

# **Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

*Prepared for*

**American Petroleum Institute (API)**

**July 2017**

Prepared by



**Northern  
Economics**

**Anchorage**  
880 H Street  
Suite 210  
Anchorage, Alaska 99501  
Phone: 907.274.5600  
Fax: 907.274.5601

**Seattle**  
1455 NW Leary Way  
Suite 400  
Seattle, WA 98107  
Phone: 206.747.8475  
Email: [mail@norecon.com](mailto:mail@norecon.com)

**PROFESSIONAL CONSULTING SERVICES IN APPLIED ECONOMICS AND SOCIAL SCIENCES**

**Principals:**

Patrick Burden, M.S. – Chairman  
Marcus L. Hartley, M.S. – President  
Jonathan King, M.S. – Vice President  
Michael Fisher, MBA – Principal  
Diane Sauer – Office Manager

**Consultants:**

Logan Blair, M.S.	Michelle Humphrey, M.S.
Leah Cuyno, Ph.D.	Don Schug, Ph.D.
Michael Downs, Ph.D.	Stephen Weidlich, M.S.
Gary Eaton, M.S.	Katharine Wellman, Ph.D.

**Administrative Staff:**

Terri McCoy, B.A. – Editor



**Northern  
Economics**

880 H Street, Suite 210  
Anchorage, Alaska 99501  
Phone: 907.274-5600  
Fax: 907.274-5601

1455 NW Leary Way, Suite 400  
Seattle, WA 98107  
Phone: 206.747.8475  
Email: [mail@norecon.com](mailto:mail@norecon.com)

## Preparers

Team Member	Project Role
Leah Cuyno	Senior Economist
Patrick Burden	Principal Economist
Terri McCoy	Editor

---

***Please cite as:*** Northern Economics, Inc. *Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios*. Prepared for American Petroleum Institute (API). July 2017.



# Contents

Section	Page
Abbreviations .....	v
Executive Summary .....	1
<b>1 Introduction.....</b>	<b>1</b>
<b>2 Description of Environmental Regulations and Regulatory Scenarios for Analysis .....</b>	<b>3</b>
2.1 The Status Quo Case .....	3
2.2 Less Restrictive Case.....	5
<b>3 Exploration, Development, and Production Activities (E&amp;D Scenarios) .....</b>	<b>7</b>
3.1 E&D Scenarios: Status Quo Case.....	7
3.1.1 Chukchi Sea .....	7
3.1.2 Beaufort Sea .....	8
3.2 E&D Scenarios: Less Restrictive Case.....	11
3.2.1 Chukchi Sea .....	11
3.2.2 Beaufort Sea .....	13
<b>4 Approach.....</b>	<b>15</b>
<b>5 Results .....</b>	<b>18</b>
5.1 Projected Expenditures.....	18
5.1.1 Status Quo Case.....	18
5.1.2 Less Restrictive Case.....	19
5.2 Projected Employment Effects.....	20
5.2.1 Status Quo Case.....	21
5.2.2 Less Restrictive Case.....	22
5.3 Projected Labor Income Effects .....	25
5.3.1 Status Quo Case.....	25
5.3.2 Less Restrictive Case.....	26
5.4 Projected Government Revenues.....	29
5.4.1 Status Quo Case.....	31
5.4.2 Less Restrictive Case.....	31
<b>6 Conclusions.....</b>	<b>33</b>
<b>7 References .....</b>	<b>38</b>

Table	Page
Table ES-1. Estimated Federal, State, and Local Government Revenues under Different Regulatory Cases, Millions of 2015\$ .....	ES-6

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different  
Regulatory Scenarios**

---

Table 1. Summary of E&D Activities in the Chukchi OCS Less Restrictive Case .....	12
Table 2. Summary of E&D Activities in the Beaufort OCS Less Restrictive Case .....	14
Table 3. Estimated Direct Expenditures: <i>Beaufort Sea Status Quo Case</i> .....	19
Table 4. Estimated Direct Expenditures: <i>Beaufort Sea Less Restrictive Case</i> .....	19
Table 5. Estimated Direct Expenditures: <i>Chukchi Sea Less Restrictive Case</i> .....	20
Table 6. Estimated Total Direct Expenditures <i>under Less Restrictive Case: Beaufort Sea and Chukchi Sea</i> .....	20
Table 7. Estimated Total U.S. Direct Employment Effects: <i>Beaufort Sea Status Quo Case</i> .....	22
Table 8. Estimated Total U.S. Indirect and Induced Employment Effects: <i>Beaufort Sea Status Quo Case</i> .....	22
Table 9. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: <i>Beaufort Sea Status Quo Case</i> .....	22
Table 10. Estimated Total U.S. Direct Employment Effects: <i>Beaufort Sea Less Restrictive Case</i> .....	23
Table 11. Estimated Total U.S. Indirect and Induced Employment Effects: <i>Beaufort Sea Less Restrictive Case</i> .....	23
Table 12. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: <i>Beaufort Sea Less Restrictive Case</i> .....	23
Table 13. Estimated Total U.S. Direct Employment Effects: <i>Chukchi Sea Less Restrictive Case</i> .....	23
Table 14. Estimated Total U.S. Indirect and Induced Employment Effects: <i>Chukchi Sea Less Restrictive Case</i> .....	24
Table 15. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: <i>Chukchi Sea Less Restrictive Case</i> .....	24
Table 16. Estimated Total U.S. Direct Employment Effects: <i>Less Restrictive Case</i> .....	24
Table 17. Estimated Total U.S. Indirect and Induced Employment Effects: <i>Less Restrictive Case</i> .....	24
Table 18. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: <i>Less Restrictive Case</i> .....	25
Table 19. Estimated Total U.S. Direct Labor Income Effects: <i>Beaufort Sea Status Quo Case</i> .....	25
Table 20. Estimated Total U.S. Indirect and Induced Labor Income Effects: <i>Beaufort Sea Status Quo Case</i> .....	25
Table 21. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: <i>Beaufort Sea Status Quo Case</i> .....	26
Table 22. Estimated Total U.S. Direct Labor Income Effects: <i>Beaufort Sea Less Restrictive Case</i> .....	26
Table 23. Estimated Total U.S. Indirect and Induced Labor Income Effects: <i>Beaufort Sea Less Restrictive Case</i> .....	26
Table 24. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: <i>Beaufort Sea Less Restrictive Case</i> .....	27
Table 25. Estimated Total U.S. Direct Labor Income Effects: <i>Chukchi Sea Less Restrictive Case</i> .....	27
Table 26. Estimated Total U.S. Indirect and Induced Labor Income Effects: <i>Chukchi Sea Less Restrictive Case</i> .....	27
Table 27. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: <i>Chukchi Sea Less Restrictive Case</i> .....	28

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

Table 28. Estimated Total U.S. Direct Labor Income Effects: <i>Less Restrictive Case</i> .....	28
Table 29. Estimated Total U.S. Indirect and Induced Labor Income Effects: <i>Less Restrictive Case</i> ..	28
Table 30. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: <i>Less Restrictive Case</i> .....	29
Table 31. Estimated Local, State, and Federal Government Revenues: <i>Beaufort Sea Status Quo Case</i> .....	31
Table 32. Estimated Local, State, and Federal Government Revenues: <i>Beaufort Sea Less Restrictive Case</i> .....	32
Table 33. Estimated Local, State, and Federal Government Revenues: <i>Chukchi Sea Less Restrictive Case</i> .....	32
Table 34. Estimated Local, State, and Federal Government Revenues: <i>Less Restrictive Case</i> .....	32
Table 35. Estimated Federal, State, and Local Government Revenues under Different Regulatory Cases, Millions of 2015\$ .....	37

<b>Figure</b>	<b>Page</b>
Figure ES-1. Estimated Potential Industry Expenditures on Petroleum Development in the Beaufort Sea and Chukchi Sea OCS under Different Regulatory Cases.....	ES-2
Figure ES-2. Estimated Potential Total U.S. Employment Effects in the Beaufort Sea and Chukchi Sea OCS under Different Regulatory Cases.....	ES-3
Figure ES-3. Estimated Potential Total U.S. Labor Income Effects in the Beaufort Sea and Chukchi Sea OCS under Different Regulatory Cases.....	ES-4
Figure ES-4. Estimated Potential Total Annual Average Federal, State, and Local Government Revenues under Different Regulatory Cases .....	ES-5
Figure 1. Current Lease Ownership in the Beaufort Sea OCS Planning Area .....	5
Figure 2. Liberty Project Area Map .....	9
Figure 3. Proposed Liberty Island Conceptual Design .....	10
Figure 4. Nikaitchuq North Project Area Map .....	11
Figure 5. Estimated Potential Industry Expenditures on Petroleum Development under Different Regulatory Cases, Millions of 2015 \$ .....	34
Figure 6. Estimated Total U.S. Annual Average Jobs under Different Regulatory Cases .....	35
Figure 7. Estimated Potential Total U.S. Labor Income Effects under Different Regulatory Cases ..	36
Figure 8. Estimated Potential Total Annual Average Federal, State, and Local Government Revenues under Different Regulatory Cases .....	37





## Abbreviations

API	American Petroleum Institute
BOEM	Bureau of Ocean Energy Management
BOP	Blowout Preventer
DPP	Development and Production Plan
E&D	Exploration, Development, and Production Activities
EIS	Environmental Impact Statement
EIA	Energy Information Administration
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+
REMI	Regional Economic Models Inc.
SID	Spy Island Drillsite
TAPS	Trans-Alaska Pipeline System



# Executive Summary

This study quantifies the potential economic benefits of petroleum development in the Arctic OCS areas in Alaska, particularly in the Beaufort Sea and Chukchi Sea. The report considers two regulatory scenarios for the analysis—1) a *Status Quo* case, which is a more restrictive regulatory framework, and 2) a *Less Restrictive* regulatory framework, which reflects the current administration's intent to increase access to these OCS areas and relax the stringent environmental regulations that were imposed by the previous administration.

In order to quantify the potential effects of petroleum development in the OCS, Northern Economics developed a set of scenarios that reflect possible industry-wide exploration, development, and production activities (E&D scenarios) for the Beaufort Sea and the Chukchi Sea OCS areas under the two different regulatory cases. It should be noted that these 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 impossible to anticipate what the actual development pattern would be, but the scenarios provide a reasonable basis to begin thinking about potential economic effects. 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 and Chukchi Sea OCS areas, as well as information from previous Northern Economics studies related to offshore and onshore petroleum development.

These E&D scenarios are the basis for determining 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 generate economic benefits to Alaska and to the rest of the nation. Direct spending also generates stimulus effects (or multiplier effects) in the economy.

For this study, the economic benefits of potential petroleum development under the two regulatory cases are measured in terms employment, income, and government revenues.

