"The Economic Value of Energy Resources on Federal Lands in the Rocky Mountain Region"

by

Dr. Timothy J. Considine
Professor of Energy Economics
School of Energy Resources
Department of Economics & Finance
University of Wyoming

June 24, 2013

About the Author

Timothy Considine is a Professor of Energy Economics and Director of the Center for Energy Economics and Public Policy (CEEPP) with School of Energy Resources and the Department of Economics and Finance at the University of Wyoming.

Acknowledgements

This report was prepared under a consulting agreement with the Interstate Policy Alliance and the Employment Policies Institute Foundation that provided the funding for this study.

Disclaimer

The opinions, findings, and conclusions expressed in the report are those of the authors and are not necessarily those of the University of Wyoming, the Interstate Policy Alliance, or the Employment Policies Institute Foundation.

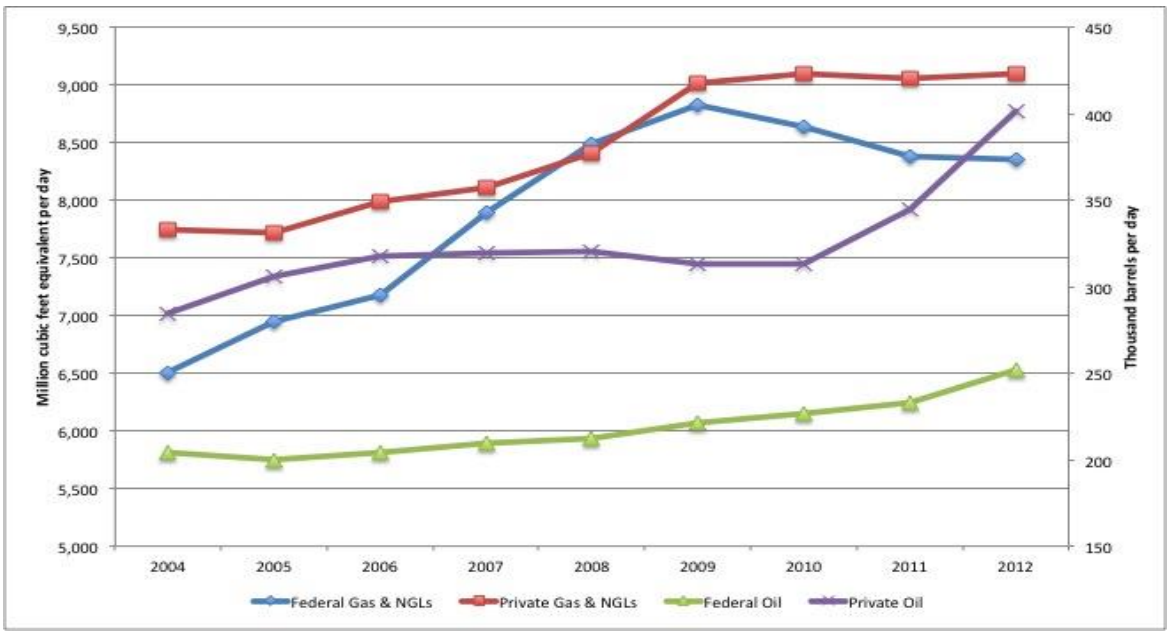
Executive Summary

The management of federal lands has always involved controversies between pro-development and conservationist forces. Development of oil, natural gas, and coal resources on federal lands often involve years of regulatory approval and litigation. In addition, many states with large tracts of federal lands are concerned about the payoffs from development in terms of employment and tax revenues. In particular, several large renewable energy projects have been put on the fast track for approval while many oil and gas projects languish in a regulatory and legal bog. To assess the opportunity costs of such a regulatory posture, this study examines the payoffs from developing renewable and non-renewable energy projects. These returns in terms of jobs, tax revenues, and gross state product, provide a basis for assessing the opportunity costs of regulatory delays or outright rejection of proposed energy projects on federal lands.

The Rocky Mountains constitute one of the major energy producing regions of the United States. This seven state region including Wyoming, Utah, Colorado, New Mexico, Montana, Nevada, and Idaho produces more than 1.2 million barrels of crude oil and natural gas liquids per day, more than 20 percent of U.S. natural gas production, and more than half our nation's coal output. Collectively this combined output of crude oil, coal, and natural gas and associated liquids is equivalent to 5.6 million barrels of oil per day, which would place the region 9th in total energy production in the world, just behind Australia.

The production of oil and gas on private property in the region has outpaced production from federal lands. While crude oil output on federal lands in the region increased almost 14 percent since 2009, production on private lands has increased at 28 percent or twice the rate. While production growth of natural gas and natural gas liquids on private lands in the region has grown 0.9 percent since 2009, production of these products on federal lands has *declined* 5.4 percent (see Figure ES1).

Figure ES1: Oil and natural gas production in Rocky Mountains

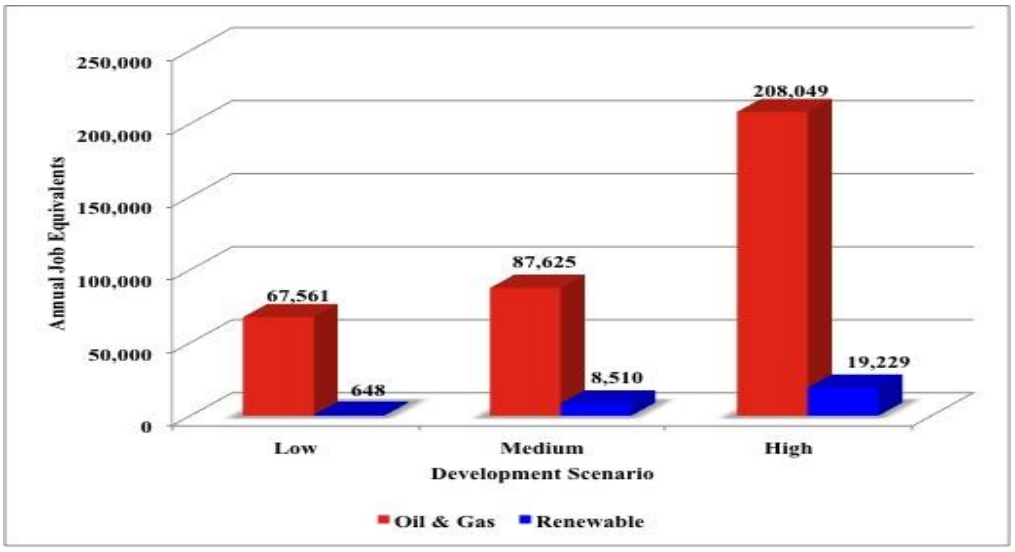


The geology of oil and gas reservoirs on federal and private lands in the Rocky Mountains shares many similar features. Indeed most of the production growth of crude oil has occurred in well-established oil fields, such as the basins of Denver-Julesburg in Colorado, the Powder River in Wyoming, and the Permian Basin in New Mexico. These production gains are realized from the application of new technology, such as three dimensional seismic, directional drilling, and hydraulic fracturing. The Bureau of Land Management and other federal agencies are developing new rules for the use of these technologies on federal lands. In addition to the existing layers of regulatory hurdles and related litigation, delays in the implementation of these rules may have contributed to the relatively slower growth of oil and gas production on federal lands.

To estimate the costs of these delays, this study develops scenarios for fossil fuel and renewable energy development for each of the seven states in the Rocky Mountain region. The scenarios for oil and gas drilling are formulated on the basis of historical data on drilling activity on federal lands and the number of wells associated with projects proposed and awaiting federal approval. The economic impacts from the construction and operation of new energy production capacity under each of these scenarios are estimated. These impacts include the direct stimulus provided to regional economies from these investments, additional gains from business-to-business or supply chain spending, and the induced impacts as households spend income earned from this additional commerce.

One of the main findings of this study is that the economic impacts associated with oil and gas development are orders of magnitude larger than those arising from proposed renewable energy projects. For example, under the medium scenario for drilling and renewable energy development, employment gains are over 87,000 per annum while those for renewable energy are less than a tenth as large at 8,500 annual job equivalents (see Figure ES2). While the upside for renewable energy development implies over 19,000 more jobs, the high development scenario for drilling could generate over 200,000 jobs for the region.

