Interior Energy Project

Quarterly Report to the Alaska State Legislature

Interior Energy Project

October 11, 2016

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LIST OF ATTACHMENTS

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
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 fifth 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 previously provided, which covers the period July 1, 2015, through September 30, 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, 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 are taking longer than anticipated. Securing this critical component is complicated by a need for a low price and flexibility on quantity 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 2018. The IEP team is sharing draft contractual language with representatives from IGU in order to facilitate closure of a final supply deal. 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, 2016 recommendation, the IEP teams, including representatives from FNG and IGU, have been working closely with Salix, Inc. under the RFP process to advance the project's commercial terms and technical design. All parties are focused on developing and financing the LNG plant in a manner that provides the lowest cost and risk to Interior natural gas customers.

Once the optimal design and commercial structure of the LNG plant are determined, the project will move into Front End Engineering and Design (FEED) with AIDEA Board approval. At the same time FEED is being performed, commercial agreements for the plant will be developed and negotiated into contracts. 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 commercial agreements will be executed and work will commence on building the new LNG plant.

Transportation

Rail option update

The Alaska Railroad Corporation (ARRC) is in the process of evaluating the economics of transporting LNG by rail to Interior Alaska via specialized 40-foot ISO containers. A shipment of empty 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 will conduct eight shipments by the end of October 2016. ARRC is 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 report. The pilot project resulted in widespread media coverage. A sampling of stories in Alaska media is included as Attachment B.

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. 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.

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 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.

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, progress continues to be made toward the potential sale 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 substantially completed 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 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 Fairbanks North Star Borough (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. Steps are underway to reintroduce PACE legislation for Legislative consideration in 2017.

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 C 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	55,338	-	-	55,338
	LNG Plant	141,915	-	-	141,915
	Trucking	14,075	-	-	14,075
	Storage	912	-	-	912
	Distribution	14,510	-	-	14,510
	Project Management	273,249	-	-	273,249
	Total	**500,000**	**-**	**-**	**500,000**
	Total	**14,668,829**	**-**	**-**	**14,668,829**
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**	**14,668,829**	**52,780,000**	**-**	**67,448,829**
	Remaining Funds	**42,831,171**	**72,220,000**	**150,000,000**	**265,051,171**

Notes

Financial data per unaudited accounting system records as of 10/06/2016

**Expenditures include Actuals, Encumbrances, and Commitments as of 10/06/2016*

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 fifth 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. The plan brought to the Board will be consistent with HB105 requirements.

The next quarterly report is due in early January 2017.

Attachment A

Alaska Railroad LNG Fact Sheet

ALASKA RAILROAD

PROJECT FACTS

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.

Hitatchi 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.

Sept. 14
2016

Attachment B

Alaska Railroad Pilot Project
Media Coverage

Energy

Alaska Railroad to become first in U.S. to haul liquefied natural gas

Author: **Alex DeMarban** Updated: 2 days ago Published 2 days ago

This photo illustration shows a 40-foot cryogenic container that will carry liquefied natural gas at 260 degrees below zero — with an inner and outer steel tank like a thermos bottle. The container was photographed in Japan in August. (Shuji Manabe / Hitachi High-Tech AW Cryo)

Looking for new business opportunities to counter a drop in revenues, the Alaska Railroad Corp. this month will become the first railroad in the U.S. to ship liquefied natural gas, in a demonstration project that could help deliver cheaper energy to Fairbanks.

The state-owned railroad has signed an agreement to borrow two LNG containers from a company based in Vancouver, British Columbia, owned partly by Hitachi in Japan.

Hitachi High-Tech AW Cryo, created in 2014 to manufacture and sell LNG tanks, will let the railroad use the containers for free to promote them in Alaska and elsewhere, an official with the company said.

The demonstration containers will be much smaller than the ones Hitachi Hi-Tech will sell, but at 40 feet long they will carry about 12 tons of LNG stored at about 260 degrees below zero.

Before they are put on the railroad, the cryogenic containers will be transported by truck on flatbed trailers about 70 miles to the Anchorage rail facility from the Titan LNG plant at Point MacKenzie, said Tim Sullivan, the railroad's external relations manager.

