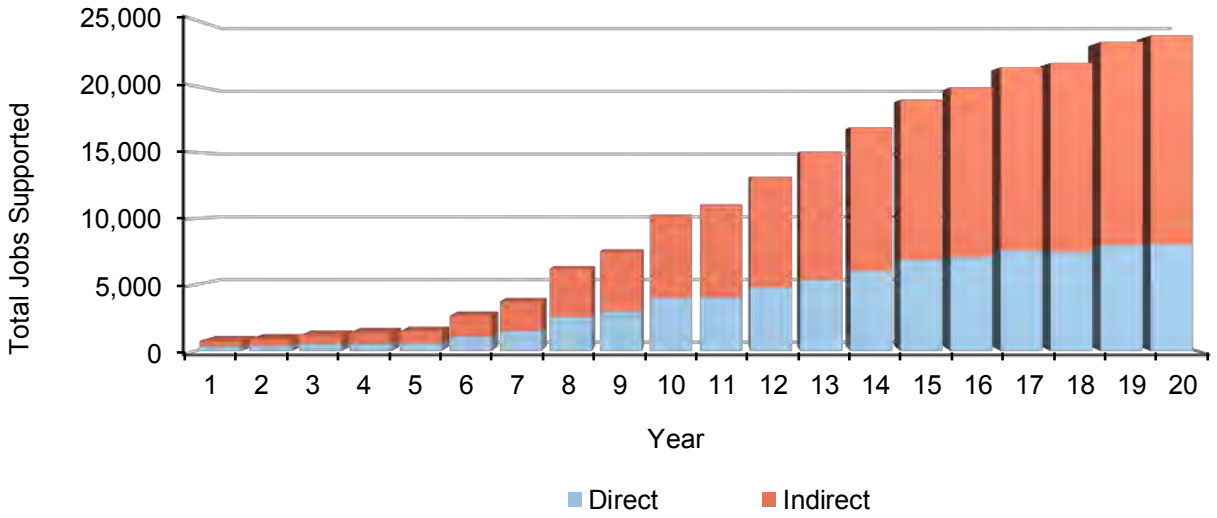
Figure 23: Projected Louisiana Spending by Sector ($ Millions per Year)



Source: Calash

Employment in Louisiana due to Eastern Gulf coast offshore oil and gas production is projected to reach nearly 24 thousand jobs at the end of the forecast period, with direct employment expected to reach over eight thousand jobs, and indirect and induced employment of nearly 16 thousand jobs expected in the same year. (Figure 24)

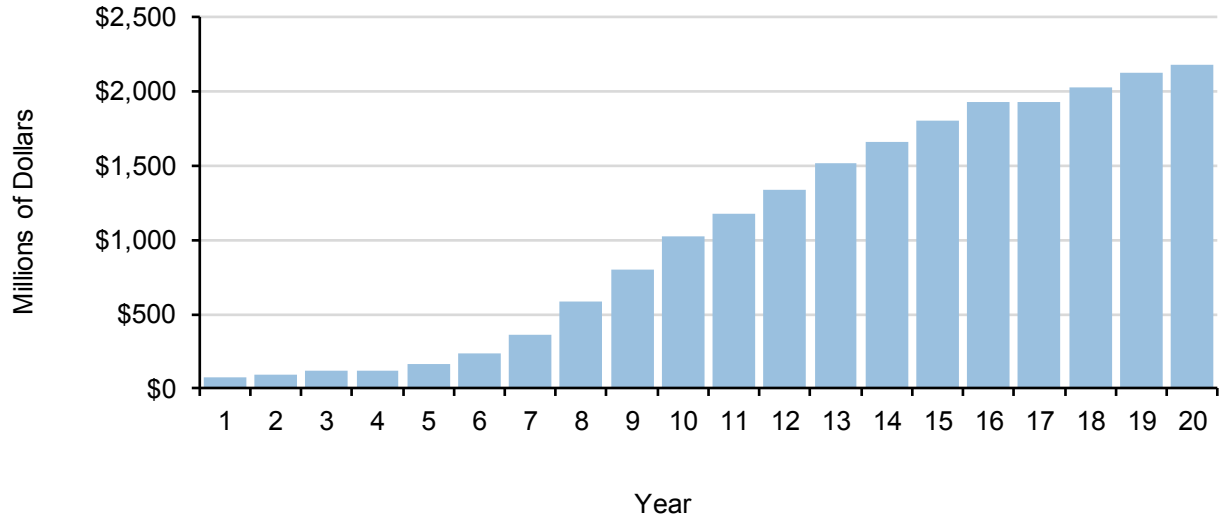
Figure 24: Projected Louisiana Employment Direct vs. Indirect and Induced



Source: Calash

At the end of the forecast period, contributions to the state economy from Eastern Gulf offshore oil and natural gas exploration and production in Louisiana are projected to reach nearly $2.2 billion per year. (Figure 25)

Figure 25: Projected Louisiana Contributions to the State Economy ($ Millions per Year)



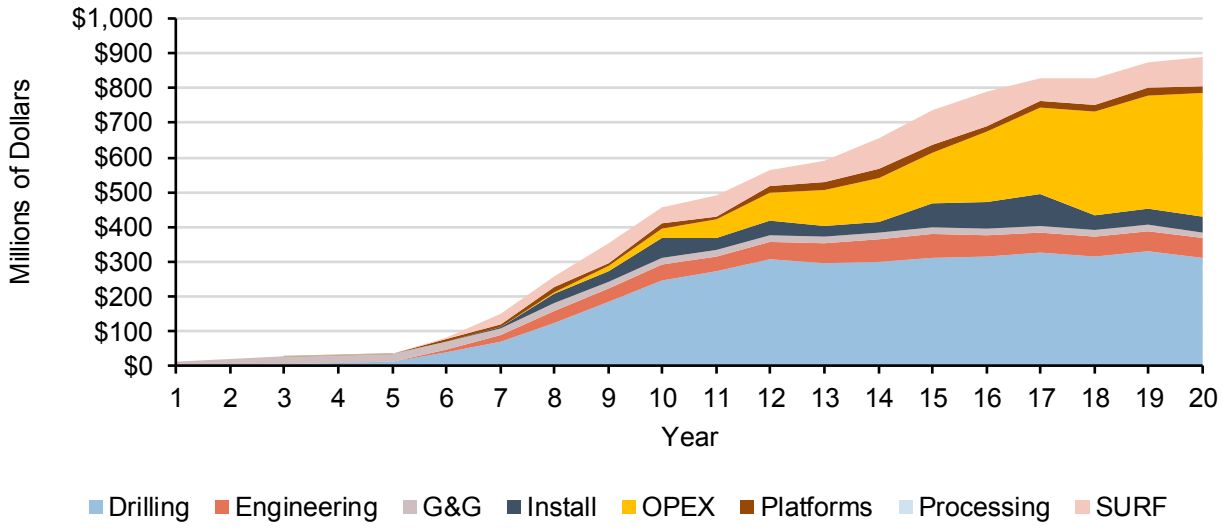
Source: Calash

Governmental revenues collected under a 37.5 percent state/federal revenue sharing agreement would be expected to create over $165 million per year in new revenues for the state of Louisiana at the end of the forecast period, with cumulative revenues across the forecast period projected to be over $1.4 billion. If a different revenue percentage were enacted, projected state revenues should be adjusted proportionally.

5.4 Alabama

Alabama is expected to receive the fourth highest levels of spending, employment, and contributions to its economy due to offshore oil and natural gas activity in the Eastern Gulf. Eastern Gulf oil and natural gas activity is estimated to lead to spending of around $890 million per year at the end of the forecast period. (Figure 26)

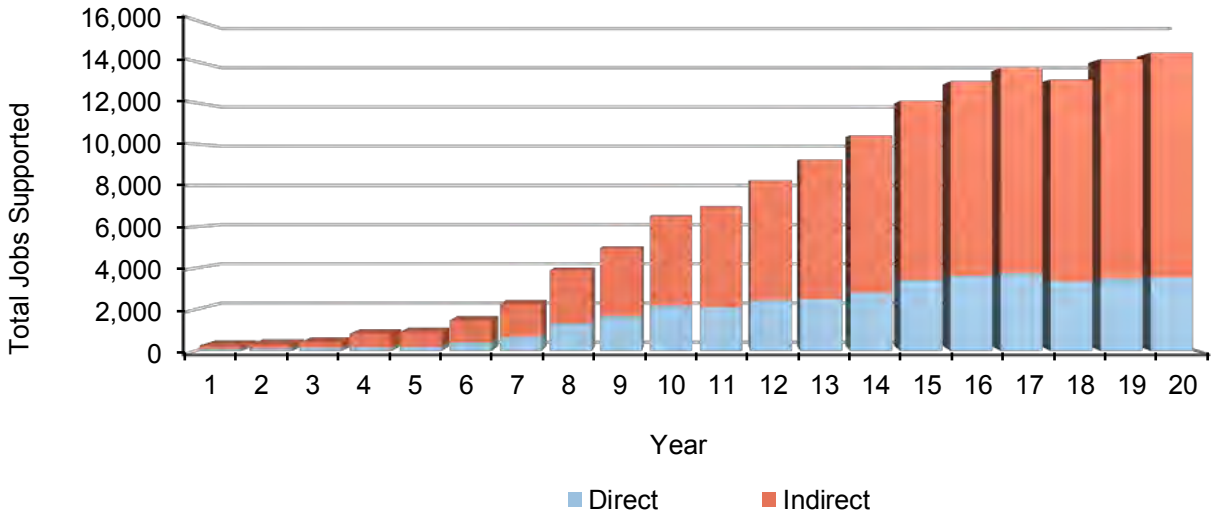
Figure 26: Projected Alabama Spending by Sector ($ Millions per Year)



Source: Calash

Employment in Alabama due to spending on Eastern Gulf offshore oil and natural gas development is projected to reach over 14 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 four thousand jobs at the end of the forecast period, with indirect and induced employment of over 10 thousand jobs expected in the same year. (Figure 27)

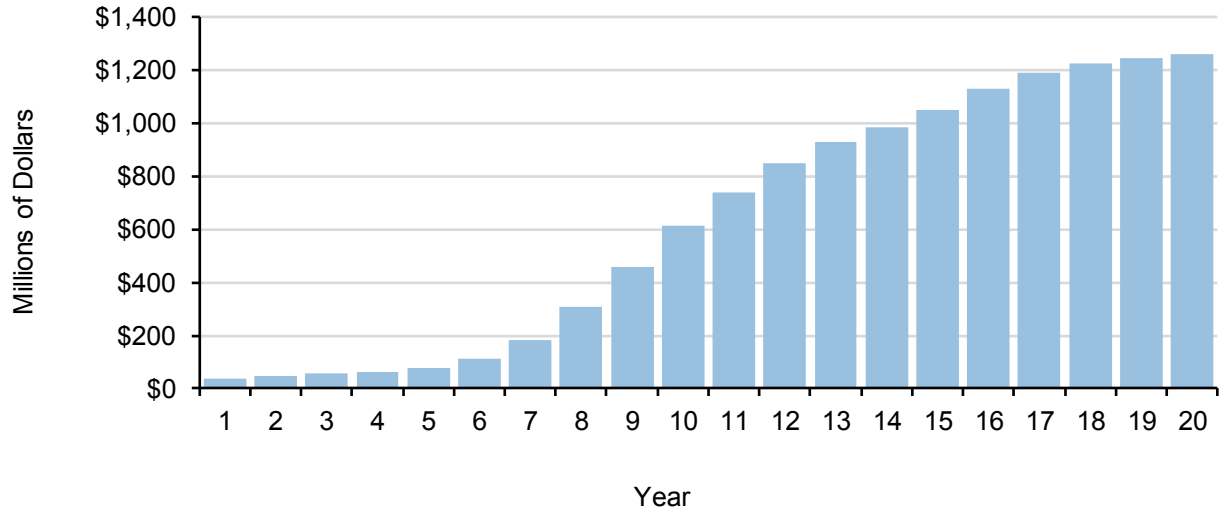
Figure 27: Projected Alabama Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Alabama's state economy due to spending by the Eastern Gulf oil and natural gas industry are projected to be over $1.2 billion per year at the end of the forecast period. (Figure 28)

Figure 28: Projected Alabama Contributions to the State Economy ($ Millions per Year)



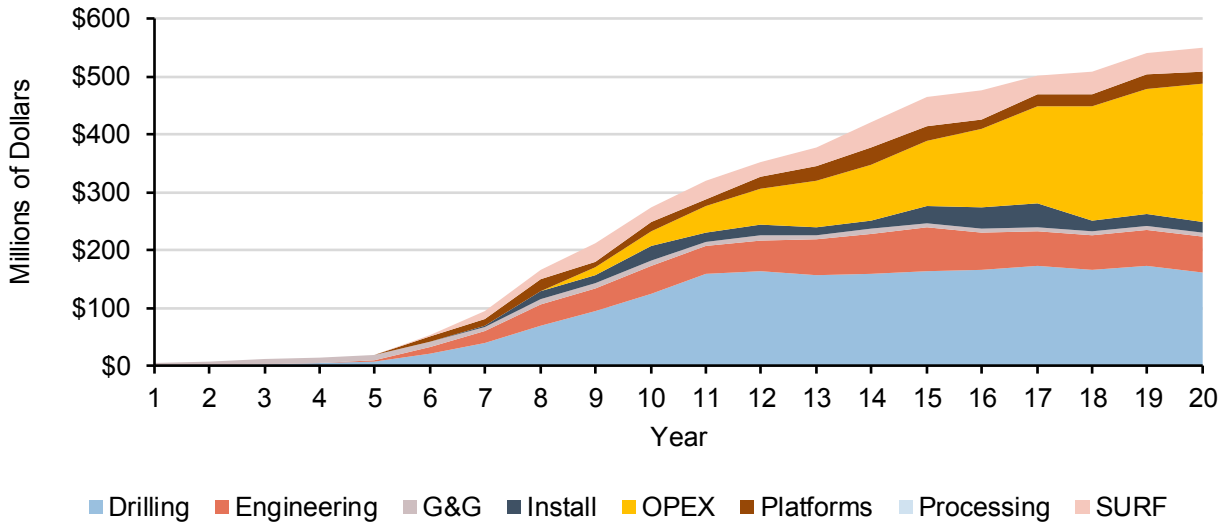
Source: Calash

With an assumed 37.5 percent revenue sharing agreement in place, Eastern Gulf oil and natural gas activities are projected to contribute over $270 million per year, and over $22.2 billion cumulatively to Alabama's budget at the end of the forecast period. If a different revenue percentage were enacted, projected state revenues would be adjusted proportionally.

5.5 Mississippi

Mississippi is expected to receive the fifth highest levels of spending, employment and gross domestic product due to offshore oil and natural gas activity in the Eastern Gulf. Spending in the state is projected to reach just around $550 million per year at the end of the forecast period. (Figure 29)

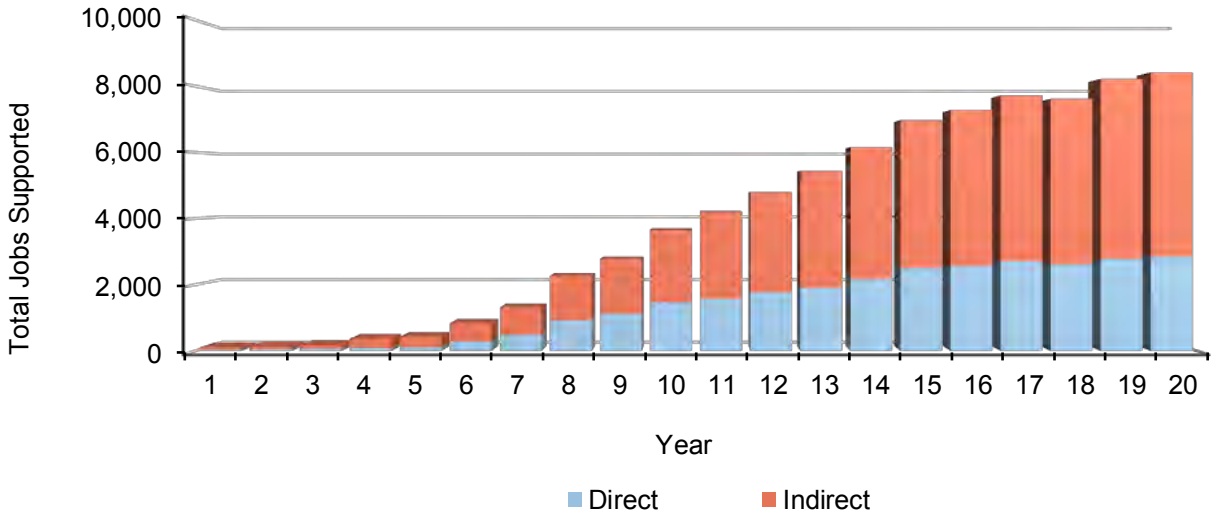
Figure 29: Projected Mississippi Spending by Sector ($ Millions per Year)



Source: Calash

Employment in Mississippi due to Eastern Gulf coast offshore oil and gas production is projected to reach over eight thousand jobs at the end of the forecast period, with direct employment due to offshore oil and natural gas exploration and production expected to reach nearly three thousand jobs at the end of the forecast period, and indirect and induced employment levels of over five thousand jobs expected in the same year. (Figure 30)

