The Next Generation

Nancy Ballout, AG&P Engineering, USA, discusses LNG infrastructure and its implementation in emerging economies.
The energy sector is at a crossroads where it can be said with conviction that the stage is set for conventional sources of energy like coal and oil to take a backseat. From the Paris CP21 agreement to domestic regulations specific to a country, the focus now lies on ramping up the presence and utility of cleaner energy sources to meet surging global energy demand as emerging economies seek to support their industrial and economic growth. While cleaner energy sources tend to be synonymous with renewables, a broad implementation of either one will only be achieved when efficiency and reliability are improved and the amount of initial capital investment required is lowered. Emerging economies today need solutions that help cut the long waiting time for a source to reach and connect scattered regions onto the supply grid. While governments are creating measures to inch closer towards the dream of vehicles, processes and industries running solely on renewable sources, in the short to mid-term, this is neither affordable, sustainable nor achievable.

However, there is a readily available cleaner energy option in the form of a fossil fuel with high efficiency and lower cost for industrial use – LNG. LNG is considered the cleanest of the fossil fuels (with about 30% less CO₂ emissions than oil) and estimates suggest that with rising global demand for LNG, the market will grow at 4 – 5% every year. However, to realise the full potential of LNG, the market must address the lack of viable supply chains, particularly in emerging economies, where all but the major centres remain stranded from existing gas pipeline networks. Despite this predicament, in 2016 the market set a record for global gas trade by reaching 258 million t, with the International Gas Union (IGU) reporting that demand for LNG was the most pronounced in Asia – notably India and Pakistan – which together added a combined 13.0 million t in LNG demand, which was mostly met with imports.

LNG is also fast growing as a preferred fuel option due to its relatively low risk factors when compared with crude oil. Moreover, with the price differential between LNG and crude oil expected to increase as crude prices surge, LNG will find favour due to its price advantage over other low sulfur oil derivatives. According to the IGU, Asia-Pacific and Asian markets demonstrated the most activity in LNG imports in 2016, with their market shares rising from 71.7% in 2015 to 72.4% in 2016. The region also remained the largest market for gas uptake with an absorption rate of 53.6% of total global supply. This correlation confirms both the need and opportunity to create reliable LNG distribution networks and to build the necessary infrastructure so it can meet the surging demand for energy across the Asian region.

With demand predicted to continue its upward trend well into 2030, the time is therefore right to establish a well-functioning

Figure 1. AG&P will deliver LNG to smaller power companies and stranded industrial customers by developing LNG receiving terminals and the associated supply chain infrastructure.
LNG supply chain in Asia’s fast-growing gas markets, notably India, Bangladesh, Sri Lanka, and archipelago countries in Southeast Asia. This starts with building and operating more small-to-mid-scale LNG import terminals and the associated onshore and floating supply chain infrastructure, to provide access to LNG for an enormous number of off-grid, energy hungry end-users that are currently without access to a reliable supply of gas.

Right-sizing infrastructure for a new generation of customers

Recognising this rising need for LNG infrastructure assets, especially in Asia, AG&P is building on its established modularisation business to develop a leadership position in the delivery of LNG to smaller power companies and stranded industrial customers via LNG receiving terminals and the supply chains emanating from them. With global over-supply driving down prices and giving rise to flexible, short term contracts, LNG importing has become a buyer’s market; thanks also to price caps and the risk of commodity prices shifting to suppliers. AG&P believes the focus will quickly switch to a mechanism for efficient LNG distribution, which is why the company is aggressively developing supply chain solutions that will stimulate demand amongst these under-served customers.

A key part of developing the small and mid-scale LNG market includes reducing the size of the current equipment traditionally used in the baseload market. Therefore, building highly cost-efficient receiving terminals and break-bulk facilities, as well as having smaller carrier vessels operating from these terminals to serve distant demand centers with smaller customers is very important. These carriers need to be appropriately scaled to reach sites that are currently not accessible with traditional LNG carriers (LNGCs) because it is physically impossible for the LNGCs to navigate through shallow waters or it is cost prohibitive for small and mid-scale LNG customers to buy an entire cargo since their demand is much smaller than what it is economically offered in the traditional baseload market. These customers will be best served using small scale LNGCs that potentially allow doorstep delivery of toiled-gas on regular routes.

