Appendix W

Economic Impact Analysis Methodology

APPENDIX W
ECONOMIC IMPACT ANALYSIS METHODOLOGY

INTRODUCTION

This appendix describes the methods and data that underlie the economic impact modeling analysis. Input-output models such as the Impact Analysis for Planning (IMPLAN) model, an economic impact analysis model, provide a quantitative representation of the production relationships between individual economic sectors. Thus, the economic modeling analysis uses information about physical production quantities and the prices and costs for goods and services. The inputs required to run the IMPLAN model are described in the following narrative and tables. The resulting estimates from the IMPLAN model, by alternative, are in **Chapter 4**, Environmental Consequences, **Section 4.22**, Social and Economic Impacts (Including Environmental Justice). The first portion of the following information describes general aspects of the IMPLAN model and how it was used to estimate economic impacts. The remaining sections provide additional detailed data used in the analysis for livestock grazing, oil and gas, coal and wind energy.

THE IMPLAN MODEL

IMPLAN is a regional economic model that provides a mathematical accounting of the flow of money, goods, and services through a region's economy. The model provides estimates of how a specific economic activity translates into jobs and income for the region. It includes the ripple effect (also called the multiplier effect) of changes in economic sectors that may not be directly impacted by management actions, but are linked to industries that are directly impacted. In IMPLAN, these ripple effects are termed indirect impacts (for changes in industries that sell inputs to the industries that are directly impacted) and induced impacts (for changes in household spending as household income increases or decreases due to the changes in production). Because IMPLAN incorporates regional trade data, it is able to separate the economic impact received by a specific region from the impact that is felt beyond the selected geographic area. The estimates reported below for output, employment and earnings reflect only the share supported in the primary and secondary study areas.

This analysis used IMPLAN 2011. This means that parameters such as productivity and trade data reflect estimates for the study area released in the 2011 IMPLAN version. These parameters typically do not meaningfully change from one year to another and would likely not be substantially affected by more recent growth trends in employment or output in specific sectors. Prior to running the model, cost and price data were converted to a consistent dollar year (2011) using sector-specific adjustment factors from the IMPLAN model. The values in this appendix are expressed in year 2011 dollars.

The current IMPLAN model has 440 economic sectors, of which 331 are represented in the Primary and 384 are represented in the Secondary Socioeconomic Study Area counties. This analysis involved direct changes in economic activity for 38 IMPLAN economic sectors, as well as changes in all other related sectors due to the ripple effect. The IMPLAN production coefficients were modified to reflect the interaction of producing sectors in the Primary and Secondary Socioeconomic Study Areas. As a result, the calibrated model does a better job of generating multipliers and the subsequent impacts that reflect the interaction between and among the sectors in the Primary and Secondary Socioeconomic Study Areas compared to a model using unadjusted national coefficients.

Key variables used in the IMPLAN model were filled in using data specific to the Primary and Secondary Socioeconomic Study Areas, including employment estimates, labor earnings, and total industry output. This data was used to estimate labor productivity and earnings per job. As explained above, recent growth trends in employment and output in specific sectors in the study area would not likely affect these parameters.

The trade data available in the current version of IMPLAN (Version 3.0) make it possible to do multi-region analysis to track how an impact on any of the IMPLAN sectors in the study area affects production in any of the sectors in any other region of the US. For this analysis, this feature allowed the estimation of how an impact in the primary study area disperses into the secondary study area, and how these effects in the secondary study area create additional local effects in the primary study area. As a result, it was possible to estimate not only the jobs and income generation in the primary study area, but to also estimate how the economic activity in the primary study area affected jobs and income generation in the secondary study area.

LIVESTOCK GRAZING

Economic impacts from changes to livestock grazing are a function of the amount of forage available and the economic value of forage.

Forage availability was measured in animal unit months (AUMs), with one AUM defined as the amount of forage needed to feed a cow, one horse, or five sheep for one month. For Forest Service data, measurements in AUMs were also obtained. Data were obtained from the BLM's Rangeland Administration System (BLM 2012a) and from the Forest Service's INFRA range module (Forest Service 2013). Two types of AUM measures were used: Active AUMs and Billed AUMs. Active AUMs measure the amount of forage from land available for grazing. The Forest Service designates this measure "permitted" AUMs. Billed AUMs measure the amount of forage that the BLM and Forest Service bill for annually. The Forest Service uses the designation "authorized" AUMs. Impacts were estimated for the range between billed and active AUMs.

