

# Northern Sea Route beckons LNG shippers

Global warming may be a threat to glaciers, oceanfront cities and fire-prone forests.

But it's also creating new economic opportunities for countries with natural resources in the far north, opportunities that some companies and governments are pushing to exploit.

Opportunities such as the Northern Sea Route, which could mean a shorter, faster way to move cargoes — including liquefied natural gas — to Asia from Russia and Norway, and to haul manufactured goods from Asia to Europe.

The Northern Sea Route runs along Russia's northern coast about 3,600 miles between Murmansk in the west and the Bering Strait in the east, taking advantage of the belt of relatively open water formed there each summer as the Arctic ice pack retreats.

"What's really driving the Northern Sea Route is global commodity prices and natural resource development, particularly in Russia," said Lawson Brigham, professor of geography and Arctic policy at the University of Alaska Fairbanks.

It's about making money, taking advantage of a climate-change induced opportunity and new technology to move stranded resources to customers.

The traditional commercial sea road to Asia from northern Europe and Russia — the long way around — runs across Scandinavia, down Europe's Atlantic coast, through the Mediterranean Sea and the Suez Canal, around the southern tip of India, and east and north through the Pacific Ocean.

Despite a spate of recent headlines suggesting that the growing traffic on the shorter Northern Sea Route

is revolutionary, a better word would probably be evolutionary. Sections of it have been used for centuries. In the early 1500s, Russia's Dmitry Gerasimov suggested using the North-Eastern Passageway (as it was then known) for marine traffic between Russia and China.

By the mid-1600s, Russian traders had reached all parts of the route, demonstrating it was theoretically possible for a single vessel to sail the entire route in one voyage. But no one had ever done it.

## SWEDEN SHOWS THE RUSSIANS

That honor fell to a Swede named Adolf Nordenskiöld. On June 22, 1878, he left Karlskrona, Sweden, in a 60-horsepower wooden sailer-steamer called the Vega and headed east at a speed of 6 to 7 knots. By late September, he was less than 140 miles from the Bering Strait when ice blocked his path and he was obliged to spend the winter near a Chukchi village called Pitulekay.

The Vega was able to get under way again on July 18, 1879, and reached the Bering Strait within two days. Nordenskiöld got back home to Sweden by sailing down the coast of Asia, through the Suez Canal, across the Mediterranean, and up the Atlantic Coast.

Such was the interest in Arctic exploration and the North-Eastern Passageway that Nordenskiöld was made a baron and a commander of the Order of the North Star, a chivalric order dating back to 1748. It was a reward for "civic merits, for devotion to duty, for science, literary, learned and useful works and for new and beneficial institutions".



Source: en.wikipedia.org

**Swede Adolf Nordenskiöld navigated a wooden sailer-  
steamer across the Northern Sea Route in 1878-1879.  
Painting by Swedish artist Georg Von Rosen.**

Regular cargo traffic on the Northern Sea Route dates back to 1933, when 130,000 tons moved — less than one-tenth of a percent of 2012 traffic through the Panama Canal.

Cargo traffic — mostly for supplying Russian facilities and settlements along its Arctic coast and the rivers that empty into Arctic waters — peaked at 6.6 million tons a year at the height of the Cold War in the late 1980s. The Soviet Union collapsed in 1991, and the route opened to international traffic that year. But by 1998 Northern Sea Route shipping had collapsed as well, down to 1.5 million tons. By 2012, it had climbed back to 3.8 million tons, still far short of its high.

As of early fall of this year, the Russian agency that administers the route had approved more than 550 voyages over at least part of it, though tonnage figures were not available. Neither was the count of vessels

planning to travel the full length of the route. (For comparison, more than 17,000 vessels moved through the Panama Canal last year.)

## LNG RENEWS INTEREST IN ROUTE

One major new development on the Northern Sea Route is the interest in using it to move liquefied natural gas to energy-hungry Asian markets.

Late last year, a tanker called the Ob River hauled the first LNG cargo over the route, from Norway to Kyushu Electric Power in Tobata, in southern Japan. The icebreaker-escorted trip, from the Snøhvit LNG terminal in Hammerfest, took 27 days, and that was in November and December, late in the season. The same trip via the Suez Canal takes about 10 days longer.

