Interior Energy Project

Economic Impact Analysis

Project Number - E114003500

Cardno ENTRIX

Shaping the Future

Document Information

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Project Manager	Lee Elder
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Prepared for:

813 West Northern Lights Boulevard, Anchorage, AK, 99503

Prepared by:

Cardno ENTRIX
5415 SW Westgate Dr. #100, Portland, OR 97221

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Executive Summary

The development of an expanded natural gas distribution system in the Fairbanks/North Pole area is a critical component of the Interior Energy Project (Project). Alaska Industrial Development and Export Authority (AIDEA) would finance a natural gas conditioning and liquefaction plant on the North Slope and also a liquefied natural gas (LNG) storage, re-gasification, and distribution system to bring natural gas to Fairbanks North Star Borough (FNSB) households.

AIDEA requires a better understanding of the regional economic implications associated with the Project upon the FNSB. Specifically, AIDEA wishes to understand the potential employment and income benefits resulting from Project construction and operation, including the following six primary analytical components:

1. Annual labor and material expenditures anticipated for project construction.
2. Annual expenditures for natural gas within the project area.
3. The number of homes and businesses to convert to natural gas on an annual basis and the cost of doing so.
4. The decrease in heating oil consumption resulting from households and businesses converting to natural gas.
5. The cost of trucking adequate quantities of LNG from the North Slope required to meet natural gas demand in the study area.
6. Savings obtained by households and businesses and the resulting increase in disposable income for those that convert to natural gas.

Each component is analyzed using an Impact Analysis for Planning (IMPLAN) model with data specific to the FNSB.

Economic Impact Analysis Methods and Data

To estimate total economic impacts, Cardno conducted a three-step analysis.

1. Identify Sources of Impact and Gather Data: In this task, data from AIDEA, the Alaska Energy Authority (AEA) and HDR Inc. were collected and evaluated to identify the change in demand for labor and goods and services in the FNSB economy.
2. Develop Economic Impact Model: Cardno developed an economic model of the FNSB regional economy using IMPLAN software and 2012 IMPLAN data (the most recent data available).
3. Estimate Total Economic Impacts: Data from AEA on construction expenditures were used to estimate the ”direct” on-site jobs and income. Data from the *Fairbanks LNG Distribution System Demand Analysis*[1] (Demand Analysis) regarding natural gas demand were used to derive ”direct” operations employment and income. Once direct impacts were determined, the regional economic impact model of the FNSB’s local economy was used to estimate the total jobs and income impact, including the indirect and induced “ripple” effects throughout other economic sectors as money re-circulates in the economy.

[1] AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014.

Total Employment and Income Impacts

This analysis evaluated the Projects construction impacts over the 2014 – 2021 period and operations impacts over the 2014 – 2028 period. Construction is anticipated to be complete by 2021, while the operations phase analyzed in this research was selected since all households and businesses willing to convert are expected to have done so by 2028.

Depending on the construction year, the Project is estimated to support between 250 and 840 total jobs and between $16.5 million and $55.2 million of total income in the FNSB. On average, the Project will support an estimated 440 jobs per year over the construction period from 2014 to 2021, of which 350 are expected to be directly employed in construction. Furthermore, the average total annual income generated by construction activities over this timeframe is expected to be $29.1 million, of which $25.0 million is expected to be construction employee income.

Regarding the long-term operations impacts, each year over the 2014 to 2028 period the Project would support on average 520 local jobs and $14.2 million in income. Of these, approximately 480 jobs and $9.2 million in income are indirectly supported at other FNSB businesses.

Table ES-1 Economic Effects from Project Construction (FNSB)

Year	Labor Income ($ millions)			Employment (jobs)		
	Direct	**Indirect and Induced**	**Total**	**Direct**	**Indirect and Induced**	**Total**
2014	$35.2	$5.7	$40.9	490	130	620
2015	$14.2	$2.3	$16.5	200	50	250
2016	$47.5	$7.7	$55.2	660	180	840
2017	$23.2	$3.8	$27.0	330	90	410
2018	$23.7	$3.8	$27.5	330	90	420
2019	$21.2	$3.4	$24.6	300	80	380
2020	$20.5	$3.3	$23.8	290	80	360
2021	$14.5	$2.4	$16.8	200	50	260
Annual average [a]	*$25.0*	*$4.1*	*$29.1*	*350*	*90*	*440*
Total	*$200.0*	*$32.5*	*$232.5*	*N/A*	*N/A*	*N/A*

Project development includes initial capital costs required to construct the distribution system, transmission system, regulator stations, and storage facilities.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the construction period (Years 2014 to 2021).

Totals may not sum due to rounding

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

Table ES-2 Economic Effects from Project Operations (FNSB)

Year	Labor Income ($ millions)			Employment (jobs)		
	Direct	Indirect/ Induced	Total	Direct	Indirect/ Induced	Total
2014	$0.3	$1.6	$1.9	0	30	30
2015	$0.8	$2.6	$3.4	10	110	110
2016	$2.1	$5.6	$7.7	20	290	310
2017	$3.3	$6.7	$9.9	30	370	400
2018	$4.1	$8.5	$12.6	30	440	470
2019	$4.8	$9.4	$14.2	40	490	530
2020	$5.4	$10.5	$15.9	40	530	580
2021	$5.9	$11.5	$17.4	50	580	620
2022	$6.5	$12.1	$18.5	50	610	660
2023	$6.8	$11.7	$18.5	60	620	680
2024	$7.0	$11.7	$18.7	60	630	690
2025	$7.1	$11.5	$18.6	60	630	690
2026	$7.1	$11.5	$18.6	60	630	690
2027	$7.2	$11.5	$18.6	60	640	690
2028	$7.2	$11.4	$18.6	60	640	690
Annual average [a]	*$5.0*	*$9.2*	*$14.2*	*40*	*480*	*520*
Total	*$75.6*	*$137.7*	*$213.2*	*N/A*	*N/A*	*N/A*

Direct project operations represent natural gas utility operations.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2028).

Totals may not sum due to rounding

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

1 Introduction

1.1 Background

On April 12, 2013, the Alaska Legislature approved the Interior Energy Project (Project) under Senate Bill 23 (SB 23), which provides financing to develop a natural gas conditioning and liquefaction plant on the state's North Slope. Additionally, SB 23 provides for the financing of Liquefied Natural Gas (LNG) storage, re-gasification, and distribution to bring natural gas to customers in the Fairbanks North Star Borough (FNSB).

Alaska Industrial Development and Export Authority's (AIDEA) involvement in the Project includes possible participation in the ownership and financing of an LNG plant on the North Slope, along with authorization to issue up to $150 million of bonds to facilitate the expansion of piped natural gas distribution in high and medium population density areas of the FNSB. The distribution components may contain LNG storage, re-gasification, and piping.

The Regulatory Commission of Alaska (RCA) has determined that two natural gas utilities will serve the broader Fairbanks and North Pole Area. Currently, approximately 1,100 natural gas customers within the core area of Fairbanks are served by the Fairbanks Natural Gas (FNG) natural gas utility. FNG purchases gas from the Cook Inlet area of Alaska and once liquefied, transports it by trucks to Fairbanks where it is stored and re-gassed for distribution to customers. The Interior Gas Utility (IGU) is a municipally owned utility formed in 2012 by the FNSB, the City of Fairbanks and the City of North Pole to bring natural gas to an area outside of the existing FNG service area. Although FNG and IGU both expressed interest in providing natural gas service to the area surrounding the existing FNG service area, the exclusive rights to serve this "expansion area" were awarded to IGU by the RCA. The RCA is a state agency that provides a utility the right to serve an area and regulates utility rates, services, and practices in Alaska.

Developing an expanded natural gas distribution system in the Fairbanks/North Pole area is a critical component of the Project. AIDEA would finance a natural gas conditioning and liquefaction plant on the North Slope and also a LNG storage, re-gasification, and distribution system to bring natural gas to FNSB households. The development of the Project would provide two major benefits to FNSB residents: 1) residential and business heating cost savings by converting to lower cost natural gas versus heating oil, and 2) improved air quality.