The plant since the late 1990s has superchilled natural gas from Cook Inlet into a liquid for delivery to Fairbanks. The gas is delivered to about 1,100 customers with Fairbanks Natural Gas, a sister company of Titan Alaska LNG.

Liquefied gas has traveled by truck to Fairbanks. But a new transportation option opened in October when the Alaska Railroad became the first in the United States to win a permit from the Federal Railroad Administration to transport LNG.

While LNG has been safely moved by rail for decades in Japan, the world's largest importer of the fuel, it has never been transported by a North American railroad, said Greg Rozitis, vice president of new business development for the Hitachi tank company.

"They've never had an incident in over 30 years in Japan," he said, adding LNG is safer to transport than other fuels such as crude oil or gasoline, in part because the liquid is not easily combustible and quickly evaporates if it's spilled.

"Some fumes might catch fire, but the flames wouldn't trail back to the actual LNG itself, like you might find with gasoline or crude," he said.

The containers, with an insulated inner tank of stainless steel surrounded by a vacuum seal and an outer steel tank, are expected to arrive in Alaska on Sunday. They began their journey in Japan, officials said.

After training for emergency response by officials along the route and by railroad personnel, the first rail shipment is expected to leave Anchorage Sept. 27 by flatcar for the 350-mile rail run to Fairbanks.

The containers will be loaded back onto flatbed trailers for a 4½-mile road trip to facilities at Fairbanks Natural Gas.

The railroad is planning eight round-trips over four weeks.

"We're pleased to be the first railroad to carry LNG and think we can do a good job representing the industry as a whole in how we get this done," Sullivan said.

In an unrelated demonstration project in December, Titan Alaska LNG tested an extra-large semitrailer with a cryogenic container sold by a company in Washington state. In that effort, the truck and trailer delivered about 23 tons of LNG to Fairbanks by road, more than traditional LNG trailers and with lower shipping costs per ton.

Titan has purchased one of those large semitrailers and ordered three more.

Rozitis said Hitachi is looking to prove that LNG can be moved more efficiently by rail than by truck, because many cryogenic containers can be hauled in a single rail shipment.

The Alaska Industrial Development and Export Authority, also a state corporation, purchased Titan Alaska and Fairbanks Natural Gas in 2015 as part of a $53 million deal.

AIDEA has also worked with other state entities on the Interior Energy Project first authorized by the Legislature in 2013 to find a solution to poor air quality and high energy costs in the region.

AIDEA has targeted liquefied natural gas as key to the solution, because natural gas is abundant and relatively inexpensive. It is working with a private company, Salix of Spokane, Washington, on a concept to expand LNG production from Inlet natural gas to support Interior energy needs.

Fairbanks relies largely on fuel oil and wood for heating, leading to poor air quality in winter and energy bills that rise with oil prices.

The railroad shares the goal of helping lower energy bills in Fairbanks, Sullivan said.

Fairbanks Natural Gas and Titan will participate in the demonstration project by filling the cryogenic containers at Port MacKenzie and unloading them in Fairbanks. The companies will be looking for potential savings, said Dan Britton, who runs both Titan and Fairbanks Natural Gas.

"We think it's potentially a good option for moving some LNG," said Britton.

The demonstration project will help the railroad determine the costs of delivering LNG and its potential value to the railroad, said Sullivan.

The railroad is always looking for new opportunities, Sullivan said. Net income at the corporation dropped to $11 million in 2015, down from about $14 million each of the two previous years.

Net income is expected to fall further, to $9.3 million in the current year, according to the railroad's 2015 annual report.

"Weakening global coal markets and less petroleum shipments" are cutting into revenues, although passenger income jumped 11 percent, the report said.

About this author

Alex DeMarban

16 Comments

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http://www.newsminer.com/news/local_news/alaska-railroad-to-haul-two-lng-containers-in-cost-effectiveness/article_4af0d6a6-7f08-11e6-a74d-33491489e3be.html

FEATURED

Alaska Railroad to haul two LNG containers in cost-effectiveness test

Matt Buxton, mbuxton@newsminer.com Sep 20, 2016

Courtesy Alaska Railroad

The 40-foot cryogenic container is one of two the Alaska Railroad will be using to transport liquefied natural gas from Southcentral A to Fairbanks as part of a demostration project this month.