While LNG tanker rates vary from company to company and season to season, short-term charters earlier this year were averaging \$90,000-plus a day, with long-term charters around \$80,000 a day, according to an August 2013 presentation by global consultants PFC Energy in Anchorage. Short-term rates spiked last year at \$150,000 a day, with long-term charters running \$120,000.

At those prices, cutting 10 days off a trip to Tobata could save \$1 million.

Tanker time wasn't the only savings, according to the agency that runs Russia's nuclear icebreakers on the Northern Sea Route. The Ob River also saved about \$80,000 in tariffs. The agency, Rosatomflot, put the ship's icebreaker fees for the trip at \$332,000, versus \$412,000 that would have been charged for passing through the Suez Canal.

"Of all the voyages on the Northern Sea Route in history, that one could be the most significant one in showing what the possibilities are," Brigham said.

## THE MILES ADD UP

Russia's immediate interest in the route centers around its Yamal project, the only Arctic LNG project under development. Its sponsor says the plant could start production in 2016, ramping up over several years to a full capacity of about 16 million metric tons of LNG a year, a volume about equal to China's LNG imports in 2012. That ambitious schedule assumes the



Source: Gazprom

**The Gazprom-chartered LNG tanker Ob River trailing its Russian icebreaker escorts in its 2012 voyage through the Northern Sea Route – the first ever by an LNG carrier.**

developer sticks to its plan for a final investment decision this year and signs up enough customers.

Compared with Snohvit, which has been producing LNG since 2007 on Norway's northwest coast, Yamal is about 1,150 miles closer to Japan by the Northern Sea Route. (Correspondingly, it's also 1,150 miles farther by the Suez route.)

Figures on sailing times between Yamal and Japan

weren't available, but it is possible to compare distances. By the Northern Sea Route, it's about 6,700 miles from Yamal to Tobata, the port in Japan where the Ob River unloaded.

By contrast, it's more than twice as far — about 15,000 miles — to Tobata via the Suez Canal.

Even allowing for the additional cost of ice-strengthened LNG tankers on the northern route and icebreaker escorts on some parts it for some of the year, cutting travel time by half or more during the approximately six months the route is navigable is a powerful inducement.

Exactly how much those Russian icebreaker escorts cost on the

Northern Sea Route is a little cloudy and more than a little negotiable.

For example, Russia's Northern Sea Route Administration, which manages the route, publishes a list of maximum icebreaker charges. It shows a cost of about \$16 per ton of cargo for accompanying bulk liquid carriers, depending on how much the ship has been strengthened for ice, how much of the voyage