The following are key findings of the study:

## **Direct Industry Investment**

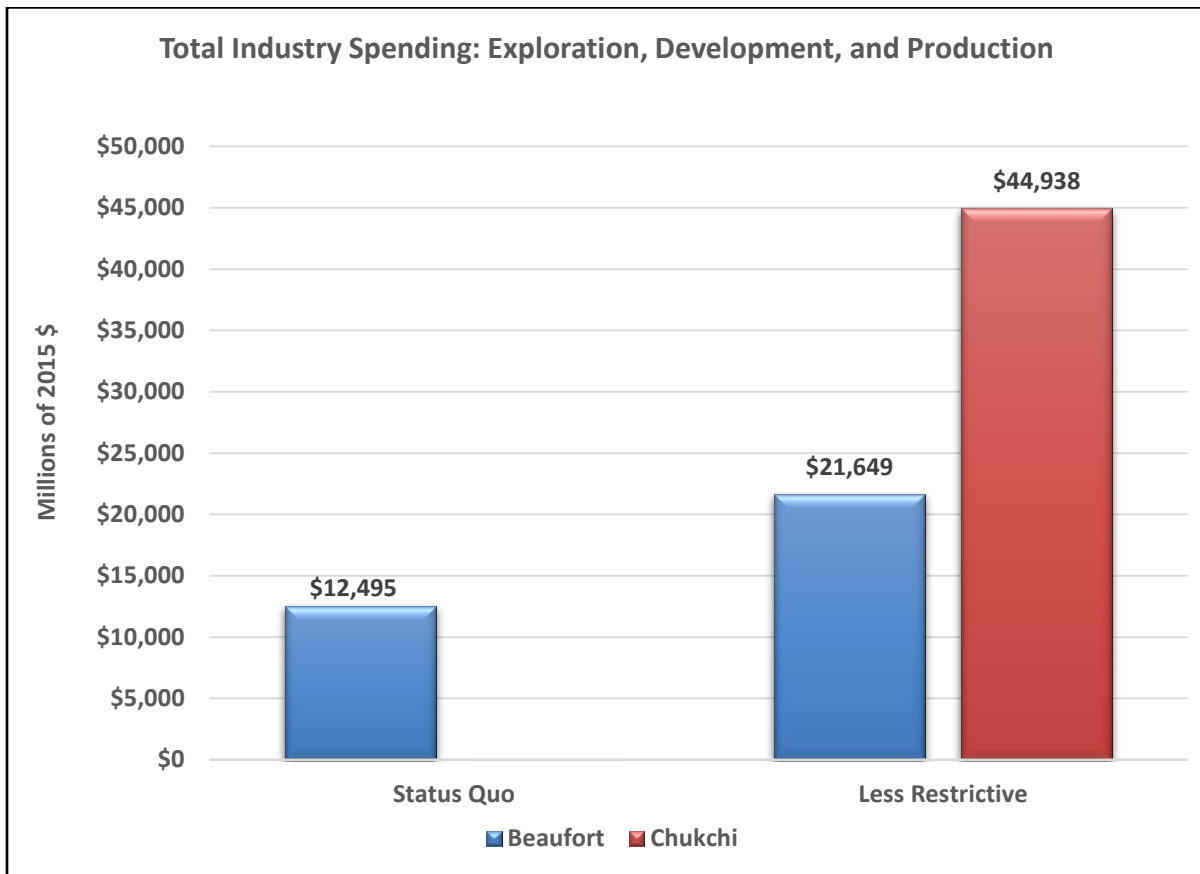
Figure ES-1 shows the estimated total industry spending on exploration, development, and production of petroleum resources under the two different regulatory cases. For the Status Quo case, the more restrictive case, it is assumed that development activities would only occur where there are current active leases. In the Chukchi Sea, there are no longer any active leases, hence, no development is assumed to occur. In the Beaufort Sea, there are two planned development projects that are being evaluated by BOEM—1) the Liberty Development Project, and 2) the Nikaitchuq North Project. Under this Status Quo case, industry spending on exploration, development and production activities is estimated to be about \$12.5 billion.

Under the Less Restrictive case, industry spending is estimated to amount to \$66.6 billion, with \$45 billion for development in the Chukchi Sea and \$21.6 billion for development in the Beaufort Sea. Under this scenario, a lease sale would be held in the Chukchi Sea planning area that would lead to a discovery of an anchor and a satellite oil field. Due to the remoteness and the lack of infrastructure in the Chukchi Sea area, any petroleum development in the area would only occur if there were a large enough discovery to make the investments pay out. Industry spending in

this area is therefore projected to be higher relative to the Beaufort Sea area and compared to the Status Quo case.

Similar to the Chukchi Sea, under the Less Restrictive case it is assumed that in the Beaufort Sea, a lease sale will be held in the future, which would lead to a discovery of a modest oil field. Given the potential petroleum resources and the availability of onshore infrastructure in this area, the scale of development assumed in the Beaufort Sea is relatively modest compared to the Chukchi Sea. Figure ES-1 compares the estimated level of spending in the two OCS areas under the two regulatory cases.

**Figure ES-1. Estimated Potential Industry Expenditures on Petroleum Development in the Beaufort Sea and Chukchi Sea OCS under Different Regulatory Cases**



Source: Northern Economics estimates.

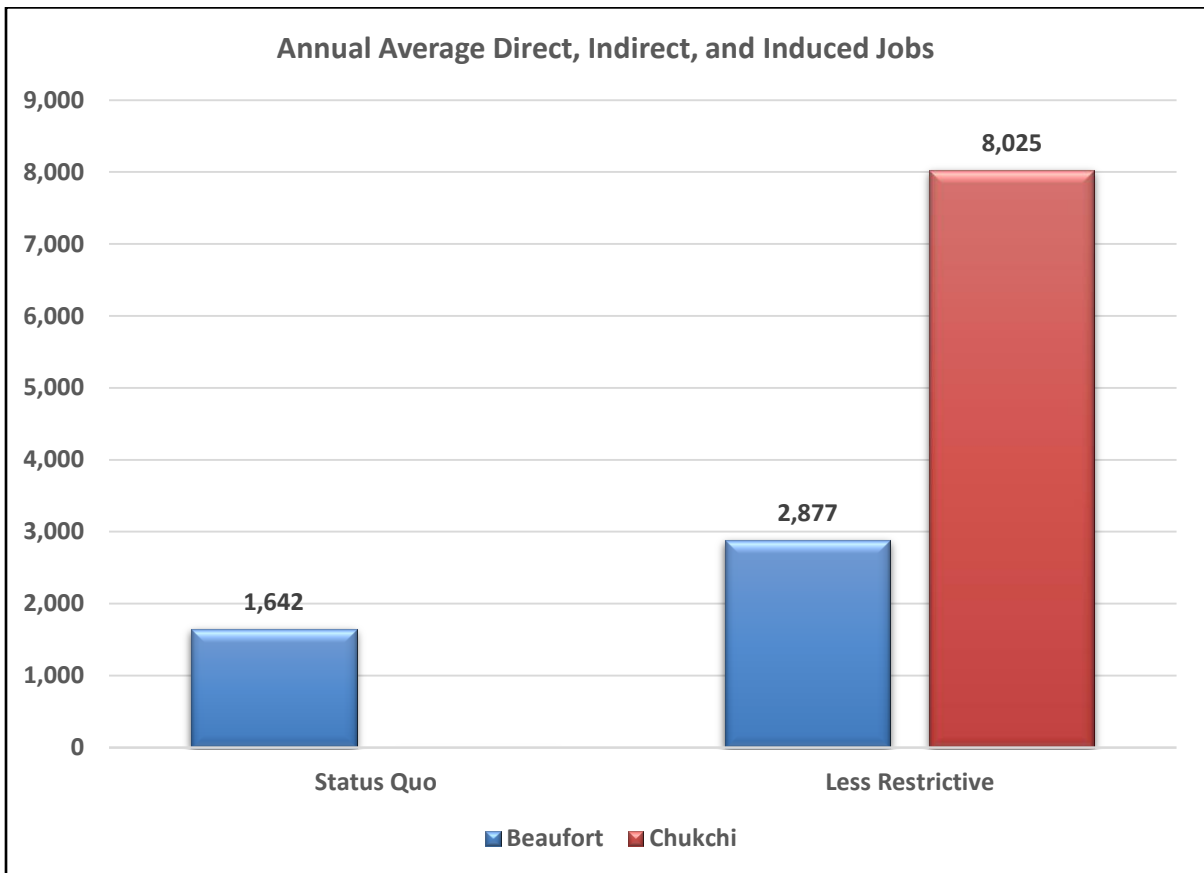
### **Employment Effects**

Figure ES-2 shows the estimated total employment effects in the U.S. (Alaska and the rest of the U.S.) under the two regulatory cases.

Petroleum development in the OCS could generate about 1,600 jobs and nearly 11,000 annual average jobs under the Status Quo case and the Less Restrictive case, respectively. Of the total U.S. jobs, about 47 percent of the jobs under the Status Quo case would be in Alaska, and under the Less Restrictive case more than half (55 percent) of the total would be Alaska jobs. 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 would also be created in other sectors of the economy; these jobs are referred to as indirect and induced jobs. These jobs are 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.

**Figure ES-2. Estimated Potential Total U.S. Employment Effects in the Beaufort Sea and Chukchi Sea OCS under Different Regulatory Cases**

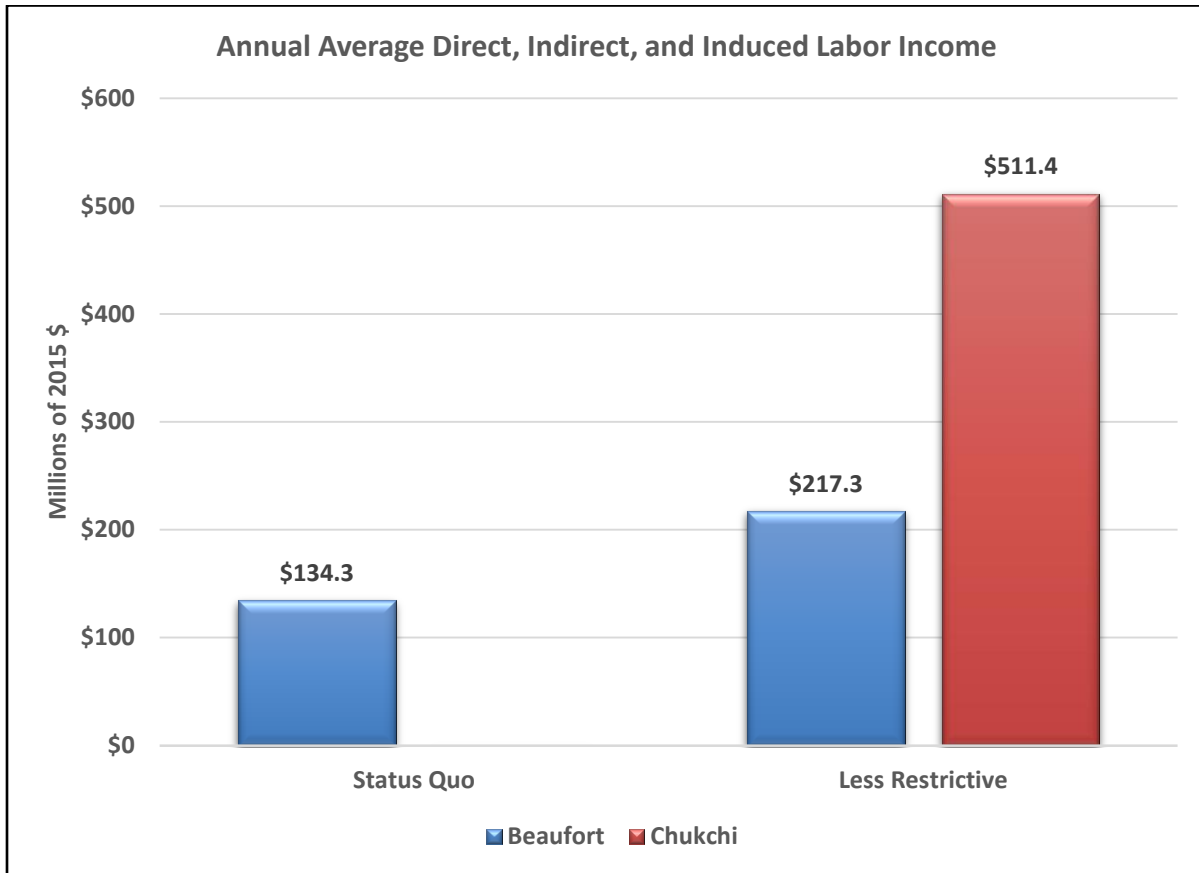


Source: Northern Economics estimates.

### **Income Effects**

Figure ES-3 presents the estimated annual average labor income effects of E&D activities under the two regulatory cases. The labor income effects include the direct, indirect, and induced income generated in the various regions as a result of petroleum development. This income is associated with the employment effects discussed above. In the Less Restrictive case, total annual average labor income is estimated to be \$594 million higher than in the Status Quo case.

Figure ES-3. Estimated Potential Total U.S. Labor Income Effects in the Beaufort Sea and Chukchi Sea OCS under Different Regulatory Cases



Source: Northern Economics estimates.