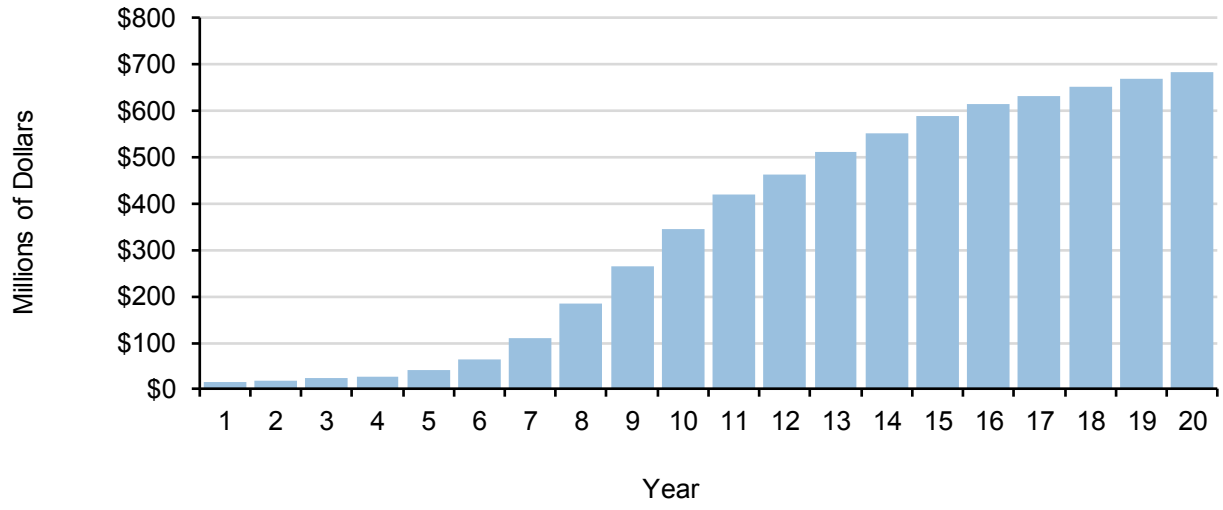
Figure 30: Projected Mississippi Employment Direct vs. Indirect and Induced



Source: Calash

Contributions to Mississippi's state economy due to spending on Eastern Gulf oil and natural gas exploration and development are projected to be over $680 million per year at the end of the forecast period. (Figure 31)

Figure 31: Projected Mississippi Contributions to the State the State Economy ($ Millions per Year)



Source: Calash

Governmental revenues collected under a 37.5 percent state/federal revenue sharing agreement would be expected to create over $120 million per year in new revenues for the state of Mississippi at the end of the forecast period, with cumulative revenues across the forecast period projected to be over $985 million.

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CALASH

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 percent[1] 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 Development[3,4]

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 percent[6] 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 billon 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 where 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 Provincce	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.

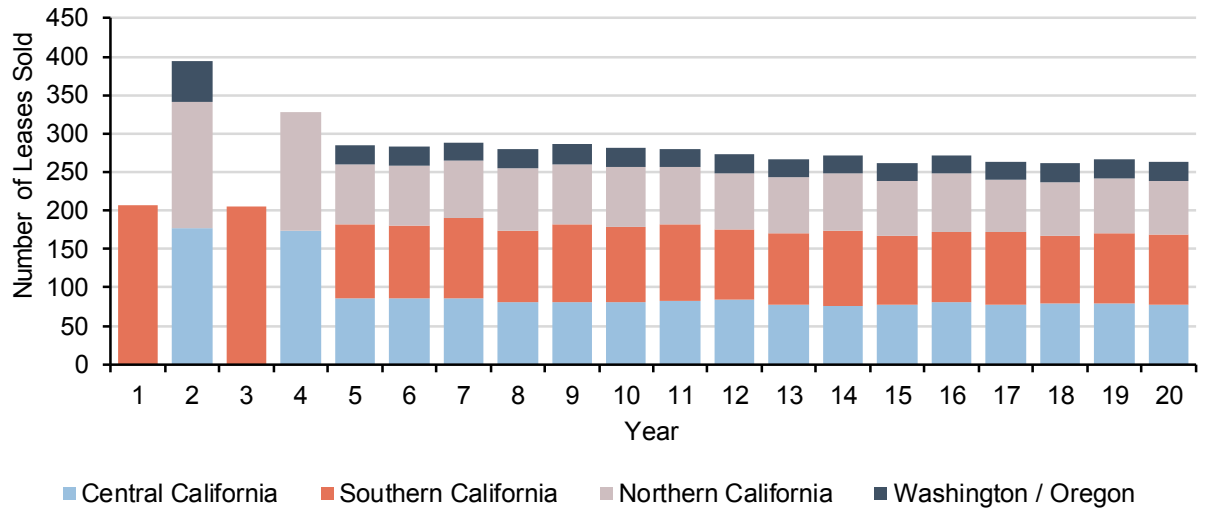
3.1 Seismic and Leasing Activity

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 OCS[9]



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

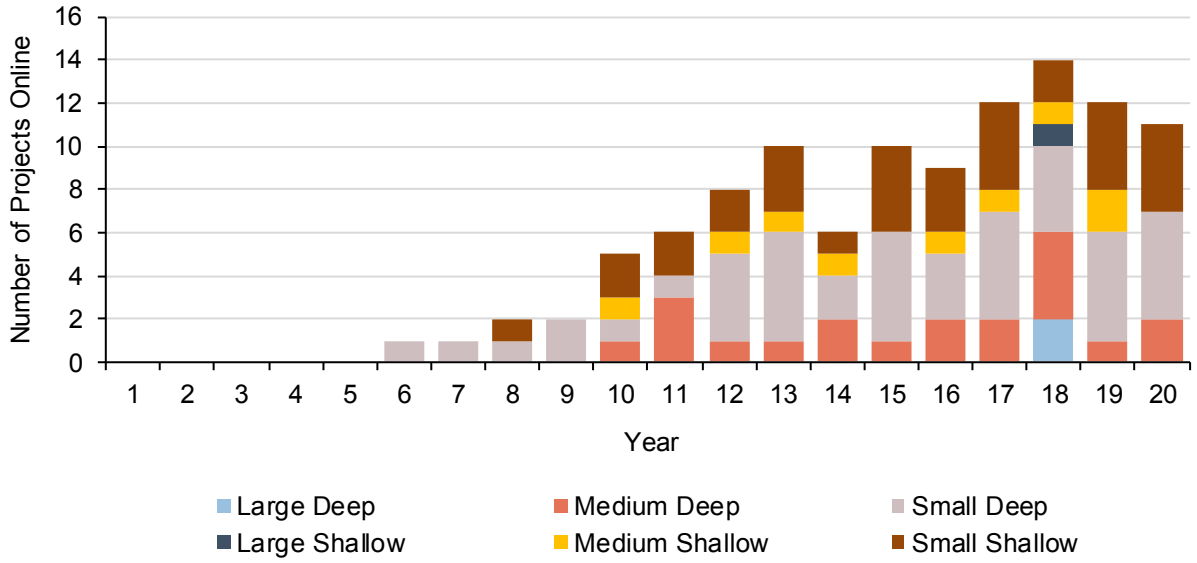
[9] Lease sales begin in year 1.

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

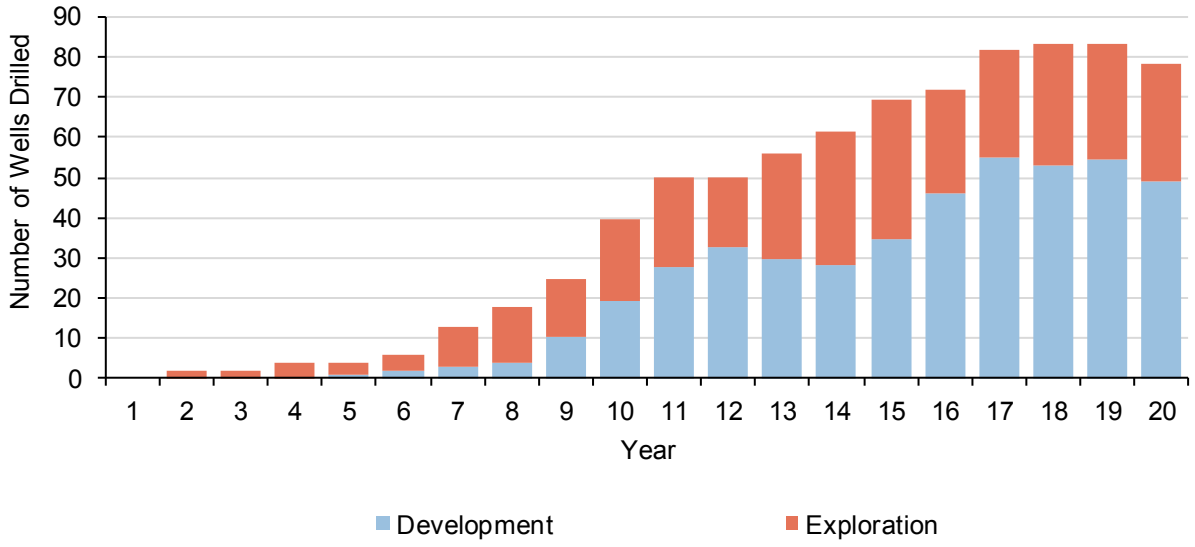
platforms and pipelines in the Southern California OCS could be used to develop new offshore projects.

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

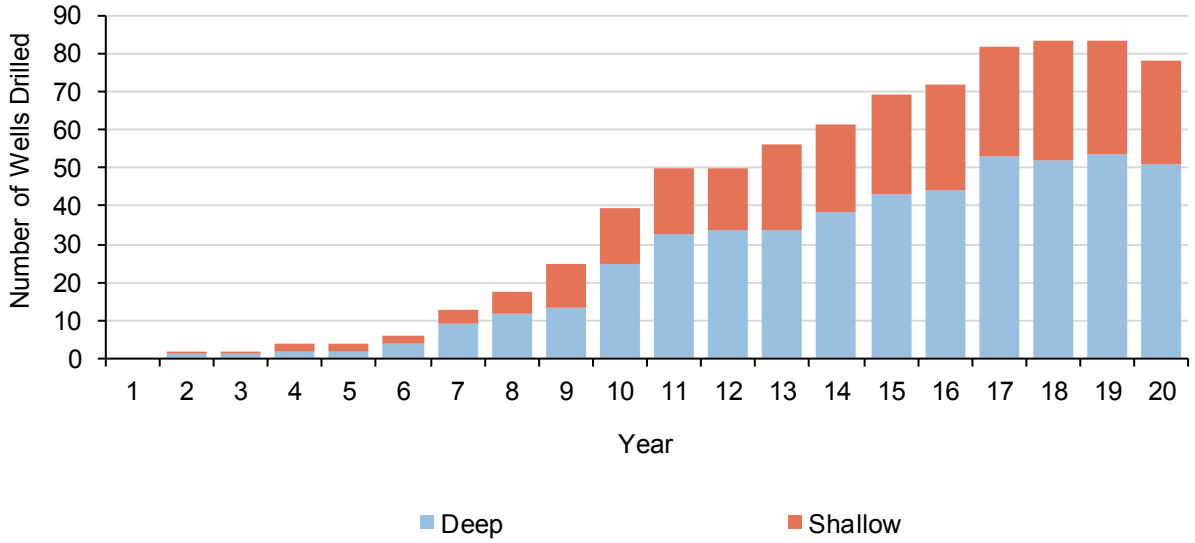


Source: Calash

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



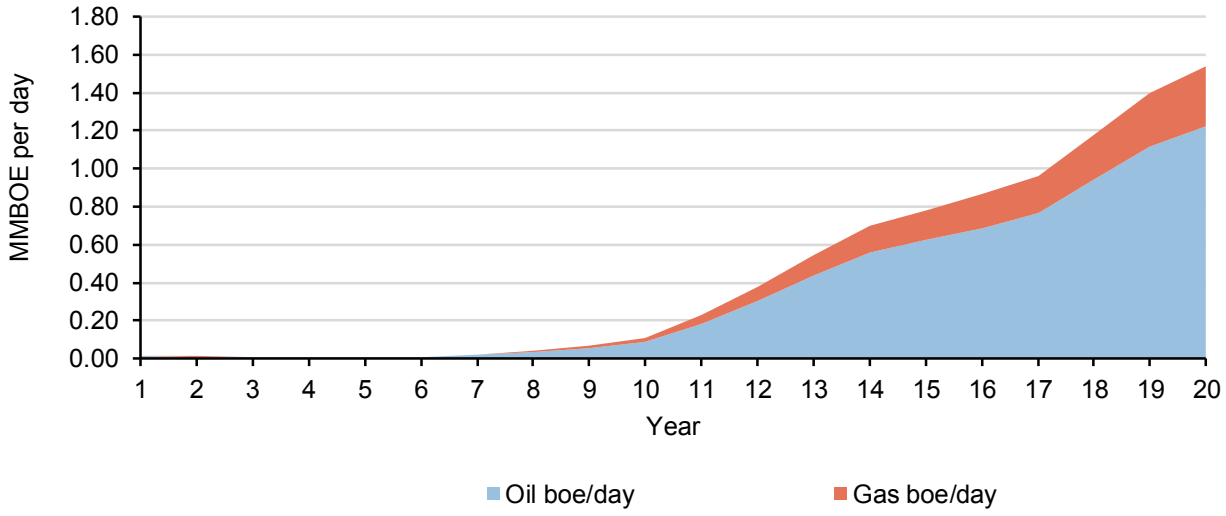
Source: Calash

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)

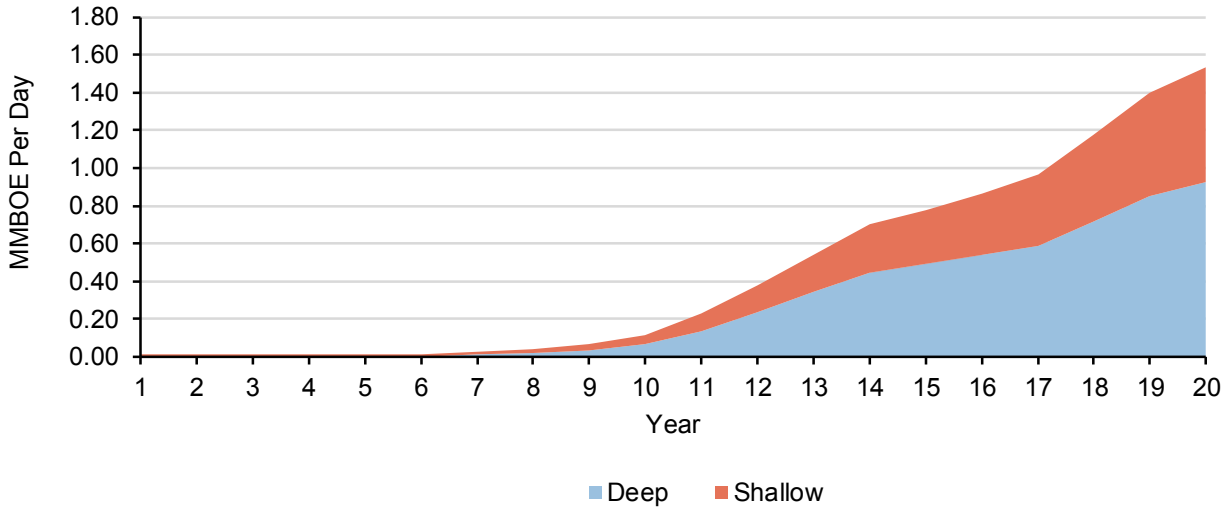
Figure 6: Projected Production by Type and Year



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.