Figure ES2: Comparison of employment impacts



The economic impacts vary considerably by state. A summary of these impacts by state is presented below in Table ES1. If all proposed oil and gas projects on federal lands in Wyoming are approved and undertaken, 1,720 wells would be drilled per year for the next 10 years, which appears below in the high scenario. As result, this level of drilling activity would generate $7.2 billion of value added or gross state product, $2.2 billion in additional taxes and royalty payments, and over 43,000 annual job equivalents. Similarly, if projects pending in Utah were approved, over 1,400 wells would be drilled per annum. The high scenarios for New Mexico and Nevada assume discovery and development of the Mancos and Chainman shale plays, respectively. The scenarios for the remaining three states, Idaho, Montana, and Colorado are based upon the 25th, 50th, and 75th quartiles of historical drilling on federal lands since 2003.

Table ES1: Regional impacts of oil and gas project on federal lands

Wyoming	*Low*	*Medium*	*High*	**Utah**	*Low*	*Medium*	*High*
Wells	1,098	1,314	1,720	Wells	244	373	1,445
Value Added	4,602	5,508	7,210	Value Added	1,112	1,703	6,598
Taxes	1,432	1,714	2,243	Taxes	201	308	1,191
Jobs	27,901	33,397	43,716	Jobs	9,411	14,416	55,848
Montana				**Nevada**			
Wells	54	103	117	Wells	3	9	264
Value Added	195	369	422	Value Added	11	32	1,797
Taxes	45	85	97	Taxes	2	7	218
Jobs	1,753	3,327	3,806	Jobs	118	353	21,797
Colorado				**New Mexico**			
Wells	234	363	408	Wells	727	836	1,234
Value Added	1,132	1,756	1,975	Value Added	2,522	2,899	8,432
Taxes	193	299	337	Taxes	600	689	1,018
Jobs	7,996	12,405	13,951	Jobs	20,305	23,341	67,968
Idaho				**Region**			
Wells	2	10	25	Wells	2,362	3,008	5,214
Value Added	6	28	69	Value Added	9,578	12,296	26,504
Taxes	2	8	21	Taxes	2,474	3,110	5,124
Jobs	77	385	962	Jobs	67,561	87,625	208,049

Valued added and taxes are in millions of 2013 dollars

In summary, under the medium scenario, oil and gas development on federal lands could generate $12.2 billion per annum in gross regional product over the next decade, support more than 87,000 jobs, and generate more than $3 billion in revenues for local, state, and federal governments.

Table of Contents

List of Tables

List of Figures

1. Introduction

The United States is forging a new frontier in oil and gas production with the development of advanced seismic sensing, directional drilling, and hydraulic fracturing. These technologies have unlocked vast reserves of natural gas and oil that hitherto were thought to be uneconomic to produce. As a result, U.S. production of natural gas increased almost 25 percent from 2008 to 2012. Natural gas liquids and crude oil production has increased 24 and 13 percent respectively over the same period. During 2012, the United States produced an additional 1.9 million barrels of crude oil and liquids from 2008 levels, a significant contribution to world oil supply.

Almost all of this new production has occurred on private lands. Private ownership of mineral rights provides financial incentives for investment to develop technology and resources. The institution of private mineral rights also facilitates the rapid development of resources when market conditions warrant, increasing the responsiveness of supply that moderates prices and eases burdens on energy consumers.

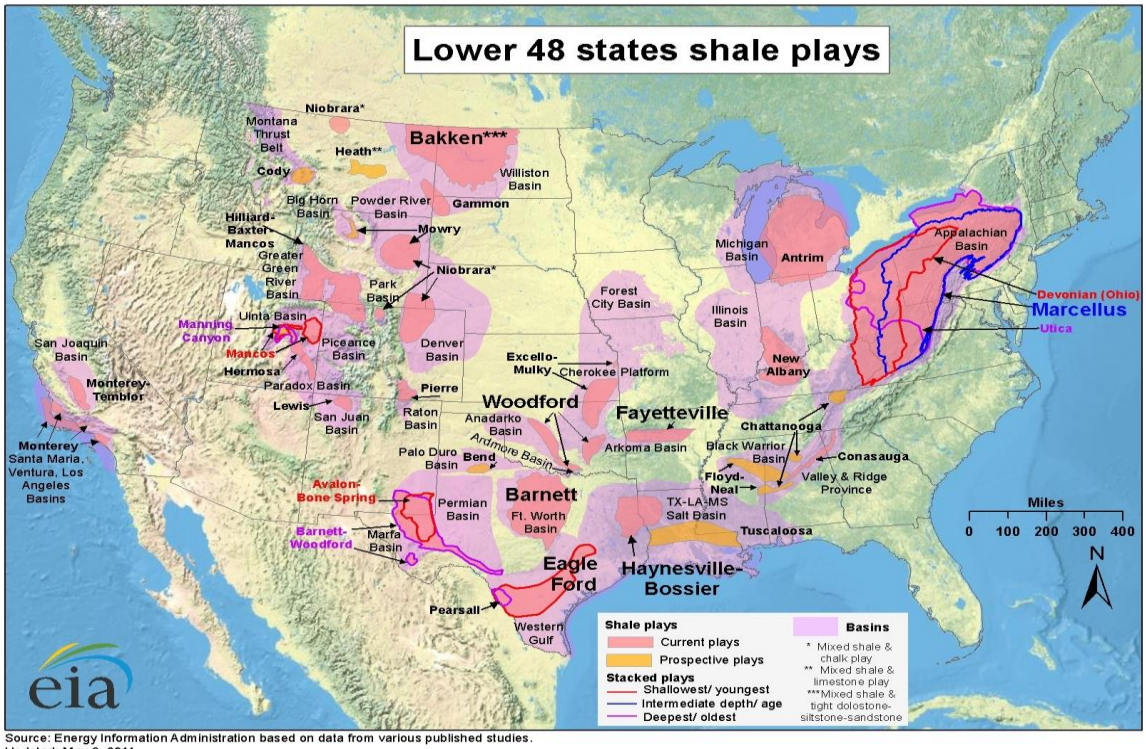
Resource development on federal lands, however, has languished under the weight of regulatory delays and litigation. For example, the Bureau of Land Management (2013) reports that the approval of new applications for drilling permits on average took 307 days during 2011, which is up from 212 in 2008. Moreover, large tracts of federal lands have been ruled off-limits for resource development under a variety of policies seeking to ensure historic preservation, ecosystem balance, and scenic preservation. As a result, production of oil and gas on federal lands decreased 5.8 percent from fiscal year 2008 to 2011 (Energy Information Administration, 2012). The end result of these policies is lower national economic output and employment.

These lost economic opportunities disproportionately affect those states with the largest tracts of federal lands. As a consequence, policy makers in many states are interested in the Federal Transfer of Public Lands Act that would transfer ownership of federally owned land to the states. Determining the value of federal lands and the economic and fiscal impacts that could result from their development is the central objective of this study. With this information, state and federal policy makers may be able to make more informed decisions on regional economic development.

Concerns over the environment also play an important role in the debate over resource development. Besides the question of whether development should occur, there is a debate over the character of that development. In addition to oil and gas, many federal lands are favorable for wind and solar energy development. Environmental groups and advocates of renewable energy argue wind and solar projects should be preferred over fossil fuel development. State policy makers are often caught in the middle of these disputes, attempting to weigh the relative employment and fiscal impacts of these choices. Hence, this project proposes to compare the economic impacts of these two paths for resource development. The focus of this study will be on seven states – Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming – that have expressed an interest in these issues.

2. Regional Resource Development

There are several conventional oil and gas basins and shale plays within the region under study as illustrated in Figure 1 below. Within Wyoming, for instance, there is the Niobrara, Hilliard-Baxter-Mancos, and Mowry shale plays in addition to promising conventional fields that that could produce additional oil and gas with the application of new technology. As the map indicates, Colorado, Montana, Utah, and New Mexico also have extensive deposits of oil and gas in shale formations.



Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

Figure 1: Oil and natural gas shale plays in the continental United States

There are several possibilities for oil and gas production in Idaho and Nevada not illustrated above in Figure 1. The Chainman Shale is a new discovery in eastern Nevada. Leasing activity in the Chainman area has increased sharply over the past year. Exploration for natural gas is also underway in western Idaho along the Oregon border.

