ALASKA NATURAL GAS TRANSPORTATION PROJECTS
OFFICE OF THE FEDERAL COORDINATOR

North Slope producers no strangers to LNG projects

The big three North Slope oil and gas producers working toward a multibillion-dollar Alaska liquefied natural gas export project have substantial LNG investments across the globe. In some cases these investments go back decades.

Taken together, ExxonMobil, BP and ConocoPhillips own stakes in LNG production plants in the Middle East, Southeast Asia, Australia, Africa, the Caribbean and North America.

In addition, ExxonMobil owns an interest in two of the dozen or so plants under construction worldwide, while ConocoPhillips has a piece of a third project.

Each company also is in the LNG importing business — investors in terminals where liquid methane can be received, stored, warmed back into a vapor then routed into the gas pipeline grid. ExxonMobil in Texas, the United Kingdom and Italy; ConocoPhillips in Texas; and BP in China — the only Western oil company with such an investment in China.

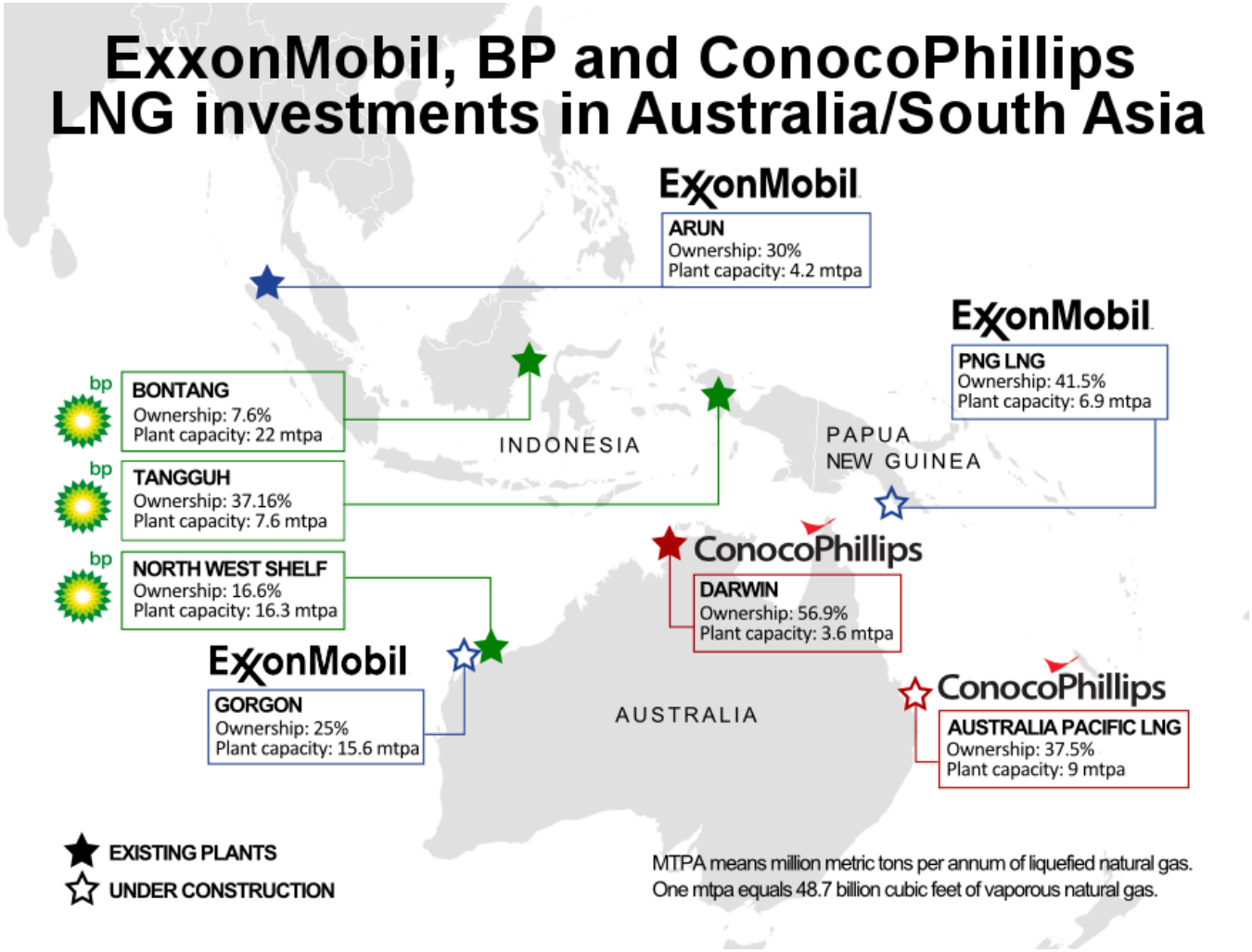
ConocoPhillips has a third LNG enterprise the other two companies lack in their portfolios: It owns one of the muscular liquefaction technologies that superchills methane to minus 260 degrees, condensing the gas into a liquid that's more cost-effective to ship long distances. ConocoPhillips debuted its technology at its Nikiski, Alaska, LNG plant in 1969, and the process is running at five other plants from Point Fortin, Trinidad, to Darwin, Australia. Four LNG plants under construction worldwide will use it as well.

