The Impact of Otter Creek Coal Development on the Montana Economy

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Acknowledgements

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0. Executive Summary

This is a study of the effects on the Montana economy of the development of Otter Creek coal in southeastern Montana. As described below, the Bureau of Business and Economic Research at The University of Montana, using a state-of-the-art policy analysis model and publicly available data describing the timing and type of investments involved, produced a detailed assessment of the ultimate impact of coal development and operations -- including the construction and operations of the railroad -- on employment, income, output, and population in the Montana economy.

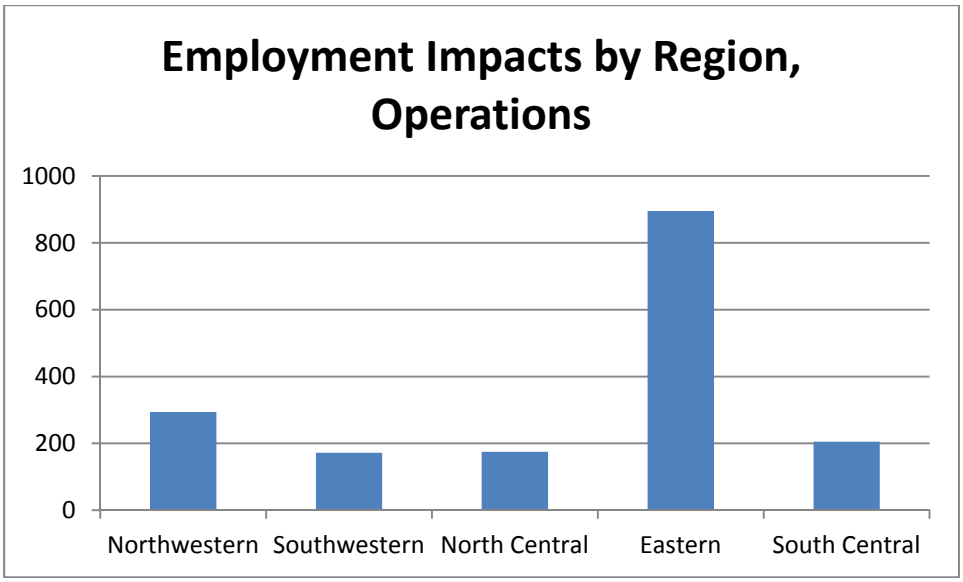
Impacts Summary

	Impacts by Phase	
Category	Construction	Operations
Total Employment	2,648 Jobs	1,740 Jobs
Private Sector	2,372 Jobs	1,338 Jobs
Personal Income	$103.5 million	$125.4 million
Disposable Personal Income	$87.7 million	$167.9 million
Population	1,025 people	2,843 people
State tax revenues	$23.5 million	$91.6 million

This study finds that with the Otter Creek coal development the state economy would be significantly larger, more prosperous, and more populous than would otherwise be the case. Specifically, we find that as a result of the development of the first of the three Otter Creek tracts, ultimately producing 20 million tons of coal, that:

- 2,648 jobs would be created during the peak year of the construction phase as the mine facilities and the railroad are built, with most new jobs created in eastern Montana;
- The impacts on income received by Montana households would be similarly substantial, with $103.5 million of new personal income and $87.7 million in after-tax income occuring during the peak construction year statewide. In eastern Montana, total household earnings would increase more than 8 percent;
- As a result of the continuing operations of the mine, 1,740 new permanent, year-round jobs would be created in the Montana economy, increasing household income by $125.4 million per year;
- Job increases would occur across a wide spectrum of industries, and, largely due to rail operations, in most regions of the state;
- Overall state population would be almost 2,850 higher and school-aged population more than 560 higher due to the operations of the mine.

- Mine operations would increase state and local tax revenue by more than $91 million per year due to both coal-specific taxes as well as growth in the overall base for Montana's other taxes.



Background and Overview

The University of Montana Bureau of Business and Economic Research at (BBER) was engaged by the Montana Contractors' Association to conduct an empirical study of how the development of the Otter Creek coal tracts in southeastern Montana would impact the economy of the state. Specifically, the BBER was tasked with (i) developing and detailing a scenario of coal development in Otter Creek, including land preparation, building, and other infrastructure preparation, and transportation improvements, including rail, (ii) developing a scenario of ongoing coal production from a new mine that reflected the capacity of the tracts, the likely limitations of a mining permit, and the conditions of the global coal marketplace, and (iii) incorporating these scenarios into an economic impact model which would fully describe how the state economy (and its subregions) would evolve should these events take place. This report presents the findings of this analysis.

This study asks and answers a simple question: How would be economies of Montana and it sub-regions react if Otter Creek coal development takes place? To address this question, we construct two future economic scenarios – a baseline, no development scenario and a coal development scenario. The difference between these two alternative futures – in the number of jobs, the dollars of income, and the number of people who live in Montana -- is the ultimate impact of the development of coal.

The coal development scenario incorporated into this study was independently developed by the BBER using publicly available information from public filings, historical

data, and the information available on other mining projects. The scenario is broadly consistent with the expected scale of the project and what is economically and operationally feasible. Thus, the results reported here are representative of how the investments and operations associated with the coal (and railroad) development will affect statewide growth.

Research Overview

The core question posed by this study is: What would the Montana economy look like if Otter Creek coal development takes place? The question essentially involves analyzing two different futures for the Montana economy: the status quo, no-investment scenario where development does not occur and a coal development scenario which includes mining, transportation, and other associated infrastructure. The latter represents a stimulus which can set off other actions and reactions in the economy.

There are three essential components to estimating the ultimate impact of new investment. These are:

- the *direct impact* (e.g., spending) the investment itself represents,
- the *indirect impacts*, which are the spending of other entities (e.g., the railroad) which are carried out by others because of the original investments, and
- the *induced impacts* that occur as the spending represented by the direct and indirect impacts propagates through the economy.

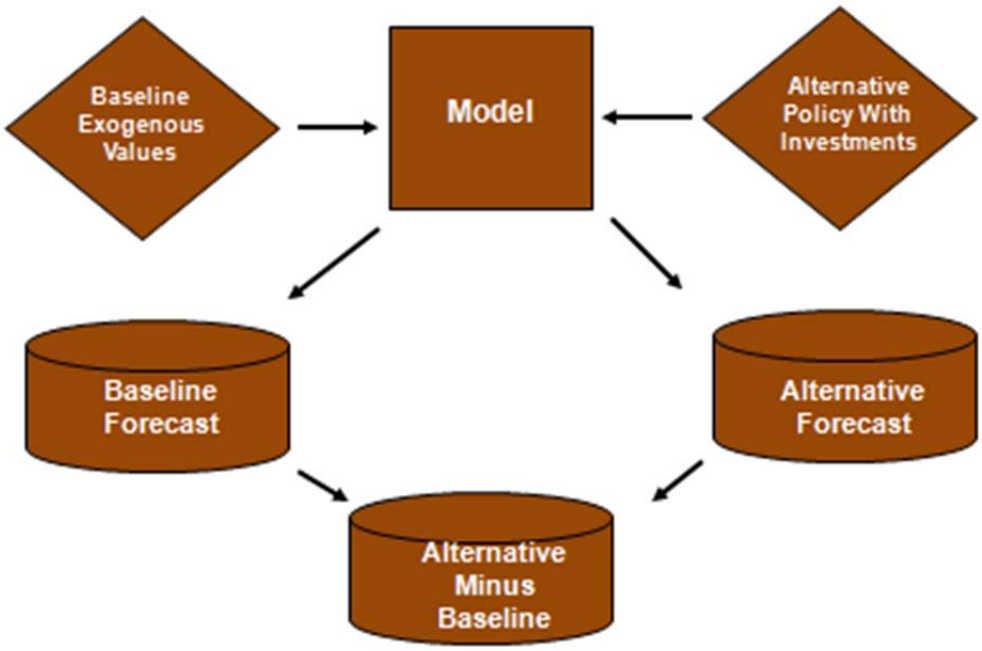
Likewise there are two different stages of any project involving significant infrastructure development:

- the *permitting and construction phase* - a one-time boost in spending and investment -- that occurs in the beginning of a project -- to plan and build infrastructure, facilities and, buildings, and
- the *operations phase* - commencing when construction is complete and ongoing operations can begin. The operations phase continues for the life of the project.

Although the precise timetable and scale of the investments that could take place as part of development of the Otter Creek coal tracts are not yet known, reasonable scenarios can be constructed based on development of similar coal seams elsewhere. This study has carefully constructed a development scenario that faithfully represents the major investments that would have to take place to develop and produce Otter Creek coal. The induced impacts, which take place as wage, vendor, and other payments are captured by Montana businesses and households and are spent again in the state and local economies, are estimated using BBER's five-region economic impact model.

To quantify the impacts of events that influence the Montana economy, the BBER uses a mathematical model of the regional economy leased from Regional Economic Models, Inc. (REMI). The fundamental premise of the REMI model is that regions compete for investment, jobs, and people. Thus, when new events occur which change the competitiveness of one particular region – such as construction and development of mining operations – investment, employment, and demographic flows in and out of the region can be affected, ultimately producing new levels of economic activities. The model thus produces impact estimates by examining the economy before and after these new events take place.

The total contribution of Otter Creek development to the economy is the difference between these two scenarios, as shown diagrammatically in the figure below. The model is a means of estimating the economy's new "resting point," which includes the changes in investment, employment, and spending that are induced by the project.



The Direct and Indirect Economic Contribution of Otter Creek Coal

The first step in the analysis is to specify the timing and the extent of spending by Arch Coal on developing the mine. Before a shovel full of Otter Creek coal can be mined, a number of regulatory, engineering, and logistical tasks must be carried out. The construction of all of the infrastructure of the mine, including land preparation, road, rail, and power distribution construction, equipment acquisition, construction of buildings and on-site processing facilities, and, finally, the excavation of the initial overburden, will take approximately two years at a cost of about $600 million.

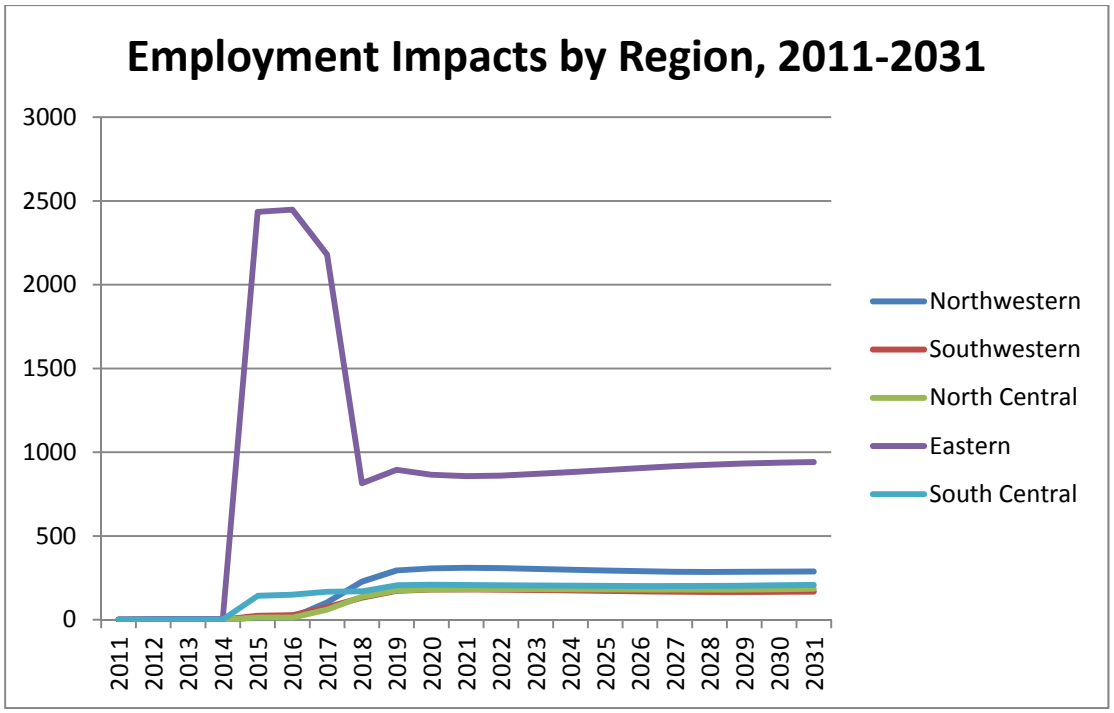
It is anticipated that when construction is completed that the Otter Creek mine will produce 20 million tons of coal annually, with approximately 300 full-time employees, plus an additional 50 contractors. We expect that the mine mouth value of this coal will be $14 per ton. We anticipate that the dominant market for this coal will be Asia, with coal shipped by rail to the (new and existing) Pacific northwest coal ports. Significant domestic customers are expected as well.

The development of the railroad represents by far the most significant indirect impact of mine development. While transporting coal by truck is possible, the economic competitiveness of the mine depends critically on access to the rail transportation network. Coincident with mine construction, we envision a new 89-mile rail spur north to connect to the main BNSF line near Miles City at a cost of about $472 million. When operational, new and existing rail links – including those owned by both BNSF and Montana Rail Link (MRL) – within Montana will see approximately $340 million in new demand for rail transportation services due to mining operations.

The Economic Impact of Otter Creek Coal

The substantial amount of spending and production occurring in both the construction and operations phases of this project represents a tremendous new injection of revenue and income for Montana businesses and households. This sets off new investment, employment, and demographic flows as secondary jobs and income are created. The investment ultimately produces a new level of economic activity, with jobs and incomes affected across the spectrum of the economy. The difference between this new level of activity and the status quo projection represents the total economic impact of Otter Creek coal.

We can measure how Otter Creek direct and indirect impacts propagate through the Montana economy with the REMI model. Comparing the trajectory of the economy with and without coal development yields an estimate of the impact of Otter Creek over the next 20 years. As can be seen from the employment impacts graphed below, with the tremendous activity in the construction phase of the project, the impacts of the project in the beginning of the project are outsized, especially in the eastern Montana region. When the construction is complete and mining operations commence, the job impacts remain significant, growing slightly over the span of the next two decades.



Since the investment and spending patterns in the construction and operations phases of the project are distinct, we present the findings of the analysis for the two phases separately. In the discussion that follows, we define the construction phase impacts as the total impacts that occur in year 2016, the peak year. The operations impacts are defined as the impacts occurring in year 2019, when all construction impacts are finished. All dollar figures are inflation-corrected, expressed in terms of 2012 dollars.