Assessing the economic value of these resources involves identification of the potential development and then the development of future trajectories for the number of rigs operating within each state and the number of oil and natural gas wells drilled over a ten-year period. Such an analysis involves considerable uncertainty so three scenarios will be developed for resource development on federal lands. The scenarios will be based upon analogs of resource development on private lands, unencumbered by regulatory delays characteristic of drilling on federal lands and where available, upon data for proposed projects that are delayed.

3. Economic Impact Analysis

The economic impacts of energy resource development, whether renewable or non-renewable, involve two stages. First, there are the impacts on value added, jobs, and tax revenues during the construction of the energy producing facilities. During the second phase, economic impacts arise during the operation of these facilities as the income generated from these facilities are spent.

The spending during the construction and operation of energy production facilities will have several economic impacts. The direct capital expenditures will indirectly stimulate support industries. For example, capital expenditures for construction of renewable energy plants involve direct purchases from companies that provide capital equipment, engineering and construction services, construction services, and other good and services. These companies in turn acquire equipment and supplies from other companies, stimulating several rounds of *indirect* spending throughout the supply chain. The direct and indirect outlays generate additional employment and income, which *induces* households to spend on additional goods and services. Together these direct, indirect, and induced impacts during construction and operation constitute the total economic impacts of the energy investments.

Regional economic impact analysis using input-output (IO) tables and related IO models provide a means for measuring these economic impacts. Input-output analysis provides a quantitative model of the inter-industry transactions between various sectors of the economy. This framework provides a means for estimating how spending in one sector affects other sectors of the economy. IO tables are available from Minnesota IMPLAN Group, Inc. (2011) based upon data from the Bureau of Economic Analysis in the US Department of Commerce. This project uses these tables to estimate the direct, indirect, and induced economic impacts from spending for the mine expansion and eventual operation.

These impacts will be compared with the economic impacts from renewable energy development. The National Renewable Energy Laboratory (NREL) has conducted surveys of spending for the construction and operation of renewable energy facilities. Using IMPLAN, NREL developed the Jobs and Economic Development Impact (JEDI) Models to estimate the impacts of biofuels, coal, concentrating solar power, geothermal, marine and hydroeletric power, natural gas, and photovoltaic power plants.[1]

4. An Overview of Regional Oil, Gas, and Coal Production

The Rocky Mountain region is one of the major oil and gas producing areas in the United States, accounting for 10 percent of total U.S. crude oil production. While production in Nevada and Idaho is currently negligible, oil and gas output from the remaining five states, Wyoming, Utah, Colorado, New Mexico, and Montana is significant. Production of crude oil in the region averaged over 650,000 barrels per day during 2012 as illustrated in Figure 2 and over 700,000 barrels per day during early 2013. Since 2004, crude oil production has increased by over a third, roughly 165,000 barrels per day. Production on federal lands fluctuated in a narrow band

[1] http://www.nrel.gov/analysis/jedi

between 38 and 41 percent of total regional production. As illustrated in Figure 3, most of the increase in crude oil production has occurred on non-federal lands within the region. For example, during 2011 and 2012, crude oil production on non-federal lands increased 88,000 barrels per day while production rose 25,000 barrels per day on non-federal lands.

Figure 2: Regional oil production on federal and non-federal lands

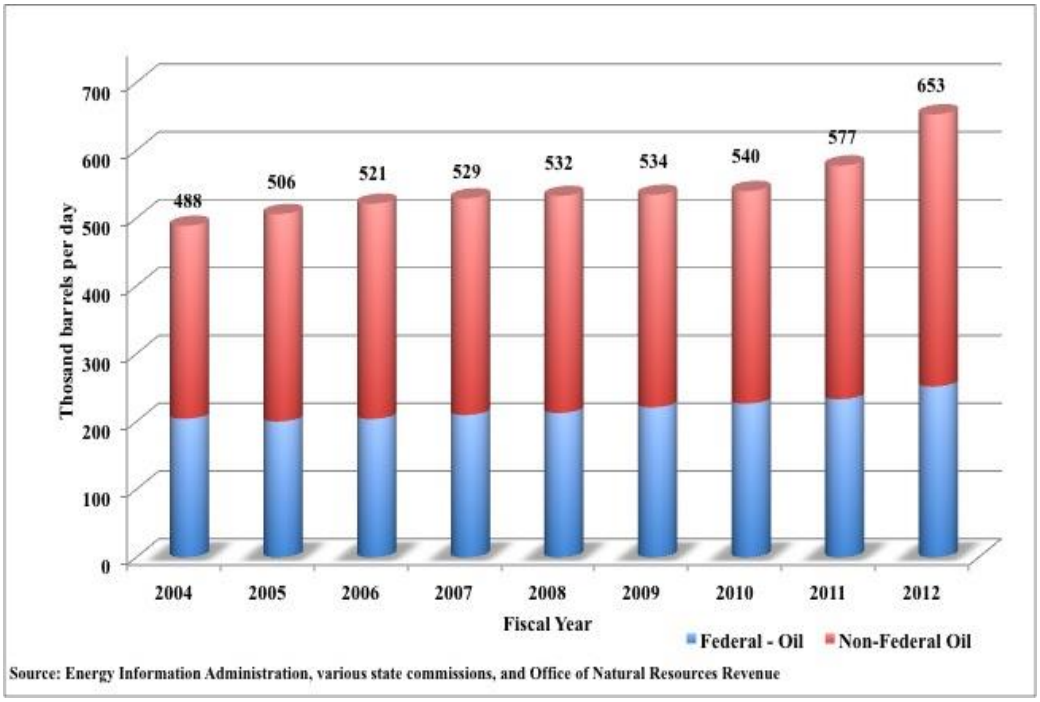
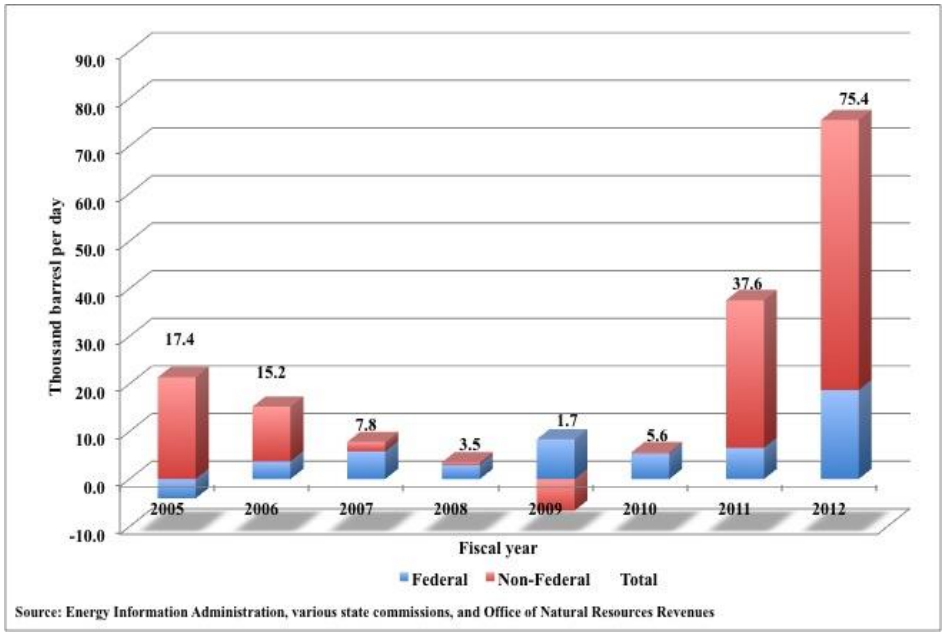


Figure 3: Changes in regional oil production on federal and non-federal lands



While some analysts have argued that federal lands are not endowed with shale reserves, such as the Bakken or the Eagle Ford shale plays, the fact remains that oil production on both federal and non-federal lands increased, no doubt in part due to relatively high oil prices. Production growth on federal lands, however, has lagged output gains on non-federal lands. Moreover, oil production gains in much of the region are in large measure from the application of new technology to existing fields. The old adage, "the best place to find oil is in an oil field," rings as true today as in the past. Uncertainty over federal regulatory policy with regard to hydraulic fracturing may have contributed to a relatively slower pace of oil production on federal lands in the Rocky Mountain region.

