

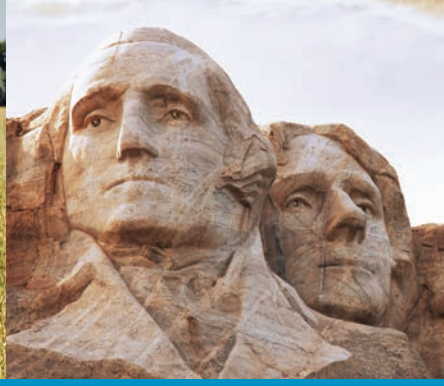

The Economic Effects of Immediately Opening Federal Lands to Oil, Gas, and Coal Leasing

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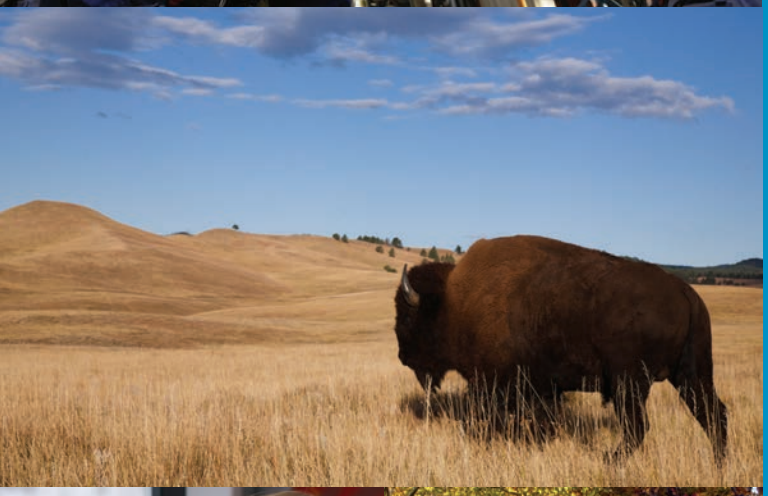
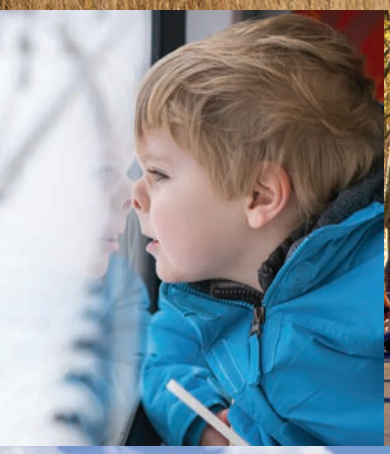

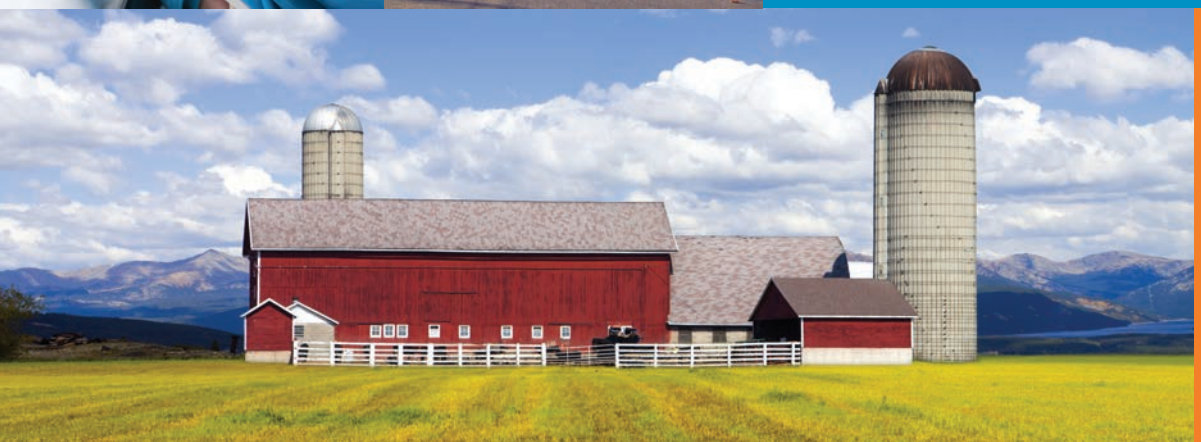

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[1] I offer special thanks to Prateek Sharma for expert research assistance with this study.

Executive Summary

While headlines have reported declining oil, gas, and coal prices, those declines do not deter from the fact that U.S. energy resources are valuable to our domestic economic growth. The most recent government estimate of those benefits was a 2012 Congressional Budget Office (CBO) study, produced at the request of the House Budget Committee, which analyzed federal lease revenues that could be expected to arise from a proposal to open federal lands and waters to oil, gas, and coal extraction.

Specifically, the study aimed to estimate the fiscal benefits of opening areas that are statutorily or as a matter of administration policy prohibited from leasing. The issue has repeatedly been a hot-button political and economic issue in the past several years, having been discussed at the beginning of the Obama administration and then again as Republican challengers in the 2012 election placed opening the lands and waters at the center of their energy policy. The issue remains relevant in the 2016 election cycle.

This paper highlights the continuing economic effects despite recent price declines, including benefits to economic growth, wages, jobs, and federal, state, and local tax revenues, from opening federal lands and waters to oil, gas, and coal leasing.

The findings of this paper demonstrate that opening federal land that is currently closed-off because of statutory or administrative action would lead to broad-based economic stimulus, including increasing GDP, employment, wages, and tax revenues. Specifically:

GDP increase:

- $127 billion annually for the next seven years.
- $663 billion annually in the next thirty years.
- $20.7 trillion cumulative increase in economic activity over the next thirty-seven years.
    - These estimates include “spillover” effects, or gains that extend from one location to another location. For example, increased oil production in the Gulf of Mexico might lead to more automobile purchases that would increase economic activity in Michigan. Spillover effects would add an estimated $69 billion annually in the next seven years and $178 billion over thirty years.

Jobs increase:

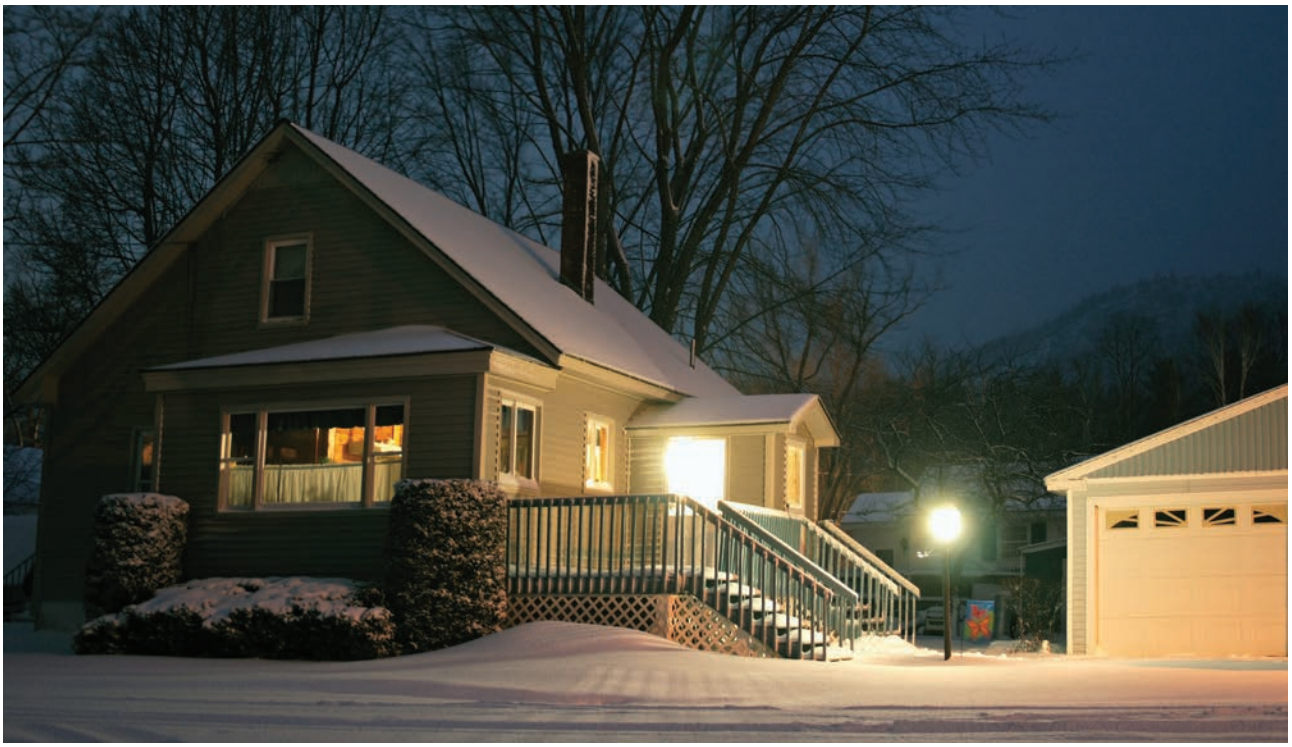
- 552,000 jobs annually over the next seven years.
- Roughly 2.7 million jobs annually over the next thirty years.
    - Jobs gains would be not only in fields directly related to oil, gas, and coal but more than 75% of the jobs would be in high-wage, high-skill employment like health care, education, professional fields, and the arts.

Wage increase:

- $32 billion increase in annual wages over the next seven years.
- $163 billion annually between seven and thirty years.
- $5.1 trillion cumulative increase over thirty-seven years.