Employment Impacts

The wide footprint of the mine's economic impacts can be seen very clearly from the distribution of new jobs by industry, shown in the table below. As would be expected, the majority of jobs in the construction phase are construction industry jobs, and in the operations phase a large number of new mining jobs are created. But in each phase there are significant ripple effects on other sectors of the economy. These include retail trade, health care, accommodations and food, and local government. The increases come about through a variety of mechanisms – some industries benefit directly from worker spending, some are due to other businesses related through the supply chain, still others come about because of population increases as people migrate to the state because of the new jobs.

The analysis shows that mine and other associated construction supports almost 2,650 new jobs statewide, and that mine operations creates more than 1,700 new permanent jobs in the Montana economy.

Employment Impacts

Industry	Job Impacts by Phase	
	Construction	Operations
Forestry, Fishing, Related Activities, and Other	0	0
Mining	(3)	346
Utilities	0	6
Construction	1,948	79
Manufacturing	4	3
Wholesale Trade	41	66
Retail Trade	129	235
Transportation and Warehousing	0	51
Information	1	3
Finance and Insurance	2	7
Real Estate and Rental and Leasing	12	45
Professional and Technical Services	30	44
Management of Companies and Enterprises	0	0
Administrative and Waste Services	25	43
Educational Services	1	7
Health Care and Social Assistance	69	165
Arts, Entertainment, and Recreation	5	20
Accommodation and Food Services	54	116
Other Services, except Public Administration	54	103
State Government	37	71
Local Government	240	331
TOTAL	2,648	1,740

Income Impacts

The impacts on Montanan's personal income as a result of Otter Creek coal investment stem from three separate mechanisms. First, income is created – both wage and salary income, as well as business proprietor income – as the new jobs described above are created. Secondly, as population increases due to increased Montana job opportunities, the total income of the state increases. The final way in which Otter Creek coal impacts after-tax income of Montanans has to do with the substantial tax

revenues paid by the mine. How these revenues would be dealt with by the Legislature is unknown. The conservative assumption made in this study is that the increased revenues allow the Legislature to fund the same amount of services with lower tax rates. These lower rates increase the after-tax income of Montana households.

As shown in the table below, the personal income impacts of Otter Creek development are substantial – amounting to $103.5 million in the construction phase and $125.4 million in permanent increases during mine operation. The increase in after-tax income during coal operations exceeds the pre-tax increase, amounting to a $167.9 million increase in Montana household purchasing power every year the mine is in operation.

Personal Income Impact, Millions of Dollars

Category	Income Impacts by Phase	
	Construction	Operations
Total Earnings by Place of Work	$123.0	$119.4
Total Wage and Salary Disbursements	81.9	88.1
Supplements to Wages and Salaries	21.0	25.5
Employer contributions for employee pension and insurance funds	13.5	16.3
Employer contributions for government social insurance	7.5	9.2
Proprietors' income with inventory valuation and capital consumption adjustments	20.2	5.8
Less: Contributions for government social insurance	15.8	18.3
Employee and self-employed contributions for government social insurance	8.3	9.1
Employer contributions for government social insurance	7.5	9.2
Plus: Adjustment for residence*	-1.7	-1.2
Gross earnings flows into Montana	2.2	2.1
Gross earnings flows out of Montana	3.9	3.3
Equals: Net earnings by place of residence	105.6	99.9
Plus: Rent, interest, and dividends	5.8	19.0
Plus: Personal current transfer receipts	-7.8	6.6
Equals: Personal Income	103.5	125.4
Less: Personal current taxes	15.7	-42.4
Equals: Disposable personal income	87.7	167.9

* Total earnings data are derived from records of employers who are located in Montana. Since some Montana workers are employed by out-of-state firms, and some Montana firms employ workers from other states, the adjustment for residence nets out these two impacts to produce an estimate of Montana residents' income.

Other Impacts

Mine operations, as well as construction, also have other significant impacts on the Montana economy, including:

- significant increases in population, in both eastern Montana as well as the entire state, as workers migrate into the state and region in pursuit of economic opportunities;
- an increase in the school-aged population as younger workers bring their young (or yet to be born children) into the state;
- increases in local government, primarily in local public schools, in response to population changes caused by the mine development and operation;
- increases in state and local tax revenues due to both (i) severance and other special taxes levied on coal, and (ii) an increase in the base of Montana's other major taxes.

Summary and Conclusion

Through an analysis of the direct, indirect, and induced economic activity surrounding the development of Otter Creek coal, we find that the total economic contribution such an activity would make to the state economy to be substantial. The construction of the mine, the new railroad construction, and the other associated infrastructure represents a total investment approaching $1 billion and is expected to create more than 2,600 construction jobs in the peak building year. The operations of the mine are expected to create more than 1,700 permanent jobs in the Montana economy and add almost $168 million in after-tax income annually. Those jobs would benefit all regions of the state as well as a broad spectrum of public and private sector businesses.

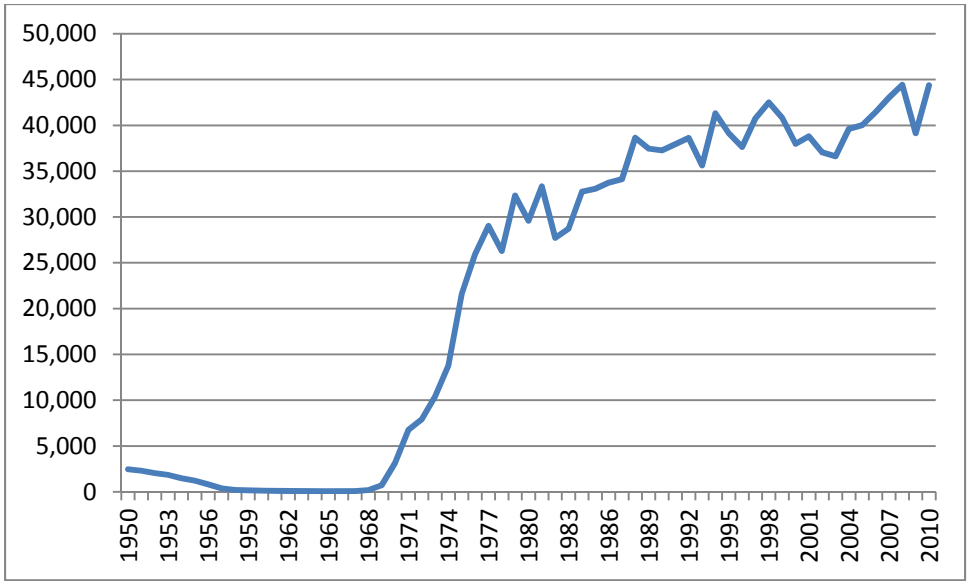
1. Background and Overview

1.1 Montana Coal: History and Prospects

Coal mining has a long history in Montana. In the age of steam, underground mines near Red Lodge, Roundup, and elsewhere supplied coal to railroads and the industrial facilities in the Butte-Anaconda area. In addition, numerous small underground and surface mines provided coal to local homes and businesses. By the 1960s, diesel locomotives and other energy sources reduced Montana coal production to practically zero.

Montana's current coal mining industry began with the Arab oil boycott of 1973 and the resulting energy crunch. There were numerous proposals to use Powder River Basin coal to produce synthetic natural gas and other fuels. In addition, the naturally low sulfur content of Powder River coal made it an attractive boiler fuel for electric utilities attempting to comply with newly formulated emission regulations. One federal study published in 1975 predicted that Montana coal production would be between 34 and 64 million tons in 1980 and from 39 to 153 million tons in 1985 (Northern Great Plains Resource Program, 1975, p. 40). A later federal-state study released in 1979 predicted Montana coal production would be 39.3 million tons in 1980 and 49.7 million tons in 1985 (U.S. Department of the Interior and Montana Department of State Lands, 1975, pp1-3).

Figure 1.1
Montana Coal Production, Thousands of Tons

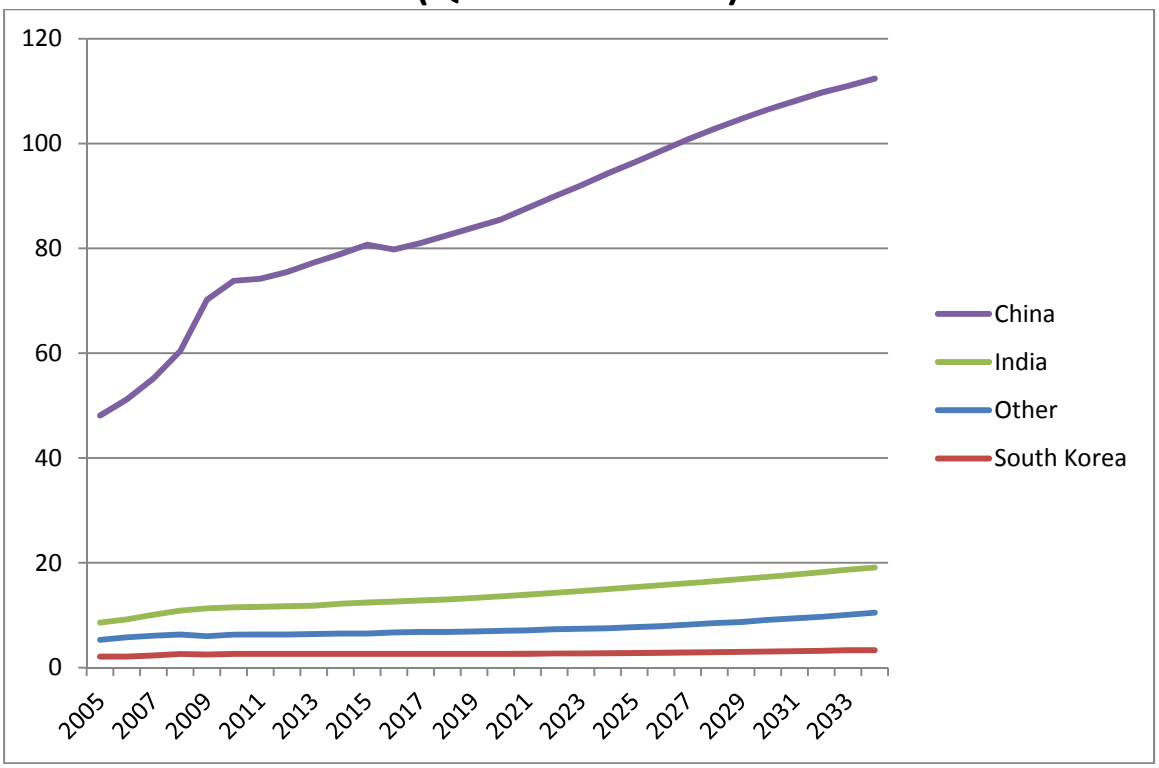


Source: Montana Coal Council.

The 1970s' forecasts for Montana production of the Powder River Basin were far too rosy. There were a number of reasons for this over-optimism. First, synthetic fuel production never materialized. Second, changes in federal emission regulations made low-sulfur coal less attractive. Third, Wyoming coal mines are closer via rail to large metro areas in the southeast and southern Midwest and they received the benefits of the fast urban growth. Finally, the nationwide demand for electricity moderated due to rising prices (Polzin, 1985).

Montana's coal production has been relatively stable over the last four decades. In 1981, about 33.3 million tons of coal was being produced at six large surface mines in eastern Montana. The more recent trends are pictured in Figure 1.1. Total Montana coal production has been between 40 and 45 million tons per year since 2000, with only a mild upward trend since the 1990s.

Figure 1.2
Actual and Predicted Asian Coal Demand
(Quadrillion BTUs)



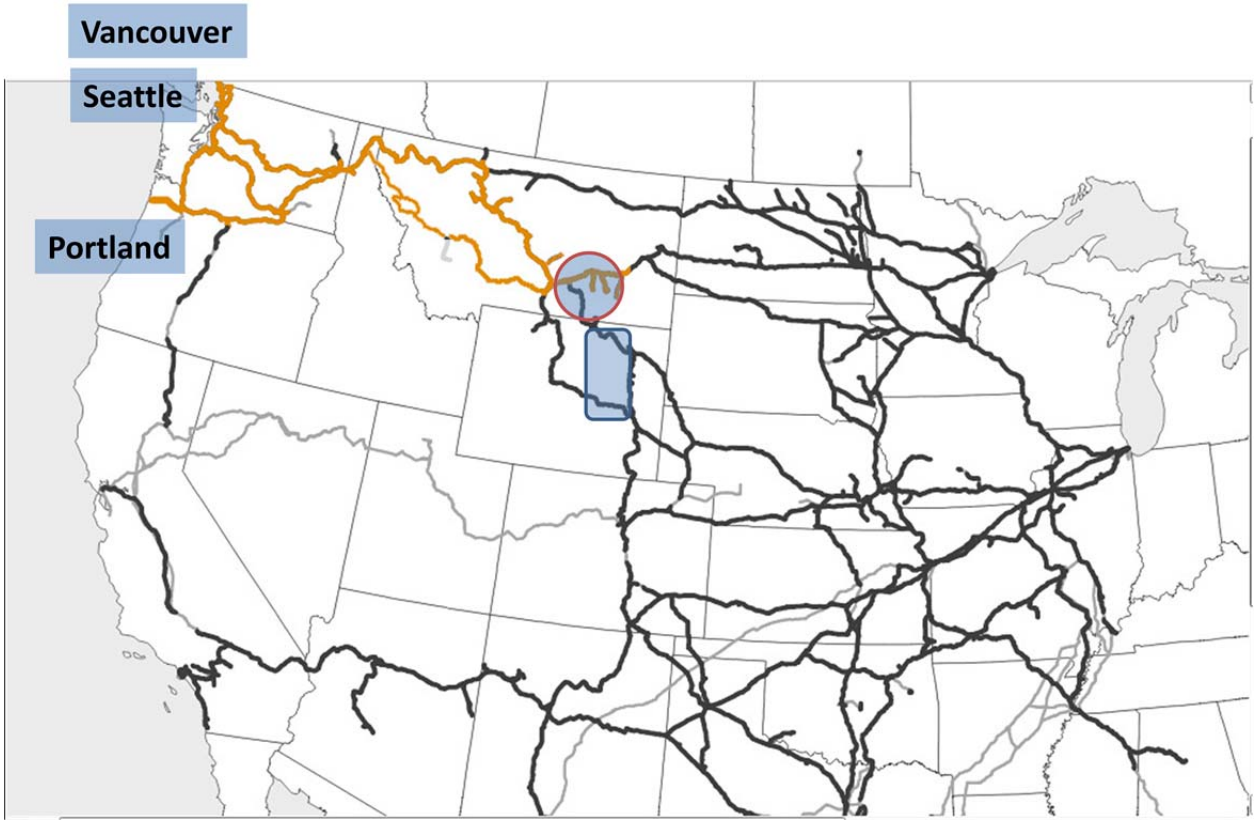
Source: U.S. Energy Information Administration (EIA), International Energy Statistics database (www.eia.gov/ies, accessed November, 2011).

