The Economic and Fiscal Contribution that the **Development of Offshore Oil and Natural Gas Resources could make to the Virginia Beach MSA**

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4201 DOMINION BOULEVARD, SUITE 114
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(804) 346-8446
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EXECUTIVE SUMMARY

This report provides an assessment of what offshore oil and natural gas activity might mean for Virginia's economy and the economy of the Virginia Beach MSA. The principal findings from that assessment are:

1) **Recent proposed actions by the federal Bureau of Ocean Energy Management (BOEM) would open significant portions of Outer Continental Shelf (OCS) to the development of offshore oil and natural gas resources.**

2) **Our analysis projects that those proposed actions would provide a significant economic opportunity to the Virginia Beach MSA.**

3) **We project that offshore oil and natural gas activity would be responsible for generating approximately $121.9 million in direct spending in the Virginia Beach MSA in year five of the 20-year period of oil and natural gas development modeled in this report, rising to $1.3 billion in year 20.**

4) **After accounting for second-round indirect and induced spending effects, we project that direct spending would generate regional impacts of approximately:**

   - 1,221 jobs in year five of development, increasing to 16,798 jobs in year 20.
   - $69.3 million in labor income in year five of development, increasing to $1.0 billion in year 20.
   - $163.4 million in total economic output in year five of development, increasing to $2.1 billion in year 20.
   - $5.4 million in state and local tax revenue in year five of development, increasing to $102.0 million in year 20.

5) **Of the approximately 16,798 jobs that offshore oil and natural gas activity is projected to generate in the Virginia Beach MSA in the 20th year of the forecast horizon, our analysis projects:**

   - 82 percent would pay wages that are above the average for the region, and
   - 62 percent would pay wages that are at least one-and-a-half-times the average for the region.

Which means that the employment growth that offshore oil and natural gas activity is projected to generate would place significant upward pressure on total regional labor income.

6) **This would provide a much needed boost to the Virginia Beach MSA's regional economy:**

   - Since mid-2011, year-over-year employment growth in the region has under-per formed both the state of Virginia and the nation as a whole.
   - The largest employment loss in the region between 2015 and 2016 occurred in Manufacturing, the region's 6th highest paying industry sector.

7) **It would also aid in diversifying the Virginia Beach MSA's regional economy by providing up to:**

   - 8,060 additional jobs in Mining, Quarrying, and Oil and Gas Extraction.
   - 1,568 additional jobs in Construction.
   - 1,492 additional jobs in Professional, Scientific, and Technical Services.

8) **In short, offshore oil and natural gas activity is projected to make a large and much needed contribution to the Virginia economy and to the economy of the Virginia Beach MSA.**

INTRODUCTION

Recent proposed actions by the federal Bureau of Ocean Energy Management (BOEM) would open significant portions of Outer Continental Shelf (OCS) to the development of offshore oil and natural gas resources. This report provides an assessment of what offshore oil and natural gas activity might mean for Virginia's economy and the economy of the Virginia Beach MSA.

The remainder of this report is divided into five sections:

- The *New Possibilities for Offshore Oil and Natural Gas Activity Along the East Coast* section provides background on BOEM and its responsibilities, and describes the recent proposed changes regarding the development of offshore oil and natural gas resources on the OCS.
- The *Review of Existing Research on the Value of Economic Development from Offshore Oil and Natural Gas Activity* section provides a brief review of previous empirical studies of the economic potential of offshore oil and natural gas activity along the Atlantic coast.
- The *Economic and Fiscal Impact Assessment* section presents an empirical analysis of the likely economic and fiscal impact the Virginia Beach MSA from the development of offshore oil and natural gas activity in years 5, 10, 15, and 20 of a 20-year modeling horizon.
- The *Effect of Oil and Natural Gas Activity on the Regional Economy* section places the preceding economic and fiscal impact into the context of recent economic trends within the Virginia Beach MSA.
- Finally, the *Conclusion* section provides a brief summary and concluding remarks.

This report was commissioned by the American Petroleum Institute and produced by Mangum Economics.

NEW POSSIBILITIES FOR OFFSHORE OIL AND NATURAL GAS ACTIVITY ALONG THE EAST COAST

The Bureau of Ocean Energy Management (BOEM) is a bureau created in 2011 within the United States Department of the Interior. It manages the offshore energy resources of the Outer Continental Shelf (OCS) while protecting the human, marine, and coastal environments.[1] BOEM manages 1.7 billion acres of the OCS.

BOEM established the National Outer Continental Shelf Oil and Gas Leasing Program to provide for oil and natural gas development in accordance with the Outer Continental Shelf Lands Act. The Act authorizes the Secretary of the Interior to grant mineral leases and to prescribe regulations governing oil and natural gas activities on the OCS. The Act also requires that the OCS be made available for expeditious and orderly development, subject to environmental safeguards while maintaining competition for the OCS resources. In addition, the Act also requires that 27 percent of all revenues from production within three miles seaward of the start of the OCS goes to the states that host production.

Through the National Outer Continental Shelf Oil and Gas Leasing Program, the BOEM provides a five-year schedule for the sale of oil and natural gas leases for the Outer Continental Shelf. There are currently about 8,000 active leases totaling almost 36 million acres of the federally owned offshore area. This leased acreage accounts for about 7 percent of America's domestic natural gas production and about 24 percent of America's domestic oil production.

BOEM recently proposed a major change to the development of the OCS. On January 4, 2018, BOEM proposed a new National Outer Continental Shelf Oil and Gas Leasing Program for the years of 2019 through 2024.[2] The current National Outer Continental Shelf Oil and Gas Leasing Program for 2017 through 2022 prohibits oil and natural gas activities in 94 percent of

[1] The term continental shelf has two related usages – a geographic meaning and a legal meaning. Geographically it refers to the edge part of a continent that lies beneath the surface of the ocean. It extends from the continental coastline to a point called the shelf break where the ocean floor drops away steeply toward the deep ocean floor. Legally, according to UN Convention on the Law of the Sea, every coastal nation has a continental shelf extending no more than 200 nautical miles from the nation's coastline. The U.S. federal system creates a related legal term, the Outer Continental Shelf (capitalized). The Outer Continental Shelf is the part of the legal US continental shelf that is not under the jurisdiction of any of the individual states of the United States. Generally, federal ownership begins three nautical miles from the shore of most coastal states, with the exception of Texas and the Gulf coast of Florida where the Outer Continental starts at about nine nautical miles from shore. The Outer Continental Shelf generally ends 200 nautical miles from the U.S. coast.

[2] 2019-2024 National Outer Continental Shelf Oil and natural gas Leasing Draft Proposed Program.

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the total acreage of the Outer Continental Shelf (OCS) due to a lack of lease sales or moratoria.[3] The new plan would almost reverse that percentage. The proposed program for 2019-2024 would make 90 percent of the total acreage of the OCS available for oil and natural gas activities. In other words, the proposed plan would prohibit oil and natural gas activities in only 10 percent of the OCS compared to 94 percent now.

One part of the draft proposed plan would allow for companies to bid on leases on the Atlantic OCS beginning in 2020. While the proposal is still in draft form, the geographic extent of lease availability is still undecided. According to BOEM, leases have not been sold for the Atlantic OCS since 1983. The last exploratory well was completed in November of 1984, and in November of 2000 the last remaining leases in the Atlantic OCS were relinquished by the lease holders.

Current offshore oil and natural gas production in the U.S. is primarily limited to the central and western part of the Gulf of Mexico. There is also some limited legacy production off the coasts of Alaska and California. Oil and natural gas development off the Atlantic coast has been restricted since the 1980's. Only 51 exploratory wells were drilled in the 1970's and 1980's, mainly in shallow water. A lease sale off the coast of Virginia was proposed in 2008 for an area known as Lease Sale 220. The lease sale was cancelled in 2010. While there have been no recent seismic surveys or exploratory wells in the Atlantic OCS, an updated reserve analysis based on historic information was released by BOEM in 2011.

REVIEW OF EXISTING RESEARCH ON THE VALUE OF ECONOMIC DEVELOPMENT FROM OFFSHORE OIL AND NATURAL GAS ACTIVITY

There have been a number of studies of the likely economic effect from opening the Atlantic OCS to oil and natural gas development. In this section, we summarize the findings from three of the most relevant of those studies.

[3] Department of the Interior, Press Release: *Secretary Zinke Announces Plan for Unleashing America's Offshore Oil and Natural Gas Potential*, January 4, 2018.

The Economic Benefits of Increasing U.S. Access to Offshore Oil and Natural Gas Resources in the Atlantic[4]

This report quantified the potential benefits to the U.S. economy from opening the Atlantic OCS to oil and natural gas exploration. The reserve and production models of this report are based on a 2011 BOEM report that identified and estimated resources in ten distinct geologic areas.

The study expected that federal offshore lease sales would lead to high levels of offshore oil and natural gas activity. In addition, such activity would require large amounts of investment and operational spending by oil and natural gas operators, totaling $195 billion between 2017 and 2035, which would be primarily spent inside the U.S. and the Atlantic coast states. The study employed such a lengthy forecast period based on the expectation that if seismic activity began in 2017 and lease sales began in 2018, the earliest that first production could occur would be 2026.

This study assumed that leasing would begin in the Mid- and South-Atlantic OCS in 2018 and in the North Atlantic OCS in 2020. The study also anticipated that the demand for Atlantic OCS leases would be consistent with historic lease sales on other parts of the OCS. More specifically, the study estimated that beginning in 2018 350 leases would be sold and that leasing would increase so as to peak at 480 leases per year.

The study developed a scenario of oil and natural gas development in the Atlantic OCS, based on the resource potential of the area, similar geologic areas, and the full value chain of oil and natural gas development and production. It then quantified the capital and other investments projected to be undertaken by the oil and natural gas industry; identified linkages to the oil and natural gas supply chain and supporting industries at state and national levels; estimated job creation and additions to existing economic development associated with oil and natural gas activities; and estimated additional federal and state government revenues from to lease bids, rents, and production royalties.

The study found that by 2035, offshore oil and natural gas development could produce an incremental 1.3 million barrels of oil equivalent per day, generate nearly 280,000 jobs, contribute up to $23.5 billion per year to the U.S. economy, and generate $51 billion in cumulative government revenue. The study also assumed that the federal government would share 37.5 percent of government revenues with East Coast states as is done with states in the Gulf of Mexico under the Gulf of Mexico Energy Security Act of 2006. Most of these benefits would accrue to states along the East Coast but the economic impacts would be felt throughout the country.

