LNG entering port – with delays

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One of the most dynamic changes facing seaports, worldwide, is the anticipated 'gold rush' in the building of new liquefied natural gas (LNG) shipping and receiving facilities in ports throughout the world, followed by the traffic these facilities will generate.

According to data assembled by Pan EurAsian, the present liquefaction capacity in the world of about 146.5 million tonnes per year will increase to 366.5 million tonnes per year by the end of 2011 (See Figure 1). This extraordinary growth is precipitating unprecedented growth in the construction of LNG facilities in ports throughout the world. All of this LNG tonnage will move in seaborne trade. About 500 LNG carriers, averaging 120,000 m^3 each, will be needed to carry this trade. Most of the LNG receiving, or regasification (regas) facilities will be located in North America, Europe, South Korea, Japan, India and China. In short, a major new seaborne trade is coming to market.

As port operators and industry participants plan for this new business, a number of critical issues will develop. This article examines one of them.

Future projects and implications

Pan EurAsian is presently tracking over 50 LNG regas projects and facilities in North America, some of which are well advanced and many of which will never get built. Most observers suggest that at most ten new projects (beyond the four existing regas terminals now in operation in the US) are actually needed to satisfy market demands for natural gas between now and 2010. An equal number of projects may be built in Europe during the same time frame. China, South Korea and Japan have plans to expand import facilities as well, with China alone considering about ten new facilities by 2010. On the supply side, Pan EurAsian has identified over 40 liquefaction facilities projects that are planned to come on line by 2011. Collectively, this constitutes a major gold rush to build LNG related facilities in ports around the world.

In addition, to support these facilities, over 100 new ship buildings are expected in the over 150,000 m^3 LNG class. The South Korean shipyards alone are presently building over 30 LNG ships per year and expect to maintain this level for the next three to four years. Beyond the difficult permitting and safety issues, all of the expected construction will create shortages and stresses in the supply of some of the highly specialised materials and construction services that are required for LNG.

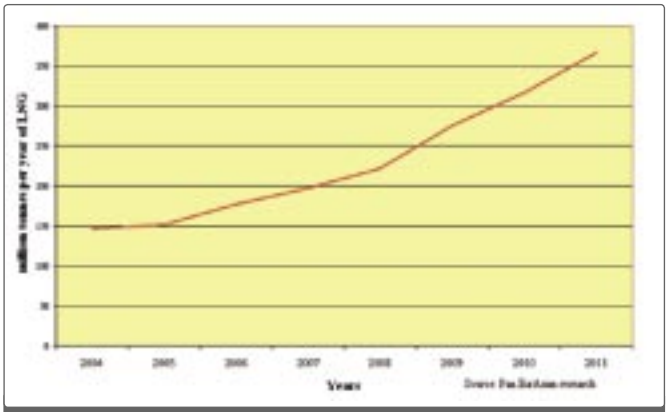

Figure 1. Worldwide Liquefaction Capacity.

Photo courtesy of Suez LNG NA

LNG Tanker in Boston Harbour.

In discussions with major developers and their suppliers, it has become apparent that the predominant critical path item in the building of new LNG facilities is storage tanks. This article addresses why this is the case.

Constraints of producing storage tanks

Storage tanks are the most visible aspect of LNG port terminal facilities. Regas terminals will have two, three or even four of them. The construction of tanks will be the most apparent visual sign that the LNG building boom is happening. In addition, LNG carriers will also have their own LNG storage tanks.

Tank specifications

The tanks located on land are large, and quite complex. The larger tanks each contain about 160,000 cubic metres of natural gas (just over one million barrels or about 100 million m^3 of gas equivalent). They rise about 175 feet (53 metres) above their base, and are about 270 feet (82 metres) in diameter.

LNG is stored in a tank within a tank. The outer tank is made either of steel or of concrete. The inner tank is made from nine per cent nickel steel plate. As is the case with other flammable liquids, the tanks are surrounded by berms that create a containment area sized to contain 110 per cent of the liquid in the tanks should some catastrophic failure occur, either naturally or unnaturally.

Nine per cent Nickel Steel in brief

ASTM Specification A553 Type 1

UNS no. K81340

EN10028-4 Grade X7 NI9

Maximum Carbon	0.13 per cent
Maximum Manganese	0.90 per cent
Maximum Phosphorus	0.035 per cent
Maximum Sulphur	0.035 per cent
Maximum Silicon	0.30 per cent
Nickel	8.5 to 9.5 per cent

Photo courtesy of Mittal Steel USA

Hot Mill: Producing nine per cent nickel steel plate.

Photo Courtesy of Cheniere Energy, Inc.

