November 2013

Energy and Economic Impacts of
Coal in Interior Alaska

PREPARED BY

McDowell GROUP

PREPARED FOR

UCM
USIBELLI COAL MINE, INC.

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Juneau • Anchorage

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Table of Contents

Executive Summary

Usibelli Coal Mine (UCM) contracted with McDowell Group, an Alaska-based research firm, to profile the role of coal in Interior Alaska's energy supply infrastructure and assess the economic impact of coal in the region's economy. UCM is the state's only operating coal mine, producing approximately 2 million tons of coal annually. Roughly half of the mine's coal production is used in Interior Alaska to generate electricity and space heat while the other half is exported to overseas markets. The mine is located near Healy, Alaska, approximately 115 miles south of Fairbanks. This analysis has identified several key findings, including:

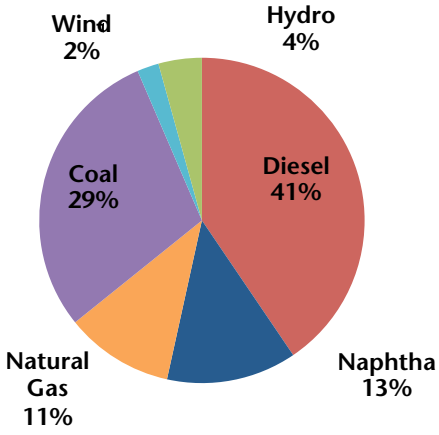
- *Coal is Interior Alaska's lowest-cost source of energy. On a per Btu basis, coal is half the cost of natural gas, one-third the cost of naphtha, and one-sixth the cost of diesel.*
- *Coal is a critical source of Interior Alaska energy. Coal accounts for over one-quarter of Interior Alaska's electrical energy capacity and nearly one-third of electrical energy generation.*
- *In the absence of Usibelli coal, energy costs in Interior Alaska would be much higher, perhaps 25 percent higher than they are today (a cost of $200 million annually depending on other fuels used).*
- *Bringing Healy Unit 2 online will double the amount of coal-fired power capacity available to Golden Valley Electric Association (GVEA), which will stabilize rates and have potential future savings of as much as $30 million annually, because of coal's much lower cost relative to other fuels.*
- *The economic impact of Usibelli Coal Mine is broad and diverse. In 2012, UCM spent $72 million with 400 different suppliers, service-providers, and organizations in Alaska.*
- *577 Interior Alaska jobs and $44 million in annual payroll are connected with mining, distribution and consumption of Usibelli coal. Statewide, the impact is 692 jobs and $52 million in payroll.*

A more detailed summary of study findings is provided below.

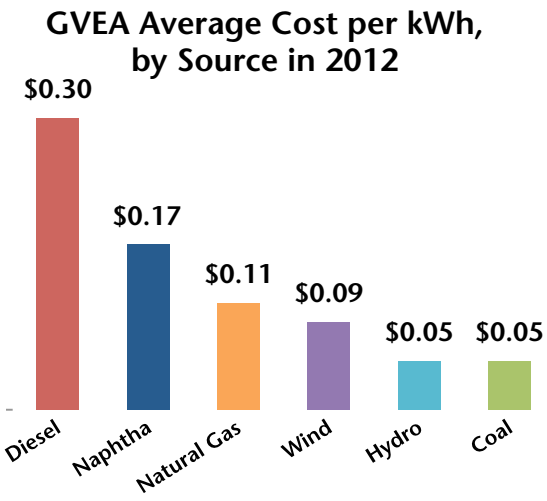
The Role of Coal in Interior Alaska Energy Generation

- Coal accounts for 29 percent of the electric power capacity in the Interior. Six coal-fired plants have a combined total of 136 megawatts (MW) of capacity. Five of the region's coal-fired plants are cogeneration plants that produce heat and electricity.
- Among the different fuel sources that can be used to generate electricity, coal is by a substantial margin the lowest cost source (excluding hydro). Based on Golden Valley Electric Association (GVEA) data, coal-generated electricity is one-sixth the cost of diesel and half the cost of natural gas-fired electricity transported over the Intertie from Southcentral Alaska.

Interior Energy Capacity, by Source



- In 2012, diesel-generated electricity cost GVEA an average of $0.30 per kilowatt-hour (kWh) to produce. The cost to generate power with naphtha (a relatively clean crude distillate) was $0.17/kWh and natural gas-fired electricity purchased over the Intertie from Southcentral Alaska averaged $0.11/kWh, according to GVEA data. Meanwhile the cost to generate electricity with coal averaged $0.05/kWh. Hydroelectric power from Bradley Lake costs $0.05/kWh, but accounted for just 4 percent of total generation. Wind-generated power from Eva Creek Wind Farm cost $0.09/kWh and accounted for 2 percent of total generation.



- If coal use was discontinued in Alaska, electricity costs would rise an estimated 25 percent in Interior Alaska, depending on what alternative fuel sources were available. Including GVEA, UAF and the military bases, the absence of coal as a fuel source would have a cost of $200 million or more annually.

- Increasing the use of coal to generate electricity will reduce the region's dependence on expensive and price-volatile petroleum products. Though the effect on consumer rates of bringing on line the coal-fired Healy Unit 2 Plant has not been determined, the project will at least stabilize rates in the near term and provide for lower costs in the future than would otherwise be the case in the absence of Healy Unit 2. Hypothetical modeling conducted for purposes of this study suggest that, with Healy Unit 2, overall generation cost savings of more than 10 percent could result, equating to $30 million a year in savings for Interior consumers, compared to what they would pay in the absence of Healy Unit 2.

- Heat generated at the five coal-fired cogeneration plants in Interior Alaska is the lowest cost heat in the region. Coal is an important, low-cost source of heat for the University of Alaska Fairbanks (UAF), the region's military bases, and most of the large buildings in downtown Fairbanks near the Aurora Energy LLC cogeneration plant.

- If the military bases in the Interior switched to natural gas, their heat and electricity costs would rise 250 percent assuming the lowest cost near-term delivery option. There is currently no natural gas available for use by the military.

UAF Case Study

- The energy cost and supply situation at UAF typifies the Interior region overall. To meet its energy needs, UAF relies on a mix of sources: coal, oil, electricity purchased from GVEA, and a small amount of natural gas. Coal accounts for 85 percent of annual energy generation but only 44 percent of the University's annual expenditures on energy. Oil accounts for 11 percent of generation and 36 percent of annual costs, and purchases from GVEA account for 3 percent of UAF's needs but 18 percent of annual spending on electricity.

- Among the energy sources available to UAF, the difference in cost is dramatic. For UAF, burning diesel is six times more costly than coal while natural gas is four times more expensive per Btu.
- UAF's 10 MW coal power plant is at the end of its useful life and will be replaced with a new, more efficient, lower-emission plant with 17 MW of production capacity. With this additional capacity, UAF does not expect to supplement its energy supply with oil, gas, or purchases from GVEA. The result will be an overall reduction in the cost of energy for UAF.
- UAF examined 13 different design options to replace their existing power plant. Weighing the factors of cost, reliability, and environmental stewardship, coal emerged as the preferred design option given new cleaner burning technology, supply stability, and lower cost than alternatives. The selected design reduces emissions (relative to the existing plant) and provides flexibility to use a blend of biomass fuel sources.
- If the new coal plant had been operating in 2012, UAF's energy cost would have been 40 to 50 percent lower.

The Economic Impact of Usibelli Coal Mine

Direct Employment and Payroll

- UCM directly employed an average of just over 140 workers in 2012. These workers earned $20.9 million in total labor income, including $15.0 million in payroll and $5.9 million in benefits.
- Average UCM wages are among the highest in the Interior and more than twice the statewide average.
- UCM jobs are a particularly important part of the Healy economy, a small community of approximately 1,100 residents. UCM directly accounts for 30 percent of all Healy employment and 60 percent of all wages paid in the community.