## Cargo from Kirkenes, Norway, and Murmansk, Russia

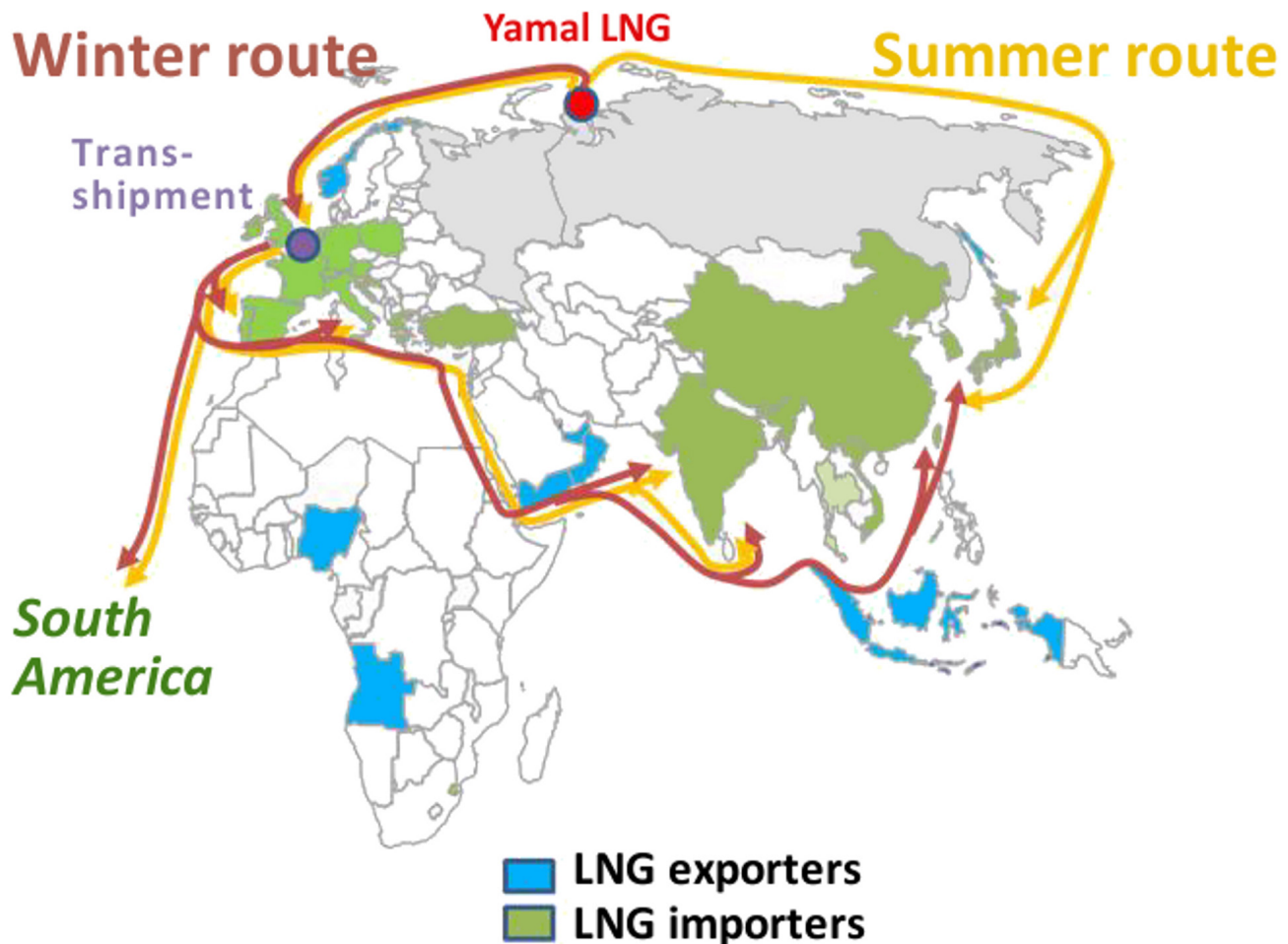
Destination	Via Suez Canal			Through Northern Sea Route			Days saved
	Distance (nautical miles)	Speed (knots)	Days	Distance (nautical miles)	Speed (knots)	Days	
Shanghai, China <sup>1</sup>	12,050	14	37	6500	12.91	211	16
Busan, Korea	12,400	14	38	6050	12.9	19.5	18.5
Yokohama, Japan	12,730	14	39	5750	12.9	18.5	20.5

<sup>1</sup>Based on an actual voyage by M/V Nordic Barents from Kirkenes to Lianyungang (China), September 2010

Source: Tschudi Kirkenes



# Yamal LNG shipping options



Source: Total, Yamal LNG

will require icebreaker support, and when the vessel will travel. Sergey Balmasov of the Center for High North Logistics in Kirkenes, Norway, said via email that actual icebreaker fees can be lower for very large cargoes.

## IT MATTERS TO RUSSIA

Two main factors are heightening interest in use of the Northern Sea Route.

The first, as mentioned above, is global warming, which opens up the lanes along the route earlier in the year and keeps them open later in the season. Nowadays, the route is generally navigable from July

through November, according to the Northern Sea Route Administration.

It may be worth noting that, in the strictest sense, the Northern Sea Route is never fully closed. If an operator has a ship with enough ice strengthening and is willing to pay for enough icebreaker support, the vessel can go anytime — even in the depths of winter.

For practical purposes, however, the term "open" as applied to the route generally means the period from early summer to late fall when the ice is thinnest, or absent altogether in some places. Then, ships with a relatively modest level of ice hardening can travel over much of it without icebreaker support.