1.2 Purpose and Scope

AIDEA requires a better understanding of the regional economic implications associated with natural gas expansion in the FNSB. Specifically, AIDEA wishes to quantify the potential employment and income effects resulting from the construction and operation of the natural gas distribution system. To meet this purpose the scope of this study evaluates the employment and income effects of six analytical components including:

1. Annual labor and material expenditures anticipated for project construction.
2. Annual expenditures for natural gas within the project area.
3. The number of homes and businesses to convert to natural gas and the cost of doing so.
4. The decrease in heating oil consumption resulting from households and businesses converting to natural gas.
5. The cost of trucking adequate quantities of LNG from the North Slope required to meet natural gas demand in the study area.

6. The savings obtained by households and businesses and the resulting increase in disposable income for those that convert to natural gas.

Cardno analyzed each of these analytical components using an Impact Analysis for Planning (IMPLAN) model with data specific to the FNSB. IMPLAN models include data on the linkages between different industries in a region and allow estimation of the total economic effects of a policy or project on a specific economy. Total economic effects include impacts directly attributable to the activity being analyzed, as well as the additional indirect and induced effects resulting from money circulating throughout the economy.

1.3 Organization

This report contains two additional chapters. Chapter 2 presents the methods and data used to estimate economic impacts of the Project on FNSB jobs and income, and Chapter 3 presents the expected short and long-term income and employment (full and part-time jobs) that the Project would support in the FNSB.

1.4 Potentially Affected Industries

It is estimated that FNSB businesses which convert from heating oil to natural gas will reduce their heating expenditures by approximately 50 percent.[2] However, there are a number of FNSB businesses that rely heavily upon heating oil sales for revenue or rely upon heating oil as a major production input including refineries, power generation facilities and regional heating oil distributors. This section provides additional information regarding FNSB businesses and institutions that could be affected by natural gas availability due to their reliance on heating oil.

1.4.1 Refineries

The State of Alaska has six refineries with a combined operating capacity of 270,500 barrels-per-stream-day. The Petro Star North Pole refinery and the Flint Hills Resources North Pole refinery are located in the FNSB and have a current total operating capacity of 109,500 barrels-per-stream-day (see **Table 1-1**). This section provides additional information regarding FNSB refineries.

Table 1-1 FNSB Refineries and Operating Capacity

Company Name	Site	Operating Capacity (barrels per stream day)
Flint Hills Resources LP	North Pole	87,000
Petro Star Inc.	North Pole	22,500

Source: Energy Information Administration (EIA), Refinery capacity data by individual refinery as of January 1, 2013, Website(http://www.eia.gov/petroleum/refinerycapacity/) accessed March 12, 2014

1.4.1.1 Petro Star Inc., North Star and Valdez Refineries

Petro Star is a wholly-owned subsidiary of Arctic Slope Regional Corporation and the only Alaskan-owned refining and fuel marketing operation in the state.[3] Petro Star's North Pole and Valdez refineries have operating capacities of 22,500-barrels-per-stream-day and 60,000-barrels-per-stream-day, respectively.[4]

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2 AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014.

3 Petro Star Inc. Corporate Profile. Website (http://www.petrostar.com/home/home.asp?page=history) accessed March 4, 2014.

4 U.S. Energy Information Administration. June, 2013. Refinery Capacity Report. Website (http://www.eia.gov/petroleum/refinerycapacity/refcap13.pdf), accessed March 4, 2014.

In a typical year, approximately one-third of Petro Star's production is ultra-low and low sulfur diesel, nearly 50 percent is jet fuel and the remaining 17 percent is home heating fuel;[5] approximately two-thirds of the heating oil consumed in FNSB is supplied by Petro Star.[6] The North Pole refinery, with approximately 20 employees,[7] produces jet fuel (commercial, military, JP4, and JetB), kerosene, diesel and home heating oil.[8]

1.4.1.2 Flint Hills Resources AK LLC (FHR)

The Flint Hills North Pole refinery is owned by Flint Hills Resources Alaska, LLC (FHR), a wholly-owned subsidiary of Koch Industries, Inc.[9] FHR recently announced that North Pole refinery will cease gas production on May 1, 2014 and stop jet fuel and other refined product production on June 1, 2014.[10] Currently, 110 full-time employees work at the North Pole refinery and each of these positions earn $166,000 per year, supporting another 11 positions in FNSB.[11] The facility produces over 330 million gallons of refined product, the majority of which is jet fuel for operations at the Ted Stevens Anchorage International Airport.[12] At present throughput volumes, the FHR North Pole refinery also produces about 41,000 gallons of home heating fuel per day.[13]

1.4.2 Golden Valley Electric Association

The Golden Valley Electric Association (GVEA) is a member-owned cooperative and regulated utility that owns and operates five power plants that provide electricity to approximately 100,000 Interior residents, including those in Fairbanks.[14] GVEA has been actively pursuing alternatives to reduce their dependence on oil. For example, in 2012 GVEA produced 43 percent of its power from oil; but by 2013, GVEA power production using oil had dropped to 29 percent.[15] GVEA has also been actively involved in developing a natural gas trucking operation from the North Slope. Furthermore, GVEA has recently indicated that depending on a fixed price agreement they envision purchasing between 1.5 and 2.5 billion cubic feet (Bcf) of natural gas annually from the Project.

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5 Alaska Department of Natural Resources, Division of Oil & Gas. March, 2013.Final Best Interest Finding and Determination for the Sale of Alaska North Slope Royalty Oil to Flint Hills Resources Alaska, LLC.

6 Fairbanks North Star Borough. 2011. Comprehensive Economic Development Strategy. Website (http://www.co.fairbanks.ak.us/mayor/EconomicDevelopment/FNSB%20CEDS%202011%20adopted%20full%20version%205%207%202011%20with%20background3.pdf), accessed March 4, 2014.

7 companies.findthecompany.com., Website (http://companies.findthecompany.com/l/18725870/Petro-Star-Inc-in-North-Pole-AK), accessed March 5, 2014.

8 Petro Star Inc. Refining. Website(http://www.petrostar.com/divisions/divisions.asp?page=refining), accessed March 4, 2014.

9 Alaska Department of Natural Resources, Division of Oil & Gas. March, 2013. Final best Interest Finding and Determination for the Sale of Alaska North Slope Royalty Oil to Flint Hills Resources Alaska, LLC. Website(http://dog.dnr.alaska.gov/Royalty/Documents/RIKDocuments/Final_BIF_FHR_3-22-13.pdf) accessed March 11, 2014.

10 Flint Hills Resources. News. Flint Hills Resources Alaska to Cease Crude Oil Processing at North Pole Refinery. February 4, 2014. Website(http://www.fhr.com/newsroom/news_detail.aspx?id=327) accessed March 11, 2014.

11 Alaska Department of Natural Resources, Division of Oil & Gas. March, 2013. Final best Interest Finding and Determination for the Sale of Alaska North Slope Royalty Oil to Flint Hills Resources Alaska, LLC. Website(http://dog.dnr.alaska.gov/Royalty/Documents/RIKDocuments/Final_BIF_FHR_3-22-13.pdf) accessed March 11, 2014.

12 Ibid.

13 Ibid.

14 Golden Value Electric Association. Letter of Interest to AIDEA. Website (http://www.gvea.com/images/energy/GVEA%20LNG%20Letter%20of%20Interest.pdf) accessed March 11, 2014.

15 Golden Value Electric Association. News. February 4, 2014. Website (http://www.gvea.com/news) accessed March 17, 2014.

1.4.3 Heating Oil Distributors

The heating oil industry has been suffering nationwide for many years, but this has been especially notable in recent years with the price of heating oil exceeding natural gas price by a considerable margin. For example, a report issued by the State of Connecticut identified that the promotion of fuel switching would negatively affect Connecticut's home heating oil industry and a reduction in demand for heating oil would result in layoffs and possibly the closure of some heating oil distributors.[16] The FNSB has ten main heating oil distributors that could be impacted by the Project (**Table 1-2**).