Workforce Residency

- The UCM workforce is 100 percent Alaska resident. This compares to a mining industry average of 65 percent Alaska resident hire and an economy-wide average of 80 percent Alaska hire. UCM's entirely resident workforce is in contrast to the Denali Borough's average of 41 percent Alaska resident workers.
- The high rate of local employment at the coal mine, along with a high level of in-region spending in support of mine operations, plus in-state downstream consumption of coal at Interior power plants, means that the economic benefits tend to stay in the Interior region.

Spending in Support of Mine Operations

- UCM has substantial indirect economic impacts. The mine's multiplier effects stem from $72 million in annual spending in Alaska in support of mine operations. This includes $51 million in spending on supplies and services, and $21 million in personnel-related expenditures.

- In 2012, approximately 400 Alaska businesses and organizations were in UCM's service and supply chain, including 195 in the Fairbanks area, 105 in Anchorage, 28 in the Mat-Su Borough, and 27 in the Denali Borough (primarily in the Healy economy). The remaining 45 businesses and organizations are scattered elsewhere in Alaska.

INDIRECT AND INDUCED EMPLOYMENT AND PAYROLL

- UCM's economic impact includes a large number of jobs and payroll associated with purchases of goods and services in support of mine operations (indirect effects) and associated with mine employees spending their payroll dollars (induced effects).

- Alaska Railroad (ARRC) is one of UCM's vendors, moving 1.8 million tons of coal in 2012 from the mine to Interior power plants or to the Seward coal export facility. Another 200,000 tons is transported from the mine in trucks to the Healy 1 plant.

- Other important sources of support activity include trucking large volumes of liquid motor fuel from Fairbanks and from Seward to the mine (to fuel the mine's heavy equipment). UCM is also an important customer for Alaska's heavy equipment dealers and service providers.

- Based on modeling conducted for purposes of this study, UCM accounts for approximately 212 indirect and induced jobs in the Interior region and $11.5 million in payroll. Statewide, UCM accounts for approximately 327 indirect and induced jobs and $18.9 million in annual payroll. This is an estimate of the total number of "upstream" jobs associated with UCM operations. It does not include "downstream" impacts, i.e., those jobs and income at power plants that rely on UCM coal.

Regional and Statewide Employment and Payroll Impacts

- Including all direct, indirect and induced employment, in 2012 UCM accounted for approximately 355 jobs in Interior Alaska and $26.5 million in total annual payroll. Statewide, the mine's impact included a total of 470 jobs and $33.9 million in payroll.

- UCM's economic impact includes financial support of non-profit organizations, through the Usibelli Foundation. The Foundation contributes to over 100 nonprofit organizations statewide, with total annual contribution averaging $112,000 over the past few years. Grants are made in the areas of education, health and social services, the arts, youth programs, and civic organizations and activities. The Usibelli Foundation also matches employee donations to United Way and several other community organizations in Healy.

Other Coal-Related Economic Impacts

- The economic impact of UCM includes significant in-state "downstream" effects. Downstream economic impacts occur when buyers of coal add value by converting it to electricity and space heat. The process of converting coal to energy has its own set of economic impacts as power plants employ workers and purchase goods and services in support of their operations.

- Downstream jobs associated with UCM include the power plants that buy and use UCM coal, namely the plants operated by GVEA, UAF, Aurora Energy LLC, and the military facilities at Clear Air Force Station, Ft. Wainwright, and Eielson Air Force Base. Employment at these facilities totaled 222 workers in 2012.

- More difficult to quantify, but perhaps more important (from an economic impact perspective) than the jobs at coal-fired power plants, is the role coal has played in keeping Interior energy costs well below what they would be in the absence of coal. Because energy costs are an important cost of doing business, the Fairbanks economy would likely be smaller if not for the low-cost energy provided by coal.

- Looking forward, the high cost of energy in Interior Alaska will continue to act as a constraint on economic development. Without the reliable and low-cost energy made possible by UCM, the Interior economy would be facing much stronger energy cost-related headwinds.

Summary of UCM Economic Impacts, 2012

	Impacts
Direct Impacts	
Annual average employment	143 jobs
UCM employee payroll	$15.0 million
UCM employee labor income (payroll plus benefits)	$20.9 million
Spending on goods and services with Alaska-based vendors	$50.7 million
Number of Alaska-based vendors	400 vendors
Upstream Multiplier Effects (related to UCM spending on goods and services)	
Indirect and induced employment in Interior Alaska only	212 jobs
Indirect and induced employment statewide	327 jobs
Indirect and induced payroll in Interior Alaska only	$11.5 million
Indirect and induced payroll statewide	$18.9 million
Downstream Impacts	
Interior Alaska coal-fired power plant employment	222 jobs
Interior Alaska coal-fired power plant payroll	$17.8 million
Total Employment and Payroll Impacts	
Total employment (direct, indirect, induced and downstream) in Interior Alaska	577 jobs
Total employment (direct, indirect, and induced) statewide	692 jobs
Total payroll (direct, indirect, and induced) in Interior Alaska only	$44.3 million
Total payroll (direct, indirect, and induced) statewide	$51.7 million

Source: Direct impact figures from UCM. All others are McDowell Group estimates.

Introduction

The purpose of this study is to profile the economics of coal in Interior Alaska, including the role of coal in the region's energy infrastructure and the economic impact of coal mining, in terms of jobs and income. The study will also explore the potential economic impact of conversion of the Interior's five cogeneration heat and power plants from coal to natural gas.

The Interior of Alaska, a region stretching from Cantwell to Delta and including the Fairbanks North Star Borough, faces a paradoxical energy situation. While an average of 500,000 barrels of crude oil run through the nearby Trans-Alaska Pipeline System every day, businesses and residents struggle with some of the highest costs of energy in the nation as a result of heavy reliance on costly petroleum products.

As petroleum prices have risen, the Interior finds itself in a difficult situation, with high and unpredictable energy costs eating into household budgets and constraining economic growth. In recent years residential rates for electricity have been as high as $0.22/ kWh (kilowatt hour) and heating oil as high as $4.30 a gallon. Heating oil, a fuel that has increased 180 percent in price in the last 10 years, warms 86 percent of residential homes. Golden Valley Electricity Association (GVEA), the utility that provides electricity to the area, relies on diesel and naphtha for 43 percent of its electric generation. Meantime, coal has provided a steady and low-cost source of energy for the region.

Currently the only active coal mine in Alaska, Usibelli Coal Mine supplies 100 percent of the coal used to generate electricity and heat in the Interior. The mine, in operation since 1943, is located 115 miles south of Fairbanks in Healy, in close proximity to the large population center of Fairbanks and military bases (Eielson Air Force Base (AFB)), Ft. Wainwright, and Clear Air Force Station (AFS)) within Interior Alaska. The mine produces an average of 2,000,000 tons of coal per year with roughly half used in the Interior for heat and electric generation and the remainder exported to overseas markets from a facility in Seward.

Understanding the role of coal in Interior Alaska requires an understanding of the entire energy landscape in the region. This report begins with a profile of Interior Alaska's existing energy supply and infrastructure. Chapter 2 provides information on the cost of various sources of energy in the region. In Chapter 3, various efforts to develop new sources of energy are profiled. Chapter 4 examines coal's place in the region's future energy supply. Finally, in Chapter 5, the economic impact of Usibelli Coal Mine is profiled, including an assessment of direct economic impacts as well as mine-related multiplier effects.

