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In this issue:

Natural gas security review focuses on Chinese demand and LNG fleet

International Energy Agency review considers areas with varying degrees of concern and optimism

Global natural gas markets are being reshaped by the development of major emerging LNG buyers such as China and by the rising production and export projects underway in the United States and elsewhere.

China's supply shortfall over the last winter, which triggered ripple effects around the world, highlighted the pivotal role of LNG in enhancing global gas security and flexibility of supply.

Figure 1: Evolving cost of increased LNG shipments to China

Demand

"The country's increasing need for natural gas was largely met by imports of LNG, which increased by 46 percent year-on-year and represented around 80 percent of the total increase in imports," said the International Energy Agency in its "Global Gas Security Review".

"The jump in demand was so strong during the winter that it grew faster than available supply, resulting in shortages in some regions and soaring import prices over the winter months," it noted.

In Europe, the response to a string of cold spell episodes and unplanned gas supply outages also showed the success of integration and emergency policy measures.

The analysis finds that, while there have been real improvements in LNG flexibility that can contribute to easing supply shortages, uncertainties remain for the future evolution of gas markets.

"This includes a risk of tightening from insufficient investment in production and infrastructure capacity, or questions surrounding future shipping capacity growth, a pre-condition for LNG market flexibility," the IEA explained.

"These uncertainties could have an impact on price volatility and hurt consumers, especially the most price-sensitive emerging buyers, and cause additional security concerns," it added.

The report also addressed how LNG markets were reshaping shipping requirements. "The risk of a lack of timely investment in the LNG carrier fleet could pose a threat to market development and security of supply, which could materialise even earlier than the risk of insufficient liquefaction capacity," said the report.

"To address these issues, supply flexibility remains a key prerequisite to ensure further global gas trade development and security," it added.

Flexibility

The IEA said that LNG flexibility had evolved with the development of secondary markets, emphasizing the role of portfolio players.

"Our report contributes to a better understanding of gas security of supply by providing more transparency on LNG markets and their role in global gas system balancing," said Fatih Birol, the IEA's Executive Director.

"It is my hope that it will be a useful and positive contribution for policymakers and market stakeholders," he stated.

Short-term LNG imports soared in various regions to meet rising demand. China's LNG imports last year totalled 52 billion cubic metres, 46 percent higher than in 2016, and China became the world's number two LNG importer after Japan, a position which Korea had held since 1994.

"The increase in LNG was four times the increase in pipeline imports. As a result, China's reliance on LNG has grown from 17 percent of total natural gas supply in 2016, to 22 percent in 2017, and 24 percent in the first half of 2018.

Australia supplied the largest share of the increase in LNG imports to China during 2017, providing 7.35 Bcm mainly via long-term contracts, followed by Qatar (3.47 Bcm) and Malaysia (2.24 Bcm). The US supplied 1.84 Bcm more than it did in 2016.

Regasification terminals located on the Chinese south coast delivered a total of 18.9 Bcm during 2017, or 36 percent of total LNG imports (52Bcm), while terminals in the north delivered 17.6 Bcm (34 percent) and those on the east-central coast of China received 15.4 Bcm (30 percent).

Additionally, a subsidiary of PetroChina announced it would accelerate the construction of a further six new Underground gas storage (UGS) facilities.

They will be located in Daqing Shengping (Heilongjian province), Pingdingshan (Henan), Huai An (Jiangsu), Liaohelei (Liaoning), Dagang Lujuhe (Tianjin) and Zhejiang Baiji (Zhejiang).

Volcanic project

Daqing Shengping will be the first volcanic rock gas storage facility in the world and will receive volumes from the

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Sino-Russian pipeline and will play an important role in meeting peak demand in the northeast provinces. The facility is due to be in operation by 2025.

Sinopec, owner of the other two existing UGS facilities, was expected to open its third facility at the end of 2018.

"With a working gas capacity of 4 Bcm, and a designed capacity of 10.4 Bcm, the facility is being constructed in the depleted Wen 23 gas field in the Zhongyuan oilfield, Henan province," said IEA report.

"It will supply gas to northern cities during the winter heating season," it added.

"Sinopec also reported last year that it was conducting preliminary works on the Huangchang salt caverns and Guanghua sandstone reservoir in the Jianghan oilfield of Hubei province," said the IEA.

"According to the findings, the 40 potential cavities at Huangchang could have a total storage capacity of 5.2 Bcm, while the Guanghua reservoir could hold 3.45 Bcm," the report explained.

The Northeast Asian market (which consists of Japan and Korea) heavily relies on LNG imports.

Mature

This mature market, with demand of over 170 Bcm in 2017, is served by a diversified portfolio of suppliers built up over decades.

The Japanese and Korean markets both experienced demand shock in the aftermath of the 2011 Great East Japan Earthquake, which significantly affected Japanese energy supply with the shutdown of nuclear power stations.

"Northeast Asia imported LNG from a total of 22 countries last year, of which 60 percent or almost 100Bcm was from three countries, Australia, Malaysia and Qatar," said the report.

'In the absence of underground storage facilities, variability in consumption needs is met by flexibility in LNG imports ...'

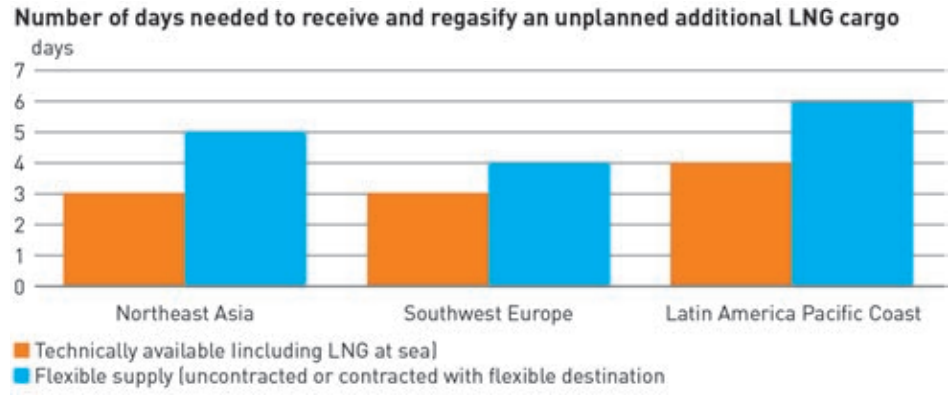


Figure 2: Re-loaded cargoes can be moved faster within Europe

More than 65 percent of total LNG imports came from within the Asia and Pacific region.

"Seasonality is observed across monthly demand, with a little over 6 Bcm in seasonal variance. The months of peak demand are in the northern hemisphere winter (December to March), with another slight demand increase in the summer (July and August)" said the report.

"These increases are due to higher residential heating needs (both power generation demand and direct heating devices) in winter and air conditioning (power generation demand) in the summer," it added.

"In the absence of underground storage facilities, variability in consumption needs is met by flexibility in LNG imports and, to a lesser extent, by storage in LNG tanks at receiving terminals or in specific storage facilities," stated the IEA.

LNG storage capacity in Asia and elsewhere has been increasing since LNG imports began in the late 1960s, mainly by converting oil import and storage terminals into LNG import terminals.

Send-out

Over 20 Bcm of LNG storage capacity and 360 Bcm of LNG send-out capacity are currently installed in total, with an average utilisation rate of 54 percent. The average conceals a wide variation.

The IEA review also analysed the impact of LNG market growth on shipping needs.

The resulting shipping balance (expressed in standard vessel equivalent) shows that after strong growth in shipping capacity in 2018 and 2019, leading to stagnation of the fleet utilisation rate, this rate then rapidly increases to reach above 90 percent from 2020 and to exceed 100 percent by 2023.

"However, tensions are likely to materialise before reaching full utilisation, and it can be assumed that under the forecast assumptions the LNG carrier market could become tight as soon as 2020," said the IEA.

Simplified view

This forecast assumes a simplified view of the LNG shipping market and therefore tends to underestimate several limits to vessel availability:

- Lack of fungibility: in spite of its limited size compared with other areas of seaborne trade, LNG shipping is technically not a single market but rather an aggregation of submarkets depending on geographical basins, vessel size, technology and fuel.
- Accessibility to ports and canals is another discriminating factor, with restrictions applying according to width, water depth or height.
- Portfolio barriers to fleet optimisation: the shipping need forecast assumes by default that cargoes can be shared and pooled, such as in a pipeline. Such optimised use of LNG vessels faces several limitations:

"Most charterers have shipping portfolios with long-term charters and are not always eager to sub-charter when they have unused capacity for fear of missing optimisation opportunities and owing to the market's lack of cargo pooling," explained the IEA.

"The technical ability to share a cargo and perform partial loading and offloading is often limited by technical considerations, such as the risk of high-impact pressure on the tank surface created by liquid movement inside the tank, also known as sloshing," the report added.

The lack of co-ordination between short-term trade requirements and technical specifications/vessel location (as explained in the previous section) can result in vessels being idle in a tight market.

"While the average age of an LNGC is 10 years, ship owners usually keep even the oldest vessels in good condition due to their high construction and replacement costs," noted the IEA.

Competitive

"As these vessels grow older the competitiveness gap with newbuild LNGCs will increase, causing price spreads and the potential emergence of submarkets for less-efficient vessels. Keeping the oldest vessels in the market (provided that they are still fit for purpose) will help alleviate risks of tonnage shortage," it said.

"But, the availability of these oldest vessels may be challenged as major importing countries adopt more stringent port regulations," stated the report.

Such risk factors could result in a tighter LNG shipping market happening sooner, especially in winter when most buyers compete for spot LNG cargoes.

"Additional LNGC orders are therefore needed in the short term in order to avoid shipping scarcity issues. During the first six months of 2018 some 26 firm orders have been placed (LNG Journal, 2018), helped by more attractive yard pricing," said the IEA,

"This may prove insufficient to keep the global LNGC market in balance, taking lead times into consideration - the earliest a newbuild can now be delivered is 2021," it added.

"The impacts of a tight LNGC market would be higher and more volatile spot charter rates, as well as a greater risk of vessels being unavailable in the short term, especially in the Atlantic Basin where LNG prices are usually less attractive than in the Pacific," said the IEA.

"LNGC availability and volatility in charter rates could therefore become a medium-term concern for the security of natural gas supply," it added.