Data for Alternatives A, B, D and E were for 2011. Estimates of Active and Billed AUMs under Alternative C1 were obtained by using GIS to remove AUMs intersecting with sage-grouse habitat. In doing so, all allotments containing sage grouse habitat were considered closed for grazing (and not just the portion with sage grouse habitat). Estimates for Active and Billed AUMs for Alternative C2 assume 60 percent of the AUMs made unavailable under Alternative C1 are made unavailable under Alternative C2. **Section 4.22** discusses the possibility of Billed AUMs not being reduced in proportion to reductions in Active AUMs under Alternatives C1 and C2.

Table W.1, below, shows estimated Animal Unit Months by management unit under each Alternative. Data for National Forests corresponds only to AUMs in the portion of those National Forests within the study area and with sage-grouse habitat.

Table W.1
Estimated Annual Animal Unit Months on Federal Lands, 2011

	Active			Billed		
	Alternative A, B, D and E	Alternative C1	Alternative C2	Alternative A, B, D and E	Alternative C1	Alternative C2
Cedar City FO	139,816	66,229	110,381	95,643	45,039	75,401
Fillmore FO	256,674	229,493	245,802	165,696	141,354	155,959
GSENM	76,816	74,896	76,048	30,153	28,639	29,547
Kanab FO	18,686	9,695	15,090	5,937	681	3,834
Moab FO	89,648	89,648	89,648	53,981	53,981	53,981
Price FO	100,375	87,530	95,237	59,536	53,213	57,007
Richfield FO	98,462	83,032	92,290	79,760	68,598	75,295
Salt Lake FO	176,398	78,370	137,187	153,381	72,706	121,111
Vernal FO	127,839	36,150	91,163	75,407	25,602	55,485
Sawtooth NF	12,348	0	7,409	12,348	0	7,409
Dixie NF	38,843	0	23,306	38,843	0	23,306
Fishlake NF	69,707	0	41,824	69,707	0	41,824
Manti-Lasal NF	55,561	0	33,337	55,561	0	33,337
Uinta-Wasatch-Cache NF	44,441	0	26,665	44,441	0	26,665
Ashley NF	43,329	0	25,997	43,329	0	25,997
Total	1,348,943	755,043	1,111,383	983,723	489,813	786,159

Sources: Calculated based on data from BLM 2012a and Forest Service 2013. Billed AUMs for Forest Service are a 10-year average and, for this reason, may be higher than Active AUMs in 2011.

The economic value of forage is estimated based on the value of production associated with the forage. Values for cattle and sheep are estimated separately, and other grazing animals are considered of negligible commercial value.

Due to price fluctuations, average per-AUM values for cattle and sheep are based on the 2002 to 2011 average value of production estimates from the (US Department of Agriculture, Economic Research Service 2012). The value for cattle is $51.19 per AUM, and the value for sheep is $58.01 per AUM in the Primary Socioeconomic Study Area (in 2011 dollars). Including indirect and induced impacts, the value of one AUM in the Primary Socioeconomic Study Area

for cattle is $102.12 and for sheep is $127.11 (in 2011 dollars). **Table W.2**, Assumptions for Analysis of Impacts on Output for Livestock Grazing, shows the economic impact assumptions for cattle and sheep. The direct economic impact is the estimated change in livestock output per AUM; IMPLAN generates the indirect and induced impacts.

Table W.3, Assumptions for Analysis of Employment Impacts for Livestock Grazing, provides a summary of the employment impacts that would result, according to IMPLAN, based on unit changes in livestock AUMs.