Methods and Sources

A variety of data sources were used for this study. Usibelli Coal Mine provided McDowell Group with data on direct employment, payroll, benefits, vendor spending, and tax payments. McDowell Group also relied on data from the Alaska Department of Labor and Workforce Development and the federal Bureau of Economic Analysis. IMPLAN, a model for estimating economic impacts of industry activity, was used to assess the mine's multiplier effect on Alaska and the local economy. McDowell Group also conducted interviews with a number of stakeholders knowledgeable about Interior Alaska energy production and consumption.

Chapter 1: Interior Alaska's Existing Energy Infrastructure and Supply

Overview

The purpose of this chapter is to provide a profile of Interior Alaska's energy infrastructure, and coal's place within that infrastructure. Interior Alaska relies on a complex blend of fuel sources and energy products. The majority of electricity comes from diesel, naphtha, and coal while heating is provided primarily from coal and heating oil. A few very large energy users in the Interior (military bases and UAF, for example) produce heat and electricity with coal cogeneration plants. Cogeneration technology allows a single power plant to provide both electricity and heat.

Other energy consumers purchase large amounts of electricity from GVEA for industrial purposes (Fort Knox gold mine, for example) and use heating oil for heating purposes. For all other consumers except the military bases and UAF, electricity is purchased from GVEA. Heating oil sold by a network of local dealers is the primary source of fuel for heat. A small, but growing, amount of coal, natural gas, propane, firewood, and pellets are used for heating residences and small commercial businesses as well.

Utilities

Four utilities serve the Interior and provide electricity and heating services: Golden Valley Electric Association (GVEA), Doyon Utilities, LLC, Fairbanks Natural Gas, LLC (FNG), and Aurora Energy, LLC.[1]

- GVEA is the largest utility in the Interior, providing electricity to residential and commercial/industrial customers. Serving an area from Cantwell to Delta, the utility has 37,270 residential meters and 501 commercial/industrial meters.
- Aurora Energy, LLC operates a coal-fired cogeneration plant that sells wholesale electricity to GVEA, and markets steam-heat and hot water heat to 192 residential and commercial customers in the downtown Fairbanks area.
- Doyon Utilities, LLC (DU) owns and operates a coal-fired cogeneration plant that produces electricity and steam for use at Ft. Wainwright. DU also owns and operates a diesel-fired steam generator that fulfills the heating needs of Ft. Greely. DU has a 50-year contract with the Department of Defense for three army posts (Fort Wainwright, Fort Greely, and JBER Richardson located in Anchorage).
- Fairbanks Natural Gas, LLC (FNG) sells natural gas for heating and domestic use to approximately 1,100 customers in Fairbanks. FNG trucks the natural gas from Cook Inlet and distributes it in the Fairbanks area. The utility plans to expand its service area and is an active player in the proposed plan to truck natural gas from the North Slope.

[1] Interior Gas Utility (IGU) is a public corporation formed in 2012 by the Fairbanks North Star Borough. IGU plans to provide sections of Fairbanks with natural gas and propane. At this time IGU has no ratepayers.

Virtually all Interior energy users rely on GVEA for electricity, and based on where they are located usually choose the lowest-cost source of heating available to them.

Fuels for Electricity Generation

Electricity used in the Interior is produced mainly from fossil fuels. Diesel, naphtha, natural gas, and coal provide approximately 90 percent of the fuel necessary to produce this electricity. Hydroelectric, wind, and a very small amount of solar complete the portfolio.

The Interior's electricity infrastructure is unique for the population that is served. Despite having just over 100,000 residents, the region has 12 major facilities that produce heat and/or electricity. Compared to other population centers, this ratio is unusually high. While a diverse energy supply base can have its benefits, the high number of facilities hampers economies of scale for electricity generation that might otherwise be possible with a more consolidated infrastructure.

Utilization of various sources of fuel for electrical energy generation is described below.

Coal

- Eielson AFB's cogeneration plant has a capacity of 25 MW (megawatts). Constructed in 1952, the plant burns approximately 180,000 tons of coal annually.
- Doyon Utilities' 20 MW cogeneration plant produces electricity for Ft. Wainwright. The facility was built in the 1940s with major additions in the mid-1950s. The plant uses 280,000 tons of coal per year and completed major refurbishments in 2003 and 2005.
- Clear AFS operates a 23 MW cogeneration plant that was built in 1961 and uses about 55,000 tons of coal per year.
- University of Alaska Fairbanks' 10 MW plant burns approximately 70,000 tons of coal per year and was built in 1964. A replacement coal plant is being permitted and the current plant will operate as back-up.
- The privately owned Aurora Energy cogeneration plant, located in Fairbanks, is a 32 MW plant that sells wholesale electricity generated to GVEA. The plant was built in 1952 and uses 210,000 tons of coal a year.
- The 25 MW Healy Unit 1 plant is operated by GVEA and uses 200,000 tons of coal per year. Located close to UCM, the plant has produced power since 1967.

Diesel

- GVEA's 40 MW Zehnder Power Plant is located in downtown Fairbanks and burns diesel.
- The GVEA North Pole Power Plant has a capacity to generate 120 MW. The plant was built in 1976 and uses two 60 MW diesel turbines to produce electricity.
- GVEA's Delta Power Plant was built in 1976 and uses diesel to generate a maximum of 27 MW. This plant is used primarily as a back-up generator.
- In total, GVEA burned 16 million gallons of diesel in 2012.

Naphtha

- GVEA's North Pole Expansion Power Plant uses naphtha and can generate 60 MW. Built in 2006, the plant can add another turbine to double its power generation capability. The power plant can be retrofitted relatively easily to burn natural gas. The plant used 26 million gallons of naphtha in 2012.

Natural Gas

- The electricity that comes through the Intertie from Southcentral Alaska is produced mainly from Cook Inlet natural gas. The Railbelt Intertie from Wasilla to Healy was completed in the 1980s and provides 70MW of transmission capacity between Southcentral and Interior Alaska. That is, Interior access to the combination of natural gas and Bradley Lake hydroelectricity is limited to 70MW. The Northern Intertie was completed in 2003 and provides a second transmission route from Healy to Fairbanks and the two transmission lines provide approximately 140MW of combined capacity between Healy and Fairbanks.

Hydroelectric

- Located 27 miles southeast of Homer, the 120 MW Bradley Lake hydroelectric dam is owned by six Alaska utilities. Completed in 1991, GVEA owns 17 percent (20 MW) of the dam's output. Bradley Lake power feeds into the Intertie that connects the Southcentral generation to the Interior.

Renewable Energy

- The 25 MW Eva Creek Wind farm is owned and operated by GVEA. Located north of Healy, the 12-turbine wind farm was completed in 2012. The plant is forecasted to operate at 36 percent capacity due to wind speed fluctuations, which means that the facility will operate at 9 MW on an annual average basis.

- A small amount of electricity comes from GVEA members who own solar panels or wind turbines. Known as the Sustainable Natural Alternative Power Program (SNAP), members are reimbursed for electricity that is fed into the grid.

Summary of Interior Electricity Generation Infrastructure, 2012

Fuel	Number of Plants*	Capacity (MW)	Percent of Total Capacity	Percent of Total 2012 Generation
Diesel	3	187	41%	13%
Coal	6	133	29	31
Intertie**	1	70	15	25
Naphtha	1	60	13	30
Wind	1	9	2	2
Total	**12**	**459**	**100%**	**100%**

Source: GVEA 2012, RCA 2012, and McDowell Group estimates. *Only plants larger than 1 MW are included.
**The Intertie includes hydroelectric and natural gas purchases from Southcentral.