Though a hot energy commodity these days, LNG is a side dish on the menu of activities these three petroleum companies are engaged in worldwide.

In the companies' annual reports, the LNG financials are too small within their global operations to earn a dedicated line on the corporate income statements. However, in the text, LNG merits mention as drawing investment capital as well as one of the many possible growth areas in the companies' portfolios.

LNG production is a business dominated by major multinational petroleum companies like these three Alaska operators, and by national oil companies in such countries as Qatar, Indonesia, Malaysia, Nigeria and Algeria.

Among the multinationals, Shell is an even bigger global LNG player than the three Alaska



Source: Office of the Federal Coordinator, Alaska Natural Gas Transportation Projects

North Slope operators. Shell makes LNG in Brunei, Malaysia, Australia, Russia, Qatar, Oman and Nigeria, with Trinidad and Tobago as well as Peru coming soon when Shell closes its purchase of Spanish oil company Repsol's interest in the plants there.

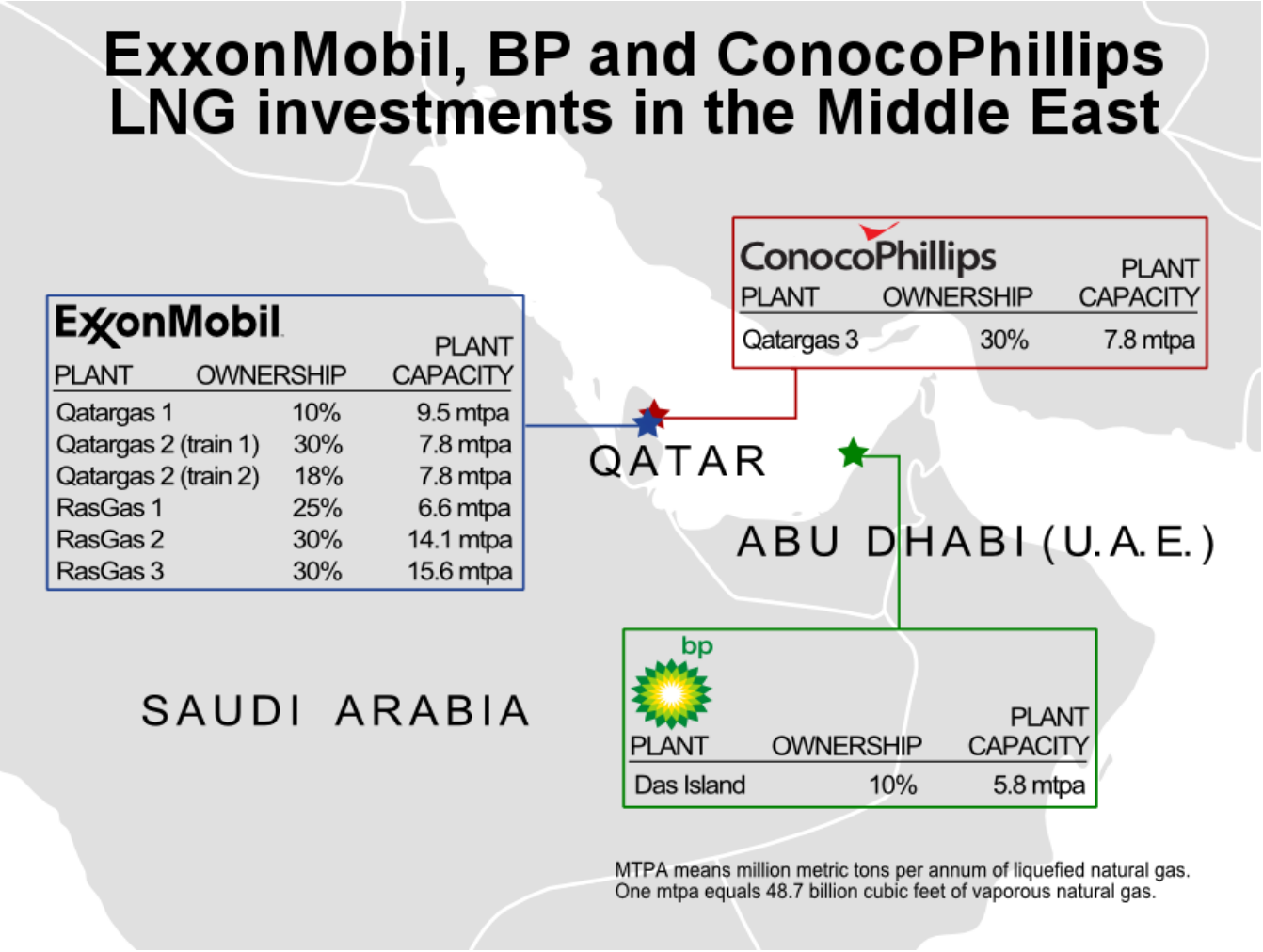
Other major international oil and gas companies with substantial investments in LNG plants include Chevron (United States), Total (France), Eni (Italy), Statoil (Norway) and INPEX (Japan).