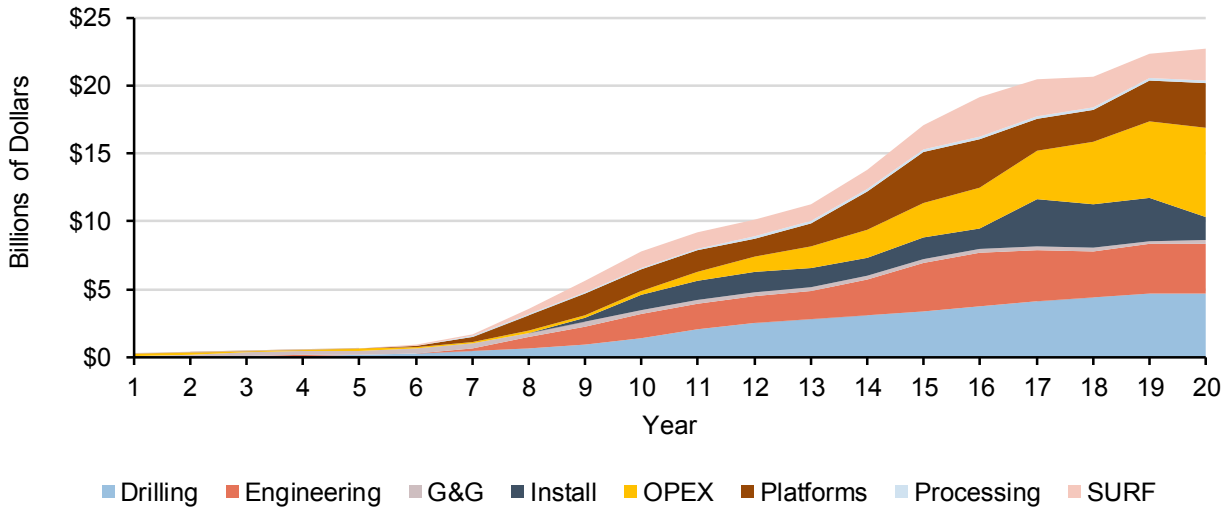
Given the expense and logistics requirements of offshore drilling, where rigs command large day rates in conjunction with high operational supply costs, drilling expenditures represent one of the largest sources of spending for any offshore project. Drilling expenditures across the forecast period, including 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,

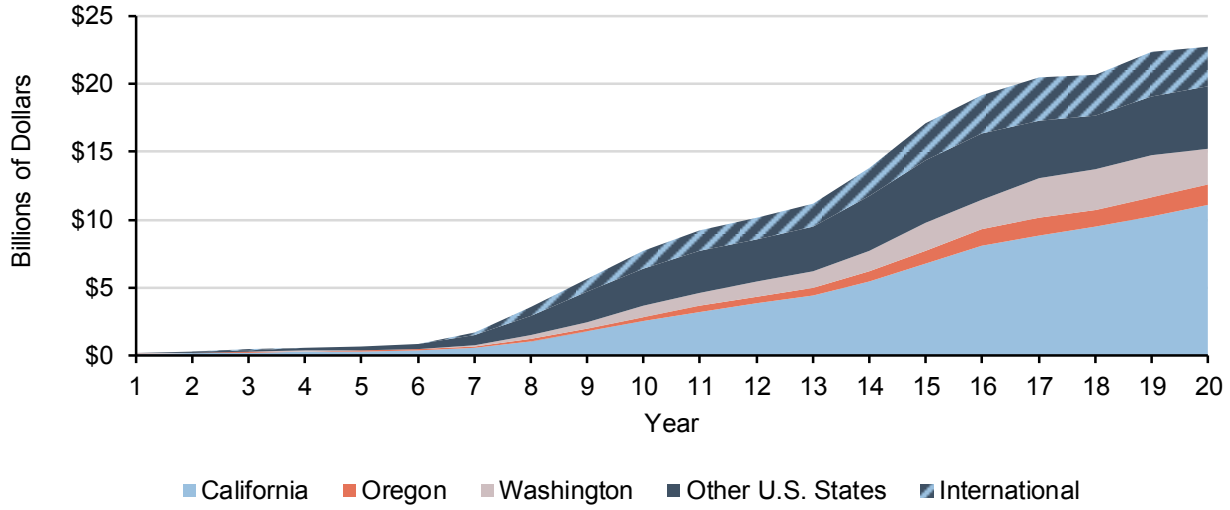
operational expenditures are expected to be nearly $700 million per year, and with OPEX spending projected to continue to climb to over $6.6 billion per year by the end of the forecast period.

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**

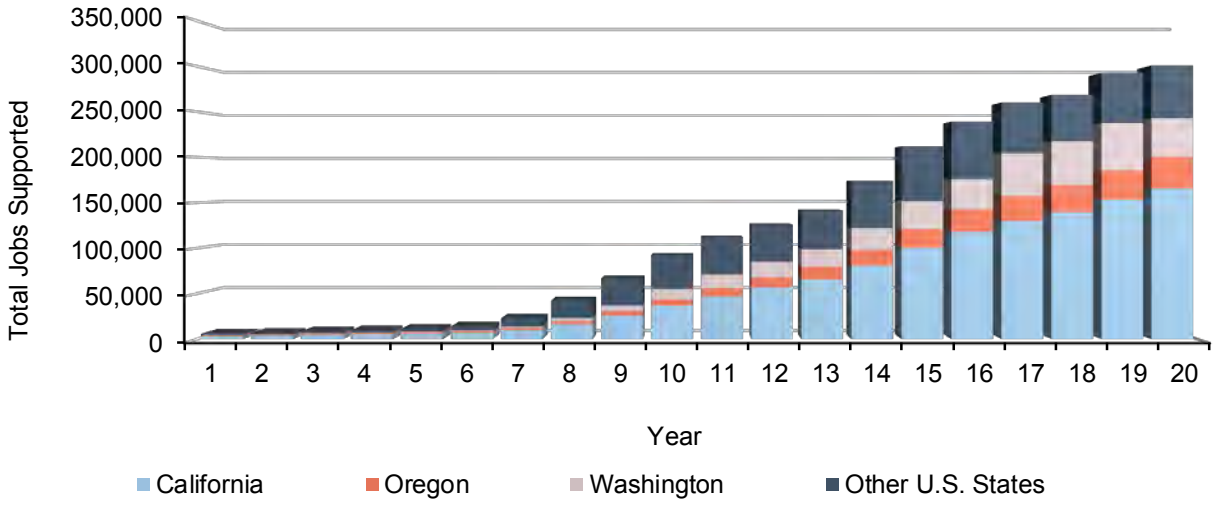
State	11	12	13	14	15	16	17	18	19	20
California	$3,217	$3,856	$4,403	$5,417	$6,809	$8,117	$8,886	$9,454	$10,264	$11,128
Oregon	$449	$522	$612	$760	$936	$1,179	$1,254	$1,312	$1,373	$1,487
Washington	$951	$1,060	$1,198	$1,522	$1,990	$2,191	$2,894	$2,927	$3,161	$2,647
Pacific Coast	$4,617	$5,437	$6,213	$7,699	$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

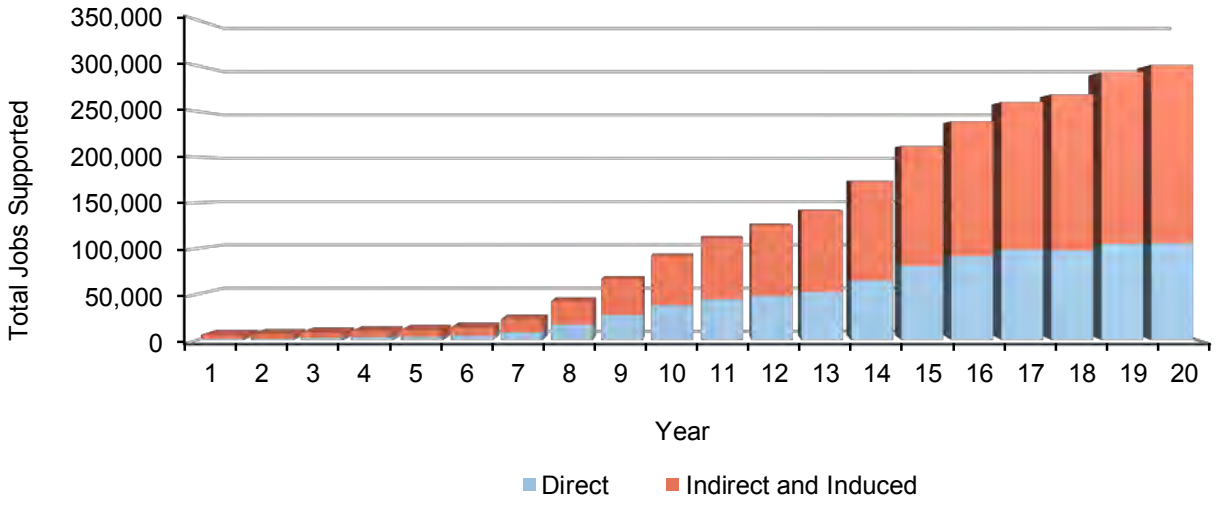


Source: Calash

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)

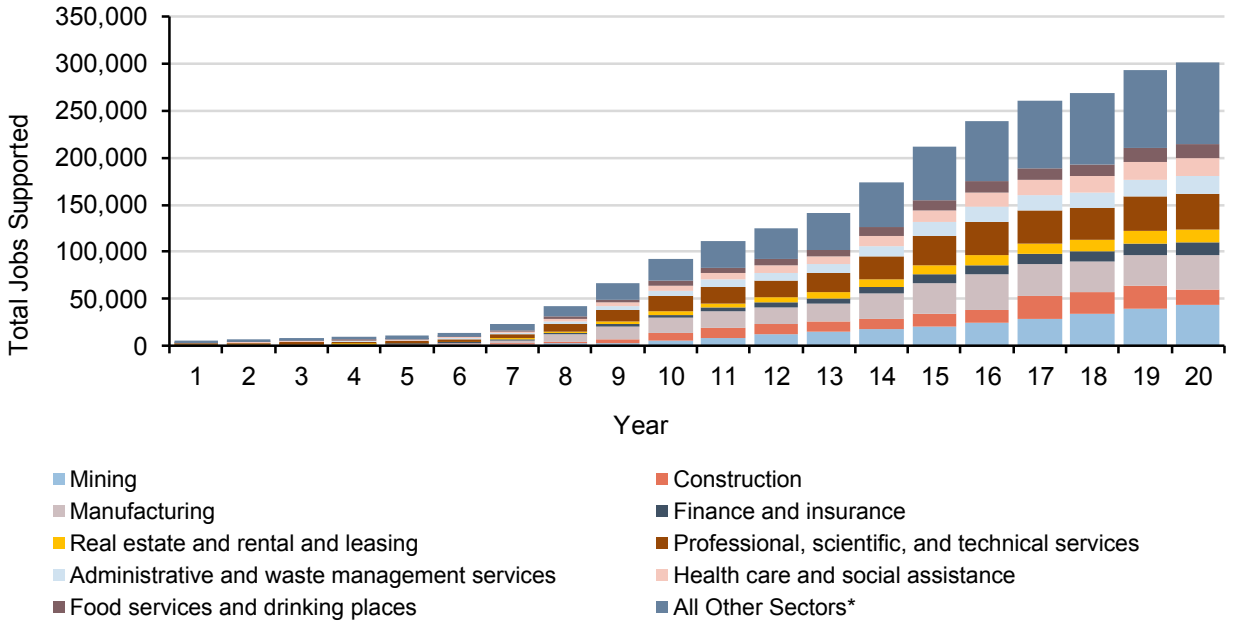
Figure 11: Projected Employment Direct vs. Indirect and Induced



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**

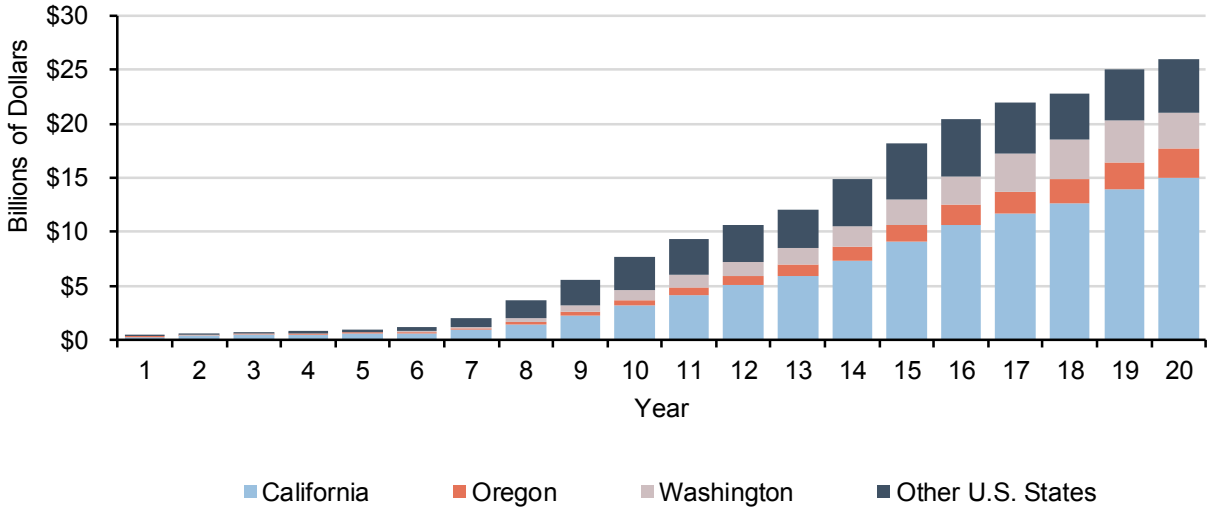
Source: Calash

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**

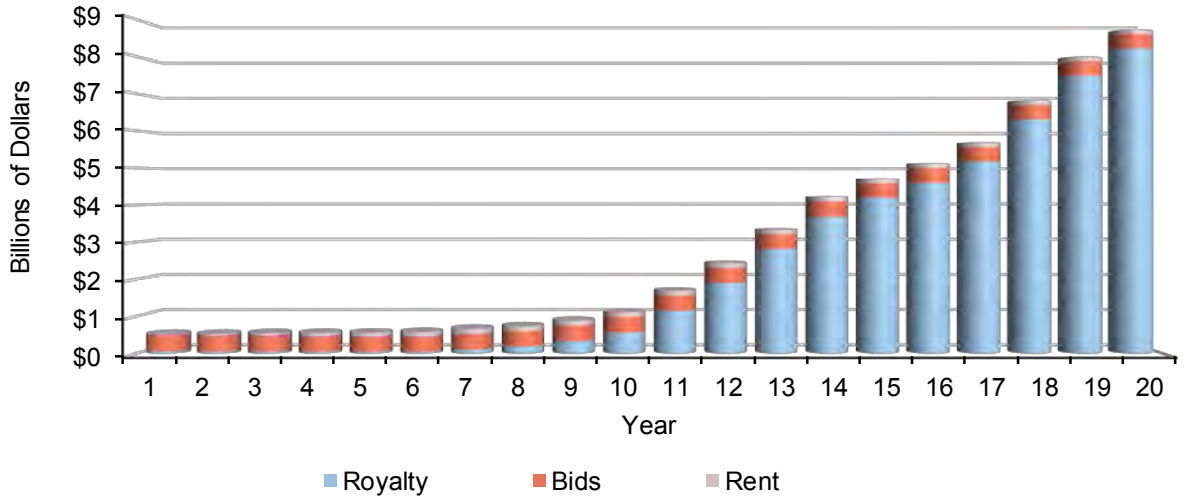
Source: Calash

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)

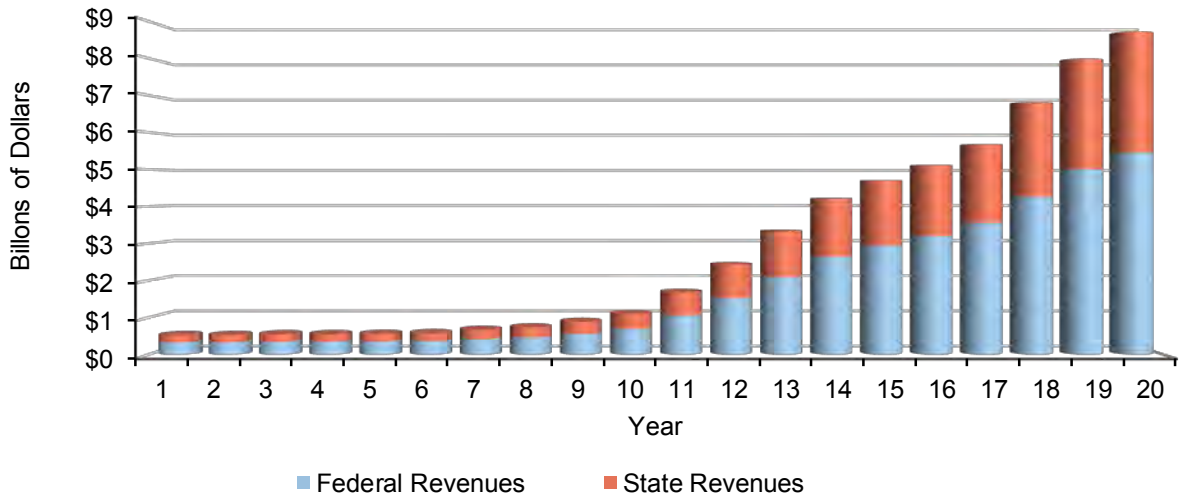
Figure 14: Projected Government Revenues – Rentals, Royalties, and Bonus Bid ($ Billions)



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 state[12] 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

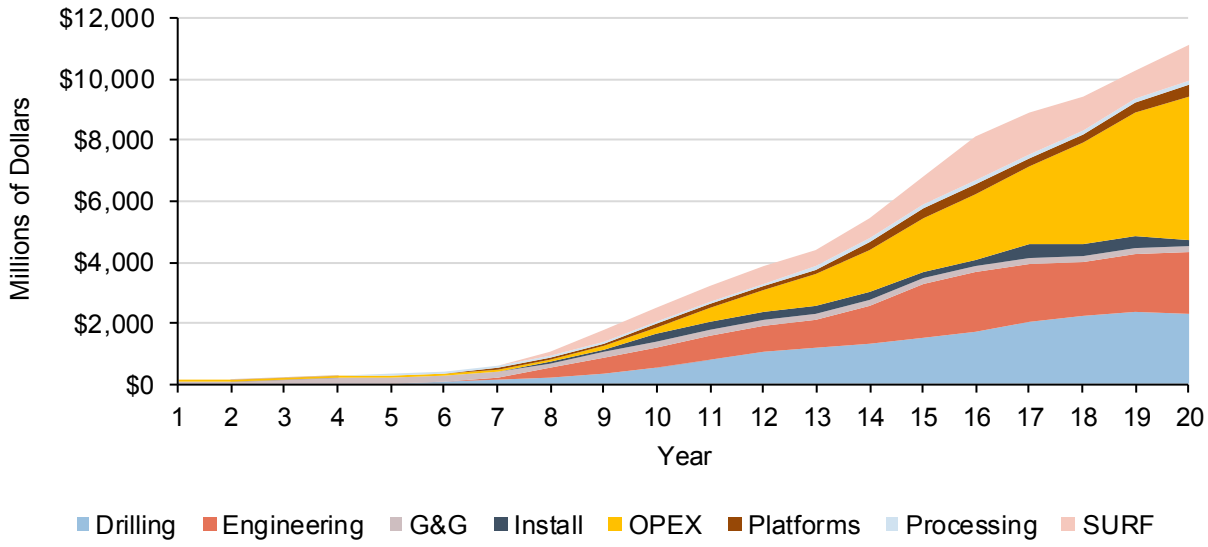
5.1 States Results

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)