"To mitigate this risk - and in addition to investment in newbuild capacity - further liquidity and transparency are required to alleviate some of the inflexibilities in the current LNGC trade," it concluded. ■

LNG and pipeline natural gas volumes take lead in efforts for Chinese environmental clean-up

President Xi Jinping hopes more LNG terminals, storage and pipelines will lead to much lower pollution

China is currently in the midst of its "Action Plan on Prevention and Control of Air Pollution" to improve overall air quality across the nation during a five-year period.

The programme has ensured high demand for LNG shipped from supplier nations such as Australia and Qatar that have provided cargoes since imports began in 2006.

Target areas

The main objectives of the action plan are to reduce heavy pollution and improve air quality in the Beijing-Tianjin-Hebei region, the Yangtze River Delta and the Pearl River Delta.

Following the introduction of the action plan, China's national oil companies (NOCs) made refinery upgrades to meet the new fuel standards.

Power companies completed retrofits on over 800 gigawatts (GW) of coal plant capacity and shut down over 100 GW of old and inefficient coal plants.

"During this period, gas-fired power generation capacity grew rapidly, reaching 76 GW, and wind and solar energy capacity also expanded quickly. Gas demand grew steadily, averaging about 15 billion cubic metres per year for the period 2011-2016," said the IEA's "Global Gas Security Review".

The 2013 action plan's objectives included the elimination of coal-fired boilers with an average rate of 10 tonnes per hour (t/h) of steam or less.

In 2014, the country had a total of 460,000 of such coal-fired boilers with an average capacity of 4 t/h (177 million t/h of total capacity), accounting for around 16 percent of overall coal consumption.

Coal problems

The situation in relation to coal-fired boilers in Beijing-Tianjin-Hebei can be summarised as follows:

- By 2016, industrial and residential coal-fired boilers with a steam capacity of less than 10 t/h had been eliminated in urban areas and newly built rural areas. Beijing and Tianjin had been accelerating the replacement or retrofitting of coal-fired boilers since 2012. During 2012-16 approximatively 1,300 coal-fired boilers were shut down or substituted by gas.
- During the spring of 2017 the switch from coal to gas gained momentum. In March 2017 the government issued the Beijing-Tianjin-Hebei and surrounding areas with the Air Pollution Control Work Plan in order to ensure the objectives and tasks defined were achieved. Coal-fired boilers of less than 10 t/h in urban areas were expected to shut down by October 2017.
- At the end of 2016, the National Development and Reform Commission (NDRC) and the National Energy Administration (NEA) released a new five-year energy development plan, where the share of gas was to be increased from 5.9 percent in 2015 to 8.3-10 percent by 2020.

Between May and September 2017, the Ministry of Ecology and Environment (at the time known as the Ministry of Environmental Protection) fined or disciplined around 18,000 companies for not complying with the emission rules.

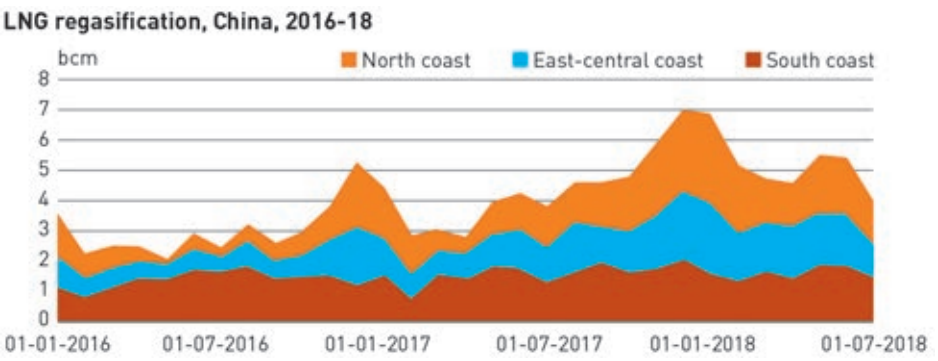
Punishment

The punishment included a total of $130 million in fines and disciplinary action against around 12,000 officials.

President Xi Jinping repeatedly stressed the need for environmental protection during his speech at the 19th Congress of the Chinese Communist Party, when he stated that, among other goals to be met between 2020 and 2035, there would be a fundamental improvement in the environment to achieve a "Beautiful China".

"Largely as a consequence of these initiatives, natural gas demand in China increased by over 30 Bcm in 2017, double the average of the previous five years. A portion of the conversions targeted residential coal use for heating, meaning that peak demand would increase even more quickly in the colder northern provinces," said the IEA report.

"Additionally, the robust industrial recovery experienced during 2017 also helped boost the need for natural gas: in 2015 industry consumed 58 Bcm, while in 2017 industrial consumption reached almost 78 Bcm (a 34 percent increase)," added the report.



Import capacity is still increasing along the south and east coasts of China

Because domestic production is falling well short of target, particularly in the winter months, pipeline imports also failed to keep pace.

Turkmenistan

During the first quarter of 2018 volumes from the former Soviet republic of Turkmenistan decreased by 3.8 percent compared to the same period last year.

Turkmenistan has experienced a series of upstream limits and compressor failures since November 2017, especially during January when volumes dropped by 14.2 percent compared with the previous January.

Turkmenistan suspended deliveries three times during that month, reducing supply by 20 million cubic metres per day compared with planned volumes.

"Consequently there was limited gas supply to 12 major distributors across the country, including four located in northeastern Shaanxi (where supply was reduced by 9 percent on average), Gansu (where some industrial gas users were forced to shut down and gas-fuelled heating boilers had to run intermittently) and Qinghai provinces. Supplies returned to normal in February," the IEA explained.

LNG build-out

While having to cope with supply disruptions, China has no major pipelines connecting the north to the south and after natural gas demand soared during last winter, especially in the northern regions due to heating needs, Chinese companies are implementing further new measures.

China National Offshore Oil Corp., the owner of the largest LNG terminal network, brought into operation its ninth regasification terminal in Shenzhen Diefu on the south coast.

And thanks to an agreement reached with China National Petroleum Corp., CNOOC will be able to deliver some capacity to the south so that CNPC can divert the volumes to northern China this winter.

CNPC subsidiary PetroChina has committed to invest more than US$3.8 billion to implement 33 interconnection projects starting in 2018-2019 to optimise the pipeline system (national and regional) and solve the bottleneck problems.

Since the beginning of 2018, PetroChina has been working with China Petroleum & Chemical Corporation, known as Sinopec, and CNOOC to connect the Guangdong LNG terminal to the regional system and connect Guangxi LNG terminal to the China-Myanmar pipeline to serve demand in the south.

CNOOC has also said it would progressively provide third-party access to their terminals in the provinces of Guangdong and Zhejiang during the second half of 2018, allowing other NOC or private companies to unload their LNG.

Sinopec also has various measures in place to reinforce winter supplies, such as renting 2,600 trucks to deliver LNG from the south to the north, increasing the purchase of spot cargoes, and improving its pipeline connection with CNPC and CNOOC pipelines.

Expansions

Petrochina and Beijing Enterprises Group announced the expansion of the

Tangshan LNG terminal with the construction of four additional storage tanks.

State-owned company CNOOC started the expansion of the Ningbo LNG terminal, adding another 4.1 Bcm per annum to its regasification capacity.

CNOOC also started the construction of its Jiangsu Binhai LNG terminal and the Zhangzhou LNG facility in Fujian province.

The Tianjin LNG terminal will be adding another six LNG storage tanks to help meet demand in the northern region of the country.

In late July Sinopec received Shandong Provincial Development and Reform Commission approval for expansion of its Qingdao LNG facility.

Sinopec is also planning to keep pursuing the development of three new LNG terminals: in Wenzhou (Zhejiang province), in Nantong (Jiangsu) and in Longkou (Shandong).

Inland LNG

Sinopec aims to reach 60 Bcm per annum of regasification capacity by the end of 2023 through the expansion of its current three terminals (Qingdao, Tianjin and Beihai with a current capacity of 12.3 Bcm per annum).

China is starting to develop inland LNG receiving and storage terminals in order to keep expanding the LNG market.

The private companies Guanghui Energy and China Huadian Corp. have announced their intention to build an inland LNG terminal in Yueyang city in Hunan province, with a capacity of 2.72 Bcm per annum.

The terminal is due to be built in three phases: the first phase is expected to be ready by December 2020 and will have a capacity of 0.68 Bcm per annum. The LNG will be sourced from Guanghui's LNG terminal in Qidong (Jiangsu province). US major ExxonMobil has also signed a preliminary deal with Guangdong Yuedian Group, as well as the local governments of Guangdong and Huizhou, to build a petrochemical complex and invest in an LNG terminal in Huizhou. ■

For the Record

ABS, the US maritime classification society, has granted approval to a deepwater floating liquefied natural gas production hull designed by Hyundai Heavy Industries of South Korea. The US class society said the FLNG hull design is based on that of a conventional LNG carrier, combined with the requirements of FLNG production, such as structural reinforcements to take topside module loads and with an operational lifespan of 25 years without dry-docking. "ABS is the market leader in the classification of offshore drilling and production units, including FLNG vessels, with more than 150 floating oil and gas facilities in the ABS-classed fleet," said ABS Vice President Global Gas Solutions, Patrick Janssens. "We have partnered in leading innovation in the offshore sector for 60 years, and we are proud to enable this latest advanced deepwater FLNG Hull approach from HHI," stated Janssens. ABS explained that Hyundai had developed a technically feasible FLNG hull approach, combining the latest industry trends with first-class shipbuilding practices and ABS rules.

A low-cost South Korean Near-Shore FLNG Hull was successfully developed and achieved ABS Approval in Principle in 2017. ABS said the same team from HHI and ABS has now worked to deliver this harsh environment Deepwater Hull to meet increasing market demand. "In the current emerging gas market, a ready-to-convert offshore FLNG hull, with ABS certification, at affordable capital expenditure is an important product for monetization of gas reserves around the globe," said Hyungkwan Kim, Executive Vice President at the HHI Shipbuilding Division. "This new line-up from HHI responds to the requirements of operators and combines HHI's unparalleled expertise in shipbuilding with ABS' stringent safety evaluation," he added. The design features a barge-shaped hull, a French GTT-supplied Mark III containment system with storage capacity of about 192,000 cubic metres and provisions for an internal turret and 45,000-ton of topside modules to deliver 2.5 MTPA of LNG. ABS also noted that the Malaysian energy company Petronas had selected ABS to class the newbuild "PFLNG 2" production hull that will be deployed over the deepwater Rotan gas field offshore Sabah, Malaysia.