Increase in tax revenue:

- $3.9 trillion increase in federal tax revenues over thirty-seven years.
- $1.9 trillion in state and local tax revenues over thirty-seven years.
- $24 billion annual federal tax revenue over the next seven years, $126 billion annually thereafter.
- $10 billion annual state and local tax revenue over the next seven years, $61 billion annually thereafter.



The federal benefits, when incorporating the CBO's estimates on leasing revenues, could be as great as $36 billion annually for the next 7 years, and $139 billion annually in the long-run.

The present analysis illustrates the considerable economic value typically ignored in the energy debate. Federal taxes from the increased output could raise as much as $24 billion annually in the short-run, and would continue to produce $126 billion annually in the long-run. The federal benefits, when incorporating the CBO's estimates on leasing revenues, could be as great as $36 billion annually for the next 7 years, and $139 billion annually in the long-run.

According to the findings of this paper, the effects of the proposal on the larger economy would also be substantial. Output would increase by $127 billion annually over the next 7 years (about 1% of current GDP), and $663 billion annually after that (about 4% of current GDP). Over 552 thousand jobs could be created for the next 7 years with almost 2.7 million jobs after that, aiding economic recovery for workers facing historically high un- and under-employment rates. Wages would increase by $32 billion annually in the short run, with long run annual effects of $163 billion.

The economic impulses created by opening federal lands and waters to oil, gas, and coal extraction could therefore help significantly to spur economic growth — and help break the economy out of its sluggish post-recessionary malaise. Importantly, those benefits would be realized without any increase in direct government spending. Rather, increased output would refill national, state, and local government coffers without additional government outlays.

I. Introduction

In February 2013, I released a study of "The Additional Economic Effects of Immediately Opening Federal Lands to Oil and Gas Leasing." Since my 2013 study, headlines have reported that oil and gas prices have declined considerably, falling by roughly half over the past 15 months.[1] Still, oil, gas, and coal resources on Federal lands are economically valuable resources, and unlocking those resources can unleash considerable economic potential.

This paper updates my prior economic estimates of the economic effects of opening Federal Lands to oil, gas, and coal leasing, including economic growth, wages, jobs, and both federal and state and local tax revenues. I rely upon recent EIA oil, gas, and coal price estimates to show these broader economic effects in order to update my prior analysis.

As before, economic activity from opening Federal lands would affect regions throughout the United States, even areas without direct claims to lease revenues or close proximity to drilling and mining sites. Moreover, those economic benefits are generated on both a short- and long-term basis. For purposes of my analysis, short-run effects are those during the first years of the investment – the pre-production phase[2] – and long-run effects are represented as expected annual effects during the production phase.[3] A summary of those estimated short- and long-run economic effects are listed in Table 1.

TABLE 1: **ANNUAL IMPACT OF OPENING RESTRICTED FEDERAL LANDS TO OIL, GAS, AND COAL DEVELOPMENT**
($ BILLIONS ANNUALLY, UNLESS OTHERWISE SPECIFIED)

	SHORT-RUN	LONG-RUN
AVG. PROCEEDS FROM FEDERAL OIL AND GAS LEASING (CBO)	$11.7	$13.5
ANNUAL FEDERAL TAX REVENUES FROM INCREASED OIL, GAS, AND COAL ACTIVITY	$24.1	$126
TOTAL FEDERAL REVENUES	**$35.8**	**$139.5**
OUTPUT	$126.9	663
EMPLOYMENT (THOUSANDS OF JOBS)	552	2,763
WAGES	32.4	162.9
STATE & LOCAL TAX REVENUES	10.3	61.5

SOURCES: "AVERAGE PROCEEDS FROM FEDERAL OIL AND GAS LEASING" FROM CBO, POTENTIAL BUDGETARY EFFECTS OF IMMEDIATELY OPENING MOST FEDERAL LANDS TO OIL AND GAS LEASING, AUG. 2012, AT TABLE 1(CBO LONG-RUN IS THE AVERAGE OF THEIR 11 YEARS OF ESTIMATES), AND AUTHOR'S ESTIMATES.

NOTE: SHORT-RUN EFFECTS ARE THOSE PROVIDED ANNUALLY DURING THE FIRST YEARS OF THE INVESTMENT (PRE-PRODUCTION) PHASE -ESTIMATED TO BE 7 YEARS; LONG-RUN EFFECTS ARE THOSE PROVIDED ANNUALLY DURING THE PRODUCTION PHASE - ESTIMATED TO BE 30 YEARS. MY ANALYSIS ONLY INCLUDES AREAS DESIGNATED AS TEMPORARILY UNAVAILABLE TO OIL AND GAS LEASING BY THE CBO AND FEDERAL LANDS IN THE POWDER RIVER BASIN AS DESCRIBED IN APPENDIX B.

In addition to the lease revenues established by the CBO in their 2012 study (which I have not updated for current prices), despite lower energy prices Federal taxes from increased oil, gas, and coal output could raise as much as $24 billion annually in the short-run, and would continue to produce $126 billion annually in the long-run. The federal benefits, when incorporating the CBO's estimates on leasing revenues, could be as great as $36 billion annually for the next 7 years, and $139 billion annually in the long-run.

The effects on the larger economy would also be substantial. Output would increase by $127 billion annually over the next 7 years (about 1% of current GDP), and $663 billion annually after that (about 4% of current GDP).[4] Over 552 thousand jobs could be created for the next 7 years with roughly 2.7 million jobs after that, aiding economic recovery for workers facing historically high un- and under-employment rates. Wages would increase by $32 billion annually in the short run, with long run effects of $163 billion. The economic gains created by opening Federal lands to oil, gas, and coal extraction could therefore help significantly spur economic growth — and help break the economy out of its continuing post-recessionary malaise. Importantly, those benefits would be realized without any increase in direct government spending. Rather, increased output would refill national, state, and local government coffers without additional government outlays.

The remainder of this paper outlines my analysis in further detail.

II. Data and Assumptions

The oil, gas, and coal industry has long been a foundation of the U.S economy and an important source of federal revenues. Hundreds of both large and small companies in the U.S. oil, gas, and coal industry create close to ten million jobs "not just in exploring, producing, refining, transporting, and marketing oil and natural gas, but also through the purchases of other goods and services that support the industry's operations."[5]

While it is sometimes argued that those jobs, wages, and tax revenues will only develop slowly over time, substantial economic activity takes place well before new oil, gas, and coal fields begin production. For instance, Shell sunk more than $7 billion into development for drilling in Alaska before recently abandoning the prospect. It is estimated that Shell will spend another $1 billion before they wrap up obligations relating to the Chukchi Sea Alaska leases. While Shell may be allowed to continue activity at a later date, as of now the investment has resulted in zero production.[6] Shell's experience is by no means unique. Since the early 2000s, large-scale projects have required considerable up-front investment. For instance, Chevron's 2002 "Tahiti" project in the Gulf of Mexico — which involves fields lying 100 miles off the U.S. coast at a depth of 4,000 feet — found "an estimated 400 million to 500 million barrels of recoverable resources."[7] Chevron estimated that it would take seven years to build the necessary infrastructure required to begin production at Tahiti.[8] The field was estimated to require an investment of about "$4.7 billion [in current dollars] — before realizing $1 of return on … investment."[9]

Such investment has spillover effects for other industries that support the U.S. energy market and employees in that sector. In my previous study on the economic effects of opening the OCS planning areas, I addressed how offshore drilling alone contributes to

While it is sometimes argued that those jobs, wages, and tax revenues will only develop slowly over time, substantial economic activity takes place well before new oil, gas, and coal fields begin production.

substantial economic growth for onshore and offshore communities.[10] Drilling projects, whether offshore or onshore, have two distinct phases: (1) the initial exploration and development of offshore facilities and (2) the extraction of reserves.[11] Both phases support numerous local and national industries, such as steelmaking, machinery production, shipbuilding, and food and support services. I ignore the effects of investments in new refining capacity and infrastructure, which again biases the estimates downward. The analysis therefore considers only the "short-term" economic effects that flow from exploration and development and the "long-term" effects that flow from production.

To calibrate the short- and long-term relevant to oil field development, I follow the method of my 2009 study and use detailed data from Chevron's Tahiti project, which is presented as a typical large-scale project for which data is available. I assume that the initial phase of investment will last 7 years and the life of an oil field or coal mine after that (the long-term effect) lasts 30 years[12] and annualize my estimates based on these assumptions. Since data on such development is largely lacking for coal, I ignore the short run benefits of such development and count only the long-term effects. Ignoring the short-run benefits of coal development reduces my estimates of economic activity, making them more conservative. During the short-term exploration and development phase for oil and gas, I apply the approximate exploration and development expenditure to the multipliers to find the economic effects. The Tahiti field referred to above was estimated to hold between 400 million and 500 million barrels of oil and oil equivalents (primarily natural gas) and expected to require an initial fixed investment of $4.7 billion. Using the mid-point resource estimate of 450 million barrels of oil equivalent, up-front development costs in Tahiti amounted to approximately $10.44 per expected barrel of oil and $1.86 per 1,000 cubic feet of natural gas resources. These costs are spread over 7 years, resulting in average up-front development expenditures equal to $1.49 per barrel of oil and $0.27 per 1,000 cubic feet of natural gas.[13]

During the long-term production phase, I apply the output value to the multiplier to determine the economic effect for the next 30 years.

I use the 2012 CBO estimates to determine the likely amount of oil and gas reserves made unavailable on Federal lands. The CBO estimates for the amount of oil and natural gas reserves are expressed in barrel of oil equivalent (BOE). In order to put gas estimates into dollar equivalents, I first convert them from BOE back to thousands of cubic feet based on the 0.178 conversion ratio provided by the CBO.[14]

The analysis therefore considers only the "short-term" economic effects that flow from exploration and development and the "long-term" effects that flow from production.