The Rocky Mountain region plays an even more important role supplying America with natural gas. During 2012, the region produced over 15 billion cubic feet of gas per day, which constituted 22 percent of total U.S. marketed production. Gas production in the region rose briskly from 2004 to 2009 but has since declined as illustrated in Figure 4 and 5. Figure 5 illustrates that production growth on federal lands contributed to most of the regional gains in production from 2004 to 2009. In sharp contrast, however, reductions in natural gas output on federal lands accounts for most of the regional decline in production since 2009. The relative profitability of production on federal lands is a key driver and to the extent that federal regulations raise costs, this diminishes production growth in the region. Many companies operating in the region also operate in other regions in the U.S. and overseas, closely comparing relative rates of returns on resource prospects as they allocate scarce investment capital.

Figure 4: Regional natural gas production on federal and non-federal lands

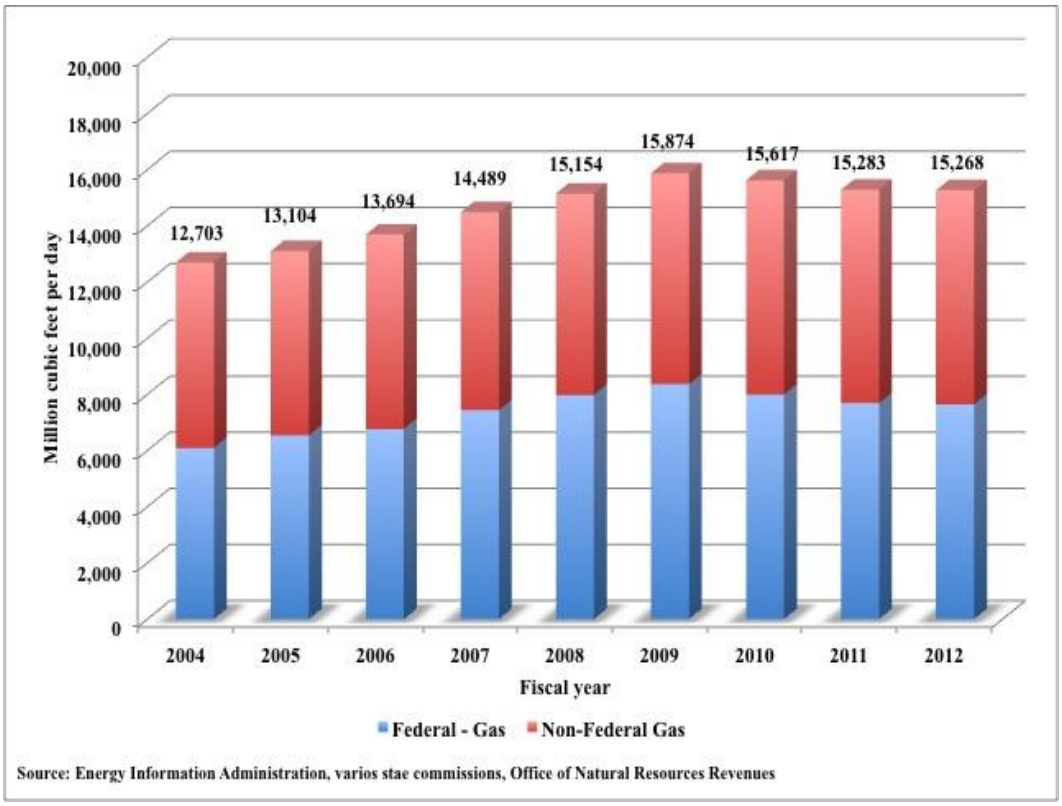
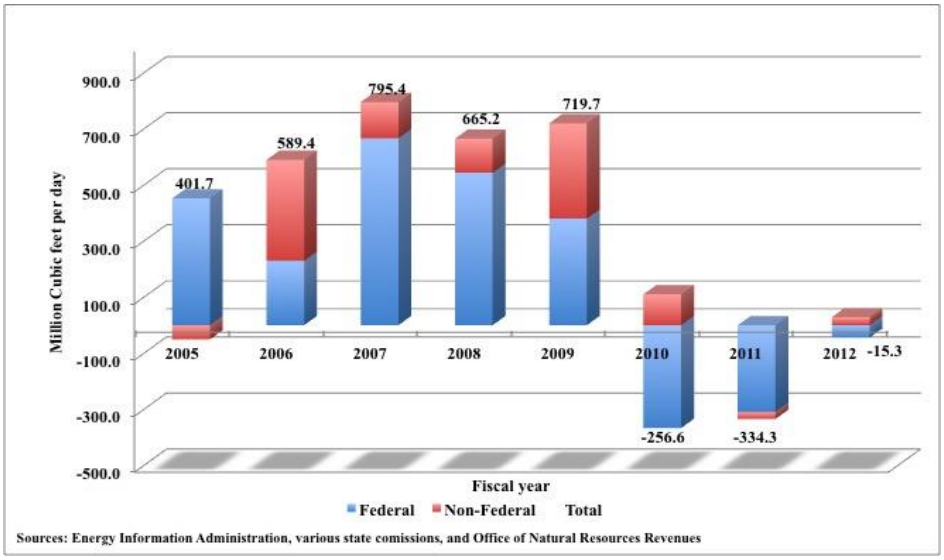


Figure 5: Changes in regional natural gas production on federal and non-federal lands



The share of production on federal lands varies considerably by state (See Figure 6 and 7). Wyoming has the largest share of production coming from federal lands with about 60 and 70 percent of oil and gas respectively from the federal domain. Oil production on federal lands in New Mexico and Utah fall between 40 and 50 percent. The share of oil production on federal production lands in Utah has fallen 10 percentage points over the past five years while oil production from federal lands in New Mexico increased. Shares of natural gas production on federal lands in Utah and New Mexico are relatively stable, slightly above and below 60 percent respectively. Production of oil and gas on federal lands in Colorado and Montana are considerably lower than shares in Wyoming, Utah, and New Mexico.

Figure 6: Federal lands shares of regional oil production by state

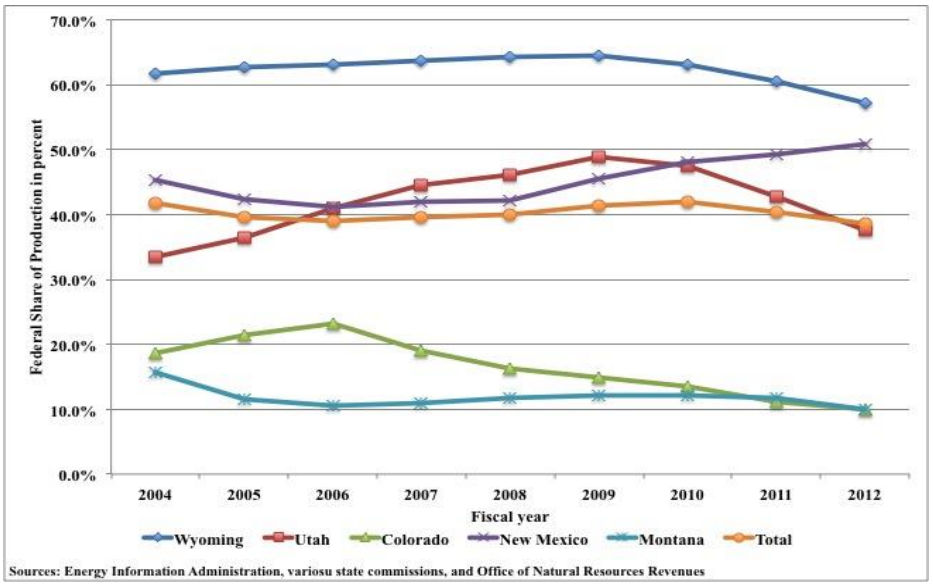
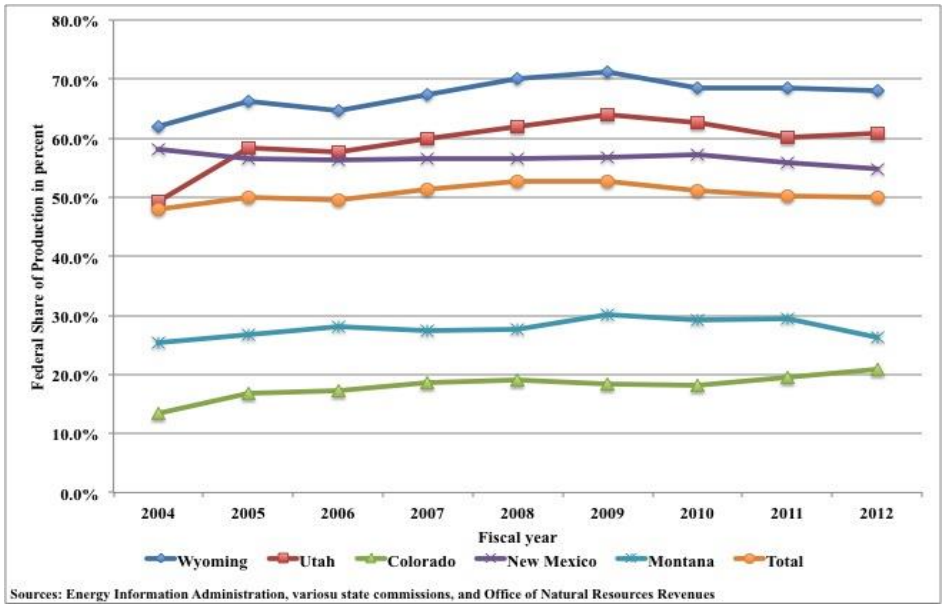


