

CB&I helps the UK build up LNG import network and storage capacity

Peter Bennett, Mike Whitney and Barbara Weber of CB&I report on the South Hook LNG terminal project and expansion at Grain LNG

The North Sea natural gas reserves that allowed the United Kingdom to become self-sufficient are now in decline, while new discoveries are becoming smaller and less frequent.

In addition, natural gas storage in the UK is very limited, making security of supply an even bigger concern. All the while, UK gas usage is forecast to continually increase, especially in the power generation sector.

In response to the predicted domestic shortfalls, the UK has created a more liberalized gas market in which suppliers can respond to the changing supply/demand balance.

Some of their strategies include developing pipeline infrastructure, as well as LNG receiving terminals and gas storage projects.

The natural gas supply/demand outlook in the UK is influenced by the availability of natural gas worldwide.

Global natural gas consumption is expected to increase at a rate of 2.4 percent annually through 2030, according to the Energy Information Administration. As increasing demand continues to put pressure on gas prices, the rising cost of natural gas is helping to fuel the growth of the LNG industry.

Advances in LNG technologies are helping to make LNG more competitive against traditionally transported (pipeline) natural gas.

Big investment

However, for countries to source natural gas from the LNG market, investment is needed in the form of liquefaction plants, new ships and LNG import terminals with regasification facilities.

A PricewaterhouseCoopers report predicts that the global LNG market will double in size until 2010 and beyond. According to the report, "the LNG market is becoming more diverse and dynamic...The part-regional, part-global market creates considerable opportunities for arbitrage and the diversion of LNG flows."

In the UK, along with other countries interested in obtaining future natural gas supplies from the LNG market, plans

are well under way to greatly increase the capacity of existing LNG import facilities and construct new ones.

The significant investments that have been made in building the infrastructure required to import LNG into the UK are already starting to make a difference. Several import terminals are currently being built, providing additional flexibility and security of gas supply for the country.

Terminals

Currently two new LNG import terminals are being completed in the UK in Milford Haven, Wales, South Hook LNG and Dragon LNG.

The country's only operating terminal is Grain LNG, located on the Thames estuary near London, has been operating since mid-2005. Grain is now undergoing two separate expansion phases.

Other UK projects under discussion include a project in Morecambe Bay and another in Anglesea. The Teesport LNG import facility using a regasification ship was completed last year but is not party to firm cargo commitments, unlike Grain (Algeria), South Hook (Qatar) and Dragon (Malaysia).

We will look at highlights of two of these projects, South Hook and Isle of Grain, and have they will affect natural gas supply and demand in the UK.

Grain LNG: The first LNG to arrive in the UK since the country ceased to be a net importer of natural gas was unloaded at the Isle of Grain facility in July 2005. The shipment came from Algeria, the same source that provided LNG to the UK years earlier. Isle of Grain, which is owned and operated by Grain LNG Ltd., a subsidiary of National Grid, is located at the tip of the peninsula between estuaries of the Thames and Medway rivers in Kent. This location is only about 30 kilometers east of central London. Well-suited for LNG shipments, the facility provides adequate access for the largest LNG ships to navigate with safety.

Isle of Grain is located in an industrial area bordered by farmland. An LNG peak-shaving facility was located here,



The Isle of Grain LNG facility southeast of London is being expanded to meet higher demand. The US engineering firm CB&I is the main contractor

which liquefies pipeline natural gas during the off-season when demand is low and stores the LNG in tanks at the site. When peak demand occurs, the LNG is regasified and fed back into the distribution system. The accessibility of the Isle of Grain to both the National Transmission System and water deep enough for LNG vessels to navigate provided an ideal location for a terminal.

Work began in 2002 to convert the Isle of Grain peakshaving facility into an LNG import terminal with an initial capacity of 3.3 million tonnes per annum of LNG. The facility had four existing LNG storage tanks with a total storage capacity of 200,000 cubic metres. The tanks were converted for importation and a new jetty and associated processing equipment were constructed.

In response to the recent decline in natural gas production, a major expansion of this facility is currently under way by CB&I which, when completed, will increase the capacity of the terminal to 9.8 MTPA. The regasification and send-out capacity of the facility will reach one billion cubic feet per day and the facility will include three full containment 190,000cm LNG storage tanks.