### **Direct Petroleum Revenues**

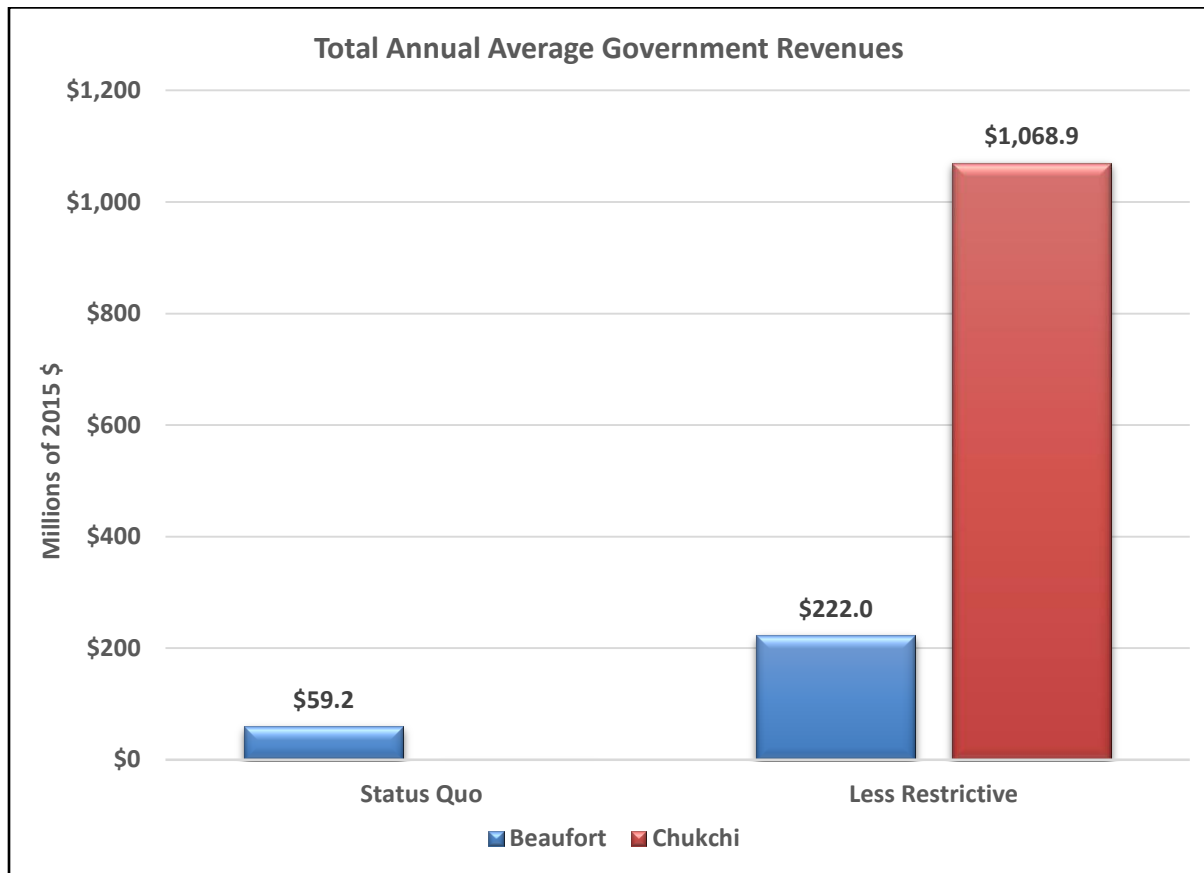
Federal, state, and local governments would directly benefit from offshore petroleum development with potential streams of revenues from property tax revenues, corporate income tax revenues, additional state revenues from additional throughput on the Trans Alaska Pipeline System (TAPS), and federal royalty payments. Total potential annual average federal, state, and local government revenues are estimated to amount to over \$1 billion in the Chukchi Sea and approximately \$220 million in the Beaufort Sea under the Less Restrictive case. Under the Status Quo case, a little over \$59 million per year on average are estimated to accrue to the local, state, and federal governments (Figure ES-4).

Table ES-1 summarizes the total potential revenues from the various revenue streams. Federal royalty payments are anticipated to account for 93 percent (\$1.2 billion) of the total annual average government take under the Less Restrictive case, and about 61 percent (\$52 million) under the Status Quo case.

Property taxes would primarily be generated from all the new onshore facilities that would be built to support the offshore operations of the industry. The state 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 also imposes a corporate income tax on petroleum activity within the state. The federal government collects revenues from royalty payments from the offshore activity. The TAPS effect refers to the additional revenues that would accrue to the state government due to the OCS oil volumes that would be transported through the Trans-Alaska Pipeline System (TAPS). Additional volumes of oil in the TAPS system would lower the pipeline tariff and would result in a higher oil netback price, which is the basis for determining state royalty payments on oil resources extracted from state lands.

**Figure ES-4. Estimated Potential Total Annual Average Federal, State, and Local Government Revenues under Different Regulatory Cases**



Source: Northern Economics estimates.

**Table ES-1. Estimated Federal, State, and Local Government Revenues under Different Regulatory Cases, Millions of 2015\$**

Revenue Categories	Status Quo Case		Less Restrictive Case					
	Beaufort Sea OCS		Beaufort Sea OCS		Chukchi Sea OCS		Total	
	Total	Annual Average	Total	Annual Average	Total	Annual Average	Total	Annual Average
<b>Local Property Taxes</b>	\$98.5	\$2.1	\$176.6	\$3.8	\$853.4	\$17.1	\$1,029.9	\$20.9
<b>State Property Taxes</b>	\$8.0	\$0.2	\$14.3	\$0.3	\$69.2	\$1.4	\$83.5	\$1.7
<b>State Corporate Income Tax</b>	\$18.4	\$0.5	\$70.8	\$2.1	\$519.8	\$10.4	\$590.6	\$12.5
<b>State (TAPS Effect)</b>	\$150.3	\$4.4	\$526.9	\$15.5	\$2,024.4	\$40.5	\$2,551.3	\$56.0
<b>Federal Royalty Payments</b>	\$1,765.2	\$51.9	\$6,808.1	\$200.2	\$49,976.1	\$999.5	\$56,784.2	\$1,199.8

Source: Northern Economics estimates.



# 1 Introduction

The American Petroleum Institute commissioned this report to develop updated information regarding the potential economic benefits of petroleum development in the Arctic Outer Continental Shelf (OCS) areas offshore of Alaska. The Arctic OCS is comprised of two planning areas: The Beaufort Sea and the Chukchi Sea. This analysis considers two regulatory scenarios: 1) the regulatory regime that currently applies to the Alaska Arctic OCS areas that is deemed more stringent relative to other OCS areas and more restrictive than BOEM's previous 5-year lease plan, and 2) a less restrictive regulatory regime that reflects the current administration's intent to increase access to Arctic OCS areas.

To date, development in the Arctic OCS areas offshore Alaska 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.

In the Beaufort Sea planning area, ten lease sales have occurred since 1979. A lease sale that was scheduled in 2015 was cancelled due to lack of industry interest and the market conditions at that time. According to BOEM, as of November 2016, there were 42 existing OCS leases in this planning area, most of which expire in 2017. In the Chukchi Sea planning area, three lease sales have been held since 1988. A number of exploratory wells have been drilled, plugged and abandoned including a gas discovery (the Burger prospect), that was deemed uneconomic in 1990. The most recent lease sale, Lease Sale 193, which was held in 2008, was the largest sale in the history of the Alaska OCS, generating approximately \$2.6 billion in revenues. A majority of the leases obtained in that lease sale have been relinquished in the last few years. In 2015, Lease Sale 237 was cancelled, again due to market conditions and lack of industry interest.

Alaska's OCS Arctic region has been estimated to contain vast petroleum resources. According to the U.S. Department of 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.

This report quantifies the economic benefits of potential exploration, development and production of petroleum resources in the Beaufort and Chukchi Seas, under two different regulatory scenarios.

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

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

## Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios

---

- Estimates of potential direct, indirect, and induced **income effects** of petroleum development;
- Estimates of potential **direct revenues** that could accrue to the local/regional, state, and federal governments resulting from Arctic OCS 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 Environmental Regulations and Regulatory Scenarios Used for Analysis
Section 3:	Potential Exploration, Development, and Production Activities in the Beaufort Sea and Chukchi Sea OCS Planning Areas
Section 4:	Approach
Section 5:	Results
Section 6:	Conclusions
Section 7:	References

## 2 Description of Environmental Regulations and Regulatory Scenarios for Analysis

Two scenarios that represent different regulatory frameworks and different levels of access to Arctic OCS areas are considered for this analysis— a “Status Quo” case and a “Less Restrictive” case.

This section describes the environmental regulations under the two cases and the considerations for developing the potential exploration, development, and production activities that could occur under these two scenarios.

### 2.1 The Status Quo Case

This regulatory scenario reflects the current environmental regulations governing the Alaska Arctic OCS. This regulatory framework is more stringent than the regulations that govern other OCS locations and more restrictive than the regulations in place before 2016 when the Department of Interior adopted additional restrictions that apply to Arctic OCS exploratory drilling activities. The final rule on these additional restrictions only applies to Arctic OCS exploratory drilling activities that use mobile offshore drilling units (MODUs) and related operations during the open-water drilling season (typically late June to early November). It does not apply to exploratory drilling in the Arctic OCS using other drilling technologies, including shallow water drilling from gravel islands or the use of a land rig on grounded or land-fast ice. Hence, exploratory drilling operations on the Arctic OCS using non-MODUs technology continue to be subject to the previous OCS oil and gas regulatory regime.

These Arctic-specific regulations focus solely on OCS exploratory drilling operations from floating vessels within the U.S. Beaufort and Chukchi Seas. These rules require oil companies to ensure proper internal controls and planning for oil spill prevention, containment and responses. The regulations codify and further develop current Arctic-specific operational standards to ensure that operators take the necessary steps to plan through all phases of OCS exploration in the Arctic, including mobilization, maritime transport and emergency response, and the conduct of safe drilling operations while in theater.

Specifically, the final rule requires operators to develop an Integrated Operations Plan addressing all phases of a proposed Arctic OCS exploration program and submit it to BOEM in advance of filing an Exploration Plan. The regulations require companies to have access to, and have the ability to promptly deploy source control and containment equipment, such as capping stacks and containment domes, while drilling below or working below the surface casing (U.S. Department of Interior, 2017).

Operators also must have access to a separate relief rig able to drill a timely relief well under the conditions expected at the site in the event of a loss of well control; have the capability to predict, track, report, and respond to ice conditions and adverse weather events; effectively manage and oversee contractors; and develop and implement an Oil Spill Response Plan designed and executed in a manner that accounts for the unique Arctic OCS operating environment, and is supported with the necessary equipment, training, and personnel for oil spill response on the Arctic OCS.

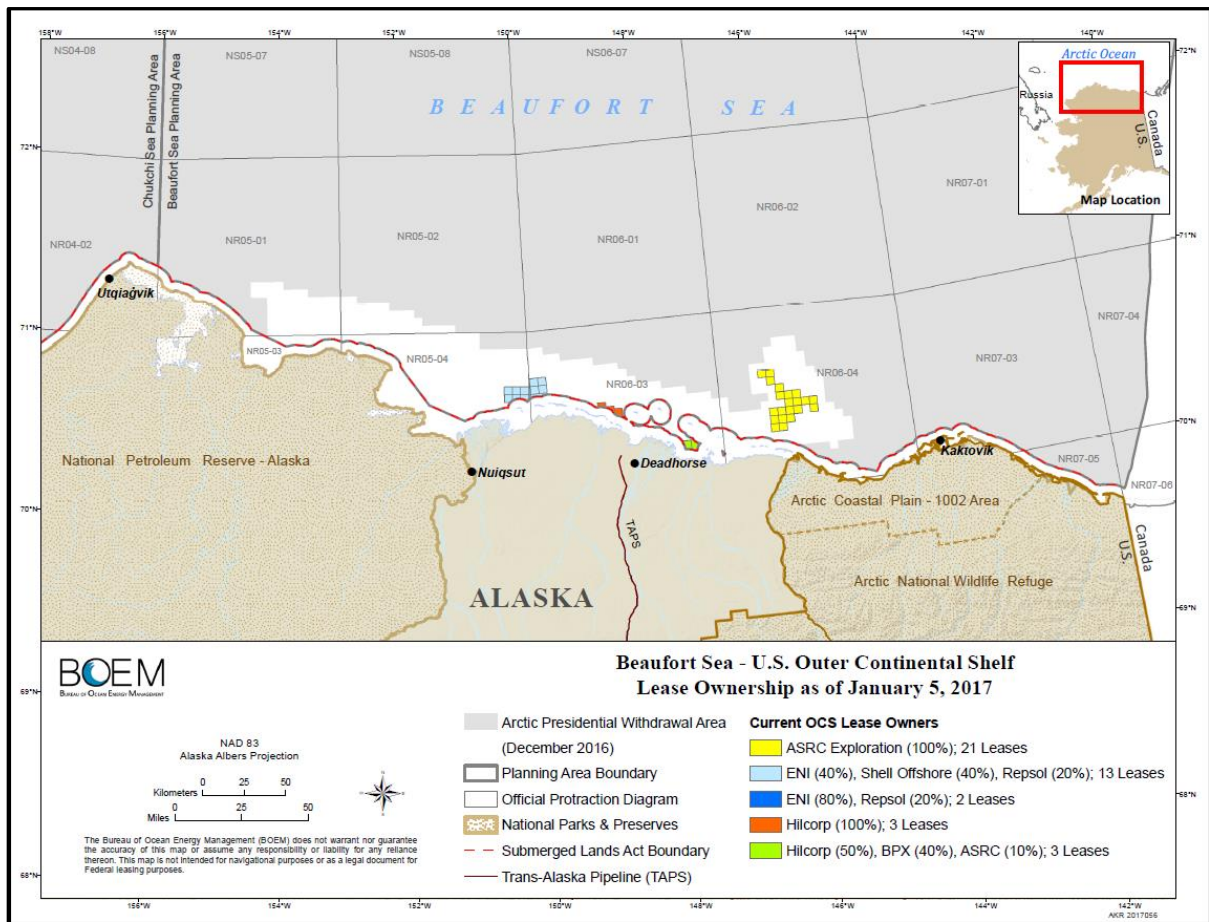
The new rules include 14 provisions that would affect oil and gas companies exploring in the Alaska Arctic OCS. Of the proposed 14 provisions, the American Petroleum Institute identified 6 items as having the potential to significantly increase costs for exploration activities, namely: 1) a requirement 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) the requirement for 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. The incremental costs of these 6 provisions were estimated by Northern Economics in 2015. The analysis showed that the average annual incremental costs resulting from the 6 provisions could range from about \$715 million to more than \$1.2 billion. In addition, several of the provisions have the potential to reduce the number of wells that could be drilled in the summer drilling season, possibly deferring production for two years and reducing the net present value of the production (Northern Economics, 2015). Note that not all of these provisions are applicable to the analysis presented in this report.