In Virginia, annual spending on oil and natural gas development activity was estimated to peak in 2035 at nearly $1.8 billion per year. Virginia was expected to see high spending levels due to significant oil and natural gas development in the resource rich waters around the state. In addition, spending was estimated to include $665 million for operational expenditures, $330 million in drilling spending, and $135 million in installation spending.

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[4] Quest Offshore Resources, *The Economic Benefits of Increasing U.S. Access to Offshore Oil and Natural Gas Resources in the Atlantic* for the American Petroleum Institute and the National Ocean Industries Association, 2013.

Given the makeup of Virginia's economy and the large amount of projected development activity off the coast of Virginia, the study estimated high levels of engineering activity in the state, with spending projected to reach nearly $400 million a year in 2035. Virginia employment due to Atlantic OCS oil and natural gas exploration and development activities was projected to reach nearly 25,000 jobs in 2035, with a direct employment level due to development activity of nearly 9,000 jobs and an indirect and induced employment level of nearly 16,000 jobs.

Atlantic OCS oil and natural gas production was expected to contribute $16.9 billion to the Virginia economy over 20 years. Virginia state government revenues from federal/state revenue sharing were projected to reach $400 million per year by the end of the study period, with the cumulative effects on the state budget from 2017 to 2035 projected to reach nearly $1.9 billion.

Economic and Environmental Impacts of Oil and Gas Development Offshore the Delmarva, Carolinas, and Georgia[5]

This study estimated the economic and fiscal impacts of a high, medium and low production scenario of offshore oil and natural gas activities from Delaware to Georgia on the OCS. The three production scenarios were based on BOEM estimates of ultimate technically recoverable reserves in the area. Like the Quest Offshore Resources study, this study assumed that lease sales would be permitted in 2018.

In 2035, under the high production scenario, output in the area was projected to reach 943,000 barrels of oil equivalent per day; the medium production scenario projected production at over 484,000 barrels of oil equivalent per day; the low scenario projected production at 169,000 barrels of oil equivalent per day. Under the high production scenario, spending for investment and operations on the Atlantic OCS was estimated to reach almost $11 billion in 2035, while the medium and low production scenarios estimated spending of $5.5 and $1.9 billion respectively. These spending levels were calibrated based on the Quest Offshore Resources study, described above.

[5] Timothy J. Considine, *Economic and Environmental Impacts of Oil and Gas Development Offshore the Delmarva, Carolinas, and Georgia*, 2014.

Higher value added was estimated under the medium and high production scenarios. Under the medium scenario, value added was estimated to be $6.9 billion in 2035. In addition, employment gains were estimated to be significant: over 15,000 in 2025, over 60,000 in 2030, and more than 87,000 in 2035. The high scenario showed gains in value added of $13.4 billion in 2035, while employment gains were estimated at over 29,000 in 2025, nearly 118,000 in 2025, and almost 170,000 in 2035.

Fiscal impacts were expected to include lease sale and royalty income and state and local taxes. Like the Quest Offshore Resources study, the study assumed that the federal government would share 37.5 percent revenues with East Coast states. In 2025, oil and natural gas lease and royalty payments to states from Delaware to Georgia would range in total from $27 million to $149 million based on the low to high production scenarios. Once production was well underway in 2030, these payments were projected to rise to between $170 million and $946 million. By 2035, lease and royalty payments were projected to be between $583 million and $3.2 billion. In addition to lease and royalty payments, the state governments from Delaware to Georgia were projected to receive additional tax revenue from $116 million under the low production scenario to over $640 million under the high production scenario by 2035.

North Carolina, South Carolina, and Virginia were estimated to be the biggest winners if Atlantic offshore oil and natural gas production was allowed. Under the high production scenario Virginia was estimated to add $13.2 billion in economic product, $2 billion in tax revenues, and 13,200 more jobs annually over a period of 19 years.

Table 1 shows the cumulative amounts of economic product and state government revenue for the 20-year period estimated by the study for the low, medium, and high levels of production.

	Low	Medium	High
Total Economic Product (Delaware – Georgia)	$10.8 billion	$30.8 billion	$60.0 billion
Annual Employment (Delaware – Georgia)	12,100	34,500	67,300
Total Government Revenue (Delaware – Georgia)	$2.1 billion	$6.0 billion	$11.6 billion
Virginia Economic Product	$2.4 billion	$6.8 billion	$13.3 billion
Virginia Annual Employment	2,400	6,800	13,200
Virginia Government Revenue	$360 million	$1 billion	$2 billion

Table 1. Economic, Fiscal and Employment Impacts (present value discounted at 3 percent in 2012 dollars)[6] by Level of Production as Reported by Timothy Considine.

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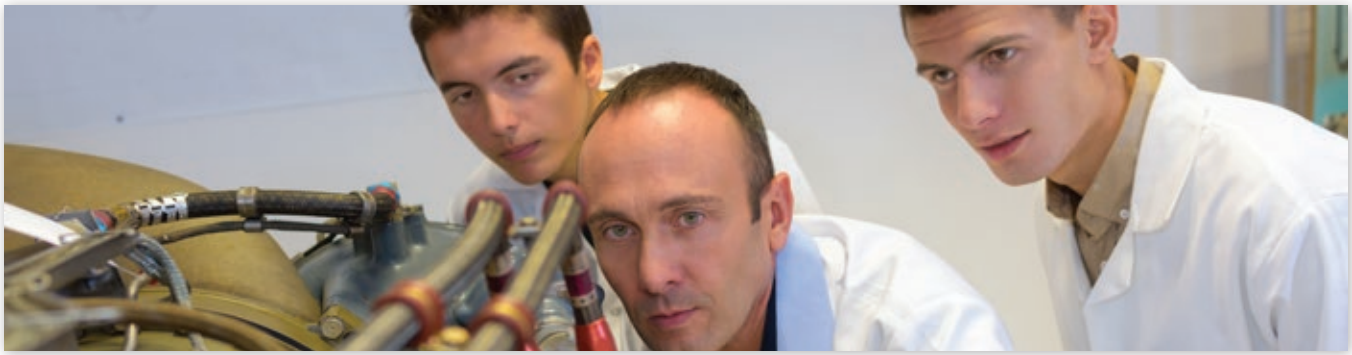
[6] Table ES2, *Economic and Environmental Impacts of Oil and Gas Development Offshore the Delmarva, Carolinas, and Georgia*, 2014.



The Economic Impacts of Allowing Access to the Atlantic OCS for Oil and Natural Gas Exploration and Development[7]

Our report relies upon estimates in a study by Calash of the impact of Atlantic OCS oil and natural gas development on the economy of the state of Virginia. Calash was commissioned by the American Petroleum Institute to project potential impacts on U.S. oil and natural gas production, supported employment, and state gross domestic product (GDP) due to oil and natural gas development of the Atlantic OCS. 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 projects spending from leasing and seismic imaging to exploratory drilling, then project development through production along with the ongoing spending that is needed to maintain and operate projects. The analysis is based on a combination of publicly-available government data and Calash's own proprietary analysis.

The report employs a 20-year modeling period. It assumes that oil and natural gas leasing on the Atlantic OCS will begin in year 1 (which coincides with 2020 in the BOEM draft proposed program), that leasing will follow the proposed lease schedule for five years, and that it will continue on a regular basis throughout the 20-year modeling period. The report uses existing U.S. Geological Survey and BOEM estimates of oil and natural gas resources in the Atlantic OCS. The report also assumes a reasonable rate of permit approvals for projects and drilling. The study projects activity, spending, employment, and economic impacts associated with these activities for 20 years.[8]

Projected economic and employment impacts are based on Calash's estimates of direct spending in eight key affected industries and Calash'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 are likely to take place. Assumptions on pricing, the locational distribution of spending, oil and natural gas prices, and economic multipliers are based on 2017 conditions. Production pricing was calculated using U.S. Energy Information Agency estimates for both West Texas Intermediate crude spot and Henry Hub natural gas prices from the 2017 Annual Energy Outlook. Depending on the timing of increased access to Atlantic oil and natural gas reserves, actual experience may differ from those assumptions.

[7] Calash, *The Economic Impacts of Allowing Access to the Atlantic OCS for Oil and Natural Gas Exploration and Development* for the American Petroleum Institute, 2018. Available at http://www.api.org/~/media/Files/Policy/Exploration/Atlantic-OCS-Development-Economic-Impacts.pdf

[8] The Calash report does not estimate personal income taxes, corporate income taxes, or local property taxes.

The estimates of direct spending presented in the Calash report account 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 and the drilling and evaluation of exploratory wells. For projects that are deemed to be commercially viable, a full range of equipment must be designed and purchased. Offshore equipment includes production platforms and potentially on-site processing facilities as well as below water equipment – subsea equipment, umbilical lines, risers, and flowlines. Finally, the equipment must be installed, and additional development wells must be drilled. Once under production, additional operational expenditures are required to perform ongoing maintenance, production operations, and other activities to maintain continued production.

After compiling the scenario of direct spending estimates, Calash separated the local content of oil and natural gas operations across the Atlantic states. 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. Then Calash modelled changes in the geographic distribution of spending based on anticipated increases in oil and natural gas development activity within the Atlantic states. In making these calculations, Calash took into account the proximity of reserves and production to locations such as shore bases and ports, as well as Bureau of Economic Analysis (BEA) data relating to each state's current industrial profile.

Development of state GDP and job data were calculated using the BEA's RIMs II Model which provides an input-output multiplier on spending at the industry and state levels. These multipliers were then used to calculate the secondary economic effects associated with the direct spending Calash estimated for eight key affected industries. The model outputs calculated from these spending effects included number of jobs and GDP multiplier effects.

The eight industries for which Calash estimated direct spending were:

- 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
- Steel Product Manufacturing from Purchased Steel
- Support Activities for Oil and Gas Operations

The Calash study projects that total direct spending by these eight key affected industries on Atlantic OCS offshore oil and natural gas development will total $3.8 billion in year 5 of the 20-year modeling horizon, $16.0 billion in year 10, $20.8 billion in year 15, and $20.4 billion in year 20. Over the 20-year modeling horizon as a whole, cumulative direct spending by these eight key affected industries is projected to be a little over $259 billion. In addition, accounting for multiplier effects this spending is projected to support a total of 48,882 jobs in year 5 of the 20-year modeling horizon, 195,371 jobs in year 10, 264,495 jobs in year 15, and 264,298 jobs in year 20.

