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ENERGY AND ECONOMIC IMPACTS OF
COAL IN INTERIOR ALASKA

PREPARED BY

McDowell GROUP

PREPARED FOR

UCM

USIBELLI COAL MINE, INC.

Energy and Economic Impacts of Coal in Interior Alaska

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Table of Contents

List of Tables

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. UCM is the state's only operating coal mine, producing approximately one million tons of coal annually. Currently, all of the mine's production is used in Interior Alaska to generate electricity and space heat, though as recently as 2014 the mine also exported half a million tons to overseas markets. The mine is located near Healy, Alaska, approximately 115 miles south of Fairbanks and 10 miles north of the entrance to Denali National Park. This analysis has identified several key findings:

- Coal is Interior Alaska's lowest-cost source of energy. On a per British thermal unit (Btu) basis, coal is one-third the cost of naphtha and a quarter the cost of diesel.
- Coal is a critical source of Interior Alaska energy. Coal accounts for 32 percent of Interior Alaska's electrical generation capacity and 39 percent of electrical generation.
- About 875,000 tons of coal are consumed annually by Interior heat and power plants. Replacing this energy with other sources would increase energy costs in the Interior by at least $140 million (considering only differences in fuel costs).
- Bringing Healy Unit 2 online will double the amount of coal-fired generation capacity available to Golden Valley Electric Association (GVEA) and reduce reliance on Intertie power from Southcentral. Comparing fuel costs at Healy 2 versus Intertie power costs, adding the coal plant could lead to annual savings of as much as $13 million. With Healy 2 online, the coal used to generate heat and power in Interior Alaska could be approximately $153 million less expensive than equivalent amounts of alternative fuels.
- The economic impact of UCM is broad and diverse. In 2016, UCM spent $27 million with 422 different suppliers, service-providers, and organizations in Alaska.
- Statewide, 295 jobs and $22.5 million in annual wages result from mining and distribution of Usibelli coal. Another 211 jobs and $17.7 million in wages at Interior coal power plants are related to UCM's operations.

A more detailed summary of study findings is provided below.

The Role of Coal in Interior Alaska Energy Generation

- Coal accounts for 32 percent of the electric power capacity in the Interior. Six coal-fired plants have a combined total of 153 megawatts (MW) of capacity. Four 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 a quarter the cost of diesel and half the cost of natural gas-fired electricity transported over the Intertie from Southcentral Alaska.

- In 2017, diesel-generated electricity cost GVEA an average of $0.19 per kilowatt-hour (kWh) to produce. The cost to generate power with naphtha (a crude distillate) was $0.09/kWh and natural gas-fired electricity purchased over the Intertie from Southcentral Alaska averaged $0.10/kWh. Meanwhile, the cost to generate electricity with coal averaged $0.05/kWh. Hydroelectric power from Bradley Lake costs $0.05/kWh but is limited to just 5 to 6 percent of total generation.

- About 875,000 tons of coal are currently consumed annually by Interior heat and power plants. Replacing this energy with other sources would increase energy costs in the Interior by at least $140 million.

- Increasing the use of coal to generate electricity will reduce the region's dependence on expensive and price-volatile petroleum products. Though the full rate impacts of bringing coal-fired Healy Unit 2 on line will depend on various factors, the project could save $13.5 million a year through reduced purchases of higher priced energy from Southcentral utilities.

- Of the six coal generation plants in Interior Alaska, four are cogeneration plants producing both heat and electricity. Heat generated at these plants is the lowest cost heat in the region. Coal is the primary 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 cogeneration plant.

- If the military bases in the Interior switched to fuel oil, their fuel costs would increase 288 percent or $71 million, based on current prices per Btu paid by UAF's power plant. With trucked natural gas, fuel costs would increase 375 percent, or over $92 million.

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, including coal, oil, natural gas, and electricity purchased from GVEA.

- Among the energy sources available to UAF, the difference in cost is dramatic. For UAF, burning diesel is 250 percent more costly than coal, while natural gas is 325 percent more expensive per Btu.

- UAF's coal-fired Atkinson Power Plant is at the end of its useful life and is currently being replaced with a new, more efficient, lower-emission plant with 17 MW of generation capacity. With additional capacity, UAF will no longer need to supplement its energy supply with purchases from GVEA and may be able to sell electricity into the grid.

- UAF examined 10 main options to replace their existing power plant. Coal emerged as the preferred design option given new cleaner burning technology, supply stability, and a lower fuel cost than alternatives. The selected design also reduces emissions relative to the existing plant, even while increasing output.

Economic Impact of Usibelli Coal Mine

DIRECT IMPACTS

- UCM directly employed an average of 109 workers in 2016, earning $12.1 million in wages. 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 1,080 permanent residents. UCM directly accounted for a quarter of all jobs in Healy and more than half of all wages paid in the community in 2016.
- The UCM workforce is 100 percent Alaska resident. UCM's entirely resident workforce contrasts with the Denali Borough's average of 25 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 downstream consumption of coal at Interior power plants, means that the economic benefits tend to stay in the Interior region.

INDIRECT AND INDUCED IMPACTS

- UCM has substantial indirect and induced economic impacts. The mine's multiplier effects stem from $12.1 million in wages and $27 million in annual spending in Alaska in support of mine operations.
- In 2016, approximately 422 Alaska businesses and organizations were in UCM's service and supply chain. Over 95 percent of UCM's in-state spending went to entities based in the Interior or Anchorage areas.
- Alaska Railroad (ARRC) is one of UCM's vendors, moving nearly 700,000 tons of coal to Interior power plants in 2016. Another 200,000 tons was transported from the mine in trucks to the Healy 1 and Healy 2 plants.
- Other important sources of support activity include trucking large volumes of liquid motor fuel from Fairbanks and 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.

REGIONAL AND STATEWIDE EMPLOYMENT AND WAGE IMPACTS

- Including all direct, indirect, and induced employment, in 2016 UCM accounted for approximately 230 jobs in Interior Alaska and $18.5 million in total annual wages. Statewide, the mine's impact included a total of 295 jobs and $22.5 million in wages.
- UCM's economic impact includes financial support of non-profit organizations by The Usibelli Foundation (TUF). The Foundation contributes to dozens of nonprofit organizations statewide, with total annual contributions of approximately $115,000 in 2016. Grants are made in the areas of education, health and social services, the arts, youth programs, and civic organizations and activities. TUF also matches employee donations to United Way and several other community organizations in Healy. In 2017, TUF and UCM together contributed $100,000 to the Greater Fairbanks Community Hospital Foundation in support of the new Surgery Center.

- UCM is a major supporter of the University of Alaska, giving almost $300,000 in 2016 to support UAF's engineering programs, a distinguished teacher award, and other efforts. The Usibelli family was named a "Philanthropist of the Century" by UAF in 2017.

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.
- 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 Fort Wainwright and Eielson Air Force Base. Employment at these facilities totaled 211 workers in 2016.
- 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.