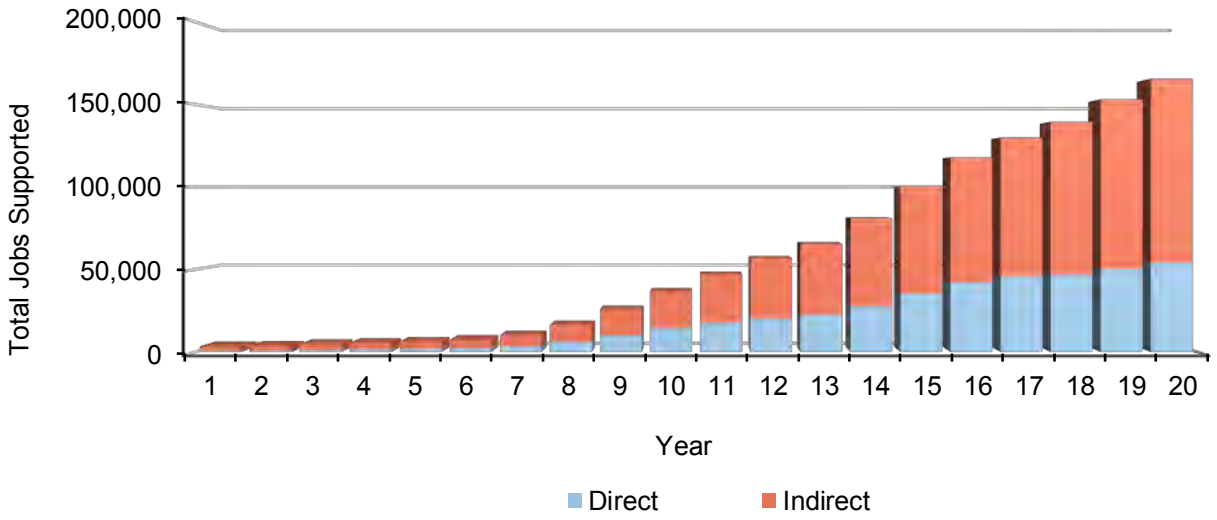
Source: Calash

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)

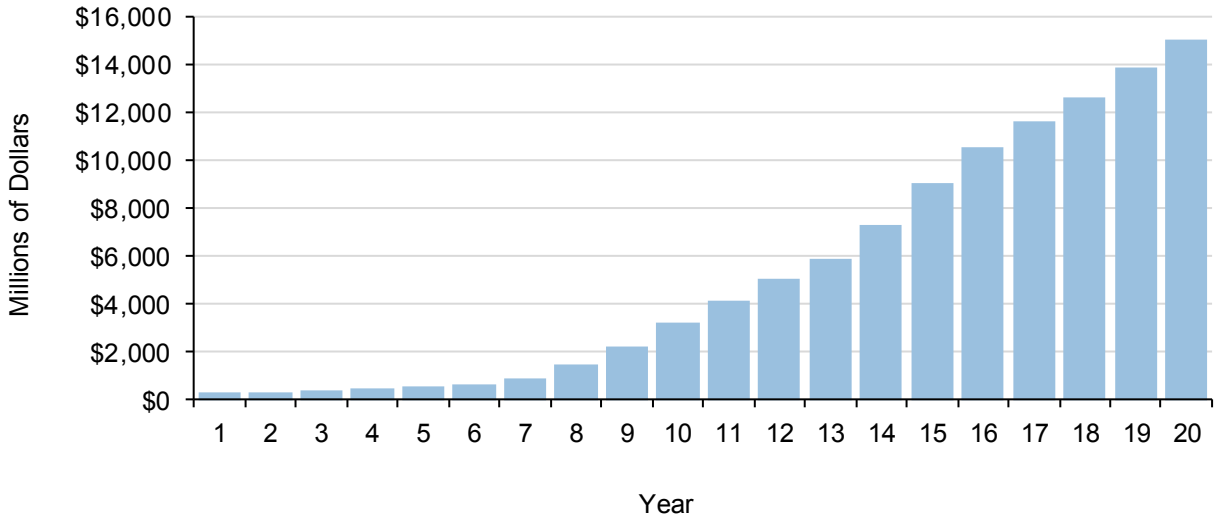
Figure 17: Projected California Employment Direct vs. Indirect and Induced



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)



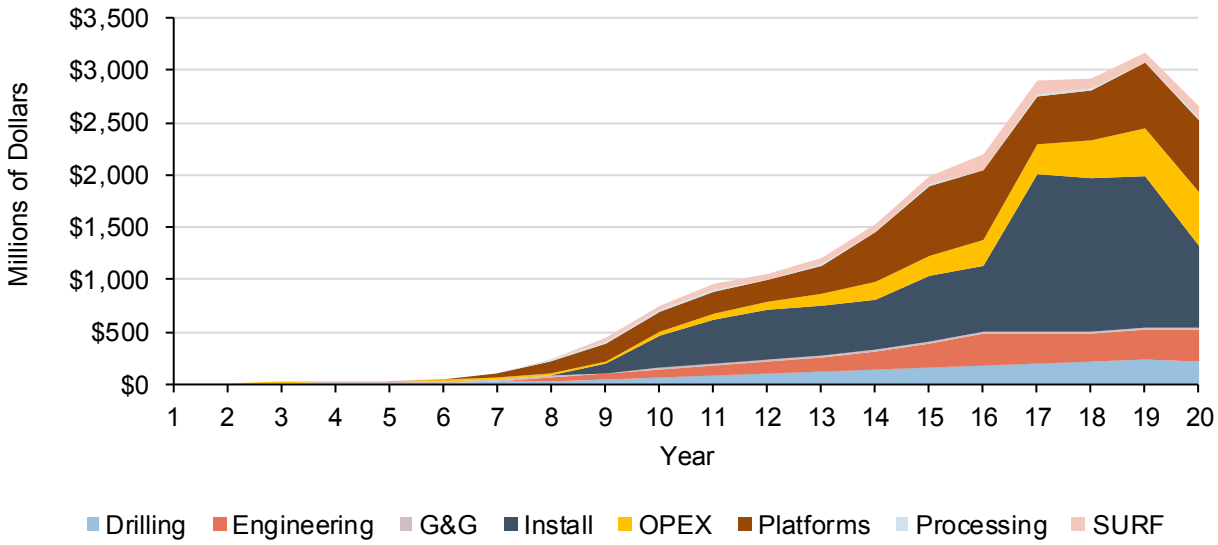
Source: Calash

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)

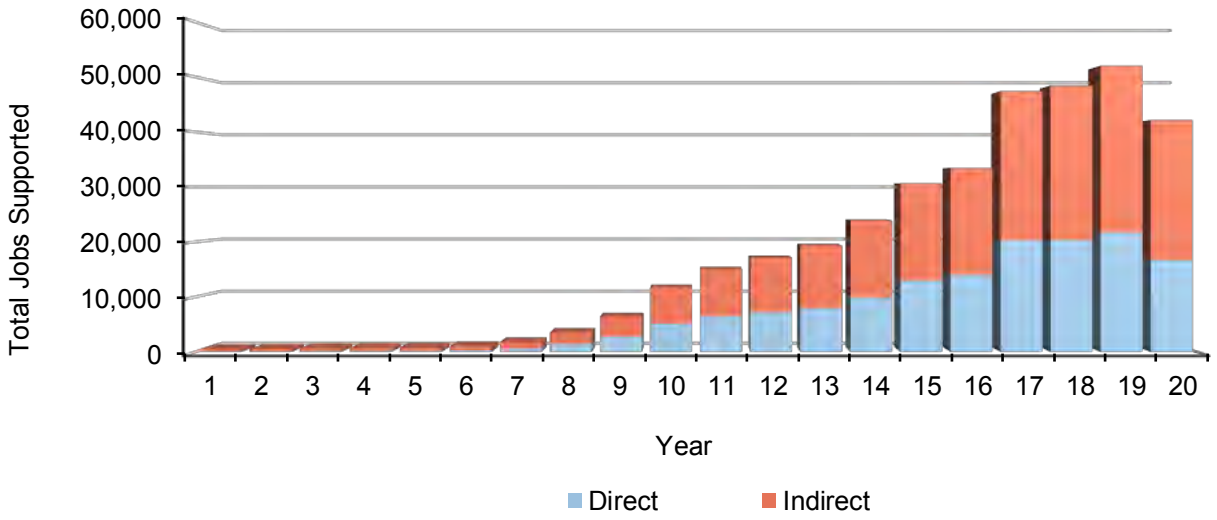


Source: Calash

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)

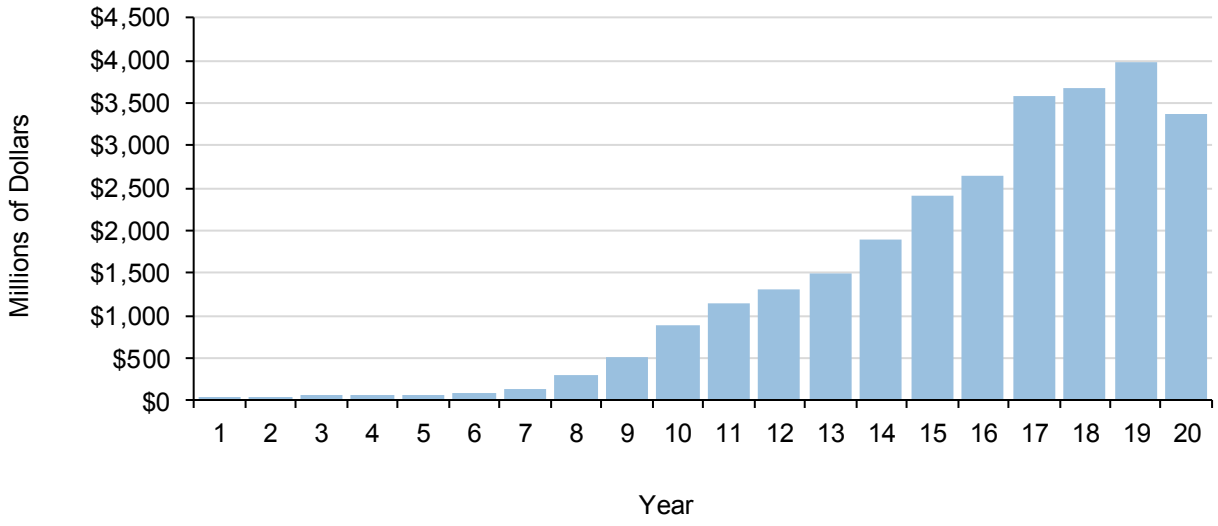
Figure 20: Projected Washington Employment Direct vs. Indirect and Induced



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

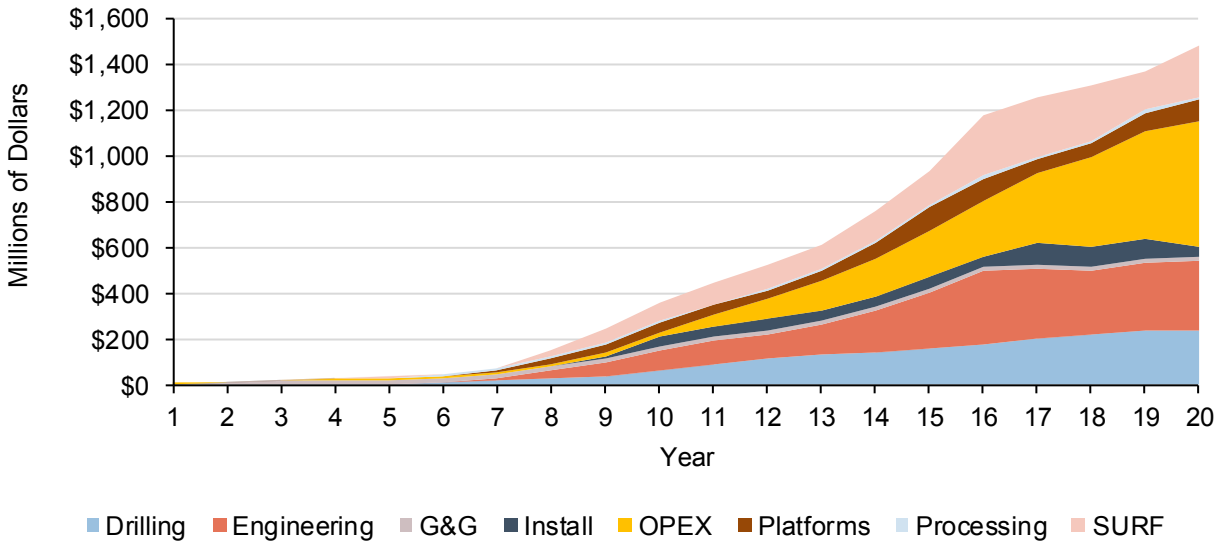
With an assumed 37.5 percent revenue sharing agreement in place, Pacific Coast oil and natural gas activities are projected to contribute nearly $450 million per year to Washington's budget at the end of the forecast period; cumulative contributions across the forecast period are

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)

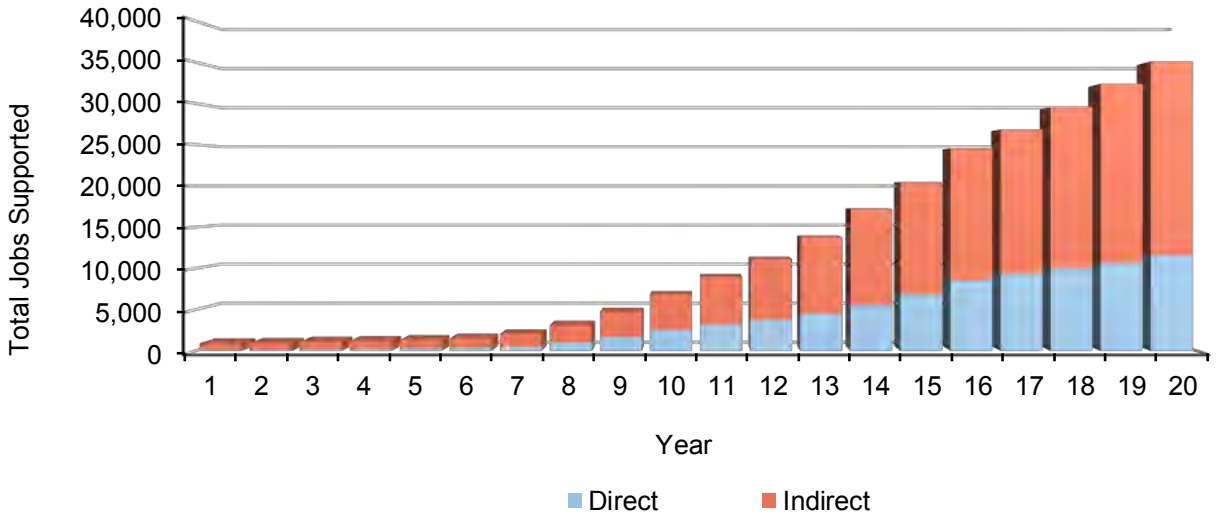


Source: Calash

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)

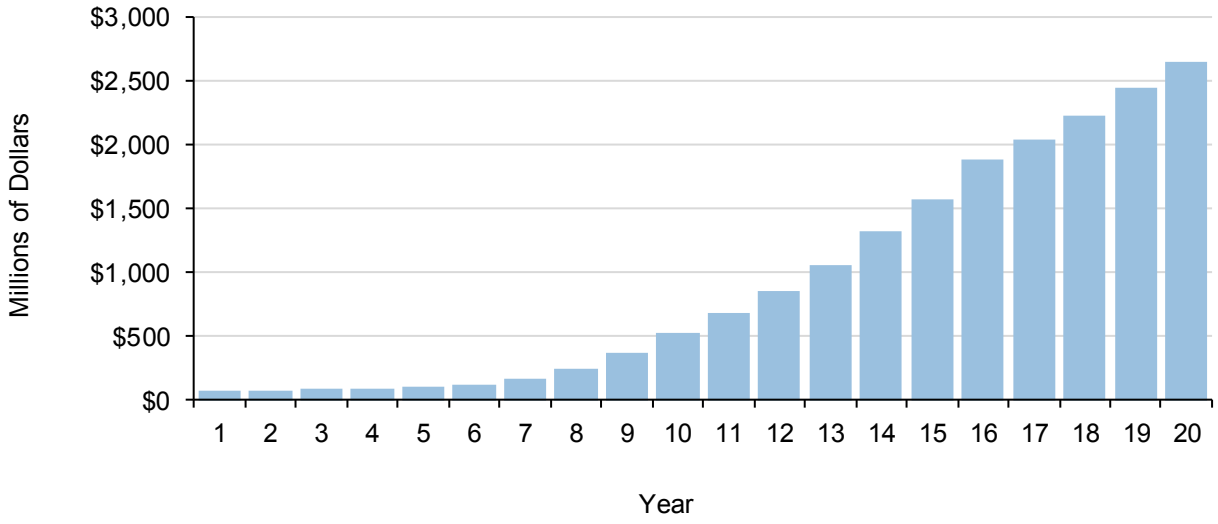
Figure 23: Projected Oregon Employment Direct vs. Indirect and Induced



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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Potential Economic Benefits of Future Exploration, Development, and Production of Petroleum Resources in Alaska OCS Areas

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American Petroleum Institute

March 2018

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Abbreviations

AEO	Annual Energy Outlook
API	American Petroleum Institute
BBL	Billion barrels
BCF	Billion cubic feet
BOEM	Bureau of Ocean Energy Management
CY	Calendar year
E&D	Exploration, Development, and Production Activities
EIS	Environmental Impact Statement
EIA	Energy Information Administration
GOA	Gulf of Alaska
MODU	Mobile Offshore Drilling Unit
NEI	Northern Economics, Inc.
NOAA	National Oceanic and Atmospheric Administration
NPR-A	National Petroleum Reserve-Alaska
NSB	North Slope Borough
OCS	Outer Continental Shelf
PI+	Policy Insight+
QA/QC	Quality Assurance/Quality Control
REMI	Regional Economic Models Inc.
TAPS	Trans-Alaska Pipeline System

Executive Summary

This study quantifies the potential economic benefits of petroleum development in selected Alaska OCS planning areas, particularly the Beaufort Sea, Chukchi Sea, Cook Inlet, and Gulf of Alaska. In order to quantify the potential economic effects of petroleum development, a set of scenarios were developed that reflect possible industry-wide exploration, development, and production activities (E&D scenarios) for each of the planning areas, following the leasing schedule proposed by the Bureau of Ocean Energy Management (BOEM) in their next 5-Year Program. The scenarios represent only a possible picture of the future. It is likely that different activities and timing will occur in the future, as each company operating in these basins would have unique plans about how to identify and recover the hydrocarbon resources. It is difficult to anticipate what the actual development pattern would be, but the scenarios presented here provide a reasonable basis to begin thinking about potential economic effects.

