

# NATURAL GAS facts

U.S. DEPARTMENT OF ENERGY  
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NATIONAL ENERGY TECHNOLOGY LABORATORY

Strategic Center for  
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## DELIVERING ALASKAN NORTH SLOPE GAS TO MARKET

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### Description

Alaskan North Slope (ANS) natural gas has long been considered a stranded asset because no economically viable method of transporting the gas to market has been identified. But forecasted U.S. demand of 32 to 35 trillion cubic feet (Tcf) by 2020 has renewed interest in developing a transportation infrastructure for the vast ANS natural gas resource. The lead time for transportation projects is so great that plans must be undertaken now to meet this anticipated long-term demand.

### Background

The giant Prudhoe Bay field, discovered on Alaska's North Slope more than 30 years ago, has been producing oil since 1977. In addition to producing oil, a significant amount of associated gas is also produced from North Slope wells, and substantial untapped gas fields exist. It is estimated that about 32 to 38 trillion cubic feet of natural gas is recoverable from known fields on the North Slope. If an economical method to transport the gas to market is developed, exploration for natural gas in the North Slope is expected to expand significantly, and even larger supplies are likely. In fact, the U.S. Geological Survey estimated in 1995 that there are an additional 63.5 Tcf of undiscovered gas resources on the North Slope and 32 Tcf from the Beaufort Sea region. Producers claim that the ultimate recoverable resource could exceed 100 Tcf. Currently, gas produced in the North Slope is reinjected into oil reservoirs to enhance production through daily pressure maintenance and tertiary oil recovery methods. With North Slope oil production steadily declining by about 10 percent per year, gas reinjection is approaching its economic limit in many oil reservoirs.



## Industry is exploring three options for developing ANS gas:



### **Liquefied Natural Gas (LNG)**

Natural gas is liquefied and exported by tanker to Asia or western U.S. and Mexico markets when they develop



### **Gas-to-Liquids (GTL)**

Natural gas is chemically converted to a liquid diesel or jet fuel



### **Pipeline to lower-48**

Natural gas is transported via gas pipeline through Canada to lower-48 states

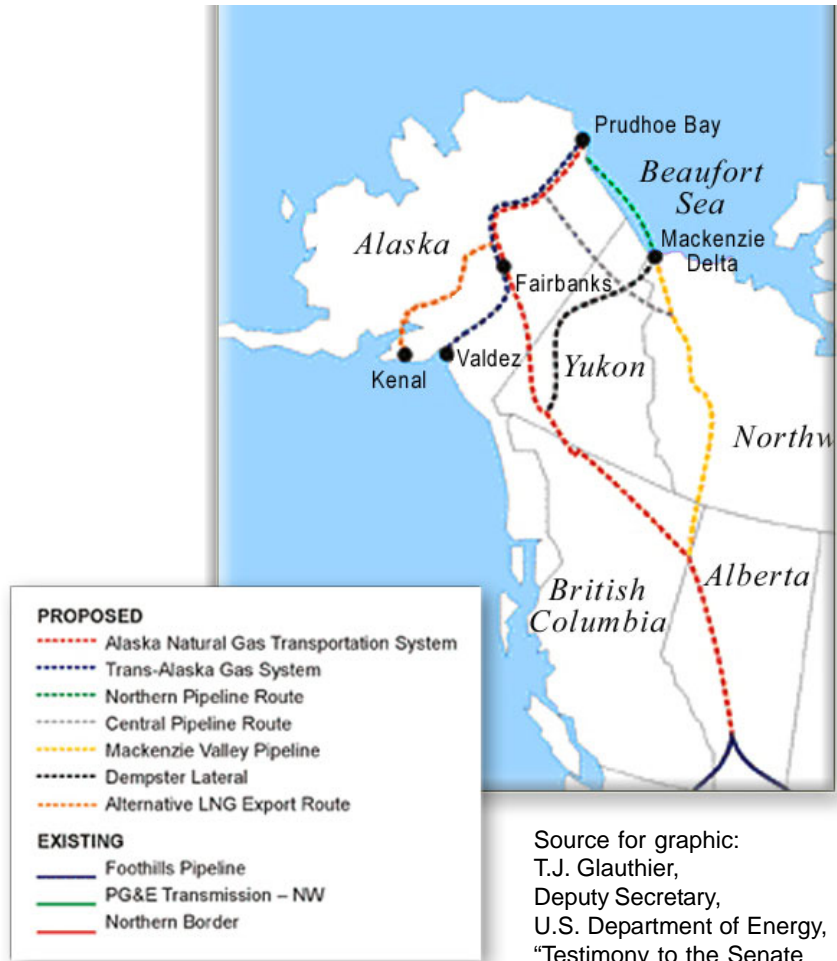
## Renewed Interest in ANS Natural Gas: Recent Events

