



Interior Energy Project

**Quarterly Report to the
Alaska State Legislature**

Interior Energy Project

January 10, 2017



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ACRONYMS LIST

AIDEA	Alaska Industrial Development and Export Authority
ARRC	Alaska Railroad Corporation
CDBG	Community Development Block Grant
CPAI	ConocoPhillips Alaska, Inc.
FEED	Front End Engineering and Design
FID	Final Investment Decision
FNG	Fairbanks Natural Gas
FNSB	Fairbanks North Star Borough
HB	House Bill
IEP	Interior Energy Project
IGU	Interior Gas Utility
LNG	Liquefied natural gas
MOU	Memorandum of Understanding
PACE	Property Assessed Clean Energy
Pentex	Pentex Alaska Natural Gas Company, LLC
RFP	Request for Proposals
RUS	Rural Utilities Services
Salix	Salix Inc.
SETS	Sustainable Energy Transmission and Supply Development Fund
Titan	Titan LNG, LLC
USDA	United States Department of Agriculture

INTRODUCTION

House Bill (HB) 105 passed the 29th Alaska Legislature on April 27, 2015, and was signed by Governor Bill Walker on June 30, 2015. This legislation was enacted to advance the Interior Energy Project (IEP), a project designed to bring low-cost energy to as many residents and businesses of Interior Alaska as possible, as quickly as possible. The financing package designed by this legislation provides the Alaska Industrial Development and Export Authority (AIDEA) the tools necessary to develop an integrated supply chain bringing low-cost natural gas or propane to residents and businesses through local utilities.

HB105 requires AIDEA to provide written quarterly reports to the Alaska State Legislature on the status of the IEP. The specific bill language includes:

“The Alaska Industrial Development and Export Authority shall submit quarterly to the legislature a written report on the Interior Energy Project. The authority shall deliver the report to the senate secretary and the chief clerk of the House of Representatives and notify the legislature that the report is available. The report must include:

- (1) a description of project progress on all components;*
- (2) an update on the status of local distribution infrastructure buildout;*
- (3) to-date and anticipated conversions; and*
- (4) a financial accounting of funds expended and funds anticipated to be spent, including loans, grants, and bonds.”*

This is the sixth quarterly report submitted under the requirements of HB105. Each section of the report will correspond to one of the four items required by HB105. This report augments the information previously provided, and covers the period October 1, 2016, through December 31, 2016.

DESCRIPTION OF PROJECT PROGRESS ON ALL COMPONENTS

The IEP work effort is structured on the following project components: Supply, Liquefaction, Transportation, Distribution (including Storage and Regasification), and Conversions. As required by HB105, the status of each of these components is summarized below.

Supply

The IEP team initiated a Request for Proposals (RFP) to secure a gas supply from the Cook Inlet basin. Fairbanks Natural Gas (FNG), through its affiliate Titan LNG, LLC (Titan), currently has a gas supply agreement with Hilcorp Alaska, LLC, to provide natural gas to the existing Titan facility through the beginning of 2018. The IEP team is working on supplanting that contract when it expires and securing additional supply for new liquefied natural gas (LNG) capacity capable of accommodating the consolidated demand of the FNG and Interior Gas Utility (IGU) service territories.

Negotiations to secure a natural gas supply continued through the period October 1 through December 31. Securing this critical component is complicated by a need for a favorable price and flexibility on quantity obligations in order to achieve the IEP goals. The IEP team and Interior utilities continue to work on a supply contract with a Cook Inlet producer for a long-term supply agreement starting in early 2018. The joint IGU/FNG negotiations for gas supply were led by IGU during the final quarter of 2016 as a result of progress being made to combine the two utilities under IGU ownership.

FNG has an existing contract with ConocoPhillips Alaska, Inc. (CPAI), for backup supplies of LNG from CPAI's plant in Nikiski, Alaska.

Liquefaction

AIDEA issued a competitive RFP to solicit potential partners to develop new LNG capacity or other sources of energy for the Interior under the IEP. The RFP Evaluation Committee recommended Salix Inc. (Salix) as the finalist to advance development of new LNG capacity in Cook Inlet. The RFP Evaluation Committee detailed their selection in a March 3, 2016, memorandum and accompanying documents distributed at the AIDEA Board meeting held the same day.