Table W.2
Assumptions for Analysis of Impacts on Output for Livestock Grazing

Economic Impact	Primary Study Area	Primary and Secondary Study Area
Cattle		
Direct Economic Impact ($/AUM)	$51.19	$51.19
Indirect Economic Impact ($/AUM)[1]	$44.22	$49.39
Induced Economic Impact ($/AUM)[2]	$6.71	$9.08
Total Economic Impact ($/AUM)	$102.12	$109.66
Multiplier (Total Impact/Direct Impact)	1.99	2.14
Sheep		
Direct Economic Impact ($/AUM)	$58.01	$58.01
Indirect Economic Impact ($/AUM)[1]	$59.85	$67.76
Induced Economic Impact ($/AUM)[2]	$9.25	$12.53
Total Economic Impact ($/AUM)	$127.11	$138.30
Multiplier (Total Impact/Direct Impact)	2.19	2.38

Note: All dollar values are in 2011 dollars.
[1] Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the livestock industry.
[2] Induced impacts reflect increased demand in the consumer and government sectors.

Table W.3
Assumptions for Analysis of Employment Impacts for Livestock Grazing

Employment Impact	Primary Study Area	Primary and Secondary Study Area
Cattle		
Direct Employment (Jobs/1,000 AUMs)	0.559	0.559
Indirect Employment (Jobs/1,000 AUMs)	0.456	0.486
Induced Employment (Jobs/1,000 AUMs)	0.067	0.087
Total Employment (Jobs/1,000 AUMs)	1.081	1.132
Multiplier (Total Impact/Direct Impact)	1.93	2.03
Average Earnings per Job (2011 dollars)	$36,738	$36,738
Sheep		
Direct Employment (Jobs/1,000 AUMs)	0.980	0.980
Indirect Employment (Jobs/1,000 AUMs)	0.760	0.801
Induced Employment (Jobs/1,000 AUMs)	0.087	0.110
Total Employment (Jobs/1,000 AUMs)	1.827	1.891
Multiplier (Total Impact/Direct Impact)	1.86	1.93

Table W.3
Assumptions for Analysis of Employment Impacts for Livestock Grazing

Employment Impact	Primary Study Area	Primary and Secondary Study Area
Average Earnings per Job (2011 dollars)	$15,408	$15,408

Note: Direct, indirect, and induced employment impacts and average earnings per job are calculated using IMPLAN.

OIL AND GAS

The economic impact of oil and gas reflects drilling, completion, and production activities. Estimation of drilling, completion, and production activities was done for a 15-year period (2014 to 2028).

The number of wells drilled and the number of wells completed under the No Action Alternative (Alternative A) were based on the average number of wells expected to be drilled or completed per year in each BLM field office's current Reasonable Foreseeable Development Scenario. Completion rates ranged from 10 percent in most counties to 85 percent for oil wells in Carbon and Duchesne counties and for gas wells in Uintah County. Drilling and completion numbers were estimated for federal surface, as well as for all surface ownership.

The BLM oil and gas specialists estimated the share of oil and gas that would intersect with GRSG habitat using GIS. The number of wells completed or drilled that would be affected by each alternative is the number that intersects with GRSG habitat, as appropriate for each alternative:

- Alternative A – Existing areas would be available for fluid mineral leasing
- Alternative B – some GRSG occupied habitat would be designated as priority habitat and would be closed to new fluid mineral leasing
- Alternative C – All GRSG occupied habitat would be designated as priority habitat and would be closed to new fluid mineral leasing
- Alternative D – Some GRSG occupied habitat would be designated as priority habitat but would not be closed to new leasing. Rather, NSO would be placed within 4-miles of an occupied lek
- Alternative E – Based on the State of Utah's Sage-Grouse Management Plan, minor constraints would be placed on management areas.

Only wells in new leases were considered to be affected by GRSG management. In addition, the BLM assumed that leases on state and private lands would be affected similarly to federal lands, if large areas of contiguous BLM-administered land are closed to new oil and gas leasing.

Table W.4, Oil and Gas Well Numbers, presents the total number of wells drilled and completed in the Primary Socioeconomic Study Area for each alternative.

