



Energy Analysis

Propane from the North Slope: Could It Reduce Energy Costs in the Interior?

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Could propane from the North Slope cut energy costs in Fairbanks and other Interior communities that heat buildings or generate electricity with fuel oil or naphtha? The Alaska Natural Gas Development Authority (ANGDA) thinks it could.

That's because a North Slope producer has agreed to sell ANGDA propane for considerably less than what it might otherwise cost, if there were a natural gas pipeline. Propane is a component of North Slope natural gas—and right now there's no way to get that gas to market.*

Naphtha and fuel oil, by comparison, are refined from oil—so their prices are closely tied to the volatile price of crude oil. ANGDA hopes getting a price break on propane could make it cheaper, at least until a pipeline is built—and it asked ISER to analyze the potential effects of one idea.

That idea is to build a plant on the North Slope, extract 2,000 barrels of propane a day from natural gas, and transport the propane to Fairbanks in tanker trucks. It assumes ANGDA would buy the propane, but that a private entity would build the plant, at a cost of \$74 million, and then operate the plant and truck the propane to Fairbanks, at a cost of \$16 million a year.

We analyzed how fuel prices in Fairbanks might compare, under those assumptions and at different crude oil prices. We estimated the price of propane delivered to Fairbanks, the wholesale price of fuel oil in Fairbanks, and the price of the naphtha that Golden Valley Electric Association (the Fairbanks utility) burns to generate electricity.

These aren't prices residential customers would pay. The propane price doesn't include costs of storing and distributing propane in Fairbanks, and we tried to make the fuel oil price comparable to that. This analysis is intended just to show relative fuel prices, given ANGDA's assumptions.

WHAT DID WE FIND?

- *At current crude oil prices, propane could be cheaper than either naphtha or fuel oil, for equivalent amounts of energy.* Liquid propane contains less energy per gallon than either naphtha or fuel oil, so to make fair comparisons we have to look at prices for equivalent amounts of energy. With crude oil at \$64 a barrel—close to what it was in mid-2009—a gallon of propane in Fairbanks would cost \$1.16. The energy-equivalent amount of naphtha would cost \$1.32 and fuel oil \$1.47.

- *Propane would be more attractive at higher oil prices.* That's because fuel oil prices would increase much more than propane prices, as crude oil prices increased. So for equivalent amounts of energy, propane would cost 79% as much as fuel oil, at a crude oil price of \$64 a barrel—but it would cost only 61% as much, at a crude oil price of \$100 a barrel.

- *Replacing naphtha with 2,000 barrels of propane per day could save about \$5.1 million a year, and replacing fuel oil could save \$7.6 million, assuming a crude oil price of \$64 per barrel.*

*Some propane is liquefied and shipped through the oil pipeline, but quantities are limited by the amount of vapor pressure that pipeline can withstand. Under terms and conditions that have been agreed on with a North Slope producer, ANGDA would pay the same price for propane that the producers pay each other, when they buy propane to fuel their North Slope operations.

The ANGDA Idea

Build plant to extract propane from natural gas

- Building plant: \$74 million
- Operating plant and transporting propane: \$16.2 million per year

Truck propane to Fairbanks

- 10 tanker trucks
- 2,000 barrels/day

How Might Fuel Prices in Fairbanks Compare at Different Oil Prices?

	Price of North Slope crude oil	
	\$64/barrel	\$100/barrel
<i>Fuel prices per gallon</i>		
Propane at Fairbanks ^a	\$1.16	\$1.34
GVEA naphtha ^b	\$1.85	\$2.76
Wholesale fuel oil ^c	\$2.13	\$3.18
<i>Prices for an amount of energy equivalent to a gallon of propane</i>		
Propane at Fairbanks	\$1.16	\$1.34
GVEA naphtha	\$1.32	\$1.97
Wholesale fuel oil	\$1.47	\$2.19
<i>Propane price as percent of price of other fuels</i>		
GVEA naphtha	88%	68%
Wholesale fuel oil	79%	61%

How Much Might Annual Savings Be From Propane?

(Use of 2,000 Barrels Propane Daily and Crude Oil at \$64 per Barrel)

	<i>Annual Savings</i>
Replaced GVEA naphtha ^d	\$5.1 million
Replaced fuel oil ^d	\$7.6 million

^aPrice for propane delivered to Fairbanks, not including costs of storing and distributing it in Fairbanks. The price assumes the cost of the extraction plant is amortized at a 6% annual interest rate over 10 years and that the system is operating at full capacity year-round.

^bPrice paid by Golden Valley Electric Association for naphtha it burns to generate electricity.

^cWe roughly estimated wholesale fuel oil prices by adjusting retail prices, based on mark-up data from the Energy Information Administration. Actual wholesale prices are not available.

^d2,000 barrels of propane generates 7,661 mmBTUs of energy

How Would ANGDA Get the Propane?

Oil and gas are intermingled in the North Slope fields, so natural gas, —which contains propane—is produced with the oil. But without a gas pipeline, almost all the gas produced has been re-injected into the fields, to help increase the amount of oil that can ultimately be recovered. Under this proposal, ANGDA would pull off a small share of the gas when it was produced, leaving the rest to be compressed and re-injected.

Why Propane?

Propane used in Alaska today is almost all barged in from Outside, making it more expensive than other fuels. The U.S. Energy Administration estimates that propane accounts for about 1% of Alaska’s residential energy use. Besides price, propane has other potential advantages and drawbacks Alaskans might want to consider, if North Slope propane became available.

