What it takes
to link a 9,000-mile LNG chain

With an investment of more than $30 billion, ExxonMobil, Qatar Petroleum, their respective affiliates and their international co-venturers are building the industry's first integrated chains to produce natural gas, manufacture LNG, transport it and regasify it at receiving terminals. Drawing on their unique strengths, the joint ventures were able to demonstrate to regulators in the U.K., Italy and the U.S. that the final links in the chain – three new LNG regasification terminals – offer capacity for importing needed energy supplies in a safe and environmentally sound manner.

When delivered to Qatar in October, the LNG ship Tenbek will be the world's largest, with a capacity of 216,200 cubic meters.

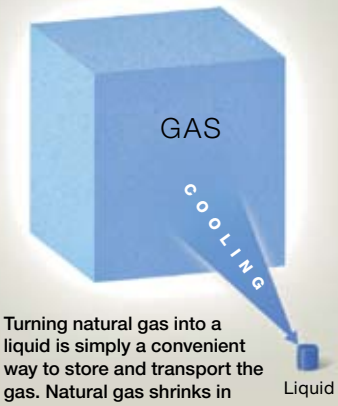
Liquefied natural gas (LNG) has become the fastest-growing segment of the hydrocarbon business. Once considered primarily to be an Asian specialty market, the global demand for LNG is expected to increase about 5 percent per year between now and 2030. By then, LNG could supply up to 16 percent of the world's natural gas market.

"We see LNG as an increasingly important piece of our business," says Steve Lidisky, ExxonMobil marketing manager for Qatar LNG. "Thanks to economies of scale, the market is opening up. ExxonMobil and Qatar Petroleum are playing a major role in turning this regional commodity into a global one."

Opening new markets

Some of the largest gas reserves in the world are in the Middle East, but until recently, Qatar Petroleum and other producers tended to sell LNG to large Asia Pacific customers – mainly in Korea and Japan – under long-term contracts.

With the growing need for LNG, ExxonMobil and Qatar Petroleum have worked steadily to make the manufacturing process more efficient. The production trains that manufacture LNG, for example, have doubled in size from 2 million tons per annum (MTA) to 5 MTA in the past 10 years and are expected to increase to almost 8 MTA by 2008.



Turning natural gas into a liquid is simply a convenient way to store and transport the gas. Natural gas shrinks in volume the colder it gets. At minus 260 degrees Fahrenheit (minus 163 degrees Celsius), the gas becomes a liquid that can be stored in heavily insulated tanks or transported in double-hulled insulated ships. On the receiving end, LNG is warmed to turn it back into a gas that can be fed into existing natural gas delivery systems. Six hundred cubic feet of gas, converted to LNG, occupy just one cubic foot of space.

 Story by Richard Cunningham

The gravity-based offshore structure for the Adriatic LNG terminal (foreground) is as long as four football fields and as tall as the Statue of Liberty. Its two large storage tanks will hold enough LNG to generate a month's worth of electricity for about 1 million homes in northern Italy.

"The scale of the ships and terminals has also increased," Lidisky adds. "As we build the larger facilities, our LNG production and delivery costs go down. It means that we can afford to deliver LNG to markets that are much farther away and still remain competitive with the price of natural gas in those markets."

All links in the chain

"Separate companies typically handle the production of LNG, the tankers and the regasification terminals," Lidisky says. "But our model is different. Few companies in the world have the expertise and financial strength to develop the gas field, build the liquefaction facility, charter the ships and construct their own terminals."

Natural gas from Qatar's North Field, the largest offshore gas reservoir in the world, will provide supply for the liquefaction facilities under construction. ExxonMobil has been working with Qatar Petroleum to develop the field since the early 1990s.

RasGas and Qatargas – joint ventures between Qatar Petroleum and ExxonMobil – are now building the world's largest LNG production trains in Qatar. With an annual capacity of 7.8 million tons each, Qatargas trains 4 and 5 and RasGas trains 6 and 7 are expected to be completed in 2008 and 2009.