Table W.4
Oil and Gas Well Numbers in New Leases in GRSG Habitat, 15-Year Period

Item	Primary Study Area
Federal Surface	
Alternative A – Wells Drilled	268
Alternative A – Wells Completed	207
Alternative B – Wells Drilled	157
Alternative B – Wells Completed	125
Alternative C – Wells Drilled	0
Alternative C – Wells Completed	0
Alternative D – Wells Drilled	204
Alternative D – Wells Completed	156
Alternative E – Wells Drilled	268
Alternative E – Wells Completed	207
Federal, State, and Fee Surface	
Alternative A – Wells Drilled	356
Alternative A – Wells Completed	276
Alternative B – Wells Drilled	216
Alternative B – Wells Completed	173
Alternative C – Wells Drilled	0
Alternative C – Wells Completed	0
Alternative D – Wells Drilled	271
Alternative D – Wells Completed	207
Alternative E – Wells Drilled	356
Alternative E – Wells Completed	276

Sources: Elaborated by BLM staff based on field office Reasonable Foreseeable Development Scenarios and available information

The production per new well was assumed based on the typical production of existing wells in the area. Each well was assumed to have a 20-year life and 75 percent of its lifetime production would be reached during the 15-year period. Total oil and gas production under Alternative A was based on multiplying production per well and the number of wells drilled and completed (estimated as described above). The production that would be affected by each alternative is proportional to the share of wells affected by GRSG habitat, as appropriate for each alternative. **Table W.5**, Projected Oil and Gas Production, 15-Year Period, presents the projected quantity of oil and gas over the 15-year forecast period on federal surface and on federal, state, and fee surface.

The costs of drilling and completing wells and producing oil and gas also are relevant for the economic impact analysis. Cost of completion or drilling per well were assumed to sum to $3,250,000, a mid-point in the $1,500,000 to $5,000,000 range typical for the region (BLM 2013a). IMPLAN was used to generate output, employment, and earnings multipliers per million dollars of expenditures. These multipliers were then applied to the estimated expenditures with drilling and completion by alternative to obtain the resulting impacts. **Table W.6**, Assumptions for Analysis of Economic Impacts for Oil and Gas Well Drilling and Completion, provides a summary of the costs of drilling and completion used for the economic analysis.

Table W.5
Projected Oil (MBO) and Gas (MMCF) Production in New Leases in GRSG Habitat, 15-Year Period

Alternative A		Alternative B		Alternative C		Alternative D		Alternative E	
Gas	Oil	Gas	Oil	Gas	Oil	Gas	Oil	Gas	Oil
Federal Surface									
189,759	5,250	111,428	3,600	0	0	143,422	3,900	189,759	5,250
Federal, State, and Fee Surface									
234,992	9,450	134,597	7,650	0	0	177,623	6,900	234,992	9,450

Sources: Elaborated by BLM staff based on field office Reasonable Foreseeable Development Scenarios and available information (BLM 2013a).
MMCF = million cubic feet; MBO = thousand barrels

Table W.6
Assumptions for Analysis of Economic Impacts for Oil and Gas Well Drilling and Completion

Economic Impact	Primary Study Area	Primary and Secondary Study Area
Drilling Impacts		
Total Drilling Costs[1]	$1,581,225	$1,581,225
Total Local Drilling Costs[2]	$1,387,397	$1,387,397
Local Direct Impact ($/well)	$1,387,397	$1,387,397
Local Indirect Impact ($/well)	$288,595	$462,057
Local Induced Impact ($/well)	$308,692	$418,811
Local Total Impact ($/well)[3]	$1,984,684	$2,268,265
Multiplier (total impact/direct impact)	1.43	1.63
Completion Impacts		
Total Completion Costs[1]	$1,668,775	$1,668,775
Total Local Completion Costs[2]	$1,014,729	$1,014,729
Local Direct Impact ($/well)	$1,014,729	$1,014,729
Local Indirect Impact ($/well)	$244,048	$376,782
Local Induced Impact ($/well)	$231,683	$314,021
Local Total Impact ($/well)[3]	$1,490,460	$1,075,532
Multiplier (total impact/direct impact)	1.47	1.68

Source: Drilling and completion costs (the first row in each part of the table) were based on the mid-point of a range provided by BLM staff (BLM 2013a), $3,250,000 per well. Remaining data is from IMPLAN, as described in the text.
[1]Conventional wells. In the case of coalbed natural gas wells, a drilling cost of $503,431 (local cost of $420,075) was assumed. Completion costs for coalbed natural gas wells were assumed to be $996,569 (local cost of $542,101). Coalbed natural gas costs correspond to the lower end of the range provided by BLM (2013), based on the notion that coalbed natural gas wells are typically cheaper than conventional wells.
[2]The local cost shares correspond to the percent of total drilling or completion costs that would be spent on goods and services purchased from the local economy and were assumed based on regional experience.
[3]Total impacts estimated using IMPLAN include direct, indirect, and induced impacts.