The other factor at work is the profit motive — the desire of natural gas producers in Norway and Russia for a shortcut to move their product to Asia.

Like Brigham, research fellow Charles Emmerson of the international British think-tank Chatham House believes the route is particularly crucial for Russia. The Russians see Arctic development as vital to expanding their reach into the Asian LNG market.

Gazprom, Russia's state-controlled gas export monopoly, operates a single LNG export terminal at Sakhalin Island just north of the Sea of Japan, with easy, year-round access to Asia. Gazprom would like to build one or two more export terminals in the region.

Natural gas exports, especially pipeline deliveries to Europe, are an important source of government revenue — and international standing — for Russia. To build on that, the country recently announced it wants to corner 20 percent of the world LNG market by 2030.

"For Russia, it is difficult to exaggerate the potential geopolitical and geo-economic importance of the Arctic," Emmerson told Insurance Journal in January of this year.

At Yamal, Russian gas producer Novatek holds the controlling interest; the French multinational energy company Total owns 20 percent, as does the China National Petroleum Corp. Novatek is looking for more buyers, though it wants to retain 51 percent ownership for itself. But besides a way to market, Yamal LNG needs one more thing: The Russian government has talked about but not yet passed a law to ease up on Gazprom's monopoly over gas exports.

And there is Norway. The gas for last year's Ob River shipment to Japan came from Norway's Snohvit offshore field. Its 2012 output totaled more than 160 billion cubic feet of gas as LNG, about 3.3 million metric tons.

Most Snohvit gas goes to Europe — about 2 million metric tons last year, roughly 63 percent of the field's total.

The single load to Japan, by contrast, was a mere 2 percent of Snohvit's output. Still, Asia buys a fair piece of Snohvit's production — some 16 percent last year. All but the Ob River load took the long way around, by

the Suez Canal.

This year, another load left Snohvit for Tokyo Electric in late August on a tanker called the Arctic Aurora. It was due at the company's Futtsu LNG terminal, near Tokyo, in mid-October. And Statoil has chartered an LNG tanker of its own to move LNG over the northern route. The tanker, the Clean World, was to start service for Statoil in the fall.

Meantime, the appetite for gas in Asia is growing. By 2030, the region's gas demand is expected by many global energy consultants to be more than twice what it was in 2012.

## MORE THAN JUST LNG

And it's not just LNG that's bound for the Northern Sea Route. Tschudi, a Norwegian shipping company, recently bought and brought back to life an idle iron mine in northern Norway. The company plans to move ore to China by the northern route.

In addition, Norilsk Nickel, the world's largest nickel producer, ships its product from northern Russia to Asia via the route.

Nor is the traffic in just one direction. Besides signing on for the Yamal LNG project and buying iron ore from Tschudi, China is bent on shipping manufactured goods to Europe via the Northern Sea Route. In August of this year, the Chinese cargo ship Yong Sheng left the port of Dalian for a voyage to Rotterdam via the northern route.

Cosco Group, which owns the Yong Sheng (and is itself owned by the Chinese government), expected the trip to take about 35 days, versus an average of 48 days for the Suez route.

China has even acquired its own icebreaker — the Snow Dragon, used primarily for research — and expects to take delivery on another in 18 months or so.

"The Arctic route can cut 12 to 15 days from traditional routes, so the maritime industry calls it the Golden Waterway," Cosco said when the Yong Sheng voyage was announced.



Source: Aker Arctic

**Finland-based Aker Arctic in 2012 won a \$7.3 million Chinese government contract to design a new icebreaking polar research vessel. The design work is scheduled for completion this year; the vessel will be built in a Chinese shipyard. The specifications call for the ship to handle second-year sea ice mixed with some multi-year ice up to about five feet thick, moving at 2 to 3 knots.**

## CHALLENGES AND TECHNOLOGY ON THE NORTHERN SEA ROUTE

Even global warming, a bounty of natural gas and growing markets can't turn the route into the saltwater equivalent of millpond on a sunny afternoon.

It's still in one of the coldest parts of the world. When open, it's subject to huge waves. It's still icebound at times, meaning icebreakers will be required at least some of the time on some of the route.