The scenarios in this study reflect the current regulatory structure that is in place for the Alaska OCS areas, which includes the additional environmental regulations governing the Arctic OCS planning areas (Beaufort Seas and Chukchi Sea) that apply to exploratory drilling activities that use mobile drilling units and related operations during open-water season. Some of these additional regulations could significantly increase the costs of exploration activities and could also cause delays in drilling activities, possibly deferring production and reducing the net present value of petroleum production. These additional regulations are considered more stringent compared to the rules that apply to other OCS areas. On April 2017, the current administration issued an Executive Order to implement an America-First Offshore Energy Strategy. The order lifts leasing withdrawals imposed on Alaska's Arctic, directs the Department of the Interior to conduct a review of the areas available for leasing, and directs a review of certain regulations governing offshore development. Specifically for Alaska, the Executive Order includes the following aspects:

- Erases Arctic 12(a) Withdrawals. Nullifies President Obama's indefinite withdrawal of the Chukchi Sea and large areas of the Beaufort Sea from oil and gas leasing.
- Potential for Leasing. Calls for a review of the existing schedule of offshore lease sales (BOEM's outer continental shelf five-year lease sale plan, 2017-2022) and directs the Secretary of the Interior to consider whether new sales should be added for the Beaufort and Chukchi leasing areas. The President has ordered the Department of the Interior to consider revising its lease sale program to include at least one sale per year in each of the Chukchi Sea and the Beaufort Sea.
- More Reasonable Regulation. Requires the reconsideration and potential revision of the Arctic rule, the Well Control Rule, and other regulations imposed by the previous administration.

In the event that the regulatory structure changes consistent with the current administration's intent, it is possible that industry interest and levels of investment in the Alaska Arctic OCS areas could be higher than the levels considered in this analysis and could subsequently lead to more economic benefits.

The scenarios used for this study are based on E&D scenarios considered by BOEM in their environmental analysis of previous lease sales in the Beaufort Sea, Chukchi Sea, Gulf of Alaska and Cook Inlet OCS areas, BOEM's latest resource assessments, as well as information from previous Northern Economics studies related to offshore and onshore petroleum development.

These E&D scenarios are the basis for projecting the level of manpower requirements (direct oil and gas employment) and the level of industry investment or spending. Industry spending associated with E&D activities is projected to generate economic benefits to Alaska and to the rest of the nation. Direct spending also generates stimulus effects (or multiplier effects) in the economy.

The economic benefits of potential petroleum development are measured in terms of employment, income, and government revenues. The timeframe of the analysis covers the proposed 5-year leasing program plus 20 years after the leasing period.

The following are the key findings of the study:

- **Direct Industry Spending**

Table ES-1 shows the projected direct industry spending associated with the exploration, development, and production activities for each of the planning areas. The Chukchi Sea and the Beaufort Sea are high cost areas given the remote location, lack of infrastructure, and the need for a sizable discovery to economically justify the investments in the area. These areas would require more manpower and equipment to support the exploration and development activities. The projected total industry spending over the timeframe considered in this study amounts to about $53.4 billion.

Table ES-1. Total Projected Direct Industry Spending by Alaska OCS Planning Area, in millions of 2016 $

Alaska OCS Planning Area	Amount
Beaufort Sea	$17,500
Chukchi Sea	$28,240
Gulf of Alaska	$2,490
Cook Inlet	$5,170
Total	**$53,400**

Source: Northern Economics estimates.

- **Employment and Labor Income Effects**

Table ES-2 summarizes the projected total annual average employment in the U.S. (Alaska and the rest of the U.S.) associated with the potential future petroleum development activities in the selected Alaska OCS planning areas. Petroleum development in these areas could generate up to about 13,500 jobs per year.

Of the total U.S. jobs, about 53 percent of the jobs are projected to be in Alaska and 47 percent are projected to be in the rest of the U.S. These jobs include direct, indirect, and induced jobs. Direct jobs (both on-site and offsite) involve jobs in exploration activities, construction of offshore and onshore production and transportation facilities, spill prevention, logistics, and operations and maintenance activities. Besides the direct jobs in the oil and gas sector, jobs are also projected to be created in other sectors of the economy; these jobs are referred to as indirect and induced jobs. These jobs are projected to be generated as a result of the multiplier effects of industry spending—industry purchases from businesses in and outside of Alaska, government spending of OCS-related revenues, and household spending of wages and salaries.

Table ES-3 shows the projected total annual average labor income associated with the direct, indirect, and induced jobs generated.

Table ES-2. Total Projected U.S. Annual Average Employment Effects by Alaska OCS Planning Area

Alaska OCS Planning Area	Number of Jobs
Beaufort Sea	4,840
Chukchi Sea	6,000
Gulf of Alaska	860
Cook Inlet	1,750
Total	**13,450**

Source: Northern Economics estimates.

Table ES-3. Total Projected U.S. Annual Average Labor Income Effects by Alaska OCS Planning Area, in millions of 2016 $

Alaska OCS Planning Area	Amount
Beaufort Sea	$297.9
Chukchi Sea	$378.4
Gulf of Alaska	$50.6
Cook Inlet	$101.7
Total	**$828.6**

Source: Northern Economics estimates.

- **Direct Petroleum Revenues**

Federal, state, and local governments are projected to directly benefit from offshore petroleum development with potential streams of revenue from property tax revenues, corporate income tax revenues, additional state revenues from additional throughput on the Trans Alaska Pipeline System (TAPS), and federal royalty payments.

Property taxes are projected to be generated primarily from new onshore facilities built to support the offshore operations of the industry. The State of Alaska collects a property tax on oil and gas related facilities within its boundaries which it shares with local political jurisdictions where those facilities are located, if the local government chooses to impose a property tax. The State of Alaska also imposes a corporate income tax on petroleum activity within the state. The federal government collects revenues from royalty payments from the offshore activity. Additional volumes of oil (from petroleum production in the Beaufort Sea and the Chukchi Sea) in the TAPS system would lower the pipeline tariff and would therefore result in a higher oil netback price, which is the basis for determining state royalty payments on oil resources extracted from state lands.

Table ES-4 summarizes the projected annual average and total government revenues accrued over the analysis timeframe for the selected planning areas. Total cumulative government revenues could amount to about $37.5 billion. As noted above, government revenues include royalty payments paid to the Federal government and in certain cases to the state government (for production in the 8(g) zone), state corporate income taxes, and property taxes paid to the State of Alaska and local governments. On an annual average basis, total government take could add up to about $2.7 billion per year.

Table ES-4. Projected Annual Average & Total Government Revenues by Alaska OCS Planning Area, in millions of 2016 $

Alaska OCS Planning Area	Annual Average Revenues	Total Revenues
Beaufort Sea	$569.4	$9,116.4
Chukchi Sea	$1,892.7	$24,738.8
Gulf of Alaska	$80.6	$887.2
Cook Inlet	$161.4	$2,752.8
Total	**$2,704.1**	**$37,495.3**

Source: Northern Economics estimates.

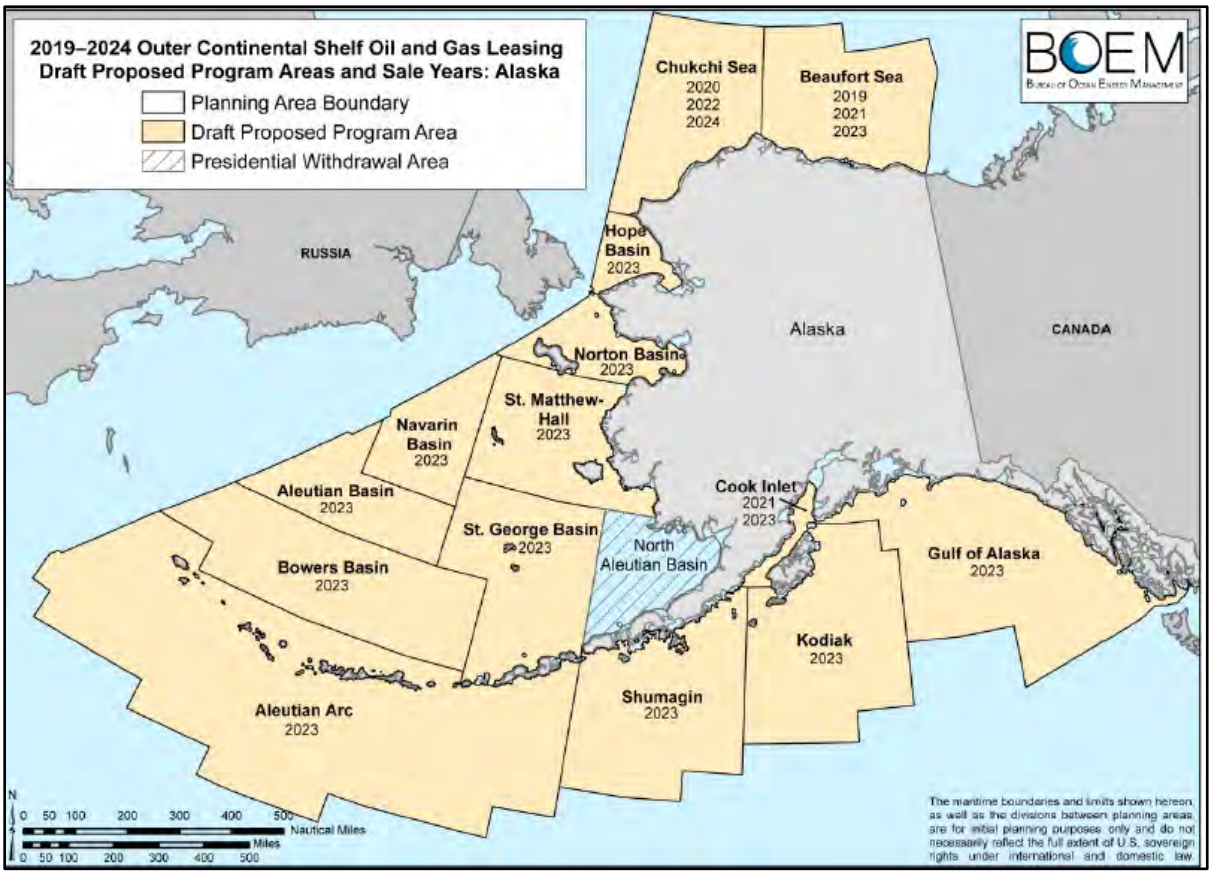
1 Introduction

The Department of the Interior's Bureau of Ocean Energy Management released its "Draft Proposal on OCS Lease Sales for 2019-2024" in January of this year. This study was requested by the American Petroleum Institute to evaluate the potential economic benefits of future exploration, development, and production of oil and gas resources in the Alaska OCS areas consistent with the Department of the Interior's proposed Five-Year OCS leasing schedule. The chosen option for the Alaska Region Program includes the following:

- Three sales in the Beaufort Sea Planning Area in 2019, 2021, and 2023;
- Three sales in the Chukchi Sea Planning Area in 2020, 2022, and 2024;
- Two sales in the Cook Inlet Planning Area in 2021 and 2023; and
- One sale each in the other Alaska OCS Planning Areas.

Figure 1 shows the various Alaska Region Planning areas and the proposed leasing schedule.

Figure 1. 2019-2024 Draft Proposed Alaska Region Program Area



Source: Bureau of Ocean Energy Management.

While the draft Five-Year Program includes all the Alaska OCS planning areas, except for the North Aleutian Basin, which is still under moratorium since December 2014, this study focuses only on potential development in the following four OCS planning areas where there has been recent industry interest and where there are estimated to be sizable undiscovered economically recoverable resources: 1) Beaufort Sea; 2) Chukchi Sea; 3) Cook Inlet; and 4) the Gulf of Alaska.
Both the Beaufort Sea and the Chukchi Sea are in the Arctic OCS. Alaska's OCS Arctic region has been estimated to contain vast petroleum resources. According to the U.S. Department of the Interior, the Beaufort and Chukchi seas together are projected to hold 23.6 billion barrels of oil and 104.4 trillion cubic feet of natural gas (BOEM, 2016). Petroleum development in these areas, if conditions allow, could generate substantial economic benefits to Alaska and the rest of the United States. Development in the Alaska Arctic OCS areas however, has proven to be challenging for the petroleum industry due to a variety of reasons including environmental, economic, and regulatory factors. The environmental conditions in the Arctic require special vessels, equipment, and facilities that can withstand severe conditions, and the remoteness of the North Slope region makes it costly to explore and develop. Environmental regulations have also affected access to the areas, increased the timeframe for permit approvals, and increased environmental permitting and compliance costs.

This analysis considers the regulatory structure that currently applies to the Alaska Arctic OCS areas that is deemed more stringent and restrictive relative to other OCS areas as it includes additional restrictions on Arctic OCS exploratory drilling activities that use mobile offshore drilling units (MODUs) and related operations during the open-water drilling season. Of the proposed 14 provisions, 6 items were identified as having the potential to significantly increase costs for exploration activities:

1. The requirement to have a separate mobile offshore drilling unit (MODU) available to drill a same-season relief well in the event of a loss of well control;
2. The shortening of the drilling season to accommodate a 45-day period to complete relief well operations before the expected return of seasonal ice;
3. Requirement of additional source control and containment equipment;
4. Discharge restrictions on petroleum-based mud and cuttings, with the potential for restrictions on water-based mud and cuttings;
5. Mudline cellar requirements to protect the well head from deep keel ice scour in the event the MODU has to move off a well due to ice incursion; and
6. Required blowout preventer (BOP) testing every seven days.

These six items have been incorporated into the modeling effort for this report.

This report projects the economic benefits of potential exploration, development and production of petroleum resources over the timeframe of the analysis which covers the proposed 5-year leasing program plus 20 years after the leasing program in the 4 selected Alaska OCS program areas.

Specifically, this report provides information on the following economic benefits at the local, state, and national levels:

- Projections of potential regional, statewide, and nationwide **direct expenditures** associated with petroleum development;
- Projections of potential direct, indirect, and induced **employment effects** of petroleum development;
- Projections of potential direct, indirect, and induced **income effects** of petroleum development;

- Projections of potential **direct revenues** that could accrue to the local/regional, state, and federal governments resulting from petroleum development;

This report does not include assessments of environmental impacts on air, water, fish, wildlife and vegetation, geological, cultural, and subsistence resources, and other resources that are typically included in an environmental impact statement.

The rest of this report is organized as follows:

Section 2: Description of Scenarios

Section 3: Approach

Section 4: Results

Section 5: Conclusions

Section 6: References

2 Description of Scenarios

E&D scenarios are conceptual views of the future and represent possible scenarios regarding the timing and extent of future petroleum activities. The E&D scenarios developed for this analysis under each regulatory case include a set of assumptions that reflect possible industry-wide exploration, development, and production activities.

Exploration activities are activities conducted to acquire information about the location, size, and characteristics of petroleum prospects within the leased area. Exploration activities include marine seismic surveys, geohazard surveys, geotechnical surveys, exploration and delineation well drilling, and associated logistical activities including environmental monitoring.