Table W.7, Assumptions for Analysis of Economic Impacts on Output for Oil and Gas Production, provides the assumptions used to determine the economic impact associated with the production of oil and gas. For the analysis, the BLM estimated a nonlabor production cost (for gas) of $4.23 per thousand cubic feet and $82.53 per barrel of oil, in year 2011 dollars, based on data from the Energy Information Administration for the Rocky Mountain Region (Energy Information Administration 2013).

The forecasted number of wells and production used for estimating employment impacts is the same as for estimating impacts on labor earnings and output. **Table W.8**, Assumptions for Employment Impact Analysis for Oil and Gas Well Drilling and Completion, shows the direct and total employment impacts attributable to drilling and completion.

Table W.9, Assumptions for Employment Impact Analysis for Oil and Gas Production, shows the direct and total employment impacts associated with production.

Table W.7
Assumptions for Analysis of Economic Impacts on Output for Oil and Gas Production

Economic Impact	Primary Study Area	Primary and Secondary Study Area
Oil Production (per thousand barrels)		
Direct Economic Impact[1]	$82,530[2]	$82,530[3]
Indirect Economic Impact[4]	$8,309	$12,123
Induced Economic Impact[5]	$2,924	$4,573
Total Economic Impact	$93,763	$99,226
Multiplier (total impact/direct impact)	1.14	1.20
Gas Production (per million cubic feet)		
Direct Economic Impact[1]	$4,230.00	$4,230.00
Indirect Economic Impact[4]	$425.87	$621.35
Induced Economic Impact[5]	$149.89	$234.40
Total Economic Impact	$4,805.75	$5.085.75
Multiplier (total impact/direct impact)	1.14	1.20

Note: All dollar values are in year 2011 dollars.
[1]Direct economic impact is the market value of output.
[2]Based on an oil price of $82.53 per barrel, which is the 2011 Utah Crude Oil First Purchase Price reported by the US Energy Information Administration (EIA 2013).
[3]Based on a gas price of $4,23 per thousand cubic feet, which is the 2010 Utah Natural Gas Wellhead Price reported by the US Energy Information Administration (EIA 2013).
[4]Indirect impacts from IMPLAN reflect increased demand in sectors that directly or indirectly provide supplies to the oil and gas industry.
[5]Induced impacts from IMPLAN reflect increased demand in the consumer sectors.

Table W.8
Assumptions for Employment Impact Analysis for Oil and Gas Well Drilling and Completion[1]

Employment Impact	Primary Study Area	Primary and Secondary Study Area
Drilling Impacts		
Direct Employment (jobs/well)	8.0	8.0
Indirect Employment (jobs/well)	2.5	3.4
Induced Employment (jobs/well)	3.0	3.8
Total Employment Impact (jobs/well)	13.5	15.2
Multiplier (Total Impact/Direct Impact)	1.69	1.90
Average Earnings per Job (2011 dollars)	$51,377	$51,337
Completion Impacts		
Direct Employment (jobs/well)	6.3	6.3
Indirect Employment (jobs/well)	2.1	2.8
Induced Employment (jobs/well)	2.2	2.8
Total Employment Impact (jobs/well)	10.6	11.9
Multiplier (Total Impact/Direct Impact)	1.68	1.89
Average Earnings per Job (2011 dollars)	$49,031	$49,108

Note: Direct and total employment impact and average earnings per job are calculated using IMPLAN.
[1]Conventional wells. Multipliers for coalbed natural gas wells are considerably smaller: 4.3 total jobs per well drilled in the primary study area and 5.3 jobs per well completed.