In winter, when the truly determined shipper can still use the route, it's cold and dark, but otherwise not unduly severe as Arctic weather goes.

The continuous ice sheet doesn't get more than about five feet thick, and temperatures don't get much below minus 20 Fahrenheit. Conditions, at least on the eastern part of the route, aren't that far from conditions on the Alaska side, including the Prudhoe Bay area. In fact, the Northern Sea Route has one slight advantage over the Alaska side of the Bering Strait: The ice is less prone to pressure ridges, which require more icebreaking punch to get through.

Still, commercial weather forecasting is limited on the northern route and insurers charge a large premium for operators using it. And because LNG tankers are

wider than their icebreaker escorts, two or three icebreakers may be required to split open a path wide enough for the tankers.

In addition, vessels suitable for unassisted travel on the route when ice, even light ice, is present have to be specially built. They have to be stronger structurally, and the equipment on board has to be designed for the low temperatures. Consequently, LNG tankers suitable for a full season on the route will cost more than conventional tankers.

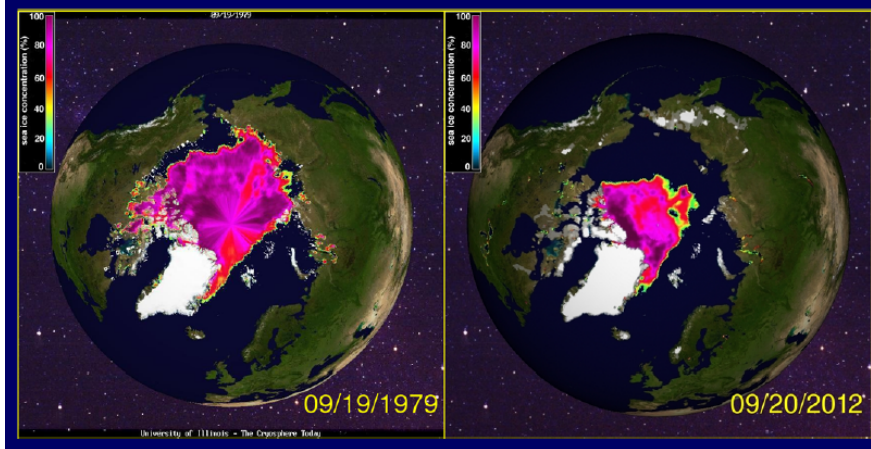
## ACCIDENTS AND ICE ARE PART OF THE EQUATION

Despite all the precautions in place today, accidents still happen. In early September, a Russian diesel tanker called the Nordvik was damaged by an ice floe on the route and started taking on water, though none of its cargo was reported to have spilled.

According to the Barents Observer news website, Russian authorities said the Nordvik was in violation of its Northern Sea Route Administration permit because it entered medium ice conditions without an icebreaker escort.

There's not much in the way of search-and-rescue resources or other support facilities along the way, so a tanker or other cargo vessel in trouble on the route

## Changing Summer Arctic Sea Ice Coverage ~ 1979-2012



Source: University of Alaska, Fairbanks

conditions on the northern route aren't completely daunting for the determined shipper, as mentioned above.

These things together mean that ice-strengthened cargo vessels are allowed to navigate without icebreaker support over some parts of the route in the summer season.

### NEW TANKERS HAVE SPLIT PERSONALITY

A new ship design could even bring about the day when dedicated icebreakers are rarely needed for hauling oil and LNG through the Northern Sea Route.

could find itself far from help. Russia opened its first search-and-rescue center along the route this year, and hopes to open nine more by 2015, but the total budget for the 10 centers is only about \$28 million.

As a result of all these considerations, it seems likely that the route will continue to be practical only part of the year, and that would-be users will tiptoe in rather than stampede.

"It is a given that the activity will increase and increase massively," said Sturla Henriksen, director-general of the Norwegian Shipowners' Association at a May 2013 conference on the Arctic. "But we believe the commercial potential will be limited for quite a few years."

On the plus side is the fact that vessels on the Northern Sea Route don't have to contend with multi-year ice. Because the route melts out completely by the peak of the season sometime in September, all ice encountered in significant amounts will be first-year ice formed the previous winter or new ice forming for the next one.