Since the 1970s' renewal, Montana coal has been primarily used to fire electrical generating plants and most is transported by train to cities in the northern Midwest. In

addition, significant amounts of coal are burned for electric generation near the mine site at Colstrip and small amounts are transported west toward the Pacific Northwest. Domestic markets are unlikely to provide significant growth for Montana coal. The overall production of U.S. coal has been stable or declining due increased environmental concerns about coal-fired electric generating plants.

The same is not true in Asia, especially Southeast Asia, where coal demand is mushrooming. As shown in Figure 1.2, the annual demand for coal in China and elsewhere in the region is projected to grow significantly between 2010 and 2035. The data in Figure 1.2 are measured in Btus rather than tons to correct for quality differences between different types of coal. To put this growth into perspective, the increase from 2010 to 2035 in China alone is more than twice the current U.S. production of coal. If this growth in Asian demand materializes, it would have some very favorable impacts on Montana. There is not sufficient capacity in Southeast Asia to satisfy this growth, so coal would have to be imported by boat from other places. There are currently only a couple of bulk loading facilities in the Northwest that can handle coal, and they are in British Columbia. But there are proposals for several more on the Washington and Oregon coast.

Figure 1.3
Major Rail Lines Serving Powder River Basin and Destination Markets



Source: BNSF Railway, System Map.

Figure 1.3 depicts the rail lines in the Northern Great Plains and Pacific Northwest along with Montana and Wyoming in the Powder River Basin. It takes only quick glance to see that the Montana coal fields are closer to Northwest ports than the Wyoming coal fields. The transportation situation may now be reversed. Just as Wyoming was in a favorable geographic position to serve the fast growth in the south and east, Montana is now better situated to serve these fast growing Asian markets.

1.2 Otter Creek Coal

In the mid-1990s the U.S. government bought property adjacent to Yellowstone National Park on which the mining company Noranda proposed to develop a gold mine, called the New World mine. Governor Marc Racicot, citing the revenue that would be lost to the state because the mine would not be developed, asked the federal government for compensation. The federal government offered Montana a choice: $10 million, or the Otter Creek coal tracts located near Ashland in Powder River County. The State of Montana chose the coal.

The Otter Creek coal tracts have not yet been developed because they have a checkerboard ownership pattern. Great Northern Properties owns slightly more than half of the 1.3 billion tons of coal and the State of Montana owns the remainder. Montana invited bids for its coal in 2009. Arch Coal was chosen as the successful bidder. Since Arch Coal already leased the coal owned by Great Northern Properties, the checkerboard ownership problem no longer inhibits the development of these deposits.

The development phase for these tracts is just beginning and few specifics have been developed. Some preliminary work has begun as the Montana Department of Environmental Quality has determined that the Arch Coal's application to begin prospecting is administratively complete.

The state's 2009 appraisal of the tracts envisioned two surface mines each producing roughly 35 million tons per year. Projects of this scale would roughly triple Montana's coal production. Very conservatively, there would be at least 500 new mining jobs, which would place them among the largest industrial employers in the state. In addition, a new railroad would have to be constructed connecting the mines with the BNSF mainline to the north.

The new mines would be subject to administrative review before they could begin production. The mine operator would have to submit detailed operating and reclamation plans to the Montana Departments of Natural Resources and Conservation (DNRC) and Environmental Quality (EQC) for permitting review pursuant to the Montana Environmental Policy Act (MEPA).

1.3 The Impact of Coal Operations and Development

It is difficult to compare the economic contribution to the state economies coal mining makes in different states. Mining technology, the quality, quantity, and placement of coal seams, access to markets, and the vintage of equipment can all play a major role in productivity, production and impacts. But some studies carried out for coal mines in the western United States can at least frame the analysis. Studies of new developments for surface mining of other minerals can be relevant as well.

- A 2010 study conducted by the University of Utah found that the 24.3 million tons of coal mined annually from Utah employed 1,888 people, and that the operations induced an additional 2,815 jobs to be created in the state economy.

- A study of the new development of a proposed surface copper mine in Arizona conducted by Arizona State University in 2010 found that the project would generate about 3,600 jobs and $152 million in personal income while under construction, with operations supporting about 2,100 jobs and $143 million per year.

- A 2005 study conducted by the University of Wyoming of different production scenarios for Powder River Basin coal and natural gas in Wyoming found that a "low" production ramp up scenario that increased coal production by about 145 million tons per year contributed to an increase of about 12,500 jobs in a six-county region of the state.

All of these studies made use of the REMI model -- which we also employ in this study -- to estimate economic impacts. These studies confirm that the development of coal and other surface mined mineral reserves represent large-scale projects with commensurate large economic impacts.

1.4 Report Overview

The remainder of this report proceeds as follows. In the next section we introduce the policy analysis model that is used in this study to estimate economic impacts of Otter Creek coal development, and describe the basic philosophy behind its construction. As we shall describe, the task of estimating economic impacts involves carefully assessing the direct investments and spending (direct impacts) of both the Otter Creek mine as well as the Tongue River railroad. This is carried out in the following two sections. Section 5 presents the results of the analysis, followed by conclusions in the last section.

2. Policy Analysis with the REMI Model

Economic impacts occur because of events or activities that create new expenditures. Spending which is new – which is over and above existing expenditures and does not simply displace spending elsewhere in the region – not only adds to economic activity in its own right, but it also induces further spending as the recipients of wages, sales and tax revenues spend a portion of their income in the local economy. Changes in the path of investment, migration, and prices and wages are possible as well.

The basic tool used in this study to assess the economic contribution of Otter Creek is an economic model, calibrated to represent the interactions in the Montana economy, leased from Regional Economic Models, Inc.. The REMI model is one of the best known and most respected analytical tools in the policy analysis arena and has been used in more than a hundred previous studies as well as dozens of peer-reviewed articles in scholarly journals. It is a state-of-the-art econometric forecasting model that incorporates dynamic feedbacks between economic and demographic variables. The REMI model forecasts employment, income, expenditures and populations for counties and regions based on a model containing over 100 stochastic and dynamic relationships as well as a number of identities. A full explanation of the design and operation of the model can be found in Treyz (1988).

The model used in this study disaggregated the state economy into five regions: Northwest, Southwest, North Central, South Central, and Eastern. It explicitly recognizes trade flows that exist between these regions, as well as between the regions and the rest of the world. The definition of the regions is shown in Figure 2.1 below.

Figure 2.1
Economic Regions

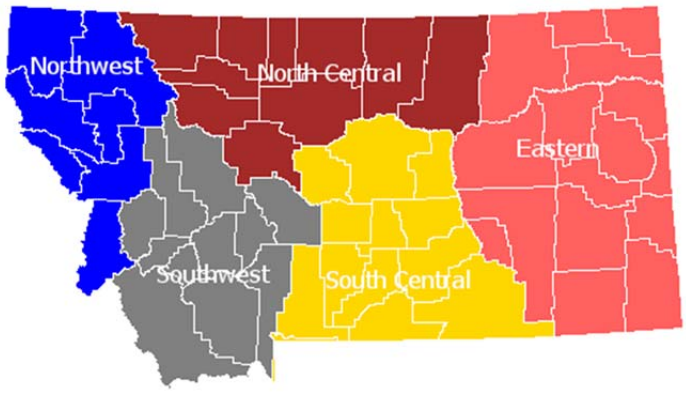
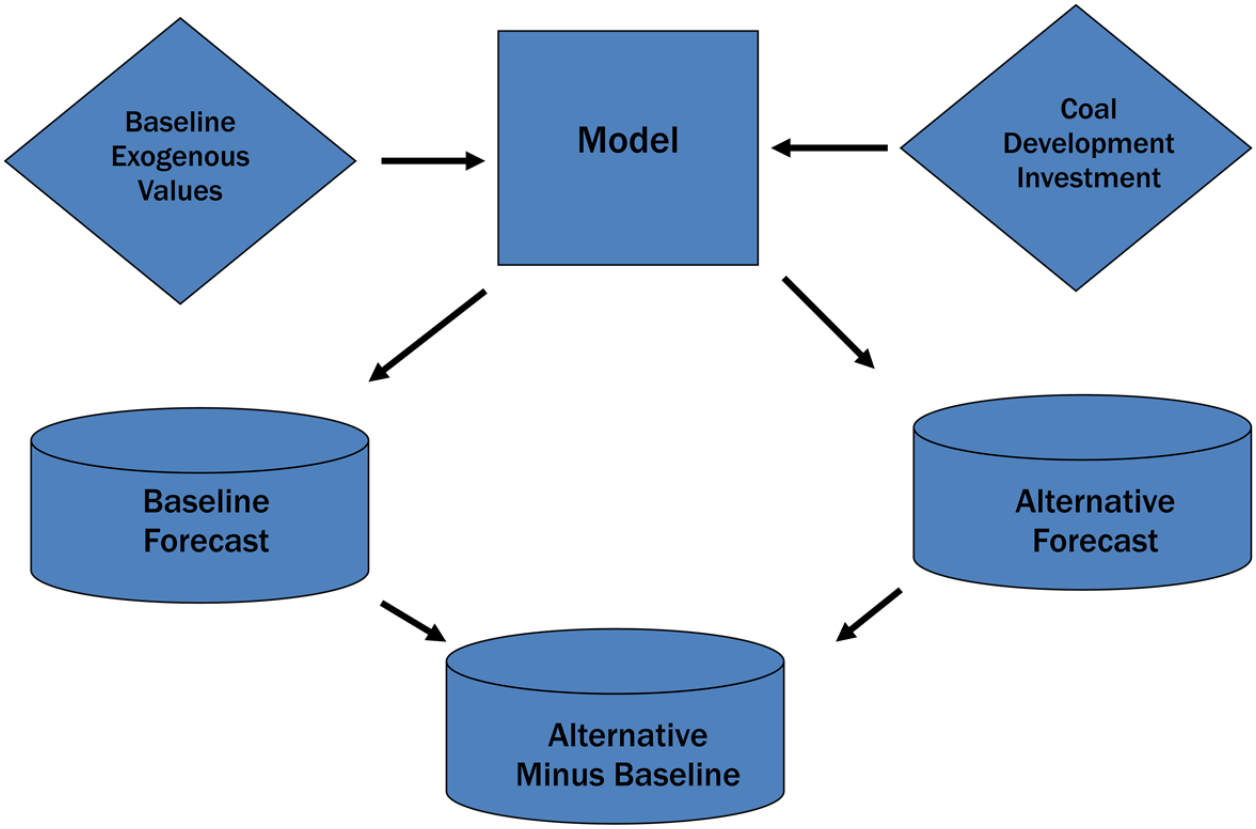


Table 2.1

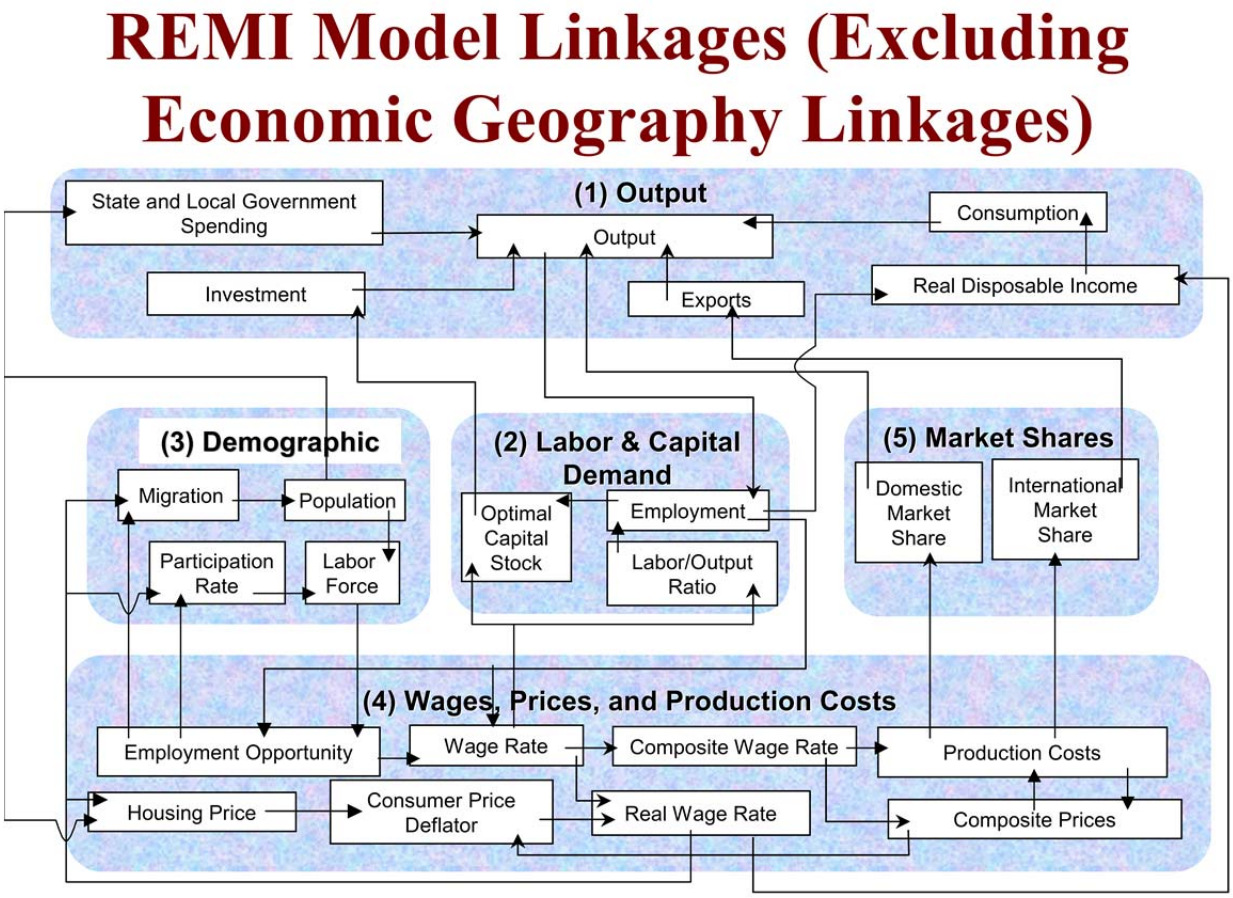
Eastern Montana Counties

Carter	Powder River
Custer	Prairie
Daniels	Richland
Dawson	Roosevelt
Fallon	Rosebud
Garfield	Sheridan
McCone	Valley
Phillips	Wibaux

Figure 2.2
Policy Analysis with the REMI Model



The use of the model to derive the results of this study is illustrated graphically in Figure 2.2. First, a baseline projection of the economy is produced using the model, utilizing inputs and assumptions which extrapolate growth and conditions of recent history. The model is then used a second time, with identical inputs – except that in this alternative scenario, the activity associated with coal development (including rail) is added. Thus the Otter Creek development is an input that ultimately produces a different economy, reflecting not only the addition of the production, employment, and expenditures of the project, but how the rest of the economy reacts to those changes. The difference between the baseline and alternative scenarios of the economy represents the economic impact of Otter Creek coal development.