Fuels for Generating Heat

Heating oil is the main source of fuel for residential space heat in the Interior. The amount of heat required in a region can be expressed in terms of heating degree days (HDD). This is a measurement of the amount of energy required to maintain a comfortable temperature (65˚F) inside a building relative to outside temperatures. A region like Hawaii requires 0 HDD, because the average daily temperature is above 65˚F, while Seattle requires 5,000 HDD.[2] With Interior Alaska at 14,000 HDD, a building in Fairbanks that is similar to a building in Seattle will require almost three times the heat to maintain a temperature of 65˚F.

Heating Oil

A 2009 housing assessment estimated that 86 percent of residential homes in Fairbanks use heating oil as a primary fuel source for home heating.[3] This study, though limited to Fairbanks, is representative of the rest of the Interior. While many commercial buildings, such as schools, stores, and office buildings, rely on heating oil, more options are available for this type of energy user. A significant number of commercial buildings are clustered in areas that have alternative sources of heat available, such as natural gas or steam from coal cogeneration facilities. Additionally, because the average commercial building requires more heat than the average residential structure, the economics of accessing and using alternative fuel sources can be more favorable.

Natural Gas

Approximately 1,100 homes and several commercial buildings use natural gas in Fairbanks. Access to natural gas is limited at this time and only available in a small portion of Fairbanks.

Coal

Coal cogeneration technology provides heat for a number of large Interior energy consumers. Steam from electrical generation is piped to buildings to be utilized for heating purposes. Used at Eielson AFB, Clear AFS, Ft. Wainwright, and UAF, this steam is the cheapest source of heat available in the Interior. In addition to these large institutional users, the Aurora plant sells steam or hot water for heating 192 homes and commercial establishments in the core of Fairbanks.

All but one (Healy 1) of the Interior's coal-fired plants are cogeneration plants, which provide heat for area buildings as well as electricity. As coal is burned, water is heated into steam. This steam is used to either turn a turbine (making electricity) or sent in underground pipes as either steam or hot water (to provide heat to buildings in close proximity – two to three miles – to the plant). This approach to heating is very common in colder areas. While opportunities for district heat are limited by the amount of steam a plant is capable of making, and by the distance from the plant, it is efficient, clean compared to alternatives, maintenance free, and cost-effective. In Interior Alaska, it is less expensive than all other options, primarily due to the attractive price of coal compared to other fuel choices.

[2] http://www.ncdc.noaa.gov/img/documentlibrary/clim81supp3/annualheatingDD_hires.jpg
[3] http://www.cchrc.org/docs/reports/TR_2009_02_2009_AK_Housing_Assessment_Final.pdf

Other Sources

The recent rise in heating oil cost has increased interest in alternative sources of fuel for heating. Many residential buildings are augmenting oil use with wood or pellets. A small number of residential and light commercial customers are using outdoor boilers that burn coal and wood. Other fuel sources, such as electricity, solar thermal, and propane, complete the types of fuel that are used for heating in the Interior.

Chapter 2:
The Cost of Energy in Interior Alaska Today

Overview

Residents of Interior Alaska pay some of the highest electric and heating costs in the United States. The combination of a sub-arctic climate and a reliance on oil for residential heating and electricity generation results in the region's high costs. Because the average home requires 1,086 gallons of heating oil per year, annual average heating costs are roughly $5,000.[4] Combined with an average annual electricity usage of 8,000 kWh, the average home in the Interior spends more than $6,000 a year for electricity and heat.[5] According to the Council for Community and Economic Research, utility costs in Fairbanks are 220 percent of the national average.[6,7] By comparison, Anchorage is 104 percent of the national average and Juneau is at 172 percent.

Electricity Costs

GVEA electricity rates have regularly exceeded 180 percent of the national average. With 43 percent of the electricity produced by GVEA in 2012 coming from diesel or naphtha, any increase in oil prices raises the cost of electricity for ratepayers. In 2012, electrical rates peaked at $0.22/kWh before settling at the current price of $0.19/kWh.

Comparison of Average Residential Electricity Rates per kWh

Location	Cost per kWh
Hawaii	$0.37
Interior Alaska	**0.19**
California	0.16
Anchorage	0.13
U.S. Average	0.12
Washington State	0.09

Source: EIA 2013, GVEA 2013, Chugach Electric 2013.

The relationship between oil prices and the cost per kWh is strong but may weaken as non-oil sources of electricity generation are brought online. The newly constructed Eva Creek Wind Farm is an example of a project that has the potential to displace expensive diesel power generation. However, any effect is expected to be small as the wind farm currently produces a relatively small amount of electricity and is not considered as reliable as electricity generated from a diesel or naphtha turbine. Whenever electricity from wind is being

[4] http://www.cchrc.org/docs/reports/TR_2009_02_2009_AK_Housing_Assessment_Final.pdf
[5] http://www.gvea.com/rates/billexplained
[6] http://labor.alaska.gov/trends/jul13.pdf
[7] Utility costs include other services such as sewer, trash, and water.

used, diesel, coal, or natural gas fired generation must still be available as back-up generation in case the wind dies.

GVEA actively manages various fuel sources for power generation to meet demand while minimizing costs. Cheaper fuel sources such as coal and the Intertie are used first and more expensive fuel sources such as diesel are brought online as demand increases. As demand for electricity has risen, the more expensive fuel sources of electricity have been used more frequently. At the same time, these sources have increased in cost with the rise of oil prices.

In contrast to oil prices, coal prices have been relatively steady over the last ten years. Purchasing 1 million British thermal unit (MMBtu) for electricity generation in the form of diesel currently costs $21 while the same amount of energy from coal costs less than $4. The availability of coal as a relatively low cost and stable source of energy has helped soften the effect of the dramatic increase in oil prices.

As illustrated in the following table, coal is a substantially lower-cost source of electrical energy; one-sixth the cost of diesel and less than half the cost of electric power provided by natural gas.

Average GVEA Production Costs per kWh in 2012 and Percent of Total Generation by Fuel Type

Energy Source	Cost per kWh	Percent of Generation
Diesel	$0.30	13%
Naphtha	$0.17	30%
Natural Gas	$0.11	18%
Wind	$0.09	2%
Coal	**$0.05**	**31%**
Hydro	$0.05	6%

Source: GVEA 2013, RCA 2013.

Heating Costs

With 86 percent of residential homes using heating oil as the primary source of heating, any increase in the price of oil raises the cost of warming a home.[8] Most commercial buildings in the Interior are in the same position.

The cost of heating oil per gallon peaked in Fairbanks at $4.30/gallon in 2008 before settling at a current price of $3.78/gallon (12-month average). With the average home in Fairbanks requiring 150 MMBtu annually, the current annual cost to heat a home is estimated to be approximately $5,000.

Some residential and commercial buildings are able to access natural gas or district heat. While less expensive than heating oil, access is limited and a relatively small number of the Interior's buildings are connected to

[8] http://www.cchrc.org/docs/reports/TR_2009_02_2009_AK_Housing_Assessment_Final.pdf

these services. As heating oil has become more expensive, wood, coal, and pellets have all increased in use. This substitution away from heating oil is occurring mainly in residential homes. A common strategy for reducing home heating costs is to continue using heating oil but augmenting its use with cheaper sources, such as wood or pellets. A 2010 survey of Fairbanks households estimated that heating oil use per household has fallen 20 percent compared to 2007.[9] An increase in the use of other fuel sources, as consumers react to expensive heating oil, is credited for this reduction.