These tanks, which will be the largest aboveground LNG storage tanks in the world, will bring the total storage capacity at the Isle of Grain facility to 770,000cm. Peak crew for the Grain expansion has reached 700-800 people, many of whom are from the local community.

The expansion project is scheduled to be completed in 2008 and is expected to provide 12 percent of the current UK gas demand.

In addition to providing substantial business to local suppliers, the project team is committed to being good corporate citizens in the community and to protecting the environment during the construction and operation of this facility.

In May 2007, an additional expansion contract was awarded to CB&I. This expansion project includes the construction of a new jetty capable of berthing LNG carriers with a capacity of up to 265,000cm and an unloading rate of 12,000cm per hour. A fourth 190,000cm full containment storage tank will be built, as well as new gas processing facilities, boosting plant capacity to 14.8 MTPA.

South Hook: The South Hook project is as unique as it is enormous. It is part of the world's first fully integrated value chain venture – QatarGas II. Unlike

most LNG projects, the QatarGas II project includes the offshore gas supply, onshore LNG production, the ships that will transport it, and the South Hook regasification facility.

By combining the gas supply, the liquefaction plant, the LNG carriers and the regasification facility into one project, many of the risks of large-scale LNG projects are minimized. This enables the owners of the project to capitalize on economies of scale and scope.

This mammoth project is a joint venture between Qatar Petroleum, Exxon Mobil and Total. The regasification terminal that is part of the QatarGas II project is to be operated by the South Hook LNG Terminal Co. Ltd., also a joint venture between the three parties.

Engineering, procurement and construction for the ship unloading system, the LNG storage tanks, the regasification facilities, and the send-out systems is being performed by CB&I on a lump-sum, turnkey basis.

Gas for the South Hook project will be supplied from Qatar's North Field, the world's largest non-associated gas field.



The South Hook project is unique. It's a joint venture between QatarPetroleum, ExxonMobil and Total and is part of the world's first fully integrated LNG value chain venture - QatarGas II. The chain includes two 7.8 MTPA LNG trains

With more than 25 trillion cm of natural gas, Qatar has almost 15 percent of the world's total gas reserves.

To provide a perspective on the size of the North Field, the South Hook LNG Web site notes that the currently

estimated proven reserves of this field would meet existing UK natural gas demand for almost 250 years.

Once the gas is produced from the North Field, it will be liquefied at the QatarGas II facility. QatarGas II includes two world-class LNG liquefaction trains, each of which has a capacity of 7.8 MTPA.

The project also includes a fleet of 14 ships currently under construction. The LNG will be transported via these ships, which will be the largest LNG tankers ever built. Eight of the ships will be using the Q-Flex design, which can carry approximately 210,000cm of LNG.

The other six ships have the Q-Max design, which can carry approximately 266,000cm of LNG. All 14 of the ships will come equipped with on-board re-liquefaction capability.

The South Hook regasification facilities will be able to process the full 15.6 MTPA of LNG produced by QatarGas II each year, delivering two billion cubic feet a day of natural gas into the UK system.

Five full containment 155,000cm storage tanks are being built to hold the LNG for a total storage capacity of 775,000cm.

Like Grain LNG, great care is being taken to enhance the local economy and protect the environment during the construction and later operation of the South Hook facilities.

The tanks and processing facilities have been strategically located to minimize their visual intrusiveness. Flora and fauna in the area are being protected, and heavy equipment is being transported

by sea to minimize road traffic.

Because the tanks are being built with a lower aspect ratio (height/diameter) than most LNG tanks to preserve the beauty of the harbor, the circumference of the tanks will be the largest ever built.

Peak work force is expected to reach 2,000 people, using as much local labor as available. Fifty permanent skilled jobs will be created, and various additional maintenance workers and other support services will also be required once the plant becomes operational.

When completed, this facility will have the capacity to meet around 20 percent of the current UK natural gas demand.

In 1958, a research program known as Operation Cryogenics was launched. For this program, the International Nickel Company, the US Steel Corp., and CB&I joined forces to demonstrate the viability of nine-percent nickel steel for vessels used to produce, store and transport liquefied gases.

The program was a success and from that point forward, nine-percent nickel steel became the industry standard for cryogenic storage.

Then in 1959, the world's first LNG tanker – the Methane Pioneer – left Lake Charles, Louisiana, with the first commercial shipment of LNG cargo.

Its destination: Canvey Island in the UK. This voyage was the first of seven shipments that launched the LNG industry worldwide by demonstrating that large quantities of LNG could be safely transported across the ocean.