The model utilizes historical data on production, prices, trade flows, migration and technological change to calibrate the relationship between five basic blocks of the regional economy as depicted above: output, labor and capital demand, population and labor force, wages and prices, and market shares. The changes in production, labor demand and intermediate demand caused by the construction and operation of Otter Creek causes these blocks of the economy to react and adjust to a new equilibrium. As described above, the difference between the baseline and the alternate scenario is the ultimate impact of coal development.

The essential philosophy of the model is that regions throughout the country compete for investment, jobs, and people. When events occur in a region they set off a chain reaction of actions causing dollar flows toward better investment and production opportunities, followed over time by a flow of workers and households toward employment opportunities and higher wages. The model embodies an 82-sector input-output matrix that describes the technological interdependence of production sectors of the economy, as well as extensive trade and capital flow data to determine the share of each sector's demand that can be met by local production.

The model is extremely well suited for the analysis described in this report. As seen in several of the energy studies listed in the references section, it has been used for similar analyses of energy-related investment and opportunities.

As powerful and flexible as the model is, the answers it provides are only as good as the questions posed to it. The majority of work in this study is carefully crafting the inputs used to construct a scenario of the Montana economy that faithfully represents all of the investments and production that encompass Otter Creek coal development. We now turn to this task.

3. The Direct Economic Contribution of Otter Creek Construction and Operations

A careful specification of the scale and timing of the investments and income flows that would occur if Otter Creek coal is developed is a critical first step in understanding how that development would ultimately impact economic activity in Montana. Using publicly available information, we have assembled a scenario of coal investment and operations that is (i) operationally and financially feasible, (ii) consistent with the coal production potential of the Otter Creek tracts, and (iii) consistent with mining developments planned or conducted elsewhere. While the precise spending and timing of actual development that unfolds in the coming years will doubtless deviate from this scenario, it faithfully represents the scale of the investment that is under consideration.

The greenfield development of even a small portion of the estimated 1.3 billion ton Otter Creek coal reserves is a major undertaking. In order to transform a single tract of the approximately 19,200 acres of public and private land in Powder River County from its current agricultural use into an operating coal mine facility, years of contractual, regulatory, engineering, and legal challenges must be addressed and hundreds of millions of dollars expended. Infrastructure to support the mine must also be planned, approved, and constructed, including significant new construction in the railroad network. The overall project would represent one of the largest industrial developments in Montana's modern history.

In this section we detail a development scenario for mining permitting, construction, and operations. In the next section we describe the investments and income flows associated with the rail transport of Otter Creek coal. Jointly these activities represent sizable one-time and continuing income flows to the economy of the state. How those new flows ultimately impact jobs and income in Montana – the central research question of this report – is then assessed using the REMI model as a tool, and the development scenario developed here as the main input.

3.1 The Permitting Phase

Broadly speaking, the permitting, or pre-construction phase of coal development in Otter Creek has been underway since the Montana Land Board voted to support opening the land to coal development in 2009. Significant resources have been expended for land acquisition, engineering and testing, planning, and for legal and lobbying services. Perhaps the most significant and visible of these is the $85.8 million lease payment made by Arch Coal to the state of Montana in 2010.

Many of these expenditures represent net new income flows to the Montana economy that are attributable to coal development in Otter Creek. Thus it is appropriate to include them as part of the direct economic contributions of the mining development and operation.

The lease payments from Arch Coal to Great Northern Properties, mineral rights owners of the privately held half of the Otter Creek properties, represent a significant investment in coal development. From the standpoint of the Montana economy, however, those payments have largely been directed outside the state. Thus there is no direct impact of this private lease arrangement.

The $85.6 million payment to the state of Montana, on the other hand, was a (one-time) new income stream to the state. It enabled, among other things, a fiscally strapped Legislature to reduce cuts to programs in the 2011-12 biennium that might otherwise have been made. However, it occurred before the beginning of the study period of this project (2012). Its impacts are embedded in the baseline projection of the economy – but not in our estimates of the economic changes caused by development.

The new income flows that were included in this analysis are the costs of the extensive engineering, environmental, and legal analyses and support services that have begun and are expected to continue as part of the preparation of the mining permit application. This creates a demand for approximately $4 million per year for professional and technical services in the state economy during the period 2012-2017.

3.2 The Construction Phase

It is assumed for purpose of this analysis that construction of the mine will commence in the year 2015 and will continue for two years. While the actual date is dependent upon the outcomes of regulatory and/or legal proceedings whose timelines and outcomes are unknown in advance, this construction scenario is consistent with a careful and thorough review of all the relevant permit applications. Events that push back the start date for construction will alter the timing, but not the size, of the ultimate economic impacts.

Construction of the railroad (with the exception of the rail spur that serves the new mine's loading facilities) is considered in the next section. For the mine facility's construction phase there are two broad categories of expenditures: equipment and facilities. Equipment includes the dragline, shovels, haul trucks, water trucks, drills, dozers, and other equipment. Facilities include an office, maintenance shop, warehouse, wash bay, power/water system, power station, road and site preparation, coal storage, coal processing plant, and rail spur and loading loop.

This study had access to three categories of information which could be used to create a construction scenario for the Otter Creek mine. These were:

(i) The Montana Otter Creek Coal Valuation study prepared by Norwest Corporation in 2009 presented construction estimates for the development of two Otter Creek tracts as part of an "income approach" to estimate of

the value of coal leases;

(ii) Construction estimates for other surface mining projects, most notably the Rosemont Copper project in Arizona;

(iii) Conversations with Mike Rowlands, director of Otter Creek Operations for Arch Coal.

This information can be summarized as follows:

Norwest Valuation Study. The Norwest study developed a detailed cost plan for development of two Otter Creek tracts as part of an income approach to lease valuation. Their estimates were based upon an independent engineering analysis and prevailing prices for materials and equipment. The model for one of their tracts, termed LMU5 (logical mining unit) in the report, is close in scale to what is studied in this report. The Norwest study estimates $591.2 million in equipment expenditures and $123.6 million in facilities spending.

Rosemont Copper Project. The development of a 15,000 acre site in Pima County, Arizona, was studied by Arizona State University in 2009 based on a detailed feasibility study made available for the project. While not a description of Otter Creek development, its estimate of $897.2 million in total construction costs for the greenfield development of a surface mine provide some support for the scale of this project.

Arch Coal. Mike Rowlands, director of Otter Creek Operations for Arch Coal, was able to share his estimates of construction costs associated with Otter Creek coal development in several conversations. His estimates of equipment costs, in particular, were informed by the existence of draglines and other major equipment items that are available internally within the company.

Priced in terms of the value of 2012 dollars, we have estimated the broad categories of construction phase expenditures associated with Otter Creek coal development as: equipment expenditures, $400 million, and facilities expenditures, $200 million.

3.3 The Operations Phase

It is projected that the development of Otter Creek coal resources envisioned in this study will create an operating mine that will ultimately produce 20 million tons of coal annually, using a year-round workforce of 300 employees with an additional 50 contractors. Production is assumed to commence in 2017, ramping up to full production levels by year 2009.

New surface mining operations such as the projected Otter Creek mine are capital intensive, with very high levels of productivity per worker. Jobs are projected to pay in the neighborhood of $78,000 per year, not including sizable benefits.

There are significant ongoing purchases from vendors of a wide range of items – from electricity to legal services – that have important ramifications for the Montana economy as a result of coal operations. The subsequent impacts of these and other income flows due to coal operations are derived from the REMI model. One purchase, however – rail transportation services – is large and important enough to be considered in its own right. We turn to that subject in the next section.

4. Construction and Operation of the Tongue River Railroad

4.1 Overview

A rail connection with the BNSF mainline in Miles City is an integral component of the Otter Creek Coal Project. This rail line would provide access to domestic and export markets for coal mined in the Ashland area and other nearby sites.

The Tongue River Railroad was first proposed in the 1970s but was never built. It began as a roughly 90-mile line from Miles City to Ashland. In the 1990s, the original project was expanded to extend the rail line south to connect with Decker (now Cloud Peak) mine at the Montana-Wyoming border. In mid-2011 a large landowner from the Birney area purchased one-third of the proposed railroad and said that the tracks would never cross his land. This effectively nullified the extension south of Ashland. Currently the railroad permits are owned in roughly equal parts by Mars, Inc., BNSF, and Arch Coal.

Then, in late 2011 the Ninth Circuit Court of Appeals in San Francisco ruled that the environmental impact statements were deficient in certain areas and construction could not proceed.

The following paragraphs describe features of the proposed Tongue River Railroad. They are based on the original environmental impact statement, the Ninth Circuit's ruling, and discussions with knowledgeable railroad experts.

The proposed railroad would proceed southeast from Miles City and generally follow the Tongue River to Ashland. For the first 70 miles it would be west of the river on the opposite bank from Highway 332. About 10 miles north of Ashland the railroad would cross the Tongue River and proceed directly south. An approximately 20-mile spur line would connect the Otter Creek mine with the terminus in Ashland. The overall ruling grade of 0.2 percent makes this line very efficient in terms of fuel consumption.

The rail line would occupy an average right-of-way of 200 feet. There would be about four microwave towers linked to a centralized traffic control board in Miles City which would be the primary communication and signaling facilities. There would be either construction or rehabilitation of an interchange yard in Miles City and the construction of a maintenance facility in Ashland. The construction period would be about three years, with the actual construction season being seven or eight months of the year. The rail line would require the construction of six sidings and 12 bridges.

The trains would require a three-person crew, and Miles City would be terminal location for these crews. A 110 car train with each hopper car holding 100 tons of coal would have a capacity of 11,000 tons. The trains could operate 24 hours a day and 350 days per year. Extracting 20 million tons of coal a year would require about 1,800 round trips

per year—or approximate 5.1 per day. Since each round trip requires two trains (one loaded, one empty), extracting 20 million tons per year would be associated with about ten trains per day. The maximum allowable speed on the Tongue River Railroad would be 40 miles per hour.

Two maintenance crews would service the proposed railroad. One crew would be headquartered in Miles City and the other in Ashland. These crews would perform daily maintenance chores as well as cleaning, oiling, and adjusting the switches.

The Tongue River Basin is sparsely populated and semiarid with a mostly agricultural base. Livestock is the dominant agricultural product and most of the land is used for grazing. Only a small portion of the land is used for crops. Only a very small portion of the cropland is irrigated. Dry land farming and irrigated cropland are concentrated in the valley floor near the Tongue River.

4.2 Construction Costs

The major components of railroad construction costs are:

- Acquisition of the right-of-way. For the most part, the right-of way would be approximately 200-feet wide. Sidings and signal devices might require greater width in certain locations.
- Materials and labor. These costs are usually computed as the cost per track foot multiplied by the length of the railroad.
- Construction grade. The average grade of the entire railroad will be an important determinant of fuel costs. The local topology will determine the amount of cut and fill needed to provide an evenly sloped surface between the starting and ending points of the proposed railroad.
- Road crossings. The costs of road crossings is determined by the number of road crossings, the material used at each crossing, the crossing length (i.e. road width), and the type of protection needed (gates, lights, etc.).
- Stream crossings. Depending on the size of the stream, either culverts will be placed under the roadway, a short span bridge built (about 23 feet per span), or a long span bridge (less than 120 feet per span) built.

According to a technical railway website, “A single track freight line with a few locomotives and simple signaling, running across a flat, geologically sound, sparsely populated landscape in a developing country might be built for as little as US$ 2 million per kilometer.” (www.railway-technical.com/finance/shtml). This converts to approximately $3.3 million per mile.

A Texas railroad consultant estimated average construction costs to be about $4.0 million per mile including centralized traffic control and other communications

equipment. For the proposed 89-mile Tongue River Railroad, this yields total construction costs of about $356 million.

The engineering department of the BNSF railroad independently estimated construction costs of the Tongue River Railroad to be about $471 million, or approximately $5.3 million per mile. We chose the BNSF calculation because the engineers are most familiar with the route and terrain associated with the Tongue River Railroad. Construction is assumed to commence in 2015 and continue for three years.

4.3 Railroad Operations

The operations of a coal mine in southeastern Montana will introduce significant new demand for rail transport. From the point of view of the economy, demand for rail transport that originates from a customer in one location is ultimately met by a combination of the local network (self supply) and networks and facilities elsewhere. From the point of view of the Montana economy, supplies of rail services from elsewhere that meet demand originating locally are essentially imports.

Based on mileage calculations to west coast port facilities, and based on an industry average transportation charge of $.03 per ton mile for coal transport, we project that Otter Creek coal production will generate just over a billion dollars of demand for rail transport annually. That new demand results in new business and higher rail employment for all regions of the state.

5. The Economic Impact of Otter Creek Coal Development

5.1 Impacts Summary

The scenario of coal development, including additions to the railroad network, described in the previous two sections represents significant new income and expenditure streams for the Montana economy. As these projects are carried out, and as the facilities go into operation, the economy of the region, and the state as a whole, can be expected to change significantly. We have analyzed these changes using the REMI model, and we detail our findings in this section of the report.

All of the economic impacts described below are total impacts – which include the spending, production, and income of coal miners, as well as those involved with coal transport, and any new jobs in other industries ultimately induced by their spending. As described in section 2 of this report, these impacts are the difference between a "coal" and "no coal" scenario for any given year.