Virginia is projected to be the third largest beneficiary of this economic activity, trailing only North Carolina and South Carolina. According to the Calash estimates, direct spending by these eight key affected industries on Atlantic OCS offshore oil and natural gas development in Virginia will total $234 million in year 5 of the 20-year modeling horizon, $1.0 billion in year 10, $1.6 billion in year 15, and $1.8 billion in year 20. Over the 20-year modeling horizon as a whole, cumulative direct spending by these eight key affected industries in Virginia is projected to total about $19.0 billion and the largest share of that cumulative spending is projected to occur in the Architectural, Engineering, and Related Services ($5.6 billion), Support Activities for Oil and Gas Operations ($4.6 billion), Construction ($3.1 billion), and Drilling Oil and Gas Wells ($2.5 billion) industries. Accounting for multiplier effects this direct spending is projected to support a total of 3,368 statewide jobs in year 5 of the 20-year modeling horizon, 13,940 statewide jobs in year 10, 22,765 statewide jobs in year 15, and 24,664 statewide jobs in year 20.

It is important to note that there are reasons to believe that the estimates presented in the Calash report may prove more conservative than actual experience. First of all, the scope of the Calash report was limited to the assessment of the development of oil and natural gas resources from known Atlantic formations in federal waters identified in BOEM reports. Even though new oil and natural gas formations (that have not yet been identified by BOEM) will likely be found as the area is developed, benefits from the development of such additional resources are not included in the report. Secondly, the Calash analysis also excludes potential benefits from the development of onshore downstream infrastructure.

ECONOMIC AND FISCAL IMPACT

In this section, we quantify the economic and fiscal contribution that offshore oil and natural gas development activities would have on the Virginia Beach MSA in years 5, 10, 15, and 20 of the 20-year modeling period of offshore oil and natural gas development employed in the Calash report. It should be noted, however, that where the study area used in the Calash report was the state of Virginia as a whole, in the analysis that follows our study area is confined to that portion of Virginia that is most likely to benefit from offshore oil and natural gas development activities – the Virginia Beach MSA. As a result, the reader should anticipate that the economic and fiscal impacts presented in our analysis will be smaller than those presented in the Calash report.

Method

To empirically evaluate the potential economic and fiscal impact that offshore oil and natural gas development activities would have on the Virginia Beach MSA, we employ a regional economic impact model called IMPLAN.[9] The IMPLAN model is one of the most commonly used economic impact simulation models in the U.S., and in Virginia is used by UVA's Weldon Cooper Center, the Virginia Department of Planning and Budget, the Virginia Employment Commission, and other state agencies and research institutes. Like all economic impact models, the IMPLAN model uses economic multipliers to quantify economic impact.

Economic multipliers measure the ripple effects that an expenditure generates as it makes its way through the economy. For example, as when firms engaged in support activities for oil and natural gas operations purchase goods and services – or when their employees use their salaries and wages to make household purchases – thereby generating income for someone else, which is in turn spent, thereby becoming income for yet someone else, and so on. Through this process, one dollar in expenditures generates multiple dollars of income. The mathematical relationship between the initial expenditure and the total income generated is the economic multiplier.

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[9] IMPLAN v.3 is produced by Minnesota IMPLAN Group, Inc.

One of the primary advantages of the IMPLAN model is that it uses regional and national production and trade flow data to construct region-specific and industry-specific economic multipliers. Moreover, as will be discussed more fully later in this section, those production and trade flow data can be customized to better capture the future growth and development of an industry that may not currently exist in the study area, just as offshore oil and natural gas development activities do not currently exist in the Virginia Beach MSA. As a result, the economic and fiscal impact estimates produced by IMPLAN are not generic, they reflect as precisely as possible the economic realities of the specific industry and the specific study area being evaluated.

In the analysis that follows, these impact estimates are divided into three categories. First-round direct impact measures the direct economic contribution of the entity being evaluated (e.g., own employment, wages paid, goods and services purchased by firms engaged in offshore oil and natural gas development activity). Second-round indirect and induced impact measures the economic ripple effects of this direct impact in terms of business to business, and household (employee) to business, transactions. Total impact is simply the sum of the preceding two. These categories of impact are then further defined in terms of employment (the jobs that are created), labor income (the wages and benefits associated with those jobs), economic output (the total amount of economic activity that is created in the study area), and state and local tax revenue (the tax revenues that are generated as a result of this economic activity).

Assumptions

In assessing the potential economic and fiscal impact on the Virginia Beach MSA from offshore oil and natural gas development activity, we rely on the estimates of direct statewide spending by industry developed in the Calash study. However, to control for the portion of that direct statewide spending that would likely be spent within the Virginia Beach MSA we rely on Local Purchase Coefficients from the IMPLAN model. These coefficients provide an estimate of the proportion of goods and services purchased from a specific industry that would likely be spent with providers within a given study area, based on the existing economic footprint of that industry within that study area.

The Local Purchase Coefficients for the eight industries that are included in our direct spending estimates for offshore oil and natural gas development activity are provided in Table 2. For the six of those industries that already have a significant economic footprint in Virginia, these Local Purchase Coefficients are based on Virginia Beach MSA specific data. However, to control for the fact that the regional economic footprint of the Drilling Oil and Gas Wells and Support Activities for Oil and Gas Operations industries is expected to grow over time with the development of offshore oil and natural gas activity, we extrapolate the Local Purchase Coefficients for these two industries from their current Virginia Beach MSA level at the beginning of the forecast period to a level that reflects comparable data from the state of Louisiana at the end of the forecast period.

In addition, we also adjust the production and spending patterns for the Drilling Oil and Gas Wells and Support Activities for Oil and Gas Operations industries within the IMPLAN model for the Virginia Beach MSA to reflect data available from the state of Louisiana, where offshore oil and natural gas development activities are far more prevalent, and then also adjust the average regional wages for these industries to reflect national data.

Louisiana was selected as a proxy for these tasks because it is one of the few states in the U.S. that hosts a mature offshore oil and natural gas industry. As a result, it provides a real-life example of what that industry and its supply network might look like by the end of the 20-year modeling scenario used in this analysis.

Industry	Local Purchase Coefficient for Virginia Beach MSA
Architectural, engineering, and related services	58.5%
Construction	99.8%
Drilling oil and gas wells	7.9% / 94.9%
Fabricated metal product manufacturing	9.1%
Mining, oil, and gas field machinery manufacturing	less than 0.1%
Natural gas distribution	57.7%
Steel product manufacturing from purchased steel	0.2%
Support activities for oil and gas operations	3.6% / 94.1%

Table 2: Local Purchase Coefficients Used to Estimate Virginia Beach MSA Direct Spending by Industry from Projected Statewide Direct Spending

Based on these adjustments, our estimates of direct spending within the Virginia Beach MSA are detailed in Table 3 for years 5, 10, 15, and 20 of the 20-year period of offshore oil and natural gas development activity modeled in the Calash study and described earlier in this report.[10]

Industry	Year 5	Year 10	Year 15	Year 20
Architectural, engineering, and related services	$52,872,273	$206,431,745	$252,071,015	$255,586,724
Construction	$67,126,948	$210,852,624	$325,590,330	$177,002,278
Drilling oil and gas wells	$888,978	$45,296,730	$158,854,438	$255,459,386
Fabricated metal product manufacturing	$0	$6,021,877	$3,640,781	$3,009,324
Mining and oil and gas field machinery manufacturing	$6,285	$26,379	$39,064	$33,958
Natural gas distribution	$0	$6,237,820	$24,049,027	$34,388,748
Steel product manufacturing from purchased steel	$104,402	$155,368	$161,178	$204,634
Support activities for oil and gas operations	$871,032	$57,753,654	$255,923,483	$618,621,390
Virginia Beach MSA Total	**$121,869,918**	**$532,776,197**	**$1,020,329,317**	**$1,344,306,442**

Table 3: Projected Direct Spending in the Virginia Beach MSA by Industry from Offshore Oil and Natural Gas Development Activity

[10] Data source: Calash, "The Economic Impacts of Allowing Access to the Mid and South Atlantic OCS for Oil and Natural Gas Exploration and Development," prepared for the American Petroleum Institute, 2017.

Results

By feeding the data provided in Table 3 into our customized IMPLAN model for the Virginia Beach MSA, we project the following estimates of potential economic and fiscal impact on the Virginia Beach MSA from offshore oil and natural gas development activity.

Employment

As graphically depicted in Figure 1 and further detailed in Table 4, we project that the first-round direct employment generated in the Virginia Beach MSA from offshore oil and natural gas development activity would rise from approximately 752 jobs in year five of the 20-year period of oil and natural gas development modeled in this report to 10,385 jobs in year 20. Accounting for economic ripple effects, we project that direct economic activity would drive second-round indirect and induced employment of approximately 469 jobs in year five of the forecast period, rising to 6,414 jobs in year 20. In combination, we project the total employment impact on the Virginia Beach MSA from offshore oil and natural gas development activities would rise from approximately 1,221 jobs in year five of the forecast period to 16,798 jobs in year 20.

