



LNG: powering Southeast Asia

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Steadfast growth stories have been scarce since the global financial crisis of 2008, with resource-dependent economies further buffeted by pronounced falls in oil, gas and other commodity markets from 2014 onwards. Indonesia and the Philippines, the largest and fourth largest economies in the Association of Southeast Asian Nations (ASEAN), respectively, however, have shown resilience with their growth stories largely intact. Since 2012, both countries have consistently delivered annual average GDP growth rates of 4.8 – 7.0% (World Bank 2016). With demographically young and fast-growing populations and large export-oriented service, manufacturing, resource and primary industry sectors



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contributing to substantial domestic income and consumption growth in these economies, the public and private sectors in these key Southeast Asian economies are acutely aware of the future infrastructure investments vital to sustain their growth trajectories.

Archipelagoes are strategising for higher power capacity

Indeed, in the first few months following its election in October 2014, the administration of President Joko Widodo tabled the Indonesian government's National Medium-Term Development Plan 2015 – 2019 (known by its Indonesian acronym, RPJMN). As part of this, funding to cover public infrastructure spending was increased, including the government's share in rolling out a planned 35 000 MW in new power generating capacity by 2019. The build-out will be



Figure 1. A 26 000 m³ floating storage unit (FSU): turnkey design and build proposal for an Indonesian customer.

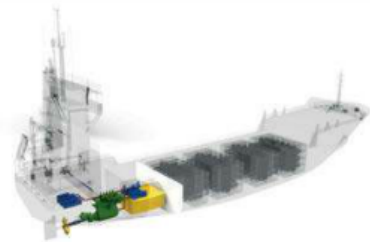


Figure 2. A 32 000 m³ LNG carrier: engineering development of self-propelled LNG carrier for fuel resupply to distributed FSU/FSRUs.



Figure 3. A 8000 m³ LNG bunkering vessel: engineering development for a Singapore client to supply LNG to storage units and vessels.

overseen by state-owned national power company, Perusahaan Listrik Negara (PLN), and the total funding requirement for Indonesia's 35 000 MW programme covering power generation and distribution is estimated by the Asian Development Bank (ADB) at US\$83.5 billion. While up to US\$73.8 billion in funding is ultimately expected to come from the private sector, supplementary project financing will be provided by multilateral agencies, such as the World Bank and the ADB.

It is worth noting that the Indonesian government's goal of 35 000 MW of additional installed power generation capacity by 2019 is merely the first part of an eventual 70 000 MW of new power capacity planned to be in place by 2024. The aim is to underwrite, in the Indonesian government's assessments, a restoration of GDP trend growth of 6% per annum and more balanced and equitable development across the vast Indonesian archipelago (ADB 2015²).

The Indonesian government plans to build 13 452 MW of new gas-fired plants across the archipelago as part of its power generation strategy. The Indonesian government, via PLN, plans to develop 7229 MW of this capacity. The private sector is expected to develop and operate approximately 6223 MW of the new gas-fired baseload and peaking power stations across the archipelago.

The Philippines' power market differs markedly from that of Indonesia due to the centrality of the private sector. Since 2001, following the comprehensive privatisation and restructuring initiatives effected by the Philippines government under the Electric Power Industry Reform Act (EPIRA), the private sector has assumed near total responsibility for legacy and greenfield power generation and power transmission scopes.

The prospect for secular growth in power demand in the Philippines is, however, similar to that of Indonesia. With current installed capacity of 16 250 MW across the key industrial and population centres of the islands of Luzon, the Visayas and Mindanao, demand for power in the Philippines is expected to grow by 60% to 29 330 MW by 2030. Even so, a shortfall of 13 000 MW is forecast in the Philippines power generation and transmission markets, requiring an estimated US\$25 billion to be invested by the private sector over the next 14 years (KPMG 2013³).

LNG: an ideal solution

Such long-term investment opportunities in the Indonesian and Philippine power generation and distribution markets have certainly garnered a lot of attention from global investors and vendors. However, the challenges in the power markets of Indonesia and the Philippines are not easy to address.

These challenges arise not only because of regulatory complexity and the existence of powerful incumbents in the two markets, but also because, at the most basic level, the maritime geographies and distributed energy requirements of these vast archipelagoes render conventional power generation, pipeline resupply and transmission approaches prohibitively expensive or technically unfeasible. This is where providers of integrated floating and terrestrial small and mid scale LNG storage, transport, regasification and power generation assets can bring transformative value to the distributed baseload and peaking power strategies of Indonesian and Philippine power generators and distributors.

The LNG supply chain assets required by a single project developer client can vary markedly. The following examples outline how small and mid scale LNG projects will be delivered

in Indonesia. If a small island offshore Kalimantan requires 10 MW of gas-fired peaking power, it could be served using a 2000 m³ floating storage regasification unit (FSRU) supplied by a 4000 m³ self-propelled LNG shuttle barge. The barge could be designed to traverse open waters and allow de-ballasting to a maximum draft of 2 m in order to navigate the shallow waters where the FSRU is moored. To cater to the power requirements of a large regional city in Kalimantan, LNG could be supplied to fuel a 450 MW gas-fired baseload power station, using a 60 000 m³ FSRU that is regularly resupplied by a 50 000 m³ ocean-going LNG carrier with no draft restrictions whatsoever.

These real-world examples point to a strategic imperative in dealing with the variety and complexity of distributed gas-fired power generation scopes in Indonesia and the Philippines.

