Interior Energy Project

Quarterly Report to the Alaska State Legislature

Interior Energy Project

July 7, 2016

AIDEA Alaska Industrial Development and Export Authority

InteriorEnergyProject.com

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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
PACE	Property Assessed Clean Energy
RFI	Request for Information
RFP	Request for Proposals
RUS	Rural Utilities Services
SETS	Sustainable Energy Transmission and Supply Development Fund
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 fourth 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 provides an update to the information compiled for the first three reports, which covered the period July 1, 2015, through March 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

With the selection of Salix, Inc., as the preferred liquefied natural gas (LNG) plant Request for Proposals (RFP) respondent, the IEP team turned its attention to securing a gas supply from the Cook Inlet basin. Fairbanks Natural Gas (FNG), through its affiliate Titan LNG, LCC, currently has a gas supply agreement with Hilcorp Alaska 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 LNG capacity to accommodate the consolidated demand of the FNG and Interior Gas Utility (IGU) service territories. The IEP team and Interior utilities are working to finalize a supply contract with a Cook Inlet producer for a long-term supply agreement starting in 2018.

The effort to secure a Cook Inlet gas supply was initiated by a Request for Information (RFI) issued by the Department of Commerce, Community, and Economic Development through AIDEA in 2015. It should be noted that 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 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 recommendation, the IEP teams, including representatives from FNG and the IGU, have been working closely with Salix under the RFP process to advance the project's commercial terms and technical design. The RFP process is expected to conclude with an executed LNG Tolling and Finance Agreement term sheet and an executed Early Works Agreement contract.

The LNG Tolling and Finance Agreement term sheet will be executed by AIDEA, FNG, IGU, and Salix. It provides detailed commercial terms for how the LNG plant will be financed, how the LNG plant capacity will be priced to Interior utilities, and how the project risks will be assigned to different parties. The LNG Tolling and Finance Agreement term sheet is an intermediate step preceding the drafting and execution of the associated contract.

The Early Works Agreement is a contract between Salix and AIDEA to fund Front End Engineering and Design (FEED) for the new LNG capacity. The Early Works Agreement will outline a Scope of

Work that Salix will perform, a list of deliverables they will produce, a timeline for the work, and a budget. IGU and FNG are both included in the development and negotiation of the Early Works Agreement. AIDEA Board authorization of a project plan consistent with the language of HB105 will be scheduled prior to advancing a project to FEED.

The project will move into FEED contingent on AIDEA Board approval, and upon completion of the LNG Tolling and Finance Agreement term sheet, as well as the Early Works Agreement contract. At the same time FEED is being performed, the LNG Tolling and Finance Agreement will be developed and negotiated into a contract. At the completion of FEED, it is expected that all parties will decide whether to make the Final Investment Decision (FID). If FID is approved, the LNG Tolling Finance Agreement contract will be executed and Salix will begin work on building new LNG plant capacity.

The IEP team is aware of recent discussions regarding possible delay of FID long enough to determine if a developable gas resource is present in the Nenana Basin. The team has evaluated available information associated with the ongoing Nenana Basin exploration.

Transportation

Rail option update

The Alaska Railroad Corporation (ARRC) has been in contact with Hitachi High-Tech AW Cryo regarding a pilot project to evaluate the logistics and economics of LNG shipment from the Titan plant at Port MacKenzie to Interior Alaska via rail. On June 1, 2016, five senior executives from Hitachi High-Tech offices in Japan and Vancouver, British Columbia, flew to Anchorage and met with ARRC senior staff. During this meeting, mutual agreement was reached to bring two 40-foot LNG ISO containers from Japan to Anchorage in late September 2016, to be used for training and for transportation of LNG between the Titan plant and Fairbanks.

Details of the proposed pilot program are being finalized with the expectation that the trial shipments will take place in October and early November 2016. The ISO containers will be returned to Japan by December 1, 2016.

The ARRC is pleased to have the opportunity to work with stakeholders along the Railbelt to demonstrate the safe and efficient transport of LNG by rail to Alaskans in the Interior. We anticipate interest from government agencies and media during the pilot program.

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 LNG trailer provided by Western Cascade.

The Western Cascade 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.

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. As a result, Titan Alaska LNG has purchased the HEIL trailer provided by Western Cascade for the test project. Titan has also 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 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 achieve AIDEA's policy and financial objectives for the Pentex acquisition and the IEP, and result 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 are to be 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. Representatives from AIDEA, FNG, and IGU met in Fairbanks on June 21, 2016, to continue collaboration on the timing, siting, and capacity of expanded LNG storage within the FNSB to serve the combined FNG and IGU service territories. Team members were asked to prepare additional information for future consideration by AIDEA, FNG, and IGU management.

Systems Consolidation

Given the timeline for completion of the plan for liquefaction capacity expansion and the uncertainty of future natural gas supply, the parties have extended the target date for the transition to a consolidated system to the end of 2016.

In parallel with gas supply and liquefaction activities, considerable progress continues to be made toward the potential transition of FNG's utility plant and operations to IGU, and functional and operational consolidation of the FNG and IGU natural gas utilities:

- AIDEA/Pentex and IGU have exchanged a series of high-level term sheets detailing the business and financial terms and conditions for the sale or other transfer of the FNG LNG storage, re-gasification, and natural gas distribution system 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.
- Using the economic and financial model developed by IGU's utility finance consultant, the parties have also mostly completed the financial plan, including concurrence on the projected sources and uses of funds for the capital requirements of the consolidated system.

AIDEA, Pentex, and IGU meet telephonically each week to continue momentum on the consolidation activities, with additional workshops as needed to finalize capital, operational, and financial plans.

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. Members of the IEP team were advised that failure to pass the legislation did not indicate a lack of general legislative support for the PACE mechanism.

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 A 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	7,665,405	-	-	7,665,405
	North Slope Pad	6,003,418	-	-	6,003,418
	Distribution	500,005	-	-	500,005
	Total	**14,168,829**	**-**	**-**	**14,168,829**
	IEP Phase 2 (Post HB 105)				
	Commodity	50,167	-	-	50,167
	LNG Plant	137,585	-	-	137,585
	Trucking	14,075	-	-	14,075
	Storage	912	-	-	912
	Distribution	14,510	-	-	14,510
	Project Management	267,612	-	-	267,612
	Total	**484,861**	**-**	**-**	**484,861**
	Total	**14,653,690**	**-**	**-**	**14,653,690**
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**	**14,653,690**	**52,780,000**	**-**	**67,433,690**
	Remaining Funds	**42,846,310**	**72,220,000**	**150,000,000**	**265,066,310**

Notes

Financial data per unaudited accounting system records as of 06/27/2016

**Expenditures include Actuals, Encumbrances, and Commitments as of 06/27/2016*

Legislative Appropriation & Authorization(s) only include those identified above and do not include AIDEA operating, Economic Development Fund, or other sources

SUMMARY

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

The next quarterly report is due in early October 2016.

Attachment A:
Heating Oil Price Sensitivity Analysis Report

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

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Document Information

Prepared for	Alaska Industrial Export Development Authority and Alaska Energy Authority
Project Name	IEP Conversion Rate Heating Oil Price Sensitivity Analysis
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Tables

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 residential[2]	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:

$$Pc = 2.43 + (-0.41) \ln Conversion\ Cost + (0.24) \ln Annual\ Savings$$[8]

Pc 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