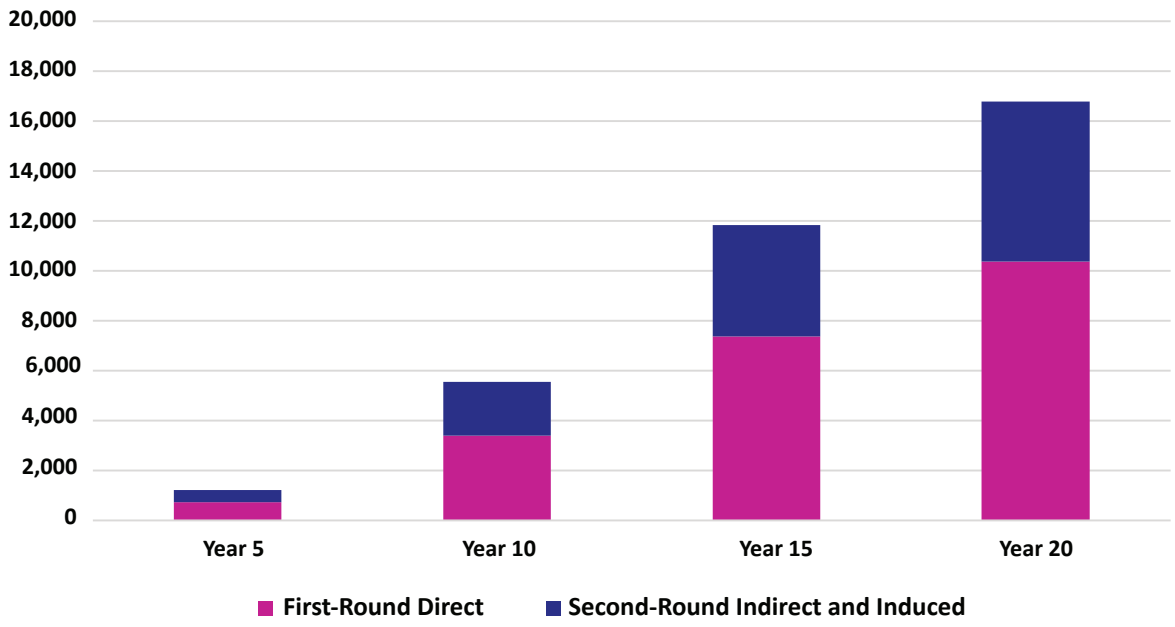

Figure 1: Projected Employment Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity – Years 5, 10, 15, and 20

Year	First-Round Direct	Second-Round Indirect and Induced	Total
5	752	469	**1,221**
10	3,411	2,158	**5,569**
15	7,387	4,447	**11,833**
20	10,385	6,414	**16,798**

Table 4: Projected Employment Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity - Years 5, 10, 15, and 20

Labor Income

As graphically depicted in Figure 2 and further detailed in Table 5, we project that the first-round direct labor income generated in the Virginia Beach MSA from offshore oil and natural gas development activity would rise from approximately $48.7 million in year five of the 20-year period of oil and natural gas development modeled in this report to $747.5 million in year 20. Accounting for economic ripple effects, we project that this direct economic activity would drive second-round indirect and induced labor income of approximately $20.6 million in year five of the forecast period, rising to $280.1 million in year 20. In combination, we project that the total labor income impact on the Virginia Beach MSA from offshore oil and natural gas development activities would rise from approximately $69.3 million in year five of the forecast period to $1.0 billion in year 20.

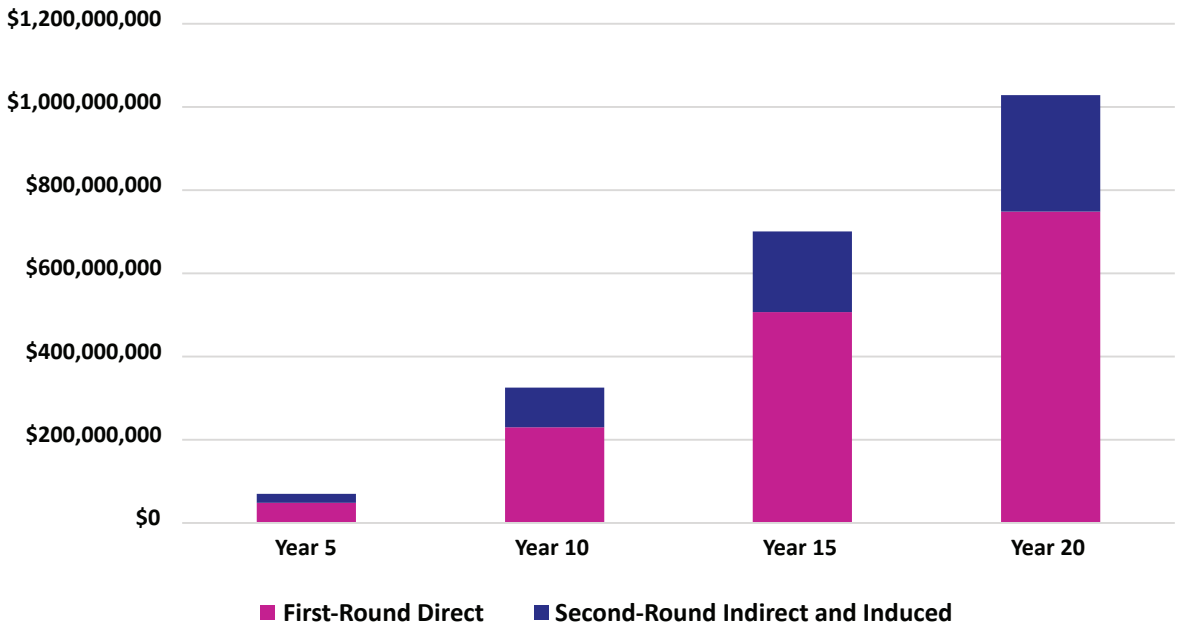

Figure 2: Projected Labor Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity – Years 5, 10, 15, and 20

Year	First-Round Direct	Second-Round Indirect and Induced	Total
5	$48,701,863	$20,626,120	**$69,327,983**
10	$230,047,882	$94,657,448	**$324,705,330**
15	$505,797,108	$194,495,456	**$700,292,563**
20	$747,507,925	$280,126,151	**$1,027,634,077**

Table 5: Projected Labor Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity – Years 5, 10, 15, and 20

Economic Output

As graphically depicted in Figure 3 and further detailed in Table 6, we project that the first-round direct economic output generated in the Virginia Beach MSA from offshore oil and natural gas development activity would rise from approximately $99.7 million in year five of the 20-year period of oil and natural gas development modeled in this report to $1.2 billion in year 20. Accounting for economic ripple effects, we project that this direct economic activity would drive second-round indirect and induced economic output of approximately $63.7 million in year five of the forecast period, rising to $873.4 million in year 20. In combination, we project that the economic output impact on the Virginia Beach MSA from offshore oil and natural gas development activities would rise from approximately $163.4 million in year five of the forecast period to $2.1 billion in year 20.

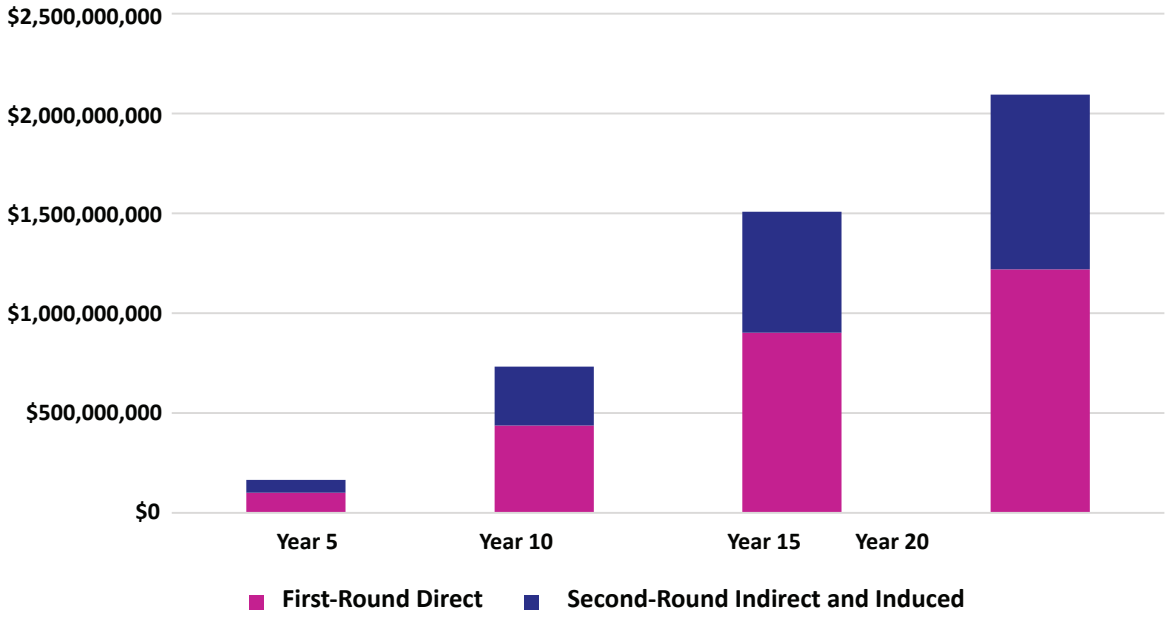

Figure 3: Projected Economic Output on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity – Years 5, 10, 15, and 20

Year	First-Round Direct	Second-Round Indirect and Induced	Total
5	$99,716,741	$63,719,215	**$163,435,956**
10	$438,509,761	$292,460,392	**$730,970,153**
15	$901,549,897	$606,469,742	**$1,508,019,639**
20	$1,220,498,574	$873,446,131	**$2,093,944,706**

Table 6: Projected Economic Output Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity - Years 5, 10, 15, and 20

State and Local Tax Revenue

As graphically depicted in Figure 4 and further detailed in Table 7, we project that the state and local tax revenue generated by the regional economic activity presented earlier would rise from approximately $5.4 million in year five of the 20-year period of oil and natural gas activity development modeled in this report to $102.0 million in year 20. These dollar amounts do not include any potential revenue from royalties or bonuses if Federal revenue sharing were to be implemented in the future.

[11] The projection of state and local tax revenue provided by the IMPLAN model is based on 14 tax categories: dividends (e.g., dividend payments to government by corporations from investments), social insurance taxes – employee contribution (e.g., social insurance contributions paid by state employees to state sponsored pensions), social insurance taxes – employee contribution (e.g., social insurance contributions paid by state government to state sponsored pensions), indirect business tax – sales tax (e.g., sales taxes paid to state and local governments by businesses), indirect business tax – property tax (e.g., real estate taxes paid to state and local governments by businesses), indirect business tax – motor vehicle (e.g., motor vehicle licensing fees paid to state and local governments by businesses), indirect business tax – severance (e.g., taxes imposed by a state on the extraction of natural resources), indirect business tax – other taxes (e.g., license, documentary, stamp, and other miscellaneous taxes paid to state and local governments by businesses), indirect business tax – non-taxes (e.g., fines paid to state and local governments by businesses), corporate profits tax (e.g., income taxes paid to state and local governments by corporations), personal tax – income (e.g., income taxes paid to state and local governments by individuals), personal tax – non-taxes (e.g., fines paid to state and local governments by individuals), personal tax – motor vehicle taxes (e.g., motor vehicle licensing fees paid to state and local governments by individuals), personal tax – property taxes (e.g., real estate taxes paid to state and local governments by individuals), and personal tax – other taxes (e.g., license, documentary, stamp, and other miscellaneous taxes paid to state and local governments by individuals). Calculations of these state and local tax revenues are based on data from the U.S. Bureau of Economic Analysis.