Another consideration in developing this Status Quo case is BOEM's 2017–2022 OCS Oil and Gas Leasing Proposed Final Program (2017–2022 Program). The plan states that,

*"After careful consideration of the Section 18 factors and robust stakeholder input, including from Alaska Native communities and the State of Alaska, the Proposed Final Program does not include the Chukchi Sea and Beaufort Sea lease sales analyzed in the Proposed Program. The State of Alaska recommended these lease sales be included in the 2017-2022 Program and that area-wide leasing be offered in all three Alaska program areas. The Secretary's decision recognizes and considers the support for Arctic lease sales that has been expressed by industry, the State of Alaska, and several of the Arctic communities since the publication of the 2017-2022 Draft Proposed Program. However, based on, among other factors, current market conditions, evidence of a lack of industry interest, and the recent increase in onshore oil and gas production, the Secretary decided that Arctic lease sales are not needed in the 2017-2022 Program to best meet the Nation's energy needs."*

According to BOEM, since February of 2016, industry has relinquished more than 90 percent of the 527 Arctic OCS leases held by industry in the Beaufort Sea and Chukchi Sea Planning Areas; in fact, at this time, there are no active leases in the Chukchi Sea OCS. Active leases in the Beaufort Sea OCS as of January 2017 are shown in Figure 1. Given the low oil prices that hinders new industry investments in these frontier areas, the incremental costs of the 2016 regulations, and BOEM's recommendation for not including the Beaufort and the Chukchi Sea Planning areas in the next 5-year plan, this analysis assumes that under the Status Quo case (more restrictive case) future exploration, development, and production activities would be limited to areas where there are existing active leases.

**Figure 1. Current Lease Ownership in the Beaufort Sea OCS Planning Area**



Source: Bureau of Ocean Energy Management, Alaska Leasing Office.

## 2.2 Less Restrictive Case

This development scenario reflects a less restrictive regulatory framework that is more similar to other OCS areas and with the Arctic MODU-related rules that were in place prior to the changes in 2016. This case represents a more optimistic development scenario given a lower operating cost structure in the Arctic OCS with less restrictive regulations and a higher potential for petroleum discovery with future lease sales occurring in the Beaufort and Chukchi Sea OCS planning areas.

This Less Restrictive case considers the current administration's intent to increase access to the Arctic OCS areas and to relax some of the more stringent rules that were recently adopted. On April 2018, 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:

## Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios

---

- 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 (Bureau of Ocean Energy Management'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.

The Executive Order requires a review of the economic impacts of development restrictions associated with marine national monuments. The order also revokes the Northern Bering Sea Climate Resilience area that President Obama had implemented. Other regulations to be reconsidered include a proposed offshore air quality rule, expedited consideration of applications for the authorization of incidental harassment to marine mammals during offshore operations, and a review of NOAA's guidance for assessing the impacts of anthropogenic sound on marine mammals.

### **3 Exploration, Development, and Production Activities (E&D 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.

The following sub-sections describe the E&D scenarios that were developed for the Chukchi Sea and the Beaufort Sea planning areas under the two regulatory cases. These E&D scenarios are primarily based on BOEM's lease sale EIS's, BOEM resource assessments, and Northern Economics' prior work for industry in the OCS and onshore Alaska. These E&D scenarios are used as inputs for the economic models used in the analysis.

#### **3.1 E&D Scenarios: Status Quo Case**

As noted above, the Status Quo case is the more restrictive regulatory case. E&D activities under this case are assumed to be limited to activities in existing leases in the Chukchi Sea and Beaufort Sea planning areas.

##### **3.1.1 Chukchi Sea**

Under the Status Quo case, this analysis assumes that no exploration, development, and production activities would occur in the Chukchi Sea OCS given that there are no active leases in the Chukchi Sea OCS and that a lease sale in this area is not included in BOEM's current 5-year lease plan (2017-2022 plan). This also reflects BOEM's opinion that the likelihood of an economically viable discovery in the region is highly unlikely, given the costs of exploring and operating in a remote frontier area with no existing support infrastructure.



### **3.1.2 Beaufort Sea**

Under the Status Quo case, petroleum development in the Beaufort Sea OCS would only include activities in areas where there are active leases. Specifically, this analysis assumes that future development under this regulatory case will be limited to the Liberty Development Project and Nikaitchuq North Exploration Drilling Project. Plans for both of these projects have been submitted to BOEM for approval.

In September 2015, BOEM announced the submission of the Development and Production Plan (DPP) for the Liberty Prospect. According to the plan, a drilling and processing facility will be built on a man-made gravel island in federal waters about five miles off Alaska's Beaufort Sea coast to develop hydrocarbon resources on the U.S. OCS. The Liberty Unit is estimated to contain approximately 150 million barrels of recoverable crude oil.

The exploration plan for the Nikaitchuq North Exploration Drilling Project was just recently submitted to BOEM. In the plan, the proponent proposes to drill into the federal submerged lands of the Beaufort Sea from the company's Spy Island Drillsite, an existing facility located on an artificial gravel island in Alaska state waters. BOEM is currently conducting an initial review of the broad drilling blueprint, which proposes to drill a well in the federal waters of the Beaufort Sea before the leases expire.

The following provides a more detailed description of the activities associated with each project.

#### **3.1.2.1 Liberty Project**

The Liberty Prospect is located about 6 miles offshore in about 20 feet of water, inside the Beaufort Sea's barrier islands. It is 20 miles east of Prudhoe Bay and about 8 miles east of the existing Endicott oil field (see Figure 2). The proponent proposes building a gravel island in approximately 19 feet of water to support a work surface of about 9.3 acres for the drilling facility at the Liberty Prospect, a site that has been evaluated and explored by industry beginning more than thirty years ago.

The Development and Production Plan (DPP) for the Liberty Project describes the timing of the development and production activities, information concerning drilling methods, the location of each proposed well or production platform or other structure, and an analysis of both offshore and onshore impacts that may occur as a result of the plan's implementation.

The following is a description of the Liberty Project as stated in the DPP:

"The Liberty Development will be a self-contained offshore drilling and production facility located on an artificial gravel island with a pipeline to shore. The island will be built about 5 miles offshore in Foggy Island Bay of the Beaufort Sea OCS in approximately 19 feet of water, about 2 miles west of the Tern Island shoal.

Infrastructure and facilities necessary to drill wells and process and export approximately 60,000 to 70,000 BOPD to shore will be installed on the island. There will be slots for 16 wells, which include accommodations for 5-8 producing wells, 4-6 water and/or gas injection wells, and up to two disposal wells at surface wellhead spacing of 15 feet between wellheads. Produced gas will be used for fuel gas, artificial lift, and re-injection into the reservoir. A nominal 12-inch sales oil pipeline inside a 16-inch outer pipe will transport crude oil to the Badami Sales Oil Pipeline. The offshore portion of the pipeline will be approximately 5.6 miles long, and the overland portion



will be approximately 1.5 miles long to the Badami pipeline tie-in point. Associated onshore facilities to support the project will include use of permitted water sources, construction of gravel pads to support the pipeline tie-in location and Badami ice road crossing, ice roads and ice pad construction, hovercraft shelter, small boat dock, and development of a gravel mine site west of the Kadleroshilik River. In addition, existing North Slope infrastructure will be used to support this project."

Figure 3 shows a conceptual rendering of the proposed Liberty Island.

Figure 2. Liberty Project Area Map



Source: Liberty Development and Production Plan

Figure 3. Proposed Liberty Island Conceptual Design



Source: Liberty Development and Production Plan

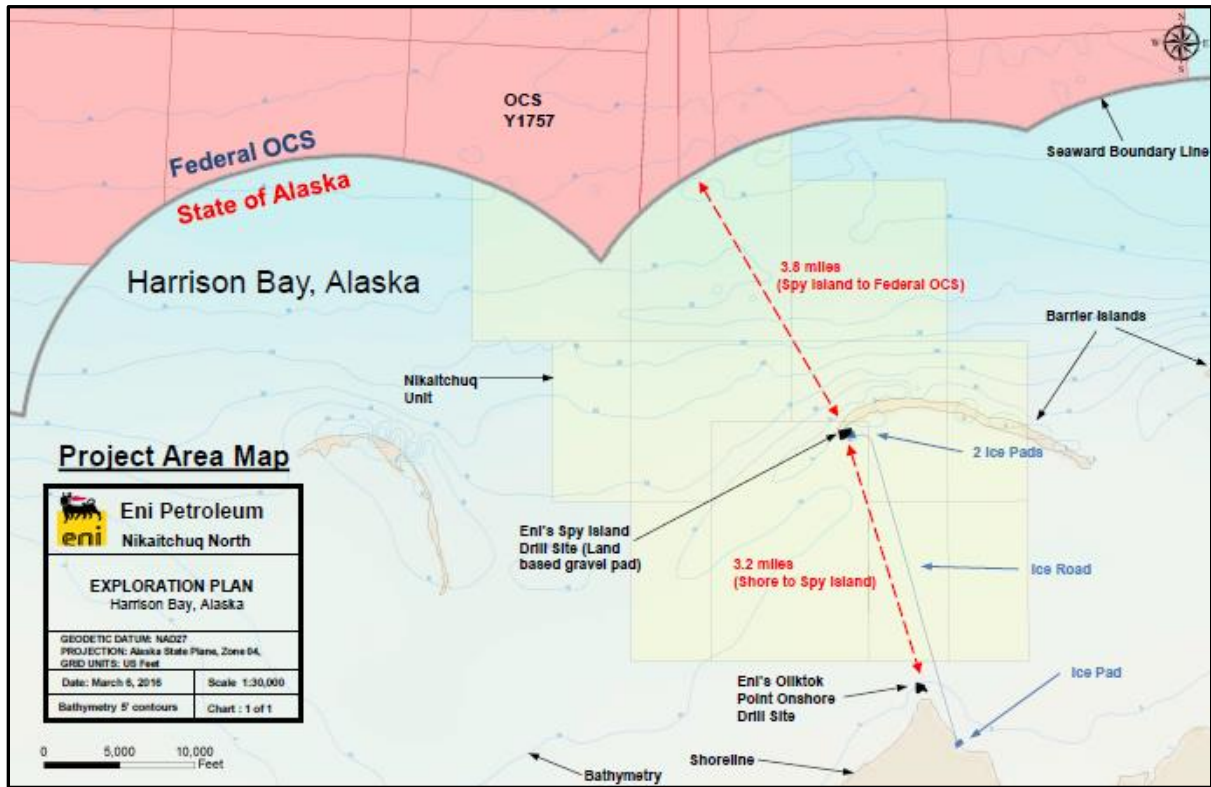
### 3.1.2.2 Naikaitchuq North Project

The proposed exploration plan is for exploratory drilling of Naikaitchuq North Project, which consists of four exploration wells, two mainbores and two sidetracks from the existing man-made island, Spy Island Drillsite (SID), on the State of Alaska lease. The proposed exploration wells will begin from the surface of SID and extend subsurface of the ocean floor, ending in federal leases on the Alaska OCS – Harrison Bay Block 6423 Unit (Leases OCS-Y-1753, OCS-Y-1754, and OCS-Y-1757). Figure 4 below shows the project area map for the Naikaitchuq North project.