Summary of UCM Economic Impacts, 2016

	Interior Alaska	Statewide
Direct Impacts		
Annual average employment	109 jobs*	109 jobs
UCM employee wages	$12.1 million*	$12.1 million
Spending on goods and services with Alaska-based vendors	n/a	$27.0 million
Number of Alaska-based vendors	n/a	422 vendors
Indirect and Induced Impacts		
Employment	121 jobs	186 jobs
Wages	$6.4 million	$10.4 million
Direct, Indirect, and Induced Impacts		
Total employment (direct, indirect, and induced)	230 jobs	295 jobs
Total wages (direct, indirect, and induced)	$18.5 million	$22.5 million
Downstream Impacts		
Interior Alaska coal-fired power plant employment	211 jobs	211 jobs
Interior Alaska coal-fired power plant wages	$17.7 million	$17.7 million
Total UCM-Related Impacts, including Downstream		
Total employment (direct, indirect, induced and downstream) in Interior Alaska	441 jobs	506 jobs

Notes: (*) Two jobs are located in Palmer but are included with Interior Alaska to avoid confidentiality issues.
Source: Direct impact figures from UCM. All others are McDowell Group estimates.

This report profiles the economics of coal in Interior Alaska, including the role the fuel plays in meeting Interior Alaska's electricity and heating needs. The study also explores the economic impacts of coal mining, as well as the economic impacts associated with a scenario in which coal is removed from the region's energy system.

The Interior Alaska region – including the Fairbanks North Star Borough and nearby areas along the Parks and Richardson Highways – faces a paradoxical energy situation. While more than 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.

Residential rates for electricity in the region are nearly $0.23 per kWh (kilowatt hour), compared to $0.19 in Anchorage, $0.12 in Juneau, and a U.S. average of $0.13.[1] Fuel oil, which provides 88 percent of residential space heat in the area, peaked at over $3.75 per gallon as recently as 2014, though it has decreased in recent years. The region's electric utility, Golden Valley Electricity Association (GVEA), relies on oil for 34 percent of its electric generation. Unlike other fuels, coal has provided a steady, low-cost source of energy for the region.

Overview of Usibelli Coal Mine

The only active coal mine in Alaska, Usibelli Coal Mine (UCM) supplies 100 percent of the coal used to generate electricity and heat in the Interior. In operation since 1943, the mine is located in Healy, 115 miles south of Fairbanks and 10 miles north of Denali National Park. In recent years, annual production has ranged from one to two million tons, depending on the export market. As recently as 2014, the mine exported half a million tons of coal via the Alaska Railroad to a Seward terminal to mostly Asian markets. However, by 2016, only one shipment (72,000 tons) to Japan occurred. Since August 2016, the coal loading facility in Seward has remained idle and is expected to remain so until a viable export market returns.

Roughly one million tons of coal is produced annually for use in Interior Alaska – with about 20 percent consumed at a power plant near the mine and the remainder shipped to Fairbanks area power plants via the Alaska Railroad. Mine production data and shipments via the Alaska Railroad are detailed in Table 1 below.

Table 1. Alaska Coal Production and Transportation, 2008-2017
(thousand short tons)

Category	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Alaska Coal Production										
Usibelli Coal Mine	1,538	1,862	2,061	2,220	2,019	1,600	1,500	1,177	930	873
Coal Shipped by Alaska Railroad										
In-state (Healy-Fairbanks area)	761	762	791	836	838	793	766	796	698	696
Export (Healy-Seward)	471	801	1,051	1,195	961	634	513	137	72	0

Sources: Alaska Railroad; Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys.

[1] Rates for Alaska utilities as of March 2018. U.S. average from Energy Information Administration and reflects December 2017 data.

Methods and Sources

A variety of data sources were used for this study. UCM provided McDowell Group with data on direct employment, wages, benefits, vendor spending, and tax payments. McDowell Group also relied on data provided by GVEA, as well data from the Alaska Department of Labor and Workforce Development, Alaska Department of Natural Resources, Regulatory Commission of Alaska, U.S. Bureau of Economic Analysis, and the U.S. Energy Information Administration. 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 GVEA representatives, power plant managers, and other stakeholders knowledgeable about Interior Alaska energy production and consumption.

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

This chapter profiles Interior Alaska's energy infrastructure, including coal's role within that system.

Interior Alaska relies on a complex blend of fuel sources and energy products. Most residences and commercial buildings purchase electricity from the regional utility, Golden Valley Electric Association (GVEA), which produces power from coal, naphtha, diesel, and wind sources.

Fuel oil sold by a network of local dealers is the primary source of fuel for residential heating. A limited amount of wood, natural gas, electricity, and other sources are used for heating residences as well as small commercial buildings. A few large energy users in the region, including the military bases and University of Alaska Fairbanks (UAF), produce their own heat and electricity with coal cogeneration plants. In a cogeneration plant, heat produced while generating electricity is captured and distributed through a district heating system to buildings and other heating loads in the surrounding area.

Utilities

Four main power producers serve the Interior with electricity, including GVEA, Doyon Utilities, LLC (DU), Aurora Energy, LLC, and UAF.

- GVEA – a member-owned, not-for-profit electric cooperative – provides electricity to approximately 39,000 residential member accounts, 6,400 small commercial accounts, and 500 large commercial accounts in the Fairbanks area. GVEA's largest industrial customer is the Fort Knox gold mine, which accounts for roughly 20 percent of GVEA's annual electricity sales. The utility maintains roughly 3,230 miles of transmission line over a service area of nearly 6,000 square miles.
- Aurora Energy, LLC operates a coal-fired cogeneration plant that sells wholesale electricity to GVEA and supplies heat (as steam or hot water) to roughly 200 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 Army Base. DU also owns and operates a diesel-fired plant that fulfills the heating needs of Ft. Greely in addition to providing a source of supplemental and backup electricity. DU has a 50-year contract with the U.S. Department of Defense for three army posts (Fort Wainwright, Fort Greely, and Joint Base Elmendorf and Fort Richardson (JBER) located in Anchorage).
- UAF operates a coal-fired heat and power cogeneration plant to service its large campus with reliable energy. In 2018, a new coal boiler and steam turbine plant will come online to meet current and projected load demands over the next 25 years. In addition to coal, UAF's plant also relies on heating fuel and trucked natural gas to fuel two auxiliary boilers. Coal is projected to provide roughly 80 percent of total energy produced going forward.

Currently, two separate, regulated natural gas utilities operate in the Fairbanks area – though they are in the process of consolidating as of the writing of this report.

- Fairbanks Natural Gas (FNG) trucks Cook Inlet natural gas to the Fairbanks area and distributes it for heating and domestic use to approximately 1,100 customers in their downtown Fairbanks service area. Subject to approval by the Regulatory Commission of Alaska, FNG's parent company Pentex Natural Gas Co. was sold to the Interior Gas Utility (IGU) in December 2017.
- IGU is a Fairbanks-based public corporation that has been developing its own service area for natural gas distribution. Build-out of the first major phase of IGU's transmission infrastructure was completed in North Pole in 2015.[2] The Alaska Industrial Development and Export Authority (AIDEA)-backed purchase of FNG by IGU is designed to consolidate these two gas utilities to build efficiencies of scale. In tandem with this purchase, a new LNG storage facility is being designed and construction is expected to be finished by 2020.