Table 1-2 FNSB Heating Oil Distribution Company Employees

Company	Number of Employees
Alaska Aerofuel	42
Alaska Fuel Service	3
Alaska Petroleum	45
Crowley Petroleum Distributors	10
Everts Air Fuel	24
Fairbanks Fuel	12
Polar Fuel	9
Sourdough Fuel	80
Suburban Propane	7
The Fuel Company	2
Total	*234*

Sources: Alaska Center for Energy and Power, University of Alaska. Fairbanks North Star Borough Baseline Greenhouse Gas Emissions Inventory Base Year 2007. Website (http://www.uaf.edu/files/acep/GHG_Assessment_Final_Version.pdf) accessed March 12,

Polar Fuel, Staff, Website (http://www.polarfuel.com/staff.html) accessed March 12, 2014

[16] Connecticut General Assembly, Office of Legislative Research. 2012. 2012-R-0478. OLR Backgrounder: Promoting Natural Gas Use in Connecticut—Potential Benefits, Costs, Risks, and Uncertainties. Website (http://www.cga.ct.gov/2012/rpt/2012-R-0478.htm) accessed March 17, 2014.

2 Economic Impact Analysis Methods and Data

This section presents the methods and data used to estimate the economic impacts of the Project on FNSB jobs and income. The Project would increase economic activity through the construction and operation of the natural gas distribution system, the installation of natural gas heating systems, and the expansion of the LNG trucking industry. Additionally, the Project would increase residential and business spending associated with the savings obtained through conversion, and have implications for regional heating oil distribution companies.

These activities would directly support employment and income on-site at the Project in the construction and gas utility sectors, as well as support other sectors that provide supplies and services to construction and gas sectors (i.e., indirect impacts). In addition as employees spend income generated by other businesses in the local economy benefit as well such as wholesale, retail, service, and other sectors. To the extent that this money is re-spent at local businesses, the money will circulate in the economy and stimulate additional local economic activity. This is known as the multiplier effect. Therefore, the following types of jobs and income are estimated in this analysis:

> On-Site Project jobs and income (direct)

> Supplier jobs and income (indirect)

> Retail/Service jobs and income (induced impact from increased spending of labor income)

The economic effects of natural gas infrastructure projects are akin to other developments that have a construction phase as well as on-going operations. These types of projects typically provide an initial, short-term boost to the local economy during project construction as goods and services and labor are purchased locally. Once construction is completed, project operations provide extended local economic benefits over the long-term through spending on goods, services, and labor that support operations. **Figure 2-1** below summarizes the sources and types of impacts analyzed in this report.

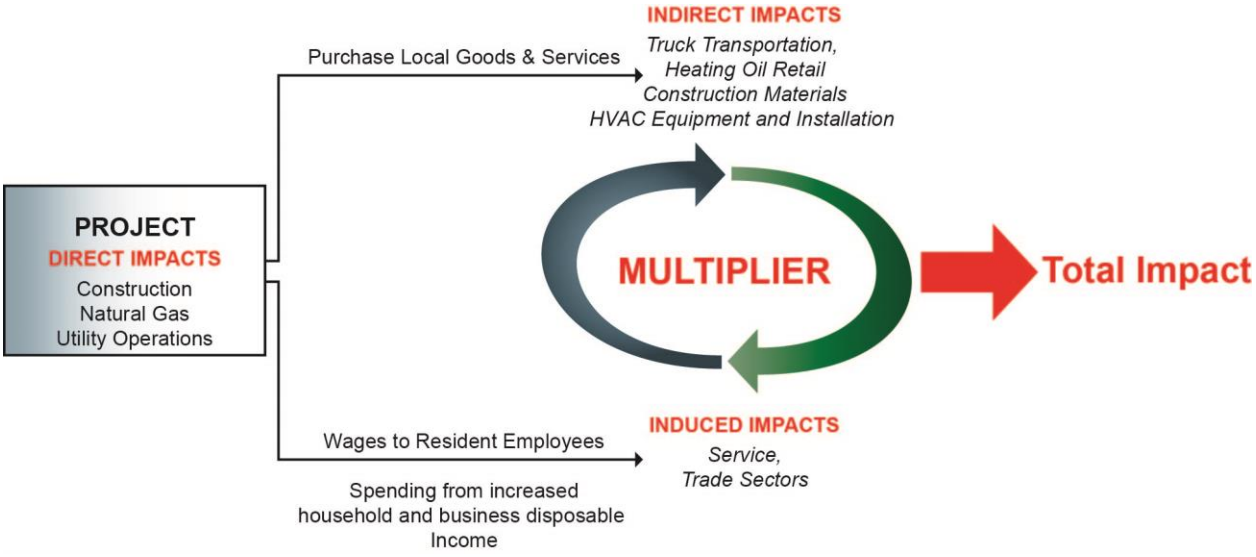

Figure 2-1 Source and Type of Economic Impacts from the Project

To estimate total economic impacts, Cardno conducted a three-step analysis. An overview of the methodology and data used is provided below, and is discussed in more detail in the remainder of the chapter.

1. Identify Sources of Impact and Gather Data: In this task, data from AIDEA, Alaska Energy Authority (AEA) and HDR Inc. were collected and evaluated to identify the change in demand for labor and goods and services in the FNSB economy.

2. Develop Economic Impact Model: Step 2 involved developing an economic model of the FNSB using IMPLAN software and 2012 IMPLAN data (the most recent data available).

3. Estimate Total Economic Impacts: In step 3, data from AEA on construction expenditures were used to estimate the 'direct,' on-site jobs and income. Data from the *Fairbanks LNG Distribution System Demand Analysis*[17] (Demand Analysis) regarding natural gas demand was used to derive 'direct' operations employment and income. Once direct impacts were determined, the regional economic impact model of the FNSB's local economy was used to estimate the total jobs and income impact, including the ripple effects (indirect and induced) throughout other economic sectors as money is re-circulated in the economy.

2.1 Data and Sources of Impact

To measure the effect of the Project on the local economy, it is necessary to identify the mix of goods and services purchased locally to construct and operate the Project. This mix of goods and services is like a recipe, with the ingredients measured in dollars; so many dollars for pipe, so many dollars for gravel, so many dollars for various labor and management skills and so on. This section highlights the assumptions used to derive the estimated project related expenditures anticipated to occur in the FNSB and subsequently affect the local economy.

The economic parameters of the Project and related assumptions, including spending estimates, sources of purchased materials, use of local labor, and other values were defined through communication with AEA and HDR Inc. and then used as inputs to the IMPLAN model. All monetary values are reported in 2014 dollars.

A summary is provided in **Table 2-1** below for each of the primary drivers of the economic impact of the Project including: 1) income of construction workers, 2) purchases of construction goods and services, 3) natural gas consumption, 4) reduced heating oil consumption, 5) expenditures for natural gas transportation, and 6) an increase in household and proprietor income.

Table 2-1 Total Project Related Expenditures for Construction and Operation (million $)

Year	Const. Labor	Const. Materials	Conversion Installation Exp.	Increased Natural Gas Demand	Reduced Heating Oil Demand	Truck Transport	House hold Savings	Proprietor Savings
2014	$35.2	$11.7	$1.0	$4.2	-$8.4	$1.5	$0.2	$4.0
2015	$14.2	$4.7	$6.3	$11.1	-$21.9	$6.8	$1.9	$8.9
2016	$47.5	$15.8	$11.6	$28.5	-$56.0	$21.4	$6.0	$21.5
2017	$23.2	$7.7	$7.3	$44.9	-$88.0	$27.4	$10.3	$32.8
2018	$23.7	$7.9	$10.0	$56.0	-$109.4	$31.5	$14.4	$39.4
2019	$21.2	$7.1	$8.8	$65.9	-$128.3	$35.1	$18.8	$44.4
2020	$20.5	$6.8	$10.0	$73.5	-$142.5	$37.9	$23.2	$47.0
2021	$14.5	$4.8	$10.4	$81.0	-$156.4	$40.6	$28.1	$49.0

[17] AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014.