Since the March 3, 2016 recommendation, the IEP teams, including representatives from FNG and IGU, worked with Salix to reduce the capital and operating costs of expanded LNG capacity at the existing Titan LNG site. In the course of these discussions, IGU and FNG independently identified costs associated with the proposed LNG plant expansion that would add to the risk of slow customer conversions if the competing price of fuel oil is low when the expanded LNG capacity came on line. As a result, AIDEA personnel approached Salix about a transition to utility ownership of the project in order to remove certain cost components. Agreement was reached, following a series of negotiations, that resulted in the AIDEA Board approving purchase of the pre-Front End Engineering and Design (FEED) package produced by Salix. The purchase price for the Salix pre-FEED package was \$250,000. This body of work will be the basis of the documentation ultimately needed to move the LNG expansion project into full FEED under a utility ownership model.

Assuming completion and signing of the IGU/FNG consolidation Memorandum of Understanding (MOU) in January, IGU, utilizing the knowledge and expertise it gains through acquisition of Pentex Alaska Natural Gas Company, LLC (Pentex), will finalize the optimal design and commercial structure of the LNG plant expansion and will consider whether to move the project into FEED. At the same time FEED is being performed, commercial agreements to secure the plant components and necessary construction services will be developed and negotiated into contracts. At the completion of FEED, it is expected that IGU will decide whether to make the Final Investment Decision (FID). If FID is approved, the commercial agreements will be executed and work will commence on increasing the capacities of the existing LNG plant and associated storage. If there is some delay in completing the consolidation MOU, Pentex will carry on the activities above to maintain the potential for earliest possible delivery of additional LNG capacity.

Transportation

Rail option update

The Alaska Railroad Corporation (ARRC) is processing information gained from trial shipments of LNG via rail in September and October of 2016. A shipment of empty ISO containers was initially transported from Anchorage to Fairbanks so that ARRC employees and local first responders could familiarize themselves with the new equipment. The Railroad then shipped two fully loaded containers on September 28, 2016. The pilot project conducted eight shipments by the end of October 2016. ARRC was the lead entity on this trial with the full cooperation of personnel at the Titan LNG plant and FNG receipt and storage facilities. A copy of an ARRC LNG Fact Sheet is included as Attachment A of this Quarterly Report.

The Center for Biological Diversity filed a lawsuit in U.S. District Court in Washington D.C. to compel the Federal Railroad Administration to release information on the process that was followed in approving the trial and potential long term shipment of LNG via the Alaska Railroad. This legal action is focused on the federal entity and does not include any State of Alaska or local utility.

Trucking option update

LNG trailers currently in use in Alaska have a capacity of approximately 10,500 gallons. In order to improve the economics of LNG transport via truck, AIDEA participated in a 2015 pilot project to test a larger capacity HEIL LNG trailer provided by Western Cascade.

The HEIL trailer has capacity of up to 13,000 gallons of LNG. However, due to Maximum Gross Vehicle Weight restrictions on Alaska highways, the net capacity allowed to be transported in the trailer is approximately 12,300 gallons. Despite this weight limitation, the lower per-unit cost of delivering LNG using larger trailers presents a viable opportunity to reduce a key component of the IEP supply chain costs.

Titan purchased the trailer used for the trial and has ordered three (3) additional large-capacity HEIL units to replace aging trailers in its current fleet. The trailers are expected to be delivered in mid-2017 and will reduce average LNG transportation costs. In order to enhance future options to further reduce the cost of transporting LNG, Titan Alaska LNG has requested that the new HEIL trailers be configured to facilitate adding a hitch at a later date that would allow pulling an additional “pup” trailer with each LNG load if this proves to be feasible.

Distribution

Existing FNG System Rates

Following AIDEA’s 2015 purchase of Pentex Alaska Natural Gas Company, LLC, Pentex filed for interim rate reductions for current FNG customers effective on January 1, 2016. After public input and separate AIDEA Board action, the interim rates became permanent on March 31, 2016. The approved rates achieved AIDEA’s policy and financial objectives for the Pentex acquisition and the IEP resulting in a residential customer rate reduction of 13.5 percent and an overall FNG system rate reduction of 10.4 percent.

Systems Expansion

No changes have been made to the distribution system since the October 1, 2015, IEP Quarterly Report. Detailed maps of the build-out accomplished in 2015 are included in that report, available at interiorenergyproject.com. Although no significant expansions were completed in 2016, FNG continues to work with the City of Fairbanks, the Fairbanks North Star Borough (FNSB), and the Alaska Department of Transportation & Public Facilities to coordinate any pipe installs that may be efficiently constructed while other major roadwork is taking place.

Although there was no active distribution expansion activity during the past 90-day period, the IEP team continues to discuss ways that future expansion activity can help facilitate consolidation of FNG and IGU into a single unified system.