The qualities needed to shine in the LNG industry are the very same traits that oil wildcatters need to grow into global petroleum producers:

- The patient endurance of a long-distance runner.
- Access to bales of money, through both strong cash flow and stellar creditworthiness.
- A risk-taking DNA.

Tackling LNG investments can entail vast scales of time, cost and risk.

On time, Joseph C. Geagea, president of Chevron Gas and Midstream, put it this way at a Tokyo LNG conference in September 2013: On average, a project takes 18 years from gas discovery to the first LNG shipment setting sail for market.[1]



Source: Office of the Federal Coordinator, Alaska Natural Gas Transportation Projects

On cost, a typical project will cost billions of dollars, even tens of billions, not counting the expense of building out the production fields that will feed natural gas to the plant. LNG developments are among the most costly capital projects a petroleum company will undertake. And lately, particularly for the eight projects under construction in Australia and Papua New Guinea, the price tag has been soaring.

The cost of building an LNG plant doubled from the early 2000s to today, said consultants PFC Energy during an Alaska seminar in August 2013. The cost of developing gas fields to support the liquefaction plants also has jumped, PFC Energy said.

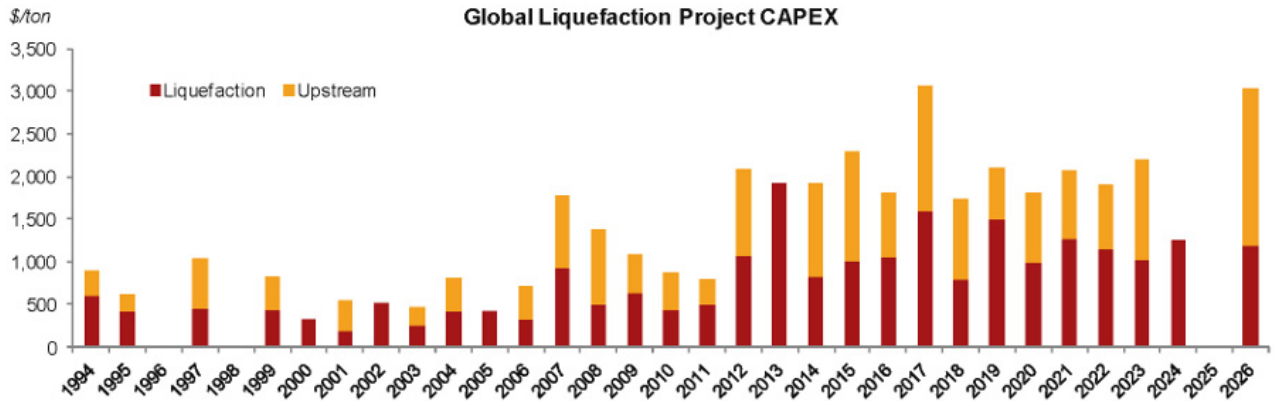
On risk, where to start. Here's a sample:

- Risks of lengthy development — including years before any positive cash flow as well as potential political, regulatory and litigation snags.
- Risks of a long construction period — including cost overruns, weather delays, labor problems and, again, litigation. What if the timing gets mismatched for different components of the development, such as the gas fields are ready but the LNG plant isn't, or tankers launch from the shipyard before the LNG plant is done?

Average LNG Project Segment Costs

- Total spending on liquefaction projects has increased dramatically over the past decade
- Global liquefaction CAPEX increased from an average of $505/ton between 2000 and 2009 to a projected $1,043/ton between 2010 and 2019

Greenfield Asia Pacific Projects	Liquefaction	Upstream
	$/ton	
Existing	640	558
Under Construction	1,331	1,308
Proposed	1,168	1,121



Source: PFC Energy

- Technology risks — glitch-prone equipment that delays startup, hampers production or causes contracted deliveries to be missed.
- Price risks — the LNG is pegged to a price index that doesn't support the cost of production, or markets change during the multiyear development and construction.

Below we look at the global LNG investments of ExxonMobil, BP and ConocoPhillips, the three companies considering the Alaska LNG project with their partner, Canadian pipeline firm TransCanada, which has no liquefaction investments.

Their early concept envisions a $45 billion to $65 billion project that includes a gas treatment plant on Alaska's North Slope, a roughly 800-mile pipeline, and a liquefaction plant with LNG storage and a two-berth tanker terminal at Nikiski in Southcentral Alaska.

The export plant would have the capacity to make 15 million to 18 million metric tons of LNG annually, the equivalent of 2 billion to 2.4 billion cubic feet a day of gas.

This would be massive undertaking for the three producers.

ExxonMobil and BP are part owners of larger LNG plants, although those plants scaled up over time. ExxonMobil is investing in a similar-sized project called Gorgon under construction in Australia right now.[2] ConocoPhillips, the smallest of the three, has no other LNG projects in its portfolio on the same scale as Alaska LNG.

In all, the three companies own stakes in more than 40 percent of the LNG production trains operating worldwide today — a typical LNG plant features several LNG trains running side by side, each liquefying methane independent of each other.

Because almost all of those investments involve minority interests in the trains, the companies' actual share of today's global LNG plant nameplate capacity totals about 13 percent.

EXXONMOBIL —

QATAR, INDONESIA: 14 TRAINS

In the 1980s and 1990s, Qatar's leaders decided the Mideast nation's ownership of the spectacular North Field — the world's largest dry -gas field — would become a cornerstone of their 21st century economy.[3]

LNG exports became the means, and ExxonMobil became the biggest outside investor propelling Qatar's leap to the top among the world's LNG makers. It owns a share in 12 of Qatar's 14 LNG trains.

Qatar's first LNG trains cranked up in the late 1990s.

Its 2003 production of about 14 million metric tons per year — about 2 billion cubic feet a day when warmed back into a vapor — already ranked Qatar as the fourth-largest LNG exporter in the world, behind Malaysia, Indonesia and Algeria.[4]

By 2011, Qatar could produce 77 mtpa, more than three times No. 2 Malaysia's output.

Exxon's entrée into Qatar and some of its other LNG ventures came via Mobil Oil. Exxon and Mobil, two massive products of the U.S. Supreme Court breakup of Standard Oil 100 years ago, merged in 1999.