Case studies

AG&P has been involved in LNG projects in both the Philippines and internationally. Some of the projects that the company has been involved in include the following:

E-houses

The company delivered e-houses to the US\$35 billion Inpex-operated Ichthys LNG project – one of the world’s largest infrastructure projects off the coast of Darwin, Australia.

AG&P was commissioned by the Japan Gas Corp., KBR and Chiyoda Corp. (JGC) consortium to design, construct and deliver 29 highly-engineered e-houses to support power for the massive project.

The e-houses are value-dense because they contain sophisticated electrical control and monitoring systems, which, when installed, govern the power distribution for the entire Ichthys LNG project and provide the central intelligence and control structure for the project’s liquefaction plant.

The e-houses were constructed entirely in AG&P’s advanced manufacturing facilities in Batangas, 80 km south of Manila, the Philippines. The complexity and sensitivity of the machinery inside of the e-houses was environmentally-controlled and explosion-proof throughout construction and during onsite operation. To achieve this, the company created a comprehensive utilities hook-up network at its manufacturing site to maintain environmental conditions within the e-houses and to fully test their operational status before delivery to Darwin.

Setting a safety record of over 24 million safe man-hours without lost time injury (LTI), AG&P delivered the 29 modules via 13 staggered shipments over 14 months from March 2015 to May 2016. At its peak, over 4500 employees, including welders, fitters, painters, insulators and electricians, worked day and night, across three shifts to meet the stringent delivery schedules. A large number of the workers were from the Batangas area.

Floating port

Another example is the Hydro Deck – the world’s first giant, floating port that is 150 m x 40 m with a 22 000 t capacity, capable of ballasting 12 m. It is currently being leased to the Ichthys LNG project. AG&P jointly owns and leases the unit with its partner, ALE. Conceptualised, designed and constructed by AG&P in partnership with ALE, under Lloyd’s Register class certification to the highest safety and quality standards, the Hydro Deck works in conjunction with modular offloading facilities for on-shoring heavy weight modules and infrastructure. It was custom designed to serve global projects faced with restricted offloading delivery windows due to unpredictable high tidal variations and where local port facilities are limited by scale or capability for a project’s specifications.

The unit facilitates 24/7 roll-on/roll-off operations for delivery of large equipment and project modules and enables load-in operations for combined loads of up to 17 000 t. This 24/7 process facilitates efficient, cost-effective and timely module delivery, which, in turn, helps to keep the construction timeline on-schedule and within budget.

Floating regasification unit

A floating regasification unit (FRU) has been designed by AG&P’s new equity partner, GAS Entec, to deliver LNG to the



Figure 4. Bali Benoa 50 million ft³/d LNG FRU: GAS Entec delivered the world’s first small scale FRU for the 200 MW Bali Benoa gas-fired power plant.



Figure 5. AG&P and GAS Entec offer customers a range of standardised, small and mid scale LNG solutions for the growing distributed energy requirements of archipelago nations, such as Indonesia and the Philippines.

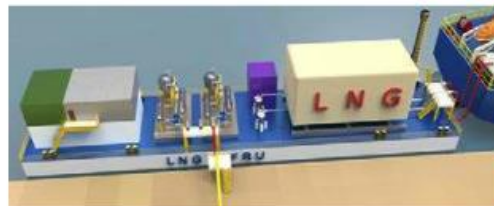


Figure 6. AG&P is finding a market for its LNG storage, transport, regasification and power solutions, taking energy from where it is abundant to where it is scarce, such as in fast-growing island nations in Southeast Asia.

island of Bali. Located in Benoa, the FRU is Indonesia's first mini LNG terminal and was officially opened by the President Joko Widodo, in March 2016.

The FRU is considered an excellent concept for a gas terminal in an archipelago, so would also be a solution for the Philippines. The FSU supplies 40 million ft³/d of gas to Bali's Pesanggaran power plant. It is projected that this energy shift to LNG at the Benoa power plant, which previously used diesel, will save Rp 1 trillion/yr – Rp 2 trillion/yr.

The FRU is a tailored solution that drives down the cost of production. It has a shorter delivery time while reducing the overall environmental impact.

LNG bunkering barge

A 2200 m³ LNG bunkering barge – the first Jones Act compliant LNG bunker barge for the marine market in North America – was also designed and engineered by GAS Entec. AG&P anticipates building vessels such as this in its facilities in the Philippines, to meet the distributed energy requirements of emerging economies in Southeast Asia.

The way forward

Small and mid scale LNG solutions, as well as the market opportunities that they open to project proponents, are comparatively new. Therefore, one must work hard to gain the confidence of not only project owners and their engineering, procurement and construction (EPC) contractors, but also that of the host communities throughout Southeast Asia where small and mid scale assets will be operating for decades to come. AG&P has collaborated with leading companies in LNG and gas engineering, such as Gaztransport & Technigaz (GTT) and GAS Entec, complementing its own expertise in the modular fabrication of turnkey plants and vessels delivered at the safety, quality and environmental standards demanded by leading EPCs and owners in the oil and gas market.

AG&P's virtual LNG pipeline comprises an integrated set of storage, delivery, cargo handling and power generation systems, including LNG carriers and shuttles, regasification terminals and smaller power plants. These small and mid scale LNG assets offer budget and schedule savings on challenging distributed energy projects in Indonesia and the Philippines.

The significant slide in oil and gas prices since mid-2014 has, in fact, created opportunities for the emerging small and mid scale LNG sector, as the low cost of feedstock is prompting public and private sector power generators to invest in new gas-fired power. LNG as a fuel is becoming central to the project development plans of power producers. Tailored deployment of small and mid scale LNG assets can transform the power sectors in archipelago nations, such as Indonesia and Philippines. **LNG**

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