Flexible delivery solutions are key

AG&P has considerable expertise in designing standardised, plug-and-play supply solutions that make LNG more accessible and economically viable for developing LNG/natural gas markets. One example is the company’s ultra-shallow draft LNGC, capable of accessing rivers and shallow harbours with a draft of only two metres. AG&P designed this first-of-its-kind vessel with a unique hull that reduces the waterline entrance angle and vessel resistance in waves. The vessel cargo capacity is scalable from 4000 – 8000 m³ with flexibility to travel near shore and take on LNG cargo from a jetty-based floating storage unit (FSU) or a FSU anchored offshore. It can navigate open seas as well as riverine waterways with a minimum speed requirement as low as eight knots, making it ideal for serving dispersed and smaller demand centres in fast-growing gas economies like Indonesia, the Philippines and South Asia.

Another innovation in AG&P’s wide range of LNG solutions is a 6000 – 16 500 m³ scalable barge, which optimises the storage and marine design to drive cost efficiencies and implementation. The design combines a shallow draft barge with a conventional hull enabling fixed cost hull construction over a scalable capacity range of 4000 – 8000 m³ for shallow water delivery and 6000 – 16 500 m³ for open water delivery. A key benefit is that both products utilise existing GTT membrane hull designs specifically configured to optimise tank configuration. Additionally, the geometrical membrane tanks are standardised which reduces re-engineering costs and by integrating standardised equipment/technologies and constructing modularly in its yards using its GTT license, AG&P can further drive down costs while accelerating schedule.

The benefit of innovative designs such as these is that they are entirely flexible, so they can be adapted to suit the site and customers’ needs. From utilisation of different storage technologies, such as Type B or C tanks; to methods of propulsion – propelled vs. towed, with or without full dynamic positioning; to navigation requirements such as multiple water depth accessibility, the key is to be able to serve many clients with these site-specific, but at the same time standardised solutions.

Can small scale solutions be cost competitive?

While great strides have been made in optimising designs for supply chain infrastructure, the fact remains that the current price structure for new large-scale LNG carriers at US$1000/m³ for a 175 000 m³ vs. a small scale carrier at US$5000 – 10 000/m³ for 4000 – 10 000 m³, makes it difficult for LNG to compete against diesel. This is where innovation and flexibility must be used to create a viable way of making LNG competitive, as well as accessible. For example, one method of drastically reducing the cost of a small scale LNG carrier is to convert existing small scale bulk carriers and container ships to LNG carrier service by incorporating LNG containment systems (membrane, type B or C

![Figure 2](source: International Gas Union)

Figure 2. Asia’s fast-growing gas markets need a well-functioning LNG supply chain (source: International Gas Union).

![Figure 3](source: AG&P)

Figure 3. AG&P is designing standardised solutions to make LNG more accessible and economically viable for developing LNG/natural gas markets. Figure shows its 6000 – 16 500m³ scalable barge.

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Each standard 125 million ft³/d regasification module consists of:
- Shell and tube vapouriser utilising indirect glycol/water or fan ambient air vapouriser or water bath type vapouriser.
- Seawater/glycol water plate and frame heat exchanger.
- Glycol water circulation pumps and corresponding filters.
- Low pressure LNG pump module (only used if BOG recondensing is required) consists of:
  - N+1 low-pressure LNG pumps.
  - BOG recondenser (optional).
- High pressure LNG pump module consists of N+1 high pressure LNG pumps.
- Off module equipment consisting of:
  - LNG surge drum.
  - LNG Separator (only used if BOG recondensing is required).
  - BOG compressor suction drum.
  - LP BOG compressor package (cryogenic).
  - HP BOG compressor package (to pressurise BOG to sendout delivery pressure – optional if recondensing is not required).
  - LNG unloading and transferring equipment as required (cryogenic hoses, marine arms with emergency release coupling and QC/DC retrieval, cryogenic drain drum if required, cranes, etc.).
  - Metering skid.
  - HI/PS and/or ESDV/F&G/CAMS.
  - Required utilities.
  - Central control room (E-house).
- All equipment is purchased utilising an inhouse approved vendor list, which allows competitive pricing based on standard products requiring no reengineering. This ensures shorter procurement times based on standardisation of equipment.
- Typical schedule – 12 months ex-works.

By developing standard modules like the 125 million ft³/d regasification module, HP and LP Pump modules as well as establishing close relationships with BOG handling package vendors, AG&P not only reduces project cost and schedule, but because the solution is easily scalable, it can meet the needs of a wider range of customers, from small to large scale projects.

Summary
The LNG industry today is highly fragmented, leaving an end-customer, who may have technical and commercial LNG expertise, with the burden of piecing together an LNG supply solution. AG&P is addressing this challenge and simultaneously changing the reach of LNG globally by providing a full technical and commercial solution from LNG supplier to end customer through its own developments, in which the company owns a major or whole stake. AG&P uniquely provides a fully integrated solution from LNG sourcing to last-mile delivery, therefore simplifying and making it affordable for customers to make the decision to switch to LNG as its energy source.

References

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