Mobil was an investor in Qatar's first LNG plants: A 10 percent stake in Qatargas 1's three trains

ExxonMobil

Existing LNG plants			
Indonesia			
Name	**Ownership**	**Plant Size**	**Year first**
Arun	30%	4.2 mtpa*	1978
Qatar			
Qatargas 1	10%	9.5 mtpa	1997
RasGas 1	25%	6.6 mtpa	1999
RasGas 2	30%	14.1 mtpa	2004
RasGas 3	30%	15.6 mtpa	2009
Qatargas 2 train 1	30%	7.8 mtpa	2009
Qatargas 2 train 2	18%	7.8 mtpa	2009
Plants under construction			
Papua New Guinea			
Name	**Ownership**	**Plant Size**	**Startup**
PNG LNG	41.5%	6.9 mtpa	2014
Australia			
Gorgon	25%	15.6 mtpa	2015
Possible future projects			
Australia	Scarborough		
Texas	Golden Pass		
Russia	Sakhalin 1		
Alaska	Alaska LNG		
Canada	British Columbia		
** million metric tons per annum*			

Source: Office of the Federal Coordinator research

and a 25 percent share of Rasgas 1's two trains.

The investments continued after the Mobil and Exxon merger. The company has stakes in seven of the nine LNG trains Qatar commissioned since, all from 2004 through 2011. National oil company Qatar Petroleum is majority owner in each train.

ExxonMobil also has partnered with Qatar Petroleum in three LNG terminals built to import Qatari LNG. One is South Hook in Wales. A

second is Adriatic LNG in Italy. The third is Golden Pass in Texas.

ExxonMobil's only LNG plant outside of Qatar is a 30 percent interest in two trains at Indonesia's Arun plant. Arun opened in 1978. But it is slated to stop exporting in 2014 to become an LNG import terminal for Indonesia's growing economy.[5]

Arun also came from the Mobil side of the company, a result of a Mobil gas discovery in 1971.

ExxonMobil is invested in two LNG plants under construction:

It is a 41.5 percent investor and operator of PNG LNG in Papua New Guinea. The $19 billion 6.9 mtpa plant — about 920 million cubic feet a day — is expected to start up in 2014.

It is a 25 percent investor in the Australia's Gorgon project, led by Chevron. The $52 billion, 15.6 mtpa project — about 2.1 billion cubic feet a day — is expected to begin producing in 2015.

Both of those ventures were Mobil plays before the 1999 merger.

BP — TRINIDAD, AUSTRALIA, INDONESIA, ABU DHABI, ANGOLA: 22 TRAINS

BP's first LNG plant opened in the 1970s. Its latest started up in 2013. In between, its LNG plants have under gone a steady pace of expansion.

That's a different trajectory from ExxonMobil's almost lightning burst onto the LNG scene with Qatar.

But BP and ExxonMobil's stories share some similarities.

Like ExxonMobil, BP can trace some of its roots to Standard Oil trust. The London-based company absorbed Sohio in 1987 and Amoco in in 1998 — they were the Ohio and Indiana arms of the old Standard Oil, respectively.

Like Exxon in its Mobil merger, BP picked up an LNG project with its Amoco merger.

Trinidad and Tobago

Amoco was nearing completion of its Trinidad and Tobago LNG plant when it merged with BP. The plant opened in 1999. Today BP's share of Atlantic LNG's four trains at Point Fortin, Trinidad, is its single biggest LNG play. The fourth train started in 2006. The partners have talked about adding a fifth train.

Australia

In the 1980s, BP became one of six partners in the North West Shelf project, the father of Australia's LNG industry. Gas production began in 1985, supplying locals in Western Australia. LNG exports began four years later when the first train began production. Four more trains were added over the years — the latest in 2008. Plant capacity now is 16.3 mtpa — about 2.2 bcf a day — roughly the same as is proposed for Alaska.

Indonesia

BP also owns a piece of a mega-plant in Indonesia, the Bontang plant. Bontang's capacity is 22.3 mtpa, or 3 bcf a day.

BP holds a minority interest in VICO — Virginia Indonesia Co. — a 1970s wildcatter that struck what became the Bontang feed gas while drilling for oil, a familiar turn of events in the annals of petroleum prospecting.[6]

VICO owns 20 percent of Bontang, which started production in 1977, added a train the 1980s and expanded four times in the 1990s. BP much later acquired VICO in a joint venture with Italy's Eni.