As we describe below, the changes in the economy evolve over time, for two primary reasons. First, the nature of the project changes significantly when facilities are completed and the operations of the mine commence. Specifically, the construction jobs associated with mine and railroad construction do not continue when capital improvements are complete. The second change in economic impacts over time is caused by population migration. The high wage jobs represent an attractive opportunity for non-residents to move to the region. This migration occurs gradually, and over time increases the population and the workforce.

For readability, we present tables in this section detailing impacts for two points in time: the peak construction year (2016) and the first year of the operations-only period (2019). These two time points are termed the "Construction" and "Operations" impacts, respectively. We also present several charts that describe the impacts visually for the entire project period. Detailed impacts for all years can be found in the Appendix.

Summary of Findings

This study finds that as a result of Otter Creek coal development, the state economy is significantly larger, more prosperous, and more populous than would otherwise be the case. Specifically, we find that as a result of the development of the first of the three Otter Creek tracts, ultimately producing 20 million tons of coal, that:

- 2,648 jobs would be created during the peak year of the construction phase as the mine facilities and the railroad are built, with most new jobs created in eastern Montana;

- The impacts on income received by Montana households would be similarly substantial. $103.5 million of new personal income, and $87.7 million in after-tax income, would occur during the peak construction year statewide. In eastern Montana, total household earnings would increase more than 6 percent;
- As a result of the continuing operations of the mine, 1,740 new permanent, year-round jobs would be created in the Montana economy, increasing household income by $125.4 million per year;
- Job increases would occur across a wide spectrum of industries, and, largely due to rail operations, in most regions of the state;
- Overall state population would be more than 2,800 higher, and school-aged population more than 560 higher, due to the operations of the mine.
- Mine operations would increase state and local tax revenue by more than $91.6 million per year, due to both coal specific taxes as well as growth in the overall base for Montana's other taxes.

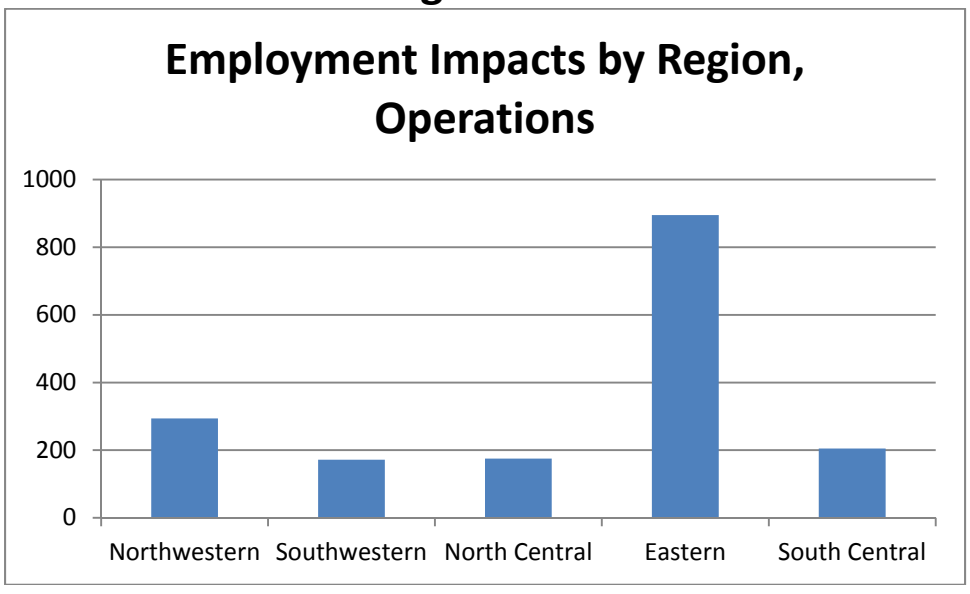
Table 5.1

Impacts Summary

	Impacts by Phase	
Category	**Construction**	**Operations**
Total Employment	2,648 Jobs	1,740 Jobs
Private Sector	2,372 Jobs	1,338 Jobs
Personal Income	$103.5 million	$125.4 million
Disposable Personal Income	$87.7 million	$167.9 million
Population	1,025 people	2,843 people
State tax revenues	$23.5 million	$91.6 million

-

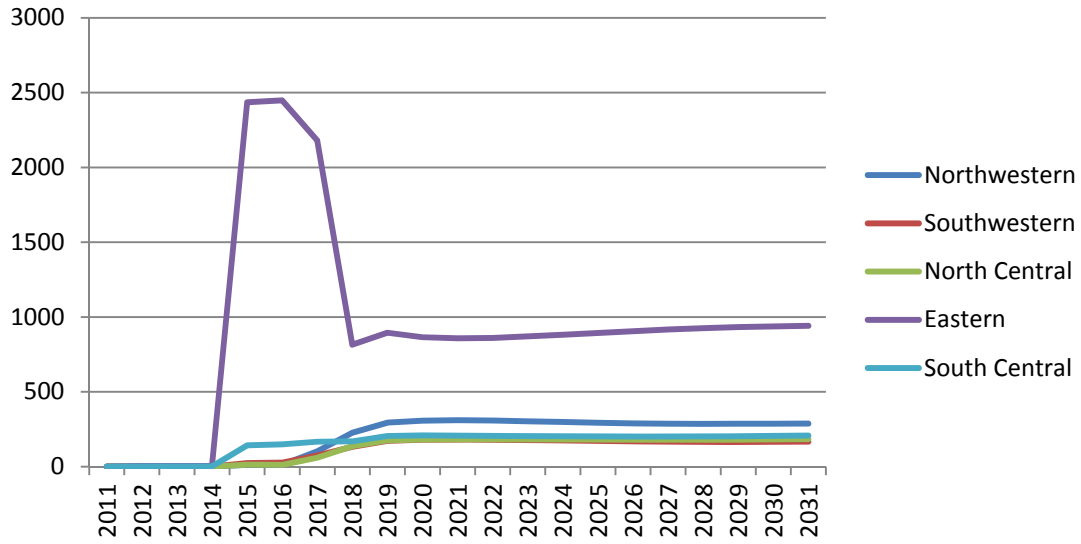
Figure 5.1



5.2 Employment Impacts

Coal development ultimately will result in a significantly higher number of jobs, both in the eastern Montana region as well as the state as a whole. The construction phase job totals peak at almost 2,650 jobs, with about 90 percent of those additional jobs created in the private sector. As shown in Figure 5.2, most of the construction phase jobs created are in eastern Montana. The next most impacted region of Montana in terms of new jobs is the south central portion of the state, which includes Billings.

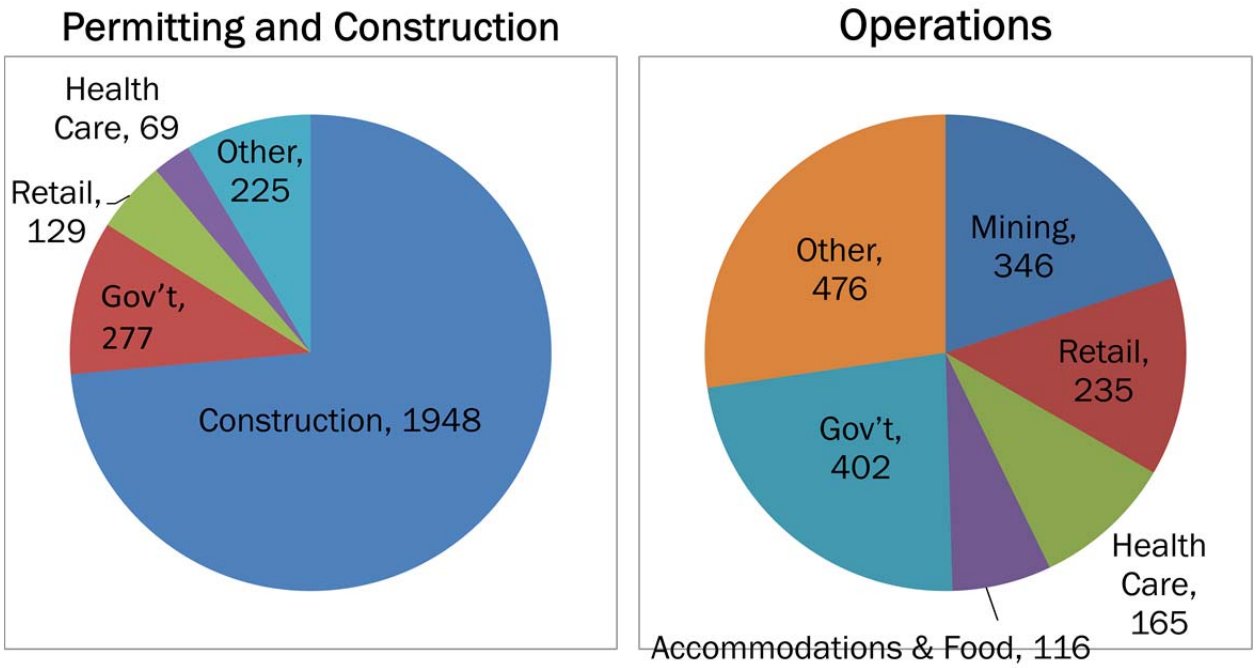
Figure 5.2
Employment Impacts by Region, 2011-2031



As the figure shows, while the construction phase jobs only persist during the period when the mine facilities and rail lines are being built, the operations jobs are permanent additions to the Montana economy. The employment impacts drift up modestly over time as population and demographic dynamics unfold. At the first year of operations, 1,740 new permanent jobs are added to the state economy due to Otter Creek coal operations.

Some insights can be made on the nature of these jobs if we examine the different industries and occupations they represent. As shown in Figure 5.3, the composition of the job impacts changes significantly after the construction phase is over. Nearly three quarters of all of the jobs created by coal development during the construction phase of the project are in the construction industry itself. Smaller, yet significant, impacts are seen in Government, Retail Trade, Health Care, and other industries as the spending of construction and other workers propagates through the regional economy.

Figure 5.3
Employment Impacts by Industry



When the operations phase is underway, the composition of the jobs impacts changes. This reflects not only the addition of the mining jobs themselves, but also the population- related increases in local public school employment (included in Government), health care jobs and such businesses as retail and restaurants. These impacts demonstrate the importance of the induced jobs created as the direct impacts of mining and railroad jobs impact services and government in the state.

A second way to look at the job impacts of coal development is by examining the impacts by occupation. The U.S. Bureau of Labor Statistics classifies each job in the economy into 23 major categories, from white collar management to blue collar production occupations. Figure 5.4 again shows that the most profound job impacts of coal development in the construction phase of the project is in the construction and extraction occupations, comprising nearly half of all jobs created. When looking at occupations, however, the job impacts are more varied in all phases of the project. There are significant management jobs involved in construction and permitting, as well as jobs in sales and administrative support, maintenance jobs and jobs in other occupations. The full list of job impacts by occupations is shown in Table 5.2.

In the operations phase, job impacts spread out across a larger number of occupations. The largest impacts are on sales and administrative support positions, construction occupations, transportation occupations, and management.

Figure 5.4
Employment Impacts by Occupation

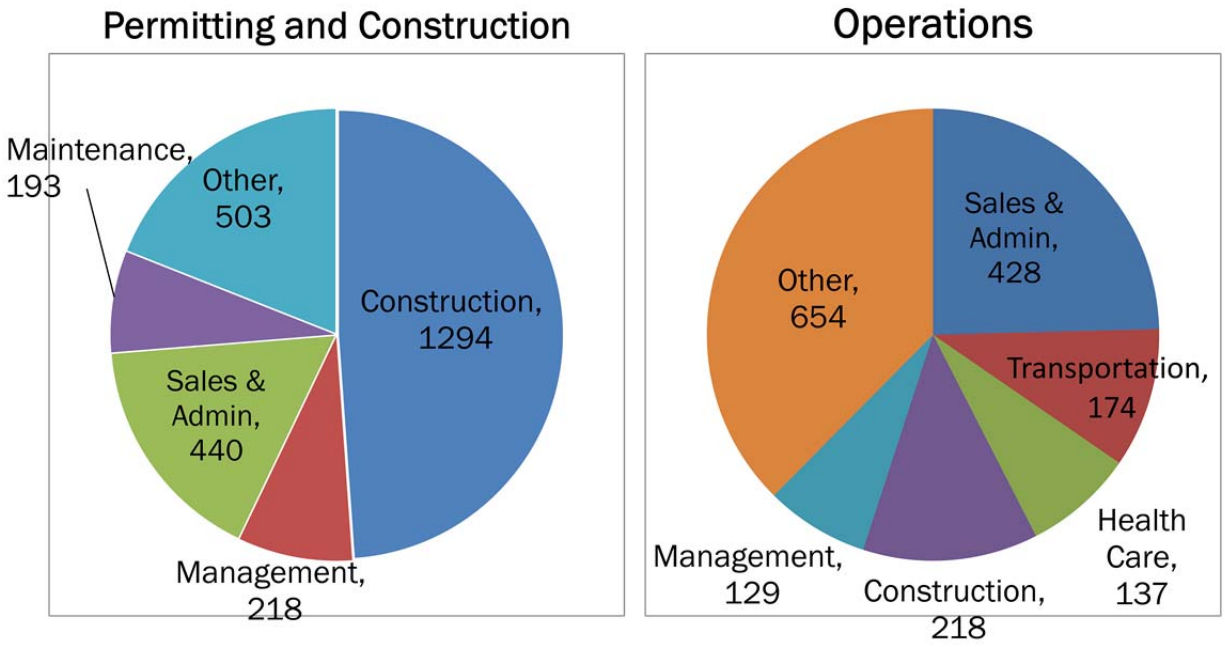


Table 5.2
Employment Impacts by Occupation

Occupation	Job Impacts by Phase	
	Construction	Operations
Management, business, financial occupations	218	129
Computer, math, architect, engineer occupations	49	49
Life, physical, social science occupations	10	16
Community, social service occupations	4	10
Legal occupations	10	15
Education, training, library occupations	8	17
Arts, design, entertainment, sports, media occupations	7	13
Health care occupations	65	137
Protective service occupations	74	110
Food preparation, serving related-occupations	59	124
Building, grounds, personal care, service occupations	60	106
Sales, office, administrative occupations	440	428
Farm, fishing, forestry occupations	2	2
Construction, extraction occupations	1,294	218
Installation, maintenance, repair occupations	193	122
Production occupations	49	71
Transportation, material moving occupations	107	174
TOTAL	2,648	1,740

5.3 Income and Compensation Impacts

The income impacts attributable to the development of Otter Creek coal are substantial, whether measured against the income of the entire state, or against the much smaller income base of eastern Montana. Both mining and railroad jobs pay wages significantly above the state average, and even though every job created by coal development is not a high paying job, the increased income due to the project is substantial.