Systems Consolidation

Given the timeline for completion of the plan for liquefaction capacity expansion and the uncertainty of future natural gas supply, the parties extended the target date for the transition to a consolidated system to the first quarter of 2017.

In parallel with gas supply and liquefaction activities, the following progress continued to be made toward the potential sale of Pentex to IGU, moving toward the functional and operational consolidation of the FNG and IGU natural gas utilities:

- AIDEA/Pentex and IGU have continued to refine an MOU detailing the business and financial terms and conditions for the sale or other transfer of the Pentex assets to IGU;

- AIDEA/Pentex and IGU continue to advance a plan for physical integration of the FNG and IGU systems, including additions to storage and re-gas capacity in Fairbanks and North Pole; and,
- Using the economic and financial model developed by IGU's utility finance consultant, the parties are nearing the completion of a financial plan, including concurrence on the projected sources and uses of funds for the capital requirements of the consolidated system.

AIDEA, Pentex, and IGU have continued to meet telephonically to maintain momentum on the consolidation activities, with additional interaction as needed to finalize capital, operational, and financial plans. In December, the pace of these discussions accelerated as there were multiple in-person negotiation sessions that ultimately led to staff-level agreement on an MOU. All parties anticipate a recommended consolidation MOU to be presented to the IGU and AIDEA Boards in January 2017.

Fiscal year alignment

The AIDEA Board approved expanding the current 2016 Pentex calendar year budget by six months at its December 1, 2016 meeting. This action aligns the fiscal year for Pentex and all its subsidiaries with the AIDEA and IGU fiscal years and will facilitate sale of the Pentex assets and operations to IGU.

Conversion

Efforts to assist consumers with conversion to natural gas have centered primarily on identification of low-cost loan funds and access to favorable financing mechanisms. Work has also been done with furnace and boiler manufacturers regarding new boiler components that may reduce the cost of individual customer conversion to natural gas.

Consumer interest in conversion assistance

The Cardno Entrix *Interior Energy Project Natural Gas Conversion Analysis*, finalized in January 2014, identified a high level of interest in converting to natural gas as a lower cost, cleaner source fuel for space heat if the delivered price approached the target of \$15 per thousand cubic feet (mcf). At this price, many homeowners indicated a desire to forgo financing conversion and instead expressed a willingness to fund this action from personal savings. For individuals without personal funds for this purpose, the ability to finance all, or a portion, of the cost over an extended period of time scored high as a necessary tool to support their conversion to gas.

The ability to pass the obligation for repayment of conversion financing to a new owner of a building proved to be very attractive to residential owners. The ability to spread natural gas conversion costs over a 10- to 20-year period and the use of transferable financing are both attributes of two energy efficiency financing mechanisms described below that have achieved widespread use across the Lower 48.

The recent decline in the price of home heating fuel oil emphasizes the value of conversion assistance that will incentivize individual property owners in the FNSB to switch to natural gas when it becomes available. The original Cardno Entrix conversion estimates and demand model have been modified to reflect the lower price of fuel oil and expected reduction in natural gas conversions. However, just as the price of home heating oil has declined unexpectedly over the last two years, the future price is also uncertain.

Property Assessed Clean Energy Financing

Property Assessed Clean Energy (PACE) is a means of financing improvements that increase the energy efficiency of commercial buildings. The improvements are financed with repayment accomplished through a voluntary assessment placed on the annual property tax bill. PACE financing is often structured to allow a longer payback period than is possible with a conventional business improvement loan. In addition, the strength of the PACE collection mechanism results in low default/low risk loans, which may justify a lower interest rate.

PACE legislation (Senate Bill 56 and HB118) advanced through the legislative process during the regular sessions of the 29th Alaska Legislature, but did not receive final approval in the Senate as the second regular session closed.

Governor Walker was successful in securing funding from the National Governors Association for a two-day conference on energy efficiency and renewable energy financing in Anchorage in early September. The second day of the conference focused on successful PACE financing programs in other states. Mayor Kassel from the FNSB was in attendance.

On-bill Financing

On-bill financing allows utility customers to borrow funds that are repaid via a voluntary line item added to their standard utility bill. This financing mechanism is often used by utilities to assist new customers in overcoming the initial cost of accessing a utility service.

The current ownership and governance structure of IGU and the purchase of FNG by AIDEA allow these local utilities the flexibility to offer an on-bill financing mechanism capable of assisting customers with the expense of converting to natural gas. Although previous conversion surveys and focus groups indicated that the mere availability of a transferable financing mechanism would prompt a higher rate of conversion to natural gas, coupling this tool with low cost loan funds will be helpful.