Another Indonesia LNG plant is the only one BP

Existing LNG plants			
Indonesia			
Name	**Ownership**	**Plant Size**	**Year first opened**
Bontang	7.6%	22.3 mtpa*	1977
Tangguh	37.16%	7.6 mtpa	2009
Abu Dhabi			
Das Island	10%	5.8 mtpa	1977
Australia			
North West Shelf	16.6%	16.3 mtpa	1989
Trinidad and Tobago			
Atlantic LNG train 1	34%	3 mtpa	1999
Atlantic LNG trains 2&3	42.5%	6.6 mtpa	2002, 2003
Atlantic LNG train 4	37.8%	5.2 mtpa	1999
Angola			
Angola LNG	13.6%	5.2 mtpa	2013

Possible future projects	
Trinidad and Tobago	Atlantic LNG expansion
Indonesia	Tangguh expansion
Australia	Browse
Alaska	Alaska LNG

** million metric tons per annum*

Source: Office of the Federal Coordinator research

operates. It's called Tangguh. It opened in 2009 and can produce 7.6 mtpa, about 1 bcf a day. A key customer is China, and the gas also goes to South Korea, Japan and even Mexico. For several years BP has discussed adding a third train to Tangguh.

Abu Dhabi

BP's first LNG investment occurred in the Middle East.

It occurred at a time — the 1970s — when British relations with the region *and with BP* were complicated and evolving. Abu Dhabi gained its independence from British rule in 1971. But the British government ruled BP as principal stockholder until it started divesting shares in the late 1970s.[7]

In the meantime, newly christened Abu Dhabi needed revenue and its leaders asked sharp questions about all the natural gas flaring at oil wells. This sparked the LNG export idea, and BP became a 10 percent investor.

The plant was the world's first Middle East LNG project.

The national oil company, ADNOC, is majority owner of the three-train, 5.6 mtpa Das Island plant — about 750 million cubic feet a day.

The plant's initial customer was Tokyo Electric Power Co., also a charter customer of the Kenai LNG plant in Alaska circa 1969. TEPCO's willingness to sign a contract with a Persian Gulf LNG maker, 7,400 miles away — twice as far as Alaska, more than that from other suppliers in Brunei and Indonesia — stretched the boundaries of what was possible in the LNG world.

Angola

BP's ownership share of Angola LNG's $10 billion+ plant is 13.6 percent. The plant sputtered to a start in 2013, more than a year behind schedule due to glitches at the plant, its gas fields and pipelines. In late 2013, the plant was still ramping up toward its nameplate capacity of 5.2 mtpa — about 700 million cubic feet a day.

Angola has substantial oil production. As with the Abu Dhabi plant and assorted others around the world, ending natural gas flaring was a catalyst behind Angola's push into LNG. The development is the country's priciest single project ever, according to Angola LNG.[8]

With plants spread across the world, BP is positioned to market LNG to customers around the globe, whether it's production from its own plants or production it buys and sells on the market. For example, BP contracted to buy Train 2 output from an LNG plant proposed for Freeport, Texas, a project in which it holds no equity interest.[9]

CONOCOPHILLIPS — ALASKA, AUSTRALIA, QATAR: 3 TRAINS

ConocoPhillips has the longest LNG history among the three Alaska North Slope producers.

It pioneered the Asian LNG trade with exports from its Kenai LNG plant in 1969, liquefying nearby Cook Inlet methane — not gas from Prudhoe Bay, which had just been discovered hundreds of miles to the north. This plant stopped producing in fall 2012 for lack of a reliable Cook Inlet supply. ConocoPhillips is mulling its options for reopening the plant.

The Phillips side of ConocoPhillips led the company's move into LNG.

Phillips Petroleum Co. was the major investor in the Kenai LNG plant. And it took the lead in the next project, a 3.4 mtpa plant — 450 million cubic feet a day — that opened in Darwin, Australia, in 2006.

Phillips and Conoco merged in 2002, when the Darwin project was well afoot. Conoco, by the way, same as ExxonMobil and BP, can trace its own genealogy to Standard Oil: Conoco sprang from Continental Oil and Transportation Co., a western U.S. fuel marketer that Standard Oil

ConocoPhillips

Existing LNG plants			
Alaska*			
Name	**Ownership**	**Plant Size**	**Year first opened**
Kenai LNG	100%	1.4 mtpa	1969
**Plant currently closed*			
Australia			
Darwin	56.9%	3.6 mtpa	2006
Qatar			
Qatargas 3	30%	7.8 mtpa	2010

Plants under construction			
Australia			
Name	**Ownership**	**Plant Size**	**Startup**
Australia Pacific LNG	37.5%	9 mtpa	2015

Possible future projects	
Australia	Darwin expansion
Australia	Sunrise
Alaska	Alaska LNG
** million metric tons per annum*	

Source: Office of the Federal Coordinator research

controlled until the U.S. Supreme Court ordered it divested.[10]

ConocoPhillips' third LNG plant, Qatargas 3, started up in 2010. It's a one-train behemoth with a 7.8 mtpa capacity — 1 bcf a day. Only five other LNG trains in the world can match that size, all in Qatar and all commissioned in 2009 or later.