The proponent already uses a man-made gravel island to extract oil from leases in state waters. The company would use the existing Spy Island site as a launching pad for extended-reach drilling that would target a potential oil reservoir in the nearby federal waters.

For this analysis, the E&D scenario assumes a successful field discovery 5.5 miles north of the Spy Island facility, with subsequent peak production of 15,000 barrels of oil per day, 3 to 4 production wells with the same number of injector wells, and a field life of 30 years. Crude oil from the new field will be processed at the existing production facilities.

Figure 4. Nikaitchuq North Project Area Map



Source: Nikaitchuq North Exploration Plan

### 3.2 E&D Scenarios: Less Restrictive Case

Under this case, there will be increased access to the Arctic OCS areas consistent with the current administration's intent as stated in its Executive Order. Under this case, this analysis assumes that there will be lease sales held in the Chukchi Sea and the Beaufort Sea as part of BOEM's 5-year lease plan.

The following provides more details on the E&D scenarios developed for the Chukchi and Beaufort Sea planning areas.

#### 3.2.1 Chukchi Sea

Under the Less Restrictive case, it is assumed that a lease sale in the Chukchi Sea OCS is included in BOEM's 2017-2022 Leasing Plan, which would lead to a development scenario that is similar to the one developed by BOEM for Lease Sale 193 (Final Second SEIS for Lease Sale 193) which assumes discovery of an anchor field and a satellite field resulting from the sale.

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 is therefore contingent

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

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.

This scenario assumes lessees will explore their leases, successfully discover an anchor field as well as a satellite field, develop necessary infrastructure, and produce approximately 4.3 billion barrels of oil with no associated gas production from the leases issued (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).

The scenario contemplates two mobile offshore drilling units (MODUs) drilling two wells each per year per drill rig. This scenario assumes successful exploration drilling of a large prospect leading to the establishment of an anchor field and subsequently a satellite field. Exploration activities continue throughout the development phase, as lessees will search for additional fields now considered economic in light of the successful development of the anchor field.

The discovery of an anchor field precipitates the development of infrastructure necessary to produce oil—onshore facilities including a supply marine vessel terminal are constructed, installation of 300 miles of onshore oil pipeline (from the NPR-A coastline to Prudhoe Bay) and 160 miles of offshore oil pipeline buried in trenches.

The continuation of exploration activities results in the discovery, and delineation of another economic field (satellite field). The ensuing development, though relatively smaller in scale, follows a similar pattern to development of the anchor field. For the anchor field, additional offshore production platforms are constructed, and service and subsea wells are drilled (with up to four drilling units operating at one time), and offshore pipelines are installed. These activities utilize the existing production base, supply boat terminal and onshore pipeline.

Oil production is based on total recoverable oil of about 2.9 billion barrels of oil from the anchor field and 1.4 billion barrels of oil from the satellite field. Oil production ends in year 53 and decommissioning activities commence 2 years after last year of oil production for each platform.

The following is a list of activities under this scenario:

**Table 1. Summary of E&D Activities in the Chukchi OCS Less Restrictive Case**

<b>E&amp;D Activity</b>	<b>Volume/Number</b>
Marine Seismic Surveys	5
Geohazard Surveys	13
Geotechnical Surveys	13
Exploration Base	1
Offshore Exploration Rigs	50
Exploration/Delineation Wells	40
Offshore Production Platforms	8
Production and Service Wells	459
Subsea Wells	90
Subsea Flowlines (# of miles)	30
Onshore pipeline (# of miles)	300
Onshore Production Base	1

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

Supply Boat Terminal	1
Air Support Base	1
Search & Rescue Base	1
Rigs for Decommissioning	30

Source: Northern Economics, Inc., based on BOEM's Lease Sale 193 EIS.

### **3.2.2 Beaufort Sea**

Under the Less Restrictive regulatory case, the Liberty Development Project and the Nikaitchuq North Project are assumed to occur, similar to the Status Quo case. In addition, with a lease sale occurring during the 2017 to 2022 period, it is assumed that there will be more E&D activities that would occur in the future. However, this activity would be at a smaller scale relative to the Chukchi Sea scenario given the history of petroleum development in the Beaufort Sea and that an anchor field is not necessary in this case. Under this case, there will be another field discovery with oil produced through offshore facilities on manmade gravel islands or bottom-founded platforms, carried by subsea pipelines buried in trenches to the onshore pipeline network connecting to TAPS. Associated and solution gas recovered with oil production is used as fuel for facilities or is reinjected to enhance oil recovery. There will be no major gas sales from the field.

The following development activities are adopted from BOEM's Beaufort Scenario developed for Lease Sale 202 with some modifications:

The development schedule assumes that 1 field, approximately 460 million barrels of oil, will be discovered 5 years after the sale. Assuming no delays in permitting, production platforms could be installed 6-7 years following the discovery well. This large field will be developed by 3 production platforms with processing facilities on one of the platforms. Each platform will hold one rig that will drill development wells and remain on the platform for well workover operations. Production facilities in water depths of 10-40 meters will be contained on bottom-founded platforms designed for pack ice conditions.

Installation of offshore pipelines between production platforms and onshore facilities will take 2 to 4 years, considering that route surveys, trenching, and pipeline laying will take place in the relatively short open-water season. Produced oil will be transported by existing onshore pipeline systems to Pump Station #1 of the Trans Alaska Pipeline System (TAPS). New landfalls could be constructed in Smith Bay (discovery in the western Beaufort) and traverse south of Teshekpuk Lake through NPR-A to the Kuparuk field infrastructure. The facilities at Oliktok Point could be expanded to accommodate a new offshore pipeline (discovery in the central Beaufort). Or a new facility in the Point Thomson area (discovery in the eastern Beaufort) could be constructed to handle oil production from the large offshore field if discovered in that area. Existing field infrastructure in the central Beaufort (Milne Point, Northstar, Endicott, Badami) could also be used for oil production from deepwater areas offshore from the central Beaufort coastline. The western Beaufort and eastern Beaufort have seen less exploration activity than the central Beaufort and it is assumed that a large discovery is more likely in those areas with fewer exploration wells.

Installation of several platforms and drilling by one rig on each platform will result in a ramp-up period of several years before peak production rates are achieved. The overall field life from



**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

---

discovery to abandonment is 30 years, or approximately 8 years from discovery to production start-up, 20 year production life, and 2 year abandonment period.

Table 2 shows the list of E&D activities included in this scenario.

**Table 2. Summary of E&D Activities in the Beaufort OCS Less Restrictive Case**

<b>E&amp;D Activity</b>	<b>Volume/Number</b>
Marine Seismic Surveys	6
Geohazard Surveys	15
Geotechnical Surveys	15
Offshore Exploration Rigs	7
Exploration/Delineation Wells	11
Offshore Production Platforms	3
Production and Service Wells	36
Offshore Pipelines (# of miles)	55
Supply Boat Terminal	1

Source: Northern Economics, Inc., based on BOEM's Lease Sale 202 EIS.

## 4 Approach

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

### ***Task 1: Review existing environmental regulations and develop E&D Scenarios***

Northern Economics conducted a review of the existing environmental regulations that are in effect in the Arctic OCS, other OCS planning areas, and environmental requirements that were in place in previous years for the Beaufort Sea and Chukchi Sea planning areas.

In order to quantify the potential benefits of petroleum development, a set of assumptions that reflect possible industry-wide exploration, development, and production activities under each of the two regulatory scenarios or cases were developed. This involved developing reasonable assumptions regarding the timing and activity levels associated with E&D in the Beaufort and Chukchi Seas over the next 30 years under the two different regulatory scenarios.

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.

As a starting point, Northern Economics reviewed previous development scenarios available in the public domain, including exploration and development plans that have been submitted to BOEM, recent EIS documents published by BOEM, and the previous development scenarios we used in our 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*.

The two sets of scenarios were summarized in a memorandum that was presented to API for review and approval.

### ***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 and labor income 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, direct manpower requirements, and government revenues that result from OCS oil and gas activities specified in the E&D scenarios. 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 to use the model for work with public or private sector clients as long as periodic updates to the model which reflect new or updated information are provided to BOEM. BOEM is not provided any proprietary data from our other work; rather, the updated model includes new equations that incorporate the additional data points, or new technologies employed by industry. The MAG-PLAN model is not available to the public.

For this particular study, the MAG-PLAN model was calibrated to fit the different development scenarios developed in Task 1. This involved calibrating the model to include additional specific types of activities that have not been considered in previous modeling work, estimating costs and manpower requirements of the new activities, and updating capital and operating cost data for activities that already exist in the model. Updates to the IMPLAN coefficients and the fiscal modules that are in the MAG-PLAN model were also conducted.

The latest projections on oil and gas prices and transportation costs were incorporated into the model. For oil prices, the latest projections in the Annual Energy Outlook (AEO 2017) published by the Energy Information Administration were used. For transportation costs, information from the latest Revenue Sources Book published by the Alaska Department of Revenue were used.

After calibrating the MAG-PLAN model to fit this study, model runs were conducted for the two regulatory scenarios. A QA/QC of the inputs and outputs of the model were 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 (PI+) model that was developed by Regional Economic Models, Inc. (REMI) for Northern Economics. The REMI model is custom-built to address the analytical requirements of a particular application. The model used for this analysis is a 17-region model with 70 industrial sectors. The REMI model was used to quantify the indirect and induced economic benefits of OCS oil and gas activities to regions outside of Alaska (rest of the U.S.).

The REMI model integrates input-output, computable general equilibrium, econometric, and economic geography methodologies to generate forecasts on an annual basis through the year 2060. A full discussion of the data sources and estimation procedures of the REMI PI+ model is available at Regional Economic Models, Inc. (2015). The REMI model incorporates economic responses to changes in wages, employment opportunities, prices, and other economic and demographic factors. Model outputs include annual projections of various socioeconomic variables, such as employment, income, gross domestic product, unemployment rate, average annual wage rate, net economic migration, and population by age cohort.



To determine economic benefits of Arctic OCS development on regions outside of Alaska, direct spending and direct jobs associated with the various Arctic OCS activities (exploration, development, and production) that would 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.

## 5 Results

This section presents the results of the study under the two regulatory cases analyzed. The results are based on a potential outcome of future offshore petroleum development in the Beaufort and Chukchi OCS areas. This potential future outcome is based on the scenarios described in the previous section.

This section summarizes the results on employment and income effects, and potential government revenues at the local, state, and federal levels. The results for each regulatory case and OCS area are discussed in separate sub-sections.

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.

### 5.1 Projected Expenditures

Industry spending (level of investment) associated with E&D activities in the Beaufort Sea and Chukchi Sea planning 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), 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.

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. 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 a large amount of the construction materials needed would be purchased out-of-state, Alaska's water, air, and truck transportation sectors would benefit from these purchases.

The following sections present the estimated economic impacts of E&D activities associated with the Beaufort Sea and Chukchi Sea scenarios under the two regulatory cases.

#### 5.1.1 Status Quo Case

This section presents the results under the Status Quo case whereby E&D activities are assumed to be limited to existing leases. Under this case, no E&D activities are assumed to occur in the

Chukchi Sea, so the results are specific to the Beaufort Sea's Liberty Project and the Nikaitchuq North Project.

Table 3 shows the estimated total, annual average, and peak year expenditures associated with the Beaufort Sea Status Quo case. Total U.S. industry spending under this case amounts to about \$12.5 billion over the entire life cycle of the two projects (Liberty and Nikaitchuq North). Average spending under this case is estimated to amount to approximately \$250 million per year.

**Table 3. Estimated Direct Expenditures: *Beaufort Sea Status Quo Case***

Category	Direct Expenditures (Millions of 2015\$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	\$253	\$5,391	\$5,644	\$6,851	\$12,495
Annual Average	\$5	\$108	\$113	\$137	\$250
Peak	\$11	\$308	\$318	\$788	\$892

Source: Northern Economics estimates.

### 5.1.2 Less Restrictive Case

A more optimistic development scenario is assumed under this case with more exploration activities, more infrastructure development to support production, and higher volumes of oil production. As shown in the results below, direct industry spending under the Less Restrictive case is significantly higher relative to the Status Quo case.

#### 5.1.2.1 Beaufort Sea

Table 4 shows the estimated total, annual average, and peak year expenditures associated with the Beaufort Sea Less Restrictive case. Total U.S. spending under this case amount to about \$21.6 billion over the entire life cycle of the projects considered in the analysis. Average spending under this case is estimated to amount to approximately \$430 million per year.