ABS held its annual China and Hong Kong business gathering at Xiamen port city on China's southeast coast at which the main issues were LNG fuel and the International Maritime Organization's sulfur cap for shipping. ABS said its annual China gathering brought together industry leaders to discuss "global challenges" facing the maritime sector. The group heard strategies to meet the IMO 2020 sulfur cap, as well as a look ahead to 2030 when vessel data will play a significant role in compliance management. "ABS has become the classification organization of choice for the Chinese shipbuilding and shipping industry, with a long track-record of working closely together on innovative projects in both marine and offshore," said Tony Nassif, ABS Executive Vice President and Chief Operating Officer. "The China and Hong Kong Committee enables ABS to bring together the diverse expertise of many knowledgeable stakeholders to continue to address the industry's complex challenges," added Nassif. Committee members come from ABS as well as ship owners, operators, charterers and representatives from flag administrations, owner associations, as well as the shipbuilding and insurance sectors. ABS also presented its work with industry partners on digital technologies, designed to improve delivery of classification services for clients.

"ABS is working at the forefront of leveraging new technologies and unique designs, with companies across China and Hong Kong, on innovative projects from dual-fuel applications, to very large ethane carriers and LNG-powered vessels, to novel FSRU and subsea production technology systems," explained ABS Senior Vice President for Eastern Hemisphere Operations, Eric Kleess. "Serving the world's largest shipbuilding nation gives us the opportunity to engage with industry and clients, offering guidance and expertise, while also forging novel solutions to help solve industry complexities," added Kleess. ABS pointed out that it had a long history in China and today serves the industry through a network of 12 offices across the mainland and Hong Kong. "The ability of ABS to provide innovative and, yet also, practical solutions enable it to be a preferred classification society in China," it said. "ABS is the largest classification society in Hong Kong based on both existing tonnage and new construction orders," the class society added.

ADANI GROUP Chairman Gautam Adani and Total Chairman and Chief Executive Patrick Pouyanne have signed an agreement for a 10-year investment plan in the Indian market, including joint ventures in liquefied natural gas and a nationwide network of stations for cleaner fuel. Adani and Total said they would set up a first Indian venture with the objective of building a retail network of 1,500 service stations over a period of 10 years, according to their joint statement. They would also set a target for developing various LNG regasification and import terminals, including the Dhamra terminal on the East Coast, where no Indian LNG facilities currently exist. Adani had been seeking a major partner for its East Coast terminal at Dhamra port on the Bay of Bengal in the state of Odisha, formerly known as Orissa. Adani is also a stakeholder in the new Mundra LNG import terminal in Gujarat state on the West Coast "We are looking forward to this opportunity to touch millions of lives by leveraging our collective footprint and domain expertise in the energy sector," said Adani Chairman Gautam Adani. "It also enables the Adani Group to be part of the country's vision of adopting cleaner energy," stated the Adani Chairman. Adani Gas, its subsidiary, is developing compressed natural gas (CNG) stations for the transport sector in India that is interesting for Total, which is already a gas fuel market leader in the US through its stake in California-based Clean Fuel Corp. In regard to Indian LNG, Total had previously held a 26 percent stake in the Hazira LNG import terminal near Mumbai, operated by Royal Dutch Shell. However, the French company agreed to sell the Hazira stake to Shell while remaining a supplier of some LNG volumes to the facility. As part of the Hazira stake sale Total signed an agreement to supply 500,000 tonnes annum for the Indian market over five

years from its global volumes of more than 40 million tonnes per annum.

Total has stakes in LNG production ventures worldwide, including the recently started Ichthys LNG plant in Australia and the Yamal liquefaction facility in Russia, and is looking for outlets for supplies in one of the world's fastest-growing economies. "India's energy consumption is set to grow the fastest among all major economies in the world over the next decade," said Total CEO Pouyanne. "The partnership between Total and the Adani Group illustrates our joint commitment to assisting India to diversify its energy mix and to ensure a supply of reliable, affordable and clean energy to consumers," added Pouyanne. "We are thrilled to build this broad partnership with the Adani Group, benefitting from its in-depth knowledge of the Indian energy market, as well as its access to infrastructures through a significant footprint in several of the country's key ports," stated the French CEO. Total has been keen to invest in the gas market in India and finds the Adani Group a suitable vehicle as it owns downstream and midstream infrastructure, including stakes in the West and East Coast LNG terminals. The East Coast Dhamra terminal when completed will serve city-gas and power projects as well as industrial customers. Natural gas from the proposed Dhamra facility will be an important supply source to the Urja Ganga Pipelines Project for national infrastructure being pushed forward by Prime Minister Narendra Modi to boost East Coast city-gas connections. The pipeline expansion venture involves laying an additional 2,540 kilometres of pipelines in five eastern states to provide gas for 40 districts and 2,600 towns and villages.

BROWNSVILLE in Texas said it was looking forward to hosting the Rio Grande LNG export plant, to be located in the Port area, and outlined its progress and benefits. The LNG project being developed by Houston, Texas-based NextDecade Corp., was highlighted in the Port's monthly report. The Port noted that Rio Grande LNG was on track and was expected to receive federal authorization in July 2019 to proceed with construction. It added that this timing was based on the Notice of Schedule released by the Federal Energy Regulatory Commission. The Port said that the FERC notice sets the dates for the final steps to bring the project to the construction and operational phase with the provision of between 4,000 and 6,000 jobs to the Lower Rio Grande Valley. The next major part of the FERC process was the release on October 12, 2018, of the draft Environmental Impact Statement, triggering a public comment period. "After further review, FERC is scheduled to release the final EIS in April 2019," it said.

"NextDecade expects to announce contracts in the first half of 2019 with customers who will buy LNG from Rio Grande LNG once commercial operations begin," said the update from the Port. "The Houston company previously completed front-end engineering and design for the project and expects to finalize a construction contract in 2019, prior to a final investment decision moving the project forward," it added. "NextDecade recently announced a competitive bid process to select an engineering, procurement and construction contractor with the technical and financial strength to safely deliver the project on-time and on-budget," it said. The Port noted that the Rio Grande has a 984-acre site located in the Port area with optimum plans to build a liquefaction and export facility with capacity of 27 million tonnes per annum, comprising six liquefaction Trains. The site would include four storage tanks each of 180,000 cubic metres capacity and with two marine berths with a turning basin and deepwater port access.

CHART INDUSTRIES, the US-based global manufacturer of engineered equipment for the LNG, industrial gas and energy industries reported solid third-quarter results and said it expected more LNG project orders through 2019 as developers moved to its products. Both the Asia-Pacific and European regions also experienced strength driven by standard tanks and LNG trailers. "While we do not anticipate large LNG project orders until the first half of 2019, we do expect to receive a small LNG-related order (less than $20 million) in the fourth quarter of 2018," said Chart. The company said its Integrated Pre-cooled Single Mixed Refrigerant (IPSMR) technology continued to be well received in the market. "Within the quarter, a major oil and gas company completed an initial technical evaluation of Chart IPSMR LNG liquefaction technology. They have indicated that they may consider IPSMR for inclusion to compete in future LNG projects," stated Chart. In

the Energy and Chemicals division, Chart said orders in the third quarter increased 38 percent, excluding the Hudson acquisition. "This reflects the continued strength in the United States natural gas processing market, where year-to-date we have sold equipment to 28 cryogenic gas plants in the West Texas Permian and Marcellus Basins," it added. "Additionally, in the third quarter, we received $3.3M of orders for an on-ship boil off gas re-liquefaction system," said Chart. Net income from continuing operations for the third quarter of 2018 was $21.5 million or $0.65 per diluted share, excluding $700,000 of income from discontinued operations, compared with loss of $600,000 in the year-ago quarter. Sales of $272M grew 34 percent organically over the third quarter of 2017, on a continuing operations basis, driven by strength in natural gas processing and US packaged gas. "During the third quarter of 2018, we announced the completion of our strategic review of the oxygen-related products with a definitive agreement to sell CAIRE Medical to NGK Spark Plug Co. for $133.5 million, a gain on the sale," said Chart. Outside of quarterly activities, Chart also signed an agreement to acquire Italian company VRV S.p.a., an engineer and designer of cryogenic equipment that will complement Chart's own offerings.

VRV, located near Monza, northeast of Milan, is a family-led business and was established in 1956 with two divisions, the Cryogenic division and the Energy & Petrochemical unit. The Italian company is one of Europe's leading niche manufacturers of pressure equipment for the cryogenic, petrochemical, refining and energy industries. Chart agreed to pay 125 million euros ($147M), which will be funded by a combination of Chart's available cash in hand and credit and will also assume VRV's outstanding debts of up to $83M. "The VRV acquisition is expected to add initial annual net sales of $120M, achieve significant cost synergies related to operational efficiencies and sourcing and close in the fourth quarter of 2018," said Chart in its earnings statement. To support these strategic moves as well as Chart's expanded focus on geographic expansion outside of North America, the company said it was realigning its divisions. It now reports its results in Energy & Chemicals (E&C), Distribution & Storage Western Hemisphere (the Americas; D&S West), and Distribution & Storage Eastern Hemisphere (Europe, Middle East, and Asia including China; D&S East). The CryoBiological product line that previously was reported through BioMedical and is not included in the pending sale of CAIRE is reflected in the D&S West segment "The sequential gross margin as a percent of sales improvement in our continuing operations reflects the execution on our right-sizing efforts that have continued throughout 2018," stated Chief Executive Jill Evanko. "Coupling those efforts with our recent launch of the 80/20 process in D&S West, we expect further margin expansion in 2019," added Evanko. "Additionally, the strategic reallocation of capital from the pending sale of CAIRE to the acquisition of VRV will allow us to grow faster than originally forecasted in 2019 and achieve our margin targets earlier in our three-year outlook," stated the CEO.

CHENIERE Energy Chief Executive Jack Fusco has provided a positive growth outlook for US liquefied natural gas exports to Asian markets, including China, during an energy forum at Rice University in Houston, Texas, and said LNG would be produced soon at the two newest Cheniere processing Trains. The Cheniere CEO said he was confident about the prospects for US LNG exports even amid market uncertainties and US trade tensions with China. He also stated that Cheniere expected to begin producing LNG shortly from the fifth liquefaction Train at Sabine Pass, taking overall output to 22.5 million tonnes per annum with one more Train expected to be built at the facility. Cheniere is also constructing a second export plant at Corpus Christi in Texas and is making progress towards putting the first Train on stream. Both were originally scheduled to produce LNG before the end of 2018. Fusco said that the Sabine Pass Train 5 was continuing with its commissioning process. "We should be making our first LNG there shortly on that Train," said Fusco. "Corpus Christi Train 1 is also ahead of schedule and we will be making LNG there shortly. It's neck and neck to see which one will produce first," he stated.