The CBO estimates reserves at the regional level, but multipliers are provided at the state level. I want to allocate reserves to states, therefore, in order to compute not only federal tax revenues, but also state and local tax revenues. For the OCS resources, I use the method of my 2009 study and allocate the CBO's

It was found that coal reserves in the US have been grossly overstated and that only less than 20% of the coal available can be economically recovered from the given resources.

reserve estimates to the adjoining coastal states in the given region based on share of coastline (see Table A1). ANWR resources are allocated to Alaska. For other onshore resources, I leave aside state estimates and measure economic activity and tax revenues only at the aggregate U.S. level.

Unavailable coal resources on federal lands, overall, have not been evaluated. Nonetheless, there have been reports of reserves in the Powder River Basin (PRB) that can be used to infer the relevant amounts.[15] Total coal resources on federal lands amount to approximately 957 billion short tons, of which approximately 57.5% are in the PRB. The PRB accounted for nearly 88% of all coal produced from federal lands.

Approximately 93% of all coal resources (about 86 billion short tons) in the PRB are in the state of Wyoming with the remaining in the state of Montana

(about 6.5 billion short tons). We use that percentage breakdown to estimate the amount of unavailable coal on federal lands in each state.

A report by the Clean Energy Action in October 2013 argued for the need to distinguish between coal resources and coal reserves, the latter being defined as the amount of coal that can be economically recovered from the existing/known coal resources. It was found that coal reserves in the US have been grossly overstated and that only less than 20% of the coal available can be economically recovered from the given resources.[16] We therefore reduce the amount of resources on Federal lands – about 464 billion short tons – in the PRB by 80% to account for that distinction, resulting in economically recoverable reserves of roughly 93 billion short tons.

We then apply EIA recovery estimates of 90.2% to exclude coal reserves on land unsuitable for mining in the two states.[17] That adjustment lowers recoverable coal to roughly 85 billion short tons, with just under 80 billion short tons located in Wyoming and just under 6 billion short tons in Montana.

I apply the prices provided by the EIA in Table A1, averaging $5.64 for gas at the Henry hub in dollars per thousand cubic feet, $100.36 per barrel for oil, and $18.66 per short ton for Wyoming, PRB: Low Sulfur Sub-Bituminous coal, to convert the reserve estimates to dollar equivalents. [18] Applying the prices to the reserve estimates yields the expected dollar output. Table A2 shows how reserves and their value are allocated across the U.S.

I use the statistical approach known as "input-output" analysis to measure how economic activities with respect to opening federal lands to oil, gas, and coal leases will spillover throughout the economy. The U.S. Department of Commerce has refined this approach, pioneered by Nobel Prize laureate Wassily Leontief,[19] into the modern Regional Input-Output Modelling System II, or "RIMS II."[20] The model is premised on the idea that when a company produces $1 more in output, that increase in industrial activity will ripple throughout the economy. This is the same style of analysis routinely used by the CBO and others for policy analysis.

Three RIMS II "final demand multipliers" are applied to changes in output and investment used in the CBO Assessment. The first of these, the BEA output multiplier, measures the total increase in economic activity—including the effect on all other industries—resulting from $1 of new industrial activity in a particular geographic region.[21] The second, the BEA earnings multiplier, measures the increase in wages resulting from $1 of new industrial activity.[22] The third, the BEA employment multiplier, measures the increase in employment (in full-time equivalent jobs) associated with a $1,000,000 increase in industrial activity.[23] Each BEA multiplier measures the changes that are expected to occur within one year.[24] I use 2010 multipliers for the state-level analyses, but 2006 multipliers at the national level, due to data availability.[25]

The BEA multipliers are based on *actual* changes in output, wages, and employment that have historically resulted from changes in economic activity.[26] Since each state has a different industry base, the effect associated with additional oil, gas, and coal extraction varies by state. For example, in Delaware an extra $1,000,000 of oil and gas extraction translates into $1,495,300 of additional annual output, $279,800 in additional annual wage income, and approximately 6 additional full-time jobs for the year. In Texas, however, the same $1,000,000 translates into $1,837,300 in additional output, $389,000 in additional wage income, and approximately 7.6 additional full-time jobs.

If a state does not have any expenditures for a particular industry—such as oil and gas extraction—the BEA calculates a multiplier of zero.[27] To circumvent this limitation, the present analysis estimates a RIMS II multiplier for each state with a BEA value of zero (states with no prior oil and gas exploration and drilling industry) by applying the simple average multiplier for all other states with valid BEA multipliers.[28] This approach is not meant to be definitive; rather, it is an attempt to roughly estimate the effect that the industry would have on states that do not presently have any oil and gas extraction activity. This treatment is applied to three states: Georgia, Maine, and New Hampshire. The final demand multipliers used for the analysis are presented Appendix Table A3.

In the following section, I apply these multipliers to their respective economic values (the value of the economic activities at their source) to determine the state-by-state (where available) and overall effect of increased oil, natural gas, and coal production on the U.S. economy.

III. Opening Federal lands to Oil, Gas, and Coal Leasing Will Create Substantial Gains in Wages, Employment, and Will Have Profound Effects on Communities throughout the Nation

The substantial economic gains estimated in this study showcase the potential benefits of opening federal lands to oil, gas, and coal leasing. The following sections present the results from the analysis. Section A explains the effect of the proposal on both regional and national economic output; Section B quantifies the effects on employment; Section C explains the expected increase in wages as a result of the proposal; and Section D describes the expected increases in state, local and federal tax revenue.

It is important to note that the BEA makes clear that while the RIMS II model estimates economic effects of projects, the figures calculated with the model do not have a direct analog with respect to GDP, historical wages, or employment data.[29] Instead, the estimates shown represent a reasonable approach to assessing the economic impact of different development proposals and, because they do not take into account the impact of increased government spending of tax and lease revenues produced by the increased activity, the effects can be considered conservative.

A. Opening up oil, gas, and coal resources on federal lands can generate $20.7 trillion in economic activity

The broadest measure of the incremental effect of the proposal is the effect on total economic output. The gain in total output from opening federal lands to oil, gas, and coal leases, could exceed $127 billion annually for the next 7 years, and $663 billion annually in the long-run.

The predicted regional increase in economic output based on the estimated output increase is presented in Table 2.[30] State-level estimates are available in Table A6.

It is important to note that the multipliers in this table only provide the increase in output that *is generated at the same location as the increase in production.* These state and regional estimates, therefore, do not consider "spillover" effects, or gains that extend from one location to another location. Since the U.S. economy is integrated, gains in one region can be felt throughout the country. For example, oil and natural gas produced in the Gulf of Mexico could be used as an input in the Midwest.

Additionally, the non-ANWR onshore resources estimated by the CBO are not allocated to specific states or regions and are therefore not included in the state/regional analysis. Comparing the total U.S. results to the sum of each state's estimates in Table A6 suggests that there will be over $69 billion in annual additional and spillover output from the assessment values in the short-run, and $178 billion in the long-run, excluding spillovers from coal mining in Montana and Wyoming.

Overall, therefore, the gain in total output from opening federal lands to oil, gas, and coal leases is likely to exceed $127 billion annually for the next 7 years, and $663 billion annually in the long-run.

B. Opening up oil, gas, and coal resources on federal lands can generate almost 2.7 million jobs

The economic output above is created on the basis of additional jobs. I estimate that the CBO assessment would also result in a gain of 552 thousand jobs[31] over the next 7 years, and over 2.7 million jobs in the long-run after that. Moreover, those job gains are not only in the energy sector but across the whole economy.

1. Total job creation analysis

Using the RIMS II final-demand employment multipliers (denominated in job-years per $1 million change in final demand), Table 3 yields the

TABLE 2: **INCREASED OUTPUT FROM OPENING FEDERAL LANDS**
($ MILLIONS ANNUALLY)

REGION	SHORT-RUN	LONG-RUN
ATLANTIC OCS	$7,588	$23,994
EASTERN GULF	$7,122	$31,325
PACIFIC OCS	$24,727	$58,445
ANWR	$17,747	$39,807
PRB COAL	N/A	$87,871
TOTAL FROM REGIONAL ANALYSIS	**$57,184**	**$241,445**
ADDITIONAL OIL AND GAS NON-ANWR (INTERIOR STATES) AND SPILLOVER EFFECTS	$69,725	$421,593
TOTAL U.S. (ONSHORE & OFFSHORE)	**$126,909**	**$663,038**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

expected average annual effects on employment.[32] Table A6 reports state-level details.

As before, the state-level RIMS II multipliers do not account for increases in employment in one state resulting from higher production elsewhere, as well as non-ANWR onshore production the CBO did not allocate to states or regions. As a result, such jobs are omitted from the regional totals. Comparing the nationwide employment effects to the sum of the state employment effects yields the additional (non-ANWR) and spillover (jobs created outside the states where resource constraints are lifted) effects of more than 318 thousand jobs over the next 7 years, and 1.9 million after that, for the subsequent 30 years of production.

2. Evaluation of the types of jobs created by opening up federal lands

The multiplier data can also be used to analyze the types of jobs created as a result of opening up oil and natural gas resources on federal lands. While there will undoubtedly be job creation in the energy sector, many additional jobs will be generated in ancillary industries that support the oil, gas, and coal industry as well as seemingly-unrelated industries located in regions where oil and gas industry earnings make up a substantial share of local economic activity.

For this analysis, the gains are broken down using specific RIMS II multipliers for each industry. Those multipliers determine which industries will stand to gain the most from the proposal. Table 4 reports the expected employment gains nationally, by industry.