Fairbanks Residential Heating Costs, 2013

Type of Fuel (Delivered)	Cost per Unit	Heat Content per Unit (Btu)	Cost per MMBtu ($)	Approximate Efficiency (Percent)	Annual Cost to Heat Average Home ($)
Electricity	$0.19/kWh	3,412	$55.69	100%	$8,353
Propane	$3.78/gallon	91,000	41.65	78	8,009
Heating Oil	$3.78/gallon	138,000	27.39	78	5,268
Natural Gas	$23.33/MCF	1,000,000	23.33	82	4,268
Pellets	$320/short ton	16,500,000	19.39	78	3,730
Birch Firewood	$325/cord	20,000,000	16.25	72	3,385
Coal	$143/short ton	15,000,000	9.53	75	1,907
District Steam	$10.50/1,000lbs	1,000,000	10.50	100	1,575
District Hot Water	$27.03/MMBtu	1,000,000	27.03	100	4,055

Notes: The average home uses 150 MMBtu/year. Cost per unit data was obtained from various fuel vendors in Fairbanks (July, October 2013).

[9] http://www.dec.state.ak.us/air/doc/Fbks_2010_HHSurvey.pdf

Chapter 3: Interior Energy in the Future

Overview

Concerns about energy supplies and rising energy prices in the Interior have spurred interest in developing cheaper sources of electricity and heating. As the future of coal in Interior Alaska's infrastructure is considered, it is useful to describe the energy development projects now underway or in various stages of planning. The projects detailed below have been, or most likely will be, funded mainly from government sources.

Healy Unit 2

Originally completed in 1998, the Healy Clean Coal Project (now being called Healy Unit 2) showcased the latest in coal burning power generation technology. Funded in part by the U.S. Department of Energy, the power plant was engineered to use coal that traditionally was discarded because of being too low in energy content. The 50 MW plant is located adjacent to the Healy Unit 1 coal plant in Healy. Disputes between shareholders caused the plant to be shut down in 1999. While the plant is currently idle, GVEA plans to start generating electricity at the facility in 2015.[10]

Negotiations with the Environmental Protection Agency (EPA) resulted in GVEA agreeing to install further emission controls on the plant at a cost of $45 million. The plant will employ 40 people. Coal-fired electrical generation capacity within the Interior will rise from 136 MW to 185 MW when the plant is brought on-line.

Susitna-Watana Hydroelectric Project

The proposed Susitna-Watana Hydroelectric Project would create a 600 MW dam across the Susitna River. Estimated to cost $5.2 billion, the dam would provide approximately 50 percent of the Railbelt's electrical needs. While difficult to project, the wholesale rate of electricity coming from the dam is estimated to start at $0.12/ kWh and after 50 years be $0.05/kWh (in 2012 dollars).[11] This initial rate falls roughly in the middle of wholesale cost paid by utilities, with coal the cheapest and diesel the most costly.

Interior Energy Project (trucking North Slope gas)

In 2013, Governor Parnell signed legislation that provides $362.5 million to build the necessary infrastructure to truck natural gas to Fairbanks from the North Slope. The Alaska Industrial Development and Export Authority (AIDEA) will provide a large portion of this funding ($275 million) in low interest financing to build a liquefaction plant and distribution system in Fairbanks. The remaining funding will be disbursed in the form of tax credits for the construction of storage capacity and capital funding. Private investors are expected to partner with AIDEA and eventually own part of the project.

[10] http://www.gvea.com/news/65-hccp-air-permit
[11] http://www.susitna-watanahydro.org/alaska-energy-authority-confident-susitna-watana-hydro-will-provide-long-term-stable-and-affordable-energy/

Known as the Interior Energy Project, a liquefaction plant will be built on the North Slope to convert natural gas into liquefied natural gas (LNG). The LNG will then be transported to Fairbanks with 30 trucks making 48 trips a day.[12] A plant in Fairbanks will warm the LNG, converting it from liquid back to gaseous state, to be distributed to customers through an underground piping system. AIDEA is projecting that natural gas will be available to customers by the end of 2015 at a rate of $14.09 to $17.09 per MCF (thousand cubic feet). At those rates, on a per Btu basis natural gas will cost approximately half the cost of diesel and 4 to 5 times the cost of coal. While natural gas is planned to be available for moderate and highly populated portions of Fairbanks, it is difficult to predict with any certainty when natural gas could supply the majority of the Fairbanks population.

Natural Gas Pipelines

For the past 50 years, many different pipelines that would transport natural gas to the Interior have been proposed. The impact on energy costs within the Interior is difficult to forecast but delivered natural gas to the Interior will likely be cheaper than diesel or naphtha, but more expensive than coal or district heat.

Pipeline to Lower 48

The proposed Alaska Pipeline Project would transport natural gas 1,700 miles from the North Slope to the Alberta/British Columbia border.[13] Connecting to the existing North American natural gas distribution system would mean that natural gas produced on the North Slope could be used in almost all major urban regions in Canada and the United States. The main issue slowing construction of this project is the precipitous fall in natural gas prices in markets where North Slope natural gas would be sold. A gas pipeline to the Lower 48 would include take-off points to provide natural gas for consumption in Alaska.

Liquefied Natural Gas Export Project

This type of project would involve the construction of an approximately 800 mile pipeline from the North Slope to Southcentral with the goal of exporting LNG. Natural gas would be liquefied at tidewater and transported by ship to the global market. Spurs along the main pipeline would provide natural gas for in-state consumption. Two private companies and one government group are examining this project. Pipeline construction costs are estimated at $45 to $65 billion. Legal issues surrounding the export of LNG and the high development cost have slowed this project.

North to South Pipeline

A 730-mile pipeline, stretching from the North Slope to Big Lake, has been examined as a way to bring natural gas to Southcentral Alaska. A 35-mile spur off the main line would provide natural gas to Fairbanks. With Southcentral Alaska facing natural gas shortages just a few years ago, this pipeline was seen as a way to alleviate the shortfall. Recent investments in Cook Inlet natural gas production have reduced the pressure to bring natural gas from the North Slope but the project is still moving forward.

[12] http://www.interiorenergyproject.com/Project%20Overview/index.html
[13] http://www.arcticgas.gov/guide-alaska-natural-gas-projects#southcentral

Chapter 4: Coal's Role in Present and Future Interior Energy Production

Examination of Interior Alaska's energy infrastructure reveals that coal is a vital fuel for stationary heat and power generation. Coal is inexpensive and abundant. Without coal in the Interior, energy costs would be substantially higher and, further, in the absence of coal, the economy of the Interior likely would not be what it is today. When considering the future of energy infrastructure in the Interior, and the various projects to reduce or slow the increase in cost, three important points are important to recognize:

- Coal is well situated to continue meeting the near term electrical generation needs of the Interior and provide cost-effective electricity and heat at stable, affordable, rates. The Healy Unit 2 project will at least stabilize if not reduce electricity rates and diversify GVEA's energy portfolio away from oil. As evidenced by the proposed UAF coal power plant, new coal burning facilities can provide both electricity and heat while balancing cost and emissions.

- Coal is increasingly clean. Coal technology has improved in the last 30 years and now offers more efficient and cost effective ways to utilize coal. Technologies such as integrated gasification combined cycle and fluidized bed combustion offer improved performance of coal burning plants.

- Coal is price-stable relative to gas or oil. This stability is an asset to GVEA and the military bases as price certainty resulting from long-term contracts lowers risk. With hundreds of years of coal resources available at current production levels and established infrastructure (both mining and transportation), coal prices in the Interior are likely to remain stable into the future.

As public debate about energy-related development occurs, especially around the role of coal, it is critical to consider the financial implications of an increase or decrease in the use of coal. UAF's replacement coal-fired cogeneration plant offers insight into the future of coal in the Interior.