Fuels for Electricity Generation

Electricity used in the Interior is produced mainly from fossil fuels. Diesel, naphtha, natural gas, and coal power approximately 90 percent of the electricity sold by GVEA. Hydroelectric, wind, and a very small amount of solar complete the portfolio.

Despite having just over 100,000 residents, the region has 12 major facilities that produce electricity. Compared to other population centers, this ratio is unusually high – a result of the unique needs of the region's military installations as well as the economics of co-generation facilities in a subarctic climate.

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

Coal

- Eielson Air Force Base (AFB)'s cogeneration plant has a capacity of 25 megawatts (MW). The plant burns approximately 180,000 tons of coal annually. The base's coal consumption is expected to rise with the expansion of Eielson to accommodate the arrival of two squadrons of F-35s in 2020.
- DU's 20-MW cogeneration plant produces heat and electricity for Fort Wainwright. The facility's four coal units came online in 1955 and use a total of roughly 230,000 tons of coal per year.
- UAF is currently constructing a 17-MW coal-fired cogeneration plant to meet the heat and power needs of the University, including projected load growth over the next 25 years. The UAF plant currently burns roughly 80,000 tons of coal per year. That demand is expected to remain steady after the new plant comes online.
- The privately-owned Aurora Energy cogeneration plant, located in downtown Fairbanks, can produce up to 280,000 pounds of steam per hour and sell up to 28 MW of wholesale electricity to GVEA. The original plant was built in 1952, though a majority of its capacity was added in a major expansion in 1971. The Aurora plant burns roughly 210,000 tons of coal a year.

[2] 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.

- The 25-MW Healy Unit 1 plant is operated by GVEA and uses around 175,000 tons of coal per year. Located close to UCM, the plant has produced power since 1967.
- GVEA purchased the 50-MW coal-fired Healy Unit 2 plant in December 2013 from AIDEA. Offline from 2000 through 2015, attempts were made to restart the unit in 2015 and 2016. However, a fire in March 2016 caused significant damage. The utility is currently making upgrades to the power plant and anticipates it will become operational in July 2018.[3]
- Clear Air Force Station previously operated a coal-fired heat and power plant, but the Air Force decided to connect the station instead to GVEA's grid and produce heat with an oil-fired boiler. Clear's coal plant was decommissioned in January 2016.[4]

Diesel

- GVEA's 41-MW diesel-powered Zehnder Power Plant is located in downtown Fairbanks.
- The GVEA North Pole Power Plant was built in 1976 and has the capacity to generate 120 MW of electricity with two 60 MW diesel turbines.
- GVEA's Delta Power Plant was built in 1976 and uses diesel to generate a maximum of 27 MW. This plant is used for backup power when the Delta area is islanded due to transmission outages.
- In total, GVEA burned 12.4 million gallons of diesel in 2017, down from 16 million in 2012.

Naphtha

- Completed in 2007, GVEA's North Pole Expansion Power Plant added 60 MW of generation capacity to the utility's existing North Pole generation infrastructure. The expansion plant runs on naphtha, a petroleum fraction that is supplied by a 600-foot pipeline from Petro Star's neighboring refinery. If demand warrants, the plant can add another turbine and double its power generation capability.
- The North Pole Expansion plant can be retrofitted to burn natural gas if a steady supply becomes available. However, GVEA signed a deal with Petro Star Inc. in 2016 for a 12-year supply of naphtha. The plant used 24.6 million gallons of naphtha in 2017.

Natural Gas

- Roughly a quarter of GVEA's electricity is currently purchased from Southcentral utilities that rely on Cook Inlet natural gas. The Railbelt Intertie from Wasilla to Healy was completed in the 1980s and provides 70 MW of transmission capacity between Southcentral and Interior Alaska. The Northern Intertie was completed in 2003 and provides a second transmission route from Healy to Fairbanks and the two transmission lines provide approximately 140 MW of combined capacity between Healy and Fairbanks.

[3] http://blog.gvea.com/wordpress/?p=3041
[4] http://csmng.com/2016/10/18/out-with-the-old-clear-afs-closes-coal-plant/

Hydroelectric

- Located 27 miles southeast of Homer, the 120-MW Bradley Lake hydroelectric dam is owned by the Alaska Energy Authority and generates power for six Alaska utilities. Completed in 1991, GVEA is allocated 17 percent (20 MW) of the dam's output. Bradley Lake power feeds into the Intertie connecting Southcentral and the Interior.

- An expansion is currently proposed for the Bradley Lake Hydro system, adding additional water through the Battle Creek Diversion Project. As of the writing of this report in early 2018, the Alaska Energy Authority (AEA) is pursuing financing for the $46.6 million expansion. Upon completion, which could come as early as 2020, the project is projected to add 37,300 MWh to Bradley Lake Hydro's total annual generation (approximately 10 percent increase). To date, GVEA has not decided to participate in the financing of the project, though it has the option to invest at a later date.

Renewable Energy

- The 25-MW Eva Creek Wind farm – the largest in Alaska – is owned and operated by GVEA. Located north of Healy, the 12-turbine wind farm was completed in 2012. Due to fluctuations in wind availability, the plant produces roughly 33 percent of its capacity on an annual basis.

- GVEA is in the process of constructing a 563-kW solar electric plant, expected to come online in November 2018.[5]

- A negligible amount of electricity comes from GVEA members who own solar panels or wind turbines and sell excess power to the grid through the utility's Sustainable Natural Alternative Power (SNAP) program.

Table 2. Summary of Interior Electricity Generation Infrastructure (>1 MW), 2017

Fuel	Number of Plants	Capacity (MW)	Percent of Total Capacity	Percent of Total Generation
Diesel	4	193	40	9
Coal	6	153	32	39
Intertie**	**	70	14	29
Naphtha	1	60	12	20
Wind	1	8	2	4
Total	**12**	**485**	**100**	**100**

Source: McDowell Group estimates based on interviews and data from GVEA, UAF, Doyon Utilities, and other power producers.
Notes: **The Intertie includes hydroelectric and natural gas purchases from various Southcentral Utilities. Due to rounding, some columns do not sum to total reported.

[5] Annual energy production is estimated to equal the annual energy used in 37 homes or 814 barrels of oil. http://www.gvea.com/energy/solar-project

Fuels for Generating Heat

Fuel 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. 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 year-round.

Fuel Oil

Alaska Housing Finance Corporation's 2014 housing assessment estimated that 88 percent of residential homes in the Fairbanks North Star Borough use fuel oil as a primary fuel source for home heating.[6,7] While no specific data are available for commercial buildings – such as schools, stores, and office buildings – the percentage relying on fuel oil is likely to be lower than that for residential buildings. A significant number of commercial buildings are clustered in areas that have alternative sources of heat available, such as natural gas (available in parts of downtown Fairbanks) or district steam/hot water heat from coal cogeneration facilities. Additionally, because the average commercial building requires more heat than the average residential structure, the economics of alternative fuel sources can be more favorable.

DU operates three boilers at Fort Greely that supply heat to the base through a steam heat distribution system. The boilers were installed in 1954 and run on Jet 50 A fuel. They are capable of producing a combined total of 150,000 pounds of 120-psi steam per hour. The heat distribution system is also used for freeze protection for water and sewer lines in utility corridors.