The results in Table 4 show that communities around the country would realize job gains associated with increased oil, gas, and coal production. These effects flow from the increase in high-wage, high-skills employment associated with the expansion. For example, a new offshore facility in Florida may induce the development of onshore support facilities such as shipyards and refineries in Virginia, or even inland, in Tennessee. Employees in these new industries, in turn, would increase community demand for health care, education, and other community services that are available to all residents (whether they are employed by the

The gain in total output from opening federal lands to oil, gas, and coal leases, could exceed $127 billion annually for the next 7 years, and $663 billion annually in the long-run.

TABLE 3: INCREASED EMPLOYMENT FROM OPENING FEDERAL LANDS

REGION	SHORT-RUN	LONG-RUN
ATLANTIC OCS	38,442	120,389
EASTERN GULF	32,333	142,408
PACIFIC OCS	101,471	238,806
ANWR	61,314	77,300
PRB COAL	N/A	260,834
TOTAL FROM REGIONAL ANALYSIS	**233,507**	**839,538**
ADDITIONAL OIL AND GAS NON-ANWR (INTERIOR STATES) AND SPILLOVER EFFECTS	318,661	1,923,793
TOTAL U.S. (ONSHORE & OFFSHORE)	**552,168**	**2,763,331**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

offshore industry or not), as well as tax revenues to fund those expansions.

It is interesting to note that more than one-third of jobs created in the short-run (37 percent) occur in professional fields such as health care; real estate; professional, scientific, and technical services; finance; education; the arts; information; and management.[33] Manufacturing, which includes food and textile manufacturing, also benefits, with 6% of the total employment gains. In both the short-run and long-run, less than 20% of the jobs created are in the mining sector, which includes oil and gas production and refining.

C. Opening up oil, gas, and coal resources on federal lands can generate $5.1 trillion of wages

The jobs created by opening up oil and natural gas resources on federal lands will also cause substantial wage gains for American workers. To estimate wage increases, I apply the RIMS II's final demand earnings (wage) multipliers to the final demand estimates. Table 5 and Table A6 present the results. The caveats regarding non-ANWR and spillover effects remain true for this wage analysis, with additional effects of another $21 billion in the short-run and $123 billion in the long-run. The proposal will result in well over $32 billion in annual wages paid to employees over the next 7 years, and $163 billion annually after that.

D. Opening up oil, gas, and coal resources on federal lands can generate $3.9 trillion in federal tax revenues and $1.9 trillion in State and Local tax revenues

The economic gains presented in this study will translate into higher tax collections and increases in public revenues for both state and local, and federal governments. In 2011, the "big three" U.S. oil and

The analysis estimates that federal tax revenues can be expected to increase by $24 billion annually in the short-run, and $126 billion annually in the long-run, while state and local government tax revenues can be expected to increase by $10 billion annually in the short-run, and 61 billion annually in the long-run.

TABLE 4: **INCREASED EMPLOYMENT FROM OPENING FEDERAL LANDS TO OIL AND GAS, BY SECTOR**[34]

	SHORT-RUN	LONG-RUN
MINING	21,550	496,453
HEALTH CARE AND SOCIAL ASSISTANCE	20,760	263,772
RETAIL TRADE	10,343	248,034
ACCOMMODATION AND FOOD SERVICES	7,741	171,363
REAL ESTATE AND RENTAL AND LEASING	39,537	170,090
PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES	15,290	157,619
MANUFACTURING	22,920	146,975
ADMINISTRATIVE AND WASTE MANAGEMENT SERVICES	12,806	146,663
FINANCE AND INSURANCE	8,007	132,655
OTHER SERVICES	14,077	126,672
TRANSPORTATION AND WAREHOUSING	11,918	88,757
WHOLESALE TRADE	14,238	73,307
EDUCATIONAL SERVICES	5,149	66,628
ARTS, ENTERTAINMENT, AND RECREATION	12,045	50,481
INFORMATION	6,341	43,177
MANAGEMENT OF COMPANIES AND ENTERPRISES	19,685	40,342
AGRICULTURE, FORESTRY, FISHING, AND HUNTING	5,046	38,420
CONSTRUCTION	12,885	16,002
HOUSEHOLDS	9,823	14,825
UTILITIES	1,409	10,236
TOTAL	**271,572**	**2,502,172**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

natural gas industry paid approximately $55 billion in federal taxes.[35] That number is not inclusive of lease royalties and bonus bids, or state and local taxes. Clearly, therefore, expanding oil, gas, and coal activity would generate jobs, wages, and tax revenues throughout our economy.

The present analysis applies a broad measure of the total tax revenues (from all sources) that both state and local and federal governments will gain from the proposed opening of federal lands to oil, gas, and coal leases. The analysis estimates that federal tax revenues can be expected to increase by $24 billion annually in the short-run, and $126 billion annually in the long-run, while state and local government tax revenues can be expected to increase by $10 billion annually in the short-run, and $61 billion annually in the long-run.[36]

I follow the approach outlined by the Federal Reserve Bank of Boston to determine annual state and local tax burdens as a share of GSP (see Table A5).[37] For each state and the District of Columbia, the state and local tax burden can be calculated by dividing annual state and local tax revenue by annual GSP. Data for state and local tax revenues are released by the U.S. Census Bureau. Maintaining consistency with my prior study, I use data from 2011.[38] Those data produce the average state and local tax burden in each state. The effective tax burdens are applied to

TABLE 5: **WAGE GAINS FROM OPENING FEDERAL LANDS**
($ MILLIONS ANNUALLY)

REGION	SHORT-RUN	LONG-RUN
ATLANTIC OCS	$1,555	$4,910
EASTERN GULF	$1,430	$6,290
PACIFIC OCS	$5,129	$10,431
ANWR	$3,258	$2,119
PRB COAL	N/A	$16,127
TOTAL FROM REGIONAL ANALYSIS	**$11,373**	**$39,898**
ADDITIONAL OIL AND GAS NON-ANWR AND SPILLOVER EFFECTS	$21,014	$123,031
TOTAL U.S. (ONSHORE & OFFSHORE)	**$32,387**	**$162,910**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

Applying a 19 percent tax rate to the increased national output as a result of the proposal yields federal tax revenues of nearly $24 billion annually in the short-run and $126 billion annually in the long-run.

the estimated increase in output as a result of the proposal. Table 6 presents the estimated gains in tax revenues per year, by state.

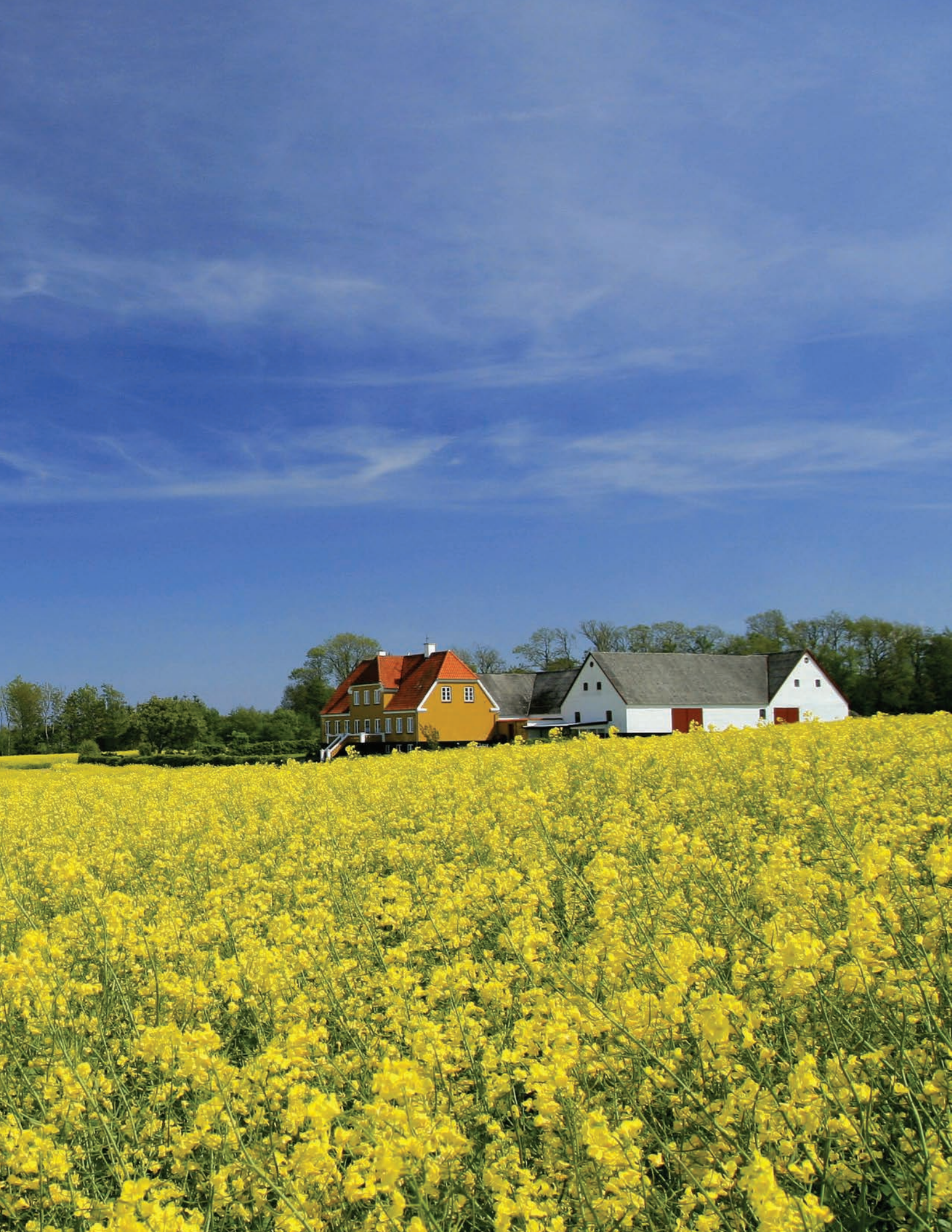
As before, the gains in tax revenues present the same caveats regarding non-ANWR and "spill-over" revenues.[39] The estimates thus represent a lower bound on potential state and local tax revenues resulting from opening protected federal lands to oil, gas, and coal leasing. In order to account for the aggregate spillover and non-ANWR revenues, I use the weighted average of tax rates, based upon GSP of the individual states.[40] Accounting for spillover and non-ANWR activities, state and local taxes amount to $10.3 billion annually in the short-run and $61 billion annually in the long-run.