Fusco also noted that Cheniere had signed two long-term supply contracts with China National Petroleum Corp. (CNPC) in February 2018. The last Cheniere cargo shipped to China arrived at the start of September. Under the sales deals with Cheniere's subsidiaries, Corpus Christi Liquefaction and Cheniere Marketing, CNPC through its subsidiary PetroChina would purchase around 1.2 million tonnes per annum of LNG. Houston-based Cheniere said a portion of the supply would begin in 2018 and the balance in 2023. "They signed a 25-year contract," said Fusco of the Chinese contract. "They have an all-in cost that's less than $8 per MMBtu. The Japan, Korea price marker (JKM) is trading at $12. They are going to lift (cargoes) all day," stated Fusco. The Cheniere CEO explained that US developers must have long-term offtake agreements to satisfy bankers, investors and the broader market that they will be able to pay off their obligations and make a profit. "I have shareholders," said Fusco said. "I have to meet my financial targets or I won't have a job. We have a business to run," he added.

CHINA Petroleum and Chemical Corp., also known as Sinopec, is in talks to buy more liquefied natural gas from Papua New Guinea from existing production and from plans by the Oceania nation to more than double its output to over 20 million tonnes per annum. Shareholders in the PNG LNG plant have said the supply deal from existing volumes would likely start in the months ahead and would be for an initial period of around three years. Sinopec is already a buyer of cargoes from the plant. The PNG plant's marketing executives have been offering 1.3 million tonnes per annum to buyers. The plant, located northwest of the capital Port Moresby, has a total nameplate capacity of 7.5 MTPA. However, the facility, operated by ExxonMobil, is achieving a record production rate from its two operating Trains and they are on track to produce as much as 9.2 MTPA. The latest PNG supply accord follows one signed in June 2018 with another Chinese major, PetroChina, adding to the existing 6.6 MTPA already under long-term contract at the PNG plant involving buyers like Sinopec, Japanese companies Jera Co. Inc. and Osaka Gas as well as CPC Corp. of Taiwan. The shareholders in the PNG LNG plant as well as in the proposed Papua LNG joint venture are also continuing discussions on the proposed construction of three additional LNG Trains with total capacity of around 11.25 MTPA.

PNG's total annual LNG output would then climb to 20.45 MTPA before the new Trains are fully ramped up. The liquefaction plant would have two new Trains to process gas from the new Papua

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LNG project, also involving French major Total, and one Train for the planned PNG LNG expansion by existing shareholders. A total of 31 cargoes were shipped from the PNG plant in the third quarter of 2018 and a good proportion headed for China and Sinopec during the quarter and in October. The 177,000 cubic metres capacity vessel "Gigira Laitebo" unloaded a PNG cargo on September 4 at the Qingdao terminal in the eastern province of Shandong. Two other shipments were sent to Qingdao. The 171,800 cubic metres capacity vessel "Papua" delivered a cargo on September 21 and the 177,000 cubic metres capacity carrier "Spirit of Hela" unloaded another PNG cargo on October 10 at Qingdao.

EGYPT is winding down its floating storage and regasification unit contracts for LNG imports as the Arab nation's natural gas crisis has eased with the discovery and development of new offshore gas fields in the East Mediterranean and the Nile Delta. Before the discovery of the giant Zohr field in the East Med, Egypt was forced to import LNG from 2015 to two FSRUs deployed at the port of Ain Sokhna on the Gulf of Suez. The Egyptians are halting LNG imports and are even seeking to have regular exports of LNG from facilities such as the re-started Idku liquefaction and export plant, just east of the port of Alexandria. Hoegh LNG Holdings has now agreed with Egypt Natural Gas Holdings Co. (EGAS) to amend the time charter of the FSRU "Hoegh Gallant". "Under the amended contract, the 'Hoegh Gallant' will be chartered as an LNG carrier to a third party, and Egas will compensate for the rate difference between the original FSRU contract and the new LNG carrier time charter," explained Hoegh. "The amended contract is expected to become effective in October 2018 and will run to April 2020, the termination date of the original five-year FSRU contract," added the Norwegian company.

As part of the original FSRU contract with EGAS, Hoegh LNG has certain equipment installed at the jetty at Ain Sokhna. Hoegh said the book value of this equipment was around $9 million and since the market value and alternative use of such equipment was unclear, Hoegh expects to record an impairment for a corresponding amount in its third-quarter 2018 earnings. "We are proud to have provided FSRU services to EGAS since 2015, during a period in which the 'Hoegh Gallant' regasification capacity was fully utilized, contributing strongly to balancing supply with demand in the Egyptian natural gas market," said Hoegh Chief Executive and President Sveinung J.S. Stohle. "Under this amended contract we maintain our highly valued relationship with EGAS, which we hope to further expand in the future as Egypt emerges as a regional energy hub," added Stohle. Egypt's gas crisis started during the "Arab Spring" social upheavals in North Africa and the Middle East in 2014 when it diverted natural gas supplies to meet growing domestic demand and to avoid power cuts. However, the Idku LNG export plant re-started some exporting in 2017 under the operatorship of Royal Dutch Shell, which acquired original operator BG Group. A second LNG export plant at Damietta has capacity of 5.5 million tonnes per annum of LNG and has two storage tanks of 150,000 cubic metres capacity. Damietta is 80-percent owned by Union Fenosa Gas, a joint venture between Spain's Gas Natural, now known as Naturgy Energy Group, and Italian energy company Eni. The remaining 20 percent belongs to EGAS and Egyptian General Petroleum Co.

ENAGAS, the Spanish natural gas network operator and LNG terminal owner, posted a third-quarter net profit of 106 million euros ($122.7M) as domestic industrial demand for natural gas edged higher, while it also reported progress on Europe's Southern Gas Corridor venture. The owner of four LNG regasification plants in Spain and two in South America said its third-quarter earnings took the Enagas nine-month total to a net 325.7 million euros ($377M), around 1 percent higher than the same period a year ago. The company operates 11,000 kilometres of high-pressure gas pipelines in Spain and 19 compressor stations and said domestic demand for natural gas grew by1.7 percent in the first nine months of 2018. "This was mainly due to the good performance of industrial consumption, which represents 60 percent of total demand," said Enagas. In its international operations, Enagas said it invested 153.6M euros in the first nine months of the year, mainly in the Trans Adriatic Pipeline (TAP) project in which the company has a 16 percent stake. The overall project is almost 80 percent complete and is part of the Southern Gas Corridor to link the Trans-Adriatic Pipeline to the Trans-Anatolian Pipeline from the Caspian Sea to near the Turkish-Greek border.

The pipeline will then cross Greece and Albania and the Adriatic Sea before coming ashore in Southern Italy to compete with European LNG shipments. Enagas has four domestic import terminals around Spain at Barcelona in the northeast, Cartagena in the southeast, Huelva in the southwest and Gijon in the northwest. It also owns a 50 percent stake in the facility serving the northwest city of Bilbao. Enagas noted that along with Belgian network operator Fluxys an agreement was reached in the third quarter for the sale of their joint stake in Sweden's transmission system operator Swedegas to the First State Investments equity fund for 1.02 billion Swedish crowns ($114.5M). Enagas said that among its remaining overseas assets it still held a 40 percent stake in the Altamira LNG terminal on the Gulf Coast of Mexico in partnership with the Dutch storage company Vopak, owner of the remaining 60 percent. Enagas is also the majority shareholder of the Quintero LNG regasification terminal in Chile.

ENI of Italy said it signed a contract in Mozambique to explore a new offshore block in the Northern Zambezi Basin after its successes in the Area 4 block of the Rovuma Basin from where it is currently developing onshore and floating liquefied natural gas projects. Eni said its executive signed the latest agreement with the Mozambican Ministry for Mineral Resources and Energy, Ernesto Max Tonela. "With this acquisition, Eni further strengthens its presence in Mozambique, a country that has a strategic relevance for the company," said the Italian company. The A5-A block was awarded to Eni as a result of its participation to the latest and fifth competitive licensing round launched by the southeast African nation. The block for exploration and development covers an area that extends over 5,100 square kilometres at water depths of between 300 metres and 1,800 metres. Eni said the area is a completely unexplored zone in front of the town of Angoche in Nampula province and located about 1,500 kilometres northeast of Maputo. As operator of block A5-A, Eni will hold a 59.5 percent share while other partners include South African energy company Sasol with 25.5 percent and Mozambican state company Empresa Nacional de Hidrocarbonetos (ENH) with 15 percent. Eni has been present in Mozambique since 2006, following the acquisition of a participation in the contract of Area 4 of the Rovuma Basin.

"Following an intense exploration campaign that spanned just three years, between 2011 and 2014, the supergiant gas fields of Coral, Mamba and Agulha were discovered with estimated natural gas reserves in place of 2,407 billion cubic metres," explained Eni. The Coral FLNG project is now being constructed and Eni also has a share in the onshore Mamba complex and LNG plant. Coral FLNG will have a liquefaction and export capacity of around 3.4 million tonnes per annum and is expected to come on stream in 2022. The onshore development programme includes the construction of a liquefaction plant composed of an initial two large-scale Trains each with 7.6 MTPA of output for a total 15.2 MTPA of LNG production with prospects of expansion. The onshore Mamba project is expected to be sanctioned in 2019 and production is scheduled to start in 2024. The Area 4 consortium is formed by Mozambique Rovuma Ventures, comprising Eni 25 percent, ExxonMobil 25 percent and China National Petroleum Corp. with 20 percent. The remaining 30 percent of shares in the licence are held in parcels of 10 percent by South Korean utility and energy company Korea Gas Corp., Galp Energia of Portugal and Mozambique's ENH.