Although FNG and IGU currently have access to on-bill financing as a means of assisting consumers with conversion to natural gas, it is unclear whether utilities that are rate-regulated by the Regulatory Commission of Alaska have such latitude. As a result, there is some interest in legislation that would amend existing Alaska statutes to clearly allow this opportunity.

Identified funding sources for conversion assistance

The Local Conversion Working Group has identified the following possible funding sources for conversion assistance:

- I. Commercial lenders
 - a. Commercial loans as part of a community-wide conversion program
- II. Local government
 - a. PACE-enabled conversion loans
 - b. Possible local government back-stop funding for PACE loans
- III. State sources
 - a. Air quality programs
 - b. Community Development Block Grants (CDBG)
- IV. Federal sources
 - a. United States Department of Agriculture (USDA) Rural Utilities Service (RUS) Energy Efficiency and Conservation Loan Program
 - b. USDA RUS Rural Energy Savings Program loans
 - c. Clean Water Fund
 - d. Environmental Protection Agency Targeted Airshed Grants

The Alaska Housing Finance Corporation Home Energy Rebate Program was removed from this list due to the closing of the program to new applicants as of March 25, 2016.

CDBGs were added as a potential funding source based on work performed by IGU staff that identified specific areas within the combined FNG and IGU service territory with income characteristics that may support access to CDBG funds.

UPDATE ON THE STATUS OF LOCAL DISTRIBUTION INFRASTRUCTURE BUILD-OUT

No changes were made to the distribution system in the last quarter. Detailed maps of the build-out accomplished in 2015 were included in the October 1, 2015, IEP Quarterly Report.

TO-DATE AND ANTICIPATED CONVERSIONS

To-Date Conversions

No conversions are currently occurring, due to limited gas supply. Until the supply is increased, there is not sufficient gas in the winter to ensure uninterrupted service to additional customers. Expanded distribution lines installed in 2015 have been pressurized and are available to supply gas to additional homes and businesses when additional natural gas is available.

Anticipated Conversions

The number of anticipated conversions provided in the October 1, 2015 IEP Quarterly Report was based on the analysis undertaken by Cardno Entrix. The report assessed “willingness to convert” based on a number of factors related to conversion costs, prior conversion history, survey data, and potential savings. A copy of that report can be found at interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf.

The significant change in the price of heating fuel required a fresh look at the “willingness to convert” with specific attention paid to the closing of the cost gap between heating fuel and the IEP natural gas price targets. Cardno Entrix was engaged to update the analysis of “willingness to convert” based on a range of scenarios of lowered heating oil prices. In the most conservative scenario, expected conversions were projected to drop by approximately one-third from the original analysis. A copy of the revised analysis, *Heating Oil Price Sensitivity Analysis Report*, is included as Attachment B of this report.

The change in projected willingness to convert, combined with an extension of the time needed to reach conversions from six years to eight years, results in a revision to the number of anticipated conversions and the anticipated demand for the project. Table 1 depicts the anticipated number of conversions, by year, based upon the revised Cardno Entrix analysis.

Table 1: Natural Gas Customer Projection

	2015	2016	2017	2018	2019	2020	2021	2022	2023
FNG	959	959	1,506	2,183	3,031	3,732	4,362	4,635	4,807
IGU	-	-	167	576	1,285	2,255	3,502	4,818	5,998

FINANCIAL ACCOUNTING OF FUNDS EXPENDED AND FUNDS ANTICIPATED TO BE SPENT, INCLUDING LOANS, GRANTS, AND BONDS

Table 2 outlines the IEP expenditures related to the \$57.5 million capital appropriation, the \$125 million of Sustainable Energy Transmission and Supply (SETS) fund capitalization, and the \$150 million of SETS bond authorization.