An effective federal income tax rate on the national output can be applied to estimate federal tax revenues. Tax rates as a percentage of GDP historically have hovered at around 19% regardless of U.S tax policy.[41] Applying a 19 percent tax rate to the increased national output as a result of the proposal yields federal tax revenues of nearly $24 billion annually in the short-run and $126 billion annually in the long-run. To put some color around these estimates from my prior study, in FY 2011 the federal government collected approximately $2.3 trillion in tax revenue. Hence, the proposal would result in a 1% increase in federal tax revenues from 2011 values annually for the next 7 years, without a single change to federal tax policies, growing to an almost 6% increase in the long-run. Moreover, the tax revenues derived above ignore royalties shared between the state and Federal governments, as well as the lease revenues directly derived from federal permits analyzed by the CBO in 2012.

TABLE 6: **ANNUAL GAINED TAX REVENUES BY STATE FROM THE PROPOSAL**
($ MILLIONS ANNUALLY)

	SHORT-RUN	LONG-RUN
STATE & LOCAL TAXES (INDIVIDUAL)	$5,869	$18,885
MAINE	$45	$141
NEW HAMPSHIRE	$1	$4
MASSACHUSETTS	$45	$137
RHODE ISLAND	$9	$134
CONNECTICUT	$15	$46
NEW YORK	$28	$87
NEW JERSEY	$35	$117
DELAWARE	$5	$17
MARYLAND	$7	$21
VIRGINIA	$20	$62
NORTH CAROLINA	$65	$200
SOUTH CAROLINA	$40	$11
GEORGIA	$19	$58
FLORIDA	$241	$1,990
CALIFORNIA	$1,111	$2,648
OREGON	$238	$562
WASHINGTON	$159	$374
ALASKA	$3,784	$8,479
MONTANA	N/A	$518
WYOMING	N/A	$6,249
STATE & LOCAL TAXES (W/ADDITIONAL OIL AND GAS NON-ANWR (INTERIOR STATES) AND SPILLOVER EFFECTS)	**$10,247**	**$61,531**
FEDERAL TAXES	**$24,113**	**$125,977**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE; U.S. CENSUS BUREAU; BUREAU OF ECONOMIC ANALYSIS



VI. Summary and Conclusions

Opening federal lands to oil, gas, and coal leasing can be expected to generate short-run benefits amounting to $126 billion in annual economic output to the nation, $32 billion in annual wages, and over 552 thousand jobs.

In the long-term, such changes can be expected to generate an additional $663 billion in annual output, $163 billion in annual wages, and over 2.7 million jobs. Many of the job increases will occur in fields such as healthcare and manufacturing. High-income, high skill fields like science and technology and finance also benefit with growth from opening Federal lands.

Perhaps the most important gains from the proposal are in state and federal tax revenues. Increased output and economic growth lead to a larger pie upon which to assess taxes. The result is a gain of $10 billion annually in state and local tax revenues in the short run, followed by nearly $61 billion annually in the long-run. Federal revenues will grow similarly, with short-term tax revenues increasing nearly $24 billion annually in the short-run and over $126 billion annually in the long-run. These revenues are substantially larger than the CBO's estimates for bonus payments, royalties, and leasing receipts, increasing Federal revenues by $3.9 trillion more than the 2012 CBO estimates over the entire period.

Appendix A: Tables and Figures

TABLE A1: BOE OIL AND GAS BY REGION (BASED ON FIGURE 1 OF CBO REPORT)
(VALUES IN BILLIONS)

	TOTAL BOE	OIL BOE	MCF
ALLOWABLE			
CENTRAL AND WESTERN GULF OCS	78	42	202
ALASKA OCS	28	28	0
ONSHORE	18	1	95
TEMPORARILY UNAVAILABLE			
EASTERN GULF OCS	8	6	11
ATLANTIC OCS	9	3	33
PACIFIC OCS	12	10	11
ONSHORE	10	5	28
UNAVAILABLE			
ANWR	8	8	0
ONSHORE	4	2	11

SOURCE: SOURCE: FIGURE 1 OF CBO REPORT
NOTES: 1,000 CUBIC FEET OF NATURAL GAS (1 MCF)=0.178 BOE

TABLE A2: **VALUE OF OIL AND GAS RESERVES AND INVESTMENT ALLOCATED TO REGIONS & STATES**
(VALUES IN BILLIONS)

REGION	STATE	LENGTH OF COASTLINE	% OF REGIONAL COASTLINE	OIL BOE BILLIONS OF BOE	GAS MCF	VALUE OF RESERVES ($BILLIONS)
ATLANTIC	MAINE	228	11%	0.32	3.48	$50.2
ATLANTIC	NEW HAMPSHIRE	13	1%	0.02	0.20	$2.9
ATLANTIC	MASSACHUSETTS	192	9%	0.27	2.93	$42.2
ATLANTIC	RHODE ISLAND	40	2%	0.06	0.61	$8.8
ATLANTIC	CONNECTICUT	96	4%	0.13	1.46	$21.1
ATLANTIC	NEW YORK	127	6%	0.18	1.94	$27.9
ATLANTIC	NEW JERSEY	130	6%	0.18	1.98	$28.6
ATLANTIC	DELAWARE	28	1%	0.04	0.43	$6.2
ATLANTIC	MARYLAND	31	1%	0.04	0.47	$6.8
ATLANTIC	VIRGINIA	112	5%	0.16	1.71	$24.6
ATLANTIC	NORTH CAROLINA	301	14%	0.42	4.59	$66.2
ATLANTIC	SOUTH CAROLINA	187	9%	0.26	2.85	$41.1
ATLANTIC	GEORGIA	100	5%	0.14	1.52	$22.0
ATLANTIC	FLORIDA	580	27%	0.80	8.84	$127.6
EASTERN GULF	FLORIDA	770	100%	6.00	11.00	$361.4
PACIFIC	CALIFORNIA	840	65%	6.50	7.15	$695.6
PACIFIC	OREGON	296	23%	2.29	2.52	$245.1
PACIFIC	WASHINGTON	157	12%	1.21	1.34	$130.0
ANWR	ALASKA	-	100%	8.00	0.00	$810.7
UNITED STATES ONSHORE & OFFSHORE OIL ANDGAS				34.00	95.00	$3,933.4

	COAL (MST)	VALUE OF RESERVES ($BILLIONS)
WEST MONTANA	5.86	$109.2
WEST WYOMING	79.52	$1,483.6

SOURCE: FIGURE 1 & TABLE 1 CBO ASSESSMENT FOR OIL AND GAS. AUTHORS' CALCULATIONS FOR COAL IN THE POWDER RIVER BASIN.
NOTES: RESERVES FROM TABLE A1 ARE ALLOCATED TO STATES BASED ON SHARE OF COASTLINE. ONSHORE IS CAPTURED ONLY IN THE TOTAL U.S. THEN THESE RESERVES ARE CONVERTED TO $ VALUES BY MULTIPLYING THEM BY THE CBO ESTIMATE FOR MCF PRICE – $5.10 (BASED ON AVERAGE PRICE ESTIMATES FOR 2012-2022) AND OIL PRICE – 101.34 (BASED ON AVERAGE PRICE ESTIMATES FOR 2012-2022); INVESTMENT COSTS ARE ESTIMATED BY MULTIPLYING RESERVE ESTIMATES BY THE ESTIMATED $ OF INVESTMENT PER MCF FROM THE TAHITI PROJECT – $1.86/7=.02 AND $10.44/7=$1.49.

TABLE A3: **RIMS II 2010 EXTRACTION MULTIPLIERS***

STATE	OUTPUT	EARNINGS	EMPLOYMENT
ALABAMA	1.5147	0.274000	8.9373
ALASKA	1.4874	0.273100	5.1389
CALIFORNIA	1.6915	0.359000	6.7674
CONNECTICUT	1.0000	0.300532	7.3216
DELAWARE	1.4953	0.279800	6.0210
FLORIDA	1.5008	0.301400	6.8132
GEORGIA	1.5599	0.305800	7.3216
ILLINOIS	1.6634	0.335700	9.7864
LOUISIANA	1.6453	0.318000	6.9802
MAINE	1.0000	0.300532	7.3216
MARYLAND	1.4906	0.290200	9.0325
MASSACHUSETTS	1.5289	0.287400	8.3572
MISSISSIPPI	1.5075	0.266900	7.7226
NEW HAMPSHIRE	1.0000	0.300532	7.3216
MONTANA**	1.6820	0.303400	5.7731
NEW JERSEY	1.5788	0.293700	8.5829
NEW YORK	1.4379	0.226500	6.4359
NORTH CAROLINA	1.5252	0.293500	6.5902
OREGON	1.5020	0.291200	6.4913
RHODE ISLAND	1.4834	0.290300	6.1671
SOUTH CAROLINA	1.5182	0.309600	7.1937
PENNSYLVANIA	1.7305	0.360100	8.5332
TEXAS	1.8373	0.389000	7.6448
VIRGINIA	1.5280	0.294300	9.1455
WASHINGTON	1.5281	0.312100	6.5555
WYOMING**	1.6457	0.300200	4.7688
UNITED STATES***	2.3938	0.610900	10.4152

SOURCE: BUREAU OF ECONOMIC ANALYSIS

NOTES: 1,000 CUBIC FEET OF NATURAL GAS (1 MCF) =0.178 BOE

*OIL AND GAS EXTRACTION MULTIPLIERS FOR 2013 WERE NOT AVAILABLE AT THE TIME OF THIS STUDY.