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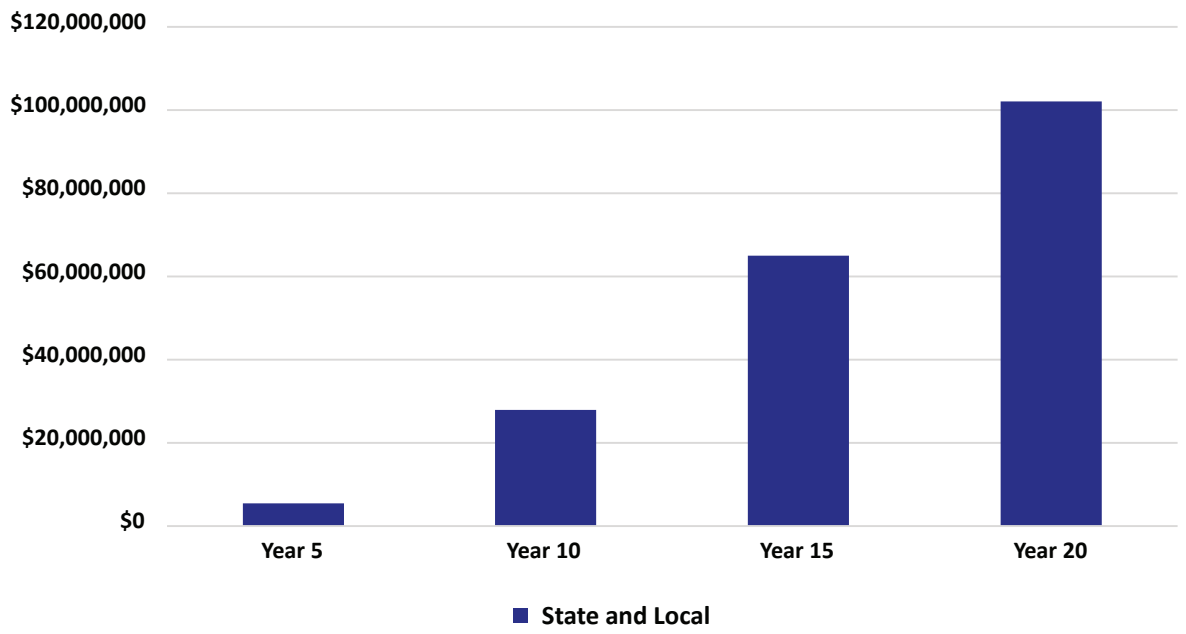

Figure 4: Projected State and Local Revenue Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity – Years 5, 10, 15, and 20

Year	Total
5	$5,416,783
10	$27,815,758
15	$65,020,626
20	$101,951,687

Table 7: Projected State and Local Revenue Impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity - Years 5, 10, 15, and 20

EFFECT OF OIL AND NATURAL GAS DEVELOPMENT ACTIVITY ON THE REGIONAL ECONOMY

In this section, we provide a broader context for the regional economic impact assessment presented in the previous section by reviewing recent economic trends in the Virginia Beach MSA and discussing how offshore oil and natural gas development activity could affect those trends.

Regional Economic Profile of the Virginia Beach MSA

In this portion of the section we provide a profile of recent economic trends in the Virginia Beach MSA.

Total Nonfarm Employment

Figure 5 depicts the trend in seasonally adjusted total nonfarm employment in the Virginia Beach MSA over the ten-year period from February 2009 through February of 2018. As these data show, employment in the Virginia Beach MSA was heavily impacted by the Great Recession of 2007. However, the regional economy began to recover in 2011, peaked in June of 2017 at 781,800 jobs, deteriorated over the last half of 2017, and experienced an uptick in the first two months of 2018. As of February 2018, seasonally adjusted total nonfarm employment in the Virginia Beach MSA stood at 780,800 jobs. This represents a 30,200 job, or 4.0 percent, gain in employment over the period as a whole. To put this number in perspective, over this same period seasonally adjusted total nonfarm employment in Virginia increased by 8.1 percent, and by 11.1 percent at the national level.[12]

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[12] Data Source: U.S. Bureau of Labor Statistics.

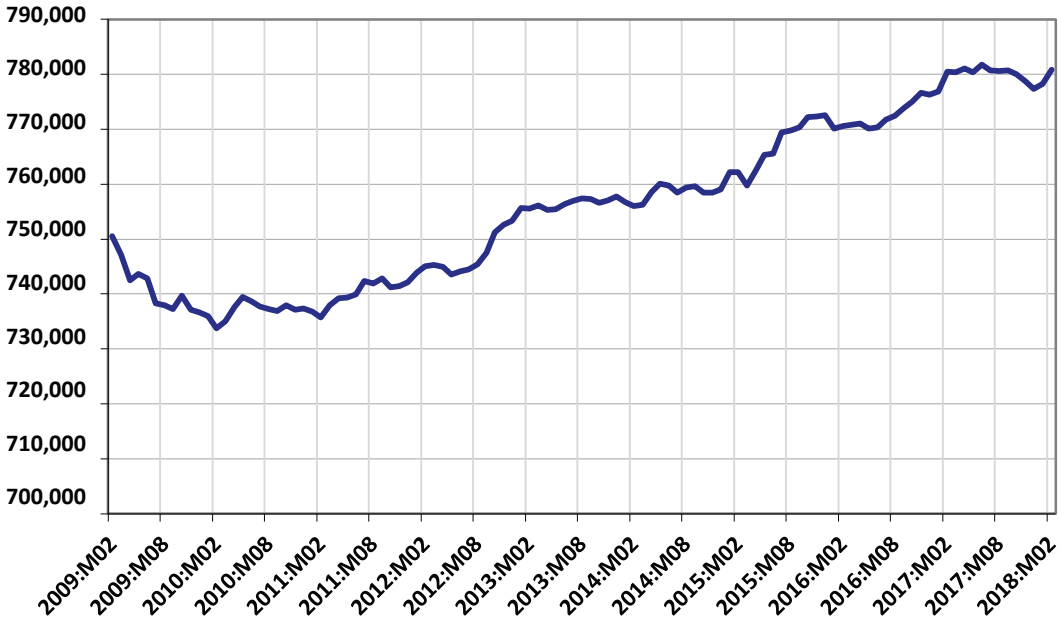

Figure 5: Total Employment in the Virginia Beach MSA – February 2008 to February 2018[13]

To provide a point of reference, Figure 6 compares the year-over-year change in seasonally adjusted total nonfarm employment in the Virginia Beach MSA to that of the state of Virginia and the U.S. over the same period. Any point above the zero line in this graph indicates positive year-over-year employment growth, while any point below the zero line indicates a decline in year-over-year employment.

As these data indicate throughout the period from mid-2011 forward, year-over-year employment changes in Virginia generally under-performed the national average, while year-over-year employment changes in the Virginia Beach MSA generally under-performed the statewide average. As of the February 2018, year-over-year employment growth was 0.0 percent in the Virginia Beach MSA, as compared to 0.9 percent statewide in Virginia and 1.6 percent nationally.

[13] Data Source: U.S. Bureau of Labor Statistics.

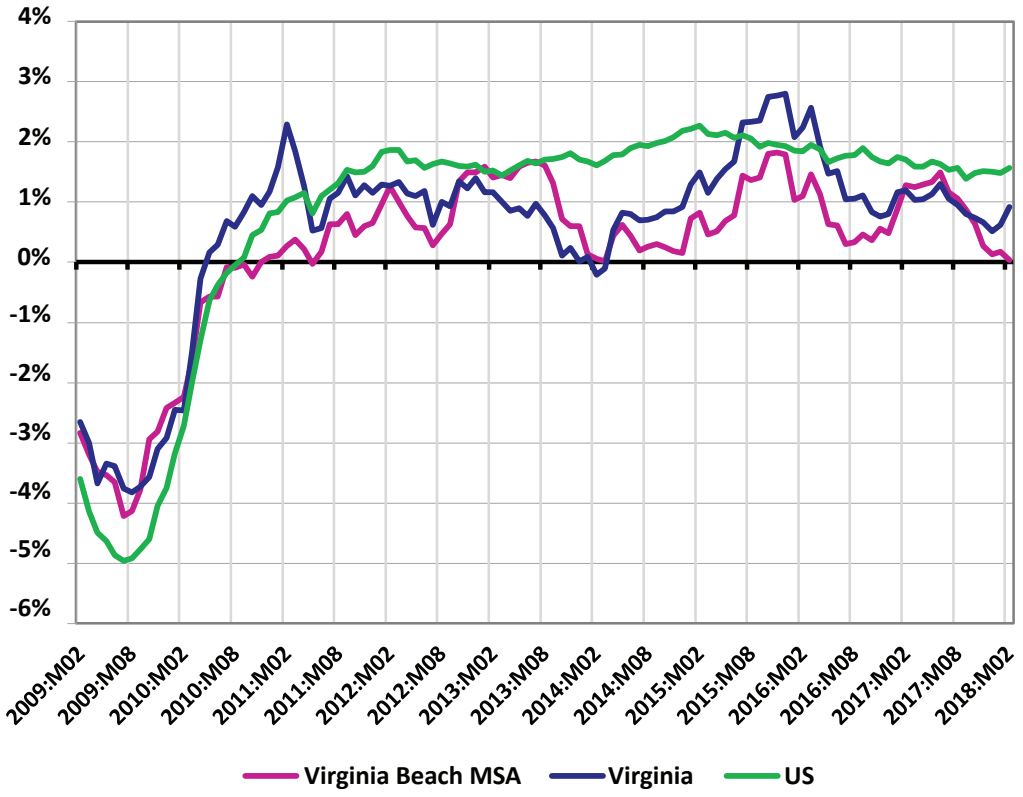

Figure 6: Year-Over-Year Change in Total Employment – February 2009 to February 2018[14]

Unemployment

Figure 7 illustrates the trend in the Virginia Beach MSA's seasonally unadjusted unemployment rate over the ten-year period from January 2009 through January 2018 and benchmarks that trend against statewide data for Virginia and the U.S. As these data show, unemployment rates in the Virginia Beach MSA generally remained above the statewide average throughout the period, but below the average for the U.S. As of January 2018, the unemployment rate stood at 4.0 percent in the Virginia Beach MSA, 3.7 percent statewide in Virginia, and 34.5 percent nationally.