UAF Case Study

UAF examined 13 different design options to replace their existing power plant. Traditional options, such as natural gas, coal, and diesel turbines, were considered along with much less traditional technologies, such as nuclear and solid waste gasification. Of these 13 options coal emerged as the best balance between cost, reliability and emissions. UAF estimates that if the plant were operating in 2012 energy cost would be 40 to 50 percent lower. [14]

While the majority of the energy used at the university comes from coal, other sources such as natural gas and diesel play a role. Electricity from GVEA is also purchased when the plant is down for maintenance or demand is beyond production capacity.

[14] Charles Ward, UAF Director of Utilities, personal communication, August 2013.

UAF's 10 MW power plant was built in 1964 and was estimated to have a 50-year operating life. As the plant approaches the end of its expected operating life, it has become increasingly expensive to maintain. A permit to build a new 17 MW coal plant has been filed with the EPA and a ruling on the permit is expected by the end of 2013.

The new plant will be a fluidized bed boiler that is much more technologically advanced than the current facility. UAF will be able to use biomass such as pellets, woodchips, paper, or grain to fuel approximately 10 percent of output. Natural gas could provide 30 percent of the required energy with a relatively easy retrofit. Compared to the current facility, emissions from the new plant will be cut drastically, as illustrated in the following table.

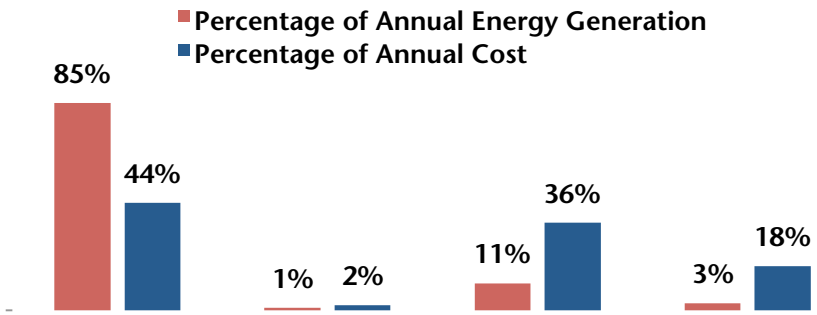
Emissions Reduction with UAF's New Coal Power Plant

Type of emission	Reduction (%)
Nitrogen Oxide (NOx)	65%
Carbon Monoxide	40
Particulates	60
Fine Particulates (PM2.5)	38
Sulfur	71

Note: Reductions are in relation to the existing UAF coal-fired power plant. Source: UAF

Within the current portfolio of energy sources that UAF can choose from, the difference in cost is dramatic. Burning diesel costs 6 to 7 times the cost of coal while natural gas is 4 to 5 times higher. The new power plant will substantially reduce the cost of energy for UAF as more coal will be used in place of the more costly sources that now fill out UAF's energy needs.[15] UAF burns an average of $3.6 million worth of coal annually. Providing an equivalent amount of energy using natural gas or diesel would cost roughly $17 million and $25 million, respectively. By continuing to use coal UAF will save $13 million to $21 million annually over alternative sources. Building a new power plant will take advantage of coal as a lower cost fuel while at the same time providing a cleaner source of energy relative to the existing plant.

Energy Generation Versus Cost for UAF, 2012



Source: UAF

[15] Charles Ward, UAF Director of Utilities, personal communication, July 2013.

Impact of Coal on Military Energy Costs

Ft. Wainwright, Eielson AFB, and Clear AFS use an estimated 515,000 tons of coal annually for cogeneration purposes. Data was not available for an in-depth analysis of energy costs for the military but examining the annual consumption of energy, in the form of coal, allows for some basic understanding. Knowing the bases require approximately 7.7 million MMBtu annually and the cost of various sources of energy, financial implications of a switch to another source of energy can be explored.

With an estimated cost of $60/ton for coal, the bases currently spend approximately $31 million annually on coal purchases. If trucked natural gas from the North Slope becomes available, the bases could switch from coal to natural gas but energy costs would more than triple. The proposed Interior Energy Project is forecasted to deliver natural gas at a cost of $14-17/MCF. Using $14/MCF, a switch to natural gas would increase annual costs from $31 million to more than $108 million, or an increase of $77 million annually.

Another way to understand the cost-saving nature of coal is to examine a scenario where the bases relied upon diesel generators for their electrical energy and heating needs. Assuming diesel costs $3 per gallon (the current market rate for large scale consumers), purchasing 7.7 million MMBtu would increase energy costs from $31 million to approximately $169 million, an increase of $138 million.

Military spending is estimated to support 30 percent of the Fairbanks economy.[16] Large increases in energy costs could risk maintaining the military's presence in the Interior.

Impact of Coal on GVEA

McDowell Group modeled GVEA's short-term generation costs to understand how the electricity rates would vary with different levels of coal use. This analysis showed that use of coal for electrical generation and GVEA generation costs are inversely related. That is, as GVEA uses more coal, electricity costs less. Two main scenarios were examined; GVEA using zero coal and the impact of Healy Unit 2.

SCENARIO-ZERO COAL

A loss of all coal-fired electrical generation would mean that Healy Unit 1 and the Aurora power plant would be idled. A reduction of this magnitude would represent roughly one third of 2012 electrical sales. Assuming consumers require the same amount of electricity, generation would be shifted to other available capacity, mainly the North Pole Expansion Plant and the North Pole Power Plant; facilities that generate electricity at $0.17 and $0.26 per kWh, respectively.[17] This switch to fuel sources 3 to 6 times more expensive than coal would likely result in a 20-30 percent increase in GVEA's cost per kWh. Assuming this cost is passed on to consumers, GVEA ratepayers would collectively pay approximately $80 million more annually for electricity.

[16] Jim Dodson, CEO Fairbanks Economic Development Corporation, personal communication, July 2013.

[17] GVEA annual filing with the Regulatory Commission of Alaska, 2012.

SCENARIO- HEALY 2

Bringing the Healy Unit 2 online would double the amount of coal-fired power capacity available to GVEA. The availability of this cheaper electricity would displace the use of diesel and naphtha at the North Pole Power Plant and the North Pole Extension Plant, as well as reduce reliance on Intertie purchases from Chugach Electric Association. Estimates of the fully loaded generation costs (capital recovery and operating cost) for Healy Unit 2 are not available and, further, it is not clear how GVEA might use Healy Unit 2 production to offset dependence on diesel, naphtha or purchases from Southcentral. Therefore it is not possible to predict with any certainty how rates paid by consumers will be affected by commissioning of Healy Unit 2.

Nevertheless, the significantly lower fuel costs associated with coal will translate into savings for consumers, either in the near-term or in the future as the region's energy demands grow. At a minimum, Healy Unit 2 will stabilize electricity rates (as suggested by GVEA) and serve to insulate consumers from future rate uncertainty. And lower rates are also a possibility. McDowell Group modeling indicates that if the cost of Healy Unit 2 electricity averages $0.10 per kWh, this doubling of coal-fueled generation could hypothetically result in overall generation cost savings of more than 10 percent, equating to perhaps $30 million a year. Again, it is important to note the hypothetical nature of these calculations. The actual affect of Healy Unit 2 on rates paid by consumers will ultimately depend on a numbers of factors too speculative to predict at this stage of GVEA's efforts to re-commission the facility.

Environmental Considerations

Environmental issues regarding coal utilization are an important part of the discussion about the future of Interior Alaska energy supply. As discussed in the UAF case study, current coal technology offers far cleaner, more efficient, and more cost effective coal-burning equipment and processes than in the recent past. Just as today's cars are cleaner and more fuel efficient, new coal plants are cleaner and more efficient.