Why does first-year ice matter?

It's because the sea salt in first-year ice makes it soft and easy to break up. But if the ice doesn't melt as the years pass, the salt leaches out and it hardens into freshwater ice, which is much more difficult to shatter.

Besides being soft, first-year ice isn't very thick — not more than about five feet — which is why even winter

That design is called the double-acting tanker.

Simply put, it's a tanker that's a conventional open-ocean ship in front and an icebreaker in back.

For a long time, getting a cargo ship through pack ice was not complicated, at least in concept: Ram an icebreaker through and let the ice-ready cargo vessel follow in the open lane.

Not complicated, maybe, but not necessarily cheap or easy, either. Icebreakers are expensive. In the case of the Northern Sea Route, the icebreakers are massive Russian behemoths up to 853 feet long and packing a nuclear-powered punch of up to 72,000 horsepower.

Enter the double-acting tanker.

As the name suggests, it's first and foremost a tanker.

But why a "double-acting" tanker? Why not just put an icebreaking bow on the front of an otherwise conventional tanker?

It has to do with the fact that the type of bow best for breaking ice is not well suited for sailing the open ocean with its big waves and its need for high cruising speeds.

Similarly, the type of bow best for the high seas isn't much good for breaking ice.

The double-acting tanker manages to be good at both of these seemingly incompatible functions by having both kinds of bows.



## The ice-breaking bow

You might think that an icebreaker cuts a furrow through the pack like the John Deere steel plow that enabled cultivation of the great American prairie in the 19th century.

But that's not the case. Instead, the bow of an icebreaker is shaped like the underside of a giant spoon. If the ice isn't too thick, it'll flex under the pressure of the icebreaker and crumble without noticeably raising the bow of the icebreaker. If it's thicker and harder, the bow rides up on the ice, which is crushed to pieces and pushed aside by the vessel's weight. Either way, the result is that the icebreaker and its "client" vessel can make their way through the resulting channel of open water cluttered with harmless ice debris.

This type of bow may be great for breaking ice, but it's less suitable for making time on the high seas or taking the pounding that big waves can deliver. For that, you need an altogether different kind of bow.

## The open-ocean bow

So, what's at the front of a high-seas vessel? More than meets the eye, and some of the most important stuff is below the waterline.

The part above water is what most of us think of as the bow — a steeply angled structure, V-shaped or perhaps flared, as in the case of tankers, that lets the vessel part the waves.

Under the water, however, is another feature also crucial to the vessel's performance. That feature is the bulbous bow. As the name suggests, it's a bulb that sticks out from the lower part of the ship's prow, somewhat like a giant dolphin's nose.

The bulbous bow is one of the great innovations in ship design. It lets a ship go faster on less fuel and also to some extent stabilizes it in heavy seas.

## The best of both worlds

What's the answer, then, if you want a ship that can bash its way through the ice when needed, then cruise like a true freighter when it reaches the high seas?

Enter the double-acting tanker: An open-ocean design in front, usually with a bulbous bow, and an icebreaking design in back, complete with the upside-down spoon that actually breaks the ice. In ice, the ship sails backward. In the open sea, it sails forward.

In addition, this type of vessel is often equipped with a relatively new type of propulsion system called the azimuth thruster. This is a pod hung under the rear of the vessel — the icebreaking end — that combines the functions of a propeller pedestal and a rudder.

The entire assembly can rotate 360 degrees. The propeller's thrust reinforces the directional push of the rudder, and the system can shove the stern of the ship forward, backward, or to either side without the propeller ever having to be reversed.



**The nuclear-powered Russian icebreaker Yamal is 490 feet long with a beam of almost 100 feet. The 23,455-ton vessel was commissioned a decade ago.**



Two of the earliest examples of the double-acting tanker are the *Tempera* and the *Mastera*, both built in Japan and delivered in 2002 and 2003 to carry crude oil through the ice-prone Baltic Sea from Russia to Finland. These vessels can break ice up to 3.3 feet thick, but they move very slowly — about 3 knots. The design has proved more effective than expected, with the result that the two ships sometimes serve as icebreakers to other vessels.