**Table 4. Estimated Direct Expenditures: *Beaufort Sea Less Restrictive Case***

Category	Direct Expenditures (Millions of 2015\$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	\$434	\$9,620	\$10,054	\$11,595	\$21,649
Annual Average	\$9	\$192	\$201	\$232	\$433
Peak	\$18	\$514	\$529	\$832	\$957

Source: Northern Economics estimates.

#### 5.1.2.2 Chukchi Sea

Table 5 shows the estimated total, annual average, and peak year expenditures associated with the Chukchi Sea Less Restrictive case. Total U.S. spending under this case amount to about \$45 billion over the entire 50 year timeframe of the analysis. Average spending under this case is estimated to amount to almost \$900 million per year.

**Table 5. Estimated Direct Expenditures: *Chukchi Sea Less Restrictive Case***

Category	Direct Expenditures (Millions of 2015\$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	\$738	\$22,673	\$23,412	\$21,527	\$44,938
Annual Average	\$15	\$453	\$468	\$431	\$899
Peak	\$25	\$749	\$775	\$874	\$1,587

Source: Northern Economics estimates.

### 5.1.2.3 Total Less Restrictive Case: Beaufort Sea and Chukchi Sea

Table 6 summarizes the combined total direct expenditures in the Beaufort Sea and the Chukchi Sea under the Less Restrictive case. As noted above, total industry spending under this case is significantly higher (\$66.6 billion) compared to the Status Quo case (\$12.5 billion).

**Table 6. Estimated Total Direct Expenditures *under Less Restrictive Case: Beaufort Sea and Chukchi Sea***

Category	Direct Expenditures (Millions of 2015\$)				
	Local	Other Alaska	Total Alaska	Rest of U.S.	Total U.S.
Total Expenditures	1,173	32,293	33,466	33,122	66,588
Annual Average	23	646	669	662	1,332
Peak	43	1,263	1,304	1,706	2,544

Source: Northern Economics estimates.

## 5.2 Projected Employment Effects

Exploring, developing, and producing petroleum resources in the Arctic OCS will require a substantial effort and will directly employ thousands of people, with many more thousands of jobs created in and outside of Alaska. This section presents the estimated employment effects under the two regulatory cases resulting from petroleum development in the Beaufort Sea and Chukchi Sea OCS areas.

The estimated employment effects include the direct, indirect, and induced jobs at the local level (the North Slope Borough region), 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 would 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 4, 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 estimated 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 annual average jobs generated over the entire timeframe (from exploration to abandonment) and the peak values. The peak employment usually occurs when construction and development activities are occurring to bring a field into production.

### 5.2.1 Status Quo Case

Table 7 and Table 8, respectively, show the estimated direct, and indirect and induced annual average and peak year employment generated under the Beaufort Sea Status Quo case.

**Table 7. Estimated Total U.S. Direct Employment Effects: *Beaufort Sea Status Quo Case***

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	20	305	326	299	625
Peak	66	1,195	1,261	619	1,838

Source: Northern Economics estimates.

**Table 8. Estimated Total U.S. Indirect and Induced Employment Effects: *Beaufort Sea Status Quo Case***

Category	Multiplier Effects: Indirect and Induced Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	10	434	443	574	1,017
Peak	43	2,452	2,495	1,777	3,377

Source: Northern Economics estimates.

Table 9 summarizes the total employment effects by region under the Status Quo case. Alaska jobs are estimated to account for about 47 percent of the total jobs.

**Table 9. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: *Beaufort Sea Status Quo Case***

Region	Number of Jobs
Local	30
Other Alaska	739
Rest of U.S.	873
<b>Total U.S.</b>	<b>1,642</b>

Source: Northern Economics estimates.

## 5.2.2 Less Restrictive Case

The Less Restrictive case is anticipated to generate higher employment effects compared to the Status Quo case given that the level of industry spending and economic activities associated with this regulatory case are expected to be higher in this more optimistic scenario.

### 5.2.2.1 Beaufort Sea

Table 10 and Table 11 show the estimated direct, and indirect and induced annual average and peak year employment generated under the Beaufort Sea Less Restrictive case.

**Table 10. Estimated Total U.S. Direct Employment Effects: *Beaufort Sea Less Restrictive Case***

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	35	518	553	510	1,063
Peak	113	1,738	1,851	1,172	3,022

Source: Northern Economics estimates.

**Table 11. Estimated Total U.S. Indirect and Induced Employment Effects: *Beaufort Sea Less Restrictive Case***

Category	Multiplier Effects: Indirect and Induced Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	17	853	869	945	1,814
Peak	44	2,522	2,566	2,525	4,438

Source: Northern Economics estimates.

Table 12 summarizes the total employment effects by region for the Beaufort Sea. It is estimated that that Alaska jobs would account for 49 percent of the total U.S. jobs.

**Table 12. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: *Beaufort Sea Less Restrictive Case***

Region	Number of Jobs
Local	51
Other Alaska	1,371
Rest of U.S.	1,455
<b>Total U.S.</b>	<b>2,877</b>

Source: Northern Economics estimates.

#### 5.2.2.2 Chukchi Sea

Table 13 and Table 14 show the estimated direct, and indirect and induced annual average and peak year employment generated under the Chukchi Sea Less Restrictive case.

**Table 13. Estimated Total U.S. Direct Employment Effects: *Chukchi Sea Less Restrictive Case***

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	105	1,716	1,821	1,192	3,013
Peak	286	4,691	4,965	2,480	7,445

Source: Northern Economics estimates.

**Table 14. Estimated Total U.S. Indirect and Induced Employment Effects: Chukchi Sea Less Restrictive Case**

Category	Multiplier Effects: Indirect and Induced Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	72	2,727	2,799	2,213	5,012
Peak	108	4,654	4,744	5,262	9,931

Source: Northern Economics estimates.

Table 15 summarizes the total employment effects by region for the Chukchi Sea. It is estimated that under this scenario, approximately 56 percent of the total U.S. jobs would be in Alaska.

**Table 15. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: Chukchi Sea Less Restrictive Case**

Region	Number of Jobs
Local	176
Other Alaska	4,444
Rest of U.S.	3,405
<b>Total U.S.</b>	<b>8,025</b>

Source: Northern Economics estimates.

### 5.2.2.3 Total Less Restrictive Case: Beaufort Sea and Chukchi Sea

Table 16 and Table 17 show the combined estimated direct, and indirect and induced annual average and peak year employment generated in the Beaufort Sea and the Chukchi Sea under the Less Restrictive case. Total employment effects under this case is significantly higher with a total of nearly 11,000 annual average jobs compared to the Status Quo case with an estimated 1,600 total annual average jobs.

**Table 16. Estimated Total U.S. Direct Employment Effects: Less Restrictive Case**

Category	Direct Oil and Gas Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	140	2,234	2,374	1,702	4,076
Peak	399	6,429	6,816	3,652	10,467

Source: Northern Economics estimates.

**Table 17. Estimated Total U.S. Indirect and Induced Employment Effects: Less Restrictive Case**

Category	Multiplier Effects: Indirect and Induced Jobs				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.



**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

Annual Average	89	3,580	3,668	3,158	6,826
Peak	152	7,176	7,310	7,787	14,369

Source: Northern Economics estimates.

Table 18 summarizes the combined total employment effects under the Less Restrictive case.

**Table 18. Total Annual Average Direct, Indirect, and Induced Employment Effects by Region: *Less Restrictive Case***

Region	Number of Jobs
Local	227
Other Alaska	5,815
Rest of U.S.	4,860
<b>Total U.S.</b>	<b>10,902</b>

Source: Northern Economics estimates.

## 5.3 Projected Labor Income Effects

This section presents the estimated labor income effects of OCS petroleum development activities under the two regulatory cases. 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.

### 5.3.1 Status Quo Case

Table 19 and Table 20 summarize the estimated direct, and the indirect and induced labor income effects under the Beaufort Sea Status Quo case. 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 estimated to amount to about \$157 million. The annualized average direct income over the entire life cycle of the two projects included in this case, is estimated to be about \$69 million.

Additional annual average labor income resulting from the indirect and induced effects is projected to amount to about \$66 million, with a peak annual amount of over \$200 million.

**Table 19. Estimated Total U.S. Direct Labor Income Effects: *Beaufort Sea Status Quo Case***

Category	Direct Oil and Gas Labor Income (Millions of 2015\$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$1.79	\$31.66	\$33.45	\$35.33	\$68.78
Peak	\$4.77	\$89.02	\$93.79	\$64.12	\$156.76

Source: Northern Economics estimates.

**Table 20. Estimated Total U.S. Indirect and Induced Labor Income Effects: *Beaufort Sea Status Quo Case***

Category	Multiplier Effects: Indirect and Induced Labor Income
----------	-------------------------------------------------------

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

	(Millions of 2015 \$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$1.01	\$27.23	\$28.24	\$37.32	\$65.56
Peak	\$3.94	\$156.17	\$160.11	\$92.28	\$204.26

Source: Northern Economics estimates.

Table 21 summarizes the total direct, indirect, and induced annual average labor income effects.

**Table 21. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: *Beaufort Sea Status Quo Case***

Region	Amount (Millions of 2015 \$)
Local	\$2.8
Other Alaska	\$58.9
Rest of U.S.	\$72.7
<b>Total U.S.</b>	<b>\$134.3</b>

Source: Northern Economics estimates.

### 5.3.2 Less Restrictive Case

Labor income effects under the Less Restrictive case are described in the sections below.

#### 5.3.2.1 Beaufort Sea

Table 22 and Table 23 summarize the estimated direct, and the indirect and induced labor income effects under the Beaufort Sea Less Restrictive case. 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 estimated to amount to about \$207 million. The annualized average direct income over the entire life cycle of the projects included in this case, is estimated to be about \$99 million.

Additional annual average labor income resulting from the indirect and induced effects is projected to amount to about \$118 million, with a peak annual amount of over \$280 million.

**Table 22. Estimated Total U.S. Direct Labor Income Effects: *Beaufort Sea Less Restrictive Case***

Category	Direct Oil and Gas Labor Income (Millions of 2015\$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$2.35	\$49.34	\$51.69	\$47.34	\$99.03
Peak	\$5.33	\$117.52	\$122.85	\$84.29	\$207.14

Source: Northern Economics estimates.

**Table 23. Estimated Total U.S. Indirect and Induced Labor Income Effects: *Beaufort Sea Less Restrictive Case***

Category	Multiplier Effects: Indirect and Induced Labor Income
----------	-------------------------------------------------------

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

	(Millions of 2015 \$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$1.78	\$54.47	\$56.25	\$62.01	\$118.25
Peak	\$4.01	\$160.93	\$164.94	\$143.71	\$280.03

Source: Northern Economics estimates.

Table 24 summarizes the total direct, indirect, and induced annual average labor income effects.

**Table 24. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: *Beaufort Sea Less Restrictive Case***

Region	Amount (Millions of 2015 \$)
Local	\$4.1
Other Alaska	\$103.8
Rest of U.S.	\$109.4
<b>Total U.S.</b>	<b>\$217.3</b>

Source: Northern Economics estimates.

### 5.3.2.2 Chukchi Sea

Table 22 and Table 23 summarize the estimated direct, and the indirect and induced labor income effects under the Chukchi Sea Less Restrictive case. 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 estimated to amount to about \$297 million. The annualized average direct income over the entire life cycle of the two projects included in this case, is estimated to be about \$180 million.

Additional annual average labor income resulting from the indirect and induced effects is projected to amount to about \$332 million, with a peak annual amount of nearly \$668 million.

**Table 25. Estimated Total U.S. Direct Labor Income Effects: *Chukchi Sea Less Restrictive Case***

Category	Direct Oil and Gas Labor Income (Millions of 2015\$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$2.56	\$106.09	\$108.65	\$71.09	\$179.74
Peak	\$7.09	\$178.55	\$183.17	\$117.34	\$296.70

Source: Northern Economics estimates.

**Table 26. Estimated Total U.S. Indirect and Induced Labor Income Effects: *Chukchi Sea Less Restrictive Case***

Category	Multiplier Effects: Indirect and Induced Labor Income (Millions of 2015 \$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$7.54	\$168.28	\$175.83	\$155.87	\$331.69
Peak	\$11.50	\$295.69	\$305.10	\$369.96	\$667.82

**Potential Economic Benefits of Petroleum Development in the Alaska Arctic OCS under Different Regulatory Scenarios**

Source: Northern Economics estimates.

Table 27 summarizes the total direct, indirect, and induced annual average labor income effects by region.

**Table 27. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: *Chukchi Sea Less Restrictive Case***

Region	Amount (Millions of 2015 \$)
Local	\$10.1
Other Alaska	\$274.4
Rest of U.S.	\$227.0
<b>Total U.S.</b>	<b>\$511.4</b>

Source: Northern Economics estimates.