Year	Const. Labor	Const. Materials	Conversion Installation Exp.	Increased Natural Gas Demand	Reduced Heating Oil Demand	Truck Transport	House hold Savings	Proprietor Savings
2022	$0.0	$0.0	$9.1	$88.4	-$170.0	$43.3	$33.2	$50.6
2023	$0.0	$0.0	$4.3	$93.4	-$179.4	$45.2	$36.8	$51.7
2024	$0.0	$0.0	$2.7	$95.8	-$183.8	$46.0	$38.6	$52.1
2025	$0.0	$0.0	$1.2	$97.1	-$186.1	$46.5	$39.6	$52.2
2026	$0.0	$0.0	$0.7	$97.6	-$187.1	$46.7	$40.1	$52.2
2027	$0.0	$0.0	$0.5	$97.9	-$187.7	$46.8	$40.4	$52.2
2028	$0.0	$0.0	$0.2	$98.1	-$188.0	$46.9	$40.6	$52.2

Sources: Adapted from AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014.

Warren, Kirk, AEA, Project Manager, Personal communication with Lee Elder, Cardno ENTRIX, February 21, 2014.

AIDEA and AEA, Unpublished Draft AIDEA Interior Energy Project: LNG Transportation Analysis, Prepared by HDR in cooperation with MEI and Prolog.

2.1.1 Project Construction

This analysis considers the construction of the Project natural gas distribution system, the transmission system, regulator stations, and the storage tank facilities within the FNSB. Direct construction labor and material expenditures were based on personal communication and input from AEA representatives.[18] In 2014, FNG is anticipated to start building Phase 1 of their service area and complete buildout in Phase 2 by 2015. IGU is anticipated to begin construction on Phase 1 of their service area in 2016 and complete buildout of Phase 6 of their service area by 2021.[19]

This analysis assumes that all construction labor will be sourced from the FNSB. Direct construction labor estimates provided by AEA were used to derive the number of construction workers employed on an annual basis. Furthermore, the construction material expenditures expected to accrue to the FNSB is based upon local material purchase estimates provided by the Jobs and Economic Development Impact (JEDI) model for transmission projects in Alaska. Approximately 10 percent of Project construction materials are anticipated to be purchased from the local area.[20] Therefore, it is assumed that 10 percent of the total construction materials will be sourced from the FNSB. In other words, roughly $1.2 million of the total construction materials for 2014 ($11.7 million x 10 percent) is anticipated to be sourced from the FNSB. This same local purchase coefficient of 10 percent is assumed for all construction material expenditures for each construction year (**Table 2-2)**.

[18] Warren, Kirk, AEA, Project Manager, Personal communication with Lee Elder, Cardno ENTRIX, February 21, 2014.

[19] It should be noted that this analysis used the best available data from AEA regarding the timing of Project construction. The construction phase presented here could begin earlier, later and/or have a shorter duration depending on a variety of construction factors and Project developer decisions. In the event that construction timing was to occur earlier, the timing of the resulting employment and income effects would occur sooner than identified in this analysis. Subsequently, the operational phase of the Project would also begin earlier, which would alter the timing of Project operation benefits.

[20] JEDI, JEDI Transmission Model, Website (http://www.nrel.gov/analysis/jedi/download.html) accessed March 18, 2014.

Table 2-2 Total FNG and IGU Construction Expenditures by Year (million $)

Year	Utility	Distribution		Transmission		Reg. Stations		Storage Tanks		Total	
		Labor	Materials	Labor	Materials	Labor	Materials	Labor	Materials	Labor	Materials
2014	FNG	$4.2	$1.4	$3.5	$1.2	$1.2	$0.4	$26.3	$8.8	$35.2	$11.7
2015		$14.2	$4.7	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$14.2	$4.7
2016	IGU	$5.0	$1.7	$5.7	$1.9	$2.4	$0.8	$34.5	$11.5	$47.5	$15.8
2017		$15.8	$5.3	$5.7	$1.9	$1.8	$0.6	$0.0	$0.0	$23.2	$7.7
2018		$17.6	$5.9	$5.0	$1.7	$1.2	$0.4	$0.0	$0.0	$23.7	$7.9
2019		$21.2	$7.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$21.2	$7.1
2020		$20.5	$6.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$20.5	$6.8
2021		$14.5	$4.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$14.5	$4.8

Source: Warren, Kirk, AEA, Project Manager, Personal communication with Lee Elder, Cardno ENTRIX, February 21, 2014.

2.1.2 Residential Heating System Purchase and Installation

Depending on equipment requirements, capital cost of converting to natural gas heating is expected to range from $2,300 to $10,700 per residential household.[21] This analysis uses the weighted average cost of conversions as determined in the Demand Analysis ($4,300) to estimate the total cost of installing residential natural gas systems. The weighted average cost was applied to the total number of residential structures converting in each year to derive total annual equipment and installation costs. Furthermore, for the purposes of this analysis, it was assumed that multifamily homes and commercial users will install a boiler. As determined by the Demand Analysis, the weighted average conversion cost for a boiler system is $9,100. This analysis assumes that all heating system installation expenditures will flow to local heating and plumbing contractors.

2.1.3 Natural Gas Utility Operations

This analysis builds upon the recently completed Demand Analysis by incorporating more recent construction buildout information to better identify the timing of annual natural gas demand. AEA recently generated updated FNG and IGU buildout plans for the Project, which will affect the timing of natural gas demand within the FNSB. Rather than assuming a 6-year/phase buildout, as was the case for the Demand Analysis, this current research uses a 2-year/phase buildout for the FNG and a 6-year/phase buildout for the IGU (see **Table 2-2** above).

Furthermore, residential and commercial demand estimates were modified to account for reduced natural gas consumption during the first year that homes and businesses covert to natural gas. The current research assumes that households and businesses that convert will use half of the 'typical' average annual demand for natural gas in the first year following conversion. This is because it is likely these homes and businesses will connect in the fall or winter of the construction year; or for those converting in

[21] AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014.

the years post-construction, it is assumed they will wait until warmer summer weather to convert and subsequently use half of the typical average annual gas consumption.

For example, a residential home is anticipated to have an average annual consumption of 151 Mcf per year.[22] However, if the homeowner wishes to convert to natural gas as soon as possible (i.e., the construction year) they would only be able to do so in the fall at the earliest (once the distribution phase has been built and energized). They would subsequently use approximately half of the estimated average annual natural gas that year. Similarly, homes that convert in any year following distribution system construction would likely wait until the summer to avoid any damage to water pipes or injury that could occur during a winter month conversion. Therefore, it is expected that in the first year that these homes connect to natural gas they will use approximately half of the annual average gas consumption (75.5 Mcf of natural gas).

Table 2-3 provides the anticipated demand for natural gas. It should be noted that not all of Project natural gas demand will generate additional economic activity. Specifically, the anticipated gas consumption from existing FNG customers is not expected to generate any additional economic activity since FNG currently uses this same quantity of natural gas. In other words, FNG currently operates their distribution system by selling approximately 0.9 Bcf of natural gas to FNSB customers. If FNG was to acquire this same quantity of natural gas from other sources it would not generate additional economic activity within the FNSB.

Furthermore, the value of natural gas provided in **Table 2-3** assumes the natural gas price of $15 per Mcf. However, this value was adjusted to accurately account for backward linkages within the IMPLAN model.[23] The value of natural gas output provided in **Table 2-3** below for residential/commercial and interruptible FNG natural gas consumption was adjusted to net out the value of the natural gas sectors purchase of truck transportation services since this backward linkage is evaluated separately in this research (see Section 2.1.5). For example, of the $15 per Mcf price paid for natural gas it is estimated that $5.49 per Mcf will go to the trucking industry for transporting LNG from the North Slope to Fairbanks. The remaining $9.51 per Mcf ($15 per Mcf minus $5.49 per Mcf) is used to model the economic impact of the natural gas utility sectors purchases of labor, goods, and services within the IMPLAN model and excludes all purchases of truck transportation industry services.