Table 2: Expenditures from and Remaining Funds of Legislative Appropriation & Authorization(s)

Expenditures* from and Remaining Funds of Legislative Appropriation & Authorization(s):				
	HCS CSSB 18 \$57.5 mill Cap Approp	SB 23 SLA 2013 \$125 mill SETS	SB 23 SLA 2013 \$150 mill Bonds	Total
Development Costs	IEP Phase 1 (Pre HB 105)			
	LNG Plant	7,585,150	-	7,585,150
	North Slope Pad	6,003,418	-	6,003,418
	Distribution	500,005	-	500,005
	Total	14,088,574	-	14,088,574
	IEP Phase 2 (Post HB 105)			
	Commodity	85,587	-	85,587
	LNG Plant	429,161	-	429,161
	Trucking	14,075	-	14,075
	Storage	912	-	912
	Distribution	21,754	-	21,754
	Project Management	335,945	-	335,945
	Total	887,434	-	887,434
	Total	14,976,008	-	14,976,008
Loans & Investments	LNG Plant	-	-	-
	Trucking	-	-	-
	Storage	-	-	-
	Distirubtion	-	-	-
	FNG Loan	-	15,000,000	15,000,000
	IGU Loan	-	37,780,000	37,780,000
	Total	-	52,780,000	52,780,000
Total	Total Expenditure	14,976,008	52,780,000	67,756,008
	Remaining Funds	42,523,992	72,220,000	150,000,000
Notes <i>Financial data per unaudited accounting system records as of 01/03/2017</i> <i>*Expenditures include Actuals, Encumbrances, and Commitments as of 01/03/2017</i> <i>Legislative Appropriation & Authorization(s) only include those identified above and do not include AIDEA operating, Economic Development Fund, or other sources.</i>				

SUMMARY

This status report provides the sixth quarterly report on the status and progress of the IEP, specified in HB105. The IEP team will continue to work with Interior utilities and Interior community leaders to bring a project recommendation to the AIDEA Board for consideration in early 2017. The plan brought to the Board will be consistent with HB105 requirements.

The next quarterly report is due in early April 2017.



Attachment A

Alaska Railroad LNG Fact Sheet

LNG Transport Demonstration

The Alaska Railroad (ARRC) will demonstrate its ability to safely transport liquefied natural gas (LNG) in intermodal LNG ISO containers from southcentral to interior Alaska during a month-long operational performance project in early fall 2016.

Hitachi High-Tech AW Cryo, Inc. based in Vancouver, British Columbia, has loaned two LNG ISO containers to ARRC for the project. The cryogenic containers carry up to 26,586 liters (7,023 gallons) or 12,495kg (27,546 lbs.) of LNG at -160°C (-260°F). The two 40-foot containers comply with T75 regulatory standards that call for fortified tank walls and protective structures around the tank. They are manufactured by Hitachi, one of several T75-compliant ISO tank makers interested in Alaska's LNG market.

The containers arrived in Anchorage on September 11, 2016. After being cleaned, inspected and labeled, they will be used in training during the two weeks before the demonstration project starts on September 27. Train crews will become familiar with LNG characteristics and safe handling procedures. ARRC is also training railbelt first response agencies September 19-23, when dozens of firefighters, emergency medical teams, police and other responders have an opportunity to become familiar with the LNG ISO containers, along with other freight and passenger railcars. Alaska Railroad personnel from Safety, Environmental, Mechanical and Train Operations departments will explain LNG characteristics, hazards and response methods, as well as overall potential hazards and

challenges specific to the railroad industry, train operations and track infrastructure.

Containers will be trucked 70 miles to the Titan LNG facility near Port MacKenzie where they will be filled with Alaska LNG, before returning to the Anchorage rail yard to be loaded onto a railroad flatcar and hauled 350 miles north as part of ARRC's northbound overnight freight train to Fairbanks. Here, the ISO containers will be transported by flatbed truck the last 4.5 miles to the Fairbanks Natural Gas storage facility. Empty ISO containers will be re-loaded onto a railroad flatcar and added to the southbound freight train headed to Anchorage. The first scheduled twice-weekly test trip will occur on September 27. Demonstration trips will continue through October.

ARRC is the first railroad in the country to obtain permission to haul LNG by rail. In October 2015, the Federal Railroad Administration (FRA) approved ARRC's request to move LNG in an effort to eventually help meet Alaska's growing energy needs, particularly in Interior Alaska. Since then, ARRC has coordinated with FRA and other local, state and federal agencies to take the next steps in developing LNG as a potential line of business. While the demonstration is not an FRA requirement, ARRC must meet several operating conditions that are addressed while planning and preparing for the demonstration project. Results will be reviewed with FRA to ensure regulators are satisfied with ARRC's ability to safely move LNG. Questions? Contact Tim Sullivan at 907.265.2357.