Figure 7: Federal lands shares of regional natural gas production by state



The region is also a significant producer of natural gas liquids (NGLs) as illustrated in Figure 8. Natural gas liquids are petroleum liquids that can be extracted from natural gas wells. Propane, ethane, butane, pentane, and isobutene constitute the bulk of natural gas liquids. These products are used by petroleum refiners and by chemical producers. Like crude oil, NGL production in the region has greatly expanded. For example, NGL production in the region increased from 417 to 584 thousand barrels per day between 2004 and 2012, a 40 percent increase. Unlike the trends in crude oil production, however, the contribution from federal and private lands is more balanced with output of NGLs on federal land accounting for 47 percent of this increase. This expansion reflects the installation of new gas processing capacity to extract NGLs from gas output on federal lands.

The combined output of crude oil, natural gas, natural gas liquids, and coal makes the Rocky Mountain region one of the major energy producing regions in the world. Production of crude oil and natural gas liquids rose from slightly over 900 thousand barrels per day in 2004 to over 1.2 million barrels per day during 2012 (Figure 9). By comparison, natural gas and coal production in the region are equivalent to 2.7 and 1.7 million barrels per day respectively. In total, the region produced the equivalent 5.6 million barrels of crude oil per day, which is 9th in the world in terms of total energy production, just behind Australia.

The production of oil and gas depends on a host of factors influencing the depletion rate for existing wells, the rate at which new wells are drilled and completed, and the rate of production from those new wells. The oil and gas industry is continuously searching for new reserves and devising new techniques to improve the rate of recovering these resources. This search requires capital investment, which generates additional gains in output, employment, and tax revenues for regional and national economies. Estimating these multipliers under plausible scenarios for drilling and completion activity is the central focus of this study. The first step in this process is to determine the level of drilling and completion activity.

Figure 8: Regional natural gas liquids production on federal and non-federal lands

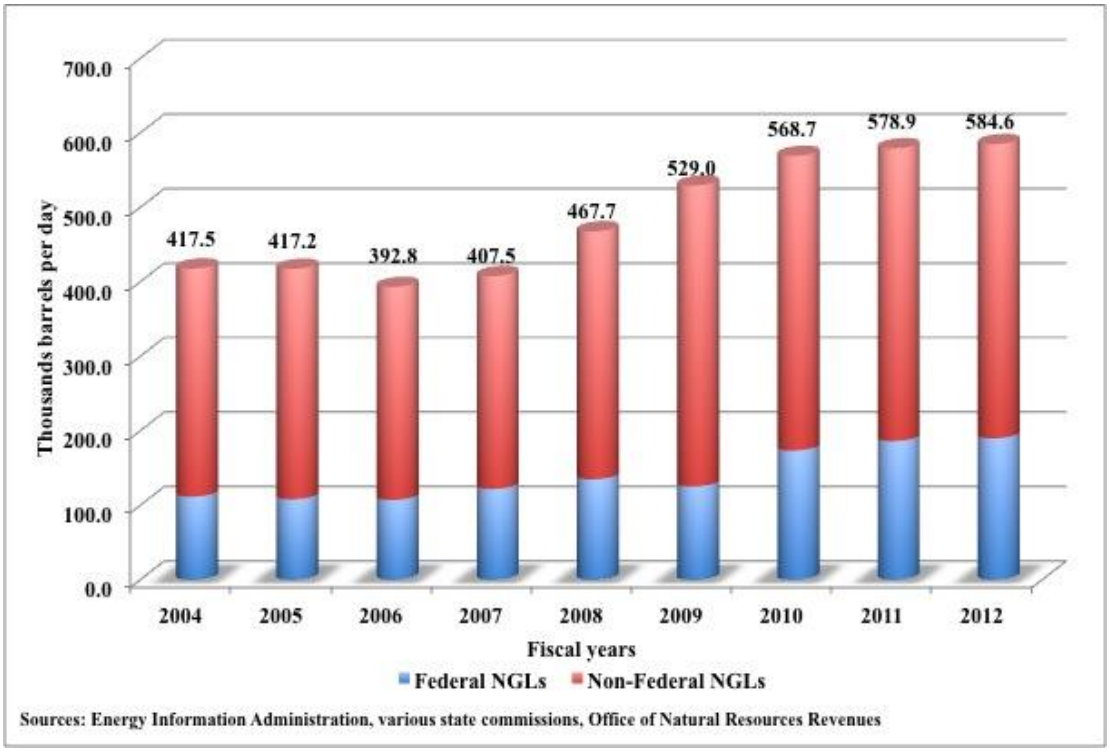
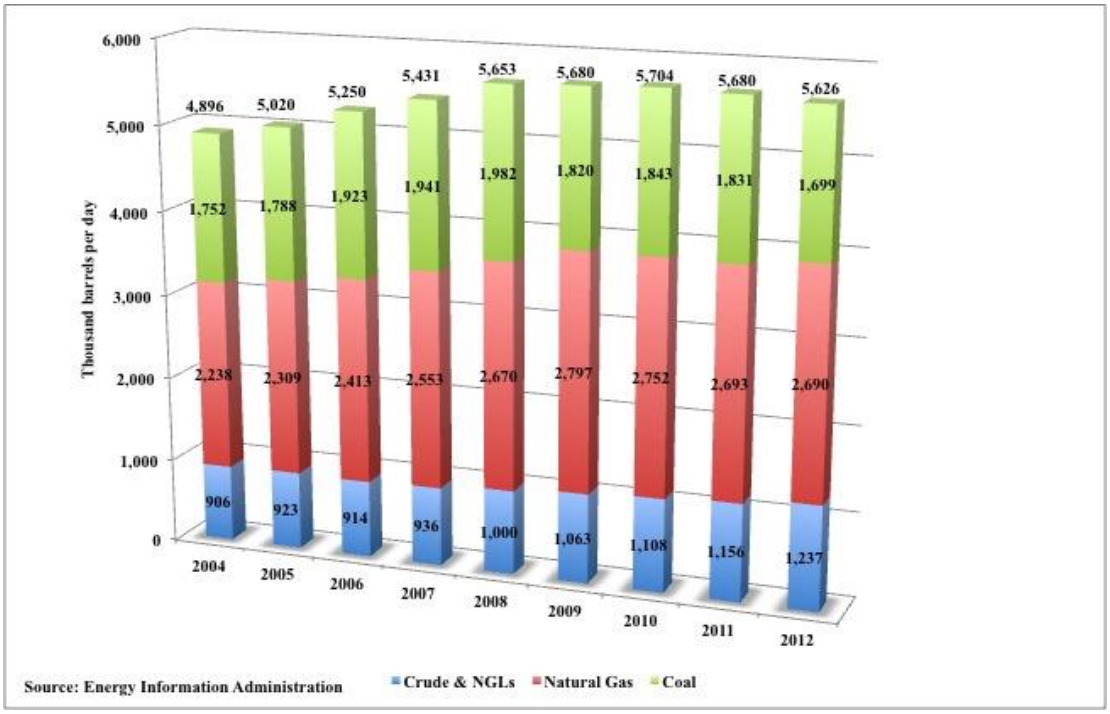


Figure 9: Regional fossil fuel production on federal and non-federal lands



5. Resource Development Scenarios

The economic impact of oil and gas resource development on federal lands depends in part upon the level of drilling activity. Well spuds for Wyoming, Colorado, Utah, Montana, and New Mexico are displayed in Figure 10 for the ten-year period 2002 to 2012. This period covers the two terms of the Bush era and the last four years of the Obama administration.