### 5.3.2.3 Total Less Restrictive Case: Beaufort Sea and Chukchi Sea

Table 28 and Table 29 summarize the combined estimated direct, and the indirect and induced labor income effects under the Less Restrictive case. Estimated labor income effects under the Less Restrictive case are higher (estimated to amount to \$729 million per year on average) compared to the Status Quo case (\$134 million per year).

**Table 28. Estimated Total U.S. Direct Labor Income Effects: *Less Restrictive Case***

Category	Direct Oil and Gas Labor Income (Millions of 2015\$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$4.91	\$155.43	\$160.34	\$118.43	\$278.77
Peak	\$12.42	\$296.07	\$306.02	\$201.63	\$503.84

Source: Northern Economics estimates.

**Table 29. Estimated Total U.S. Indirect and Induced Labor Income Effects: *Less Restrictive Case***

Category	Multiplier Effects: Indirect and Induced Labor Income (Millions of 2015 \$)				
	Local	Other Alaska	AK Total	Rest of U.S.	Total U.S.
Annual Average	\$9.32	\$222.75	\$232.08	\$217.88	\$449.94
Peak	\$15.51	\$456.62	\$470.04	\$513.67	\$947.85

Source: Northern Economics estimates.

Table 30 summarizes the combined total direct, indirect, and induced annual average labor income effects by region.

**Table 30. Total Annual Average Direct, Indirect, and Induced Labor Income Effects by Region: *Less Restrictive Case***

Region	Amount (Millions of 2015 \$)
Local	\$14.20
Other Alaska	\$378.20
Rest of U.S.	\$336.40
Total U.S.	\$728.70

Source: Northern Economics estimates.

## 5.4 Projected Government Revenues

Petroleum development in the Beaufort Sea and Chukchi Sea OCS areas could generate significant government revenues through taxes and lease payments. This section presents the estimated 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 (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 in the case of the North Slope Borough, is 18.5 mills.

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**

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 estimated 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 estimated 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 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 were estimated 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 2017). 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.

#### 5.4.1 Status Quo Case

The estimated government revenues that could accrue to local, state, and federal governments resulting from potential development in the Beaufort Sea under the Status Quo case are shown in Table 31. The total estimated government take under this scenario is projected to amount to approximately \$2 billion over the entire timeframe of the development activities.

**Table 31. Estimated Local, State, and Federal Government Revenues: *Beaufort Sea Status Quo Case***

Category	Direct Revenues (Millions of 2015\$)					
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	Total Revenues
Total	\$98.46	\$7.98	\$18.36	\$150.26	\$1,765.22	\$2,040.29
Annual Average	\$2.14	\$0.17	\$0.54	\$4.42	\$51.92	\$59.19
Peak	\$3.20	\$0.26	\$2.39	\$17.45	\$229.35	\$252.65

Source: Northern Economics estimates.

#### 5.4.2 Less Restrictive Case

As shown in the results below, under the Less Restrictive case, government revenues are expected to be significantly higher compared to the Status Quo case. This is because under this scenario, oil production volumes are higher which would generate more royalty payments, and there would be more taxable oil facilities on state and local property.

In the Beaufort Sea E&D, taxable facilities include both onshore and offshore (in state waters) oil pipelines, a supply boat terminal, and an onshore production base (50 percent of the Liberty gravel island facility would be subject to state property taxes).

In the Chukchi Sea E&D, taxable facilities include onshore and offshore (in state waters) oil pipelines, exploration and production bases, a supply boat terminal, and an air support base.

##### 5.4.2.1 Beaufort Sea

The estimated government revenues that could accrue to local, state, and federal governments resulting from potential development in the Beaufort Sea under the Less Restrictive case are shown in Table 32. The total estimated government take under this scenario is projected to amount to approximately \$7.6 billion over the entire timeframe of the development activities.

**Table 32. Estimated Local, State, and Federal Government Revenues: *Beaufort Sea Less Restrictive Case***

Category	Direct Revenues (Millions of 2015\$)					
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	Total Revenues
Total	\$176.58	\$14.32	\$70.80	\$526.93	\$6,808.09	\$7,596.72
Annual Average	\$3.84	\$0.31	\$2.08	\$15.50	\$200.24	\$221.97
Peak	\$5.70	\$0.46	\$4.75	\$31.31	\$456.76	\$498.98

Source: Northern Economics estimates.

#### 5.4.2.2 Chukchi Sea

The estimated government revenues that could accrue to local, state, and federal governments resulting from potential development in the Chukchi Sea under the Less Restrictive case are shown in Table 33. The total estimated government take under this scenario is projected to amount to approximately \$53.4 billion over the entire timeframe of the development activities.

**Table 33. Estimated Local, State, and Federal Government Revenues: *Chukchi Sea Less Restrictive Case***

Category	Direct Revenues (Millions of 2015\$)					
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	Total Revenues
Total	\$853.36	\$69.19	\$519.75	\$2,024.41	\$49,976.08	\$53,442.79
Annual Average	\$17.07	\$1.38	\$10.40	\$40.49	\$999.52	\$1,068.86
Peak	\$28.08	\$2.28	\$25.23	\$76.33	\$2,425.71	\$2,557.62

Source: Northern Economics estimates.

#### 5.4.2.3 Total Less Restrictive Case: Beaufort Sea and Chukchi Sea

Table 34 summarizes the combined total estimated local, state, and federal government revenues by revenue stream under the Less Restrictive case.

**Table 34. Estimated Local, State, and Federal Government Revenues: *Less Restrictive Case***

Category	Direct Revenues (Millions of 2015\$)					
	Local Property Taxes	State Property Taxes	State Corporate Income Tax	State (TAPS Effect)	Federal Royalty Payments	Total Revenues
Total	\$1,029.94	\$83.51	\$590.55	\$2,551.34	\$56,784.17	\$61,039.51
Annual Average	\$20.91	\$1.69	\$12.48	\$55.99	\$1,199.76	\$1,290.83
Peak	\$33.78	\$2.74	\$29.98	\$107.64	\$2,882.47	\$3,056.60

Source: Northern Economics estimates.



## 6 Conclusions

Alaska's OCS Arctic region has been estimated to contain vast petroleum resources. To date, however, development in the Arctic OCS areas offshore Alaska has proven to be challenging 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, which poses economic challenges to the industry. Environmental regulations have also affected access to the areas, increased the timeframe for permit approvals, and increased environmental permitting and compliance costs. Petroleum development in these areas, if conditions allow, could generate substantial economic benefits to Alaska and the rest of the United States.

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 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.

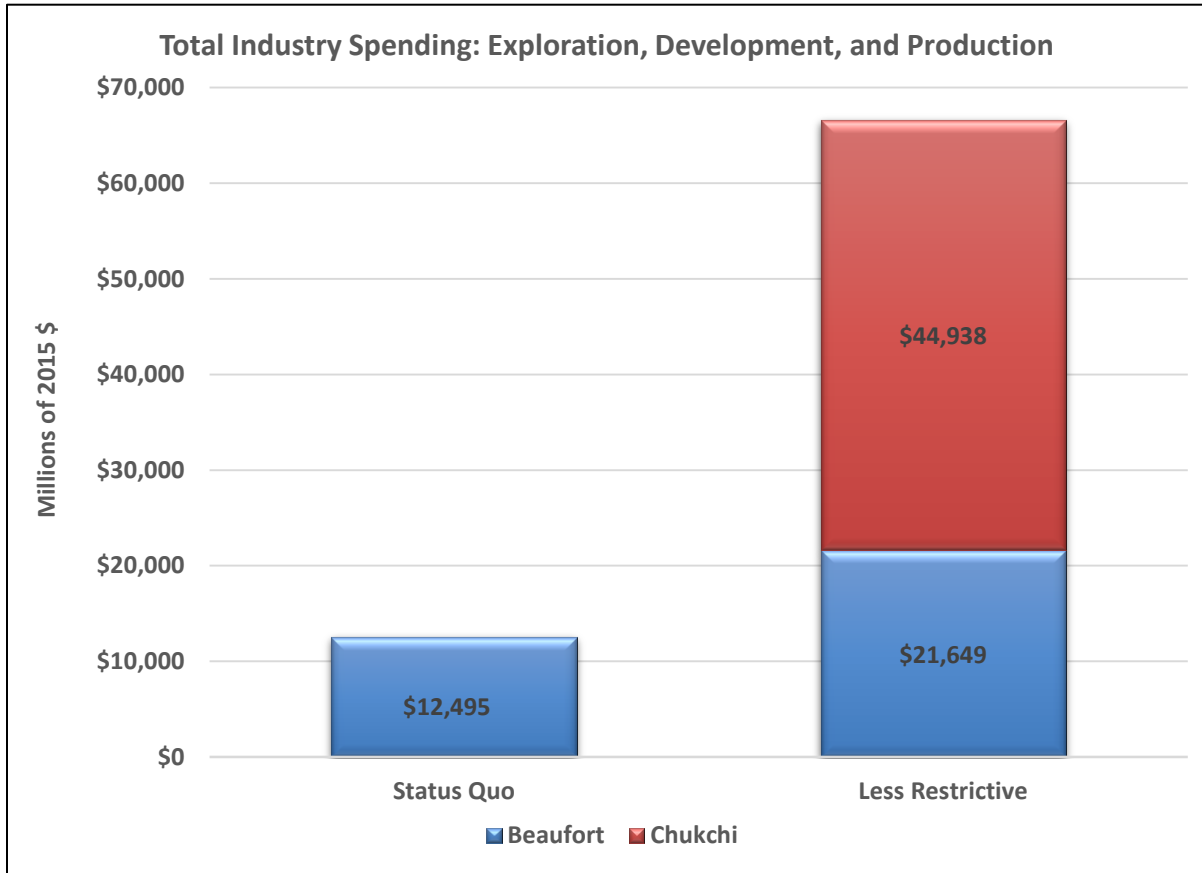
Under the Status Quo case, the more restrictive regulatory case, the E&D activities are assumed to be limited to activities in existing lease, so that there is only development in the Beaufort Sea planning area.

Under the Less Restrictive case, it is assumed that there will be increased access to the Arctic OCS areas consistent with the current administration's intent as stated in its Executive Order. Under this case, there will be lease sales held in the Chukchi Sea and the Beaufort Sea in BOEM's 5-year lease plan. A more optimistic development scenario is assumed under this case-- with more exploration activities, more infrastructure development to support production, and higher volumes of oil production.

Direct industry spending under the Less Restrictive case is significantly higher relative to the Status Quo case. Hence, the potential economic benefits under this case are also significantly higher relative to the Status Quo case.

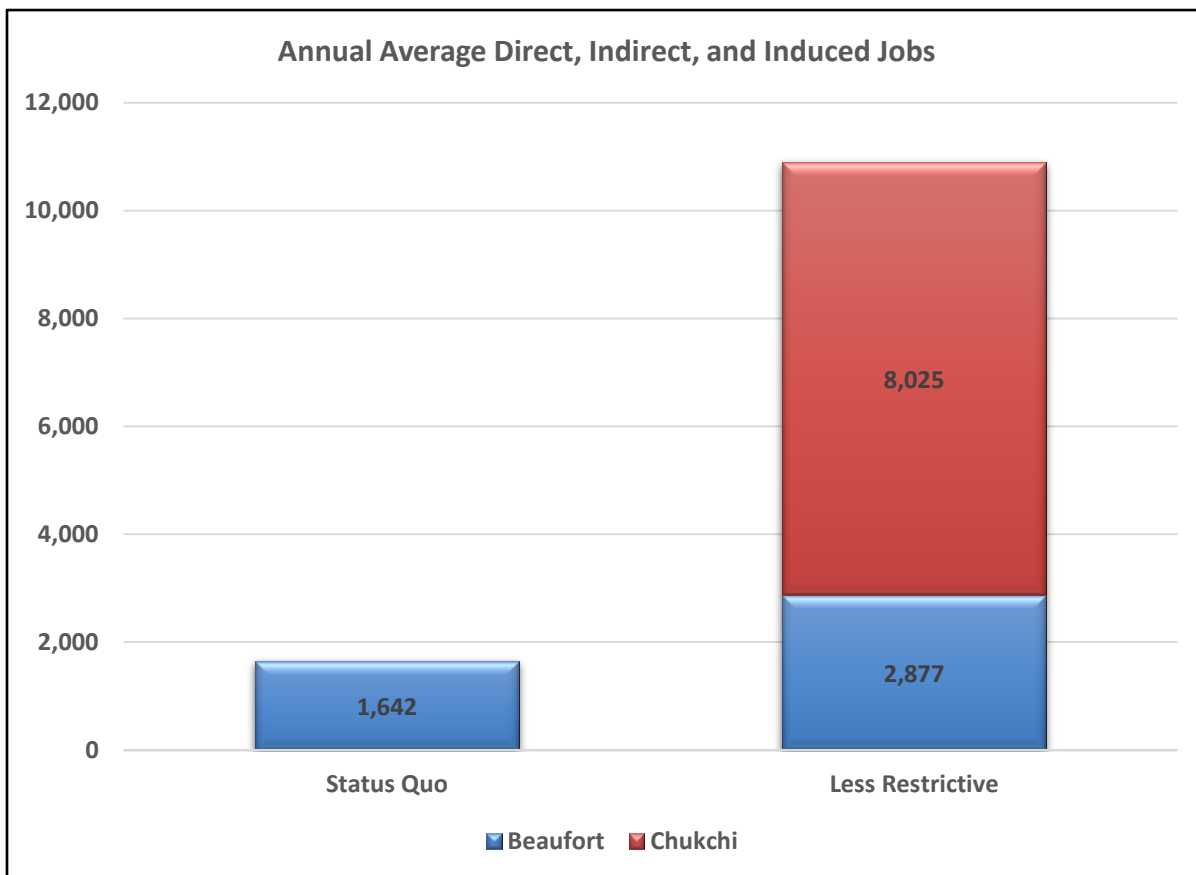
The following figures and table present a comparison of the total potential economic benefits that could result under the two regulatory cases.