Development activities are activities conducted to build the infrastructure needed for production. These activities include installation of the offshore platforms, production well drilling, installation of offshore and onshore pipelines, installation of feeder lines, construction of shorebases such as onshore processing facilities, air support and search and rescue bases, and supply boat and marine terminals.

Production activities include in-fill drilling operations, processing, environmental monitoring, logistics support, and well-workovers. Decommissioning and abandonment are also considered as part of the production phase.

For the Beaufort Sea and Chukchi Sea (Arctic OCS areas), the scenarios reflect a development scenario under the current regulations. This includes the additional restrictions adopted by the Department of the Interior in 2016 that were specifically designed to apply to Arctic OCS exploratory drilling activities that use mobile offshore drilling units (MODUs), ice islands, and related operations during the open-water drilling season. Some of the additional restrictions could significantly increase the costs of exploration activities and could also cause delays in drilling activities, possibly deferring production for two years and reducing the net present value of oil and gas production. This restrictive regulatory framework is more stringent than the regulations that govern other OCS locations.

These E&D scenarios are used as inputs for the MAG-Plan Alaska model, the regional economic impact model used by BOEM for planning purposes and for environmental impact assessments.

The scenarios developed for this analysis are based on BOEM's lease sale EIS's, BOEM's 2016 and 2017 resource assessments, and our prior work for industry in the OCS and onshore Alaska.

2.1 Cook Inlet OCS Planning Area

According to BOEM, six lease sales have been conducted in this area since 1977. There are 14 existing leases in the planning area. All of these leases were issued as a result of Lease Sale 244 which was held last year on June 21, 2017. There have not been any commercial discoveries in this planning area although 13 exploratory wells have been drilled on earlier leases. In the upper Cook Inlet, extensive exploration and development in state submerged lands have been occurring during the past 40 years. The State of Alaska offers annual area-wide lease sales in state submerged lands. Annual production from non-OCS leased acreage during calendar year (CY) 2016 totaled approximately 5.7 million barrels of oil (bbl) and about 296 billion cubic feet of natural gas (BOEM 2018). Existing infrastructure in the upper portion of Cook Inlet includes 17 platforms in state waters, associated oil and gas pipelines, and onshore drill pads, processing and support facilities.

BOEM's proposed 5-year Program includes lease sales in years 2021 and 2023 in the Cook Inlet planning area. Under this development scenario, we make the following assumptions: It is assumed that two discoveries would occur, one resulting from each of the future lease sales, with 5 years of marine

seismic, geohazard, and geotechnical surveys occurring in the 2020 to 2026 period. Exploration drilling is assumed to occur over a 4-year period starting in 2023 with a total of 12 wells drilled. Five jack-up rigs would be installed to support the exploration program. Two production towers to support the two assumed discoveries would be installed, one in 2028 and the second tower in 2030. New infrastructure would be limited to offshore (125 miles each for oil and gas) and onshore (75 miles each for oil and gas) pipelines. Existing onshore facilities in the Upper Cook Inlet would support the development and production activities in the new fields. Gas resources are assumed to be associated gas and would follow the same production profile as oil production. The first field is assumed to produce 168 million barrels of oil and 44 billion cubic feet (BCF) of associated gas. The second field is slightly smaller and is assumed to produce a total of 131 million barrels of oil and 34 BCF of associated gas. The assumption is that 22 percent of the estimated remaining Cook Inlet OCS resources are discovered and produced for each of the fields. The remaining resources are estimated based on the 2016 BOEM resource assessment. This assumption is similar to the E&D scenario used by BOEM for the analysis of the Cook Inlet Lease Sale 244. The table below summarizes the activities under this scenario.

Table 1. Summary of Assumed E&D Activities: Cook Inlet Planning Area

Activity	Volume/Number
Marine Seismic Surveys	2
Geohazard Surveys	3
Geotechnical Survey	3
Exploration Base	0
Offshore Exploration Rigs (Jack-up rigs)	5
Exploration/Delineation Wells	12
Offshore Production Platforms (Tower)	2
Production and Service Wells	48
Subsea Wells	0
Subsea Flowlines (# of miles)	250
Onshore pipeline (# of miles)	150
Onshore Production Base	0
Supply Boat Terminal	0
Air Support Base	0
Search & Rescue Base	0

Source: Northern Economics.

2.2 Gulf of Alaska OCS Planning Area

Three lease sales were held from 1976 to 1981 in the Gulf of Alaska. Twelve exploratory wells were drilled, but no commercial discoveries have been found. The lease sale scheduled in the 1997–2002 Program was canceled, primarily due to low prices and low industry interest. There are no existing leases in this planning area.

BOEM's proposed 5-year Program includes one future lease sale in the Gulf of Alaska planning area which is scheduled in year 2023. For this OCS area, we make the following assumptions: It is assumed that marine seismic survey starts in 2022, a year before the lease sale to enable industry to bid appropriately in the sale. Geohazard and geotechnical surveys would occur in year 2024. A modest discovery is assumed with development occurring after construction of the new Cook Inlet infrastructure south of the existing facilities to tie into and use new Cook Inlet infrastructure. Production from this modest discovery would begin when there is capacity in the new Cook Inlet infrastructure. No new infrastructure is assumed to result from the 2023 GOA lease sale other than 70 miles of offshore pipeline

(35 miles each for oil and gas). The total resources assumed to be produced from this discovery amount to 68 million barrels of oil and 356 BCF of associated gas. First oil (and gas) is assumed to occur in 2034 (10 years after the lease sale). Two exploration platforms (drill ships) would support the exploration program with a total of 4 wells drilled. Production would occur offshore from a semi-submersible production platform with 18 production and service wells. The table below summarizes the activities under this scenario.

Table 2. Summary of Assumed E&D Activities: Gulf of Alaska Planning Area

Activity	Volume/Number
Marine Seismic Surveys	1
Geohazard Surveys	1
Geotechnical Survey	1
Exploration Base	0
Offshore Exploration Rigs (drill ship)	2
Exploration/Delineation Wells	4
Offshore Production Platforms (semi-submersible)	1
Production and Service Wells	18
Subsea Wells	0
Subsea Flowlines (# of miles)	70
Onshore pipeline (# of miles)	0
Onshore Production Base	0
Supply Boat Terminal	0
Air Support Base	0
Search & Rescue Base	0

Source: Northern Economics.

2.3 Chukchi Sea OCS Planning Area

BOEM's proposed 5-year Program includes 3 future lease sales in the Chukchi Sea program area which are scheduled to occur in years 2020, 2022, and 2024.

The Chukchi Sea area is considered a frontier area and as such is characterized by its remoteness, high costs of doing business, lack or scarcity of existing infrastructure, and lack of production data to inform forecasts of future activity. It is extremely costly to develop the infrastructure required to extract frontier area resources from the ground and transport them to market. Successful development and production of resources from frontier areas has typically been contingent upon successful exploration of an "anchor field" – a large discovery in the course of pioneering exploration that justifies the substantial capital investments required for an initial commercial petroleum development. Because of this, it is assumed that E&D activities in this OCS program area are significantly more extensive compared to the scenarios in the non-Arctic OCS areas.

For the Chukchi Sea scenario, we make the following assumptions: It is assumed that a sizable field will be discovered with total recoverable oil resources amounting to about 2.9 billion barrels of oil with no gas production (it is highly speculative at this point to assume that a gas pipeline or a liquefied natural gas project will be built to transport natural gas to markets or that the sales price would be sufficient to support gas-related infrastructure). The discovery is a result of the 2024 lease sale. First oil occurs in year 2032, 8 years after the 3rd scheduled lease sale. Marine seismic activities start in year 2019 and the geotechnical and geohazard surveys start in 2021. The exploration effort results in 19 wells drilled from a total of 24 offshore exploration rigs (12 of which are drill ships and another 12 semi-submersible

platforms). The drill ships are the primary exploration platform while the semi-submersibles are the backup rigs required under these regulations to drill a relief well if needed. The jack-up rigs during development drilling are for subsea wells. Three gravity-based production platforms will be installed and 8 jack-up rigs will be used during the summer drilling seasons. There will be 187 production and service wells and 24 sub-sea wells. New infrastructure includes 160 miles of subsea oil pipelines and 375 miles of onshore pipelines across the NPR-A to tie into TAPS. A supply boat terminal and an air support base will also be built to support development in this area. The table below summarizes the activities under this scenario.

Table 3. Summary of Assumed E&D Activities: Chukchi Sea OCS Planning Area

Activity	Volume/Number
Marine Seismic Surveys	3
Geohazard Surveys	3
Geotechnical Survey	3
Exploration Base	1
Offshore Exploration Rigs (12 drill ships and 12 semi-submersibles)	24
Exploration/Delineation Wells	19
Offshore Production Platforms (3 Gravity-based and 8 jack-up rigs)	11
Production and Service Wells	187
Subsea Wells	24
Subsea Flowlines (# of miles)	160
Onshore pipeline (# of miles)	375
Onshore Production Base	0
Supply Boat Terminal	1
Air Support Base	1
Search & Rescue Base	0

Source: Northern Economics.

2.4 Beaufort Sea OCS Area

BOEM's proposed 5-year Program includes three future lease sales in the Beaufort Sea planning area which are scheduled to occur in years 2019, 2021, and 2023.

BOEM conducted a 2017 assessment for the Western Beaufort to update the recent significant discoveries near shore and in state waters for the Nanushuk and Torok geologic plays. These plays extend offshore into the OCS but are generally in shallower waters. Hence, the scenario developed for this analysis includes the use of more ice islands and gravel islands for exploration and production.

Furthermore, since there are still other resources in the western Beaufort this scenario assumes that in deeper water they will be explored and produced from platforms other than ice islands and gravel islands. Shallow water ice islands are drilled in the winter while deeper water exploration platforms are drilled in the summer so there are substantially more total platforms under the current regulatory structure.

For the Beaufort Sea scenario, we make the following assumptions: A discovery of 5 fields is assumed, ranging in size from 100 million to 380 million barrels of economically recoverable oil resources, producing a total of 980 million barrels of oil. Also, under this scenario, there will be production occurring in the 8(g) zone.

As in the Chukchi Sea scenario, no gas is produced from this OCS area. It is assumed that no new onshore infrastructure would need to be built as existing facilities would be used to support the development.

Exploration activities begin in 2018 and last for 10 years. A total of 17 exploration wells are drilled. Exploration platforms include 18 ice islands and 10 jack-up rigs. Production activities would be supported by 2 gravel islands and 3 gravity-based structures. A total of 252 production and service wells will be drilled. The only new shore-based infrastructure that will be built is 55 miles of offshore and 40 miles of onshore pipelines. The following table summarizes the E&D activities under this scenario.

Table 4. Summary of Assumed E&D Activities: Beaufort Sea OCS Planning Area

Activity	Volume/Number
Marine Seismic Surveys	3
Geohazard Surveys	5
Geotechnical Surveys	3
Exploration Base	0
Offshore Exploration Rigs	28
Exploration/Delineation Wells	17
Offshore Production Platforms	5
Production and Service Wells	252
Subsea Wells	0
Subsea Flowlines (# of miles)	55
Onshore pipeline (# of miles)	40
Onshore Production Base	0
Supply Boat Terminal	0
Air Support Base	0
Search & Rescue Base	0

Source: Northern Economics.

3 Approach

This section describes the major study tasks and the economic modeling methodology used for this analysis.

Task 1: Develop scenarios for OCS development for each of the OCS planning areas.

A set of assumptions that reflect possible industry-wide exploration, development, and production activities were developed. This involved developing reasonable assumptions regarding the timing and activity levels associated with exploration, development, and production of oil and gas resources in the Beaufort Sea, Chukchi Sea, Gulf of Alaska, and Cook Inlet planning areas.

Specifically, these assumptions include the following:

- Time frames for the exploration, development, and production phases;
- Number of marine seismic, geohazard, and geotechnical surveys
- Type and number of exploration drilling rigs and number of exploration and delineation wells by year;
- Type and number of production rigs and number of production wells by year;
- Oil and gas production by year;
- Supply and maintenance modes and facilities, including the number of platforms that can be served by a single supply vessel, ice breaker, and helicopter;
- Onshore facilities.

This work involved a review of previous development scenarios available in the public domain, including exploration and development plans that have been submitted to the Bureau of Ocean Energy and Management (BOEM), recent EIS documents published by BOEM, as well as the previous development scenarios we used in our publicly-available work for Shell in 2009 on the *Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and the North Aleutian Basin* and in 2011 on the *Potential National-Level Benefits of Alaska OCS Development*. Our previous research work for API that looked at regulations affecting the Beaufort Sea and Chukchi Sea OCS planning areas served as a starting point for developing the scenarios for the Alaska Arctic OCS areas.

The development of the scenarios for the Cook Inlet and Gulf of Alaska planning areas were guided by BOEM's recent analysis of the lease sale in the Cook Inlet area.

Task 2: Calibrate and run the economic impact model for Alaska

The MAG-PLAN Alaska model was used to quantify the economic benefits to Alaska, both at the regional and statewide levels. MAG-PLAN Alaska is a region-specific economic impact model used by BOEM to evaluate potential economic impacts that may result from federal actions such as lease sales in OCS areas, and when it prepares a new 5-year OCS oil and gas program. MAG-PLAN estimates potential employment, income, and economic output effects that could result from any alternative or exploration and development scenario being considered.

In 2010, BOEM commissioned Northern Economics to update the model. The previous model was developed in 2005 using information that was gathered in the late 1990s and early 2000 for two earlier Alaska OCS models. The updated MAG-PLAN Alaska model which was completed in 2012 provides BOEM with an integrated model that provides estimates of Stage 1 and Stage 2 economic impacts of OCS exploration, development, and production. Stage 1 estimates the level and allocation of direct expenditures as well as direct manpower requirements, and government revenues resulting from OCS

oil and gas activities specified in the exploration and development scenarios, while Stage 2 estimates the multiplier effects of spending associated with OCS activities on potentially affected regions in Alaska.

Northern Economics has an ongoing agreement with BOEM whereby we can use the model for work with public or private sector clients as long as we provide BOEM with periodic updates to the model which reflect new or updated information. BOEM is not provided any proprietary data from our other work; rather, the updated model includes new equations that incorporate the additional data points. The MAG-PLAN model is not available to the public.

For this particular study, the MAG-PLAN model was calibrated to fit the development scenarios developed in Task 1. This involved calibrating the model to include additional specific types of activities that have not been considered in our previous work, estimating costs and manpower requirements of the new activities, and updating capital and operating cost data if needed for activities that already exist in the model. Model updates for the Gulf of Alaska and the Cook Inlet planning areas were more extensive since these areas have not been analyzed since the model was developed in 2010.

Updates to the IMPLAN coefficients and the fiscal module that are in the MAG-PLAN model were also done to apply the latest available data. The latest projections on oil and gas prices and transportation costs are incorporated into the model. The latest projections in the Annual Energy Outlook published by the Energy Information Administration for oil and gas prices and in the Revenue Sources Book published by the Alaska Department of Revenue for the transportation costs were applied to the model.

After calibrating the MAG-PLAN model to fit this study, model runs were conducted for all scenarios. A QA/QC of the inputs and outputs of the model was done to ensure reasonable and reliable results.

Task 3: Quantify the economic benefits to the rest of the U.S.

This task involved using the Policy Insight model developed by Regional Economic Models, Inc. (REMI) for Northern Economics. The REMI model can be used to quantify the economic benefits—jobs, income, and economic output of OCS oil and gas activities—to regions outside of Alaska (the rest of the U.S.).

To determine economic benefits of petroleum development on regions outside of Alaska, direct spending and direct jobs associated with the various Alaska OCS activities (exploration, development, and production) that could occur outside of Alaska were determined. This also included spending of wages in other states by direct employees that are not residents of Alaska. These outside spending and jobs associated with the various E&D activities were categorized into different economic sectors such as architectural, engineering, and related services, construction, oil and gas extraction, transportation and logistics sectors, etc. These were used as inputs into the REMI model. A QA/QC of the inputs and outputs of the model were conducted to ensure reasonable and reliable results.

Other tasks conducted for this study included development of a memorandum that describes the proposed scenarios, and preparation of the draft and final report.

4 Results

Petroleum development is expected to generate direct, indirect, and induced jobs and income, as well as revenues to the local, state, and federal governments. The magnitude of these economic benefits would ultimately depend on the volumes of petroleum resources that might be discovered in the OCS areas, the levels of investment that oil and gas explorers, developers, and producers would be willing to spend in these areas, and the fiscal regime or tax structure that would be in effect as OCS petroleum development occurs. Assumptions about all these factors determine the results of the study.

This section presents the quantitative results of the economic impact assessment of potential economic benefits for each of the selected planning areas. The results are based on the reasonable future offshore petroleum development scenarios that were assumed for each of the planning areas described in Section 2 of this report. As noted earlier the scenarios used in this study reflect the current more stringent regulations governing the Arctic OCS areas. In the event that the regulatory structure changes consistent with the current administration's intent, it is possible that industry interest and levels of investment in the Alaska Arctic OCS planning areas could be higher than the levels considered in this analysis and could subsequently lead to more economic benefits.

The following sub-sections present projected total industry expenditures, employment and income effects, and potential government revenues at the local, state, and federal levels for each of the selected program areas.