FAIRBANKS — This fall, the Alaska Railroad will be getting a couple of new passengers for its first ride on a U.S. railway.

The Alaska Railroad will be running a pair of liquefied natural gas containers this month as part of a demonstration project to determine whether rail could be a low-cost way of getting natural gas from Southcentral Alaska to Fairbanks.

It'll be the first time in the United States that liquefied natural gas has been moved by rail. In October 2015, the Alaska Railroad won approval from the Federal Railroad Association to begin hauling LNG.

"We're really proud to be the first railroad in the country to be permitted to be able to do this," said Tim Sullivan, the spokesman for the railroad. "While it's done in other places of the world like Japan and Europe, moving LNG by rail is not done in the United States."

Sullivan said the pair of 40-foot containers, which are insulated and reinforced to carry more than 7,000 gallons of LNG at a frigid 260 degrees below zero, are on loan from manufacturer Hitachi.

The demonstration project, which isn't necessary for approval, will help prove if the entire process from loading to delivery is cost-effective.

Currently, LNG is delivered to Fairbanks from a processing facility Point MacKenzie by truck. The rail cars, which are intermodal and can be carried via rail, flatbed truck or barge, will be filled at the Point MacKenzie plant, trucked 70 miles to the rail yard and hauled to Fairbanks. Once in Fairbanks, they'll be unloaded and trucked another 4.5 miles to the Fairbanks gas storage facility.

"We want to feel out the efficiencies and logistics of what it is to move LNG specifically from Southcentral Alaska to Interior Alaska for the folks in Fairbanks," Sullivan said. "When you're moving a lot of heavy stuff over land, railroad is the most efficient way to do that. … We hope that eventually leads into being part of the solution to natural gas growth in Fairbanks, so there is not a concern about supply."

The first containers, set to arrive in Fairbanks, on Friday will be empty, but later runs will deliver natural gas into the Fairbanks Natural Gas' distribution system.

Dan Britton, the head of Fairbanks Natural Gas, said he'll be watching for how the entire process shakes out and how it'll affect the final price gas customers pay.

"For the most part, (we're asking) is it economic? Does it provide any other benefits?" he said. "We know what it takes to truck LNG and how could it work in the rail environment? ... We're looking at all avenues."

Contact staff writer Matt Buxton at 459-7544. Follow him on Twitter: @FDNMpolitics.

http://www.newsminer.com/opinion/editorials/a-new-venture-for-the-railroad-liquefied-natural-gas-delivery/article_7370b85c-807b-11e6-bf67-077eec981d12.html

A new venture for the railroad: Liquefied natural gas delivery test could provide low-cost energy transport

Fairbanks Daily News-Miner editorial Sep 22, 2016

News-Miner opinion: The Alaska Railroad is more than a century old, but every now and again, it still gets to blaze new ground. That will be the case next week, as the railroad is set to become the first in the nation to transport liquefied natural gas. It's a meaningful first for the railroad as well as the Interior, as it could prove a cost-effective delivery method that would help the Interior Energy Project achieve its price goals.

Since its inception in 1914, the railroad has been instrumental in moving freight and fuel, enabling commerce along the Railbelt that stretches from its southern terminus in Seward to its northern one here in Fairbanks. In 1943, the Usibelli Coal Mine in Healy was established, providing an in-state source of fuel for power as well as eventually for export to other countries. The railroad, which ran right by the mine, was instrumental in fulfilling both of those objectives. Later, when oil was discovered in Prudhoe Bay, the railroad became the preferred in-state option for transporting large quantities of refined fuel to Railbelt communities.

Unfortunately for the railroad and Alaska, both of those energy commodities have run upon hard times. Although Interior power plants still use Healy coal, low energy prices and a rise of alternative energy sources have quashed international demand for the fuel. An export facility in Seward was mothballed this year, and there is little optimism for demand to rebound in the near term. Transport of refined fuels has similarly declined because of the shutdown of the North Pole Refinery. In-state fuel production is at a low ebb and the railroad is feeling the pinch.

But just as energy markets adapt to new global conditions and technologies, so does the railroad. On Friday, the first two LNG containers will arrive in Fairbanks. That first haul is a dry run, with the containers empty, but on Tuesday, the railroad will transport filled containers from Anchorage to Fairbanks — the first ever shipped on an American railway.