Table W.9
Assumptions for Employment Impact Analysis for Oil and Gas Production

Employment Impact (annual number of jobs per thousand barrels or million cubic feet)	Primary Study Area	Primary and Secondary Study Area
Oil Production (per thousand barrels)		
Direct Employment	0.028968	0.028968
Indirect Employment	0.067014	0.087647
Induced Employment	0.027978	0.040935
Total Employment	0.123960	0.157550
Multiplier (Total Impact/Direct Impact)	4.28	5.44
Average Earnings per Job (2011 dollars)	$52,485	$52,242
Gas Production (per million cubic feet)		
Direct Employment	0.001485	0.001485
Indirect Employment	0.003435	0.004492
Induced Employment	0.001434	0.002098
Total Employment	0.006353	0.008075
Multiplier (Total Impact/Direct Impact)	4.28	5.44
Average Earnings per Job (2011 dollars)	$52,485	$52,242

Note: Direct, indirect, and induced employment impact and average earnings per job are calculated using IMPLAN.

The analysis of potential changes in tax revenues is based on tax rates of 12.5 percent of taxable value for federal mineral royalties and 5 percent of taxable value for state severance taxes: Utah severance tax rates are 5 percent for value above a minimum, so 5 percent is an upper bound (University of Utah 2010). Taxable value was assumed to be 87.5 percent of value of sales based on a report for neighboring Colorado.[1] **Table W.10**, Tax Collections from Oil and Gas Production, Annual Average, 2011 $ shows tax collections for the annual average production under each alternative.

COAL

The economic impact of coal production is estimated based on the volume of coal produced and the sales price of coal. BLM projected coal production in the State of Utah to 2028 based on information from the US Energy Information Administration (EIA) and the Utah Geological Survey (BLM 2013; Utah Geological Survey 2010). These projections incorporate expected future trends of related prices and quantities (e.g. the price of gas). Although these projections include coal from San Juan County, which is not part of the Study Area for this EIS, the coal from San Juan would not be affected by the choice of alternatives and therefore does not affect the comparison of alternatives. For the estimation of the impacts of the alternatives on coal production, the following assumptions were made, based on information in various documents:

- 77 percent of all production is from federal mineral lands
- New coal leases would be required for underground coal production from 2017 onwards
- BLM made the assumption for analysis purposes only that no new subsurface leasing would occur in priority habitat (for Alternative B) or occupied habitat (for Alternative C). The idea that closing GRSG habitat to new leases would effectively preclude underground coal mining represents a worst-case scenario because nothing in this alternative would preclude leasing of subsurface materials.
- The Alton coal field would generate 1,840,000 tons of coal per year starting in 2016 from surface coal mining, under Alternatives A, D and E (BLM 2011). For analytical purposes only, this coal is assumed to be produced entirely from federal lands. BLM assumed that no production would occur from the Alton coal field in Alternatives B and C, based on it being a surface mine. To the extent that some underground mining of the deposit could still occur, accessed through surrounding non-Federal lands, this assumption of no production under alternatives B and C may overstate the actual impacts of those alternatives.

[1] This was based on information available for the State of Colorado from the Colorado Oil and Gas Association (Colorado Oil and Gas Association 2011). Valuation for Utah may be slightly above or below this number.

Table W.10
Tax Collections from Oil (MBO) and Gas (MMCF) Production, 15 Year Period, 2011 $

	Alternative A		Alternative B		Alternative C		Alternative D		Alternative E	
	Gas	Oil	Gas	Gas	Gas	Oil	Gas	Oil	Gas	Oil
Total production	189,759	5,250	$111,428.25	$3,600	0	0	143,423	3,900	189,759	5,250
Prices	$4,230	$82,530	$4,230	$82,530	$4,230	$82,530	$4,230	$82,530	$4,230	$82,530
Assessed valuation	87.5%	87.5%	87.5%	87.5%	87.5%	87.5%	87.5%	87.5%	87.5%	87.5%
Assessed value	$702,345,499	$379,122,188	$412,423,810	$259,969,500	$0	$0	$530,842,528	$281,633,625	$702,345,499	$379,122,188
Federal royalties rate	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%
Federal royalty tax	$87,793,187	$47,390,273	$51,552,976	$32,496,188	$0	$0	$66,355,316	$35,204,203	$87,793,187	$47,390,273
State severance rate	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
State severance tax	$35,117,275	$18,956,109	$20,621,191	$12,998,475	$0	$0	$26,542,126	$14,081,681	$35,117,275	$18,956,109
Total taxes	$122,910,462	$66,346,383	$72,174,167	$45,494,663	$0	$0	$92,897,442	$49,285,884	$122,910,462	$66,346,383

Source: Production volumes elaborated by BLM staff based on field office Reasonable Foreseeable Development Scenarios and available information. Prices are from Energy Information Administration (2013). Assessed valuation percentage is based on information available for Colorado (Colorado Oil and Gas Association 2011).
MMCF = million cubic feet; MBO = thousand barrels

The estimated annual average volume of coal produced on federal lands under each alternative is presented in **Table W.11** below.