Since they entered service, more double-acting tankers have been built and Novatek has said it has ordered tankers of that design to haul LNG from its Yamal project, though they will be much less powerful than dedicated icebreakers and thus still subject to some limitations on the northern route.



**The *Tempera*, built a decade ago in Japan, was the first double-acting tanker ever launched. It can handle several feet of ice without the need for icebreaker assistance. It operates mainly in the Baltic Sea, carrying Russian crude to Finland.**

## COMPETITION FOR LNG SALES

The opening of the LNG demand window has not gone unnoticed by the industry. The world, it's fair to say, is awash in LNG export projects under construction or consideration at the moment, and many of the sponsors are eyeing Asian markets.

While many of these projects will doubtless fizzle out before production starts, or at least encounter delays, more than a dozen in the Asia-Pacific region (mostly Australia) and Africa are under development, ranging from actual construction to serious planning to back of the napkin.

And that's not counting the almost three dozen proposed, possible and potential LNG plants in the United States and Canada. Only one of those is under construction (in Sabine Pass, La.). The U.S. Department of Energy has approved three more, but none of the three has received all of its other regulatory approvals and a final investment decision from sponsors

Thanks to the U.S. shale gas boom that is projected to trigger far more natural gas production than is needed for domestic consumption, developers envision exporting LNG from export terminals on the East Coast and the Gulf of Mexico. From there, it could travel through the Panama Canal to the Pacific side, and then to Asian ports.

The idea of exporting LNG from the Lower 48 has become somewhat controversial, however, because of fears it will raise prices to domestic consumers. The critics even include Dow Chemical CEO Andrew Liveris. Dow is a big consumer of gas, which it uses to make plastics and other petrochemical products.

In Canada, energy companies are flocking to British Columbia to build LNG export terminals catering to Asian markets. The Canadian government this summer approved three export licenses, and applications for four others have been filed. Still more projects have been proposed. But none of the projects has signed up enough customers to advance to a corporate go-ahead for construction.

## ALASKA IS PART OF THE MIX

And then there is Alaska, where North Slope producers ExxonMobil, BP and ConocoPhillips have teamed up with pipeline partner TransCanada to look at a \$45 billion to \$65 billion project to pipe gas 800 miles to tidewater, where it would be liquefied and loaded aboard tankers for Asia.

Some have looked at a map and wondered why the companies don't just build a liquefaction plant at Prudhoe Bay and send out tankers from there, saving the expense of an 800-mile pipeline to an ice-free port. But the North Slope is critical habitat for polar bears, whales and other threatened species; lacks the deep water needed by tankers; is guarded in winter by the Arctic ice pack and its pressure ridges that would present formidable challenges to coastal operations; and meeting air emissions standards is no easy chore for an industrial operation.

Distance counts in shipping LNG or any other cargo. In that department, Alaska has something going for it. An ice-free port on Cook Inlet or Prince William Sound would be closer to Japan than any other North American prospect for an LNG plant. And much closer than Norway or Russia.

Cook Inlet, for example, lies about 3,800 miles from Yokohama, a major port in central Honshu, Japan's main island. The area is home to Tokyo and several

LNG import terminals. Yamal is double that — about 7,800 miles away. The proposed Kitimat project in British Columbia is almost 4,700 miles from Yokohama.

Additionally in Alaska's favor, the Northern Sea Route faces the handicap of being closed by ice for several months of the year for the foreseeable future, global warming notwithstanding. That has prompted consideration of some creative adaptations for potential shippers.

One idea: During winter, shuttle Yamal LNG in costly ice-class tankers with icebreaker escorts westward to an ice-free port in Europe, transfer the LNG to cheaper non-ice-class tankers, and take it to Asia via the Suez Canal.

Another idea: Do a trade-out with a gas exporter such as Qatar, a huge supplier in the Middle East. In summer, Asian customers would get their gas from Norwegian and Russian producers via Northern Sea Route; in winter, they'd get it from Qatar. Similarly, Europe would get its gas from Norwegian and Russian producers in winter, and from Qatar in the summer.

"I do think it's an interesting issue," said Lou Pugliaresi, president of the Washington, DC-based Energy Policy Research Foundation. "It's a hard sell to move LNG out of that region."



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