Figure 5. Estimated Potential Industry Expenditures on Petroleum Development under Different Regulatory Cases, Millions of 2015 \$



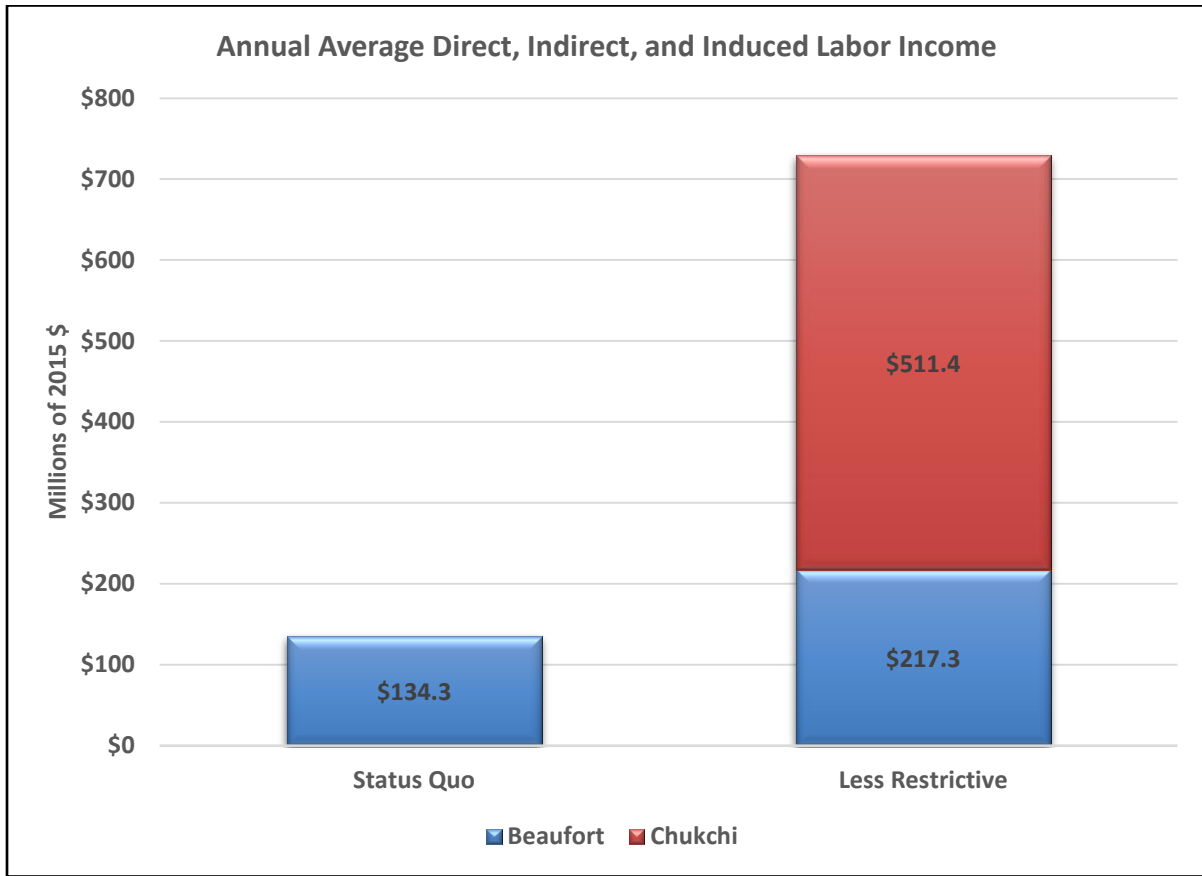
Source: Northern Economics estimates.

Figure 6. Estimated Total U.S. Annual Average Jobs under Different Regulatory Cases



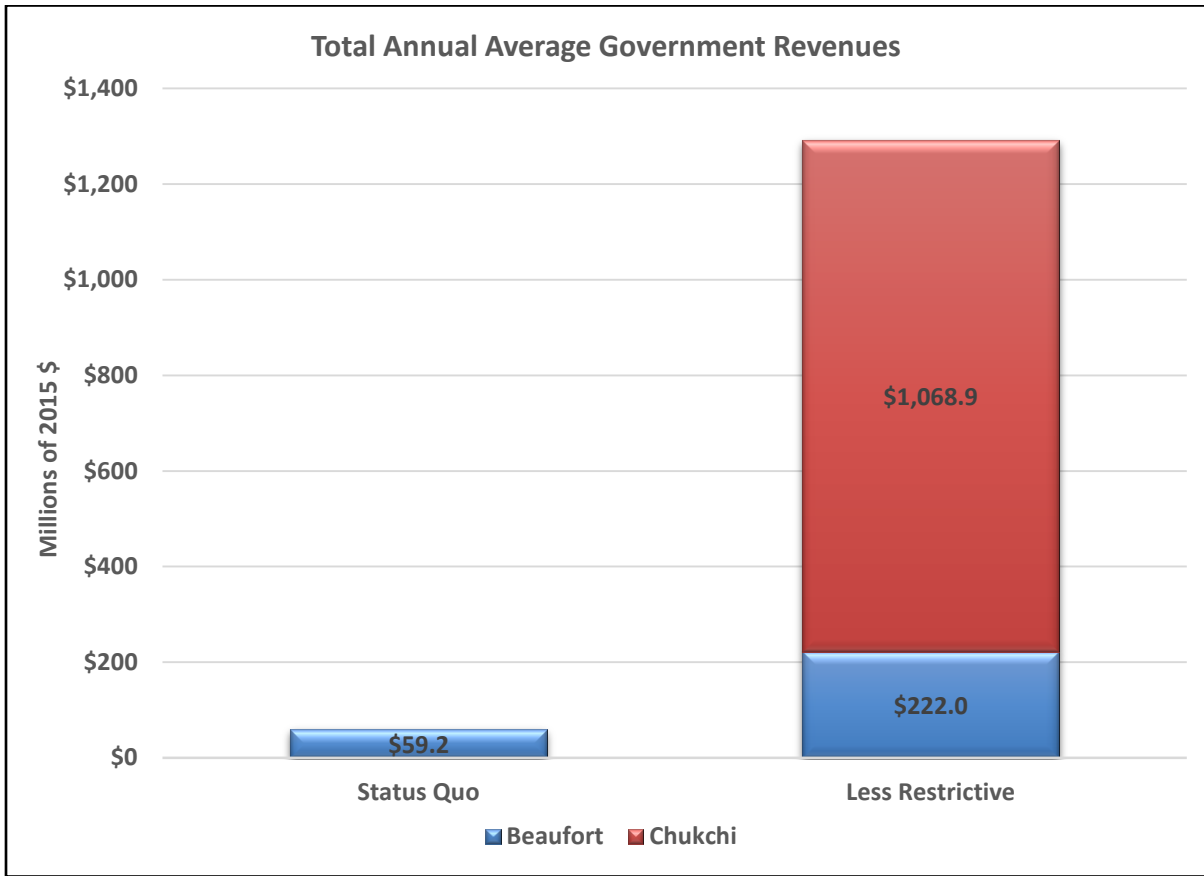
Source: Northern Economics estimates.

Figure 7. Estimated Potential Total U.S. Labor Income Effects under Different Regulatory Cases



Source: Northern Economics estimates.

**Figure 8. Estimated Potential Total Annual Average Federal, State, and Local Government Revenues under Different Regulatory Cases, Millions of 2015\$**



Source: Northern Economics estimates.

**Table 35. Estimated Federal, State, and Local Government Revenues under Different Regulatory Cases, Millions of 2015\$**

Revenue Categories	Status Quo Case		Less Restrictive Case					
	Beaufort Sea OCS		Beaufort Sea OCS		Chukchi Sea OCS		Total	
	Total	Annual Average	Total	Annual Average	Total	Annual Average	Total	Annual Average
Local Property Taxes	\$98.5	\$2.1	\$176.6	\$3.8	\$853.4	\$17.1	\$1,029.9	\$20.9
State Property Taxes	\$8.0	\$0.2	\$14.3	\$0.3	\$69.2	\$1.4	\$83.5	\$1.7
State Corporate Income Tax	\$18.4	\$0.5	\$70.8	\$2.1	\$519.8	\$10.4	\$590.6	\$12.5
State (TAPS Effect)	\$150.3	\$4.4	\$526.9	\$15.5	\$2,024.4	\$40.5	\$2,551.3	\$56.0
Federal Royalty Payments	\$1,765.2	\$51.9	\$6,808.1	\$200.2	\$49,976.1	\$999.5	\$56,784.2	\$1,199.8

Source: Northern Economics estimates.

## 7 References

- Alaska Department of Revenue, 2017. 2017 Revenue Sources Book Spring 2017. Published on April 14, 2017. Available at <http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1331r>. Accessed on June 1, 2017.
- Bureau of Ocean Energy Management, 2003. Final Environmental Impact Statement, Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, and 202.
- Bureau of Ocean Energy Management, 2014. Final Second Supplemental Environmental Impact Statement, Chukchi Sea Planning Area Oil and Gas Lease Sale 193.
- Bureau of Ocean Energy Management, 2016. 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Final Program. Released on November 2016.
- Bureau of Ocean Energy Management, 2016. Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf. Available at <https://www.boem.gov/National-Assessment-2016>. Accessed on June 1, 2017.
- Bureau of Ocean Energy Management, 2017. Map of Beaufort Sea OCS Lease Ownership. Available at <https://www.boem.gov/Beaufort-Sea-OCS-Lease-Ownership-map/>. Accessed on July 5, 2017.
- Energy Information Authority, 2017. Annual Energy Outlook 2017, with projections to 2050. Released on January 5, 2017. Available at [https://www.eia.gov/outlooks/aeo/pdf/0383\(2017\).pdf](https://www.eia.gov/outlooks/aeo/pdf/0383(2017).pdf). Accessed on June 1, 2017.
- Eni US Operating Co. Inc., 2017. Initial Exploration Plan: Nikaitchuq North, Alaska. Exploration plan submitted to the Bureau of Ocean Energy Management on March 2017.
- Hilcorp Alaska, LLC, 2015. Liberty Development Project: Development and Production Plan. Revised plan submitted to the Bureau of Ocean Energy Management on September 8, 2015.
- Northern Economics, Inc., 2015. Costs of Proposed Regulations for Exploratory Drilling in the Arctic OCS. A report prepared for the American Petroleum Institute.
- Regional Economics Model Inc., 2016. Policy Insight+ model and data developed by REMI for Northern Economics.
- The White House, Office of the Press Secretary, 2017. Presidential Executive Order Implementing an America-First Offshore Energy Strategy. Issued on April 2017. Accessed on June 15, 2017. Available at <https://www.whitehouse.gov/the-press-office/2017/04/28/presidential-executive-order-implementing-america-first-offshore-energy>.
- U.S. Department of Interior, 2016. "Interior Issues Final Regulations to Raise Safety and Environmental Standards for Any Future Exploratory Drilling in U.S. Arctic Waters." A press release issued by the Office of the Secretary of the Interior on July 7, 2016.