FLEX LNG, the growing LNG shipping company listed on the Oslo bourse with shareholders including trusts connected to Norwegian shipping magnate John Fredriksen, is set to acquire five newbuilds at a cost of under $1 billion, partly financed with a private share placement. Flex had more than doubled first-half 2018 revenues compared with the year before, though reported a loss as it awaited more of its own ships to increase charter operations. The five LNG newbuilds comprise three ships with M-type, electronically-controlled, gas injection (MEGI) engines currently under construction at Daewoo Shipbuilding and Marine Engineering Co. in South Korea. The three vessels are scheduled for delivery in 2020. A further two vessels with dual-fuel propulsion being built at Hyundai Samho Heavy Industries for Fredriksen's Geveran Trading and due for delivery in 2021 are also set to come under Flex ownership. Flex said the five vessels could be acquired for about $918 million. The purchase price includes $180M per carrier on a delivered basis, including supervision costs, plus $6M for each of the DSME carriers for the addition of full reliquefaction systems.

The company completed its private

placement of shares on October 11 and said it would proceed with the carrier purchases. Flex's share placement involved new ordinary shares for gross proceeds of 2.46 billion Norwegian crowns, or around $300M. The subscription price for the shares was determined by the Board based on an accelerated book-building process," explained Flex. "The net proceeds from the placement will be used to partially fund instalments on the acquired vessels and for working capital and general corporate purposes," it added. Fredriksen's Geveran Trading, Flex's largest shareholder, guaranteed that the share placement was fully subscribed. Geveran was allocated 57.64 million shares at 14.25 crowns each and amounting to around $100M. The Fredriksen company retains 44.6 percent ownership of Flex following the placement. Flex had retained mainly Nordic financial institutions and brokers for the share transaction. They included DNB Markets, part of DNB Bank ASA, Pareto Securities AS, Arctic Securities AS, Fearnley Securities AS and Skandinaviska Enskilda Banken AB (Oslo Branch), as well as ABN Amro Bank N.V. of the Netherlands.

FLUXYS, the Belgian natural gas network operator and owner of the Zeebrugge LNG import terminal, and Russian Yamal LNG export plant majority stakeholder Novatek have signed a land lease agreement to build and operate an LNG terminal in the northeast German port of Rostock. Fluxys and Novatek have formed a joint venture called Rostock LNG and envisage a facility to offer LNG as a maritime fuel in the North Sea and Baltic shipping markets as well as for truck-loading and small-scale distribution. Fluxys said that the aim was for LNG fuel to be offered as the low-emission alternative to heavy fuel oil, diesel and liquefied petroleum gas in North and Central Europe and the Baltic Sea areas. The Belgian company has a 51 percent stake in the German LNG venture and Novatek owns 49 percent. Rostock LNG would be a terminal for receiving and unloading mid-scale LNG

carriers, keeping LNG in storage and providing services to enable downstream distribution. "This will include truck-loading (and possibly rail carriages) to supply LNG to industry or LNG-fueling stations for trucks, reloading to supply LNG for other uses such as bunker fuel for ships operating in the Baltic Sea," said Fluxys. The Rostock LNG plan is the third import and regasification venture proposed for Germany, which currently has no import facilities. Uniper, the Duesseldorf-based German energy company with future LNG volumes booked from the US and Canada, is considering taking part in the development of an import terminal at the German North Sea port of Wilhelmshaven.

It is a rival project to one first proposed at the end of 2016 for Brunsbuettel on the Elbe River near Hamburg where the German utility RWE, based in the city of Essen, will be the main capacity holder. "The mid-scale LNG storage terminal in the port of Rostock is to receive LNG carriers from the liquefaction facility which Novatek is currently building in the Russian port of Vysotsk, near St. Petersburg," said Fluxys. Fluxys said that now that the land lease has been signed the Rostock LNG company would proceed with the engineering and permitting processes. "Fluxys as gas infrastructure partner is pleased to team up with Novatek in this venture to facilitate the market for LNG as a low-emission fuel," said Pascal De Buck, Managing Director of Fluxys. "Gas and gas infrastructure are key to developing a sustainable, reliable and affordable energy system and the Rostock project will allow industry, ship owners and haulage companies to significantly cut emissions impacting health and air quality as well as reducing their carbon footprint," stated De Buck. Fluxys and Novatek are already partners through the trans-shipment agreement for Yamal LNG at the Zeebrugge terminal. As Russia's Yamal LNG export plant has been ramped-up since it started operations at the end of 2017, more shipments have been pointed at Zeebrugge and other European terminals

as trans-shipment ports. Ice-class carriers are now calling regularly at Zeebrugge and other terminals, bringing LNG from Yamal in Siberia to Western Europe, where it is loaded onto the conventional LNG vessels for delivery to their destination markets. Fluxy's Zeebrugge terminal and the Russian marketing company, Yamal Trade, have signed a 20-year agreement for the trans-shipments, which will gather pace as all three processing Trains enter production at the Yamal plant in 2019 and a fifth LNG storage tank is commissioned at Zeebrugge.

GRTGAZ, the French pipeline company, has inaugurated its Val de Saone project in eastern France that will fully amalgamate LNG and pipeline supplies and boost capacity on the North-South axis, creating a single natural gas market in France from November. The ceremony at Palleau in the department of Saone-et-Loire was attended by the Chief Executive of GRTgaz, Thierry Trouve, as well as representatives of the European Commission, France's Energy Regulatory Commission and local and national politicians. The infrastructure for the project was spread across three regions, Grand Est, Burgundy-Franche-Comte and Auvergne-Rhone-Alpes. "The project marks the culmination of a decade of major infrastructure projects and more than 6 billion euros ($7 billion) invested by GRTgaz to promote the opening of the market and strengthen the security of supply in France," said GRTgaz. From November, there will be a single French gas marketplace called the Trading Region France. Created jointly by the main pipeline operator GRTgaz and southern regional operator TIGF, the new market will have a single exchange point for gas known as the PEG and which was previously divided into the PEG North and the PEG South. "The commissioning of the infrastructure of the Val de Saone project, comprising 188 kilometres of pipelines and additional compression facilities between Etrez and Voisines in eastern France, completed an essential link to improve the transit between markets in the North and South," explained GRTgaz. Most of France's gas supply is imported, 70 percent by pipelines from Russia and Norway via the Netherlands and 30 percent as LNG delivered to four terminals, mostly from Algeria, Nigeria, Qatar and Norway.

Three of France's LNG import terminals are operated by Elengy, a subsidiary of GRTgaz within the Engie Group. France has a dozen gas-fired power stations and the GRTgaz network operates 32,414 kilometres of pipelines. The network is interconnected with the German, Belgian, and Swiss networks, as well as with the TIGF network which serves the south-west of France where the network has two connections to Spain. While GRTgaz is the dominant partner, TIGF and its Terega network still transports 12 percent of France's gas supply and has 24 percent of French storage capacity. GRTgaz said the Val de Saone pipeline project will bring more than 250 gigawatts per day of capacity between the North and the South of France, the equivalent of 10 nuclear power units. "The work on the Val de Saone project was carried out in compliance with costs, deadlines, regulatory and safety requirements," stated GRTgaz. "Associated with the commissioning of work on the Terega network (transmission system operator in the South-West) and some adaptations on the GRTgaz network in the South of France, this development offers the much needed transportation capacities for the creation of a single gas market zone in France, effective on 1 November 2018," added the company. "This new infrastructure will thus contribute to facilitating access to the most competitive gas sources, in particular for gas suppliers and industrial consumers and to increase the attractiveness of the wholesale gas market in France," added GRTgaz. "The new structures increase the availability of the capacities and therefore allow more flows to transit from the North to the South," explained GRTgaz.

GTT, the French LNG storage technology company and Dongsung Finetec, a South Korean thermal insulation maker, have signed an accord for joint venture production during the Paris visit of a trade delegation accompanying South Korean President Moon Jae-In. Both companies said a memorandum of understanding was signed for the commercial development of GTT technology called LNG Brick and comprising integrated storage tanks with capacity below 3,000 cubic metres and suitable for vessels using LNG as propulsion fuel. The GTT- Dongsung Finetec agreement was signed at the France-Korean business summit also attended by Bruno Le Maire, the French Minister of Economy and Finance. "GTT and Dongsung Finetec wish to promote the innovative and promising LNG Brick for LNG fuel applications," they said. "LNG Brick will eventually be built by Dongsung Finetec and will be outfitted on a large range of commercial vessels such as container vessels and bulk carriers and roll-on-roll ships," they added. GTT and Dongsung said that they shared the same understanding and analysis regarding the future use of LNG in the marine fuel market.

"With the entry into force of the global sulphur cap in January 2020, limiting sulphur emissions to 0.5 percent and considering the solid economics of LNG, the two companies view this new market in LNG-fueled vessels as very promising" they explained. GTT has developed the LNG Brick technology based on its Mark III tank technology to offer a cost-effective and competitive solution for LNG fuel tanks. Dongsung has already been closely associated in its industrialisation through the construction of a prototype. "It is a great occasion for GTT to contribute to the development of LNG as marine fuel and we are delighted to do it in partnership with Dongsung Finetec with whom we have been collaborating for numerous years on the LNG carrier market," said GTT Chairman and Chief Executive Philippe Berterottiere at the signing ceremony. Ryu Wan-Soo, President and CEO of Dongsung, said he was delighted to sign the construction agreement. "It is a great leap to produce LNG Brick for the marine fuel market and we are pleased to cooperate with GTT," stated Ryu.

INDIAN LNG imports rose 3.2 percent in September, the seventh straight month of increases as shipments were received from nations such as Qatar, Angola and Nigeria, while the costs of the cargoes also continued to rise for the Asian nation and amounted to about $800 million last month. LNG deliveries to India's three main import terminals at Dahej, Hazira and Dabhol near the West Coast port of Mumbai in September amounted to 1.71 million tonnes (2.35 billion cubic metres) compared with the 1.66MT logged in September 2017. The imports totalled 10.41MT for the first six months of the fiscal year from April to September, a rise of 15.4 percent compared with the 9.02MT of shipments received in the corresponding period of the previous fiscal year, according to the figures from the Indian Ministry of Petroleum and Natural Gas. The figures showed that September LNG shipments cost India around $800M versus $600M in the same month of 2017. On a cumulative basis, the cargoes cost $4.9 billion for the April-to-September period compared with $3.1Bln in the same six months of the previous fiscal year. The August LNG imports had amounted to 1.70MT versus 1.55MT in the same month of 2017, an increase of 9.9 percent. The government figures show that imports of the fuel have risen for seven consecutive months of the calendar year since March 2018 after they had declined by 1 percent in February. The imports rose as India's own natural gas production decreased in September to 2.68 billion cubic metres, which was 1.4 percent lower than in September 2017.