Following this initial shipment, an agreement was made with Algeria that resulted in the transportation of LNG

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from Algeria to the UK on a regular basis from 1964 until 1979. The LNG industry was born.

CB&I built the first commercial double wall LNG storage tank at Lake Charles to hold the LNG destined to become the first LNG cargo shipped across the ocean to Canvey Island.

For this project, the resilient blanket was developed and introduced by CB&I. This innovation has been used successfully ever since to control compaction of the perlite insulation between the inner tank and the outer shell.

The resilient blanket insulation prevents insulation compaction by acting as a spring that contracts or expands with the inner shell movements due to thermal cycles.

Since 1959, the natural gas importation needs of the UK have risen, decreased, and then risen again.

The original Canvey Island LNG import terminal was used for liquefied petroleum gas storage in the 1980s when domestic natural gas supplies increased and the need for LNG subsequently decreased.

Calor Gas Ltd., the owner of this LPG terminal, has been looking at the possibility of converting it back into an LNG import facility but has had trouble gaining planning permission.

What's next for the UK?

As the second-largest economy in the European Union -- behind only Germany -- the economy of the UK is strong and is expected to continue to be robust, with current forecasts for 2007 growth ranging between 2.75 and 3.25 percent.

While natural gas demand declined during the past couple of years due to the sharp rise in price as production slowed, continued strong economic conditions will likely lead to an increase in demand for natural gas.

The population of the country, which is currently just over 60 million, is also

expected to continue growing. As the population grows and the economy remains strong, the demand for electricity is expected to continue to rise.

Natural gas is increasingly important for power generation in the UK, with same new gas-fired power projects planned.

Although the rising price of gas has brought about a modest upturn in using coal to fuel power stations, natural gas remains the biggest source of fuel for the UK power generation sector.

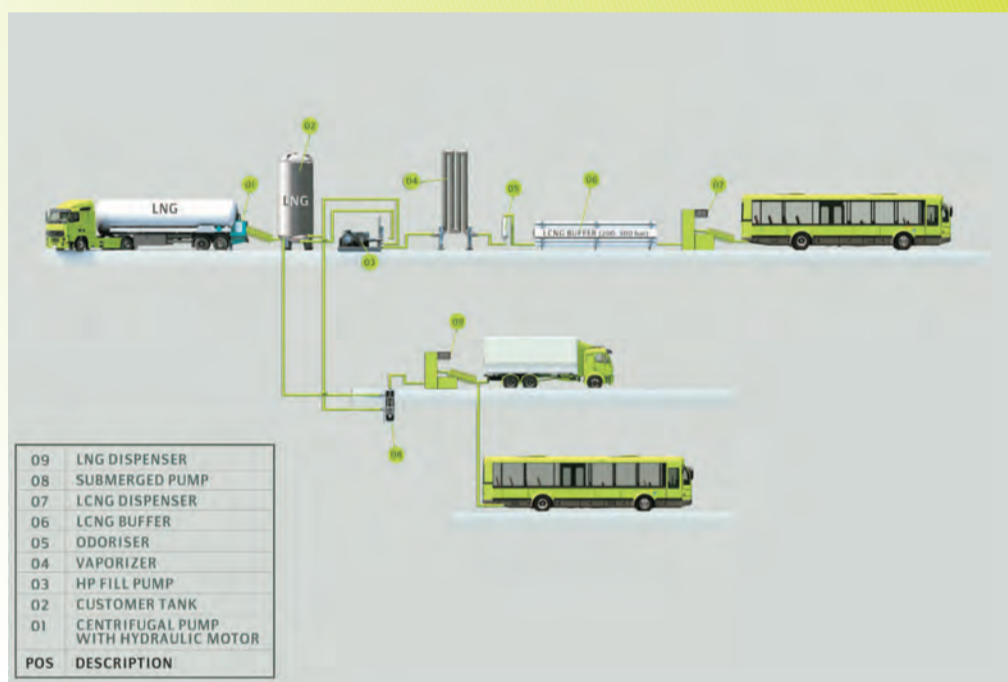
LNG will help balance natural gas supply and demand in the UK, as

regasification projects like the Isle of Grain expansion and South Hook are completed.

With a growing population and healthy economy, the UK anticipates security of natural gas supply for heating, cooling and power generation long into the future. ■



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