Attachment B

Heating Oil Price Sensitivity Analysis Report

Final IEP Single-Family Residential Willingness to Convert Heating Oil Price Sensitivity Analysis



Document Information

Prepared for Alaska Industrial Export Development Authority and Alaska Energy Authority

Project Name IEP Conversion Rate Heating Oil Price Sensitivity Analysis

Project Number E515018001

Project Manager Lee Elder

Date October 13, 2015

Prepared for:



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Acronyms

AEA	Alaska Energy Authority
AIDEA	Alaska Industrial Development and Export Authority
FNG	Fairbanks Natural Gas
FNSB	Fairbanks North Star Borough
IEP	Interior Energy Project
IGU	Interior Gas Utility
Mcf	thousand cubic feet

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1 Introduction

In January 2014, Cardno completed the *Interior Energy Project (IEP) Natural Gas Conversion Analysis*, which estimated the demand for natural gas from the IEP and the associated economic benefits of natural gas conversion.¹ As part of that analysis, Cardno estimated study area residential willingness to convert, which relied upon the cost of converting to natural gas and the estimated savings obtained from converting to natural gas. The saving estimates relied on a natural gas price of \$15 per thousand cubic feet (Mcf) and a heating oil price of \$4 per gallon, or the equivalent of \$29.85 per Mcf.²

The Alaska Industrial Development Export Authority (AIDEA) and Alaska Energy Authority (AEA) wish to better understand heating oil price effects upon residential willingness-to-convert estimates. Therefore, the following sensitivity analysis builds upon the previously completed *IEP Natural Gas Conversion Analysis* to estimate single-family residential willingness to convert under various heating oil prices.

1.1 Purpose and Scope

This study estimates single-family residential willingness to convert under a range of heating oil price scenarios. The analysis assumes the same rate of conversion, or the speed in which residences will convert to a natural gas system, as was assumed for the *IEP Natural Gas Conversion Analysis (Table 2)*. This sensitivity analysis differs from the *IEP Natural Gas Conversion Analysis* in that it does not estimate multi-family, industrial, or commercial users' willingness to convert under various heating oil prices. Finally, this sensitivity analysis does not quantify single-family households' natural gas demand for different heating oil price points.

The study area for this analysis is the proposed natural gas service area surrounding and encompassing Fairbanks and North Pole and includes both the Interior Gas Utility (IGU) and Fairbanks Natural Gas (FNG) service areas. The study area is based on a mock 6-year build-out developed by AEA based on personal communication with the IGU and FNG. Within the study area there are an estimated 20,077 single-family residential households.³

1.2 Data Sources

This analysis relied on several key sources of data to estimate the total number of single-family households expected to convert to natural gas. The following key model components and parameters were used in the *IEP Natural Gas Conversion Analysis*, and subsequently in this sensitivity analysis, to estimate study area single-family residential willingness to convert.

- **Willingness-to-convert predictive model** – A survey of 800 Fairbanks North Star Borough (FNSB) residents was conducted as part of the IGU study titled *Natural Gas in the Fairbanks North Star Borough: Results from a Residential Household Survey* (IGU study).⁴ The survey elicited respondents' willingness to convert based on different combinations of conversion costs

¹ AIDEA and AEA, January 2014, IEP Natural Gas Conversion Analysis, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/IEP_Conversion_Analysis_Final.pdf) accessed October 22, 2014.

² AIDEA and AEA, July 2013, Interior Energy Project Feasibility Report, Website (http://www.interiorenergyproject.com/Resources%20and%20Documents/Feasibility_Report_72013.pdf) accessed October 20, 2014.

³ AIDEA and AEA, Personal communication with Lee Elder, Cardno, September 17, 2013.

⁴ Interior Gas Utility, November 2013, Natural Gas in the Fairbanks North Star Borough: Results from a Residential Household Survey, Prepared by Northern Economics.

and fuel savings. Responses were statistically analyzed to generate a predictive model for FNSB residents' willingness to convert to natural gas.