The cumulative domestic production of natural gas was 16.25 Bcm for the six months of the fiscal year to September, down 1.0 percent from last year. The Dubai-Kuwait-India index price for September LNG cargoes in the spot market quoted in Singapore averaged about US$10.95 per million British thermal units in September, higher than long-term contract prices. The latest Indian LNG import figures were released as the energy company owned by the Indian West Coast state of Gujarat inaugurated its Mundra import terminal and one of the shareholders, the Adani Group in India, signed an LNG cooperation agreement with French energy major Total. The Mundra terminal is the fourth sited in the northwest Indian states and the fifth on the West Coast, while no facilities currently operate on the East Coast. As regards East Coast terminal projects, there are about half-a-dozen regasification terminal development ventures underway. Among the September shipments, the 160,500 cubic metres capacity "Sonangol Sambizanga" delivered a cargo on September 1 to the Dahej terminal operated by Petronet from the Anglo plant at Soyo in southwest Africa. The 210,100 cubic metres capacity carrier "Al Ruwais" unloaded a Qatargas cargo on September 13 at the Hazira terminal operated by Shell India. Among the other deliveries, the 141,000 cubic metres capacity vessel "LNG Cross River" delivered a Nigerian cargo on September 19 to the Dahej terminal operated by Petronet.

JAPANESE liquefied natural gas imports in September increased by 7.8 percent as shipments from the Middle East, Russia, the US and the spot market all rose as the nation's monthly LNG costs also jumped more than 42 percent year-

on-year on higher prices and volumes. Shipments of LNG amounted to 6.27 million tonnes in September versus 5.82MT in the same month of 2017. Japanese imports of the fuel had risen 4.4 percent in August compared with the year-ago period even as more nuclear power was now on line. LNG shipments to Japan in August had amounted to 7.57MT compared with 7.25MT in the same month a year ago. Several more of Japan's nuclear power plants, numbering more than 50, came on line in August and during September there was a total of seven in operation. The latest data from the Finance Ministry showed that the LNG shipments cost Japan 385.94 billion yen ($3.43Bln) in September compared with the 270.62Bln yen ($2.40Bln) logged in September 2017, a rise of 42.6 percent. The monthly cost of the cargoes in August was 28.6 percent more than the year-ago period at $444.56 billion yen ($3.95Bln) versus 345.58Bln yen ($3.07Bln) in August 2017 In addition to a rise in LNG shipments, Japan also purchased 9.26MT of thermal coal last month, up 8 percent compared with September 2017 at a cost that was 35.2 percent more at 127.60Bln ($1.13Bln). The Ministry data for September 2018 showed that Asian shipments were the only ones to decline in the month. Cargoes from nations such as Malaysia and Indonesia, Papua New Guinea and Brunei dropped 34.1 percent to 1.23MT.

Imports from the Middle East region were up 11.5 percent, with shipments from countries like Qatar, the United Arab Emirates and Oman totalling 1.26MT in September. Monthly Russian shipments from the Sakhalin Island plant in the Far East jumped 52.5 percent to 598,000 tonnes. Imports from the US amounted to 186,000 tonnes and there had been no US shipments in September 2017. Japan will be importing more cargoes in the months ahead from both the Cheniere Energy-owned Sabine Pass plant in Louisiana and the Cove Point plant in Maryland operated by Dominion Energy. The balance of imports from other nations in the preliminary figures for September amounted to 2.99MT versus 3.77MT in

August, with most volumes coming from Australia, as well as some shipments from Africa and the spot market. Japan had ended last year with an LNG import tally for 2017 of 83.63MT, just 0.4 percent higher than the 2016 total but with higher costs. Japan paid 19.3 percent more in 2017 for its LNG with 3,915 billion yen ($35.58Bln) of expenditure versus 3,281Bln yen ($29.81Bln) in 2016 for its 83.34MT. Annual Japanese imports are forecast to edge lower over the next few years to offset higher oil price-linked LNG shipments.

JGC Corp. Chairman and Chief Executive Masayuki Sato, whose company was awarded the LNG Canada contract, said the engineering, procurement and construction business was now surging ahead and a high level of performance was crucial for all contractors worldwide. "As crude oil prices have topped US$70 a barrel this year, we sensed that international oil companies (IOCs), the oil majors, and national oil companies (NOCs), the state-run oil companies, are becoming more open to capital investment," said Sato. "Large LNG projects are a good example, an area where the market has been stagnant for years. We see signs that these projects are now resuming, driven by increased LNG demand in China, India and Southeast Asia," stated Sato. The Japanese company is a world leader in building liquefaction plants and has worked on the leading plants worldwide, most recently in constructing the Gorgon and Ichthys LNG plants in Australia and the Yamal LNG facility in Arctic Russia. "Refinery and petrochemical investment continues to rise in Southeast Asia," said the JGC CEO. "The tide has turned and the plant market is emerging from a long slump. Looking forward to a full market recovery, we aim to secure JGC's highest level of orders ever, at 1 trillion yen ($8.82 billion) with 850Bln yen in overseas orders," he added. "LNG Canada is a 'lump-sum' contract, and we recognize that monetary amounts for this size of project do carry considerable risk,' said Sato in the JGC annual report in reference to the order won with Fluor Corp. of the US. "By its very nature, our work in the Engineering, Procurement and Construction business area fulfils a direct role in creating value for society and the environment," explained Sato. "The issues we can help solve through the JGC business, and the social and environmental value that is created, will provide greater access to energy in a world where energy needs are growing," he said. "By contributing to economic and industrial development in emerging economies and resource-producing countries, we play a role in bridging the economic gap between developed and developing countries. This also calls for fostering a sustainable, low-carbon society," added Sato.

Tadashi Ishizuka, President and Chief Operating Officer said he had taken part in this LNG Canada project from the proposal stage and spent some time broadly assessing risks. "Our accumulated expertise and experience from the Ichthys LNG and Yamal LNG projects were applied in the evaluation of construction methods for module fabrication. We took the utmost care in risk profiling," said Ishizuka. For the Yamal project in Russia JGC had the modules constructed in China and has a cooperation deal with China Offshore Oil Engineering Co. The Chinese firm constructed the core modules for JGC for the Yamal liquefaction plant near the port of Sabetta in Siberia as part of a contract awarded in 2014 and worth more than $1.64 billion. "Effective project execution is a matter of mitigating risk," stated the JGC President. "We have seen positive results from the changes in awareness and risk profiling that we began emphasizing last year to sharpen our sensitivity to project risks," he explained. "This will remain a focus of ours in fiscal 2018, with the goal of it contributing to meeting our full-year earnings forecasts," added Ishizuka. "An EPC business relies on the cooperation of joint venture partners, equipment manufacturers, subcontractors, and all of our business partners," noted Ishizuka. "It is also essential that not only JGC but also our partners and suppliers adopt the stance of increasing value across the supply chain. We will continue taking steps toward this end," added the Japanese executive.

KBR, the US engineering company, said its UK subsidiary was awarded a front-end engineering design contract by BP of the UK for the first phase of the Tortue natural gas field development located on the maritime border between Senegal and Mauritania that will provide feed-gas for at least two floating LNG export projects. "The agreement contains a mechanism to allow transition of the contract to an engineering, procurement and construction management (EPCM)

contract at a later date," said KBR. The Greater Tortue project is aiming for first gas in late 2021 and is being developed by BP in partnership with the independent Dallas, Texas-based exploration and production company Kosmos Energy. Golar LNG, the Bermuda-based fleet operator and project company, has signed a preliminary charter agreement on the provision of at least one floating LNG production hull for the Senegal-Mauritania venture. BP and Kosmos have estimated that the Tortue field has resources for LNG production of around 25 trillion cubic feet of feed-gas and an additional 15 Tcf is contained in nearby fields. KBR said that under the terms of its contract, the US company's Granherne unit in the UK would provide management of the quarters and utilities and the provision of supplemental services for the LNG hub in Senegal and Mauritania.

The US company said the FEED work was to be performed up to the end of 2018 to support the final investment decision. "We are proud to continue to be part of this significant project providing this technical assurance and facilities integration role to BP," said Jay Ibrahim, KBR President for energy projects outside of the US. "This win is indicative of KBR's strategic commitment to our partner BP, building on concept work done by our subsidiary Granherne, and then the pre-FEED that was executed by KBR and now to this FEED award," explained Ibrahim. KBR said that estimated revenue associated with this project will be booked into backlog of unfilled orders for KBR's Hydrocarbons Services Business segment in the fourth quarter of 2018. "Local content was carefully considered as part of the regular contract evaluation process, and will continue to be closely reviewed to identify potential opportunities during KBR's FEED engineering work," stated the US company.

KBR said it won a concept definition engineering contract for the two natural gas floating production storage and offloading facilities for the proposed development to send Browse Basin feed-gas to the North West Shelf

liquefaction and gas plant in Western Australia. The contract was awarded by Woodside Energy as operator for the Browse joint venture that had initially planned a separate LNG project and has now settled on transporting the gas to the North West Shelf facility. "Woodside has launched the engineering services contract to define all elements of the hull and topsides of two FPSOs for remote environment operations utilizing cutting edge technology," said KBR. "The engineering work is expected to be performed up to the end of the first half of 2019," said the US company. The Browse venture participants maintain seven petroleum retention leases in the area. The companies include Woodside, Royal Dutch Shell, BP, Japan Australia LNG - involving Mitsubishi and Mitsui - and Chinese major PetroChina. They have made significant progress in narrowing alternative concepts for the potential development of the Browse resources.

The proposed offshore development concept involves two gas FPSO facilities delivering feed-gas via 1,000-kilometres of pipeline to existing production facilities. The gas fields are located about 425 kilometres north of the town of Broome in Western Australia at water depths of up to 700 metres. Contingent resources are about 16 trillion cubic feet of natural gas and 466 million barrels of condensate. "We are delighted to be awarded the concept definition engineering of the two FPSO facilities delivering our operational agility in the execution of projects, strong base business and world-class asset performance to the project," said Stuart Bradie, KBR President and Chief Executive. "KBR is uniquely positioned to offer our proven technologies, digital delivery platform and our global portfolio of expertise," added Bradie. "Alignment and collaboration are vital in this dynamic environment and with the increase in global energy demand, we are committed to strengthening our existing relationship with Woodside," stated the CEO.