Natural Gas

Approximately 1,100 residential and commercial customers are currently using natural gas for heating in Fairbanks. Access to natural gas is limited at this time and only available in a small portion of downtown Fairbanks. Natural gas distribution infrastructure was installed in parts of North Pole in 2015; however, gas supply and other issues have so far prevented that system from becoming operational.

As of the writing of this report in early 2018, significant efforts were underway to bring affordable natural gas to a much larger number of Fairbanks homes and businesses. If AIDEA-supported plans come to fruition, a roughly $42 million LNG storage plant will be built and become operational by 2020, allowing for the expansion of the two distribution systems described above with the intention of reducing prices from the current $20 per mcf.

[6] https://www.ahfc.us/efficiency/research-information-center/alaska-housing-assessment/housing-assessment/
[7] While a more current housing assessment was released by AHFC in 2018, no residential space heat sources data was presented.

Coal

Coal cogeneration technology provides heat for several large Interior energy consumers. Steam is produced for electrical generation and then piped to buildings to be utilized for heating purposes. The Aurora plant sells steam and hot water for heating to roughly 200 homes and commercial establishments in the core of Fairbanks. Coal-fired steam and hot water is the least expensive source of heat available in the Interior.

All the coal-fired plants in the Interior area are cogeneration plants, with the exception of the two plants in Healy. In a cogeneration plant, steam is produced and run through a turbine to generate electricity and then distributed via underground pipes to provide heat to buildings in close proximity – within roughly two to three miles – of the plant. Local building owners find district heating attractive because of its affordability and reduced maintenance requirements.

Other Sources

Many residential buildings augment oil use with wood or pellets. A small number of residential and light commercial customers are using outdoor boilers that burn coal and/or 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

This chapter presents a summary of energy costs in Interior Alaska.

Residents of Interior Alaska pay some of the highest electric and heating costs in the United States. The combination of a subarctic climate and a reliance on oil for residential heating and electricity generation results in the region's high costs. According to the Council for Community and Economic Research, utility costs in Fairbanks are 218 percent of the national average.[8] By comparison, Anchorage is 104 percent of the national average and Juneau is at 120 percent. Total electricity and heating costs are estimated at roughly $5,500 a year for an average home in Interior Alaska. This is based on 150 million British thermal units (MMBtu) per year for space heating and annual electricity usage of 8,000 kWh.[9]

Electricity Costs

GVEA electricity rates have regularly exceeded 150 percent of the national average.

Table 3. Comparison of Average Residential Electricity Rates per kWh

Location	Cost per kWh
Hawaii	0.31
Interior Alaska	**0.23**
Anchorage	0.19
U.S. Average	0.13
Juneau (Nov-May Peak/Jun-Oct Off-peak)	0.12/0.10
Washington State	0.10

Sources: GVEA, March 2018; Chugach Electric, March 2018; AEL&P, March 2018.
Notes: EIA data used for non-Alaska rates and reflects December 2017 prices.

GVEA actively manages its generation and power purchase options to meet demand while minimizing costs. Fuel price (or purchased power price in the case of the Intertie) is the driving factor in these decisions, as other fixed costs will be incurred regardless. Cheaper fuel sources such as coal and naphtha are used first, followed by more expensive fuel sources, such as diesel, as demand increases. Some diesel power is required to facilitate integration of the Eva Creek Wind project into GVEA's grid.[10]

[8] https://www.c2er.org/ Utility costs include other services such as sewer, trash, and water.
[9] http://www.gvea.com/rates/billexplained
[10] Other GVEA electricity sources are too slow to adjust to fluctuations in wind production, as coal plants take longer to ramp up and power purchases via the Intertie must be scheduled a day in advance.

In contrast to oil prices, coal prices have been relatively steady over the last ten years. Purchasing 1 MMBtu for electricity generation in the form of diesel currently costs $15.33 while the same amount of energy from coal costs roughly $4.40.[11] The availability of coal as a relatively low cost and stable source of energy has helped soften the effect of fluctuations in diesel and naphtha prices.

As illustrated in the following table, coal is a substantially lower-cost source of electrical energy. Only hydropower can be supplied at comparable rates, though the supply is limited (as described elsewhere in this report).

Table 4. Average Energy and Production Cost per kWh and Percent of GVEA's Total Generation, by Fuel Type, 2017

Energy Source	Percent of GVEA Generation	Fuel Cost per kWh	Purchase Cost per kWh
Natural Gas (Intertie)	29%	-	$0.10
Coal	**26%**	**$0.05**	**$0.09***
Naphtha	25%	$0.09	-
Diesel	9%	$0.19	-
Hydro (Intertie)	6%	-	$0.05
Wind	4%	$0.00	-

Source: GVEA.
Note: *Purchase cost for coal power is for the Aurora power plant.

Heating Costs

According to the 2014 Alaska Housing Assessment, 88 percent of residential space heat in the Fairbanks North Star Borough (FNSB) is derived from fuel oil.[12] Wood (8 percent), electricity (2 percent), and natural gas (2 percent) fuel most of the remaining residential space heating. Only 0.2 percent of space heat is produced by appliances burning coal, according to the assessment, which is primarily based on data collected during home energy ratings and reported to the Alaska Housing Finance Corporation.

These results are similar to those in the 2009 Alaska Housing Assessment (86 percent fuel oil). Similarly, a series of home heating surveys conducted for the Alaska Department of Environmental Conservation shows little change in residential fuel oil usage in recent years, though the actual percentages differ from those in the Alaska Housing Assessments.[13] According to these telephone surveys, 72.6 percent of residential heat was derived from fuel oil in 2011, compared to 73.0 percent in 2015 – well within the margin of error.

[11] Based on resource prices paid by University of Alaska Fairbanks, February 2018.
[12] https://www.ahfc.us/efficiency/research-information-center/alaska-housing-assessment/housing-assessment/
[13] Sierra Research, 2015. *Analysis of Fairbanks 2013-2015 Home Heating Surveys*. Prepared for the Alaska Department of Environmental Conservation.

Fuel oil is the cheapest source of widely-available, convenient heat in the region. Some sources are cheaper but require more handling (wood and coal) and other sources are available only in limited areas (district heat and natural gas). See the table below for more information, including estimated annual costs to heat a home with each fuel type (based on 150 million Btu per year and common appliance efficiency ratings).

Table 5. Fairbanks Residential Heating Costs, Fall 2017

Fuel	Cost per Unit	Heat Content per Unit (Btu)	Appliance Efficiency (Percent)	Cost per Million Btu	Estimated Annual Cost
Electricity	$0.21/kWh	3,412	100	$61.84	$9,276
Propane	$4.34/gallon	91,333	85	$55.90	$8,385
Fuel Oil	$2.78/gallon	135,000	85	$24.25	$3,638
Natural Gas	$20.20/mcf	1,010,000	85	$23.53	$3,530
District Hot Water	$21.05/MMBtu	1,000,000	100	$21.05	$3,158
Pellets	$272/ton	16,000,000	85	$20.00	$3,000
Cordwood, birch	$278/cord	20,500,000	70	$19.36	$2,904
District Steam	$19.59/1,000lbs	1,066,000	100	$18.38	$2,757
Coal (Retail)	$120/ton	15,200,000	55	$14.35	$2,153

Source: Fairbanks North Star Borough Community Research Quarterly, Fall 2017.
Notes: Based on an average home using 150 MMBtu/year. Sorted by estimated annual cost.