4.1 Projected Direct E&D Industry Expenditures

Industry spending (level of investment) associated with E&D activities in the selected program areas would directly benefit companies that are operating in and outside of Alaska. In the North Slope Borough (the directly impacted local region for the Beaufort Sea and Chukchi Sea areas), and the Kenai Peninsula Borough (the directly impacted local region for the Cook Inlet and the Gulf of Alaska) there are several companies operating primarily in the petroleum support services sector. These companies provide utilities, camp services including security, cleaning, and food services, environmental monitoring, and other logistics services. The majority of the petroleum support services sector companies are located in other regions of Alaska at the economic and transportation hubs (mostly in Anchorage and Fairbanks). The Municipality of Anchorage is the center of the state's transportation industry, and Fairbanks serves as Interior Alaska's transportation hub.

It is assumed that major material items, such as steel pipe, equipment, and industrial machinery, including major production and camp modules, would be manufactured out-of-state or globally and shipped via marine transport to Alaska ports. It is also assumed that businesses located in Fairbanks and Anchorage would be the sources of most Alaska-sourced supplies because these two cities are the supply centers for the state's construction and oil and gas industries. In addition, while we assume that a large amount of the construction materials needed would be purchased out-of-state, Alaska's water, air, and truck transportation sectors are projected to benefit from these purchases.

4.1.1 Cook Inlet OCS Planning Area

Table 5 shows the projected total, annual average, and peak year expenditures associated with the Cook Inlet E&D scenario developed for this study. Total projected U.S. spending under this case amounts to about $5.2 billion over the timeframe considered in the analysis. Average spending is projected to amount to approximately $190 million per year with a peak of $480 million in year 2030.

Table 5. Projected Direct E&D Industry Expenditures: Cook Inlet OCS Planning Area

Category	Direct Expenditures (Millions of 2016$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	$1,030	$2,260	$3,280	$1,890	$5,170
Annual Average	$40	$80	$120	$70	$190
Peak	$80	$230	$300	$210	$480

Source: Northern Economics estimates.

4.1.2 Gulf of Alaska OCS Planning Area

Table 6 shows the projected total, annual average, and peak year expenditures associated with the Gulf of Alaska E&D scenario developed for this study. Total U.S. spending under this case is projected to amount to about $2.5 billion over the timeframe considered in the analysis. Average spending is projected to amount to approximately $100 million per year with a peak of $250 million in year 2034.

Table 6. Projected Direct E&D Industry Expenditures: Gulf of Alaska OCS Planning Area

Category	Direct Expenditures (Millions of 2016$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	$510	$1,020	$1,540	$950	$2,490
Annual Average	$20	$40	$60	$40	$100
Peak	$50	$150	$200	$180	$250

Source: Northern Economics estimates.

4.1.3 Chukchi Sea OCS Planning Area

Table 7 shows the projected total, annual average, and peak year expenditures associated with the scenario for the Chukchi Sea planning area. Total U.S. spending under this case is projected to amount to about $28.2 billion over the timeframe considered in the analysis. Average spending is projected to amount to approximately $1 billion per year with a peak of $3.1 billion during the development phase.

Table 7. Projected Direct E&D Industry Expenditures: Chukchi Sea OCS Planning Area

Category	Direct Expenditures (Millions of 2016$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	$360	$8,880	$9,240	$19,000	$28,240
Annual Average	$10	$330	$340	$700	$1,050
Peak	$40	$1,010	$1,040	$2,210	$3,140

Source: Northern Economics estimates.

4.1.4 Beaufort Sea OCS Planning Area

Table 8 shows the projected total, annual average, and peak year expenditures associated with the scenario for the Beaufort Sea planning area. Total U.S. spending under this case is projected to amount to about $17.5 billion over the timeframe considered in the analysis. Average spending is projected to amount to approximately $650 million per year with a peak of $1.7 billion during the development phase.

Table 8. Projected Direct E&D Industry Expenditures: Beaufort Sea OCS Planning Area

Category	Direct Expenditures (Millions of 2016$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	$330	$7,230	$7,560	$9,940	$17,500
Annual Average	$10	$270	$280	$370	$650
Peak	$70	$850	$860	$1,490	$1,740

Source: Northern Economics estimates.

4.2 Projected Employment Effects

Exploring, developing, and producing petroleum resources in the Alaska OCS planning areas requires a substantial effort and is projected to directly employ thousands of people, with additional indirect and induced jobs created in and outside of Alaska. This section presents the projected employment effects resulting from petroleum development in the selected Alaska OCS planning areas.

The projected employment effects include the direct, indirect, and induced jobs at the local level (the North Slope Borough region for the Beaufort Sea and the Chukchi Sea and the Kenai Peninsula Borough for the Cook Inlet and the Gulf of Alaska), the rest of the state, and the rest of the U.S.

Direct jobs include on-site and off-site oil and gas workers. On-site workers are those engaged in E&D activities. Other direct employment is associated with headquarters jobs and pipe coating. The model for estimating direct employment associated with OCS oil and gas activities recognizes about 25 activities from exploration to abandonment. There are three major sources of on-site employment: 1) construction and operation of onshore facilities; 2) operation and drilling of production platforms and wells; and 3) operation and drilling of exploration platforms and wells.

In addition to these on-site jobs, other direct jobs are created at the administrative and operational headquarters for the on-site activities. The headquarters jobs are estimated at 15 percent of total on-site jobs. This percentage is the historical average for Anchorage oil and gas employment compared to statewide oil and gas employment excluding Anchorage. These headquarters jobs are assumed to be located in Anchorage. In addition, jobs are created in Alaska and outside of Alaska for engineering, permitting, and other work prior to and during the construction and development activities.

The number of exploration rigs or production platforms operating in any given year, ongoing construction activities, the number of wells drilled, miles of pipeline laid, and similar assumptions drive the need for helicopters and workboats, maintenance, and similar support activities that are estimated within the model. The vector that is the sum of each activity is then multiplied by the vector for person requirements for each activity and the duration vector to arrive at the total average employment for each activity in each year.

The direct investments (spending) on petroleum development are projected to initiate subsequent rounds of re-spending resulting in additional indirect and induced jobs. These indirect and induced impacts are collectively termed "multiplier effects." Indirect effects would occur when contractors,

vendors, and manufacturers receiving payment for goods or services required for exploration, development, and production of OCS petroleum resources are, in turn, able to pay others who support their businesses. Indirect jobs are jobs associated with third-party contractors, vendors, and manufacturers that receive payments for goods or services in support of the direct activities.

Induced effects would occur when persons directly employed for exploration, development, and production activities make purchases from retailers and service establishments in the normal course of household consumption. Government spending of revenues generated from OCS activities also create significant multiplier effects and these effects are included in the induced effects. Induced jobs are therefore associated with jobs affected by household and government spending.

Potential employment effects of OCS development in Alaska were generated using the MAG-PLAN Alaska model. As described in Section 3, this model is a region-specific economic impact model used by BOEM to evaluate potential economic impacts that may result from federal actions such as lease sales in OCS areas.

The projected multiplier employment effects of OCS development on the rest of the nation were quantified using the REMI Policy Insight+ model. As noted in the Approach section, this model is a dynamic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric, and economic geography methodologies. PI+ was developed by Regional Economic Models, Inc. (REMI) and is widely used by government agencies (including most U.S. state governments), private and public research firms, and utilities. The inputs to the PI+ model were the estimated annual direct jobs associated with the different OCS activities starting from geological survey all the way to abandonment. These direct job estimates were generated using the MAG-PLAN Alaska model.

The tables presented below show the projected annual average jobs generated over the timeframe for this analysis and the peak values. The peak employment usually occurs when construction and development activities are occurring to bring a field into production.

4.2.1 Cook Inlet OCS Planning Area

Table 9 and Table 10, respectively, show the projected potential direct, and indirect and induced annual average and peak year employment effects under the Cook Inlet E&D scenario.

Under this scenario, it is projected that petroleum development in the Cook Inlet OCS planning area could generate about 740 direct jobs and an additional 1,010 indirect and induced jobs in the U.S. on an annual average basis.

Table 9. Projected Direct Employment Effects: Cook Inlet OCS Planning Area

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	110	400	510	260	740
Peak	270	2,070	2,260	970	3,230

Source: Northern Economics estimates.

Table 10. Projected Indirect and Induced Employment Effects: Cook Inlet OCS Planning Area

Category	Multiplier Effects: Indirect and Induced Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	130	360	490	520	1,010
Peak	290	890	1,140	2,250	2,860

Source: Northern Economics estimates.

4.2.2 Gulf of Alaska OCS Planning Area

Table 11 and Table 12, respectively, show the projected potential direct, and indirect and induced annual average and peak year employment effects under the Gulf of Alaska E&D scenario.

Under this scenario, it is projected that petroleum development in the Gulf of Alaska OCS planning area could generate about 330 direct jobs and an additional 530 indirect and induced jobs in the U.S. on an annual average basis.

Table 11. Projected Direct Employment Effects: Gulf of Alaska OCS Planning Area

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	60	190	240	90	330
Peak	1,340	1,420	1,420	270	1,690

Source: Northern Economics estimates.

Table 12. Projected Indirect and Induced Employment Effects: Gulf of Alaska OCS Planning Area

Category	Multiplier Effects: Indirect and Induced Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	160	210	370	200	530
Peak	290	520	800	540	1,060

Source: Northern Economics estimates.

4.2.3 Chukchi Sea OCS Planning Area

Table 13 and Table 14, respectively, show the projected potential direct, and the indirect and induced annual average and peak year employment effects under the Chukchi Sea E&D scenario. It is projected that petroleum development in the Chukchi OCS planning area could generate about 2,430 direct jobs and an additional 3,570 indirect and induced jobs in the U.S. on an annual average basis.

Table 13. Projected Direct Employment Effects: Chukchi Sea OCS Planning Area

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	120	1,450	1,560	880	2,430
Peak	330	3,990	4,290	2,220	6,260

Source: Northern Economics estimates.

Table 14. Projected Indirect and Induced Employment Effects: Chukchi Sea OCS Planning Area

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	80	1,510	1,580	2,000	3,570
Peak	140	4,530	4,670	5,110	9,400

Source: Northern Economics estimates.

4.2.4 Beaufort Sea OCS Planning Area

Table 15 and Table 16, respectively, show the projected potential direct, and indirect and induced annual average and peak year employment effects under the Beaufort Sea E&D scenario.

It is projected that petroleum development in the Beaufort Sea OCS planning area could generate about 1,760 direct jobs and an additional 3,080 indirect and induced jobs in the U.S. on an annual average basis.

Table 15. Projected Direct Employment Effects: Beaufort Sea OCS Planning Area

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	80	920	990	770	1,760
Peak	230	2,270	2,400	2,130	3,920

Source: Northern Economics estimates.

Table 16. Projected Indirect and Induced Employment Effects: Beaufort Sea OCS Planning Area

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	20	1,410	1,430	1,650	3,080
Peak	70	5,060	5,120	6,020	6,960

Source: Northern Economics estimates.

4.3 Projected Labor Income Effects

This section presents the projected labor income effects of OCS petroleum development activities for the selected Alaska OCS planning areas. The labor income effects include the direct, indirect, and induced income generated in the various regions as a result of petroleum development. This labor income is associated with the employment effects discussed above.

4.3.1 Cook Inlet OCS Planning Area

Table 17 and Table 18 summarize the projected direct, and the indirect and induced labor income effects under the Cook Inlet scenario. At the peak level of economic activity, total U.S. direct labor income that would be disbursed in various regions of the U.S. is projected to amount to about $153 million. The annualized average direct income over the analysis timeframe is projected to be about $42

million. Additional annual average labor income resulting from the indirect and induced effects is projected to amount to about $60 million, with a peak annual amount of over $183 million.

Table 17. Projected Total U.S. Direct Labor Income Effects: Cook Inlet OCS Planning Area

Category	Direct Oil and Gas Labor Income (Millions of 2016$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$7.7	$21.9	$29.7	$12.4	$42.0
Peak	$15.9	$94.3	$110.2	$48.8	$153.3

Source: Northern Economics estimates.

Table 18. Projected Total U.S. Indirect and Induced Labor Income Effects: Cook Inlet OCS Planning Area

Category	Multiplier Effects: Indirect and Induced Labor Income (Millions of 2016 $)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$5.2	$19.5	$24.7	$35.0	$59.7
Peak	$11.1	$47.8	$58.0	$150.4	$183.3

Source: Northern Economics estimates.

4.3.2 Gulf of Alaska OCS Planning Area

Table 19 and Table 20 summarize the projected direct, and the indirect and induced labor income effects under the Gulf of Alaska scenario. At the peak level of economic activity, total U.S. direct labor income that would be disbursed in various regions of the U.S. is projected to amount to about $113 million. The annualized average direct income over the timeframe for the analysis is projected to be about $21 million.

Additional annual average labor income resulting from the indirect and induced effects is projected to amount to about $29 million, with a peak annual amount of over $57 million.

Table 19. Projected Total U.S. Direct Labor Income Effects: Gulf of Alaska OCS Planning Area

Category	Direct Oil and Gas Labor Income (Millions of 2016$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$4.7	$11.3	$15.9	$5.3	$21.2
Peak	$9.6	$84.0	$89.0	$23.7	$112.7

Source: Northern Economics estimates.

Table 20. Projected Total U.S. Indirect and Induced Labor Income Effects: Gulf of Alaska OCS Planning Area

Category	Multiplier Effects: Indirect and Induced Labor Income (Millions of 2016 $)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$4.8	$8.3	$13.2	$13.7	$29.4
Peak	$11.8	$26.6	$38.5	$39.1	$57.2

Source: Northern Economics estimates.

4.3.3 Chukchi Sea OCS Planning Area

Table 21 and Table 22 summarize the projected direct, and the indirect and induced labor income effects under the Chukchi Sea scenario, respectively.

Table 21. Projected Direct Labor Income Effects: Chukchi Sea OCS Planning Area

Category	Direct Oil and Gas Labor Income (Millions of 2016$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$2.5	$79.7	$82.2	$46.2	$128.4
Peak	$6.0	$218.8	$224.8	$116.3	$341.1

Source: Northern Economics estimates.

Table 22. Projected Indirect and Induced Labor Income Effects: Chukchi Sea OCS Planning Area

Category	Multiplier Effects: Indirect and Induced Labor Income (Millions of 2016 $)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$8.1	$101.9	$110.0	$140.0	$250.0
Peak	$15.0	$312.9	$327.7	$392.2	$688.3

Source: Northern Economics estimates.

4.3.4 Beaufort Sea OCS Planning Area

Table 23 and Table 24 summarize the projected direct, and the indirect and induced labor income effects under the Beaufort Sea scenario, respectively.

Table 23. Projected Direct Labor Income Effects: Beaufort Sea OCS Planning Area

Category	Direct Oil and Gas Labor Income (Millions of 2016$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$1.2	$58.3	$59.5	$32.0	$91.6
Peak	$4.5	$151.9	$156.4	$87.8	$214.3

Source: Northern Economics estimates.

Table 24. Projected Indirect and Induced Labor Income Effects: Beaufort Sea OCS Planning Area

Category	Multiplier Effects: Indirect and Induced Labor Income (Millions of 2016 $)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	$1.8	$96.2	$98.0	$108.3	$206.3
Peak	$68.3	$5,050.2	$5,118.5	$367.8	$447.5

Source: Northern Economics estimates.

4.4 Projected Government Revenues

Petroleum development in the Alaska OCS areas could generate significant government revenues though taxes and lease payments. This section presents the projected potential local, state, and federal government revenues from petroleum development. The analysis of potential government revenue effects is focused on the following revenue categories—1) property taxes which accrue to both the local and state governments, 2) state corporate income taxes, 3) additional royalties to the state government due to the increase in TAPS throughput from OCS production, and 4) federal royalty payments.

Property Taxes

Property taxes from oil and gas facilities are a major source of revenue for both the North Slope Borough and the Kenai Peninsula Borough (local government) and the State of Alaska. A local tax is levied on the state's assessed value for oil and gas property within a city or borough, and is subject to the local property tax limitations established in AS 29.45.080 and AS 29.45.100. The state's mill rate is effectively 20 mills minus the local rate, which varies depending on the municipality impacted.

New onshore facilities as well as offshore facilities that are within state waters built to support petroleum development will be subject to property taxes. These facilities could include onshore pipelines, production facilities, marine terminals, search and rescue and air support bases. The various E&D scenarios in this analysis includes several of these facilities.

State Corporate Income Taxes

The state also obtains revenue from the special state corporate income tax on petroleum activity. The tax base is the Alaska share of worldwide income for each corporation. The Alaska income is calculated using a "modified apportionment formula," which averages the Alaska share of corporate worldwide property, sales, and extraction and applies that formula to calculate the Alaska share of worldwide income. The formula used to apportion income for all other types of corporations includes property, sales, and payroll. Consequently, the Alaska tax base for the special corporate income tax on petroleum depends not only on activity within Alaska, but also on activity in other locations, making it difficult to predict. Historically the ratio of tax revenues to the wellhead value of production has averaged 2.6 percent, but ranged from a low of 0.3 percent to a high of 5.1 percent.

For this analysis, the estimate of the direct corporate income tax revenues to the state from OCS activity is based on the wellhead value of OCS production and a modified apportionment formula that reflects the special OCS conditions. First, it is assumed that the sales and extraction components of the formula are zero, because OCS sales and extraction would occur outside the jurisdiction of Alaska (in federal waters). Second, it is assumed that only that share of the property associated with OCS activities which is onshore would be included in the formula. The result is a very small allocation of OCS income to the state petroleum income tax base.