Site groundbreaking at Cheniere's Sabine Pass LNG terminal site. The site is located on the Louisiana side of the Sabine Pass Channel. There will be three LNG storage tanks of 160,000 m^3 each. The terminal is planned to be in service in late 2007.

Availability of nickel steel alloy

Building these tanks is presently considered the critical path in the actual construction of an LNG liquefaction or regas facility. The constraint is the availability of the steel plate for building the inner tank, a nine per cent nickel steel alloy that is very complex to produce. Nine per cent nickel steel is used throughout the LNG chain; presently at liquefaction plants and at regas terminals. Although nine per cent nickel steel has not been used for storage tanks on LNG ships, new ship tank designs are emerging that will require it as well.

Natural gas (mostly methane) is liquid at -256ºF (-161ºC). Therefore, the material used to contain and pipe LNG must be able to withstand such temperatures without failure. There is zero tolerance for corrosion. The nine per cent nickel steel alloy that is used for the inner tank is selected for its excellent performance with cryogenic liquids.

The inner tank holds the liquefied natural gas. The outer tank actually encloses the inner tank and contains the LNG at a slight pressure of about two psig. Between the two tanks, the void is filled with insulating material. Because LNG is stored at slightly above atmospheric pressure, the liquid is constantly boiling: about 0.05 per cent of the gas is boiled off per day. The boiled off gas is either used o site, put into a pipeline and sold, or re-liquefied and put back into the tank depending on the particular circumstances of the facility.

In modern LNG storage tanks, there are no penetrations of the inner tank shell. All the piping and control connections are through the open top of the inner tank. Submersible pumps are used to remove LNG from tanks for regasification.

Producers of nickel steel alloy

Only a few steel mills in the world have the ability to produce a nine per cent nickel steel plate that will reliably conform to the tight specifications for this service. The main producers for LNG projects worldwide are Nippon Steel in Japan and Arcelor (Industeel) in Europe. Dillinger Hütte, who once produced the material and stopped, is now resuming production. In the US, there is only one producer: Mittal Steel. Up until now, the demand for this difficult alloy has not been great. Its uses are mostly for cryogenic installations, most of which use far less material than the large LNG storage tanks do. But with the present expansion of the LNG business, already over the last one–two years, the demand for nine per cent nickel steel has trebled.

Not only must the alloy itself be pure, but the heat treating requirements for producing the plates are very demanding. It is a custom product. At every step, the process for making these plates is labour intensive. Each plate is carefully inspected for flaws and consistency. The surface must be prepared by hand grinding or special blasting. The heat treating oven must be specially cleaned and prepared for processing these plates. This labour intensive process for making these plates slows down production at the mill to the point where tonnage output is considerably diminished. Demand for this product has historically never exceeded supply, thus the industry has chosen to expand and modernise capacity to produce other, more robust product lines. The present LNG gold rush is putting unprecedented demands on the few steel mills that can produce this product.

Timing

The high demand for LNG facilities, and the need for these specialised steel plates, comes at an inconvenient moment in the world steel industry. The steel industry is just coming out of a long period of decline and restructuring. A number of facilities that existed ten or fifteen years ago no longer are in operation, or have been trimmed back substantially.

Just as that process of rationalisation was concluding, world demand for steel turned around and entered into its own period of high demand driven mainly by China's growth and a recovery in worldwide manufacturing. A market of significant strength is the shipbuilding sector with high demand for double-hulled super-tankers for the international oil trade.

The resultant combination of strong demand for steel for other markets, with the unprecedented need for nine per cent nickel steel for LNG storage and transport tanks, means that lead times for this product are starting to get longer. Anyone just now deciding they want to build an LNG import or export facility, who has not already ordered their tank materials, may have to wait a while. We expect to see some slippage on targeted completion dates beginning to occur.

Some developers are mitigating this problem by ordering critical materials before they actually get their permits to build, perhaps taking comfort in the thought that they could always sell their delivery positions to other developers should their project not materialise for some reason. This process of anticipation has, so far, kept lead times within workable limits.

In summary, there is a 'gold rush' in the construction of LNG facilities. The availability of critical materials, like nine per cent nickel steel plates, may delay these projects, but we do not expect it will stop it.

There is no doubt: LNG is coming into port.

ABOUT THE AUTHOR AND THE COMPANY

Zachariah Allen is President of Pan EurAsian Enterprises, Inc, a consulting firm that specialises in market analysis and project development support for the energy industry. Pan EurAsian publishes the North American Terminal Survey (NATS) for LNG Imports and Regasification. The services of the firm and its capabilities are more fully described on its website.

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