Chapter 3: Interior Energy in the Future

This chapter highlights the potential changes proposed for the Interior energy market.

Concerns about energy supplies and energy prices have spurred interest in developing cheaper sources of electricity and heating in the region. 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.

Healy Unit 2

Originally completed in 1998, Healy Unit 2 (previously known as the Healy Clean Coal Plant) showcased the then-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 as too low in energy content. The 50-MW plant is located adjacent to the Healy Unit 1 coal plant in Healy. Disputes between stakeholders caused the plant to be shut down in 1999.

GVEA purchased the 50-MW Healy Unit 2 plant in December 2013 from AIDEA. The utility is currently making upgrades to the power plant to address issues in the coal feed system identified after restarting the plant in 2015 and 2016. Currently, GVEA anticipates Healy Unit 2 will become operational in July 2018.[14]

Coal-fired electrical generation capacity within the Interior will rise from 103 MW to 153 MW when the plant is brought online. According to GVEA officials interviewed, the primary effect of adding Healy Unit 2 will be to reduce the amount of natural gas-derived power the utility needs to purchase from Southcentral utilities.

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 electricity needs. While difficult to project, the wholesale rate of electricity coming from the dam was estimated to start at $0.12/kWh dropping to a 50-year average of $0.05/kWh (in 2012 dollars).[15]

Spending on the Susitna-Watana project was halted in December 2014 by Governor Walker, citing budgetary constraints due to low oil prices and a large state budget deficit.

Interior Energy Project

The Interior Energy Project (IEP) is a state-backed effort to address high energy costs in Interior Alaska, supported by state legislation and appropriations passed in 2013 and 2015. The project is focused on expanding

[14] http://blog.gvea.com/wordpress/?p=3041
[15] http://www.susitna-watanahydro.org/alaska-energy-authority-confident-susitna-watana-hydro-will-provide-long-term-stable-and-affordable-energy/

the availability of natural gas in the Fairbanks area and bringing down the fuel's cost through economies of scale. The project has required extensive state involvement and subsidies.

In December 2017, AIDEA and other partners announced the sale of Pentex Alaska Natural Gas Company and its assets, including Fairbanks Natural Gas (FNG), to the Interior Gas Utility (IGU). This move will consolidate Fairbanks' two natural gas service areas into a unified, locally controlled gas utility. December 2017 also saw the finalization of engineering and construction contracts for a 5.25 million-gallon LNG storage tank facility in the Fairbanks area. The roughly $42-million facility is projected to become operational by 2020, allowing for the expansion of the two distribution systems described above and an eventual reduction in prices to a target of $15 per mcf through economies of scale.

A quarterly report to the Alaska State Legislature, dated January 5, 2018, provides an update on various other components of the IEP.[16] The decline in oil prices in recent years affects assumptions about conversion rates and new approaches, such as Property Assessed Clean Energy (PACE) and on-bill financing, are being explored. PACE policies allow property owners to fund certain energy improvements through their property tax bills.

Natural Gas Pipelines

For the past 50 years, multiple pipelines have been proposed that would bring Alaska's abundant North Slope natural gas resources to market. Interconnections would be built into any such pipeline, allowing Interior Alaska access to low-cost natural gas. The impact on energy costs within the Interior is difficult to forecast but, if constructed, pipeline natural gas would likely be cheaper than diesel, naphtha, or trucked natural gas, but still more expensive than coal or district heat.

Two separate but related projects are currently being pushed by the State of Alaska – Alaska LNG and the Alaska Stand Alone Pipeline (ASAP). According to the Alaska Gasline Development Corporation (AGDC), "while AGDC has been advancing both projects at different stages, the corporation is primarily focused on the Alaska LNG Project. ASAP remains the State's back-up project."[17]

Alaska LNG

The Alaska LNG Project proposes an 800-mile, 42-inch diameter pipeline from the North Slope to a terminal in Nikiski, where the gas would undergo liquefaction for export to international LNG markets. The project would have an estimated throughput of 3.1 billion cubic feet per day. Spurs along the main pipeline would provide natural gas for in-state consumption. Following over $600 million in expenditures and years of study, AGDC submitted a formal application to the U.S. Federal Energy Regulatory Commission (FERC) in April 2017, including over 55,000 pages of documents documenting engineering, environmental, and other plans for the pipeline.[18] Construction costs for the entire system are currently estimated at $27.9 billion, though contingencies and other costs bring the total project cost to $43.4 billion.

[16] http://interiorenergyproject.com/Resources%20and%20Documents/IEP_Quarterly_Report_January_2018_AIDEA_Final.pdf
[17] https://agdc.us/about-us/alaska-stand-alone-pipeline-asap-project/
[18] https://alaska-lng.com/regulatory-process/ferc-process/

Additional progress in 2017 includes a non-binding joint development agreement with China, which contemplates an arrangement where Chinese entities would finance 75 percent of the project cost in exchange for 75 percent of the LNG produced. This arrangement would leave a quarter of the gas for export to regional markets to generate a return on the State of Alaska's equity investment. Under the plan, 500 MMcf of natural gas per day would be available to Alaskans, an amount equivalent to 2.5 times the state's current daily consumption.[19]

The market feasibility of the Alaska LNG Project remains uncertain at this time.

Alaska Stand Alone Pipeline (ASAP)

A 733-mile pipeline, stretching from the North Slope to Point MacKenzie, has been examined to bring natural gas to Interior and 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 intended as a way to alleviate the shortfall. Recent investments in Cook Inlet natural gas production have reduced the urgency to bring natural gas from the North Slope but the project is still active. Current work involves the completion of a Supplemental Environmental Impact Statement to address changes in project design, gas composition, and other factors.[20]

Railbelt Transmission Upgrades

The Alaska Railbelt Cooperative Transmission & Electric Company (ARCTEC) – a cooperative of the six Railbelt utilities formed in 2011– has developed a list of priorities for the region's transmission system. These priorities include the significant transmission upgrades described in the maps below.

ARCTEC Priority Projects for the Railbelt Transmission System

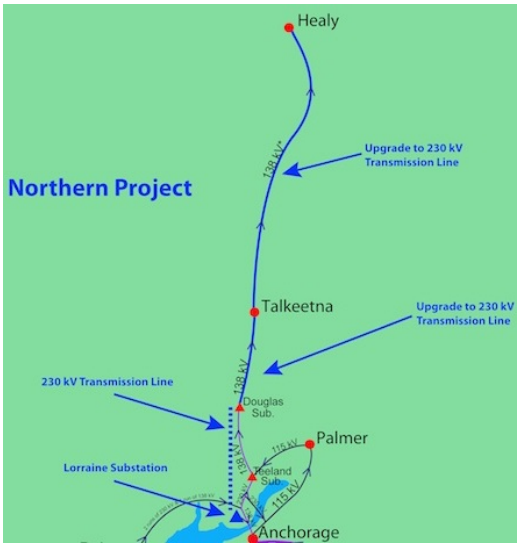
Source: http://arctec.coop/railbelt-reliability-and-planning-2/

[19] http://alaska-lng.com/wp-content/uploads/2018/02/House-Resources-Committee.01242018.pdf
[20] http://asapgas.agdc.us/index.html

ARCTEC's identified priorities largely align with those identified in AEA's 2017 Railbelt Transmission Plan.[21] The priorities in common include upgrading the transmission line to Bradley Lake, adding an Intertie across Cook Inlet between Soldotna and Beluga, upgrading the transmission lines from Southcentral to Healy to 230 kV and various other improvements.