**MULTIPLIERS FOR COAL ONLY (2013)

*** THIS DATA IS FROM 2006 BECAUSE THE BEA HAS CEASED PRODUCING NATIONWIDE MULTIPLIERS. THE MULTIPLIER SHOULD NONETHELESS BE RELATIVELY STABLE OVER TIME.

TABLE A4: **RIMS II OIL & GAS EXTRACTION EMPLOYMENT MULTIPLIERS, BY INDUSTRY**

INDUSTRY	EXTRACTION MULTIPLIER
MINING	2.0662
HEALTH CARE AND SOCIAL ASSISTANCE	1.0978
RETAIL TRADE	1.0323
ACCOMMODATION AND FOOD SERVICES	0.7132
REAL ESTATE AND RENTAL AND LEASING	0.7079
PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES	0.6560
MANUFACTURING	0.6117
ADMINISTRATIVE AND WASTE MANAGEMENT SERVICES	0.6104
FINANCE AND INSURANCE	0.5521
OTHER SERVICES	0.5272
TRANSPORTATION AND WAREHOUSING	0.3694
WHOLESALE TRADE	0.3051
EDUCATIONAL SERVICES	0.2773
ARTS, ENTERTAINMENT, AND RECREATION	0.2101
INFORMATION	0.1797
MANAGEMENT OF COMPANIES AND ENTERPRISES	0.1679
AGRICULTURE, FORESTRY, FISHING, AND HUNTING	0.1599
CONSTRUCTION	0.0666
HOUSEHOLDS	0.0617
UTILITIES	0.0426
TOTAL	**10.4151**

SOURCE: BUREAU OF ECONOMIC ANALYSIS;
NOTES: THIS DATA IS OF 2006 BECAUSE THE BEA STOPPED PRODUCING U.S. LEVEL INDUSTRY EMPLOYMENT DATA. THE MULTIPLIERS HOWEVER ARE RELATIVELY STABLE OVER TIME.

TABLE A5: 2011 STATE TAX BURDEN

STATE	STATE AND LOCAL TAXES ($2011)	GROSS STATE PRODUCT ($2011)	TAX BURDEN (ESTIMATED)
ALABAMA	8,635,527,000	150,330,000,000	5.7%
ALASKA	9,532,624,000	44,702,000,000	21.3%
ARIZONA	12,247,616,000	227,098,000,000	5.4%
ARKANSAS	7,635,370,000	91,496,000,000	8.3%
CALIFORNIA	115,565,925,000	1,735,360,000,000	6.7%
COLORADO	9,589,681,000	234,308,000,000	4.1%
CONNECTICUT	13,177,045,000	201,386,000,000	6.5%
DELAWARE	3,079,166,000	57,293,000,000	5.4%
FLORIDA	34,120,038,000	661,091,000,000	5.2%
GEORGIA	17,850,125,000	365,809,000,000	4.9%
HAWAII	5,102,871,000	57,977,000,000	8.8%
IDAHO	3,529,196,000	51,463,000,000	6.9%
ILLINOIS	29,619,110,000	582,094,000,000	5.1%
INDIANA	15,246,515,000	240,933,000,000	6.3%
IOWA	6,653,147,000	128,597,000,000	5.2%
KANSAS	7,165,501,000	113,367,000,000	6.3%
KENTUCKY	10,112,843,000	141,266,000,000	7.2%
LOUISIANA	10,697,358,000	205,877,000,000	5.2%
MAINE	3,653,983,000	44,821,000,000	8.2%
MARYLAND	16,897,413,000	264,373,000,000	6.4%
MASSACHUSETTS	21,722,664,000	348,577,000,000	6.2%
MICHIGAN	25,292,388,000	337,427,000,000	7.5%
MINNESOTA	18,296,318,000	244,912,000,000	7.5%
MISSISSIPPI	6,626,204,000	84,272,000,000	7.9%
MISSOURI	10,941,653,000	216,099,000,000	5.1%
MONTANA	2,548,268,000	31,983,000,000	8.0%
NEBRASKA	4,143,035,000	79,889,000,000	5.2%
NEVADA	6,041,767,000	112,503,000,000	5.4%
NEW HAMPSHIRE	2,166,334,000	56,572,000,000	3.8%
NEW JERSEY	29,940,234,000	426,765,000,000	7.0%
NEW MEXICO	5,136,455,000	70,497,000,000	7.3%
NEW YORK	64,164,437,000	1,016,350,000,000	6.3%
NORTH CAROLINA	22,392,452,000	385,092,000,000	5.8%
NORTH DAKOTA	2,600,821,000	34,262,000,000	7.6%

— CONTINUED ON NEXT PAGE —

TABLE A5: 2011 STATE TAX BURDEN (CONTINUED)

STATE	STATE AND LOCAL TAXES ($2011)	GROSS STATE PRODUCT ($2011)	TAX BURDEN (ESTIMATED)
OHIO	27,480,438,000	418,881,000,000	6.6%
OKLAHOMA	8,814,218,000	134,146,000,000	6.6%
OREGON	8,493,308,000	186,228,000,000	4.6%
PENNSYLVANIA	31,716,660,000	500,443,000,000	6.3%
RHODE ISLAND	2,729,507,000	43,663,000,000	6.3%
SOUTH CAROLINA	8,253,067,000	143,278,000,000	5.8%
SOUTH DAKOTA	1,348,017,000	34,443,000,000	3.9%
TENNESSEE	11,223,774,000	233,997,000,000	4.8%
TEXAS	44,919,866,000	1,149,908,000,000	3.9%
UTAH	5,798,868,000	108,329,000,000	5.4%
VERMONT	2,366,479,000	22,968,000,000	10.3%
VIRGINIA	18,093,846,000	375,747,000,000	4.8%
WASHINGTON	17,489,540,000	310,906,000,000	5.6%
WEST VIRGINIA	4,947,847,000	55,765,000,000	8.9%
WISCONSIN	15,009,179,000	221,741,000,000	6.8%
WYOMING	2,487,141,000	31,542,000,000	7.9%
WASHINGTON D.C.	5,390,557,000	91,643,000,000	5.9%
WTD AVG. (GSP)	778,686,396,000	13,108,469,000,000	5.9%

SOURCE: U.S. CENSUS BUREAU, BUREAU OF ECONOMIC ANALYSIS

TABLE A6: **STATE LEVEL RESULTS**
($ MILLIONS ANNUALLY, EXCEPT FOR EMPLOYMENT)

	OUTPUT		EMPLOYMENT		WAGES		LOCAL & STATE TAXES	
STATE	**SHORT**	**LONG**	**SHORT**	**LONG**	**SHORT**	**LONG**	**SHORT**	**LONG**
MAINE	$557	$1,724	4,078	12,686	$167	$521	$45	$141
NEW HAMPSHIRE	$32	$104	233	769	$10	$31	$1	$4
MASSACHUSETTS	$717	$2,222	3,920	12,150	$135	$417	$45	$137
RHODE ISLAND	$145	$468	603	1,945	$28	$91	$9	$134
CONNECTICUT	$235	$709	1,717	5,218	$70	$214	$15	$46
NEW YORK	$446	$1,390	1,997	6,222	$70	$218	$28	$87
NEW JERSEY	$501	$1,685	2,726	8,701	$93	$308	$35	$117
DELAWARE	$102	$320	412	1,292	$19	$60	$5	$17
MARYLAND	$113	$331	684	1,856	$22	$64	$7	$21
VIRGINIA	$418	$1,308	2,502	7,834	$81	$252	$20	$62
NORTH CAROLINA	$1,121	$3,458	4,846	14,944	$216	$665	$65	$200
SOUTH CAROLINA	$694	$2,133	3,286	10,110	$141	$435	$40	$11
GEORGIA	$381	$1,176	1,788	5,061	$75	$230	$19	$ 58
FLORIDA (ATLANTIC)	$2,126	$6,961	9,635	31,602	$27	$1,397	$110	$361
FLORIDA (EASTERN GULF)	$7,122	$31,325	32,333	142,207	$1,430	$6,290	$368	$1,628
CALIFORNIA	$16,687	$39,531	66,763	157,501	$3,542	$6,698	$1,111	$2,648
OREGON	$5,222	$12,218	22,566	52,804	$1,012	$2,368	$238	$562
WASHINGTON	$2,818	$6,696	12,088	28,501	$575	$1,364	$159	$374
ALASKA	$17,747	$39,807	61,314	137,534	$3,258	$2,119	$3,784	$8,479
MONTANA	N/A	$6,483	N/A	24,994	N/A	$1,280	N/A	$518
WYOMING	N/A	$81,387	N/A	235,840	N/A	$14,846	N/A	$6,429
TOTAL FROM REGIONAL ANALYSIS	**$57,184**	**$241,445**			**$11,373**	**$39,878**	**$6,105**	**$18,885**
ADDITIONAL OIL AND GAS NON-ANWR AND SPILLOVER EFFECTS	**$69,725**	**$333,720**			**$21,014**	**$123,031**	**$4,142**	**$42,646**
TOTAL U.S. (ONSHORE & OFFSHORE)	**$126,909**	**$663,038**			**$32,387**	**$162,910**	**$10,247**	**$61,531**

Appendix B: **Estimation of Coal Reserves**

Total coal resources on Federal lands amount to approximately 957 billion short tons, of which approximately 57.5% are in the Powder River Basin. The Powder River Basin accounted for nearly 88% of all coal produced from federal lands, and hence, is the main focus area of this study.