- **Primary/secondary heating systems** – The IGU study also solicited survey respondents regarding the number of household heating systems, the types of fuel used for each heating system, and the age of heating systems.
- **Home energy consumption estimates** – To estimate the existing and post-conversion single-family residential unit heating expenditures (and the associated savings) within the study area, this analysis relied on primary and secondary heating system energy consumption estimates provided by the IGU study. These estimates were modified for those households with furnaces to account for hot water energy consumption since it is assumed the conversion to a natural gas boiler or furnace would also include the installation of a natural gas water heater. Energy consumption estimates used in the sensitivity analysis relied on primary/secondary heating system energy consumption as determined by the IGU study. Across all primary/secondary heating systems, the average annual energy consumption for each residential property within the study area was estimated at 161 Mcf.
- **Conversion costs** – Interviews with six regional heating system experts were relied on to develop a range of equipment and installation costs for natural gas conversion. Conversion costs for the study area are defined as the purchase price for a boiler, furnace, space heater, or burner. Conversion costs estimates also include the cost of piping, valves, and labor for full installation of each of these heating systems.
- **Natural gas price** – As provided by the AIDEA and AEA *IEP Natural Gas Conversion Analysis*, the price of natural gas within the study area was assumed to be \$15 per Mcf.
- **Case-study analysis and focus groups** – Case studies and focus group input were used to ground-truth willingness-to-convert estimates generated by the IGU study and natural gas predictive model. These case studies assessed willingness to convert in other Alaska communities where natural gas distribution system expansion has recently occurred (e.g., Homer and Kachemak City). Additionally, ENSTAR representatives provided further input on community willingness to convert to natural gas. Finally, a series of four focus groups were conducted in Fairbanks and North Pole to better understand focus group participants' willingness to convert.

2 Methodology

All model parameters, with the exception of heating oil prices, previously used in the *IEP Natural Gas Conversion Analysis* (i.e., primary/secondary heating systems, conversion costs, home energy consumption estimates, heating oil prices, etc.) were held constant for the sensitivity analysis.

The model assumes that heating oil prices for the first year of analysis will equal current heating oil prices for each scenario (\$2.75 per gallon).⁵ Each of the following scenarios assumed prices in the second and third years would be 10 percent greater or less than current prices (either \$2.48 or \$3.03 per gallon), while the fourth year would either be current heating oil prices (\$2.75 per gallon) or \$4.00 per gallon.

Table 1 below illustrates the eight heating oil price scenarios considered within the sensitivity analysis as well as the baseline heating oil price scenario (\$4.00 per gallon) evaluated previously in the IEP analysis.

Table 1 FNSB Heating Oil Price Scenarios, dollars per gallon

Scenario	Year 1	Year 2	Year 3	Year 4 and Beyond
#1	\$2.75	\$2.48	\$2.48	\$2.75
#2	\$2.75	\$2.48	\$2.48	\$4.00
#3	\$2.75	\$2.48	\$3.03	\$2.75
#4	\$2.75	\$2.48	\$3.03	\$4.00
#5	\$2.75	\$3.03	\$2.48	\$2.75
#6	\$2.75	\$3.03	\$2.48	\$4.00
#7	\$2.75	\$3.03	\$3.03	\$2.75
#8	\$2.75	\$3.03	\$3.03	\$4.00
Baseline	\$4.00	\$4.00	\$4.00	\$4.00

Research on conversions in Homer indicates that the rate of conversion will be influenced by the construction season, which will affect when natural gas will be available to households and businesses alike. The timing of residential conversions within the study area relies on conversion rate estimates provided by ENSTAR. As illustrated in **Table 2**, ENSTAR expects 60 percent of the total customer base to convert within the first year of a system build-out and approximately 75 percent of the customer base to have converted by the end of the second year. Within 3 years of providing natural gas service to an area, ENSTAR expects approximately 90 percent of the residential housing units to convert, and 95 percent to convert by the seventh year, with no additional conversions thereafter.⁶ Stated differently, of those single-family residential properties that are going to convert, all will have done so 7 years following build-out or by year 8.

This analysis assumes that owners of single-family rental properties will be as willing to convert to a natural gas system as owner-occupied single-family properties, but at a slower rate. Therefore, we assume single-family rental owners will take an additional year compared with property owners to fully convert.

⁵ Sourdough Fuel, Personal communication with Lee Elder, Cardno, September 9, 2015.

⁶ Pierce, Charlie, ENSTAR, Southern Division Manager, Personal communication with Lee Elder, Cardno, September 23, 2013.

Table 2 **Estimated Cumulative Residential Rate of Conversion by Year**

	Construction (Year 1) ¹	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Single-family residential²	15%	60%	75%	90% ³	93%	95%	98%	100%	100%
Single-family renter-occupied	15%	45%	60%	75%	90%	93%	95%	98%	100%

1 Assumed existing Homer construction year rate of conversion for study area

2 Source (unless noted): Pierce, Charlie, ENSTAR, Southern Division Manager, Personal communication with Lee Elder, Cardno, September 23, 2013.

3 Source: Starring, Coleen, Personal communication with Lee Elder, Cardno, Shanna Zuspan, Agnew::Beck, and Tanya Iden, Agnew::Beck, September 18, 2013.