Interior Alaska has the advantage of access to clean coal. Coal can be classified into four ranks that are separated based on the amount of energy within the fuel. Lignite has the lowest amount of energy per unit, followed by, sub-bituminous, bituminous, and anthracite with the highest energy content. The composition of coal ranges as well; the amount of compounds such as sulfur and mercury change depending on where the coal is mined. Healy coal used in Interior Alaska is sub-bituminous with ultra low sulfur content of 0.2 percent.[18,19] Other coal used elsewhere has a sulfur content of 5-6 percent or more. Mercury content of Alaska coal at 0.07 ppm is also much less than the national average of 0.17 ppm. [20,21]

[18] http://pubs.usgs.gov/dds/dds-077/dds77text.html#heading128041696
[19] http://pubs.usgs.gov/of/1998/of98-763/ofr98-763.pdf
[20] http://pubs.usgs.gov/fs/fs095-01/fs095-01.html
[21] http://webcache.googleusercontent.com/search?q=cache:38TSEZsRbv0J:www2.bren.ucsb.edu/~keller/courses/esm595F/EmissionRedElecIndustry/Appendix%2520A.doc+&cd=26&hl=en&ct=clnk&gl=us&client=firefox-a

Chapter 5:
Economic Impact of Coal in Interior Alaska

This chapter examines the employment and payroll impacts of Usibelli Coal Mine (UCM). In addition to jobs at the mine, there is a range of multiplier effects associated with mine operations. Jobs are created throughout the economy, the mine purchases supplies and services in support of its operations and mine employees spend their payroll dollars on supplies and services.

UCM Employment and Payroll

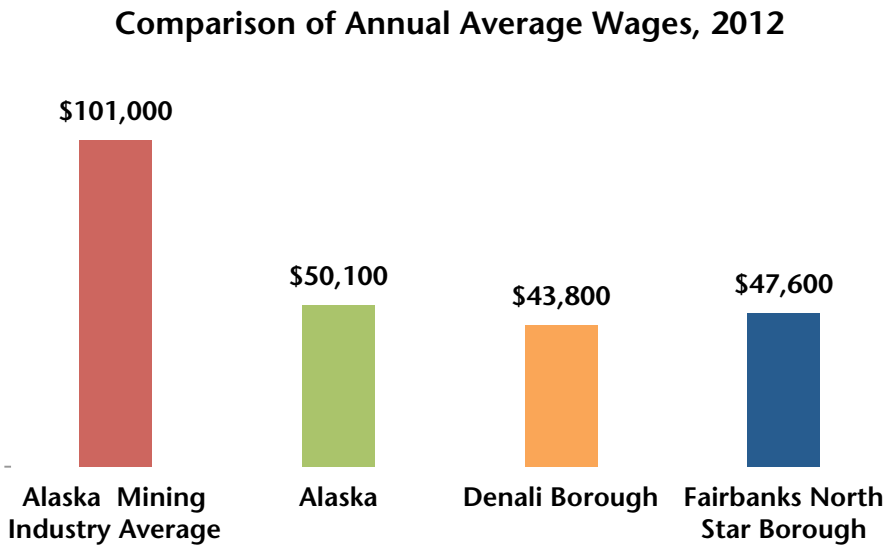
Jobs

UCM employed an average of just over 140 workers in 2012. Jobs at the mine include equipment operators, along with a variety of professional, technical, mechanical, and administrative staff. Employment is consistent throughout the year, ranging from a July peak of 149 to a December low of 129. More than 90 percent of UCM employment is in Healy; seven positions are based in Fairbanks and two positions are based in Palmer. UCM's steady employment is particularly important in a local (Denali Borough) economy that is characterized by high seasonal employment fluctuations. In the visitor industry-dominated Denali Borough, overall 2012 employment ranged between a high of 3,636 in July and a low of 832 in January. For the months November through March, UCM directly accounts for one in six jobs in the Denali Borough.[22]

Payroll and Average Wages

UCM wages are on par with pay levels in the mining industry throughout Alaska. Mining wages are among the highest in the state, averaging $101,100 in 2012. In fact mining is second only to the oil and gas industry, where annual wages averaged $127,200 in 2012. Mining wages are more than double the 2012 average annual wages for all workers in Alaska overall and in the Interior (Fairbanks North Star Borough and Denali Borough combined). According to the Alaska Department of Labor and Workforce Development (ADOLWD), the average annual wage in Alaska was $50,100 in 2012, while the average annual wage in the Denali Borough was $43,800.[23] In the Fairbanks North Star Borough, the average annual wage was $47,600 in 2012. These wage comparisons are important because they illustrate the role of UCM in providing family-wage jobs when many of the new jobs being added to the Interior economy are relatively lower-paying, seasonal, service sector jobs.

[22] Based on November through March employment.
[23]. *http://laborstats.alaska.gov/qcew/qcew.htm*



Workforce Residency

All UCM employees are Alaska residents. In comparison, the statewide metal mining industry average is 65 percent Alaska resident employment, a statewide private sector average of 77 percent, and the Alaska economy-wide (all-industry) average of 80 percent, according to 2011 ADOLWD data.[24] UCM's entirely resident workforce is in sharp contrast to the Denali Borough's average of only 41 percent Alaska resident workers.

Other Employment Related to UCM

The employment and payroll impacts of UCM go substantially beyond the direct jobs at the mine. UCM-related employment also includes:

- Indirect impacts, including jobs and income in businesses providing goods and services to the mine in support of its operations. These impacts are some sometimes termed "upstream" economic impacts and are measured using multipliers derived from econometric models.[25]
- Induced impacts, including the jobs and income created as a result of UCM employees spending their payroll dollars in the local and regional economies. Induced impacts are also part of the upstream economic impact and are measured with model-generated multipliers.
- Employment and payroll in operations that consume UCM coal, particularly the region's power plants. These are "downstream" economic impact effects. Downstream impacts are not captured in multipliers and therefore must be considered separately from upstream effects.[26]

[24] *Residency of Alaska Workers, 2011*, Alaska Department of Labor and Workforce Development, January 2013.

[25] While from an operational perspective transporting coal from the mine to power plants is a downstream activity, for purpose of this study the economic impact of rail shipment of coal is included in the analysis of upstream (indirect) impacts. ARRC is UCM's single largest vendor.

Indirect and Induced Employment and Payroll (Upstream Effects)

Indirect jobs are those jobs supported by UCM's spending on the wide variety of goods and services that are required to operate the mine and move coal to customers. In 2012, UCM spent $61 million with approximately 600 businesses and organizations in Alaska and elsewhere. Approximately 400 of those businesses and organizations are based in Alaska or otherwise have a physical presence in Alaska. In-state spending by UCM totaled $50.7 million. Anchorage ($27.0 million) and Fairbanks ($21.6 million) capture the majority share of this spending. The greatest amount is reported in Anchorage because all UCM spending with the Alaska Railroad Corporation (ARRC) is reported in Anchorage, where ARRC is headquartered.

ARRC is the single largest provider of services to UCM, in terms of annual spending in support of mine operations. ARRC hauls UCM coal to the mine's primary in-state customers and to the Seward Coal Loading Facility for shipment to overseas customers. The Alaska Railroad has approximately 614 year-round employees and 114 seasonal employees (as of spring 2013). Though specific data is not publically available, ARRC likely accounts for over $40 million in annual payroll.

Usibelli Coal Mine Spending in Alaska, 2012, by Community

Location	Number of Vendors	Spending ($millions)
Anchorage	105	$27.0
Fairbanks North Star Borough	195	21.6
Denali Borough	27	0.5
Mat-Su Borough	28	0.4
All Other Alaska	45	1.2
Total Spending in Alaska	**400**	**$50.7**

Source: UCM.

Movement of coal is an important part of the railroad's overall viability. Coal accounted for about 20 percent of all freight revenue earned by ARRC in 2012 and approximately one in six of all operating revenue dollars earned by ARRC. As a very important customer for ARRC, UCM plays a key role in supporting the more than 700 Alaskan's employed by the railroad.