The following table gives a breakdown of total federal coal reserves in the US (excluding Alaska)[42].

BASIN/ REGION	MST*	PERCENT
POWDER RIVER	550,206	57.5%
WILLISTON	27,200	2.8%
HANNA	2,350	0.2%
GREEN RIVER	1,200	0.1%
COLORADO PLATEAU	361,860	37.8%
GULF OF MEXICO COASTAL PLAIN	10,350	1.1%
APPALACHIAN	4,051	0.4%
TOTAL	**957,217**	

MST = MILLION SHORT TONS

SOURCE: INVENTORY OF ASSESSED FEDERAL COAL RESOURCES AND RESTRICTIONS TO THEIR DEVELOPMENT, U.S. DEPARTMENTS OF ENERGY, INTERIOR AND AGRICULTURE (AUGUST 2007)

Not all coal resources available in the Powder River Basin can be leased out for mining. Total land available for mining can be classified into the following three categories.

1. leasing available under standard lease terms or with no surface occupancy
2. leasing permitted with restrictions (possible leasing); and
3. leasing prohibited

Of the total federal lands, leasing is prohibited on approximately 591,000 acres which constitutes 10.9% of the area, roughly 82,000 acres or 1.5% of the area is available under standard lease terms and 431,000 acres or 7.9% of the total area is available with no surface occupancy. The major portion i.e. 4.3 million acres which constitutes 84.3% of federal land in the Powder River basin can be leased in the future. This area holds approximately 463 billion short tons of coal.

The following table gives a breakdown of the lease conditions in the PRB[43].

	AREA		COAL TYPE (MST)				TOTAL COAL	
CATEGORY	ACRES	% FEDERAL	HYPOTHETICAL	INFERRED	INDICATED	MEASURED	MST	% FEDERAL
NLS	184,385	3.4%	245	9,636	4,524	872	15,277	2.8%
NLA	406,172	7.5%	280	10,494	5,064	1,043	16,881	3.1%
PL-PLUP	3,571,162	65.8%	28,875	243,230	93,926	21,435	387,466	70.4%
PL-PSOC	738,827	13.6%	-	29,919	37,471	9,128	76,518	13.9%
NSOA/OA	430,941	7.9%	515	12,506	8,756	1,864	23,641	4.3%
SUR-MIT	12,208	0.2%	-	179	1,744	739	2,662	0.5%
SLT	81,962	1.5%	255	9,148	14,156	3,676	27,235	4.9%
TOTAL FEDERAL	5,425,657	100.0%	30,696	315,113	165,641	38,757	550,206	100.0%
NON FEDERAL	1,403,858		10,589	52,881	28,135	5,875	97,480	
TOTAL*	**6,829,515**		**41,285**	**367,994**	**193,776**	**44,632**	**647,686**	

** TOTAL MAY DIFFER DUE TO ROUNDING AT EACH LEVEL.*

The following table defines each of the categories. Our analysis is focused on the PL-PLUP and PL-PSOC regions where leasing is possible but has not yet been undertaken.

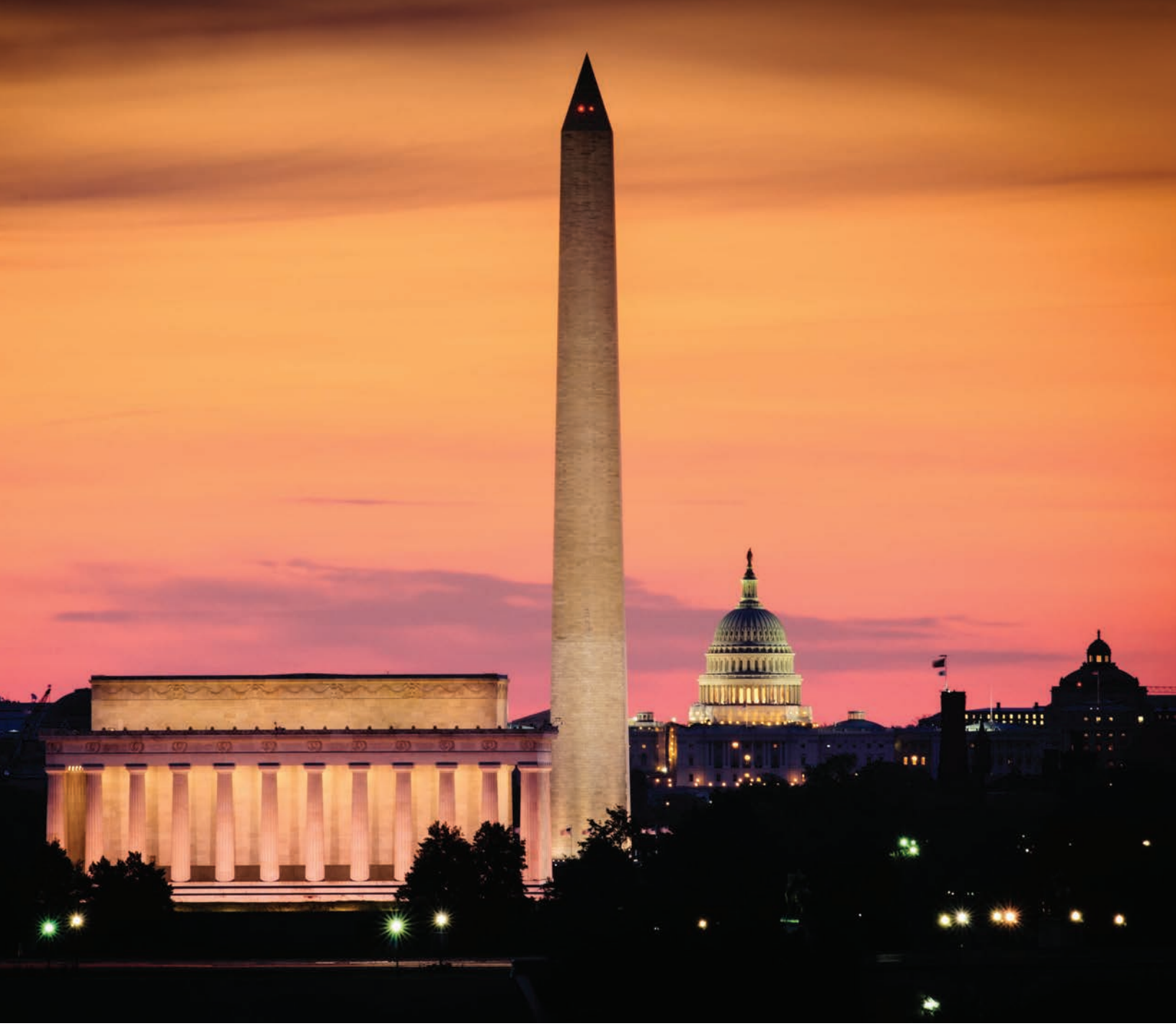
NLS	NO LEASING (STATUTORY/ EXECUTIVE ORDER)
NLA	NO LEASING (ADMINISTRATIVE) GENERAL CATEGORY
PL-PLUP	POSSIBLE LEASING (ADMINISTRATIVE), PENDING LAND USE PLANNING OR NEPA COMPLIANCE
PL-PSOC	POSSIBLE LEASING (ADMINISTRATIVE), PENDING SURFACE OWNER CONSENT
NSOA/OA	LEASING, NO SURFACE OPERATIONS ANTICIPATED/ OFFSET AREA
SUR-MIT	SURFACE MINING ALLOWED WITH MITIGATION
SLT	LEASING, STANDARD LEASE TERMS