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[14] Data Source: U.S. Bureau of Labor Statistics.

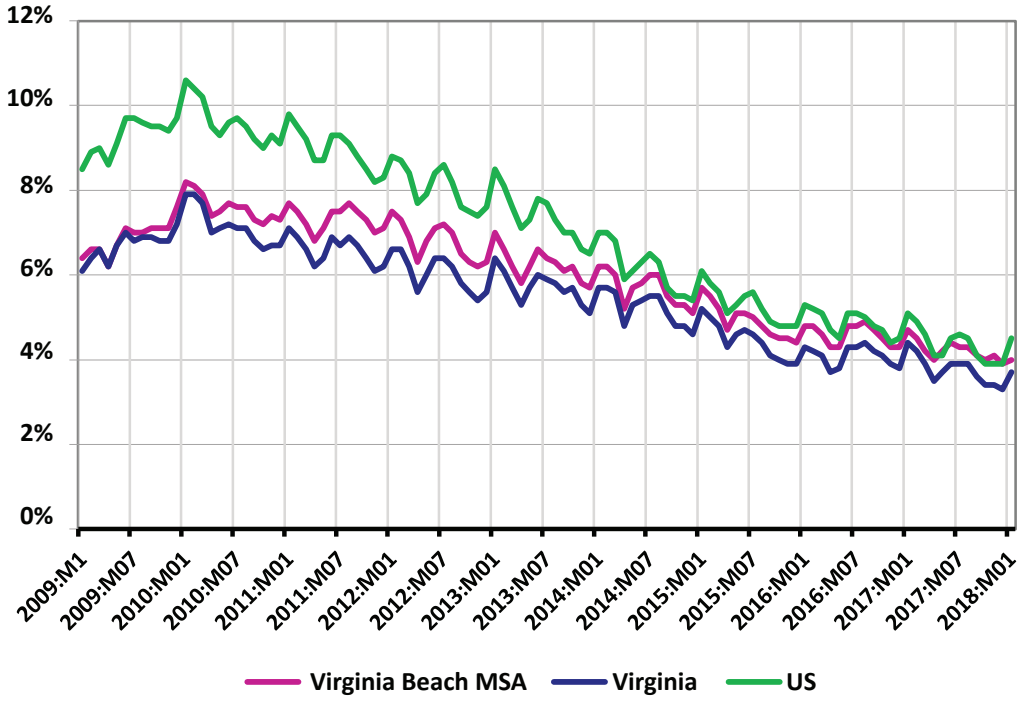

Figure 7: Unemployment Rate – January 2009 to January 2018[15]

Employment and Wages by Major Industry Sector

To provide a better understanding of the factors motivating the total nonfarm employment trends depicted in Figures 5 and 6, Figures 8 through 10 provide data on recent trends in private sector employment and wages in the Virginia Beach MSA by major industry. Figure 8 provides an indication of the distribution of private sector employment across major industries in the Virginia Beach MSA by ranking each industry by total employment in 2016. As these data indicate, the Virginia Beach MSA's largest private sector industry that year was Health Care and Social Assistance (90,518 jobs), followed by Retail Trade (86,501 jobs), Accommodation and Food Services (76,638 jobs), Manufacturing (50,667 jobs), and Professional, Scientific, and Technical Services (45,786 jobs).

Figure 9 provides a similar ranking for average private sector weekly wages by major industry in the Virginia Beach MSA in 2016. As these data show, the highest paying private sector industries in the Virginia Beach MSA that year were Management of Companies and Enterprises ($1,873 per week), Utilities ($1,683 per week), Professional, Scientific, and Technical Services ($1,352 per week), Mining, Quarrying, and Oil and natural gas Extraction ($1,321 per week), and Finance and Insurance ($1,312 per week). By way or reference, the average weekly wage across all private sector industries in the Virginia Beach MSA that year was $825 per week.

[15] Data Source: U.S. Bureau of Labor Statistics.

Lastly, Figure 10 details the change in private sector employment between 2015 and 2016 by major industry in the Virginia Beach MSA. Over this period, the largest private sector employment gains occurred in Health Care and Social Assistance (up 2,426 jobs), Accommodation and Food Services (up 1,903 jobs), and Transportation and Warehousing (up 1,024 jobs). While at the other end of the spectrum, the largest private sector employment losses occurred in Manufacturing (down 2,398 jobs), Administrative and Support and Waste Management (down 1,140 jobs), and Real Estate and Rental and Leasing (down 631 jobs).

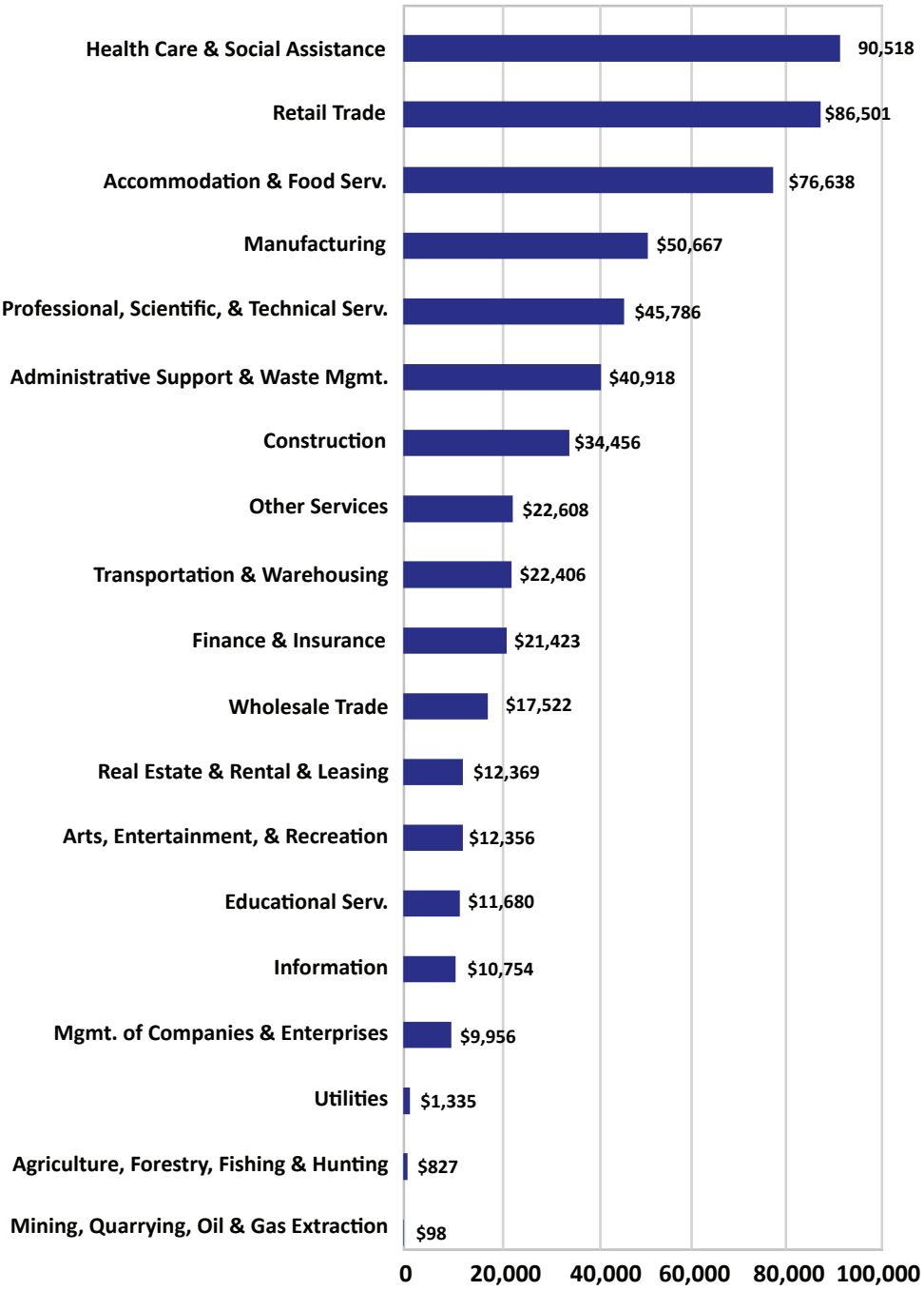

Figure 8: Private Sector Employment by Major Industry in the Virginia Beach MSA in 2016[16]

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[16] Data Source: Virginia Employment Commission.