The chief question the railroad is trying to answer with the test LNG shipments are whether transporting the fuel via rail is more cost-effective than trucking it. At present, local LNG utility Fairbanks Natural Gas trucks gas to Fairbanks for its customers. If shipping the gas on train cars

proves cheaper, that could bring down costs for present FNG customers as well as future customers of FNG and the borough-wide Interior Gas Utility who would be served by the Interior Energy Project. As that future customer base is forecast to be much larger than at present, transport of LNG via railroad would also take some pressure off of the Parks Highway as a transportation corridor — though trains can add cars without any disruption to line schedules, the addition of several fuel trucks per day to winter road traffic would have ripple effects on other highway users.

There's no guarantee that rail will prove the best option for transporting LNG. But it's an important test, and if it proves out, it would benefit both Interior energy customers and the railroad.

http://www.frontiersman.com/news/shipping-lng-by-rail-sets-milestones/article_e1df5c5a-82d1-11e6-ac06-ef44d27f017d.html

Shipping LNG by rail sets milestones

BY STEVEN MERRITT Sep 25, 2016

Courtesy Alaska Railroad

Later this week, the state-owned Alaska Railroad will ship two specially-designed LNG containers by flatcar to Fairbanks, a first state as well as the nation, according to the railroad. The railroad received permission from the Federal Railroad Administration October 2015 to haul LNG.

WASILLA — The Alaska Railroad will achieve two milestones this week as it works to complete a demonstration project aimed at transporting liquefied natural gas to the Interior.

Part of that testing will involve a longtime LNG facility at Point MacKenzie.

Later this week, the state-owned railroad will ship two specially-designed LNG containers by flatcar to Fairbanks, a first for the state as well as the nation, according to the railroad. The railroad received permission from the Federal Railroad Administration in October 2015 to haul LNG.

The railroad signed an agreement to borrow the two cryogenic containers built by Hitachi High-Tech AW Cryo, a company based in Vancouver, British Columbia, that is partly owned by Japanese manufacturing giant Hitachi. The tanks, which arrived in Anchorage Sept. 11, can be shipped via truck or rail.

In the past two weeks the two 40-foot containers have been the subject of training for both railroad crews and emergency responders, who received instruction on the characteristics of the tanks as well as the LNG itself. The liquefied gas is typically chilled to a temperature of 250 degrees below zero. Both tanks are capable of carrying 7,000 gallons, or some 27,000 pounds of LNG, according to Tim Sullivan, the railroad's external affairs manager.

Globally, LNG is considered safer to transport than crude oil, as the liquid evaporates quickly if spilled and is not as easily combustible.

According to the railroad, plans call for the containers to be trucked from Anchorage to the Titan LNG facility off Ayrshire Road at Point MacKenzie, where they will be filled and returned to Anchorage. From there, starting Sept. 27, the containers will be loaded onto a railroad flatcar for the 350-mile trip to Fairbanks. The railroad plans eight LNG round trips to Fairbanks over four weeks.

Once in Fairbanks, a flatbed truck will transport the containers 4 ½ miles to the Fairbanks Natural Gas storage facility.

Fairbanks Natural Gas, which provides a supply service in central Fairbanks that serves around 1,100 customers, is owned by the Alaska Industrial Development and Export Authority. AIDEA's Interior Energy Project is looking at the use of railroad transportation to ship LNG to Fairbanks in conjunction with a broadened gas supply for the city.

Residents in the region pay some of the highest energy costs in the state, and the Fairbanks area often is plagued by poor winter air quality with the burning of wood for heat.

As part of the Interior Energy Project, Fairbanks Natural Gas last winter tested the use of a prototype trailer for shipping LNG via road from the Titan plant as well as from the North Slope. Built in the 1990s, the Titan plant's feedstock is Cook Inlet natural gas.

Two tanker trucks a day already leave the Titan facility bound for the Fairbanks Natural Gas storage facility, but use smaller trailers. The 75-foot, 13,000-gallon-capacity prototype trailer was an attempt to get a transportation cost estimate on the larger-volume shipment.