Endnotes

1. See https://research.stlouisfed.org/fred2/series/DCOILWTICO/downloaddata
2. The initial investment phase is estimated to be 7 years, as estimated by Chevron in a recent project. See, Statement of Peter J. Robertson, Vice Chairman, Chevron Corp., Prepared for the House Select Committee on Energy Independence and Global Warming, Apr. 1, 2008 [hereinafter *Chevron Testimony*] ("In 2002, we used leading-edge technology to drill in 4,000 feet of water and found an estimated 400 million to 500 million barrels of recoverable resources. It will take seven years to build the infrastructure required to produce the oil and gas more than a 100 miles offshore.").
3. Estimated to last for the life of the oil field or coal mine – typically 30 years; See, *Chevron Testimony*, *supra*, at 6 ("Once in production, Tahiti is expected to produce for up to 30 years.") and Documentation of the Resource Allocation and Mine Costing (RAMC) Model (Methodology Description) Final Report, Energy Information Administration, January 1992 at 122.
4. 2014 U.S. GDP was approximately $17 trillion, so $663 billion/17 trillion≈3.90%. See https://research.stlouisfed.org/fred2/release/tables?rid=53&eid=41047.
5. *America's oil and natural gas industry supports over 9 million jobs.* American Petroleum Institute, Apr. 5, 2010 (available at http://www.api.org/aboutoilgas/).
6. Dlouhy, Jennifer A. "Shell leaves door open for future exploration in Alaska's Arctic," Houston Chronicle, November 2, 2015 at http://www.adn.com/article/20151102/shell-leaves-door-open-future-exploration-alaskas-arctic (Last accessed Nov 30, 2015).
7. Statement of Peter J. Robertson, Vice Chairman, Chevron Corp., Prepared for the House Select Committee on Energy Independence and Global Warming, Apr. 1, 2008 [hereinafter *Chevron Testimony*], at 6 ("In 2002, we used leading-edge technology to drill in 4,000 feet of water and found an estimated 400 million to 500 million barrels of recoverable resources. It will take seven years to build the infrastructure required to produce the oil and gas more than a 100 miles offshore.").
8. *Id.*
9. *Id.* ("When Tahiti finally comes on line, we will have invested $4.7 billion — before realizing $1 of return on our investment.").
10. *See* Joseph R. Mason, *The Economic Contribution of Increased Offshore Oil Exploration and Production to Regional and National Economies*, AMERICAN ENERGY ALLIANCE, Feb. 2009. Available at http://www.americanenergyalliance.org/images/aea_offshore_updated_final.pdf?phpMyAdmin=fa972a975ccbf0bd709c38b1080539f 5 [hereinafter *Mason 2009*].
11. My previous study, Mason 2009, supra, also investigated refinery developments that would be necessary to process the increased production. A later study discussed additional infrastructure that is necessary to move domestically-produced and refined products to final markets. See Mason, Joseph R. *The Perverse Dynamics of Long-term Low Interest Rates: Evidence from Oil Prices*, SMALL BUSINESS AND ENTREPRENEURSHIP COUNCIL, May 2012, available at http://www.sbecouncil.org/uploads/SBEC%20Mason%20Monetary%20Policy%20Final%20Paper.pdf
12. The initial investment phase is estimated to be 7 years, as estimated by Chevron in a recent project. ("In 2002, we used leading-edge technology to drill in 4,000 feet of water and found an estimated 400 million to 500 million barrels of recoverable resources. It will take seven years to build the infrastructure required to produce the oil and gas more than a 100 miles offshore."); *Chevron Testimony*, *supra*, at 6 ("Once in production, Tahiti is expected to produce for up to 30 years."). See also *Documentation of the Resource Allocation and Mine Costing (RAMC) Model (Methodology Description) Final Report*, Energy Information Administration, January 1992 at 122 ("EIA accepted the 30-year ICF estimate for large surface," mines.)
13. $10.44 per barrel of oil / 7 years = $1.49 per barrel of oil per year, and $1.86 per 1,000 cf / 7 years = $0.27 per 1,000 cf per year.
14. Congressional Budget Office, POTENTIAL BUDGETARY EFFECTS OF IMMEDIATELY OPENING MOST FEDERAL LANDS TO OIL AND GAS LEASING, Congressional Budget Office, Aug. 2012 [hereinafter the *"CBO Assessment"*] Figure 1 at 5.
15. See Appendix B for details.
16. WARNING:FAULTY REPORTING OF US COAL RESERVES, Why Reports of a "200 Year Supply" of Cheap US Coal Are Faulty and The Imperative of Repowering the United States (Clean Energy Action, October 2013)
17. Recoverable Coal Reserves and Average Recovery Percentage at Producing Mines by State, 2013 and 2012, Annual Coal Report 2013
18. EIA Annual Energy Outlook 2015
19. Wassily W. Leontief, *Input-Output Economics*, 2nd edition, 1986.
20. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)*, Bureau of Economic Analysis, U.S. Department of Commerce, 3rd edition, 1997, 1.
21. *See id.* at 3 ("In this [final demand output multiplier] table, each column entry indicates the change in output in each row industry that results from a $1 change in final demand in the column industry. The impact on each row industry is calculated by multiplying the final-demand change in the column industry by the multiplier for each row.").
22. *Id.*

23. *See id.* at 4 ("In the final-demand employment multiplier table, each column entry indicates the change in employment in each row industry that results from a $1 million change in final demand in the column industry. The impact on each row industry is calculated by multiplying the final-demand change in the column industry by the multiplier for each row.").
24. *Id.* at 8 ("RIMS II, like all I-O models, is a 'static equilibrium' model, so impacts calculated with RIMS II have no specific time dimension. However, because the model is based on annual data, it is customary to assume that the impacts occur in 1 year."). Jobs, as well as dollar amounts of economic activity and wages, are also reported on an annual basis. While it is natural to sum the annual dollar amount of wages and economic activity over years to a cumulative effect, jobs do not naturally lend themselves to the same interpretation. It may help the reader to interpret the resulting jobs numbers as "job-years" or divide the number of jobs by the number of years to establish the number of jobs created for the life of the project. I use the job-years concept below in reporting my results — the standard method for reporting results of RIMS II analysis — and leave it to the reader to interpret the numbers appropriately.
25. RIMS II state-level multipliers were updated from 2006 to 2010 on the BEA site after the November 2012 elections. The national-level multipliers were still not updated as of the date of this report. Approximately 93% of all coal resources in the Powder River Basin are in the state of Wyoming with the remaining in the state of Montana. I do not estimate national effect from coal production because Power River Basin operations are largely limited to those two states.
26. *See* U.S Department of Commerce, Bureau of Economic Development, Brief Description: RIMS II Methodology, *available at* http://www.bea.gov/bea/regional/rims/brfdesc.cfm ("RIMS II uses BEA's benchmark and annual I-O tables for the nation. Since a particular region may not contain all the industries found at the national level, some direct input requirements cannot be supplied by that region's industries. Input requirements that are not produced in a study region are identified using BEA's regional economic accounts." Note that in both cases multiplier estimates as based on government-maintained industry data.).
27. *RIMS II Handbook, supra* note 45, at 18 ("The impact estimation is complicated by the treatment of the industry in RIMS II; inasmuch as this industry does not yet exist in the economic area, the column entries in the final-demand multiplier table for the industries from which the glass-container industry purchases inputs are zero." Note that this discussion is limited to an example applying final-demand multipliers to a glass-container plant, but that it clearly applies to both direct and final-demand multipliers for all industries.).
28. The BEA suggests that a "bill-of-goods" approach — in which survey data about probable wage and production expenditures from firms can be established for such an industry in a region in which there is no production — can be applied to predict changes in output in such situations (*Id.*). That approach requires, however, very specific data for each and every project in each state and lengthy surveys with potentially affected business owners. Because specific bill-of-goods data is not available for future oil and gas projects on Federal lands, a bill-of-goods approach cannot be applied here.
29. See, for instance, Ambargis, Zoë O., "RIMS II: Regional Input-Output Modeling System," Presentation at the BEA/PNREAP/University of Nevada Regional Economic Workshop, Reno, NV, September 2009.
30. Additional detail is provided in Appendix Table A3.
31. A job is defined by the BEA method in terms of "full time person years of employment." (Lynch, Timothy, "Analyzing the Economic Impact of Transportation Projects using RIMS II, IMPLAN and REMI," Florida State University Institute for Science and Public Affairs, October 2000.) According to Zoë O. Ambargis of the BEA, a common mistake is to confuse FTE impacts and employment statistics. By the BEA method, two employees reduced to half time, for instance, constitute one job. (*See*, for instance, Ambargis, Zoë O., "RIMS II: Regional Input-Output Modeling System," Presentation at the BEA/PNREAP/University of Nevada Regional Economic Workshop, Reno, NV, September 2009.)
32. The employment impact estimates from BEA's RIMS II multipliers are simply one employed position at a firm, as measured by BEA. They are not full-time equivalents. The BEA data does not distinguish between full-time and part time jobs. Thus, the employment figures represent merely an estimate of how reported company payrolls are likely to change in response to changes in demand. Nonetheless, a common mistake in interpreting the RIMS II models is to confuse BEA "jobs" with Full-Time Equivalent (FTE) job impacts and employment statistics. See, for instance, Zoë O. Ambargis. "RIMS II: Regional Input-Output Modeling System," BEA/PNREAP/University of Nevada Regional Economic Workshop, Reno, NV, September 2009.
33. For a full listing of the jobs see *U.S. Census Bureau's 2007 NAICS Codes and Titles*, (available at http://www.census.gov/naics/2007/NAICOD07.HTM).
34. Excluding coal.
35. *See* "Which Companies Pay The Most In Taxes?," *Forbes*, April 16, 2012. "ExxonMobil in 2011 made $27.3 billion in cash payments for income taxes. Chevron paid $17 billion and ConocoPhillips $10.6 billion. And not only were these the highest amounts in absolute terms, when compared with the rest of the 25 most profitable U.S. companies (see our slideshow for the full rundown of who paid what), the trio also had the highest effective tax rates. Exxon's tax rate was 42.9%, Chevron's was 48.3% and Conoco's was 41.5%. That's even higher than the 35% U.S. federal statutory rate, which is already the highest tax rate among developed nations."
36. Note that this analysis is conservative because it does not consider the state and local taxes produced from "spill-over" effects. These tax revenues cannot be accurately measured because spill-over output cannot be attributed to particular states. Because spill-over output is significant, however, my estimate significantly understates the total incremental state and local taxes that would be produced *annually*.

37. Matthew Nagowski, *Measures of State and Local Tax Burden*, New England Public Policy Center, Federal Reserve Bank of Boston, Jul. 13, 2006, (available at http://www.bos.frb.org/economic/neppc/memos/2006/nagowski071306.pdf).
38. U.S. Census Bureau, Federal State and Local Governments, State and Local Government Finances (available at http://www.census.gov/govs).
39. It is impossible to quantify these benefits because state and local taxes differ from state to state and because the BEA does not provide a means to allocate the spill-over revenues to particular states. To be conservative, the analysis estimates only the revenues that can be accurately assigned and measured.
40. Using the weighted average by increased output generates nearly identical results.
41. Using the weighted average by increased output generates nearly identical results.
42. Inventory of Assessed Federal Coal Resources and Restrictions to Their Development, U.S. Departments of Energy, Interior and Agriculture (August 2007)
43. Inventory of Assessed Federal Coal Resources and Restrictions to Their Development, U.S. Departments of Energy, Interior and Agriculture (August 2007)



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