- Concern over energy security and the impact of energy on the U.S. economy have high-lighted the need for increased production of domestic resources to meet forecasted demand.
- Proponents of four projects to move Alaska North Slope natural gas to market summarized their projects at a meeting of Commonwealth North Feb. 27<sup>th</sup> in Anchorage, Alaska:
  - Natural Gas Owners (BP, ConocoPhillips, ExxonMobil and north slope producers) In 2001 they sponsored a \$100 million feasibility study of various pipeline options and concluded that only the Alaska gas pipeline project works
  - Alaska Gas Transmission Co. was formed in 2004 as a subsidiary to pipeline company MidAmerican Energy Holdings (a Berkshire Hathaway subsidiary). As a pipeline company and heir to the ANGTS project, they were considered the lead group, but withdrew in April 2004 because the State of Alaska could not give them an exclusive right to the project

- Alaska Gasline Port Authority was established in 1999 by residents of the North Slope and Fairbanks North Star Boroughs and Fairbanks. (North Slope Borough has since withdrawn.) They favor a “Y” project with a split for a line to Valdez for LNG and the other line to Canada with a spur to the South Central Alaska gas grid
- Alaska Natural Gas Development Authority was established by Alaska voters in November, 2002 to pursue taking ANS gas to market as LNG and delivering natural gas for in-state use
- Canadian gas producers and aboriginal groups announced in January 2002 that they will formally propose to build the Mackenzie Valley gas pipeline. The first regulatory applications are expected in the fourth quarter of 2004. This project is going forward and is targeted to be operational in 2010 and will deliver 1.5 BCF/day of natural gas.
- The State of Alaska has ruled out any northern route, offshore or onshore to connect with the Mackenzie Delta gas
- The recently debated conference comprehensive energy bill, H.R. 6 included an Alaska Natural Gas Pipeline title that included up to \$18 billion in loan guarantees, a well-head price floor and dictated the Southern route. The recently crafted, but not passed replacement S. 2095 dropped the well-head price support, but maintained the route and loan guarantees. There is no industry consensus on the issue of the price support or loan guarantee. The bill appears to be dead for this session.
- Technological progress continues to reduce pipeline construction and operating costs.

*The 32-38 Tcf  
of recoverable gas  
in the North Slope  
is nearly equal to  
20 percent of proven  
gas reserves in  
the lower-48 states  
(both onshore  
and offshore),  
and it has the  
energy equivalent  
of over  
4 billion barrels  
of crude oil.*

## Proposed Options for Transporting ANS Natural Gas to Market



Source for graphic:  
T.J. Glauthier,  
Deputy Secretary,  
U.S. Department of Energy,  
“Testimony to the Senate  
Committee on Energy and  
Natural Resources”  
(September 14, 2000).

### Liquefied Natural Gas (LNG)

A proposed natural gas pipeline runs parallel to the existing Trans Alaska Pipeline System (TAPS), and gas is liquefied at the pipeline’s terminus on Alaska’s South Shore and exported to markets in Asia. A project called the Trans-Alaska Gas System (TAGS) was authorized by the Department of Energy in November 1989.

## Gas-to-Liquids (GTL) Natural Gas

GTL natural gas is chemically converted into liquid fuels. A GTL plant could be located either at Prudhoe Bay (liquids are shipped through the extra capacity on TAPS following a decline in oil production), or on Alaska's south shore (a gas supply pipeline mostly following the TAPS route provides the feedstock).