Table 2-3 Project Natural Gas Demand and Value (million $)

Year	Residential and Commercial Conversion		Interruptible FNG Demand Assuming Uninterrupted		FNG Existing Uninterrupted Demand	
	Quantity (Bcf)	Value	Quantity (Bcf)	Value	Quantity (Bcf)	Value
2014	0.1	$0.9	0.2	$3.3	0.9	$13.3
2015	0.5	$7.8	0.2	$3.3	0.9	$13.3
2016	1.7	$25.1	0.2	$3.3	0.9	$13.3
2017	2.8	$41.5	0.2	$3.3	0.9	$13.3
2018	3.5	$52.7	0.2	$3.3	0.9	$13.3
2019	4.2	$62.6	0.2	$3.3	0.9	$13.3
2020	4.7	$70.2	0.2	$3.3	0.9	$13.3
2021	5.2	$77.7	0.2	$3.3	0.9	$13.3
2022	5.7	$85.0	0.2	$3.3	0.9	$13.3

[22] Ibid.

[23] See Section 2.2 for additional information on backward linkages.

Year	Residential and Commercial Conversion		Interruptible FNG Demand Assuming Uninterrupted		FNG Existing Uninterrupted Demand	
	Quantity (Bcf)	Value	Quantity (Bcf)	Value	Quantity (Bcf)	Value
2023	6.0	$90.0	0.2	$3.3	0.9	$13.3
2024	6.2	$92.4	0.2	$3.3	0.9	$13.3
2025	6.2	$93.7	0.2	$3.3	0.9	$13.3
2026	6.3	$94.3	0.2	$3.3	0.9	$13.3
2027	6.3	$94.6	0.2	$3.3	0.9	$13.3
2028	6.3	$94.8	0.2	$3.3	0.9	$13.3

Source: Adapted from AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014

2.1.4 Petro Star and Heating Oil Distribution Companies

The quantity of reduced heating oil consumption was derived using the same approach as the Demand Analysis, but adapted to account for the modified construction schedule and first year conversion timing as described in Section 2.1.3. It is anticipated that the availability of natural gas in the FNSB will reduce heating oil demand by 47.0 million gallons from current consumption levels by 2028.

The decrease in heating oil demand is expected to have implications upon the Petro Star refinery and regional heating oil distribution companies. However, given the variety of products currently being produced at the Petro Star refinery, it is reasonable to assume that Petro Star will respond to decreased regional heating oil demand by producing more diesel and jet fuel to compensate for the lost home heating fuel market share. Furthermore, with the recent announcement of the FHR closure there will likely be additional opportunities for Petro Star to capture market share previously held by FHR.[24]

In contrast, reduced heating oil demand is expected to adversely affect FNSB heating oil distributors since it is unlikely these companies can readily develop other markets to offset the loss. Therefore, the retail market share for heating oil sales (11.1 percent of each dollar spent on heating oil) is considered forgone economic activity in the model. As an example, in 2014 only the retail portion (11.1 percent) of the $8.4 million value of heating oil (see **Table 2-1**) or $932,000 in heating oil retail output is no longer purchased as a result of natural gas conversions. Subsequently, $932,000 is utilized within the economic model to determine the implications of lost heating oil sales upon the heating oil retail industry and the broader FNSB.

2.1.5 Truck Transportation Expenditures

Transport of LNG from the North Slope will likely be accomplished by existing or future trucking companies based out of the Fairbanks area[25] at costs ranging from $4.80 to $5.49 per Mcf.[26] Based upon personal communication with experts; this analysis uses $5.49 per Mcf estimate to determine total annual transportation costs.[27] In addition to FNSB residential and business demand, GVEA predicts the use of

[24] GEVA, GVEA anticipates no disruption of power, February 4, 2014, Website (http://www.gvea.com/news) accessed March 16, 2014.

[25] AIDEA and AEA, Feasibility Report: Proposed Project – North Slope LNG Plant, July 2013, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/Feasibility_Report_72013.pdf) accessed March 16, 2014.

[26] AIDEA and AEA, Unpublished Draft AIDEA Interior Energy Project: LNG Transportation Analysis, Prepared by HDR in cooperation with MEI and Prolog.

[27] Clark, Chris, HDR Alaska, Inc., Personal communication with Lee Elder, Cardno, March 14, 2014.

approximately 2.0 Bcf of natural gas annually.[28] This additional natural gas demand from GVEA will benefit regional trucking companies, and along with FNG interruptible demand and residential and commercial conversion demand it is included in the regional economic model.

As described in Section 2.1.3 above, LNG transportation costs associated with existing FNG customers have been excluded given that the economic activity associated with existing FNG operations is currently occurring and not a new economic activity. However, transportation costs associated with natural gas demand for residential and commercial conversion, interruptible FNG customers, and GVEA are considered new economic activities for the FNSB. The $5.49 per Mcf estimate is applied to the total annual natural gas consumed by these users to derive total annual LNG transportation costs (see **Table 2-4**). The IMPLAN model local purchase percentage for the truck transportation industry (97 percent) was applied to total truck transportation cost to estimate the impacts of these expenditures.

Table 2-4 LNG Truck Transportation Expenditures (million $)

Year	Residential and Commercial Resulting from Conversions		Interruptible FNG Demand Assuming Uninterrupted		GVEA		Total Trucking Expenditures	
	Quantity (Bcf)	Trucking Cost	Quantity (Bcf)	Trucking Cost	Quantity (Bcf)	Trucking Cost	Quantity (Bcf)	Trucking Cost
2014	0.1	$0.3	0.2	$1.2	0.0	$0.0	0.3	$1.5
2015	0.5	$2.8	0.2	$1.2	0.5	$2.7	1.2	$6.8
2016	1.7	$9.2	0.2	$1.2	2.0	$11.0	3.9	$21.4
2017	2.8	$15.2	0.2	$1.2	2.0	$11.0	5.0	$27.4
2018	3.5	$19.3	0.2	$1.2	2.0	$11.0	5.7	$31.5
2019	4.2	$22.9	0.2	$1.2	2.0	$11.0	6.4	$35.1
2020	4.7	$25.7	0.2	$1.2	2.0	$11.0	6.9	$37.9
2021	5.2	$28.4	0.2	$1.2	2.0	$11.0	7.4	$40.6
2022	5.7	$31.1	0.2	$1.2	2.0	$11.0	7.9	$43.3
2023	6.0	$33.0	0.2	$1.2	2.0	$11.0	8.2	$45.2
2024	6.2	$33.8	0.2	$1.2	2.0	$11.0	8.4	$46.0
2025	6.2	$34.3	0.2	$1.2	2.0	$11.0	8.5	$46.5
2026	6.3	$34.5	0.2	$1.2	2.0	$11.0	8.5	$46.7
2027	6.3	$34.6	0.2	$1.2	2.0	$11.0	8.5	$46.8
2028	6.3	$34.7	0.2	$1.2	2.0	$11.0	8.5	$46.9

Source: AIDEA and AEA, Unpublished Draft AIDEA Interior Energy Project: LNG Transportation Analysis, Prepared by HDR in cooperation with MEI and Prolog.

2.1.6 Household and Business Savings

Natural gas for home heating is expected to generate sizable savings for FNSB households and businesses that convert from heating oil. This increase in household and business owner disposable income is expected to be spent on other goods and services rather than on heating oil. This analysis assumes that increased household disposable income will be spent locally, while only a portion of this increased business disposable income will be spent locally.

[28] Ibid.

Total business savings were adjusted to account for the proportion FNSB businesses that are locally owned. FNSB business owners that do not reside within the Borough are not expected to spend their increased disposable income within the Borough and thus will not affect the local economy.