To transport the increased LNG volumes, a fleet of 27 tankers, including seven of the largest ever built, are nearing completion at shipyards in Korea. These ships will be under long-term charter to Qatargas II and Ras Laffan 3 – additional joint ventures between Qatar Petroleum and ExxonMobil – to deliver LNG from Qatar to the new regasification terminals in the U.K. and United States.

In addition, another Qatar Petroleum and ExxonMobil joint venture, Ras Laffan LNG II, has chartered and put into operation six conventional-sized carriers for long-term delivery of LNG to Italy.

The Italian connection

The most challenging of the three new LNG regasification terminals is the one that will serve northern Italy. The main structure is being built in Spain, but is to be installed in the Adriatic Sea off the east coast of northern Italy.

"Adriatic LNG will be the world's first gravity-based offshore LNG regasification terminal," says Randy Howard, vice president, ExxonMobil Development Company. "The main structure will rest on the seabed in 95 feet of water, about 10 miles offshore, and out of sight from land."

Because of the lack of a suitable construction area and port in Italy, the gravity-based structure is being built in Algeciras, Spain. The topsides, LNG loading arms and the modular LNG storage tanks are all being built elsewhere

in Europe and Asia. They will be assembled in Spain, and the entire structure will be floated to Italy and installed on the sea bottom at the offshore site.

"This location was selected as the terminal site because it is close to Italy's highest gas demand centers and near electrical power plants that will use the gas to run their generators," Howard explains. "The Italian government is very interested in seeing new gas supplies enter the country."

South Hook and Golden Pass

Two of the three new terminals, South Hook in Wales and Golden Pass in the United States, are larger and much different projects than the Adriatic LNG terminal. The main difference is that they are both located on land.

Golden Pass is a new industrial site near Sabine Pass on the Gulf Coast of Texas, near the border between Texas and Louisiana. The plan there includes a dock and unloading facilities for LNG ships, five large storage tanks, regasification equipment and a 78-mile pipeline to connect to several natural gas trunk lines that feed Texas and much of the eastern United States.

The Golden Pass facility, which is about 9,000 miles from the Middle East, will be the most distant destination for Qatar's LNG and is expected to commence operation in 2009.

All of the necessary permits for Golden Pass were secured from multiple federal and state agencies. Construction began in 2006, less than two years after starting the regulatory process – an industry best.

"The potential impact on wetlands was a major focus of the Golden Pass project and the permitting agencies," says Ray Mentzer, Safety, Health and Environmental manager for ExxonMobil Development Company. "The pipeline route crosses numerous wetland areas, and we have designed our project to reduce the impacts on these areas."

Approximately 3,000 pilings will be driven more than 200 feet into the ground to provide the support for the five LNG tanks at Golden Pass.

The South Hook Terminal in the U.K. is being built on the site of a former Esso refinery.

Many sections of the Golden Pass pipeline will be installed with equipment that can tunnel horizontally for long distances, leaving the surface untouched. In places where working at the surface is unavoidable, wetland restoration projects are being undertaken in accordance with government-approved plans.

ExxonMobil is also working to restore some 240 acres of coastal marsh that have been lost to salt water intrusion over the past 75 years. Additional wetland purchases have been funded for donation to the federal park system.

The South Hook terminal, located in Milford Haven, Wales, on the site of a former Esso refinery shut down in the 1980s, is expected to be prepared to receive LNG in 2008. The terminal's most striking feature will be a pier connecting the regasification plant to the loading docks a kilometer offshore.

The Adriatic LNG terminal will have throughput capacity of approximately 800 million cubic feet of gas per day, and South Hook and Golden Pass will each be able to process the LNG equivalent of 2 billion cubic feet of gas per day. The processing capacity should help balance the seasonal shifts in supply and demand in the markets.

"A major selling point in obtaining the necessary permits for all three terminals was that Qatar Petroleum and ExxonMobil are involved in the entire supply chain," Mentzer says. "But ultimately, it was our joint ventures' commitment to safety and environmental protection that was critical to receiving the approvals to proceed." theLamp

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