Though a detailed accounting of all operational, maintenance, and administrative personnel that are in some way dependent on coal (from an operational or revenue perspective) is not available, it is estimated that between 30 and 40 ARRC employees are directly or indirectly related to the movement of coal. This is a conservative estimate of the number of ARRC personnel who would not be employed if UCM and its coal were entirely absent from ARRC's mix of customers. However, the employment implications of a railroad without coal may be much greater than just the jobs directly or indirectly connected to coal. Coal plays a critical role in generating revenue for ARRC, and, therefore, in the railroad's continuing economic

[26] Upstream effects are also known as "backward linkages." That is, they capture only jobs associated with purchases of goods and services by a mine (for example) and its employees. Downstream effects are also known as "forward linkages," or those jobs associated with adding value to a mine's product (such as generating energy or heat from burning coal).

sustainability in general. This has broad regional implications. ARRC is a critical part of Alaska's transportation infrastructure, with 685 miles of track and serving Anchorage, Fairbanks, Denali National Park, the ports of Anchorage, Whittier and Seward (and soon Pt. MacKenzie), and military bases along Alaska's Railbelt.

There are similar linkages between UCM and many other businesses in Alaska, including trucking companies, fuel suppliers, heavy equipment dealers and service providers, tire dealers, insurance companies, GVEA (for electric power needed for mine operations), professional and technical services firms, and many others.

It is not practical to determine the employment and payroll effects of UCM purchases for each of the hundreds of businesses that provide equipment, materials, supplies, and services to the mine. However, it is possible to use models, such as IMPLAN, to estimate the total combined employment and payroll effects of UCM spending.[27]

IMPLAN is a predictive input-output model of local and state economies, and is widely used across the country to measure the economic impact of industries and industrial/commercial development. IMPLAN uses borough and statewide level employment and payroll data to define linkages between industries in the local economy and multipliers that predict the total impact of an economic stimulus. For Alaska, IMPLAN typically requires modification to account for non-resident labor and/or supply constraints. As noted above, IMPLAN only captures upstream economic impacts, that is, jobs and income related to purchases made by UCM and its employees. It does not capture the jobs and income at power plants that rely on UCM coal.

IMPLAN can also be used to guide the assessment of induced effects, i.e., jobs and income connected with UCM employees spending their payroll dollars. Mine workers and their families spend money throughout the local and regional economies, in stores, gas stations, auto repair shops, recreational facilities, doctor's offices, and a range of other places. The mine related population also creates jobs for school teachers, local government administrators, public safety personnel, and other public service providers.

Based on vendor data provided by UCM and multipliers derived from the IMPLAN model, UCM spending on goods and services generated 355 jobs in Interior Alaska and 470 jobs statewide in 2012. Indirect annual payroll totaled an estimated $26.5 million in the Interior and $33.9 statewide.

[27]The IMPLAN® (IMpact analysis for PLANning) economic impact modeling system is provided by IMPLAN Group LLC, Inc.

Direct and Upstream Employment and Payroll Impacts of Usibelli Coal Mine, 2012, including Direct, Indirect, and Induced Employment

	Interior Alaska	Statewide
Employment	**355**	**470**
Direct	143	143
Indirect/Induced	212	327
Payroll (dollars in millions)	**$26.5**	**$33.9**
Direct	$15.0	$15.0
Indirect/Induced	11.5	18.9

Source: Direct employment and payroll from UCM. Indirect/Induced are McDowell Group estimates. Does not include downstream employment at power plants that burn UCM coal.

UCM has a remarkably large multiplier effect. Based on this analysis, UCM's regional employment multiplier is 2.5 (for every job at the mine, there are 1.5 jobs indirect and induced jobs created elsewhere in the economy, for a total multiplier of 2.5). The statewide UCM employment multiplier is approximately 3.3. These employment multipliers do not include jobs at power plants that burn UCM coal (these jobs are described in the next section of this report).

In Alaska, employment multipliers are rarely above 2.0, meaning that, for example, 100 direct jobs would be linked to no more than 100 indirect and induced jobs, for a total employment impact of 200. UCM's multiplier is high for several reasons, but mainly it is the result of a very high level of in-state spending on goods and services ($51 million annually) relative to the number of direct jobs at the mine. The mine's much higher-than-average wages also place more money into the support sector than lower wage jobs. In addition, UCM is the foundation of the Healy economy, a community of about 1,100 residents. Without the jobs provided by UCM (which directly accounts for 30 percent of all jobs in Healy and 60 percent of all wages paid in the community), the local economy would be much smaller than would be indicated by the customary model-driven analysis of multiplier effects.[28]

Downstream Employment and Payroll

Another unique aspect of the economic impact of UCM is that coal production in Alaska has significant in-state downstream effects. Downstream economic impacts occur when buyers of a product (such as crude oil, coal, fish, or mineral-rich ore concentrates) add value to a product through some form of processing. However, the vast majority of the oil, seafood, and metallic mineral resources mined in Alaska are sold to out-of-state buyers and, therefore, do not create downstream economic activity in Alaska. In contrast, about half of all UCM coal production is sold and consumed in Alaska.

[28] According to ADOLWD data, employment averaged 454 jobs in 2012 in Healy. Those jobs accounted for wages totaling $24.5 million.

Downstream jobs (forward linkages) associated with UCM include the power plants that buy and use Usibelli coal (including the power and steam plants operated by GVEA, University of Alaska Fairbanks, Aurora Energy LLC, and military facilities at Clear AFS, Ft. Wainwright, and Eielson AFB). Employment at these facilities totaled 222 workers in 2012.[29]

Coal-Fired Power Plant Employment in Alaska, 2012 (UCM-Related Downstream Employment)

Facility	Estimated Employment
GVEA Healy Unit 1	30
UAF	38
Aurora Energy	20
Clear Air Force Station	31
Fort Wainwright (operated by Doyon)	47
Eielson Air Force Base	56
Total	**222**

Though payroll data is not available for these facilities, based on statewide average wages in the power generation sector, these jobs likely account for approximately $17.8 million in annual payroll. According to ADOLWD, workers employed in power generation-related jobs earned an average $80,300 in 2012.

Unlike the jobs connected with UCM through backward linkages, not all of these power plant jobs would be foregone in the absence of an in-state coal supply. Alternative sources of energy would have been developed. However, alternative sources of energy, such as oil and natural gas, in addition to being more expensive on a per Btu basis, are less labor intensive and, therefore, would account for far fewer jobs in the Interior.

Total UCM-Related Employment and Payroll

UCM spent approximately $82 million in support of its operations in 2012, including personnel and non-personnel related expenditures. All but about $10 million, was spent within Alaska. This spending had a total annual employment impact in Alaska of approximately 470 jobs and $34 million in total annual payroll. Approximately three-quarters of those jobs and income are in the Interior Alaska economy: 355 jobs and $27 million in annual payroll. In addition, Alaska's coal-fired power plants directly accounted for an estimated 222 jobs and $17.8 million in annual payroll, all in the Interior.

Finally, it is important to note that UCM's economic impact includes support of non-profit organizations. The Usibelli Foundation's mission is to provide funds to facilitate learning by supporting education, preserve Alaska's uniqueness by supporting its heritage, and strengthen communities. The Foundation contributes to over 100 nonprofit organizations statewide. The average pay-out over the past few years has been approximately $112,000 annually. Grants are made in the areas of education, health and social services, the arts, youth programs, and civic organizations and activities. The Usibelli Foundation also matches employee donations to United Way and several other community organizations in Healy.

[29] Based on interviews conducted with plant managers.