The total number of businesses with a physical location and a mailing address in Fairbanks (4,770) was used in conjunction with the total number of businesses with a Fairbanks physical address (5,110) to derive a local business ratio of 93.4 percent.[29] This ratio is applied to the total estimated increase in business disposable income provided in **Table 2-5** below to determine the amount of disposable income that FNSB would spend in the region.

Table 2-5 Annual Savings Obtained from Converting to Natural Gas (million $)

Year	Household Savings	Proprietor Savings	Total Savings
2014	$0.2	$4.0	$4.2
2015	$1.9	$8.9	$10.8
2016	$6.0	$21.5	$27.5
2017	$10.3	$32.8	$43.2
2018	$14.4	$39.4	$53.8
2019	$18.8	$44.4	$63.1
2020	$23.2	$47.0	$70.2
2021	$28.1	$49.0	$77.0
2022	$33.2	$50.6	$83.8
2023	$36.8	$51.7	$88.5
2024	$38.6	$52.1	$90.7
2025	$39.6	$52.2	$91.8
2026	$40.1	$52.2	$92.3
2027	$40.4	$52.2	$92.6
2028	$40.6	$52.2	$92.8

Source: Adapted from AIDEA, Fairbanks LNG Distribution System Demand Analysis, January 14, 2014, Prepared by Cardno, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed March 15, 2014

2.2 Economic Model

To understand how an economy is affected by a business or industry, such as construction and natural gas distribution, it is necessary to understand how different sectors or industries in the economy are linked to each other. For example, natural gas utilities require natural gas from the natural gas extraction sector, which in turn requires pipe from the steel manufacturing sector, which in turn purchases from a range of other industries – these are referred to as backward linkages. Sectors that use natural gas as an input, such as electricity generation, are called a forward linkage. The natural gas distribution industry is linked through both forward and backward linkages to other economic sectors in each state and local economy.

[29] Fairbanks Economic Development Corporation, Business Retention and Expansion Database, Website (http://www.investfairbanks.com/projects/business-retention-expansion) accessed March 18, 2014.

Typically, most economic sectors import some goods and materials from outside of a local economy. Money spent on imports is a "leakage" from a local economy, which is expected to be large for some components of Project-related spending due to the specialized nature of large scale infrastructure projects. Likewise, businesses typically do not sell all of their production to businesses in the local area, but sell some or all of their production to businesses outside the local area. Products sold outside the local area are exports, and money received for exports brings "new" money into the area and increases the size of the local economy through multiplier effects.

The size of the multiplier effect, or the extent to which new money generated by exports are able to expand the local economy is largely dependent on how much of the money is spent and re-spent in the local economy. A proportion of money received by an industry is spent to procure local supplies, and then these local suppliers re-spend that money. If there are few local suppliers, much of the money will leak from a local economy, and the multiplier effect will be smaller. In other words, the size of the multiplier effect depends on how local businesses are linked and how much leakage occurs in the form of imported inputs.

The household sector is linked to all sectors as it provides the labor and management for local businesses. Changes that affect household income typically have greater impacts on a local economy when compared to changes in the sales of other sectors because households typically spend most of their income locally in retail and service industries.

This study utilizes an economic model known as IMPLAN to develop this understanding of the local economy, including the sectors that exist in a local area, the links between them, and the level of economic activity. The remainder of this section describes the IMPLAN model and the approach used to measure the total impacts of Project expenditures.

2.2.1 IMPLAN Model

IMPLAN is a software tool and database that allow economists to construct economic input-output (I-O) models.[30] I-O models are constructed based on the concept that all industries within an economy are linked together; the output of one industry becomes the input of another industry until all final goods and services are produced. I-O models can be used to both analyze the structure of a regional economy and to estimate the total economic impact of projects or policies. For this analysis, a 2012 economic impact model for the FNSB economy was constructed using IMPLAN. Separate analyses were conducted to help estimate impacts for the construction phase of the Project.

The key model outputs used in this analysis are income and employment. Total income is the sum of labor income (including employee and proprietor income and all payroll and benefits) and gross operating surplus or profit. It is equivalent to value added (a measure of the contribution to GDP of a proposed enterprise) less taxes paid. Employment represents the annual average number of employees, whether full or part-time, of businesses producing output.

IMPLAN has some limitations. One of the most important is that I-O models assume that resources that become unemployed or employed due to a change in final demand have no alternative employment. This is likely the most important assumption in our analysis as it assumes that increased economic activity associated with the Project will increase local employment – when in fact, if existing workers can increase productivity, then new jobs may not be created but existing workers may produce more output. For this reason, throughout the analysis we identify the number of jobs *supported* by the Project, rather than the number of jobs *created.*

Another assumption is that of fixed proportions: for any good or service, all inputs are combined in fixed proportions that are constant regardless of the level of output. Hence, there is no substitution among

[30] The IMPLAN model consists of commercial software and region-specific economic data, which is maintained and distributed by the Minnesota IMPLAN Group, Inc.

production inputs and no economies of scale are possible. Also, each production function incorporates fixed technology, so for example the same proportion of labor and capital are used. This limitation could have implications on our predicted future employment and income estimates if the inputs for natural gas distribution change overtime as would be the case for LNG trucking in the event a natural gas pipeline from the North Slope to Fairbanks was developed. I-O models do not incorporate model price effects that might be important to a region. Regardless of the level of production, it is assumed that price and returns per unit of production are constant.

Finally, the IMPLAN database contains 509 sectors at the national level. While this is a large number of sectors, some sectors contain a wide range of products or services and the production functions reflect the average or aggregate production technology for the goods or services produced. For example, while there is a retail gasoline sector in IMPLAN, there is no industry sector that corresponds specifically to heating oil retailers.

3 Total Employment and Income Impacts

Chapter 3 presents the expected short and long-term income (labor income, proprietor income, and other property income) and employment (full and part-time jobs) that the Project would support in the FNSB. The period of the analysis includes the construction and operations phase of the Project. Construction would likely begin in 2014 and complete in 2021, while the operational impact of the Project was evaluated for a 14-year period from 2014 through 2028. This operational period was selected because it is expected that households and businesses that are willing to convert will have done so by 2028. Therefore, 2028 is the first year within the Project area that full project benefits are realized (i.e., all households and businesses have converted and the maximum savings level has been reached). As the Project is expected to operate beyond the assumed 14-year operational period used in this analysis, Project effects will likely continue for many years beyond 2028.

This chapter first summarizes the total economic benefits for Project construction and operation on the FNSB. Subsequent subsections provide more detailed benefit estimates for each operational project component including:

> Natural gas operations,

> Expenditures for heating and plumbing contractors,

> Truck transportation expenditures

> Increased household and business disposable income.

> Reduced spending in the heating oil retail sector

The income and employment benefits of the Project are presented for the short-term construction period and long-term operations phase on an annual basis. The construction phase includes the construction of the distribution system, transmission system, regulator stations, and storage facilities.

Increased economic activity would provide employment and income at the Project site (direct effects)[31], and support employment and income at businesses supplying goods and services to the Project (indirect impacts) and its employees (induced effects).[32] Economic impacts are therefore estimated for all economic sectors in the FNSB. Note that employment figures are estimates of the number of jobs, full and part-time, that the Project would support in the FNSB. These figures are estimated based on the average ratio of economic output per job in each sector in the FNSB. All employment and income benefits presented accrue to FNSB residents.

3.1 Total Economic Impacts

Jobs and income supported within the FNSB are summarized in **Table 3-1**. Depending on the construction year, the Project is estimated to support between 250 and 840 total jobs and $16.5 million to $55.2 million in total income in the FNSB. Average total annual employment over the 2014 to 2021 construction period is estimated at 440 jobs, of which 350 are expected to be directly employed in construction industry. Further, the average total annual income generated by construction activities over this timeframe is expected to be $29.1 million, of which $25.0 million is income for construction workers. Regarding long-term impacts, each year over the 2014 to 2028 period the Project would support on

[31] Direct effects are effects on the sector with the initial change in economic output, which in this case is the construction and power generation sector.