## Gas Pipeline Options to the Lower-48 States

- *Southern Route.*

This pipeline route, also known as the Alaska Natural Gas Transportation System (ANGTS), runs parallel to TAPS to near Fairbanks, where it turns east running roughly parallel to the Alaska Highway through the Yukon Territory, and British Columbia, to link up with existing pipelines in Alberta, Canada. Approved as the designated route by President Carter and Congress in September 1977, it was agreed to by Canada in an Agreement on Principles.

- *Northern Route.*

Also referred to as the "over-the-top" route, it runs eastward from Prudhoe Bay, through a shallow off-shore pipeline under the Beaufort Sea, and comes ashore in the Mackenzie Delta area in northern Canada. It connects with the proposed Mackenzie Valley Pipeline allowing otherwise stranded gas resources in the Mackenzie Delta to be tapped, and travels south through the Northwest Territories to interconnect with pipelines in Alberta, Canada.

- *Central Route.*

Exploiting the gas resources in Canada's Mackenzie Delta without traveling under the Beaufort Sea, this route follows ANGTS to below the Arctic National Wildlife Refuge and travels southeast into the Northwest Territories connecting into the proposed Mackenzie Valley Pipeline.

- *Dempster Lateral.*

This line taps Mackenzie Delta gas resources, and travels through the Yukon Territory following the Dempster Highway from Inuvik to connect with the proposed ANGTS.

## Significance / Potential Impacts

### STAKEHOLDERS

**Alaskan Natives**

[www.alaskanative.com](http://www.alaskanative.com)

**ANGTL Company**

[www.angtl.com](http://www.angtl.com)

**Arctic Resources Company**

**BP Exploration (Alaska), Inc.**

[www.bp.com/alaska](http://www.bp.com/alaska)

**Cook Inlet Terminus Group**

[www.borough.kenai.ak.us/  
AlaskaGasLine](http://www.borough.kenai.ak.us/AlaskaGasLine)

**Enbridge, Inc.**

[www.enbridge.com](http://www.enbridge.com)

**ExxonMobil**

[www.exxonmobil.com](http://www.exxonmobil.com)

**Foothills Pipelines, Ltd**

[www.foothillspipe.com](http://www.foothillspipe.com)

**Phillips Petroleum**

[www.phillips66.com](http://www.phillips66.com)

**State of Alaska**

[www.state.ak.us](http://www.state.ak.us)

**Yukon Pacific Corporation**

[www.csx.com/business/ypc](http://www.csx.com/business/ypc)

Can adequate supplies of natural gas be provided to meet increased projected demand at a reasonable price? Natural gas is currently the third-largest source of U.S. electricity generation, but by 2007 it is expected to overtake nuclear power as the Nation's second largest source of electricity. Natural gas consumption for home heating, transportation, and industry and manufacturing processes is also expected to grow. The projected rise in natural gas production from the lower-48 states may not be sufficient to meet this demand. ANS gas may fill this gap. Without it, supply shortages, high gas and electric prices, and greater dependence on imports could be the result.

Numerous issues exist regarding the feasibility of transporting ANS gas:

- Environmental considerations are a concern with all options.
- Extremely high-cost, high-risk projects are not economically viable at current natural gas prices without federal or state incentives. Project cost estimates range up to \$20 billion, and some studies estimate that prices need to be sustained at more than \$3 per million Btu at the wellhead for ANS gas transport to be viable.
- Large incremental source of ANS supply will have significant impact on market dynamics and the North American pipeline grid.
- Delays in producing Alaskan gas could hurt the economics if competing gas sources from Canada come to market first, postponing the need for ANS gas.
- The EIA Annual Energy Outlook assumes the Alaskan gas pipeline to be transporting Alaskan gas to the lower 48 states in 2018. In, 2025 total Alaskan gas production (annually) is projected to be 2.7 trillion cubic feet.
- Technological innovations are required to reduce costs of emerging technologies like GTL.