While the railroad is hoping is boost sagging shipping revenues with the transport of LNG, AIDEA also is looking to possibly expand Point MacKenzie's LNG potential. In March, AIDEA announced the selection of Salix Inc. to build a $68 million liquefaction plant that could produce

3 billion cubic feet per year, or some 100,000 gallons a day. The location also would be near the 32-mile Port MacKenzie rail extension, a project that remains incomplete due to state budget cuts.

Salix is a subsidiary of Spokane-based Avista Corp., which runs electric and natural gas utilities in Washington, Oregon and Idaho and also owns Juneau's Alaska Electric Light and Power.

The Interior Energy Project group is currently in negotiations with Salix on commercial terms for the project, according to AIDEA, and also is working on a gas supply agreement with a Cook Inlet producer.

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ALASKA Journal of Commerce (/)

Alaska Railroad prepares for first U.S. shipments of natural gas

By: Dan Joling (/authors/dan-joling),
Associated Press

Updated: Thu, 09/22/2016 - 3:37pm

As the Alaska Railroad prepares to become the first rail freight service to transport liquefied natural gas in the United States, emergency responders receive training specific to the transportation of LNG by rail, on Sept. 20 in Wasilla. (Photo / Courtesy / Alaska Railroad Corp.)

ANCHORAGE — The Alaska Railroad is making final preparations for the first U.S. rail shipments of liquefied natural gas, a fuel that could be used to alleviate air pollution problems in the state's second-largest city.

The railroad Tuesday will send two loaded 40-foot LNG containers from Anchorage to Fairbanks as part of a demonstration. Seven more round-trips over four weeks will follow, said Tim Sullivan, manager of external affairs.

"We're going to take the information that we get in terms of our efficiencies, the logistics of moving this stuff, find out where we can improve, what we can improve, and the things we can't improve, and start making decisions as to whether we can make this a line of business," he said.

It will also depend on whether Fairbanks Natural Gas LLC, a company providing Cook Inlet natural gas to about 1,000 customers in Fairbanks, will want to use the railroad as a shipper.

Expansion of natural gas use is a longtime hope of Fairbanks residents looking for a cheaper alternative to fuel oil to heat homes.

Natural gas also is part of a state plan to clean up some of the worst winter air pollution in the country.
The Fairbanks area regularly exceeds allowable federal fine particulate levels. Microscopic particulate inhaled deep in the lungs is linked to heart attacks, decreased lung function and premature death in people with heart or lung diseases.

Particulate is emitted by cars and coal-fired heating systems but especially by wood stoves, which some in Fairbanks use as an alternative heat source to fuel oil.

A pipeline carrying North Slope natural gas past Fairbanks for shipment to out-of-state markets has been an unfulfilled dream for Alaska for decades. In the absence of a pipeline in the petroleum-rich state, Fairbanks Natural Gas moves LNG by truck.

Alaska Railroad workers this week are offering LNG safety training to emergency responders in Anchorage, Wasilla and Fairbanks. The railroad on Friday will send cars north with empty containers takes to demonstrate the equipment.

The two 40-foot containers are on loan from Hitachi High-Tech AW Cryo, one of several tank-makers interested in Alaska's LNG market, according to the railroad. LNG is shipped regularly in Japan and Europe.

"LNG is considered to be a lower risk hazardous material than other petroleum products that are moved," Sullivan said.

Planning and applying for a Federal Rail Administration permit was a task that covered several years, Sullivan said.

"We had to put in quite an application to do so," Sullivan said. "I believe it stood several feet tall."

The FRA in October issued a two-year permit that runs through December 2017. It authorizes three roundtrip trains per week. Each could carry 12 tanks per train. That's beyond the current need in Fairbanks, Sullivan said.

The containers can carry up to 7,024 gallons or 27,546 pounds of LNG chilled to minus 260 degrees. After unloading at the Fairbanks rail yard, the containers will be driven 4.5 miles to the Fairbanks Natural Gas storage facility.

Lois Epstein, a licensed engineer who works as Arctic program director for The Wilderness Society in Anchorage, said Tuesday she has concerns about safety where trains carrying LNG cross roads.

"I think that's one of the weak links," she said, and the state-owned railroad may want to consider additional overpasses.

Alaska Journal of Commerce
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Attachment C

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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Project Manager	Lee Elder
Date	October 13, 2015

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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