Table W.11
Estimated Annual Average Coal Production on Federal Lands in Utah (tons), 2014-2028

	Underground	Surface	Total
Alternative A	15,291,616	1,594,667	16,886,283
Alternative B	13,150,790	0	13,150,790
Alternative C	12,080,377	0	12,080,377
Alternative D	15,291,616	1,594,667	16,886,283
Alternative E	15,291,616	1,594,667	16,886,283

Source: BLM 2013b

Estimates of the impacts of coal production were developed using IMPLAN and assuming a price for underground coal of $33.80 per ton, which is the EIA's 2011 coal price estimate for Utah (EIA 2013), and a price of $23.86 per ton for surface coal. The price for surface coal is estimated as the average between the price for underground coal for Utah and the price of surface mining in Wyoming's Powder River Basin (used as a reference). The basis for this is the fact that the Alton mine coal is expected to have 10,000 BTU per pound (BLM 2011). Surface coal mined from the Powder River Basin in Wyoming contains about 8,800 BTU per pound and has an average price of $13.56 per ton. The EIA estimates the price of underground coal in Utah to be $33.80 per ton based on 11,700 BTU per pound of coal. The simple average in prices would approximate the expected BTU for the coal from the Alton mine.

Table W.12 and **Table W.13** show the multipliers for output and employment, respectively, estimated for coal.

Table W.12
Assumptions for Analysis of Impacts on Output for Coal

Economic Impact	Primary Study Area	Primary and Secondary Study Area
Underground		
Direct Economic Impact ($/MT)	$33,800	$33,800
Indirect Economic Impact ($/MT)[1]	$8,147	$15,218
Induced Economic Impact ($/MT)[2]	$5,305	$8,258
Total Economic Impact ($/MT)	$47,251	$57,276
Multiplier (Total Impact/Direct Impact)	1.40	1.69
Surface		
Direct Economic Impact ($/MT)	$23,680	$23,680
Indirect Economic Impact ($/MT)[1]	$5,149	$7,886
Induced Economic Impact ($/MT)[2]	$3,018	$4,357
Total Economic Impact ($/MT)	$31,847	$35,923
Multiplier (Total Impact/Direct Impact)	1.34	1.52

Source: IMPLAN; Note: All dollar values are in 2011 dollars.
[1]Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the coal industry.
[2]Induced impacts reflect increased demand in the consumer and government sectors.

Table W.13
Assumptions for Analysis of Impacts on Employment for Coal

Employment Impact	Primary Study Area	Primary and Secondary Study Area
Underground		
Direct Employment (jobs/MT)	0.089502	0.089502
Indirect Employment (jobs/MT)	0.048266	0.079295
Induced Employment (jobs/MT)	0.050768	0.073988
Total Employment Impact (jobs/MT)	0.188536	0.242785
Multiplier (Total Impact/Direct Impact)	2.11	2.71
Average Earnings per Job (2011 dollars)	$63,113	$61,601
Surface		
Direct Employment (jobs/MT)	0.044862	0.044862
Indirect Employment (jobs/MT)	0.026481	0.038363
Induced Employment (jobs/MT)	0.028898	0.039331
Total Employment Impact (jobs/MT)	0.100241	0.122556
Multiplier (Total Impact/Direct Impact)	2.23	2.73
Average Earnings per Job (2011 dollars)	$65,666	$63,715

Source: IMPLAN; Note: All dollar values are in 2011 dollars.
[1]Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the coal industry.
[2]Induced impacts reflect increased demand in the consumer and government sectors.

Potential changes in tax revenues associated to Federal mineral royalties are estimated based on a 12.5 percent royalty rate for surface coal and 8 percent royalty rate for underground coal (BLM). The value of coal output under each alternative was estimated as discussed above. **Table W.14**, Estimated Coal Royalties in Primary Study Area, 15-Year Period shows royalties collections for the estimated production under each alternative.