On the import side, the company is part owner, with Qatar Petroleum and ExxonMobil, of an LNG-receiving terminal in Texas.[11] The Golden Pass terminal opened in 2010 to coincide with startup of Qatargas 3. But with ample U.S. shale gas production, Golden Pass mostly has stood idle. Qatar and ExxonMobil want to add

liquefaction equipment so Golden Pass can make and export LNG.

ConocoPhillips has a 37.5 percent stake in the 9 mtpa — 1.2 bcf a day — Australia Pacific LNG project under construction in Gladstone, Australia. The two-train plant is expected to open in 2015.

That plant, as well as two more that other companies are building in Gladstone, will use ConocoPhillips' liquefaction technology.[12] A Cheniere Energy LNG plant under construction in Sabine Pass, La., also will use the technology.

ConocoPhillips liquefaction technology

Plants using ConocoPhillips LNG technology	
United States	Kenai LNG in Nikiski, Alaska
Trinidad and Tobago	Atlantic LNG in Point Fortin
Egypt	Egyptian LNG in Idku
Australia	Darwin LNG in Darwin
Equatorial Guinea	Equatorial Guinea LNG in Malabo
Angola	Angola LNG in Soyo

Plants under construction installing the technology	
United States	Sabine Pass in Sabine Pass, La.
Australia	Australia Pacific LNG in Gladstone
Australia	Queensland Curtis LNG in Gladstone
Australia	Gladstone LNG in Gladstone

Source: Office of the Federal Coordinator, Alaska Natural Gas Transportation Projects

Among operating LNG plants, ConocoPhillips' plants in Alaska and Darwin, Australia, use the technology as do other companies' plants in Trinidad and Tobago, Equatorial Guinea, Egypt and Angola.

ConocoPhillips' method is a distant No. 2 to those of Air Products and Chemicals Inc., a Pennsylvania company with an 82 percent market share of the liquefaction plant business, according to the International Gas Union, a trade group.

"However, ConocoPhillips' Optimized Cascade technology is growing in usage and makes up just under half of projects that have reached FID (final investment decision) — all of which are located in the United States or Australia," the IGU said in its "World LNG Report 2013" publication.[14]

The company's technology market share should double to 21 percent by 2017, the IGU forecast.

Notes

[1] Bill White, "Buyers and sellers debate LNG pricing change at Tokyo conference," http://www.arcticgas.gov/buyers-and-sellers-debate-lng-pricing-change-tokyo-conference.

[2] Chevron Australia, "Injecting Billions of Dollars Across Australia," http://www.chevronaustralia.com/ourbusinesses/gorgon.aspx.

[3] U.S. Energy Information Administration, "Qatar," http://www.eia.gov/countries/cab.cfm?fips=QA.

[4] U.S. Energy Information Administration, "Qatar accounts for a growing share of LNG exports," http://www.eia.gov/countries/cab.cfm?fips=QA.

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[7] Encyclopedia Britannica, "BP PLC," http://www.britannica.com/EBchecked/topic/80326/BP-PLC.

[8] Angola LNG, "About Us," http://www.angolalng.com/project/aboutLNG.htm.

[9] Freeport LNG, "Liquefaction Project," http://www.freeportlng.com/Liquefaction_Project.asp.

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[11] Department of Energy, Office of Fossil Energy, "Key Publications - Natural Gas Regulation," http://energy.gov/fe/key-publications-natural-gas-regulation.

[12] ConocoPhillips, "The ConocoPhillips Optimized Cascade Process," http://lnglicensing.conocophillips.com/EN/lng_tech_licensing/cascade_process/Pages/index.aspx.

[13] International Gas Union, "IGU World LNG Report 2013," http://www.igu.org/news/igu-world-lng-report-2013.pdf.

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