- *Propane and natural gas can be used in many of the the same appliances and facilities, without major modifications.* So if Fairbanks consumers switched to propane, they could convert to natural gas later.
- *Propane condenses to a liquid under relatively little pressure, so it can be transported more easily by truck or barge than natural gas.* Natural gas is mostly methane, which requires more pressure to condense. But it can, with adequate pressure, also be liquefied and then trucked or barged. The Alaska Gasline Port Authority (made up of several municipalities) has announced it will try to sell revenue bonds, so it can build a plant to liquefy natural gas on the North Slope—and then truck the gas to Fairbanks. A Fairbanks company already trucks some Cook Inlet natural gas to Fairbanks.
- *Propane reverts to a gas when released from pressure, so spills are not a problem, as they are with fuel oil.* But because propane is heavier than air, it can be a fire threat if accidentally released.
- *Propane takes more space to transport and store than an equivalent amount of energy in fuel oil.* That’s because liquid propane produces less energy, per gallon, than fuel oil or naphtha. Propane would require pressurized storage tanks, and more of them.
- *Residential propane tanks and lines need to be well-insulated from the cold, because at very cold temperatures, propane turns from gas to liquid —meaning whatever was fueled by the propane would stop working.*
- *Propane burns cleaner than fuel oil or naphtha.* But natural gas is even cleaner (see table).

Conclusions and Limits of This Analysis

Propane could be a less-expensive bridge fuel to the time North Slope natural gas is available to many Alaskans who currently have to rely on fuel oil. Once a pipeline is built, propane might lose its advantage, because: (1) its price would be determined by the market; and (2) natural gas would become available along the pipeline route.

A gas pipeline is at least a decade away, and there’s no guarantee it will be built by then. In our analysis, we assumed the costs of a propane extraction plant would be recovered in 10 years. But if the pipeline were delayed, the plant could operate longer and the costs be spread out over a longer time, which would also reduce propane prices in Fairbanks. Also, some Alaska places won’t have access to gas, even after a pipeline is built. And even at market prices, propane might have some advantages over fuel oil.

We analyzed one idea for using North Slope propane. It’s by no means a complete analysis of propane’s potential in Alaska. But it demonstrates that propane is worth considering, to help reduce and stabilize energy costs.

Energy Content and CO₂ Emissions of Selected Fuels

Content by Volume (BTUs per Gallon)		CO ₂ Emissions (Pounds per Million BTUs)
Propane	91,200	139
Naphtha	127,500	161
Fuel Oil	132,669	161
Natural gas	N/A*	117

*Natural gas isn’t sold by the gallon. But as measured by standard cubic foot (scf), the heating value of propane is more than twice that of methane.

Sources: ANGDA, personal communication; U.S. Energy Information Administration; Michael Baker Jr., Inc., *Transport of Natural Gas to Tidewater*, April 2005

What is Natural Gas?

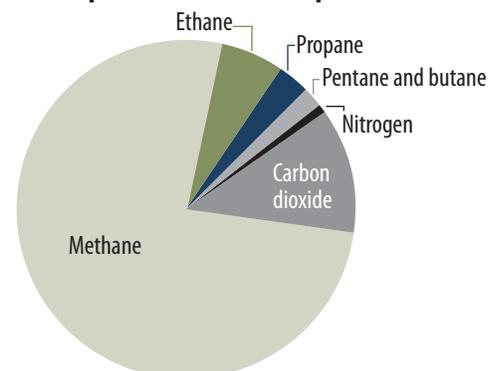
Finally, to help put propane in context, here we take a brief look at the overall composition of North Slope natural gas. Many Alaskans probably think of North Slope natural gas as some single, specific kind of gas—and it is true that it’s mostly methane. But it also contains carbon dioxide, nitrogen, and various gases known collectively as natural gas liquids (NGLs).

Propane is one of those NGLs, which also include ethane, butane, and pentane. They’re called “natural gas liquids” because they condense from gas to liquid at much lower pressure than methane. They’re valuable as part of the natural gas mix—they have higher heating values, by volume, than methane. Also, they can be separated from the mix and sold on their own for many uses.

It is known that North Slope gas contains significant quantities of propane, ethane, and butane. But the exact composition isn’t public information. The leaseholders consider that proprietary information. Also, as a report prepared for ANGDA points out, the composition of North Slope gas can vary from one field to the next.

The pie chart shows an estimate, done for ANGDA in 2005, of the general composition of North Slope natural gas before processing. We’re including it here just to help readers understand what’s in natural gas. Most of the carbon dioxide—which has no heating value —is taken out of the mix during processing.

Estimated Composition of North Slope Natural Gas*



*Before processing. The actual composition of North Slope natural gas is proprietary information of the leaseholders. Also, the composition varies among individual gas fields. This figure is intended only to show a general picture of the gases that make up natural gas.

Source: *Transport of Natural Gas to Tidewater*. Prepared for Alaska Natural Gas Development Authority by Michael Baker Jr., Inc., April 2005

To get more Alaskans thinking about North Slope propane, ANGDA held a conference in Fairbanks last June, inviting potential propane users and distributors and financial institutions. ISER did this analysis for that conference. To learn more about the conference, go to ANGDA’s Web site: www.angda.state.ak.us