[32] Indirect effects are changes in industries that provide inputs to sectors with increased economic output. Induced effects are changes in industries that provide goods and services to employees in directly and indirectly affected industries (i.e. changes due to increased household income and associated spending).

average 520 local jobs and $14.2 million in income. Of these, approximately 480 jobs and $9.2 million in income are indirectly supported at other FNSB businesses.

Table 3-1 Economic Effects from Project Construction (FNSB)

Year	Labor Income ($ millions)			Employment (jobs)		
	Direct	**Indirect and Induced**	**Total**	**Direct**	**Indirect and Induced**	**Total**
2014	$35.2	$5.7	$40.9	490	130	620
2015	$14.2	$2.3	$16.5	200	50	250
2016	$47.5	$7.7	$55.2	660	180	840
2017	$23.2	$3.8	$27.0	330	90	410
2018	$23.7	$3.8	$27.5	330	90	420
2019	$21.2	$3.4	$24.6	300	80	380
2020	$20.5	$3.3	$23.8	290	80	360
2021	$14.5	$2.4	$16.8	200	50	260
Annual average [a]	*$25.0*	*$4.1*	*$29.1*	*350*	*90*	*440*
Total	*$200.0*	*$32.5*	*$232.5*	*N/A*	*N/A*	*N/A*

Project development includes initial capital costs required to construct the distribution system, transmission system, regulator stations, and storage facilities.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the construction period (Years 2014 to 2021).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

Table 3-2 Economic Effects from Project Operations (FNSB)

Year	Labor Income ($ millions)			Employment (jobs)		
	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
2014	$0.3	$1.6	$1.9	0	30	30
2015	$0.8	$2.6	$3.4	10	110	110
2016	$2.1	$5.6	$7.7	20	290	310
2017	$3.3	$6.7	$9.9	30	370	400
2018	$4.1	$8.5	$12.6	30	440	470
2019	$4.8	$9.4	$14.2	40	490	530
2020	$5.4	$10.5	$15.9	40	530	580
2021	$5.9	$11.5	$17.4	50	580	620
2022	$6.5	$12.1	$18.5	50	610	660
2023	$6.8	$11.7	$18.5	60	620	680
2024	$7.0	$11.7	$18.7	60	630	690
2025	$7.1	$11.5	$18.6	60	630	690
2026	$7.1	$11.5	$18.6	60	630	690

Year	Labor Income ($ millions)			Employment (jobs)		
	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
2027	$7.2	$11.5	$18.6	60	640	690
2028	$7.2	$11.4	$18.6	60	640	690
Annual average [a]	*$5.0*	*$9.2*	*$14.2*	*40*	*480*	*520*
Total	*$75.6*	*$137.7*	*$213.2*	*N/A*	*N/A*	*N/A*

Direct project operations represent natural gas utility operations.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2018).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

3.2 Summary of Operational Impacts by Project Component

Section 3.2 provides additional information for sectors considered to be components of Project operations. Natural gas utility operation is considered to be the industry driving the initial change in regional economic output; or in other words, natural gas utility employees and their earnings are direct operational effects. With exception of construction and natural gas utility activities, all other activities affected by natural gas availability in the FNSB are considered indirect or induced operational effects stemming from natural gas utility operations. This section highlights the employment and income effects of each operational project component.

3.2.1 Natural Gas Utility Operations

As illustrated in **Table 3-3** below, natural gas utility operations directly support an average of 40 positions over the 2014 to 2028 period. Over this same timeframe, natural gas utility purchases of goods and services in the local economy support an average of 30 jobs each year (10 indirect and 20 induced) in supporting FNSB industries. Over the same timeframe, natural gas operations directly support an average of $5.0 million of income for the natural gas utility sector and an additional $1.6 million of income throughout the FNSB annually ($0.7 million indirect and $0.9 million induced).

Table 3-3 Economic Effects of Natural Gas Utility Operations (FNSB)

Year	Income				Employment			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
2014	$0.3	$0.0	$0.1	$0.4	0	0	0	0
2015	$0.8	$0.1	$0.1	$1.1	10	0	0	10
2016	$2.1	$0.3	$0.4	$2.7	20	0	10	30
2017	$3.3	$0.4	$0.6	$4.3	30	10	10	50
2018	$4.1	$0.5	$0.7	$5.4	30	10	20	60
2019	$4.8	$0.6	$0.9	$6.3	40	10	20	70
2020	$5.4	$0.7	$1.0	$7.0	40	10	20	80
2021	$5.9	$0.8	$1.1	$7.8	50	10	20	90
2022	$6.5	$0.9	$1.1	$8.5	50	10	30	90
2023	$6.8	$0.9	$1.2	$8.9	60	10	30	100

Year	Income				Employment			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
2024	$7.0	$0.9	$1.2	$9.2	60	10	30	100
2025	$7.1	$0.9	$1.3	$9.3	60	10	30	100
2026	$7.1	$0.9	$1.3	$9.4	60	10	30	100
2027	$7.2	$1.0	$1.3	$9.4	60	10	30	100
2028	$7.2	$1.0	$1.3	$9.4	60	10	30	100
Annual average [a]	*$5.0*	*$0.7*	*$0.9*	*$6.6*	*40*	*10*	*20*	*70*
Total	*$75.6*	*$10.0*	*$13.4*	*$99.0*	*N/A*	*N/A*	*N/A*	*N/A*

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2028).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

3.2.2 Heating and Plumbing Contractors

As described in Section 3 above, the purchase and installation of natural gas heating equipment is an indirect activity associated with natural gas utility operations (i.e., the availability of natural gas in the project area creates additional spending in the FNSB for heating and plumbing contractors). However, when the heating and plumbing industry is evaluated exclusively as it is in **Table 3-4** below, expenditures by households and businesses for natural gas heating devices and their installation is a direct impact for the heating and plumbing industry.

As illustrated in **Table 3-4**, household and business purchases of goods and services from the heating and plumbing industry directly supports an average of 10 heating and plumbing positions from 2014 to 2028. Over this same timeframe, purchases of goods and services from the heating and plumbing sector support an average of 8 additional jobs annually (4 indirect and 4 induced) in other FNSB industries. Household and business expenditures on heating and plumbing goods and services directly support an annual average of $0.8 million in heating and plumbing sector income from 2014 to 2028. Over this same timeframe, heating and plumbing operations support an annual average of $0.4 million in income throughout the FNSB ($0.2 million indirect and $0.2 million induced).

Table 3-4 Economic Effects of Project Operations on Heating and Plumbing Contractors

Year	Income				Employment			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
2014	$0.1	$0.0	$0.0	$0.2	0	0	0	0
2015	$0.9	$0.2	$0.2	$1.2	10	0	0	20
2016	$1.6	$0.3	$0.3	$2.3	20	10	10	40
2017	$1.0	$0.2	$0.2	$1.4	10	0	0	20
2018	$1.4	$0.3	$0.3	$2.0	20	10	10	30
2019	$1.2	$0.3	$0.2	$1.7	20	10	10	30
2020	$1.4	$0.3	$0.3	$2.0	20	10	10	30
2021	$1.4	$0.3	$0.3	$2.0	20	10	10	30
2022	$1.3	$0.3	$0.3	$1.8	20	10	10	30

Year	Income				Employment			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
2023	$0.6	$0.1	$0.1	$0.8	10	0	0	10
2024	$0.4	$0.1	$0.1	$0.5	10	0	0	10
2025	$0.2	$0.0	$0.0	$0.2	0	0	0	0
2026	$0.1	$0.0	$0.0	$0.1	0	0	0	0
2027	$0.1	$0.0	$0.0	$0.1	0	0	0	0
2028	$0.0	$0.0	$0.0	$0.0	0	0	0	0
Annual average [a]	*$0.8*	*$0.2*	*$0.2*	*$1.1*	*10*	*4*	*4*	*20*
Total	*$11.7*	*$2.5*	*$2.4*	*$16.6*	*N/A*	*N/A*	*N/A*	*N/A*

Direct and Indirect effects are considered to be an indirect operations effect in the context of total Project operations.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2028).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

3.2.3 Heating and Oil Retail

The heating oil retail sector is considered an indirectly affected component of natural gas utility operations (i.e., natural gas utilities produce natural gas that offsets heating oil purchases and subsequently decreases purchases from heating oil retail companies). However, when the heating oil retail industry is evaluated exclusively (**Table 3-5**), reduced expenditures for heating oil due to natural gas utility operations is considered a direct impact for the heating oil industry.