This analysis assumes that only those households currently using heating oil (92 percent of all study area households) would consider converting to natural gas (i.e., that conversion among those who exclusively use wood or other non-oil sources would be zero percent).⁷

Willingness to convert is a function of conversion costs and estimated annual savings. Willingness-to-convert estimates are generated when applying the heating system conversion cost along with the associated annual savings within the predictive model developed by the IGU study:

$$P_c = 2.43 + (-0.41) \ln \text{Conversion Cost} + (0.24) \ln \text{Annual Savings}^8$$

P_c represents the portion of respondents that would be willing to convert to a natural gas system from their current heating system and “ln” represents the natural logarithm. The price of heating oil is modified within this sensitivity analysis to calculate different annual saving estimates for each of the heating systems, which then feeds into the predictive model function to generate willingness-to-convert estimates.

⁷ This assumption is supported by recent survey data (Sierra Research, 2013, Wood Tag Survey) indicating that approximately 11 percent of households would continue burning wood, even if natural gas were available at prices less than \$1 per gallon equivalent of heating oil, and 26 percent would continue burning wood if natural gas were available at prices below \$2 per gallon equivalent of heating oil (projected natural gas prices are approximately \$2.15 per gallon equivalent of heating oil).

⁸ Interior Gas Utility, November 2013, Natural Gas in the Fairbanks North Star Borough: Results from a Residential Household Survey, Prepared by Northern Economics.

3 Results

As illustrated in **Table 3** below, heating oil prices in the FNSB affect residential conversion rates. Scenarios in which heating oil price increases to \$4.00 per gallon by the fourth year and remains at that level from that time on (Scenarios 2, 4, 6, and 8) achieve the same residential conversion rates as the baseline scenario. However, up until year 3, heating oil prices of \$2.48 and \$3.03 per gallon support residential conversion rates of 14 percent and 21 percent, respectively, whereas, a price of \$4.00 per gallon supports a residential conversion rate of 25 percent. For those scenarios in which heating oil price remains \$2.75 per gallon from year 4 and on (Scenarios 1, 3, 5, and 7) residential conversion rates are expected to be 54 percent by year 13. **Table 4** provides the total cumulative number of residences expected to convert each year for each heating oil price scenario.

Table 3 Cumulative Rates of Residential Conversation (Across All Phases)

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
#1	2%	8%	14%	25%	33%	40%	46%	49%	52%	52%	53%	53%	54%
#2	2%	8%	14%	36%	46%	56%	65%	70%	72%	74%	75%	75%	75%
#3	2%	8%	21%	25%	33%	40%	46%	49%	52%	52%	53%	53%	54%
#4	2%	8%	21%	36%	46%	56%	65%	70%	72%	74%	75%	75%	75%
#5	2%	12%	14%	25%	33%	40%	46%	49%	52%	52%	53%	53%	54%
#6	2%	12%	14%	36%	46%	56%	65%	70%	72%	74%	75%	75%	75%
#7	2%	12%	21%	25%	33%	40%	46%	49%	52%	52%	53%	53%	54%
#8	2%	12%	21%	36%	46%	56%	65%	70%	72%	74%	75%	75%	75%
Baseline	3%	14%	25%	36%	46%	56%	65%	70%	72%	74%	75%	75%	75%

Table 4 Cumulative Number of Residential Conversation (Across All Phases)

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
#1	460	1,640	2,840	5,110	6,580	8,050	9,270	9,930	10,340	10,510	10,630	10,710	10,750
#2	460	1,640	2,840	7,180	9,250	11,320	13,040	13,980	14,550	14,790	14,960	15,070	15,120
#3	460	1,640	4,130	5,110	6,580	8,050	9,270	9,930	10,340	10,510	10,630	10,710	10,750
#4	460	1,640	4,130	7,180	9,250	11,320	13,040	13,980	14,550	14,790	14,960	15,070	15,120
#5	460	2,380	2,840	5,110	6,580	8,050	9,270	9,930	10,340	10,510	10,630	10,710	10,750
#6	460	2,380	2,840	7,180	9,250	11,320	13,040	13,980	14,550	14,790	14,960	15,070	15,120
#7	460	2,380	4,130	5,110	6,580	8,050	9,270	9,930	10,340	10,510	10,630	10,710	10,750
#8	460	2,380	4,130	7,180	9,250	11,320	13,040	13,980	14,550	14,790	14,960	15,070	15,120
Baseline	640	2,880	5,010	7,180	9,250	11,320	13,040	13,980	14,550	14,790	14,960	15,070	15,120