Table W.14
Estimated Coal Royalties in Primary Study Area, 15-Year Period

	Alternatives A, D and E			Alternative B			Alternative C		
	Underground	Surface	Total	Underground	Surface	Total	Underground	Surface	Total
Mtons	15,292	1,595	16,886	13,151	0	13,151	12,080	0	12,080
Output (2011 $000)	$516,857	$37,762	$554,619	$444,497	$0	$444,497	$408,317	$0	$408,317
Royalties (%)	8.0%	12.5%		8.0%	12.5%		8.0%	12.5%	
Royalties (2011 $000)	$41,349	$4,720	$46,069	$35,560	$0	$35,560	$32,665	$0	$32,665

WIND ENERGY

The economic impact of wind energy depends on the expenditures made with installation and operations of wind farms. Expenditures made in the Primary Study Area were estimated based on the amount of electricity (nameplate capacity in megawatts, MW) projected under each alternative, and the installation and operations costs per MW.

BLM projected 17,328 acres of reasonably foreseeable wind development in the Hamlin and Bald Hills Sage-Grouse population areas, under Alternative A. Using Utah's Milford Wind Corridor Project as a baseline, BLM estimated that this would correspond to approximately 210 MW of installed capacity. The same installed capacity would be projected under Alternative E. Based on GIS analysis, 121 MW would be potentially installed under Alternatives B, C and D.

Installation and operations costs per MW were obtained from default values for the State of Utah used by the Jobs and Economic Development Impact (JEDI) model. The JEDI model for wind energy was developed by the National Renewable Energy Laboratory and default values for construction and operation costs per MW were determined based on extensive interviews with power generation project developers, state tax representatives, and others in the appropriate industries (NREL 2012). Default values were based on projects of 100 MW (50 turbines of 2,000 kilowatts each) and were estimated to be, in 2008 dollars, $2,000 per kilowatt for installed project costs and $20 per kilowatt for operations and maintenance costs.

Tables W.15 and W.16 below show the estimated multipliers for output and employment during installation and operations.

Table W.15
Assumptions for Analysis of Impacts on Output for Wind Energy

Economic Impact	Primary Study Area	Primary and Secondary Study Area
	Installation	
Direct Economic Impact ($/MW)	$303,774	$303,774
Indirect Economic Impact ($/MW)[1]	$53,862	$94,884
Induced Economic Impact ($/MW)[2]	$46,892	$67,484
Total Economic Impact ($/MW)	$404,527	$466,142
Multiplier (Total Impact/Direct Impact)	1.33	1.53
	Operations	
Direct Economic Impact ($/MW)	$17,176	$17,176
Indirect Economic Impact ($/MW)[1]	$572	$845
Induced Economic Impact ($/MW)[2]	$5,390	$6,664
Total Economic Impact ($/MW)	$23,138	$24,685
Multiplier (Total Impact/Direct Impact)	1.35	1.44

Source: IMPLAN. Note: All dollar values are in 2011 dollars.
[1]Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the installation and operations of wind farms.
[2]Induced impacts reflect increased demand in the consumer and government sectors.

Table W.16
Assumptions for Analysis of Impacts on Employment for Wind Energy

Employment Impact	Primary Study Area	Primary and Secondary Study Area
	Installation	
Direct Employment (jobs/MW)	1.77	1.77
Indirect Employment (jobs/MW)	0.37	0.57
Induced Employment (jobs/MW)	0.45	0.61
Total Employment Impact (jobs/MW)	2.58	2.94
Multiplier (Total Impact/Direct Impact)	1.46	1.67
Average Earnings per Job (2011 dollars)	$40,834	$42,141
	Operations	
Direct Employment (jobs/MW)	0.24	0.24
Indirect Employment (jobs/MW)	0.01	0.01
Induced Employment (jobs/MW)	0.05	0.06
Total Employment Impact (jobs/MW)	0.29	0.30
Multiplier (Total Impact/Direct Impact)	1.24	1.28
Average Earnings per Job (2011 dollars)	$41,985	$42,157

Source: IMPLAN. Note: All dollar values are in 2011 dollars.
[1]Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the installation and operations of wind farms.
[2]Induced impacts reflect increased demand in the consumer and government sectors.

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