Reduced heating oil consumption due to natural gas utility operations is anticipated to decrease employment in the heating oil distribution sector by 260 jobs by 2028. In addition, it is expected that employment in other sectors that rely in part on heating oil distribution in the FNSB will decrease by 60 jobs (20 indirect and 40 induced) by 2028. Direct income associated with these employment reductions is estimated to decline by $9.6 million by 2028, and indirect and induced income will decline by $2.5 million.

Table 3-5 Economic Effects of Project Operations on Heating Oil Retailers (FNSB)

Year	Income				Employment			
	Direct	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
2014	-$0.4	$0.0	-$0.1	-$0.5	-10	0	0	-10
2015	-$1.1	-$0.1	-$0.2	-$1.4	-30	0	0	-40
2016	-$2.9	-$0.3	-$0.5	-$3.6	-80	-10	-10	-90
2017	-$4.5	-$0.4	-$0.8	-$5.7	-120	-10	-20	-150
2018	-$5.6	-$0.5	-$1.0	-$7.1	-150	-10	-20	-180
2019	-$6.6	-$0.6	-$1.1	-$8.3	-180	-10	-30	-220
2020	-$7.3	-$0.7	-$1.2	-$9.2	-200	-10	-30	-240
2021	-$8.0	-$0.7	-$1.4	-$10.1	-220	-20	-30	-260
2022	-$8.7	-$0.8	-$1.5	-$11.0	-230	-20	-30	-290
2023	-$9.2	-$0.8	-$1.6	-$11.6	-250	-20	-40	-300
2024	-$9.4	-$0.8	-$1.6	-$11.9	-250	-20	-40	-310
2025	-$9.5	-$0.9	-$1.6	-$12.0	-260	-20	-40	-310
2026	-$9.6	-$0.9	-$1.6	-$12.1	-260	-20	-40	-320
2027	-$9.6	-$0.9	-$1.6	-$12.1	-260	-20	-40	-320
2028	-$9.6	-$0.9	-$1.6	-$12.2	-260	-20	-40	-320
Annual average [a]	*-$6.8*	*-$0.6*	*-$1.2*	*-$8.6*	*-180*	*-10*	*-30*	*-220*
Total	*-$102.2*	*-$9.2*	*-$17.5*	*-$128.9*	*N/A*	*N/A*	*N/A*	*N/A*

Direct and Indirect effects are considered to be an indirect operations effect in the context of total Project operations.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2028).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

3.2.4 Trucking

As described in Section 3 above, the trucking component of Project operations is an indirect component of natural gas utility operations (i.e., natural gas utilities require trucking sector output and therefore natural gas operations indirectly support production activities). However, when the trucking industry is evaluated exclusively (**Table 3-6**) expenditures by the natural gas utility sector for trucking is considered a direct impact for the trucking industry.

Expenditures for trucking directly support an annual average of 210 trucking sector jobs from 2014 to 2028, which includes drivers and other support staff. Over the same timeframe, trucking operations support an average of 110 additional jobs annually (50 indirect and 60 induced). Revenues generated for trucking industry support an annual average income of $14.0 million in the trucking sector over the 2014 to 2028 period. In addition to direct income effects, on average trucking operations support an additional $5.5 million in annual income ($2.8 million indirect and $2.7 million induced).

Table 3-6 Economic Effects of Project Operations on Trucking Operations (FNSB)

Year	Income				Employment			
	Direct	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
2014	$0.6	$0.1	$0.1	$0.9	10	0	0	10
2015	$2.7	$0.5	$0.5	$3.8	40	10	10	60
2016	$8.6	$1.7	$1.6	$11.9	130	30	40	200
2017	$11.0	$2.2	$2.1	$15.3	170	40	50	250
2018	$12.6	$2.5	$2.4	$17.6	190	40	60	290
2019	$14.1	$2.8	$2.7	$19.6	210	50	60	320
2020	$15.2	$3.0	$2.9	$21.1	230	50	70	350
2021	$16.3	$3.2	$3.1	$22.7	250	50	70	370
2022	$17.4	$3.5	$3.3	$24.2	260	60	80	400
2023	$18.1	$3.6	$3.4	$25.2	270	60	80	410
2024	$18.5	$3.7	$3.5	$25.7	280	60	80	420
2025	$18.7	$3.7	$3.5	$25.9	280	60	80	420
2026	$18.7	$3.7	$3.6	$26.0	280	60	80	430
2027	$18.8	$3.7	$3.6	$26.1	280	60	80	430
2028	$18.8	$3.7	$3.6	$26.1	290	60	80	430
Annual average [a]	*$14.0*	*$2.8*	*$2.7*	*$19.5*	*210*	*50*	*60*	*320*
Total	*$210.2*	*$41.9*	*$39.9*	*$292.0*	*N/A*	*N/A*	*N/A*	*N/A*

Direct and Indirect effects are considered to be an indirect operations effect in the context of total Project operations.

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2028).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).

3.2.5 Spending Due to Disposable Income Increase

As illustrated in **Table 3-7** below, household and business purchases of goods and services resulting from increases in disposable income creates induced effects in the local economy. As previously described, induced effects are changes in industries that provide goods and services to employees in directly and indirectly affected industries (i.e., changes due to increased household income and associated spending).

Increased household and business disposable income and the resulting increase in spending for FNSB goods and services supports an annual average of 340 jobs and $15.0 million in income from 2014 to 2028.

Table 3-7 Economic Effects from Additional Disposable Income Spending (FNSB)

Year	Income				Employment			
	Direct	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
2014	N/A	N/A	$1.0	$1.0	N/A	N/A	20	20
2015	N/A	N/A	$2.5	$2.5	N/A	N/A	60	60
2016	N/A	N/A	$6.3	$6.3	N/A	N/A	140	140
2017	N/A	N/A	$9.9	$9.9	N/A	N/A	220	220
2018	N/A	N/A	$12.3	$12.3	N/A	N/A	280	280
2019	N/A	N/A	$14.5	$14.5	N/A	N/A	320	320
2020	N/A	N/A	$16.1	$16.1	N/A	N/A	360	360
2021	N/A	N/A	$17.7	$17.7	N/A	N/A	400	400
2022	N/A	N/A	$19.3	$19.3	N/A	N/A	430	430
2023	N/A	N/A	$20.3	$20.3	N/A	N/A	460	460
2024	N/A	N/A	$20.8	$20.8	N/A	N/A	470	470
2025	N/A	N/A	$21.1	$21.1	N/A	N/A	470	470
2026	N/A	N/A	$21.2	$21.2	N/A	N/A	480	480
2027	N/A	N/A	$21.3	$21.3	N/A	N/A	480	480
2028	N/A	N/A	$21.3	$21.3	N/A	N/A	480	480
Annual average [a]	*N/A*	*N/A*	*$15.0*	*$15.0*	*N/A*	*N/A*	*340*	*340*
Total	*N/A*	*N/A*	*$225.6*	*$225.6*	*N/A*	*N/A*	*N/A*	*N/A*

Monetary values are reported in constant 2014 dollars.

[a] Annual average values correspond to the period required for households and business to fully convert to natural gas (Years 2014 to 2028).

Totals may not sum due to rounding.

Source: Cardno ENTRIX 2014 (based on IMPLAN modeling).