APPETITE FOR LNG GROWS

INDUSTRY STRUGGLES

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Despite record low LNG prices, and the ever increasing capital costs of new production plants, there is pressure on the industry in Asia-Pacific to increase capacity by improving existing plant efficiencies and constructing more facilities.

Demand for LNG as a carbon-friendly energy source continues to grow in many regions, with the appetite being highest in the Asia-Pacific region. Before the end of the decade, when most of the current under-construction projects reach production, there will be a short period of oversupply, but not for long. By 2021 the world will need additional supply capacity — more output, more plants.

Nonetheless, in the current volatile economic climate, and because of the relatively long project construction timelines of 5 to 10 years, investors are reluctant to commit to new LNG projects.

At a macro level there are engineering design solutions that can aid in mitigating the investment risk, assist with optimising design and lowering construction costs, as well as, at a detailed level, improving efficiencies for existing production facilities.

LNG price on the slide

The crude oil spot price continues to fall, and since the LNG price is indexed to the oil price, it is no surprise that the LNG supply prices are racing to the bottom. This is despite the fact that in the Asia-Pacific region the LNG supply contracts are long term (as Australia has signed with Japan), and so these contracts really only delay the inevitable. From the start of 2014, the LNG price at the Japan/Korea Marker (JKM) has fallen from around $18/MMBtu to $7.2/MMBtu — down 60%.

The impact on existing large Australian LNG plants, mostly using offshore gas feeds, is devastating, and they are scrambling to find ways to improve efficiency and reduce operating costs (OPEX).

Optimising the existing plant, with a focus on the liquefaction process (which accounts for 40% of the operating costs), offers the quickest and most significant OPEX reduction. Optimising this process by implementing advanced process control (APC) can improve efficiency and bolster plant reliability, resulting in greater yield and lower costs.

LNG demand on the climb

The demand for LNG from the Asia-Pacific region continues to grow at around 4% pa. This is despite the fact that, since 2012, Japanese consumption has dropped as they recommission their nuclear power plants that were mothballed after the Fukushima disaster. The excess supply has been absorbed by increased purchasing from China and Korea, but in anticipation of significantly higher demand, offshore natural gas and CSG-to-LNG projects were launched nearly a decade ago, and as these come online there will be an oversupply for a few years, and then a supply

shortage from 2021. It is anticipated that by 2017, Australia will be the world's largest LNG exporter.

According to Philip Olivier, CEO of ENGIE Global LNG, "Oil will not stay at current lows so we should avoid being hit by a double-whammy of rebounding oil prices and a growing shortage of LNG supply. New liquefaction and export projects need to be carefully advanced through the current down-cycle, though many investors shy back from taking FID (Final Investment Decisions) in the current low price environment."[1]

Looking forward from 2021, and with a 5- to 10-year construction timeline, more new LNG facilities need to be on the drawing boards right now. But the construction costs (CAPEX) of LNG facilities, recognised as one of the most expensive process plants to build, have increased by 20–30% since 2005, and 80% of the current projects are over budget and behind schedule.

By implementing leading-edge process plant design software that incorporates sophisticated capital cost estimating, it is possible to mitigate against inefficient upfront design, avoid over-engineering (and overspending), and better manage project execution. Using these tools will help to reduce the capital costs and project blowouts, thereby reducing investor risk and uncertainty.

Modelling the market

To further reduce FID hesitation in this volatile LNG market, investors demand greater assurance than ever before that every conceivable business scenario has been simulated and tested.

Economic scenarios such as future oil prices (which will determine LNG prices), future demand, the impact of renewable energy sources, long-term contract viability in an oversupplied market, political stability at plant locations and much more need to be modelled by the economic strategists.

As importantly, it is imperative that the potential LNG project, including conceptual design, detailed design, project costing, anticipated throughput, planned efficiency, operations and maintenance, as well as ROI, is extensively modelled and tested to take into account every conceivable scenario, such as:

- gas feed composition variations
- gas feed pressure changes
- output demand volatility
- environmental considerations such as ambient temperature (after all producing LNG is a cryogenic process)
- plant reliability impacting shutdowns and start-ups

The latest process plant design software tools incorporate the option to perform realistic and extensive technical simulations, ensuring that investment risks are mitigated and worst-case/best-case outcomes are considered during future plant operations.

Chiyoda Corporation, the largest Japanese integrated engineering company and the world's leading LNG contractor with major involvement in the Inpex Ichthys project off Darwin, uses these tools to verify operability and controllability of new LNG plants, including the gas cleaning, NGL recovery and liquefaction sections of the plant. Chiyoda examines possible transient scenarios, such as operation procedures for start-up and shutdown, including compressors. This allows Chiyoda to design more reliable and robust LNG plants, with stable operation of the NGL recovery unit and less risk in the start-up of the plant and operation of the equipment, specifically the compressors.