The historical ratio of revenues to the value of production is adjusted downward and is used to estimate future corporate petroleum revenues to the state from OCS production. The percentages are applied to the value of production to determine the corporate income tax estimates.

Additional State Royalties due to TAPS Pipeline Tariff Reduction Effect

It is assumed that OCS oil from the Beaufort Sea and the Chukchi Sea would be transported to market through the existing TAPS oil pipeline from the North Slope to Valdez. The TAPS pipeline is currently operating at about one-third of its capacity of 2 million barrels per day, and may be carrying less oil in the future as North Slope production continues to decline. The pipeline tariff, based on the cost of its operation, is sensitive to the volume of oil and tends to increase as the volume falls. If OCS oil were

added to the TAPS pipeline it would increase the throughput, and this would tend to reduce the tariff on all the oil flowing through the line.

Because the price of oil at the wellhead is a "netback" price based on the market price net of transportation costs, a lower pipeline tariff would increase the wellhead value of North Slope oil. Since the royalty on oil from state lands and the production tax are based on the wellhead value of the oil, a lower tariff would increase the revenues to the state from the royalties and the production tax. The maximum tariff reduction is projected to only be $1 (nominal $). In other years, the tariff reduction would be less because the incremental throughput would be less. The tariff reduction is projected based on the relationship between projected TAPS throughput in future years and the TAPS tariff.

Federal Royalty Payments

A royalty is a share of the minerals produced from a lease. It is a percentage of production paid either in money or in kind that a federal lease is required to pay. On the Alaska OCS, typically a 12.5 percent royalty rate is applied for OCS leases that are in production. A minimum royalty payment is typically established as part of the lease agreement. The lessee pays a minimum royalty at the expiration of each lease year with a credit applied for actual royalty paid during the lease year.

Under certain circumstances, a royalty relief or suspension is granted by the Secretary of the Interior to promote increased oil and gas production. The royalty suspension is prorated by lease acreage and is subject to price thresholds. This analysis assumes that no royalty suspension would apply to any of the Alaska OCS leases.

For the purpose of this analysis, royalties from production in the Beaufort Sea and Chukchi Sea were projected based on projected Brent oil prices from the publicly available long-term price projections for oil generated by the Energy Information Administration (Annual Energy Outlook 2018). The Annual Energy Outlook presents a projection and analysis of U.S. energy supply, demand, and prices through 2050. The projections are based on results from the Energy Information Administration's National Energy Modeling System. To calculate the royalties, netback prices for oil and gas were used. The netback price reflects the price of the resource at the point of production (market price less transportation costs). The transportation costs used in this analysis were obtained from the latest Revenue Sources publication issued by the Alaska Department of Revenue. For royalties from production in the Cook Inlet and the Gulf of Alaska, the prevailing royalty oil prices in the region were used and future prices were extrapolated following the year-over-year change in real prices as projected by the EIA.

4.4.1 Cook Inlet OCS Planning Area

The projected government revenues that could accrue to local, state, and federal governments resulting from potential development in the Cook Inlet scenario are shown in Table 25. The total projected government take under this scenario is approximately $2.7 billion over the timeframe considered in the analysis.

Table 25. Projected Local, State, and Federal Government Revenues: Cook Inlet OCS Planning Area

Category	Direct Revenues (Millions of 2016$)						
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	State Royalty Payments	Total Revenues
Total	$73.82	$102.57	$26.52	--	$2,549.92	--	$2,752.82
Annual Average	$4.10	$5.70	$1.56	--	$150.00	--	$161.35
Peak	$4.79	$6.66	$3.84	--	$369.60	--	$384.89

Source: Northern Economics estimates.

4.4.2 Gulf of Alaska OCS Planning Area

The projected government revenues that could accrue to local, state, and federal governments resulting from potential development in the Gulf of Alaska scenario are shown in Table 26. The total projected government take under this scenario is approximately $900 million over the timeframe considered in the analysis.

Table 26. Projected Local, State, and Federal Government Revenues: Gulf of Alaska OCS Planning Area

Category	Direct Revenues (Millions of 2016$)						
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	State Royalty Payments	Total Revenues
Total	$4.48	$6.23	$9.02	--	$867.51	--	$887.24
Annual Average	$0.37	$0.52	$0.82	--	$78.86	--	$80.58
Peak	$0.41	$0.57	$1.84	--	$177.33	--	$180.15

Source: Northern Economics estimates.

4.4.3 Chukchi Sea OCS Planning Area

The projected government revenues that could accrue to local, state, and federal governments resulting from potential development in the Chukchi Sea scenario are shown in Table 27. There are no state royalty payments under this scenario since there is no production assumed to occur on 8(g) areas (areas where the Federal royalty is shared with the state). Total projected government take over the analysis timeframe is approximately $24.7 billion. The majority of the revenues would accrue to the Federal government in the form of royalty payments.

Table 27. Projected Local, State, and Federal Government Revenues: Chukchi Sea OCS Planning Area

Category	Direct Revenues (Millions of 2016$)						
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	State Royalty Payments	Total Revenues
Total	$526.51	$42.69	$241.39	$717.44	$23,210.80	--	$24,738.83
Annual Average	$30.97	$2.51	$18.57	$55.19	$1,785.45	--	$1,892.68
Peak	$36.80	$2.98	$32.63	$79.47	$3,137.48	--	$3,289.36

Source: Northern Economics estimates.

4.4.4 Beaufort Sea OCS Planning Area

The projected government revenues that could accrue to local, state, and federal governments resulting from potential development in the Beaufort Sea scenario are shown in Table 28. The total projected government take under this case is approximately $9.1 billion over the timeframe considered in the analysis.

Table 28. Projected Local, State, and Federal Government Revenues: Beaufort Sea OCS Planning Area

Category	Direct Revenues (Millions of 2016$)						
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	State Royalty Payments	Total Revenues
Total	$82.08	$6.66	$88.72	$407.78	$8,216.27	$314.88	$9,116.39
Annual Average	$4.83	$0.39	$5.55	$25.49	$513.52	$19.68	$569.45
Peak	$7.02	$0.57	$14.35	$55.22	$1,359.29	$58.23	$1,494.68

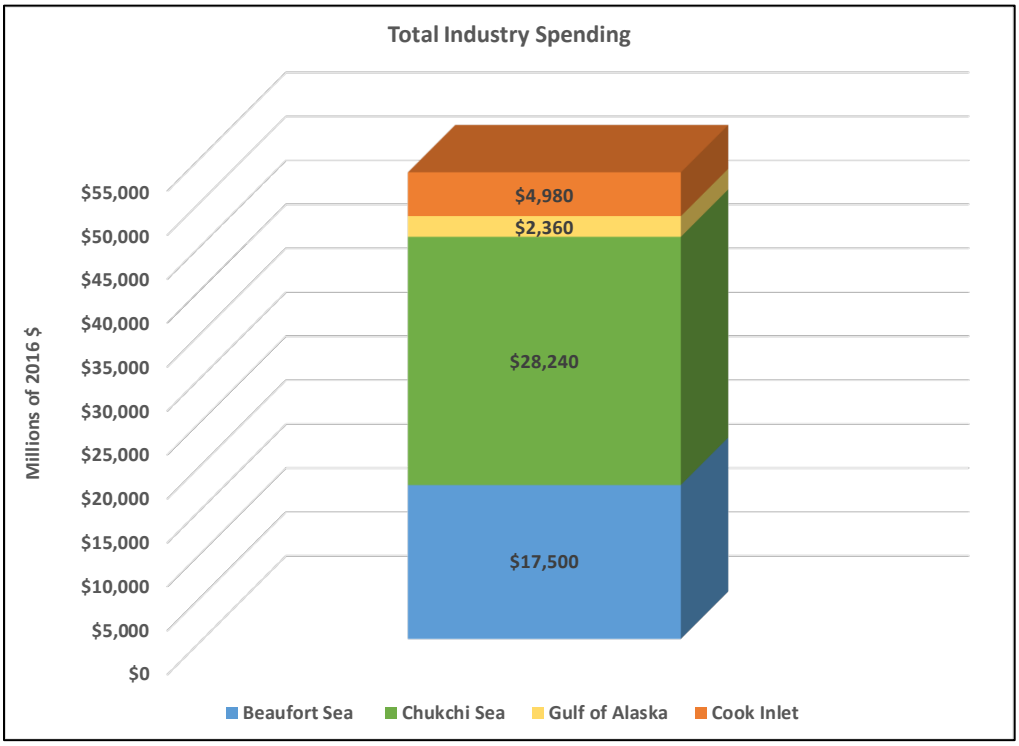
Source: Northern Economics estimates.

5 Conclusions

Petroleum development would generate industry investment; direct, indirect, and induced jobs and income; and revenues to the local, state, and federal governments. The magnitude of these economic benefits ultimately depends on the volumes of petroleum resources that might be discovered in the OCS areas, the levels of investment that oil and gas explorers, developers, and producers would be willing to spend in these areas, and the fiscal regime or tax structure that would be in effect as OCS petroleum development occurs. Assumptions about all these factors determine the results of the study.

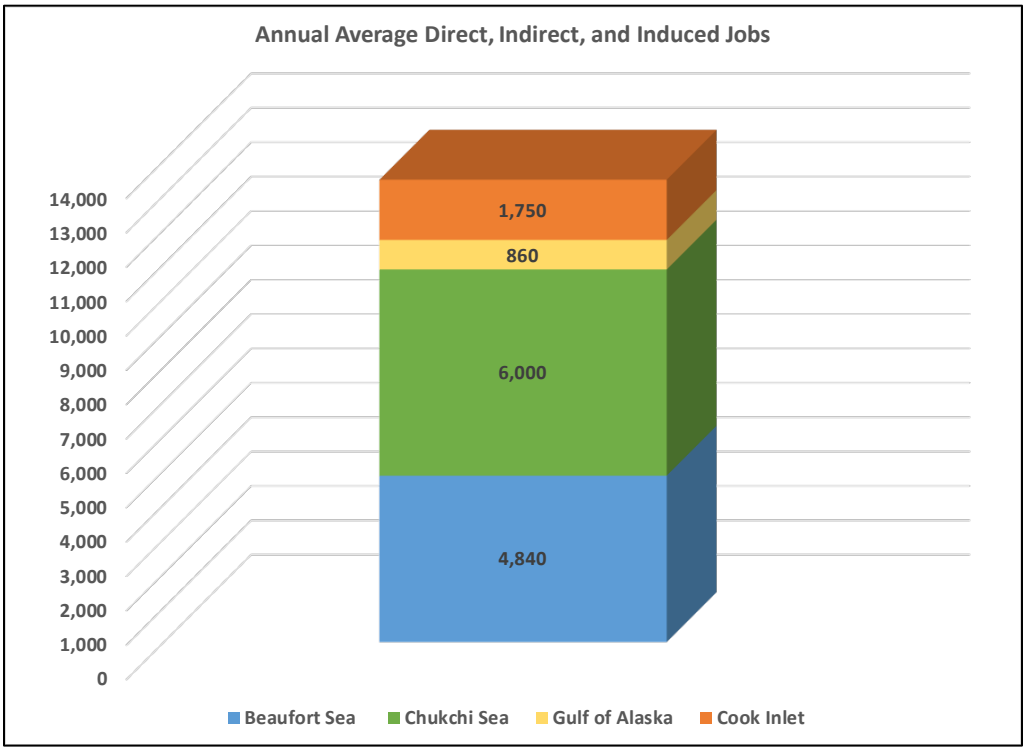
The following figures summarize the total potential economic benefits that could result from petroleum development over the timeframe of the analysis in the four selected Alaska OCS areas.

Figure 2. Projected Potential Total Industry Expenditures on Petroleum Development



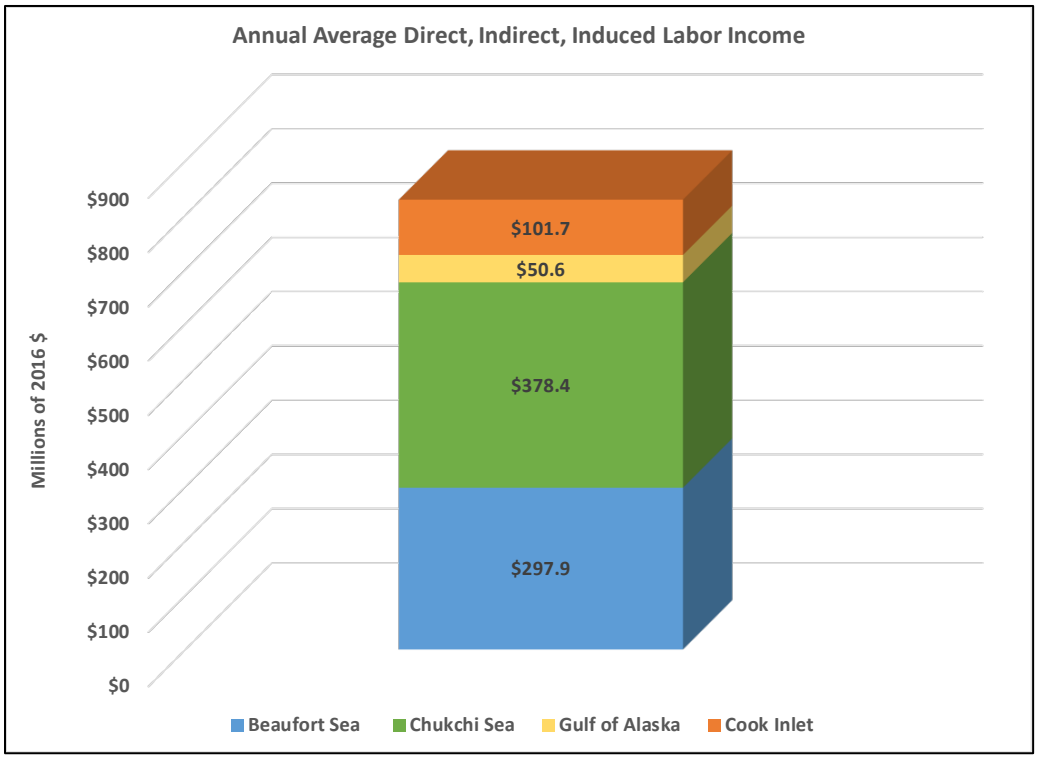
Source: Northern Economics estimates.

Figure 3. Projected Potential Total U.S. Annual Average Jobs



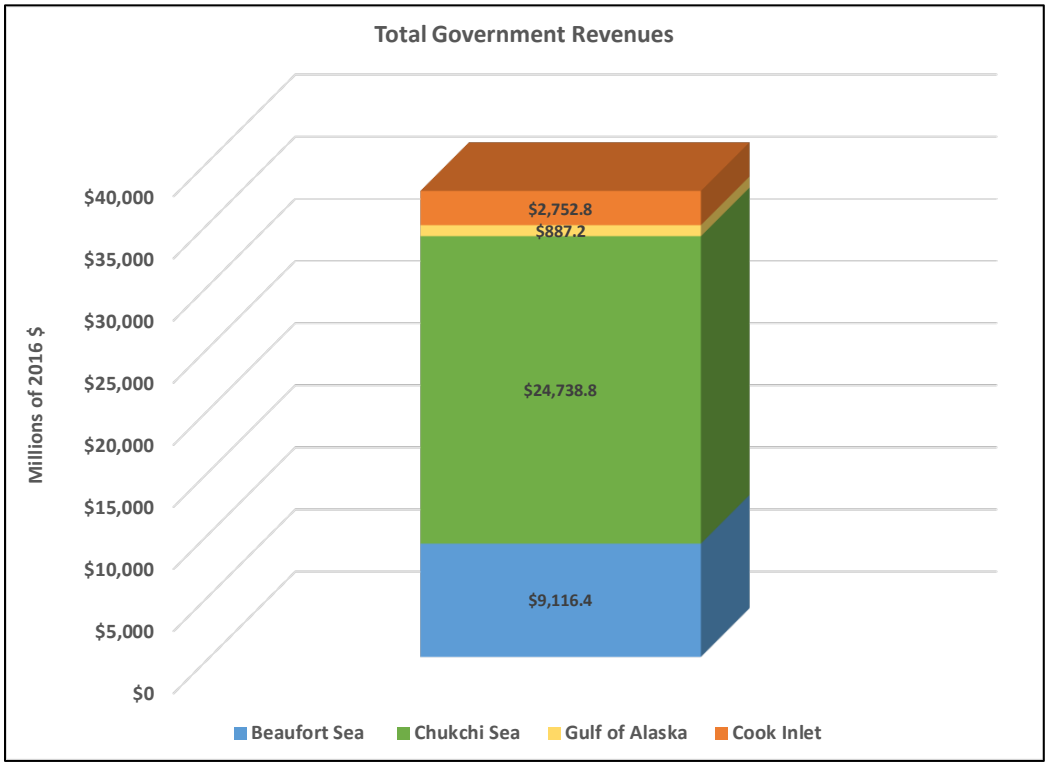
Source: Northern Economics estimates.

Figure 4. Projected Potential Total U.S. Annual Average Labor Income Effects



Source: Northern Economics estimates.

Figure 5. Projected Total Government Revenues



Source: Northern Economics estimates.

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