KOSMOS ENERGY, the US exploration and production company based in Dallas, said it was making more progress on developing multiple African liquefied natural gas production hubs offshore Senegal and Mauritania with UK partner BP and an investment decision was due soon. "The company continues to make progress in Senegal and Mauritania with the Tortue LNG development," said Kosmos in a third-quarter update on its activities. "The first phase Unit Development Plan has been submitted to the energy ministries of both countries and all parties are aligned and actively working to achieve a final investment decision (FID) around year-end," stated Kosmos. The Greater Tortue project is aiming for first gas in late 2021 and Golar LNG, the Bermuda-based fleet operator and project company, signed a preliminary charter agreement on the provision of at least one floating LNG production hull. The first gas from the Kosmos-BP floating LNG Train 1 is scheduled for 2021 and the start of a second FLNG Train is set for 2023. Golar is carrying out front-end engineering design on behalf of BP's two project companies set up with minority partner Kosmos, BP Mauritania Investments and BP Senegal Investments. The agreements commit the parties to negotiate future commercial terms for the development of the first phase of the Greater Tortue-Ahmeyin natural gas field on the offshore maritime border between Mauritania and Senegal. Kosmos has estimated that the Greater Tortue Complex has resources for LNG production of around 25 trillion cubic feet of feed-gas and an additional 15 Tcf is contained in nearby fields. "Kosmos continues to advance its frontier exploration program with a strong portfolio of high-impact exploration opportunities for long-term, sustainable growth and expects to be active in 2019 with a number of exploration and appraisal opportunities," said the US company.

"Kosmos maintains an active new ventures and seismic acquisition program to enable drilling in 2020 and beyond," said the company, referring to the Atlantic Margin fields in areas such as West Africa and including Equatorial Guinea, Ghana and Suriname in Central America. Kosmos added that its production offshore the West African state of Ghana continued to grow from its two fields it has developed with several partners, including Ghana National Petroleum Corp. At the main Ghanaian Jubilee oil field, production averaged around 94,500 barrels of oil per day for the quarter, delivering two cargos net to Kosmos. "One new producer well at Jubilee was brought online in the third quarter, with a second expected in the fourth quarter," said Kosmos. At the Tweneboa, Enyenra and Ntomme (TEN) oil fields, production averaged around 62,600 barrels of oil per day for the quarter, delivering one cargo net to Kosmos. Kosmos said the first Suriname drilling results had been disappointing. "We are in the early stages of exploring the emerging Suriname-Guyana basin, and given the indications of a mature source, quality cretaceous reservoir, and the independent nature of the prospectivity we believe there is significant remaining potential in Block 42," said Andrew G. Inglis, Kosmos Chairman and Chief Executive. "Our current plan is to test the next prospect in 2020," he added. Kosmos holds rights in the Block 42 contract area under a production sharing contract with the Government of Suriname and its partners are US companies Chevron Corp. and Hess Corp.

LNG LTD, the Australian-based developer of two North American export projects, said both ventures in the US state of Louisiana and in the Canadian province of Nova Scotia were more viable than ever before and would be moving forward in a period of rapid expansion for the industry. "Our Magnolia LNG project is the most mature of all the competing US Gulf Coast greenfield LNG projects," said LNG Ltd Chairman Paul J. Cavicchi in reference to the project in Louisiana in presenting his company's annual report. "Likewise, our Bear Head LNG (Nova Scotia) project is fully permitted and is looking to partner with producers to export gas to global markets," added Cavicchi. The LNG Ltd Chairman said the company's own LNG processing technology system, known as OSMR, provided environmental attributes "coveted" by the evolving global gas markets. "Coupled with the industry knowledge and project execution experience of our team, we are excited by the current opportunities," he stated.

"We are now working extremely hard to progress our projects to a positive financial investment decision," said Cavicchi. "The combination of the "shovel-ready" Magnolia LNG project with increasingly supportive market conditions fuels our confidence to achieve success," he added. "We anticipate contracting facility off-take from world-class, credit-worthy companies and to begin construction of the project," he said. Cavicchi explained that there were positive market indicators throughout 2018 with seasonally robust spot LNG prices, a strengthening European natural gas market and an overall stronger energy market. "These factors all contribute to a business environment supportive of new LNG investment," he said. "With increasing demand and unsustainably low numbers of recent financial investment decisions for new liquefaction facilities globally, a tighter LNG market will unfold," he stated.

LYSE GROUP, the Norwegian company owned by 16 municipalities that first acquired waterfall rights one hundred years ago to help develop hydro-electric power stations, has sold its remaining 30 percent in Nordic LNG company Skangas to majority-owner Gasum of Finland. The transaction agreement was signed in the Norwegian port of Stavanger and now leaves Finnish natural gas network owner Gasum with 100 percent of Skangas. Among its activities, Skangas parent company Gasum imports LNG to Finland and also promotes the processing of waste to produce biogas in Finland and Sweden. Skangas has become a leading Nordic LNG supplier and continues to strengthen its position with regasfication and bunkering assets to cater for various LNG markets from shipping to the industrial sectors in Finland, Sweden and Norway. Gasum first increased its shareholding in Skangas in June 2017 to 70 percent by buying more shares from Lyse. "Lyse has through Skangas contributed to environment friendly energy solutions and to establish lasting jobs in the region," said a Lyse statement.

"The investment has given a good return for Lyse," it added, without disclosing the value of the sale of its final 30 percent stake to Gasum. "Lyse with this transaction has exited LNG and will in the energy segment going forward mainly focus on its strategy related to efficient utilization of adjustable hydropower," said the company. "The new Lysebotn hydropower station, which was opened last month, positions Lyse well for hydropower's new role in Europe," it added. "Gasum will through its 100 percent ownership in Skangas be even stronger positioned to build and develop the Nordic gas ecosystem and to respond to growing demand for cleaner fuel solutions," stated Lyse. Skangas owns the Finnish LNG import terminal at the port of Pori. Pori was the first Finnish terminal to start operations in 2017 and is located on the West Coast. A second Finnish import terminal, the Tornio Manga facility, has been completed as a joint venture at the northern Port of Tornio involving Skangas and partners. Skangas also owns and operates a small-scale liquefaction plant in Risavika in

Norway and two other regasification terminals at Ora in Norway and in Lysekil in Sweden. Skangas is additionally involved in the LNG fuel and shipping market. It has the 5,800 cubic metres capacity "Coralius", an LNG bunkering vessel, and the small-scale chartered LNG carrier, the "Coral Energy".

ORIGIN ENERGY, a stakeholder in the Australia Pacific LNG plant in Queensland, said the facility shipped more cargoes during the Sydney-based company's fiscal year as its integrated gas business surged because of higher LNG revenues. "I'm pleased to report our Integrated Gas business continues to go from strength to strength," said Chief Executive Frank Calabria in addressing the annual meeting at the Sydney Sofitel in Wentworth on October 17. "A recovery in commodity prices and record production at Australia Pacific LNG saw underlying earnings increase by 67 percent to A$1.3 billion (US$928 million), and we hit the milestone of net cash flows back to Origin of A$363M," added the CEO. Calabria said APLNG, whose other shareholders include ConocoPhillips and Chinese major Sinopec, shipped 125 LNG cargoes during Origin's fiscal year and continued to be a major supplier of gas to the domestic market, supplying close to 30 percent of total annual East Coast demand. "We continued to make progress on plans to be a lower cost, globally competitive gas producer, including implementing a simpler, flatter, asset-led operating model," he said. "We also reduced well costs by lowering overheads, improving surface facilities design and re-pricing rig and construction contracts," added Calabria. He told shareholders that the APLNG plant's feed-gas reserves increased on the back of improved recovery estimates from operated areas. Outside of APLNG, Origin continued to pursue opportunities to bring on new sources of gas supply. Origin has entered into early project planning, or front-end engineering and design, for a stage one development of the Ironbark coal-seam gas project in the Surat Basin in Queensland.

"We are assessing our strategic options for Ironbark which will determine the optimum pathway to bring the gas to market while delivering the best overall value to Origin," said Calabria. "We are also continuing our highly prospective exploration and appraisal in the Beetaloo Basin in the Northern Territory," he added. "Following a thorough scientific inquiry into hydraulic fracturing, the Northern Territory Government lifted its moratorium on onshore production earlier this year," he explained. "This has paved the way for entering stage two of our existing farm-in commitments in the Beetaloo Basin, including one vertical and two horizontal appraisal wells in the 2019 dry season," he said. Calabria also spoke out against the low levels reached in public debate of issues such as fracking for shale gas, climate-change policies and gas prices. "While the business was performing very well, this year can also be characterised by the increasingly fractious debate over energy and climate policy," stated the CEO. "Our actions to put downward pressure on prices have been acknowledged by governments, but as energy affordability is still a key concern, there is an increasing risk of intervention in the market," he stated. "We also secured a significant amount of gas for the domestic market, increasing gas sales to large customers during the year and it was good to see the Australian Energy Market Operator (AEMO) report that there is expected to be no shortfall of supply for 2019," added Calabria. Origin Chairman Gordon Cairns said the company had played a constructive role in attempting to reach a rational energy policy, most recently in its tangible support for the National Energy Guarantee, a framework for an Australian energy prices policy that would also encourage investment. "We are disappointed the NEG hasn't progressed. It's now time to move past the emotive rhetoric and work on solutions," stated Cairns. "We remain resolute that Australia needs a rational energy framework that brings energy prices down, creates transparency of pricing through a reference pricing mechanism, delivers emission reductions and ensures reliability of supply," added the Chairman.

PAVILION Energy of Singapore and its shipping partner BW Group have signed an agreement for Pavilion to charter two more LNG carriers, each with capacity of 173,400 cubic metres and scheduled for delivery between 2019 and 2020. The vessels will be used to enable wider distribution of Pavilion's volumes of LNG as the Asian city-state company increases its trading activities. Pavilion, owned by the Singaporean wealth fund Temasek, already operated two carriers from the BW shipping line, the "BW Pavilion Vanda" and the "BW Pavilion Leeara". "The long-term charters of these MEGI newbuilds from our long-standing shipping partner BW will strengthen Pavilion Energy's global LNG trading activities, especially on long-haul voyages from Atlantic liquefaction plants to Singapore and Asian markets," explained Frederic Barnaud, Group Chief Executive of Pavilion Energy. "This will reinforce our already strong Asian LNG supply and trading strategy to connect markets and supplies regionally and globally," added Barnaud. Yngvil Asheim, Managing Director of BW LNG, said, the shipping company remained committed to its partnership with Pavilion.