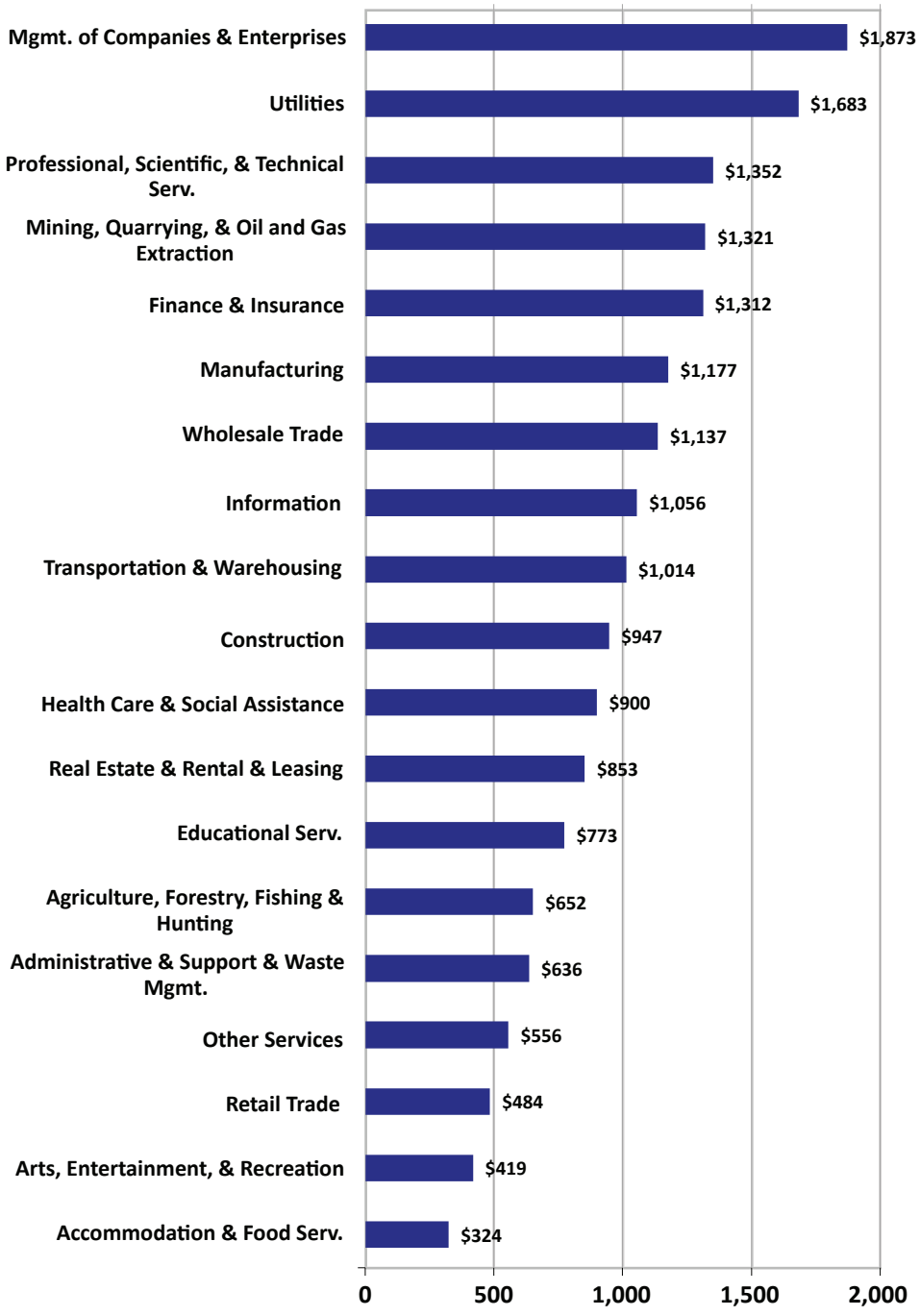

Figure 9: Average Private Sector Weekly Wages by Major Industry in the Virginia Beach MSA in 2016[17]

[17] Data Source: Virginia Employment Commission.

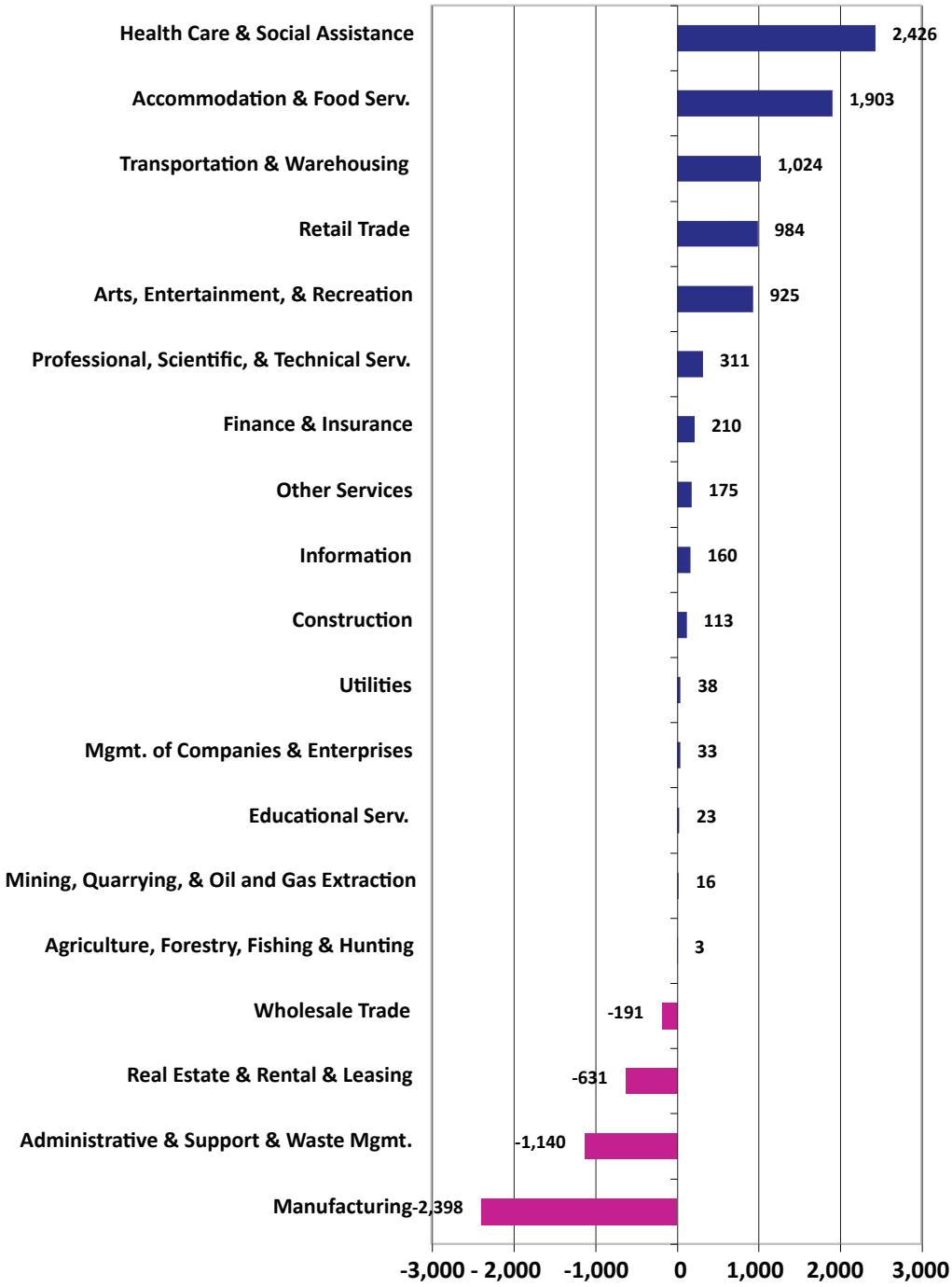

Figure 10: One-Year Change in Private Sector Employment by Major Industry in the Virginia Beach MSA between 2015 and 2016[18]

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[18] Data Source: Virginia Employment Commission.

In Sum

The Virginia Beach MSA has confronted a challenging economic environment in recent years. Since mid-2011, year-over-year employment growth in the region has generally under-performed both the state of Virginia and the nation as a whole. In addition, between 2015 and 2016 the largest employment gains in the region were in Health Care and Social Assistance (up 2,426 jobs), while the largest employment losses were in Manufacturing (down 2,398 jobs). In considering the juxtaposition of these two trends, it is important to note that Health Care and Social Assistance ranks as the region's 11th highest paying industry sector, while Manufacturing ranks as the regions 6th highest paying industry sector.

Effect of Offshore Oil and Natural Gas Development Activity on the Regional Economy

Recall from our analysis of potential economic and fiscal impact from the previous section that the total employment impact from offshore oil and natural gas development activity on the Virginia Beach MSA in the 20th year of the modeling horizon was projected to be approximately 16,798 jobs. Figure 11 draws on that analysis to provide a breakdown of that employment by major industry sector.[19]

As these data show, the largest regional employment gains are not surprisingly anticipated in Mining, Quarrying, and Oil and Gas Extraction (up 8,060 jobs). Recall from Figures 8 and 9 that although Mining, Quarrying, and Oil and Gas Extraction is currently the Virginia Beach MSA's smallest major industry sector in terms of employment, it is also its 4th highest paying sector with an average weekly wage of $1,321 (60 percent above the regional average of $825).

[19] The industry totals depicted in Figure 11 may not sum due to rounding.

The 2nd largest regional employment gains in the 20th year of the modeling horizon are anticipated in Construction (up 1,568 jobs). Recall from Figures 8 and 9 that Construction is currently the Virginia Beach MSA's 7th largest industry sector and also its 10th highest paying sector with an average weekly wage of $947 (12 percent above the regional average of $825).

The 3rd largest regional employment gains in the 20th year of the modeling horizon are anticipated in Professional, Scientific, and Technical Services (up 1,492 jobs). Recall from Figures 8 and 9 that Professional, Scientific, and Technical Services is currently the Virginia Beach MSA's 5th largest industry sector and also its 3rd highest paying sector with an average weekly wage of $1,352 (64 percent above the regional average of $825).

Importantly, overall 82 percent of the jobs depicted in Figure 11 pay wages that are above the average for the region, and 62 percent pay wages that are at least one-and-a-half-times the average for the region. Which means that the employment growth that offshore oil and natural gas activity is projected to generate would place significant upward pressure on total regional labor income.

An additional and more detailed analysis of the economic output impact of offshore oil and natural gas development activity on the Virginia Beach MSA by industry category is provided in the Appendix to this report.