Down with downtime

The extremely 'tight' LNG industry — with low selling prices, volatile demand and high capital costs — demands high plant reliability and minimal downtime. This requirement is even more critical in CSG-to-LNG plants due to the upstream implications of a gas train malfunction.

Typically, an LNG train is supplied by hundreds of CSG wells. Less groundwater needs to be pumped out and treated, the longer a well is in operation. Consequently, if the gas demand on wells is reduced due to a train shut, then the groundwater builds up and has to be pumped out in greater volume at a later stage, incurring additional costs. Alternatively, the wells can be allowed to supply gas as normal but the gas is then flared to the atmosphere, which is both costly and environmentally harmful. Added to the fact that the train is not producing and earning revenue, these additional costs are extremely undesirable.

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A prerequisite for success in this market is robust detailed overall design, coupled with intensive design and simulation testing of each phase of the process, each sub-process and even individual critical pieces of equipment such as compressors, refrigerators and heat exchangers. The ability to model the performance, for example, of a plate fin heat exchanger, as it is pushed to the limits of its operating envelope, can reduce the risk of a plant shut as greater efficiency is chased.

Implementing a high granularity plant-wide software engineering tool that incorporates the ability to drill down to component level can ensure sufficient detailed simulation and testing, and deliver a robust, reliable LNG facility.

Within Fives for example, the Cryogenic|Energy business group is a major manufacturer of brazed aluminium heat exchangers (BAHX), using exchanger design and rating simulation software products to understand the heat exchanger's impact on the entire process rather than as a sole unit. Specifically, Fives wanted to monitor multiple BAHX in series, and the real pressure levels at BAHX outlets along with thermo-hydraulic coupling to optimise the final design of the cold box. This strategy not only allowed Fives to optimise the equipment design in the context of the process, but also to optimise CAPEX and OPEX simultaneously over the life of the equipment.

Big data, big gas

One of the strongest challenges in the oil and gas industry is to manage information, to understand the processes and implement strategies to increase efficiencies. According to Curtin University's Dr Brian Evans, Director of Subsea Engineering Projects, "Our ability to become lean and mean will come down to our ability to master data analytics."[2]

The second report in Lloyd's Register Energy's Oil and Gas Technology Radar research series[3] maintains that any number of reasons can be cited for oil and gas companies' inability to use data more effectively. Simply handling and safely storing the large volumes of data being collected is a challenge for many companies. The same is true of dealing with unstructured data — the type that originates, for example, from images or maps, or text embedded in email, social media and other forms of communication.

According to Duco de Haan, commercial development director at Lloyd's Register Energy, "Two factors stand out as hindrances to upstream companies' better use of data. Silos (in companies) are the biggest problem. The lack of data integration across different parts of the business is rated the toughest challenge oil and gas firms face in improving their use of data. It was not uncommon, over the years, for different business units of large, integrated operators or contractors — or even different departments within the same units — to adopt slightly different formats in entering the data they collected. This presents a huge headache when seeking to apply advanced analytics tools to generate insights from data that business managers can use. Databases can of course be cleaned and formats standardised, but it can be a long and expensive process."[3]

Tim Walsh, COO, assurance operations, Lloyd's Register Energy, claims, "The biggest challenge for asset management is working out basic information about the configuration of the plant and what condition it's in.

"Much of this could be expedited through better use of data — understanding what data is available, what form it's in and having systems that are joined up. System integration is a big issue. There can be four or five systems that look at the same thing. A lot of historical data is poorly structured and, often, operators don't have any way to assess the quality of the data."[3]

The situation is exacerbated when operators and engineers, looking for increased efficiencies, start with plant optimisation which is typically 'tested' using extensive spread-sheeting, and playing the 'what-if' game. The results of this scenario planning are not available to all stakeholders and very seldom tested in conjunction with the overall control system.

Until recently there has been no readily available plant optimisation software that includes a data historian and the ability to seamlessly interface into multiple formats of data. Now it is possible to run 'what-if' modelling as before, but integrated into the optimisation software so that the iterations are evaluated and stored for future reference.

Opportunities in gas

Within five to six years there will be a shortfall in LNG supply, and with design and construction taking 5 to 10 years, it is critical for new projects to be 'on the table', if not already in initial building phase.

The current low oil/LNG prices will not continue for much longer, especially when demand outstrips supply, and then returns on investment will be meaningful. But it is essential that owners of existing, and planned, LNG facilities employ the latest engineering software tools to ensure reliable and 'proven by simulation' design, efficient processes and optimised process control. In this way risks can be minimised and ROI maximised.

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References

1. Olivier P, 2015, *Mind an LNG supply deficit 2021*, LNG Journal, 27 October 2015.
2. Lloyd's Register Energy, 2015, *Innovating in a New Environment*, p34, ‹http://www.lr.org/en/energy/technology-and-innovation/technology-and-innovation-radar/›
3. Ibid., p38