Total drilling on federal lands in these five states almost doubled from 2,600 wells in fiscal year 2002 to nearly 5,000 wells in 2007. Since then, drilling has come back down to where it was in 2002. A substantial share of this decline is due to a sharp drop in drilling activity on federal lands in Wyoming. In fact, well spuds in Wyoming were 776 during fiscal year 2012, the lowest in a decade. Drilling on federal lands in the other four states also have not recovered to their peak levels, however drilling levels in Utah and Colorado are now at levels somewhat higher than they were during 2002. Drilling in Montana is down but from very low levels. Finally, drilling on federal lands in New Mexico during 2012 is about where it was in 2002.

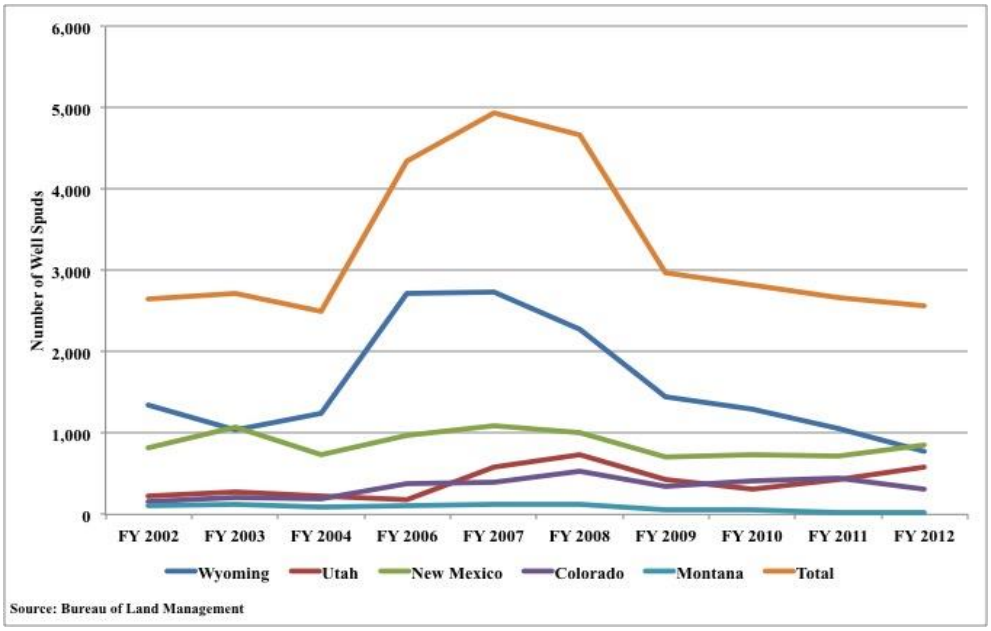


Figure 10: Well spuds on federal lands in five western states, 2002-2012

There are a variety of explanations for these movements in drilling activity over this period. Natural gas prices were relatively high during 2005 to 2008 but then plunged to historic lows from 2009 through 2012. Clearly, these trends in natural gas prices mirror the trend in regional drilling activity. Indeed, the simple correlation coefficient between drilling and real natural gas prices is 0.58 during this period. Oil prices also peaked during 2008, declined during 2009, but have since recovered and have remained relatively high. In this case, the correlation between real oil prices and drilling activity is a relatively weak 0.12.

A more detailed analysis of the drilling data is presented in Table 1, which presents the quartiles of the data and the average level of drilling on federal lands by state in the region during the Bush and Obama Administrations. During the Bush Administration well spuds

averaged 3,287 per annum while during the Obama years, drilling averaged 2,754 wells per year, roughly a 16 percent decline. Average drilling levels decreased in Wyoming, New Mexico, and Montana but increased slightly in Utah and Colorado, probably reflecting better oil prospects in those two states.

Table 1: Summary statistics for well spuds on federal lands in five western states

	Wyoming	*Utah*	*New Mexico*	*Colorado*	*Montana*	*Region*
Minimum	776	181	706	156	23	2,493
25% Percentile	1,098	244	727	234	54	2,662
Median - 50% Percentile	1,314	373	836	363	103	2,771
75% Percentile	2,068	544	992	408	117	4,013
Maximum	2,740	736	1,088	527	131	4,949
Average	1,591	399	868	339	86	3,287
Average 2002-2008	1,591	399	868	339	86	3,287
Average 2009-2012	1,140	440	749	381	42	2,754
Difference	-451	41	-118	41	-44	-533

The statistics in Table 1 provide useful benchmarks for developing possible scenarios for future drilling activity on federal lands. The 25th percentile reported above provides a reasonable lower bound on average annual drilling on federal lands over the next 10 years. Likewise, the medians for drilling in each state constitute the medium-drilling scenario. Similarly, with the exception of Wyoming and Utah, the 75th percentile of the sample defines the high scenario for drilling activity. SWCA Environmental Consultants (2012) identified specific projects under some phase of evaluation under the National Environmental Policy Act (NEPA), finding nine projects involving 1,720 wells drilled per year in Wyoming and 10 proposed projects in Utah requiring 1,445 wells drilled per annum. After searching federal records for these five states, only one other state, Colorado, was found to have only one, small project under consideration. Due to the vagaries of markets and regulatory policy, using the SWCA estimates for Wyoming and Utah for the high drilling scenario seems a reasonable, conservative choice.

Table 2: Scenarios for drilling on federal lands in five western states

Scenarios	*Wyoming*	*Utah*	*New Mexico*	*Colorado*	*Montana*
Low	1,098	244	727	234	54
Medium	1,314	373	836	363	103
High	1,720	1,445	992	408	117

The drilling scenarios for Nevada and Idaho will be developed separately below because these states are essentially new frontiers in oil and gas exploration with no historical track record. Likewise, the scenarios for renewable energy development will be presented in the sections for each state that now follow.

6. Montana

Like the previous four states, Montana is a significant oil producer. The state contains the western edge of the Bakken shale that recently has been estimated to contain 6.7 billion barrels of oil. While crude oil output has been increasing in Montana since 2011, recent drilling activity is starting to decline. Natural gas production is relatively small and declining (see Figure 16).