A point of difference between the two plans regards the need for an additional 171-mile power line between Southcentral Alaska and Healy. AEA estimates this line will cost $246 million and describes the benefits as follows:

> *The addition of a second line between Anchorage and Fairbanks increases the amount of energy capable of being transferred between the areas from 69 MW of non-firm in the existing system to over 189 MW of firm power sales with Healy 2 online (all of Fairbanks area load). . . . The second transmission line spanning the 171 miles between Healy and Anchorage will prevent loss of load in Fairbanks for single line outages and will allow GVEA to access electrical and gas markets in the Southcentral system. It will also allow GVEA to evaluate the most economic solution for replacement generation capacity as its power production fleet continues to age or if coal resources are retired.*



However, this second power line is not included in ARCTEC's list of priorities. Additionally, an interviewee representing GVEA emphasized that the addition of Healy Unit 2 will decrease the need for power purchases from Southcentral.

[21] Alaska Energy Authority and Electric Power Systems, Inc., 2017. *Alaska Energy Authority Railbelt Transmission Plan. Project #15-0481.*

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

Examination of Interior Alaska's energy infrastructure reveals coal is a vital fuel for stationary heat and power generation. The region's producers rely heavily on coal due to its proven track record, affordable and stable pricing, and well-developed local production and supply chain. Without coal production 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, three points are important to recognize:

- Coal is well situated to continue meeting the near- and mid-term electrical generation and heating needs of the Interior and provide cost-effective energy at stable, affordable rates. The Healy Unit 2 project will at least stabilize, if not reduce electricity rates, and will decrease GVEA's reliance on more expensive purchased power from outside the region. As evidenced by UAF's new heat and power plant currently under construction, new coal-burning facilities can provide both electricity and heat while balancing cost and emissions.

- Coal technology has improved in the last 30 years and now offers more efficient and cost-effective ways to utilize coal. Technologies such as gasification and circulating 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's current heat and power (cogeneration) plant came online in 1964 and is comprised of two coal-fired and two auxiliary oil-fired boilers. Combined, the coal boilers can produce roughly 80,000 pounds of steam per hour, which run turbines to produce electricity and supply steam to heat the university's 3 million square feet of facilities.

After over 50 years of service, UAF's coal boilers have suffered critical failures and require increasing levels of maintenance. According to UAF's utilities director, the service life of UAF's coal boilers was shortened through near constant use. Fearing a potential midwinter shutdown, UAF initiated a planning process in 2006 that compared an upgraded central heat and power plant with an increasing reliance on GVEA-supplied power and decentralized, stand-alone building heating units. The central heat and power approach was considered more favorable.

A subsequent analysis in 2010 considered a variety of options for an improved heat and power plant. Ten main options were studied, including four coal-based options, three natural gas options, an all-electric option, and two options that would rely on municipal solid waste gasification.[22] The results of this analysis indicated that coal provided the most favorable net present value. While requiring a larger initial capital investment, a coal plant was considered significantly less expensive to operate and benefited from coal's proven, stably-priced track record in the region.

Construction of UAF's new 17-MW coal plant began in 2015 and is expected to be completed by Fall 2018. The $245-million project was funded through a combination of state government capital appropriations, bonds, and operating revenues. The new coal boiler will be able to produce up to 240,000 pounds of steam per hour and will use a newer, more efficient technology known as circulating fluidized bed boiler (CFB). CFB technology can burn multiple types of solid fuel, which are mixed with limestone and burned while moving fluidly in midair. The existing plant's auxiliary boilers will remain in operation, including one oil-fired boiler and one boiler that can run on oil or natural gas (currently trucked Cook Inlet natural gas).

UAF was initially planning to be able to use biomass such as pellets, wood chips, paper, or grain to fuel approximately 15 percent of the new coal boiler's output, but the modifications required were postponed due to cost overruns.[23]

According to the most recent analysis available, emissions from the new plant will be cut drastically compared to the current plant, as illustrated in the following table. Emissions are an important consideration due to the U.S. Environmental Protection Agency's ongoing designation of Fairbanks North Star Borough as an air quality nonattainment area.

Table 6. Expected Emissions Reductions with UAF's New Coal Heat and Power Plant

Type of Emission	Reduction (%)
Nitrogen Oxide (NOx)	64
Carbon Monoxide	41
Total Particulates	65
Fine Particulates (PM2.5)	45
Sulfur	60
Carbon Dioxide	3

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

Within the current portfolio of energy sources that UAF can choose from, the difference in cost is dramatic. Burning diesel or trucked natural gas costs nearly 3 to 5 times the cost of coal. The new power plant will substantially reduce the cost of energy for UAF as more coal will be used in place of the more expensive sources that now fill out UAF's energy needs. UAF burns an estimated $5.4 million worth of coal annually. Providing an equivalent amount of energy using diesel or natural gas would cost roughly $13 million and $23 million, respectively. By continuing to rely on and maximize their use of coal, UAF will substantially reduce utility costs

[22] GLHN Architects and Engineers, 2011. *2010 Evaluation of Energy Options, Heat and Power, University of Alaska Fairbanks.*
[23] Charles Ward, UAF Director of Utilities, personal communication, February, 2018.

– savings that are needed more than ever as it faces budgetary constraints. The new power plant will produce roughly 18 percent more electricity than the current plant but will consume the same amount of coal due to increased efficiencies.

Impact of Coal on Military Energy Costs

Ft. Wainwright and Eielson AFB use an estimated 410,000 tons of coal annually for cogeneration purposes.[24] Data was not available regarding fuel prices paid by the military but examining the annual consumption of coal allows for some basic comparisons. Understanding that the bases require approximately 6.2 million MMBtu annually and the cost of various sources of energy, financial implications of a switch to another source of energy can be explored.

Based on an estimated cost of $60/ton for coal, the bases currently spend approximately $24.6 million annually on coal purchases. If the bases were able to and switched from coal to diesel, energy costs would more than triple. Based on February 2018 prices paid by UAF ($2.07 per gallon), Eielson AFB and Ft. Wainwright would pay $96 million under this hypothetical scenario – an increase of $71 million.

Replacing coal with trucked natural gas would be even more costly for the Interior military bases. At $19/mcf (February 2018 price paid by UAF), purchasing 6.2 million MMBtu would increase energy costs from $24.6 million to approximately $117 million, an increase of $93 million over the cost to use coal. The proposed IEP is working to deliver natural gas at a target price of $15/mcf. At that price, annual fuel costs incurred by the military would still increase to more than $92.5 million, or an increase of almost $68 million annually over coal.