Since income is measured in dollars, and the impacts of coal development occur in the future, it is important to take into account the effect of wage and price inflation when reporting these results. All impacts measured in dollars in this report are calculated according to their purchasing power in year the 2012. Thus with inflation, a dollar amount of income realized in, say, year 2019 would yield a somewhat smaller amount

Table 5.3
Personal Income Impact, Millions of Dollars

Category	Income Impacts by Phase	
	Construction	Operations
Total Earnings by Place of Work	$123.0	$119.4
Total Wage and Salary Disbursements	81.9	88.1
Supplements to Wages and Salaries	21.0	25.5
Employer contributions for employee pension and insurance funds	13.5	16.3
Employer contributions for government social insurance	7.5	9.2
Proprietors' income with inventory valuation and capital consumption adjustments	20.2	5.8
Less: Contributions for government social insurance	15.8	18.3
Employee and self-employed contributions for government social insurance	8.3	9.1
Employer contributions for government social insurance	7.5	9.2
Plus: Adjustment for residence*	-1.7	-1.2
Gross earnings flows into Montana	2.2	2.1
Gross earnings flows out of Montana	3.9	3.3
Equals: Net earnings by place of residence	105.6	99.9
Plus: Rent, interest, and dividends	5.8	19.0
Plus: Personal current transfer receipts	-7.8	6.6
Equals: Personal Income	103.5	125.4
Less: Personal current taxes	15.7	-42.4
Equals: Disposable personal income	87.7	167.9

* Total earnings data are derived from records of employers who are located in Montana. Since some Montana workers are employed by out-of-state firms, and some Montana firms employ workers from other states, the adjustment for residence nets out these two impacts to produce an estimate of Montana residents' income.

of purchasing power in 2012, and the inflation correction (which reduces it) reflects that fact.

As shown in Table 5.3, there is considerably more to personal income – the income received by Montana households – than the wages and salaries workers receive from employment. Most – but not all – of the income impacts listed in the table for both the construction and operations phase of the project are connected to employment. Total earnings are $123 million higher during the construction phase of the project, including benefits and an additional $20.2 million earned by business owners during the same year due to coal development. Even some categories of so-called non-earned income, such as dividends, interest, and rent are positively impacted by coal development, largely through the population impacts of the project.

The U.S. Bureau of Economic Analysis defines personal income as wages and benefits net of social security contributions, but prior to paying personal income tax. The impact on personal income is $105.6 million during the peak year of the construction phase, and falls only slightly to just shy of $100 million per year during the operations phase. The very small decrease, despite the much fewer number of jobs when construction is over, reflects the high paying nature of the rail and mining jobs that commence with mine operation.

After tax, or disposable personal income, impacts actually are higher during the operations phase, at about $168 million per year. This is because of the treatment of the severance taxes paid to state government during mining operations. As described in section 3, these taxes are assumed to be used to finance state expenditures with a slightly lower personal tax rate. As shown in the table, the net effect of this tax decline with the increase base is a $42.4 million decrease in personal tax payments (to both the state and federal government).

The earnings and income impacts of coal development are significant. With the construction phase concentrated in less populous eastern Montana, the additional income attributable to coal development in the last year of construction (2017) for this single project represents more than 3.5 percent of total income for the entire region. In the operations phase of the project, the average earnings per new job added ($68,600) exceeds the state average by a sufficient margin to actually raise the total compensation per job in the entire state economy (Table 5.4). It is clear that in terms of income, coal development is an important event.

Table 5.4
Compensation Impacts

Category	Units	Compensation Impacts by Phase	
		Construction	Operations
Wage and Salary Disbursements	$ Millions	81.9	88.1
Compensation	$ Millions	102.9	113.6
Earnings by Place of Work	$ Millions	123.0	119.4
Average Annual Wage Rate	$ Thousands	0.003	0.054
Average Annual Compensation Rate	$ Thousands	0.001	0.071
Average Annual Earnings Rate	$ Thousands	0.010	0.060

Note: Compensation includes cash and non-cash employee benefits, including health, retirement, and other employer-funded programs. Earnings includes employee compensation and proprietor's income. All compensation is measured on a place-of-work basis.

5.4 Output Impacts

A third aspect of the impact of coal development on the Montana economy can be evaluated by examining the impacts on economic output. This is particularly relevant for capital-intensive industries whose employment impacts may understate their reaction to changes that occur as a result of new coal activity. Net output is measured in inflation-corrected dollars, using value added (revenues minus costs) by industry.

Table 5.5 reveals that the impact on economic output is almost 60 percent higher during mining operations than during the construction phase of the project, even as the total employment impact falls after construction. This occurs as the two most capital intensive industries – mining and rail transport – ramp up as mining operations commence. The table clearly reveals the outsized impact contribution of mining's value added during the operations phase.

These output gains are substantial, especially as measured against the comparatively smaller regional economy of eastern Montana. Whereas the overall output increase of $231.1 million per year during the operations phase only represents about 0.4 percent of total state output, $150.3 million of that change comes from producers located in eastern Montana. Mining operations at this single facility in Powder River County are thus responsible for more than 4 percent of total economic output of the entire region.

Table 5.5
Gross Domestic Product Impacts
(Private Sector, $ Millions)

	GDP Impacts by Phase	
Industry	**Construction**	**Operations**
Forestry, Fishing, Related Activities, and Other	0.0	0.0
Mining	(0.3)	138.9
Utilities	0.1	2.4
Construction	110.7	6.4
Manufacturing	0.5	0.4
Wholesale Trade	5.0	9.1
Retail Trade	7.1	14.8
Transportation and Warehousing	(0.0)	10.1
Information	0.1	0.4
Finance and Insurance	0.4	1.4
Real Estate and Rental and Leasing	1.8	6.0
Professional and Technical Services	1.8	2.9
Management of Companies and Enterprises	(0.0)	(0.0)
Administrative and Waste Services	1.0	2.0
Educational Services	0.0	0.2
Health Care and Social Assistance	4.9	12.0
Arts, Entertainment, and Recreation	0.1	0.4
Accommodation and Food Services	1.4	3.1
Other Services, except Public Administration	1.7	2.8
Total	136.3	213.1

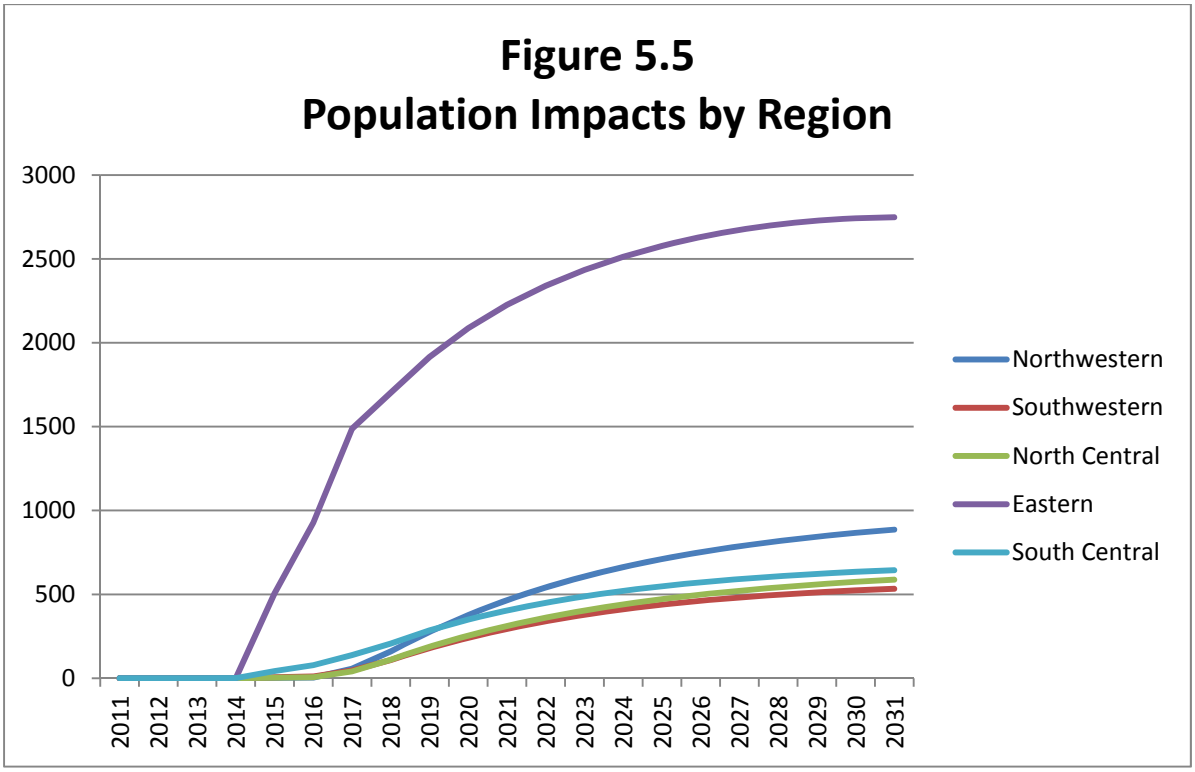
5.5 Population Impacts

The economic opportunity represented by a large scale energy investment paying compensation per job substantially in excess of the Montana average is attractive to potential workers. As has actually occurred in the wake of other significant capital

investments that create high paying jobs – e.g., Colstrip in the 1980s – we can expect to see a significant increase in the population of southeastern Montana resulting from coal development. A second, less pronounced, draw for new migrants to the state could result from the ability of state government to meet its obligations with slightly lower personal taxes – making up the difference with severance taxes collected from the new mine. This effectively increases the after-tax wage of every Montana job, making state jobs slightly more attractive than the "no coal" scenario situation.

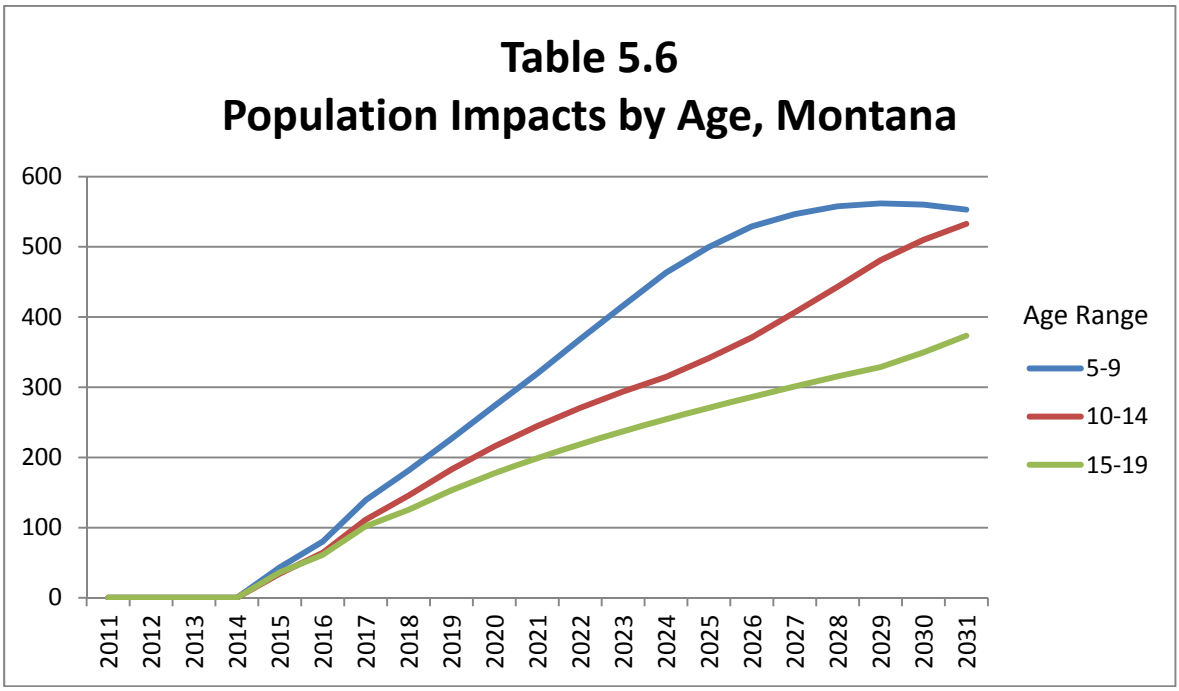
Population changes take time to develop, for two reasons. First, as an empirical matter, years typically pass before increased opportunity induces a nonresident household to relocate. This is due in part to the expense and complexity of moving families. A second reason is that children born to those who migrate may not show up until years after the move. This is especially prevalent since mobility is prominent for those in prime child-bearing ages groups.

For these reasons, the population impacts of coal development in Otter Creek given in summary Table 5.1 at the beginning of this section significantly understate the changes in population that the development will eventually produce.



As is clear from Figure 5.5 above, the population impacts grow significantly beyond year 2019, which is the first year of full mine operation reported in the overall impacts summary. Indeed, by year 2031 mining operations will ultimately be responsible for the addition of almost 5,400 more people throughout the state, with roughly half living in eastern Montana. This gradual increase in population will create additional demand for housing, health care, consumer goods, and government services.

Since younger people are more mobile, population migration has particular impacts on the younger aged cohorts. Of particular interest to rural school districts in the slower growing areas of the state is the impact of coal development on the school-aged population.



The statewide impacts are shown in Figure 5.6 above for three five-year age cohorts. These correspond roughly to elementary, middle school, and high school populations. These population impacts build over time, such that in year 2031 we would expect the total increase to approach 1,500. This could stabilize or increase the demand for public schooling in the affected communities.

5.6 Summary

This section has examined in detail the changes that can be expected to occur in the Montana and the eastern Montana economies as a result of coal development in Powder River County. Not only is the development of the coal and rail infrastructure and facilities responsible for almost 2,700 jobs and more than $100 million in personal income in the peak construction year of the projects, but the operations of the mine will create 1,740 permanent, high-paying jobs across the state. By any measure, these are significant impacts that help create a more productive, prosperous, and populous state economy.

6. Conclusion

The research question posed by this study is "What would the economy of Montana look like if Otter Creek coal development takes place?" It is a hypothetical question – we have no special insight on the prospects for those investments, from either an economic or a political standpoint. Yet in a policy and political environment where the contributions of coal development to the state economy are poorly understood or perhaps taken for granted, it deserves to be carefully analyzed and answered.