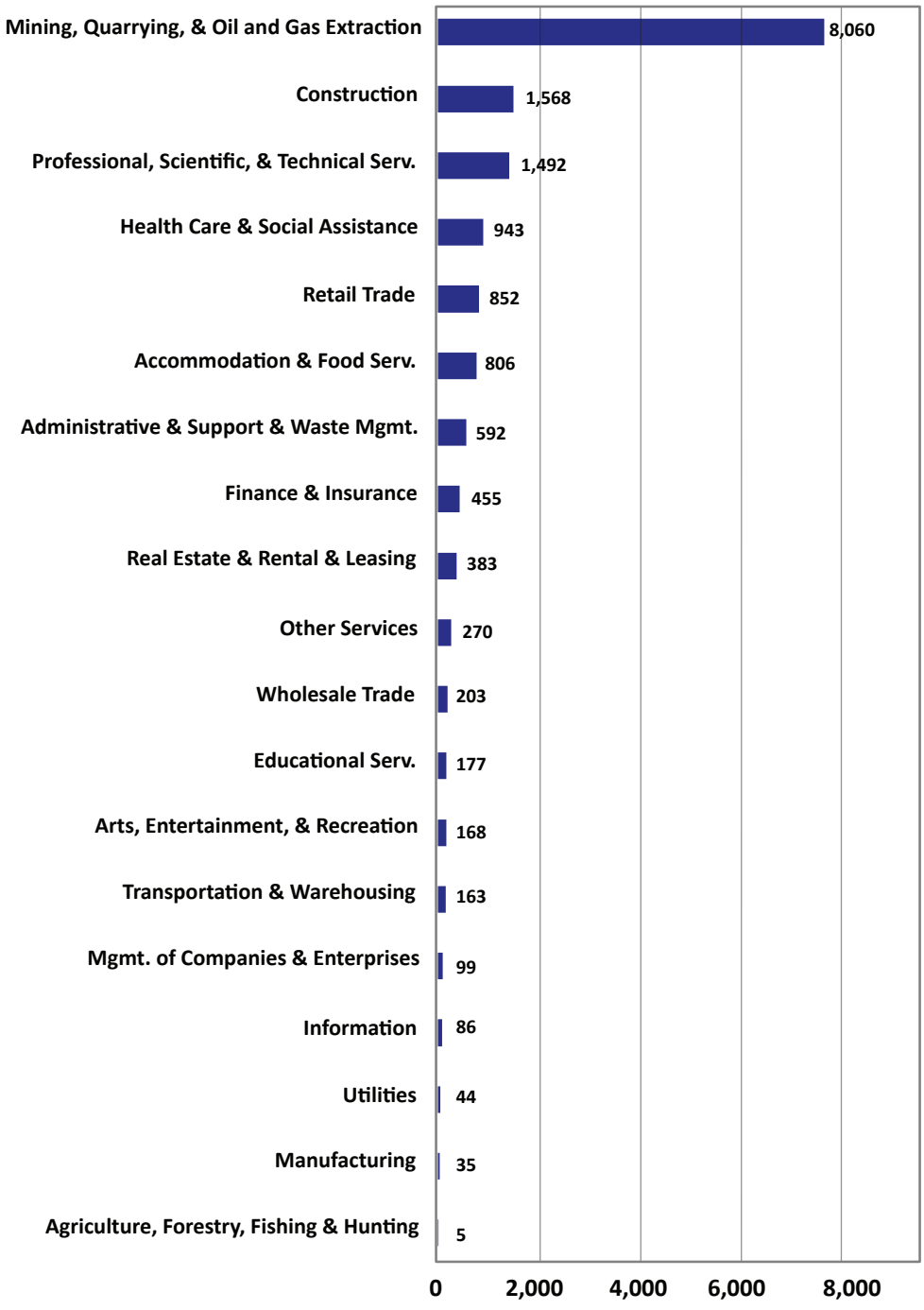

Figure 11: Projected Increase in Private Sector Employment by Major Industry in the Virginia Beach MSA Associated with Offshore Oil and Natrual Gas Activity in the 20th Year of Development

CONCLUSION

Recent proposed actions by the federal Bureau of Ocean Energy Management (BOEM) would open significant portions of Outer Continental Shelf (OCS) to the development of offshore oil and natural gas resources. In this report we have provided an empirical assessment of what offshore oil and natural gas development activity might mean for the economy of the Virginia Beach MSA. What that assessment projects is the offshore oil and natural gas development activity would make a substantial economic and fiscal contribution to the economy of the Virginia Beach MSA, a region that has confronted a challenging economic environment in recent years.

We project that offshore oil and natural gas activity would be responsible for generating approximately $121.9 million in direct spending in the Virginia Beach MSA in year five of the 20-year period of oil and natural gas development modeled in this report, rising to $1.3 billion in year 20. After accounting for second-round indirect and induced spending effects, we project that direct spending would generate regional impacts of approximately:

- 1,221 jobs in year five of development, increasing to 16,798 jobs in year 20.
- $69.3 million in labor income in five one of development, increasing to $1.0 billion in year 20.
- $163.4 million in total economic output in year five of development, increasing to $2.1 billion in year 20.
- $5.4 million in state and local tax revenue in year five of development, increasing to $102.0 million in year 20.

Our analysis also projects that this significant increase in economic activity would provide a much-needed boost to the Virginia Beach MSA's regional economy. Since mid-2011, year-over-year employment growth in the region has under-performed both the state of Virginia and the nation as a whole. In addition, the largest employment loss in the region between 2015 and 2016 occurred in Manufacturing, the region's 6th highest paying industry sector.

In this context, it is important to note that of the approximately 16,798 jobs that offshore oil and natural gas activity is projected to generate in the Virginia Beach MSA in the 20th year of the modeling horizon, 82 percent are projected to pay wages that are above the average for the region, and 62 percent are projected to pay wages that are at least one-and-a-half-times the average for the region. Which means that the employment growth that offshore oil and natural gas activity is projected to generate would place upward pressure on total regional labor income. Finally, our analysis has also shown that offshore oil and natural gas activity is likely to aid in diversifying the Virginia Beach MSA's regional economy by providing up to 8,060 additional jobs in Mining Quarrying, and Oil and Gas Extraction, 1,568 additional jobs in Construction, and 1,492 additional jobs in Professional, Scientific, and Technical Services.

In short, our analysis concludes that offshore oil and natural gas activity would make a large and much needed contribution to the Virginia economy and to the economy of the Virginia Beach MSA

APPENDIX

Oil and natural gas development activities on the Atlantic OCS off the coast of Virginia is projected to generate significant amounts of additional economic output in the Virginia localities that comprise the Virginia Beach MSA. To provide a better sense of the specific regional industries that are projected to benefit from this increased economic output, in this section we breakdown the total economic output figures presented in Figure 3 and Table 6 by industry. For ease of explication, however, we have aggregated the hundreds of individual industries that undergird that estimate into 20 broad industry categories.

Those industry categories are:

- **Agriculture** – Farming, Fishing, Logging
- **Civic Organizations** – Religious, Charitable, Labor, and Professional Associations
- **Education** – Colleges, Community Colleges, and Universities
- **Entertainment, Recreation and Tourism** – Performing Arts, Lodging, and Restaurants
- **Financial Services** – Insurance, Credit, Banking, and Brokerage Services
- **Food Manufacturing** – Human and Animal Food
- **Health and Personal Care Services** – Hospitals and Day Care
- **Information and Communication** – Data Processing and Telecommunication Services
- **Light Manufacturing** – Electronics, Tools, and Printing
- **Materials Manufacturing** – Wood, Stone, Cement, Paper, Plastics, and Chemical Products
- **Natural Resource Extraction** – Oil and Natural Gas
- **Non-Residential Construction, Maintenance and Repair** – Commercial and Manufacturing Buildings and Structures, including Ships

- **Personal Services** – Beauty, Fitness, Laundry, and Appliance Repair Services
- **Professional and Business Services** – Architectural, Engineering, Accounting, Employment, Legal, Equipment Rental, Computer Systems Design, Environmental, Scientific Research, Marketing, Cleaning, Waste, Security, and Management Services
- **Real Estate** – Realty Services
- **Residential Construction, Maintenance and Repair** – Homes and Apartments
- **Retail and Wholesale Trade** – Stores (including Automotive, Building Materials and Clothing), Storage, Brokers, and Warehouses
- **Transportation** – Air, Road, Rail, and Water Transportation (Passenger and Freight)
- **Utilities** – Electricity, Natural Gas, and Water (Generation, Transmission, and Distribution)
- **Vehicle, Heavy Equipment and Industrial Manufacturing, Maintenance and Repair** – Boats, Trucks, Vehicle Engines and Parts, Foundries, Pumps and Compressors, and Cranes

Table 8 provides detail on the additional economic output that offshore oil and natural gas development activity is projected to generate in these sectors in the Virginia Beach MSA in years 5, 10, 15, and 20 of the 20-year modeling horizon. As these data show, the largest output increases are anticipated in:

- Natural Resource Extraction ($881,900,000 in additional economic output in year 20).
- Professional and Business Services ($313,800,000 in additional economic output in year 20).
- Non-Residential Construction, Maintenance and Repair ($191,400,000 in additional economic output in year 20).
- Retail and Wholesale Trade ($112,000,000 in additional economic output in year 20).
- Financial Services ($101,700,000 in additional economic output in year 20).

Industry Sector	Year 5	Year 10	Year 15	Year 20
Natural Resource Extraction	$1,800,000	$104,300,000	$419,100,000	$881,900,000
Professional and Business Services	$44,000,000	$180,300,000	$262,600,000	$313,800,000
Non-Residential Construction, Maintenance & Repair	$67,500,000	$213,600,000	$333,200,000	$191,400,000
Retail & Wholesale Trade	$9,200,000	$40,000,000	$82,500,000	$112,000,000
Financial Services	$6,000,000	$29,600,000	$65,400,000	$101,700,000
Health & Personal Care Services	$6,700,000	$31,300,000	$67,600,000	$99,300,000
Residential Construction, Maintenance & Repair	$6,100,000	$28,600,000	$61,700,000	$90,400,000
Real Estate	$5,600,000	$25,000,000	$49,500,000	$68,900,000
Entertainment, Recreation & Tourism	$4,100,00	$19,300,000	$40,800,000	$61,100,000
Civic Organizations	$2,600,000	$11,800,000	$24,500,000	$35,400,000
Information & Communication	$2,700,000	$12,100,000	$24,300,000	$34,500,000
Utilities	$900,000	$7,700,000	$22,600,000	$32,300,000
Transportation	$1,900,000	$8,000,000	$15,700,000	$20,100,000
Vehicle, Heavy Equipment & Industrial Manufacturing, Maintenance & Repair	$900,000	$4,200,000	$8,600,000	$11,900,000
Personal Services	$800,000	$3,700,000	$8,000,000	$11,600,000
Education	$800,000	$3,600,000	$7,800,000	$11,500,000
Materials Manufacturing	$1,100,000	$3,800,000	$6,800,000	$6,600,000
Food Manufacturing	$400,000	$1,900,000	$4,200,000	$6,200,000
Light Manufacturing	$400,000	$1,900,000	$2,800,000	$3,100,000
Agriculture		$100,000	$300,000	$400,000

Table 8: Projected Economic Output impact on the Virginia Beach MSA from Offshore Oil and Natural Gas Development Activity by Industry Category – Years 5, 10, 15, and 20