With military spending supporting as much as a third of the Fairbanks economy, any large increases in energy costs could potentially risk the sustainability of the military's current presence in the Interior and stability of the Fairbanks economy.[25]

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. Two scenarios were examined – one in which GVEA uses no coal and another where GVEA uses additional coal through the addition of Healy Unit 2.[26]

These two scenarios described below only consider cost differences related to the purchase of fuel (for GVEA plants) and/or power (via the Intertie to Southcentral). Other costs – including capital costs, debt service, and non-fuel production/administration/other costs – are considered fixed costs for the purposes of this analysis.

[24] Clear Air Force Station decommissioned its coal cogeneration plant in early 2016 and is not considered in this analysis.
[25] Jim Dodson, Fairbanks Economic Development Corporation, personal communication.
[26] Healy Unit 2 is currently scheduled to be fully operational in July 2018.

No Coal Scenario

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-quarter of 2017 electricity production. Under this scenario, generation would be shifted to other available capacity, mainly the North Pole Expansion Plant and the North Pole Power Plant; these facilities generate electricity at $0.09 and $0.19 per kWh, respectively.[27] Assuming increased costs are passed on to consumers, GVEA ratepayers would collectively pay approximately $56 million more annually for electricity under this hypothetical scenario.

Adding Healy 2 Scenario

Bringing Healy Unit 2 online would double GVEA's coal-fired generation capacity. The availability of cheaper electricity from Healy 2 would primarily result in reductions in Intertie purchases from Southcentral utilities, according to GVEA officials interviewed. Under this scenario, roughly half of GVEA's electricity would be produced from coal and half from plants using other fuel sources.

McDowell Group modeling indicates that shifting Intertie purchases to Healy Unit 2 could result in energy cost savings of roughly $13.5 million for GVEA ratepayers (not including any capital costs associated with Healy 2). This analysis is based on a capacity factor of 80 percent and a fuel cost of $0.06/kWh at Healy Unit 2 (conservative estimate provided by a GVEA official) – compared to a cost of $0.098/kWh for natural gas-derived electricity purchased via the Intertie.

Overall Fuel Cost Increase without Coal

Roughly 875,000 tons of coal are consumed annually by Interior heat and power plants. Replacing this energy with other sources would increase energy costs in the Interior by at least $140 million, based on fuel costs alone.

Again, it is important to emphasize that these calculations consider only the amount of coal consumed and the difference between the price of that coal and the price of an equivalent amount of the next cheapest fuel source. The cost of constructing plants capable of burning alternative types of fuel, where necessary, is not included.

Table 7: Cost Implications of Alternative Fuel Substitutes for Coal in Interior Alaska, 2017

Plant	Tons of Coal Consumed	Million Btus	Cost of Coal	Next Cheapest Fuel Source and Price	Alternative Fuel Cost
UAF	80,000	1,216,000	$5.4 million	Fuel Oil $2.07/gallon	$13 million
Military Bases	410,000	6,232,000	$24.6 million	Fuel Oil $2.07/gallon	$71 million
GVEA	385,000	5,852,000	$20.8 million	Naphtha ($1.24/gallon) Fuel Oil ($1.91/gallon)	$56 million
Total	**875,000**	**13,300,000**	**$50.0 million**		**$140 million**

Source: McDowell Group.
Notes: Estimates based on:
a) Average coal, fuel oil, and naphtha prices paid by GVEA in 2017 (from GVEA's 2017 Annual Report to Regulatory Commission of Alaska)
b) February 2018 coal and fuel oil prices paid by UAF's power plant (for UAF and military bases).
c) GVEA's alternative fuel cost estimate includes shifting one quarter of coal energy to the naphtha plant (maximizing its capacity) and the rest to diesel generation capacity.

[27] GVEA 2017 Annual Report, filed with Regulatory Commission of Alaska, April 2018.

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 cleaner, more efficient, and more cost-effective coal-burning equipment and processes than in the recent past.

Interior Alaska has the advantage of access to high-quality coal resources. Coal can be classified into four ranks 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, such as the amount of sulfur and mercury, ranges as well depending on where it is mined.

Healy coal used in Interior Alaska is sub-bituminous with ultra-low sulfur content of 0.15 percent.[28] In comparison, coal from the top coal-producing states in eastern and western U.S. average about 3 percent and 0.5 percent sulfur, respectively.

Another environmental consideration is the fact that coal-fired cogeneration facilities are built with tall flue-gas stacks that release exhaust gases at higher elevations than other heating options. The availability of coal heat can eliminate the need for hundreds of building-specific heating units, primarily oil boilers, that release exhaust gases at ground level.

[28] U.S. Energy Information Administration (EIA), Coal Data Browser.

This chapter examines the employment and wage impacts of UCM. In addition to jobs at the mine, there are a range of multiplier effects associated with mine operations. Jobs are created throughout the economy as the mine purchases supplies and services in support of its operations and mine employees spend their earnings in the region. UCM's contribution to supporting jobs at Interior coal-fired heat and power plants is also discussed.

Direct Impacts

Jobs

UCM employed an average of 109 workers in 2016 – the most recent year for which data were available. Two-thirds of UCM jobs are in operations and maintenance, including equipment operators, mechanics, and reclamation specialists.

UCM employment is steady throughout the year, ranging from a June peak of 117 to a December low of 103. More than 85 percent of employment is based in Healy (remaining jobs are in UCM offices in Fairbanks and Palmer). UCM's stable year-round employment is particularly important locally, where the economy is otherwise characterized by high seasonal employment fluctuations. In the visitor industry-dominated Denali Borough, overall 2016 employment ranged between a high of 3,940 in July and a low of 876 in January. During the off-season months (November through March), UCM directly accounts for one in eight jobs in the Denali Borough.

Wages

UCM wages in 2016 totaled $12.1 million. Mining wages are among the highest in the state ($108,000 in 2016), second only to wages in the oil and gas industry.[29] UCM's average wages are more than double the 2016 average for all workers in Alaska overall ($53,000), in Fairbanks North Star Borough ($50,500), and in Denali Borough ($44,500).[30] These wage comparisons are important because they illustrate the role of UCM in providing family-wage jobs in a region where most employment is in relatively lower-paying, seasonal, service sector jobs.

Workforce Residency

All UCM employees are Alaska residents. UCM's entirely resident workforce is in especially sharp contrast to that in the Denali Borough, where only a quarter of workers are Alaska residents.

Indirect and Induced Impacts

The employment and wage impacts of UCM go beyond the direct jobs at the mine. UCM-generated employment and wage impacts also include:

[29] The Economic Benefits of Alaska's Mining Industry, 2016. Prepared by McDowell Group for the Alaska Miners Association.
[30] http://live.laborstats.alaska.gov/qcew/

- Indirect impacts – the jobs and income 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.
- Induced impacts – the jobs and income created as a result of UCM employees spending their wages in the local and regional economies.