Using a state-of-the-art policy analysis model of the Montana economy that has been peer-reviewed and used in dozens of other studies, we have carefully examined the contribution made to both the economy of eastern Montana as well as to the state economy as a whole by the proposed Otter Creek mine. Our study has revealed the footprint of this single facility in Powder River County to be substantial. Comparing the status quo economy to one that would exist if the construction and operations of the mine took place as envisioned, we find that:

- 2,648 jobs, including 2,372 private sector jobs,
- more than $103 million of personal income received by Montanans, and
- $136 million in net output produced in Montana

would be created and sustained annually throughout the construction period for both the mine and the railroad. Almost three-quarters of these new jobs would be in the state's hard-hit construction industries.

When the mine goes into operation and ramps up to the 20 million tons of annual production envisioned, there will be:

- 1,740 permanent jobs, including 1,338 private sector jobs,
- more than $125.4 million in annual personal income,
- 2,843 more people, and
- almost $92 million in additional annual state tax revenues

in the Montana economy that are attributable to Otter Creek operations. To state it another way, without Otter Creek, the Montana economy will be smaller, less prosperous, and less populous by these amounts.

There are several aspects of Otter Creek coal development that lead directly to this impressive result. First, the facility will pay wages and benefits to its workforce that are substantially above the state and regional average. When employees spend part of their money in the local and state economy, many other jobs are supported. Second, the operation of the facility is a boon to another high-paying industry with a significant presence in Montana, namely, the railroad. Finally, the project involves a huge capital

investment – well in excess of $1 billion – to be committed to the equipment, facilities, rail, and other support infrastructure in the state.

Finally, the product produced by Otter Creek – high quality coal delivered to domestic and overseas markets – does not displace or crowd out other Montana producers. Thus it's activities add to, rather than supplant or replace, other activities in the economy. The uses and demand for electricity worldwide continue to grow, and the prospects for the state with the nation's largest coal reserves to take advantage of the opportunity are very good.

7. References

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APPENDIX

REMI Tables

Otter Creek Summary

Economic Summary

C:\Users\Pat.Barkey\Documents\REMI\PI+ Montana Regions v1.3.5 (Build 2599)\Workbooks\Otter Creek with RR and taxes.rwb
Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Economic Summary

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total Employment	Individuals (Jobs)	+6	+6	+6	+2,626	+2,648	+2,585	+1,481	+1,740	+1,740	+1,739
Total Employment as % of Nation	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Private Non-Farm Employment	Individuals (Jobs)	+5	+5	+5	+2,364	+2,372	+2,246	+1,175	+1,338	+1,337	+1,333
Private Non-Farm Employment as % of N	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Gross Domestic Product	Millions of Fixed (2005) D	+0	+0	+0	+121	+123	+149	+134	+180	+179	+179
Gross Domestic Product (GDP) as % of N	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Output	Millions of Fixed (2005) D	+0	+0	+0	+212	+214	+267	+251	+342	+343	+343
Value Added	Millions of Fixed (2005) D	+0	+0	+0	+121	+123	+149	+134	+180	+179	+179
Personal Income	Millions of Current Dollar	+0	+0	+0	+96	+112	+152	+125	+144	+151	+157
Personal Income as % of Nation	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Disposable Personal Income	Millions of Current Dollar	+0	+0	+0	+82	+95	+156	+161	+193	+201	+208
Disposable Personal Income as % of Nati	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
PCE-Price Index	2005=100 (Nation)	0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Real Disposable Personal Income	Millions of Fixed (2005) D	+0	+0	+0	+64	+71	+115	+116	+136	+139	+140
Real Disposable Personal Income as % of	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Population	Individuals	+0	+1	+1	+559	+1,025	+1,770	+2,289	+2,843	+3,308	+3,701
Population as % of Nation	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

Otter Creek Summary

Economic Summary

C:\Users\Pat.Barkey\Documents\REMI\PI+ Montana Regions v1.3.5 (Build 2599)\Workbooks\Otter Creek with RR and taxes.rwb
Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Economic Summary

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
+1,736	+1,735	+1,736	+1,738	+1,743	+1,750	+1,758	+1,768	+1,776	+1,787	+1,795	+1,805	+1,810	+1,813	+1,813
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+1,327	+1,325	+1,324	+1,325	+1,330	+1,336	+1,344	+1,353	+1,361	+1,371	+1,380	+1,390	+1,396	+1,400	+1,402
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+178	+178	+179	+179	+180	+180	+181	+182	+184	+185	+186	+188	+190	+191	+192
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+343	+344	+345	+345	+347	+348	+349	+351	+353	+355	+357	+359	+361	+363	+364
+178	+178	+179	+179	+180	+180	+181	+182	+184	+185	+186	+188	+190	+191	+192
+162	+168	+175	+181	+188	+196	+204	+213	+223	+234	+245	+258	+271	+283	+297
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+215	+223	+231	+239	+247	+256	+266	+277	+288	+301	+314	+328	+342	+356	+372
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+142	+143	+144	+146	+147	+148	+150	+151	+153	+155	+158	+160	+162	+164	+167
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+4,031	+4,310	+4,546	+4,745	+4,913	+5,054	+5,171	+5,266	+5,341	+5,398	+5,437	+5,462	+5,472	+5,468	+5,453
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

Otter Creek Summary

Personal Income

C:\Users\Pat.Barkey\Documents\REMI\PI+ Montana Regions v1.3.5 (Build 2599)\Workbooks\Otter Creek with RR and taxes.rwb
Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Personal Income

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total Earnings by Place of Work	Millions of Fixed (2012) D	+0	+0	+0	+114	+123	+154	+109	+119	+116	+112
Total Wage and Salary Disbursements	Millions of Fixed (2012) D	+0	+0	+0	+74	+82	+108	+81	+88	+86	+83
Supplements to Wages and Salaries	Millions of Fixed (2012) D	+0	+0	+0	+19	+21	+28	+22	+25	+26	+26
Employer contributions for employee pe	Millions of Fixed (2012) D	+0	+0	+0	+12	+13	+18	+14	+16	+16	+16
Employer contributions for government	Millions of Fixed (2012) D	+0	+0	+0	+7	+8	+10	+8	+9	+9	+9
Proprietors' income with inventory valua	Millions of Fixed (2012) D	+0	+0	+0	+21	+20	+17	+6	+6	+4	+3
Less: Contributions for Government Socia	Millions of Fixed (2012) D	+0	+0	+0	+14	+16	+21	+16	+18	+18	+18
Employee and Self-Employed Contributior	Millions of Fixed (2012) D	+0	+0	+0	+7	+8	+11	+8	+9	+9	+9
Employer contributions for government s	Millions of Fixed (2012) D	+0	+0	+0	+7	+8	+10	+8	+9	+9	+9
Plus: Adjustment for Residence	Millions of Fixed (2012) D	0	0	0	-2	-2	-2	-1	-1	-1	-1
Gross In	Millions of Fixed (2012) D	+0	+0	+0	+2	+2	+3	+2	+2	+2	+2
Gross Out	Millions of Fixed (2012) D	+0	+0	+0	+4	+4	+5	+3	+3	+3	+3
Equals: Net Earnings by Place of Residenc	Millions of Fixed (2012) D	+0	+0	+0	+98	+106	+131	+92	+100	+96	+93
Plus: Rental, Personal Interest, and Persor	Millions of Fixed (2012) D	+0	+0	+0	+3	+6	+11	+15	+19	+22	+25
Plus: Personal Current Transfer Receipts	Millions of Fixed (2012) D	0	0	0	-10	-8	-4	+5	+7	+9	+12
Equals: Personal Income	Millions of Fixed (2012) D	+0	+0	+0	+91	+103	+138	+111	+125	+128	+130
Less: Personal current taxes	Millions of Fixed (2012) D	+0	+0	+0	+14	+16	-4	-32	-42	-42	-43
Equals: Disposable personal income	Millions of Fixed (2012) D	+0	+0	+0	+77	+88	+141	+144	+168	+171	+173

Otter Creek Summary

Personal Income

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Personal Income

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
+108	+105	+103	+101	+99	+98	+97	+97	+97	+97	+98	+99	+99	+100	+100
+81	+79	+77	+76	+75	+74	+73	+73	+73	+74	+74	+74	+75	+75	+76
+26	+26	+26	+26	+26	+26	+27	+27	+27	+27	+28	+28	+28	+28	+29
+17	+17	+17	+17	+17	+17	+17	+17	+17	+17	+18	+18	+18	+18	+18
+9	+9	+9	+9	+9	+10	+10	+10	+10	+10	+10	+10	+10	+10	+10
+2	+1	0	-1	-2	-3	-3	-3	-3	-4	-4	-4	-4	-4	-4
+18	+17	+17	+17	+17	+17	+17	+17	+17	+17	+18	+18	+18	+18	+18
+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8
+9	+9	+9	+9	+9	+10	+10	+10	+10	+10	+10	+10	+10	+10	+10
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2
+3	+3	+3	+3	+3	+3	+3	+3	+3	+3	+3	+3	+3	+3	+3
+90	+87	+84	+82	+81	+80	+79	+79	+79	+79	+79	+80	+80	+81	+81
+28	+30	+32	+34	+36	+37	+39	+40	+42	+43	+44	+46	+47	+48	+50
+14	+16	+17	+19	+20	+21	+22	+23	+24	+25	+27	+28	+29	+30	+31
+132	+133	+134	+135	+137	+138	+140	+142	+144	+147	+150	+153	+156	+159	+162
-43	-43	-43	-43	-43	-43	-43	-42	-42	-42	-42	-41	-41	-41	-41
+174	+176	+177	+178	+179	+181	+182	+185	+187	+189	+192	+195	+198	+200	+203

Otter Creek Summary

Employment | Industry | Private Non-Farm | Private Non-Farm Employment | Sector Level

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Sector Level

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Forestry, Fishing, Related Activities, and (	Individuals (Jobs)	+0	0	0	+0	+0	+0	+0	+0	+0	+0
Mining	Individuals (Jobs)	0	0	0	-1	-3	+346	+345	+346	+335	+326
Utilities	Individuals (Jobs)	+0	+0	0	+1	+0	+2	+4	+6	+5	+5
Construction	Individuals (Jobs)	+0	+0	+0	+1,978	+1,948	+1,218	+50	+79	+89	+94
Manufacturing	Individuals (Jobs)	+0	+0	+0	+5	+4	+3	+2	+3	+3	+3
Wholesale Trade	Individuals (Jobs)	+0	+0	+0	+31	+41	+60	+60	+66	+63	+60
Retail Trade	Individuals (Jobs)	+0	+0	+0	+106	+129	+208	+213	+235	+230	+226
Transportation and Warehousing	Individuals (Jobs)	+0	0	0	+0	0	0	+47	+51	+50	+48
Information	Individuals (Jobs)	+0	+0	+0	+1	+1	+1	+2	+3	+2	+2
Finance and Insurance	Individuals (Jobs)	+0	+0	0	+2	+2	+4	+6	+7	+7	+7
Real Estate and Rental and Leasing	Individuals (Jobs)	+0	+0	+0	+14	+12	+26	+35	+45	+45	+43
Professional and Technical Services	Individuals (Jobs)	+4	+4	+4	+27	+30	+34	+37	+44	+43	+42
Management of Companies and Enterprise	Individuals (Jobs)	0	0	0	0	0	0	0	0	0	0
Administrative and Waste Services	Individuals (Jobs)	+0	+0	+0	+25	+25	+33	+34	+43	+43	+43
Educational Services	Individuals (Jobs)	+0	+0	+0	+1	+1	+3	+5	+7	+8	+8
Health Care and Social Assistance	Individuals (Jobs)	+0	+0	+0	+67	+69	+125	+137	+165	+167	+171
Arts, Entertainment, and Recreation	Individuals (Jobs)	+0	+0	+0	+5	+5	+11	+16	+20	+20	+21
Accommodation and Food Services	Individuals (Jobs)	+0	+0	+0	+47	+54	+87	+95	+116	+125	+134
Other Services, except Public Administrati	Individuals (Jobs)	+0	+0	+0	+55	+54	+84	+87	+103	+101	+99

Otter Creek Summary

Employment | Industry | Private Non-Farm | Private Non-Farm Employment | Sector Level

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Sector Level

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
0	0	0	+0	+0	+0	+0	+0	+0	+0	+0	+1	+1	+1	+1
+317	+309	+301	+293	+286	+279	+273	+266	+259	+254	+247	+242	+236	+230	+224
+5	+5	+5	+6	+6	+6	+6	+6	+6	+6	+6	+6	+6	+6	+5
+95	+96	+95	+96	+97	+98	+101	+103	+105	+108	+110	+114	+117	+119	+121
+3	+3	+3	+3	+3	+4	+4	+4	+4	+4	+4	+5	+5	+5	+5
+58	+55	+54	+52	+51	+50	+49	+48	+47	+46	+45	+45	+44	+43	+43
+222	+220	+217	+216	+215	+214	+213	+213	+213	+214	+215	+215	+215	+215	+214
+47	+46	+45	+45	+44	+43	+43	+42	+42	+41	+41	+40	+39	+39	+38
+3	+3	+3	+3	+3	+4	+4	+4	+4	+5	+5	+5	+5	+5	+5
+7	+7	+8	+8	+9	+9	+10	+11	+11	+12	+12	+13	+13	+14	+14
+42	+40	+39	+38	+37	+37	+37	+37	+37	+37	+37	+38	+38	+38	+38
+41	+41	+40	+41	+41	+42	+43	+44	+45	+46	+47	+48	+49	+50	+51
0	0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+43	+43	+43	+43	+43	+44	+44	+45	+45	+46	+47	+47	+48	+48	+48
+9	+9	+9	+10	+10	+10	+10	+10	+11	+11	+11	+11	+11	+11	+12
+175	+180	+186	+192	+198	+205	+211	+218	+225	+231	+238	+244	+250	+255	+259
+22	+23	+24	+25	+25	+26	+27	+28	+29	+30	+31	+32	+32	+33	+34
+141	+148	+154	+160	+165	+169	+173	+176	+179	+182	+184	+186	+187	+188	+189
+98	+97	+97	+96	+96	+97	+97	+98	+98	+99	+99	+100	+100	+100	+100

Otter Creek Summary

Employment | Industry | Government | State and Local

C:\Users\Pat.Barkey\Documents\REMI\PI+ Montana Regions v1.3.5 (Build 2599)\Workbooks\Otter Creek with RR and taxes.rwb
Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
State and Local