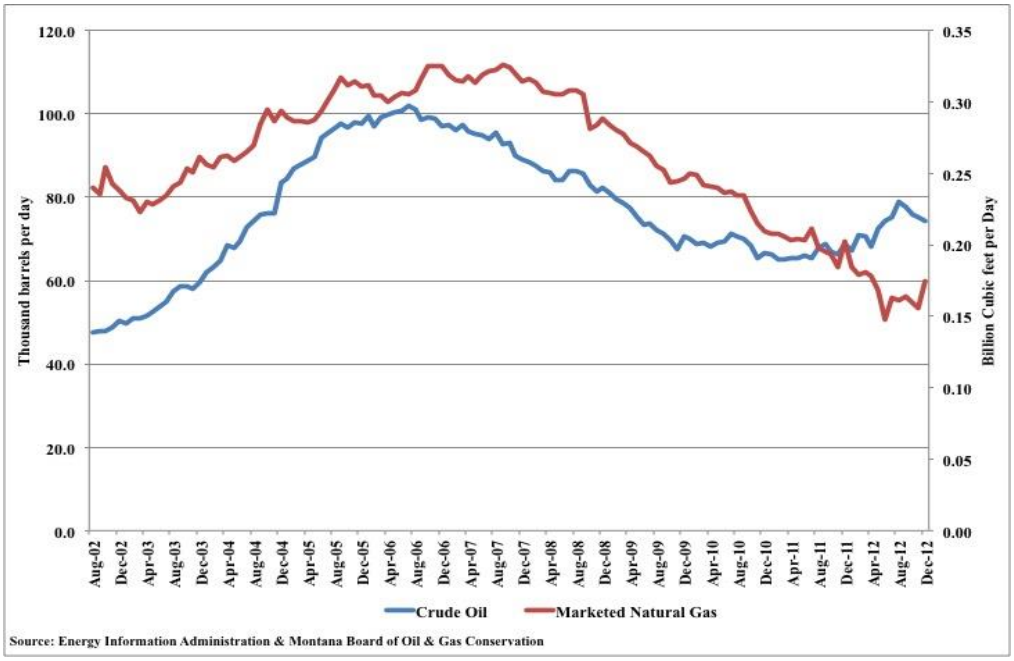


Figure 16: Montana oil and natural gas production, 2002-2012

Montana contains over one-quarter of recoverable coal in the United States but produces less than 4 percent of U.S. output. The prolific Powder River Basin that supports more than 400 million tons of coal production per year in Wyoming also extends into Montana. Coal production in Montana is a tenth that of Wyoming. Higher taxes and deeper coal seams contribute to this disparity. Electric power generation from wind turbines increased 34 percent in 2011.

An overview of the contribution of the minerals sector to the Montana state economy appears in Table 24. Mining contributes 4.4 percent of value added generated in Montana during 2011 with 1.4 percent coming from oil and gas. Other minerals, such as coal, copper, palladium, molybdenum, platinum, and gold, contribute the remaining 3 percent contribution. The average wage in the minerals sector is $62,667 while the statewide average is $34,873. Total employment in the mining sector is 10,374 with roughly half, 5,421 in the oil and gas sector.

Table 24: Economic contribution of mineral sector in Montana during 2011

		Gross Output	Wages	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
Oil & Gas	Jobs			Millions of 2013 dollars			

Drilling	574	378.9	48.3	0.3	87.1	6.7	142.4
Support	1,810	386.7	151.6	1.6	27.1	7.7	188.0
Extraction	3,037	961.7	56.5	11.7	155.8	46.1	270.0
Sub-Total	5,421	1,727.4	256.3	13.6	270.0	60.5	600.5
Coal	1,346	448.0	102.2	2.4	82.6	31.5	218.7
Other Minerals	3,607	1,558.0	291.6	9.9	700.9	56.1	1,058.5
Coal & Other	4,953	2,006.1	393.8	12.3	783.5	87.6	1,277.2
Total Minerals	10,374	3,733	650	26	1,054	148	1,877.7
Total Montana	639,733	84,565.7	22,309.3	3,712.3	13,384.3	2,854.5	42,260.4
Oil & Gas Share	0.8%	2.0%	1.1%	0.4%	2.0%	2.1%	1.4%
Minerals Share	1.6%	4.4%	2.9%	0.7%	7.9%	5.2%	4.4%

Source: IMPLAN, Inc.

6.1 Impacts from Developing Oil and Gas on Federal Lands in Montana

Drilling activity in Montana has declined sharply in recent years. From 2002 to 2008, the average number of well spuds on federal lands was 115. Between 2009 and 2012, the number of well spuds on federal lands declined to 42, a 64 percent decline.

While data on Montana well spuds on private lands is unavailable, well completions on private lands declined from an average of 487 during 2002 to 2008 to a per annum average of 187 from 2009 to 2012 for a 62 percent decline. Hence, the data on drilling activity does not reveal any substantial difference between drilling activity on federal and private lands. As a comparison with other states reveals, however, there are likely other factors particularly tax policy that are conspiring to depress drilling activity on all lands in Montana.

During fiscal year 2012, only 29 wells were drilled on federal lands in Montana. So even the low scenario based upon the 25th percentile of observations of 54 (see Table 24) for annual average well spuds is well above that level. The medium scenario envisions a more than three-fold increase in drilling from currently depressed levels. The high scenario has 117 well spuds per annum.

The economic and fiscal impacts associated each of these three scenarios are presented in Table 25. The medium scenario generates $400 million in value added, over $84 in government revenue, and more than 3,300 jobs. The low case yields roughly half these impacts. Given that the high scenario or the 75th percentile is relatively close to the median of the observations, the economic impacts are similar to the medium scenario.

Table 25: Impacts of oil & gas projects on Montana federal lands

	Wells Drilled per Annum		
	Low	Medium	High
Well Spuds	54	103	117
	Millions of 2013 dollars		
Gross Output	490.7	931.5	1,065.5

Value Added	194.5	369.2	422.4
Wages	84.4	160.2	183.3
Taxes			
State & Local	20.4	38.7	44.2
Federal	20.3	38.6	44.2
Ad Valorem	1.1	2.0	2.3
Severance	1.0	1.9	2.1
Federal Royalties	1.8	3.4	3.8
Taxes & Royalties	44.5	84.5	96.7
	Annual Job Equivalents		
Employment	1,752.8	3,327.1	3,805.9

6.2 Impacts from Developing Renewable Energy on Federal Lands in Montana

There are a number of wind energy projects in the pipeline in Montana, some of which are likely to be constructed on federal lands. To estimate the economic and fiscal impacts from the development of renewables on federal lands, and the potential losses from their delay, the metrics developed in Table C4 and Table D4, in Appendices C and D respectively are applied to three possible development scenarios for wind.

To form a business as usual or low projection for the development of wind, this study assumes that the generating capacity of wind in Montana grows at the same rate as that forecast for the Northwest Power Pool Area of the Western Electricity Coordinating Council by the EIA's 2013 Annual Energy Outlook, Reference Case Scenario. These projections imply that over the next 10 years, wind-generating capacity in Montana will expand from 645 MW in 2012 to 714 MW in 2022. This implies an average annual growth rate of 1%.

The medium renewable energy scenario assumes a higher average annual growth rate of wind at 5%, with wind capacity reaching 1,095 MW by 2022. The high renewable energy scenario is designed to reflect the possibility that all proposed wind projects in Montana go ahead. Thus an additional 500 MW of wind capacity comes online from 2015 onwards. Total installed wind capacity in Montana reaches 5,150 MW by 2022 in this scenario.

These three development scenarios provide projections for the total build out of wind in Montana (i.e. on both state and federal lands). 30% of land in Montana is federal land. Therefore, this study assumes that 30% of the build out in each of the three development scenarios will take place on federal lands.

The average annual total economic impacts (i.e. impacts from construction and operation) associated with each of these scenarios over forecast horizon of 2013-2022 are presented below in Table 26. Under the medium scenario, value added and taxes are $6 and $1 million higher respectively and the employment level is 103 higher. This means that delays in the approval of wind projects on federal lands forego these gains. Hence, the annual average cost of delays is $6 million in terms of lost economic output, or value added. Under the low wind scenario, the costs of delays could be $1 million while under the higher wind scenario the costs of delays could be $33 million.

Table 26: Impacts of proposed wind projects on Montana federal lands

	Construction per Annum (MW nameplate)		
	Low	Medium	High
Wind	2	13	135
	Economic Impacts in millions of 2013 dollars		
Gross Output	1.6	11.8	105.2
Value Added	0.8	6.0	53.9
Wages	0.6	4.2	32.7
Taxes			
State & Local	0.0	0.4	4.3
Federal	0.1	0.7	7.2
Severance	0.0	0.0	0.4
Total taxes	0.2	1.2	11.9
	Annual Job Equivalents		
Employment	14.5	102.8	796.9

7. Summary

Across all seven states, oil and gas development over the next ten years could generate more than $10 billion in value added per annum under the medium drilling scenario that envisions slightly over 3,000 wells drilled per year. This scenario also would support more than 87,000 job equivalents and generate more than $3 billion in tax and royalty payments per year. This scenario assumes that a substantial proportion of the projects proposed on federal lands would be approved in a timely fashion so that drilling activity returns to levels above currently depressed levels. If drilling on federal lands remains at currently depressed levels, which are due in part to restrictive regulatory policies, then the gains under the medium scenario would not be realized. Hence, these foregone opportunities would represent the opportunity cost of restrictive regulatory policy.