PROJECT	DETAILS	PROS AND CONS
Southern route (ANGTS)	Distance: 1998 miles Capacity: 4 Bcfd	<ul style="list-style-type: none"> <li>+ Regulatory head start, near existing road/support infrastructure, southern portion already completed, favored by Alaskan politicians</li> <li>- Bypasses Mackenzie Delta gas, longer than northern route, covers mountainous terrain, environmental reviews need to be revisited</li> </ul>
Northern Route (Over-the-Top)	Distance: 1650 miles Capacity: 4 Bcfd	<ul style="list-style-type: none"> <li>+ Shorter than southern route, taps stranded Mackenzie Delta gas, avoids mountains</li> <li>- Alaska senate bill blocks construction in Beaufort sea, environmental concerns, requires separate spur line to provide gas to Alaska</li> </ul>
Central Route <i>(Connects ANGTS with Mackenzie Valley Pipeline)</i>	Distance: 580 miles	<ul style="list-style-type: none"> <li>+ Avoids environmental problems of Beaufort Sea, facilitates exploitation of Mackenzie Delta gas</li> <li>- Faces opposition of crossing Yukon Flats Natural Wildlife refuge, requires construction of temporary roads</li> </ul>
Mackenzie Valley Pipeline	Distance: 1350 miles Capacity: 1 - 1.6 Bcfd	<ul style="list-style-type: none"> <li>+ Fast track for delivering Canadian gas to market, has Aboriginal support, uses existing rights-of-way</li> <li>- If supplied by Canadian-only gas, it competes with ANS gas</li> </ul>
Dempster Lateral <i>(Alternative to Mackenzie Valley Pipeline)</i>	Distance: 745 miles	<ul style="list-style-type: none"> <li>+ Provided means to tap Canadian gas with ANGTS route when land claims prohibited Mackenzie Valley pipeline</li> <li>- Mackenzie Valley route more economically-attractive now that land claims are resolved</li> </ul>
LNG (TAGS)	Distance: 800 mile pipeline Capacity: 9 – 18 million ton/yr	<ul style="list-style-type: none"> <li>+ All Alaskan location, DOE authorized LNG export to Asia, pipeline would parallel TAPS, could serve multiple markets in Asia and U.S.</li> <li>- Competitive Asian LNG market makes for difficult economics</li> </ul>
GIL	Emerging technology still under development	<ul style="list-style-type: none"> <li>+ Uses existing TAPS, would delay when oil reserves are “shut-in” due to sub-economic pipeline utilization</li> <li>- Reformer costs must be reduced to improve economics, successful demonstration of technology needed</li> </ul>

## **INFORMATION LINKS**

### **National Energy Policy**

[www.whitehouse.gov/energy](http://www.whitehouse.gov/energy)

### **Senate Testimony**

<http://energy.senate.gov>

### **State/Federal Joint Pipeline Office**

[www.corecom.net/JPO](http://www.corecom.net/JPO)

## **Interagency Task Force**

In May 2001, the President's National Energy Policy recommended that an interagency task force work closely with Canada, the State of Alaska, and all other interested parties to expedite the construction of a pipeline to deliver natural gas to the lower-48 states.

A Federal Task Force was established, co-chaired by the Department of Energy and the State Department, to identify any impediment to processing a permit application and to recommend ways to streamline the process. Members include the Departments of Energy, State, Interior (Bureau of Land Management and Minerals Management Service), Transportation (Office of Pipeline Safety), and the Federal Energy Regulatory Commission.

If a project developer decides that a project is commercial, the Task Force will optimize the regulatory process by reducing regulatory delays and making the process as efficient and predictable as possible.

## **How DOE is Addressing the Issue**

### **Technology Solutions**

Should any of these options to transport Alaskan natural gas to market come to fruition, technologies under development at the National Energy Technology Laboratory and its Strategic Center for Natural Gas may provide efficiency, environmental, cost, and safety improvements:

- High-tech ways to improve the safety and performance and reduce the cost of transporting natural gas, including cutting edge automation, new sensors and leak detectors, corrosion monitors, and other advanced devices that can improve the way natural gas is transported through tomorrow's gas infrastructure.
- Technologies that maximize gas recovery (the percentage of gas-in-place that is ultimately produced) by extending the life of producing wells, ensuring that valuable natural resources are not overlooked or left in-ground prematurely and therefore lost.
- Advanced gas-to-liquids technologies that could lower the costs of this option primarily through reduced capital costs and conversion efficiency gains.
- Strategic assessments of pipeline and storage needs are expected to provide key insights for future infrastructure-related research, development, and demonstration as well as support policy development.