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
State Government	Individuals (Jobs)	+0	+0	+0	+35	+37	+50	+54	+71	+73	+73
Local Government	Individuals (Jobs)	+0	+0	+0	+228	+240	+289	+251	+331	+331	+334

Otter Creek Summary

Employment | Industry | Government | State and Local

C:\Users\Pat.Barkey\Documents\REMI\PI+ Montana Regions v1.3.5 (Build 2599)\Workbooks\Otter Creek with RR and taxes.rwb
Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
State and Local

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
+73	+73	+73	+73	+73	+72	+72	+72	+72	+73	+73	+73	+73	+73	+73
+335	+337	+339	+340	+341	+342	+342	+343	+343	+343	+342	+342	+341	+340	+338

Otter Creek Summary

Employment | Occupation | Summary Level

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Summary Level

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Management, business, financial occupatic	Individuals (Jobs)	+1	+1	+1	+217	+218	+196	+105	+129	+129	+129
Computer, math, architect, engineer occu	Individuals (Jobs)	+1	+1	+1	+48	+49	+55	+40	+49	+48	+48
Life, physical, social science occupations	Individuals (Jobs)	+0	+0	+0	+9	+10	+14	+13	+16	+16	+16
Community, social service occupations	Individuals (Jobs)	+0	+0	+0	+4	+4	+7	+8	+10	+11	+11
Legal occupations	Individuals (Jobs)	+0	+0	+0	+10	+10	+12	+12	+15	+15	+15
Education, training, library occupations	Individuals (Jobs)	+0	+0	+0	+8	+8	+12	+13	+17	+17	+18
Arts, design, entertainment, sports, media	Individuals (Jobs)	+0	+0	+0	+7	+7	+10	+10	+13	+13	+13
Healthcare occupations	Individuals (Jobs)	+0	+0	+0	+62	+65	+107	+113	+137	+138	+140
Protective service occupations	Individuals (Jobs)	+0	+0	+0	+70	+74	+92	+84	+110	+110	+111
Food preparation, serving related occupati	Individuals (Jobs)	+0	+0	+0	+51	+59	+94	+102	+124	+133	+141
Building, grounds, personal care, service c	Individuals (Jobs)	+0	+0	+0	+60	+60	+88	+88	+106	+105	+104
Sales, office, administrative occupations	Individuals (Jobs)	+2	+2	+2	+421	+440	+489	+366	+428	+421	+416
Farm, fishing, forestry occupations	Individuals (Jobs)	+0	+0	+0	+2	+2	+2	+2	+2	+2	+2
Construction, extraction occupations	Individuals (Jobs)	+0	+0	+0	+1,314	+1,294	+955	+192	+218	+220	+220
Installation, maintenance, repair occupatic	Individuals (Jobs)	+0	+0	+0	+193	+193	+197	+108	+122	+121	+119
Production occupations	Individuals (Jobs)	+0	+0	+0	+48	+49	+80	+65	+71	+69	+68
Transportation, material moving occupatic	Individuals (Jobs)	+0	+0	+0	+105	+107	+174	+160	+174	+170	+167

Otter Creek Summary

Employment | Occupation | Summary Level

C:\Users\Pat.Barkey\Documents\REMI\PI+ Montana Regions v1.3.5 (Build 2599)\Workbooks\Otter Creek with RR and taxes.rwb
Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Summary Level

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
+129	+129	+129	+129	+129	+130	+131	+132	+133	+134	+135	+136	+136	+137	+137
+47	+47	+47	+47	+47	+47	+48	+48	+48	+49	+49	+49	+50	+50	+50
+16	+16	+16	+16	+16	+16	+16	+17	+17	+17	+17	+17	+17	+17	+17
+12	+12	+13	+13	+14	+14	+15	+15	+16	+16	+16	+17	+17	+17	+18
+15	+15	+15	+15	+15	+15	+15	+16	+16	+16	+16	+16	+16	+16	+16
+18	+19	+19	+19	+20	+20	+20	+21	+21	+21	+21	+22	+22	+22	+22
+13	+13	+14	+14	+14	+14	+14	+15	+15	+15	+16	+16	+16	+16	+16
+143	+147	+150	+154	+158	+162	+166	+171	+175	+180	+184	+188	+192	+195	+198
+112	+112	+113	+113	+114	+114	+114	+115	+115	+115	+115	+115	+115	+115	+115
+149	+155	+161	+166	+171	+175	+179	+182	+185	+188	+190	+192	+193	+194	+194
+103	+102	+102	+103	+103	+104	+104	+105	+106	+107	+108	+109	+109	+110	+110
+411	+408	+405	+404	+403	+404	+405	+406	+408	+410	+412	+414	+416	+416	+416
+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2
+217	+214	+211	+208	+206	+204	+204	+202	+201	+201	+200	+200	+199	+199	+198
+118	+117	+115	+114	+114	+113	+113	+112	+112	+112	+111	+111	+111	+110	+110
+67	+66	+65	+64	+63	+63	+62	+62	+61	+61	+61	+60	+60	+59	+59
+163	+161	+158	+155	+153	+151	+149	+147	+146	+144	+143	+141	+140	+138	+136

Otter Creek Summary

Gross Domestic Product | Real Gross Value Added by Sector, Fixed Dollars | Private Non-Farm | Sector Level

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Sector Level

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Forestry, Fishing, Related Activities, and (	Thousands of Fixed (201	0	0	0	+4	+4	+5	+3	0	-5	-10
Mining	Thousands of Fixed (201	0	-1	-1	-85	-337	+56,511	+95,945	+138,913	+137,041	+136,750
Utilities	Thousands of Fixed (201	+1	+1	+0	+436	+115	+1,069	+1,520	+2,357	+2,249	+2,170
Construction	Thousands of Fixed (201	+12	+17	+20	+110,853	+110,725	+70,549	+4,410	+6,409	+7,243	+7,645
Manufacturing	Thousands of Fixed (201	+0	+1	+0	+467	+450	+365	+290	+367	+361	+347
Wholesale Trade	Thousands of Fixed (201	+6	+6	+6	+3,658	+5,032	+7,675	+8,107	+9,135	+8,955	+8,773
Retail Trade	Thousands of Fixed (201	+12	+13	+14	+5,701	+7,131	+12,010	+12,957	+14,772	+14,677	+14,603
Transportation and Warehousing	Thousands of Fixed (201	+0	0	0	+41	-30	-32	+9,022	+10,099	+10,078	+10,058
Information	Thousands of Fixed (201	+1	+1	+1	+157	+106	+236	+318	+386	+330	+283
Finance and Insurance	Thousands of Fixed (201	+2	+2	+2	+454	+374	+771	+1,115	+1,351	+1,250	+1,157
Real Estate and Rental and Leasing	Thousands of Fixed (201	+8	+8	+8	+2,078	+1,809	+3,639	+4,745	+6,001	+5,858	+5,611
Professional and Technical Services	Thousands of Fixed (201	+232	+232	+233	+1,620	+1,847	+2,139	+2,369	+2,869	+2,841	+2,794
Management of Companies and Enterprise	Thousands of Fixed (201	+0	0	0	-2	-20	-16	-13	-3	-8	-9
Administrative and Waste Services	Thousands of Fixed (201	+5	+5	+5	+980	+1,012	+1,408	+1,608	+2,049	+2,075	+2,087
Educational Services	Thousands of Fixed (201	+0	+0	+0	+25	+30	+75	+118	+155	+170	+182
Health Care and Social Assistance	Thousands of Fixed (201	+12	+11	+12	+4,797	+4,924	+8,963	+9,952	+12,031	+12,168	+12,412
Arts, Entertainment, and Recreation	Thousands of Fixed (201	+0	+0	+0	+94	+89	+205	+289	+363	+372	+379
Accommodation and Food Services	Thousands of Fixed (201	+4	+4	+4	+1,193	+1,353	+2,235	+2,513	+3,118	+3,351	+3,564
Other Services, except Public Administrati	Thousands of Fixed (201	+4	+4	+4	+1,749	+1,718	+2,409	+2,311	+2,752	+2,688	+2,640

Otter Creek Summary

Gross Domestic Product | Real Gross Value Added by Sector, Fixed Dollars | Private Non-Farm | Sector Level

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Sector Level

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
-15	-19	-22	-25	-28	-30	-32	-33	-34	-36	-37	-38	-39	-41	-42
+136,466	+136,338	+136,162	+136,064	+136,055	+135,990	+136,094	+136,099	+136,230	+136,430	+136,577	+136,820	+137,094	+137,394	+137,717
+2,117	+2,085	+2,063	+2,050	+2,041	+2,031	+2,024	+2,014	+2,003	+1,990	+1,973	+1,956	+1,936	+1,914	+1,889
+7,801	+7,848	+7,862	+7,885	+7,970	+8,110	+8,305	+8,468	+8,661	+8,901	+9,168	+9,494	+9,813	+10,112	+10,405
+333	+320	+310	+304	+301	+301	+303	+306	+310	+314	+319	+325	+330	+334	+338
+8,615	+8,490	+8,390	+8,311	+8,257	+8,221	+8,204	+8,201	+8,216	+8,253	+8,294	+8,358	+8,412	+8,461	+8,508
+14,556	+14,544	+14,558	+14,598	+14,670	+14,766	+14,889	+15,049	+15,249	+15,481	+15,709	+15,970	+16,199	+16,403	+16,597
+10,048	+10,047	+10,053	+10,063	+10,077	+10,094	+10,112	+10,132	+10,153	+10,175	+10,199	+10,224	+10,251	+10,278	+10,308
+246	+219	+201	+189	+184	+182	+184	+189	+194	+201	+206	+215	+220	+224	+226
+1,076	+1,012	+963	+927	+902	+887	+880	+881	+884	+893	+904	+921	+935	+946	+958
+5,311	+5,001	+4,711	+4,447	+4,218	+4,028	+3,869	+3,745	+3,633	+3,539	+3,447	+3,374	+3,283	+3,181	+3,057
+2,749	+2,720	+2,708	+2,713	+2,734	+2,769	+2,814	+2,869	+2,927	+2,991	+3,058	+3,131	+3,200	+3,265	+3,329
-7	-2	+6	+15	+25	+35	+46	+56	+66	+76	+85	+93	+100	+107	+113
+2,097	+2,112	+2,133	+2,158	+2,188	+2,223	+2,263	+2,308	+2,354	+2,405	+2,455	+2,509	+2,558	+2,603	+2,646
+191	+200	+207	+213	+219	+225	+230	+235	+240	+244	+249	+253	+257	+261	+265
+12,731	+13,123	+13,571	+14,041	+14,544	+15,079	+15,647	+16,257	+16,850	+17,476	+18,093	+18,743	+19,351	+19,906	+20,442
+387	+395	+403	+412	+421	+431	+442	+453	+464	+475	+486	+497	+507	+514	+521
+3,755	+3,929	+4,085	+4,225	+4,351	+4,462	+4,565	+4,663	+4,748	+4,823	+4,889	+4,951	+4,998	+5,032	+5,057
+2,601	+2,574	+2,558	+2,548	+2,547	+2,553	+2,566	+2,588	+2,609	+2,638	+2,667	+2,705	+2,734	+2,757	+2,778

Otter Creek Summary

Industries

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Industries

Category	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Employment	Individuals (Jobs)	+6	+6	+6	+2,626	+2,648	+2,585	+1,481	+1,740	+1,740	+1,739
Employment as % of Nation	Percent	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Regional Purchase Coefficient	Proportion	0	0	0	0	0	0	0	0	0	0
Average Annual Wage Rate	Thousands of Current Dc	0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Average Annual Compensation Rate	Thousands of Current Dc	0	0	+0	0	+0	+0	+0	+0	+0	+0
Average Annual Earnings Rate	Thousands of Current Dc	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
Demand	Millions of Fixed (2012) D	+4	+4	+4	+673	+730	+559	+1,292	+1,466	+1,465	+1,461
Imports of Goods and Services	Millions of Fixed (2012) D	+4	+4	+4	+444	+496	+357	+1,177	+1,326	+1,322	+1,318
Self Supply	Millions of Fixed (2012) D	+0	+0	+0	+229	+234	+202	+115	+140	+142	+144
Exports of Goods and Services	Millions of Fixed (2012) D	+0	+0	+0	+19	+17	+111	+179	+261	+259	+258
Output	Millions of Fixed (2012) D	+0	+0	+0	+248	+251	+313	+294	+400	+402	+402
Value Added	Millions of Fixed (2012) D	+0	+0	+0	+141	+144	+175	+157	+210	+209	+209
Wage and Salary Disbursements	Millions of Fixed (2012) D	+0	+0	+0	+74	+82	+108	+81	+88	+86	+83
Compensation	Millions of Fixed (2012) D	+0	+0	+0	+94	+103	+137	+104	+114	+111	+109
Earnings by Place of Work	Millions of Fixed (2012) D	+0	+0	+0	+114	+123	+154	+109	+119	+116	+112
Labor Productivity	Thousands of Fixed (200	0	0	0	0	0	+0	+0	+0	+0	+0
National Deflator	2005=1 (Nation)	0	0	0	0	0	0	0	0	0	0

Otter Creek Summary

Industries

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Regional Simulation 1 compared to Standard Regional Control — Difference
Region = All Regions
Industries

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
+1,736	+1,735	+1,736	+1,738	+1,743	+1,750	+1,758	+1,768	+1,776	+1,787	+1,795	+1,805	+1,810	+1,813	+1,813
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+1,458	+1,456	+1,454	+1,453	+1,452	+1,452	+1,453	+1,455	+1,457	+1,460	+1,463	+1,467	+1,470	+1,472	+1,475
+1,313	+1,310	+1,308	+1,305	+1,304	+1,303	+1,302	+1,302	+1,303	+1,304	+1,304	+1,306	+1,307	+1,308	+1,308
+145	+146	+146	+147	+148	+150	+151	+153	+155	+157	+159	+161	+163	+165	+166
+258	+257	+257	+258	+258	+258	+258	+259	+259	+260	+260	+260	+260	+260	+260
+402	+403	+404	+405	+406	+408	+410	+411	+414	+416	+418	+421	+423	+425	+427
+209	+209	+209	+210	+210	+211	+212	+214	+215	+217	+219	+220	+222	+224	+225
+81	+79	+77	+76	+75	+74	+73	+73	+73	+74	+74	+74	+75	+75	+76
+107	+105	+103	+102	+101	+100	+100	+100	+100	+101	+101	+102	+103	+104	+104
+108	+105	+103	+101	+99	+98	+97	+97	+97	+97	+98	+99	+99	+100	+100
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0