Table 33: Economic of oil and gas projects on western federal lands

	Wells Drilled per Annum		
	Low	Medium	High
Well Spuds	2,362	3,008	5,214
	Millions of 2013 dollars		
Gross Output	21,786.0	24,025.3	46,627.2
Value Added	9,578.5	10,594.3	19,912.4
Wages	3,958.7	4,342.1	8,345.7
Taxes			
State & Local	891	1,135	1,967
Federal	890	1,133	1,964
Ad Valorem	186	227	321
Severance	185	224	317
Federal Royalties	322	391	554
Taxes & Royalties	2,473.5	3,109.9	5,123.7
	Annual Job Equivalents		
Employment	67,561	87,625	208,049

If federal policy is accommodative, resource prices favorable, and the Mancos and Chainman shale plays develop, federal lands in the western states could contribute close to $20 billion in value added and more than 200,000 jobs per annum. However one views the posture of federal policy, this scenario clearly demonstrates there is considerable upside potential from developing oil and natural gas on federal lands. These gains should be kept in mind in formulating regulatory policies affecting access and management of federal lands.

Expanding coal export capacity by 100 million tons over a ten year period would generate $176 million in value added, generate 772 jobs in Wyoming, and more than $98 million in tax and royalty income. If capacity is expanded to 150 million tons, these gains increase to $772 million in value added and $147 million in annual tax and royalty income.

This study also surveyed proposed renewable energy projects on federal lands. Under the medium development scenario an average of 453 megawatts of renewable energy generation capacity is built each year, which is slightly less than an average sized coal-fired power plant. Under this scenario, the construction and operation of these facilities would on average generate $629 million in value added, support 8,500 jobs per annum, and provide $133 million in government revenues. Under the high development scenario, the equivalent of two coal fired power plants are built each year yielding about $1.4 billion in value added, over $330 million in taxes, and supporting 19,000 jobs. The net economic value of these projects would be lower because the relatively high cost of electricity produced from these projects would raise electricity rates and lower economic activity. Regardless, even the gross economic gains from building and operating renewable energy projects are orders of magnitude lower than the gains achieved from developing oil and gas on federal lands.

Table 34: Economic impacts of renewable energy projects on western federal lands

	Construction per Annum (MW nameplate)		
	Low	Medium	High
Wind	21	146	646
PV	5	211	420
CSP	14	96	217
Total	40	453	1,283
	Economic Impacts in millions of 2013 dollars		
Gross Output	91.2	1,081.5	2,509.8
Value Added	49.8	628.8	1,443.2
Wages	39.2	465.2	1,032.9
Taxes	1.0	4.4	23.9
State & Local	3.3	39.2	95.1
Federal	6.7	89.3	210.3
Severance	0.0	0.3	1.9
Total taxes	11.0	133.2	331.2
	Annual Job Equivalents		
Employment	647.5	8,509.9	19,229.2

References

Bureau of Land Management (2013) "Average Application for Permit to Drill (APD) Approval Timeframes: FY2005 - FY2012," http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/statistics/apd_chart.html

Considine, T.J. and E. Manderson, "Energy Development in California: A Comparison of Renewable and Conventional Paths," *Energies*, (forthcoming).

Considine, T.J. , R. Watson, and S. Blumsack, "The Pennsylvania Marcellus Shale Natural Gas Industry: Status, Economic Impacts, and Future Potential," The Pennsylvania State University, July 2011, 59 pages.

Considine, T.J. "The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia," The American Petroleum Institute, 45 pages.

Energy Information Administration (2012) "Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2013 through FY 2011." March, http://www.eia.gov/analysis/requests/federallands/pdf/eia-federallandsales.pdf

Appendix A: Economic Impacts of oil and gas wells by state

Table A1: Montana economic impacts per well drilled

	Drilling & Completion			
	2013 dollars			
	Gross Output	*Value Added*	*Wages*	*Jobs*
Direct	4,387,260	1,626,128	554,579	6.3
Indirect	1,365,628	620,459	387,184	8.2
Induced	702,140	389,230	210,455	6.1
Total	6,455,028	2,635,817	1,152,219	20.7
	Production			
Direct	1,611,814	437,276	110,374	4.8
Indirect	775,136	393,069	227,124	4.9
Induced	245,490	136,145	73,592	2.1
Total	2,632,439	966,490	411,090	11.8
	Total Impacts			
Direct	5,999,074	2,063,403	664,953	11.1
Indirect	2,140,763	1,013,529	614,308	13.1
Induced	947,630	525,375	284,047	8.3
Total	9,087,467	3,602,307	1,563,309	32.5

Appendix B: Fiscal Impacts of oil and gas wells by state

Table B1: Montana fiscal impacts per well drilled

Tax Category	*Drilling*	*Production*	*Total*
State Taxes			
Dividends	380	127	507
Social Security – Employee Contributions	907	299	1,206
Social Security – Employer Contributions	1,608	530	2,138
Sales Tax	30,376	21,376	51,752
Business Property Tax	69,418	48,851	118,269
Business Motor Vehicle	3,431	2,415	5,846
Non-taxes	13,792	9,706	23,498
Other Business Tax	7,915	5,570	13,485
Personal Fines & Fees	4,598	1,659	6,257
Personal Motor Vehicle	2,269	819	3,088
Personal Property Tax	522	188	710
Other Personal Taxes	4,492	1,620	6,112
Personal Income taxes	18,687	6,742	25,429
Corporate Profits Taxes	12,688	4,259	16,947
Total State & Local Taxes	171,083	104,161	275,244
Federal Taxes			
Social Security – Employee Contributions	17,658	17,658	35,316
Social Security – Employer Contributions	22,944	22,944	45,888
Excise Tax	7,662	7,662	15,324
Custom Duty	3,233	3,233	6,466
Proprietor Income	2,812	2,812	5,624
Corporate Profits Tax	28,413	28,413	56,826
Personal Income Tax	20,503	20,503	41,006
Total Federal Tax	103,225	103,225	206,450
Mining Specific Taxes & Royalties			
State Severance Tax		145,063	145,063
Federal Mineral Royalty		225,978	225,978
Total Mining Specific Taxes		371,042	371,042
Total All Taxes	274,308	578,428	852,736

Appendix C: Economic Impacts of wind turbines by state

Table C1: Montana economic impacts per Montana 2 MW wind turbine

	Construction			
	2013 dollars			
	Gross Output	*Value Added*	*Wages*	*Jobs*
Direct	864,061	410,170	359,780	8.3
Indirect	302,705	143,732	85,577	2.1
Induced	325,712	183,305	102,678	2.9
Total	1,492,479	737,206	548,036	13.4
	Operation (annual)			
Direct	20,022	11,787	6,040	0.1
Indirect	5,698	2,864	1,567	0.0
Induced	5,528	3,111	1,742	0.0
Total	31,248	17,762	9,349	0.2
	Total Impacts			
Direct	884,083	421,957	365,820	8.4
Indirect	308,403	146,596	87,144	2.1
Induced	331,240	186,416	104,420	2.9
Total	1,523,727	754,968	557,385	13.6

Appendix D: Fiscal Impacts of wind turbines by state

Table D1: Montana fiscal impacts per 2 MW wind turbine

	2013 Dollars	
Tax Category	***Construction***	***Operation***
State Taxes		
Dividends	42	2
Social Security – Employee Contributions	366	7
Social Security – Employer Contributions	648	13
Sales Tax	8,296	563
Business Property Tax	18,959	1,287
Business Motor Vehicle	937	64
Non-taxes	3,767	256
Other Business Tax	2,162	147
Corporate Profits Tax	1,401	53
Personal Income Tax	9,089	152
Personal Fines & Fees	2,236	37
Personal Motor Vehicle	1,104	19
Personal Property Tax	254	4
Other Personal Taxes	2,185	37
Total State & Local Taxes	51,445	2,639
Federal Taxes		
Social Security – Employee Contributions	21,583	420
Social Security – Employer Contributions	28,044	546
Excise Tax	2,974	202
Custom Duty	1,255	85
Proprietor Income	5,259	49
Corporate Profits Tax	9,345	352
Personal Income Tax	27,640	463
Total Federal Tax	96,098	2,118
Wind Specific Taxes		
State Severance Tax	4,220	286
Total All Taxes	151,763	5,043