Indirect and induced jobs and wages are estimated using IMPLAN – an input-output model of local and state economies that is widely used across the country to measure the economic impact of industries and industrial/commercial development.[31] IMPLAN uses borough and statewide level employment and wages data to define linkages between industries and produce multipliers that estimate the total impact of an economic stimulus. For Alaska, IMPLAN typically requires modification to account for non-resident labor and/or supply constraints.

IMPLAN only captures economic impacts resulting from purchases made by UCM and its employees. It does not capture the jobs or income at power plants that rely on UCM coal (discussed separately below).

Indirect Impacts

In 2016, UCM spent $38 million on goods and services in support of the mine's operations. About 71 percent of this spending ($27 million) went to approximately 422 Alaska-based vendors (businesses and organizations). Anchorage ($14.4 million) and Fairbanks ($11.5 million) captured most of this in-state spending.

Table 8. Usibelli Coal Mine Spending in Alaska, 2016, by Community

Location	Spending (millions)
Anchorage	14.4
Fairbanks North Star Borough	11.5
Denali Borough	0.3
Mat-Su Borough	0.2
All Other Alaska	0.6
Total Spending in Alaska	**$27.0**

Source: UCM.

Alaska Railroad Impacts

UCM's single largest vendor is the Alaska Railroad (ARRC), which is headquartered in Anchorage. UCM's customers contract with the mine for delivered coal and UCM subcontracts with ARRC to make those deliveries. As of May 2016, the Alaska Railroad had approximately 597 year-round employees and 129 seasonal employees and an Alaska hire rate of 94 percent.[32] According to their 2016 Annual Report, ARRC made payments totaling roughly $60 million to employees and $40.8 million to suppliers that year.[33]

[31] http://www.implan.com/company/
[32] https://www.alaskarailroad.com/sites/default/files/Communications/2017_ARRC_Facts-Figures_or.pdf
[33] https://www.alaskarailroad.com/sites/default/files/akrr_pdfs/2016_ARRC_Annual_Report%20Final%203-30-17.pdf

Movement of coal is an important part of the railroad's overall business. Coal accounted for about 11 percent of all freight revenue and approximately 5 percent of all operating revenue dollars earned by ARRC in 2016 (down from 20 and 16 percent, respectively, in 2012). As an important customer for ARRC, UCM plays a key role in supporting the more than 700 Alaskans employed by the railroad.

Though a detailed accounting of ARRC personnel that are dependent on coal (from an operational or revenue perspective) is not available, it is estimated that between 15 and 20 ARRC employees are directly or indirectly tied 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 operating revenue for ARRC, and, therefore, in the railroad's continued viability. Revenue from passengers, real estate, and other areas have increased in recent years but not enough to cover revenue lost from lower freight volumes. Because of these and other issues (such as declining coal moved to Seward for export), ARRC operated at a net loss of $4.3 million in 2016.

Induced Impacts

While employment averaged 109, a total of 124 employees worked at UCM in 2016, earning $12.1 million in wages. These 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.

Total Induced and Indirect Impacts

Based on data provided by UCM and multiplier analysis, UCM spending on wages, goods, and services supported 230 jobs in Interior Alaska and 295 jobs statewide in 2016.[34] The combined annual wages at these UCM-generated jobs is estimated at $18.5 million in the Interior and $22.5 million statewide.

Table 9. Direct and Upstream Employment and Wages Impacts of Usibelli Coal Mine, 2016, including Direct, Indirect, and Induced Employment

	Interior Alaska	Statewide
Direct	109*	109
Indirect/Induced	121	186
Total Employment	**230**	**295**
Direct	$12.1*	$12.1
Indirect/Induced	6.4	10.4
Total Wages ($millions)	**$18.5**	**$22.5**

Source: Direct employment and wages from UCM. Indirect/Induced are McDowell Group estimates.
Notes: Does not include downstream employment at power plants that burn UCM coal.
* Two UCM jobs are based in Palmer but included with Interior Alaska for confidentiality reasons.

[34] Two UCM jobs are located in Palmer but included with Interior Alaska for confidentiality reasons.

UCM's regional employment multiplier is 2.1 (for every 1.0 job at the mine, there are 1.1 indirect and induced jobs created elsewhere in the economy, for a total multiplier of 2.1). The statewide UCM employment multiplier is approximately 2.7. These employment multipliers do not include jobs at power plants that consume UCM coal (these jobs are described separately below).

In Alaska, employment multipliers are rarely above 2.0, meaning, 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 high level of in-state spending on goods and services ($27 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 1,080 residents. Without the jobs provided by UCM (which directly accounts for 23 percent of all jobs in Healy and 53 percent of all wages paid in the community), the local economy would be much smaller than would be indicated by the customary model-driven multiplier analysis.[35]

Employment and Wages at Interior Coal Plants

A 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 clear 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, nearly all UCM's 2016 coal production was sold and consumed in Alaska.

Downstream jobs (forward linkages) associated with UCM include the power plants that buy and use UCM coal (including the power and steam plants operated by GVEA, UAF, Aurora Energy LLC, and military facilities at Ft. Wainwright and Eielson AFB).

As shown in the table below, employment at these facilities totaled 211 workers in 2016.[36] Though wage data are not available for these facilities, based on statewide average wages in the power generation sector ($84,000 in 2016), these jobs are estimated to generate approximately $17.7 million in annual wages.

Table 10. Alaska Coal-Fired Power Plant Employment, 2016
(UCM-Related Downstream Employment)

Facility	Estimated Employment
GVEA Healy Unit 1	25
GVEA Healy Unit 2	25
UAF	38
Aurora Energy	20
Fort Wainwright (operated by Doyon Utilities)	44
Eielson AFB	59
Total	**211**

Notes: GVEA's Healy Unity 2 was only operational for part of 2016. It is expected to be fully operational again starting in July 2018 at similar employment levels.

[35] According to DOL&WD data, employment averaged 482 jobs in 2016 in Healy. Those jobs accounted for wages totaling $22.9 million.
[36] Based on interviews conducted with plant managers.

Unlike the jobs resulting from spending by UCM and its employees, not all 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. For instance, in 2016, 50 employees worked at GVEA's two coal plants (combined capacity of 78 MW) and 23 employees ran GVEA's active oil-fired plants (combined capacity of 221 MW). Applying the employee per MW ratio at GVEA's non-coal plants, it would only take nine employees to run plants with equivalent capacity as GVEA's Healy 1 and 2.

UCM Charitable Giving

Finally, it is important to note that UCM's economic impact includes support for more than 100 non-profit organizations. The Usibelli Foundation (TUF)'s mission is to provide funds to facilitate learning by supporting education, preserve Alaska's uniqueness by supporting its heritage, and strengthen communities. Created in 1991, TUF has distributed a total of $2.43 million over the life of the organization, including approximately $115,000 annually in recent years. Grants are made in the areas of education, health and social services, the arts, youth programs, and civic organizations and activities. TUF also matches employee donations to United Way and several other community organizations in Healy. In 2017, TUF and UCM together contributed $100,000 to the Greater Fairbanks Community Hospital Foundation in support of the new Surgery Center.

UCM is also a major supporter of the University of Alaska system, giving almost $300,000 in 2016 to support UAF's engineering programs, a distinguished teacher award, and other efforts. In 2017, UAF named the Usibelli family "Philanthropist of the Century."