"The vessel design incorporates BW LNG's many years of LNG experience and we look forward to further serving Pavilion Energy's need for safe and efficient transport," added Asheim. The companies said the two vessels are also equipped with the M-type, electronically controlled, gas injection (MEGI) propulsion system. "These engines offer higher efficiency and lower carbon emissions, an integral part of both companies' efforts have environmentally sustainable operations," they added. Pavilion Energy and BW, also headquartered in Singapore, formed a joint venture in 2014 to acquire, manage and charter maritime assets, including LNG carriers.

SANTOS of Australia, a stakeholder in three liquefied natural gas export plants, posted record quarterly LNG sales revenue as its average LNG price soared to US$10.43 per million British thermal units compared with US$7.50 in the same three months of 2017. Overall oil and gas sales revenue rose 10 percent to A$973 million (US$692.6M), including record quarterly LNG revenues of A$405M. Santos said the Papua New Guinea LNG plant, operated by ExxonMobil, achieved a record daily production rate equivalent to 9.2 million tonnes per annum. A total of 31 cargoes were shipped from the PNG plant northwest of Port Moresby during the three-month period versus 29 cargoes in the year-ago quarter. "Santos along with the other PNG LNG parties and the Papua LNG Joint Venture are also continuing discussions to build alignment for the proposed construction of three additional LNG Trains at the PNG LNG site, with two Trains to process gas from the Papua LNG project and one Train for the planned PNG LNG expansion," stated Adelaide-based Santos. Santos itself is operator of the Gladstone LNG plant in Queensland and is a shareholder in the Darwin plant in the Northern Territory operated by US major ConocoPhillips. "Third-quarter sales revenues were higher than the prior quarter primarily due to higher commodity prices, a full quarter of production from PNG LNG following the impact of the earthquake in the first-half and the planned one-month maintenance shutdown of the Bayu Undan-Darwin LNG facilities in May," explained Santos. Santos said a total of 14 cargoes were shipped from Darwin LNG compared with nine in the previous quarter and 11 in the third quarter of 2017. "A final investment decision on the Barossa project to backfill Darwin LNG is targeted towards the end of 2019," said Santos.

"The FPSO design competition between Modec and the TechnipFMC-Samsung consortium is progressing well," it added. "The successful development of Barossa would extend the operating life of Darwin LNG for more than 20 years," it said. At Gladstone LNG, third-quarter production of 1.2 million tonnes was in line with the previous quarter and 20 cargoes were loaded. "Higher GLNG equity gas production contributed to higher volumes delivered to the domestic market, while GLNG equity gas delivered to the LNG plant was in line with the prior quarter," said Santos. The company's Cooper Basin oil production in south Australia increased 17 percent, including the highest monthly production rates since 2009. At the end of the third quarter, the drilling started at the first of the Moomba South appraisal wells targeting "significant" resources. "With a balance sheet now supportive of growth, we also announced the value accretive acquisition of Quadrant Energy's high-quality portfolio of low-cost, long-life conventional natural gas assets in Western Australia,"

Diary of events

February
3rd Annual LNG USA Summit
26-27 February, 2019
Houston, Texas
www.lng-usa.com

April
19th International Conference & Exhibition on LNG
1-5 April, 2019
Shanghai, China
www.LNG19.com

May
Canada Gas & LNG Exhibition and Conference
21-23 May, 2019
Vancouver, Canada
www.canadagaslng.com

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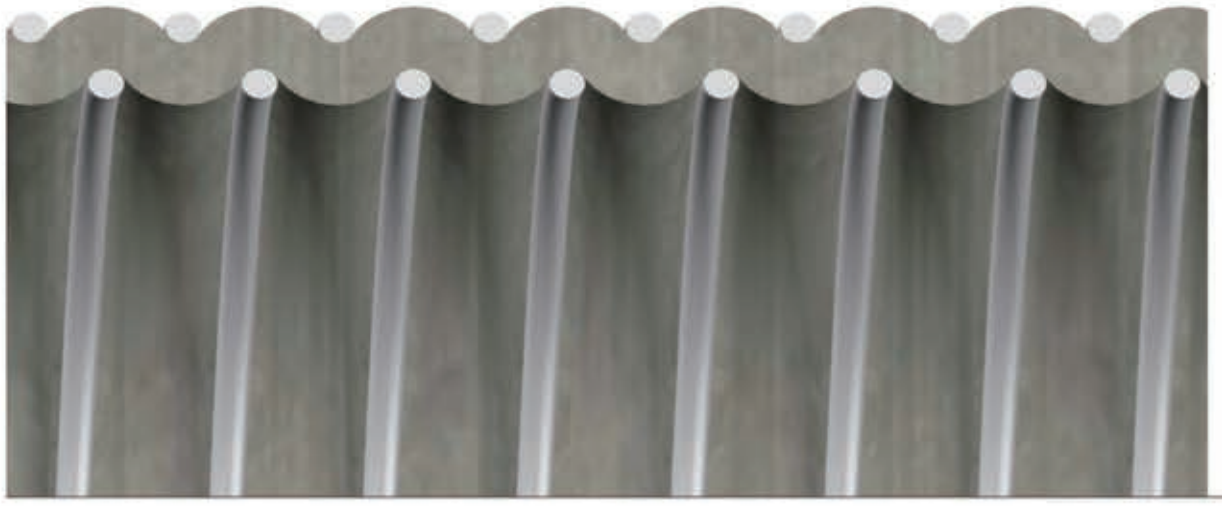
<Cross section view of Dolphinflex® hose>



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- Multi layered hose
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- Manufactured by Sangbong corporation

Advantage of Dolphinflex hose

- Fully embeded inner wire
- Improved durability in extreme condition
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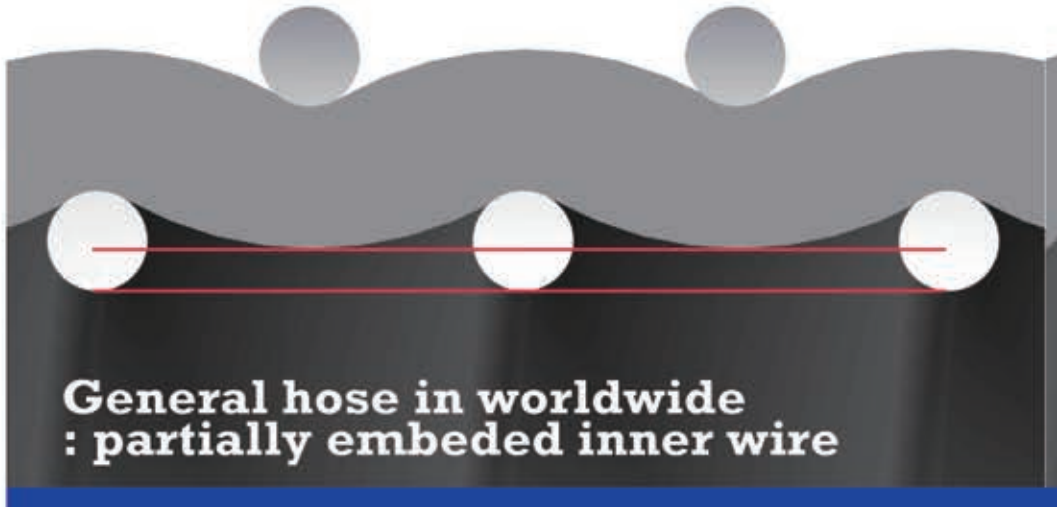
<Enlarged view>



General hose in worldwide
: partially embeded inner wire

<Enlarged view>

Dolphinflex® hose
: fully embeded inner wire

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said Chief Executive Kevin Gallagher in the third-quarter activities report. "The acquisition will also give us a leading position in the highly prospective Bedout Basin, including the recent significant Dorado-1 oil discovery," added Gallagher. "Santos is now positioned for growth with a number of upstream brownfield development opportunities leveraging existing infrastructure positions across each of our five core assets and is targeting production of more than 100 million barrels of oil equivalent by 2025, almost doubling current levels of production," stated Gallagher.

STEELHEAD LNG, the Canadian project developer, said its Kwispaa floating export venture proposed for Sarita Bay at Vancouver Island has filed for regulatory permits from the provincial British Columbia government and the federal authorities in Ottawa. The Kwispaa FLNG venture has already provisionally ordered two hulls for production and storage from the Hyundai Heavy Industries shipyard in South Korea. The project is being developed through a co-management relationship with the Huu-ay-aht First Nation. The 475-hectare site provides natural deep water and is a short distance to open ocean for efficient access to market. The final investment decision is scheduled for 2020 and the first phase of the project is expected to be operational by the end of 2024 and will provide capacity of around 12 million tonnes per annum of LNG with prospects of rising later to 24 MTPA. "We are incredibly proud of the special co-management relationship that we have formed for Kwispaa LNG," said Huu-ay-aht Chief Councillor Robert J. Dennis Senior. "We look forward to continuing to work together with Steelhead throughout the environmental assessment process to ensure that this project achieves world-leading outcomes for the environment and our people for generations to come," he added. Steelhead plans to liquefy natural gas sent through underground pipelines to its FLNG hull and to export to Asian markets. Steelhead has already been awarded a Canadian National Energy Board export licence for up to 24 MTPA of exports from a plant at Sarita Bay.

"The project has entered the next phase of project development with the submission of the project description to the British Columbia Environmental Assessment Office and Canadian Environmental Assessment Agency," said Steelhead. "The project description provides a comprehensive overview of Kwispaa LNG and represents the culmination of several years of engagement and planning, the results of which have been integrated into ongoing environmental studies and engineering work," added Steelhead. The company said that all front-end engineering work for the BC project is fully supported by the Huu-ay-aht First Nation and is expected to commence in early 2019. "From the beginning, we have believed in developing LNG projects in Canada that emphasize relationships with First Nations and respect their role as stewards of the environment," said Steelhead Chief Executive Nigel Kuzemko. "The project description that we have submitted to regulators reflects our shared commitment with the Huu-ay-aht First Nation to provide Canadian natural gas to global markets in a way that generates long-lasting benefits to First Nations, local communities, British Columbia and Canada," added Kuzemko.

SWITZERLAND, the base for some of the leading global commodities traders in LNG and other fuels, is facing energy challenges, though it was unlikely a permit awarded to drill for hydrocarbons in Lake Geneva would be implemented anytime soon, according to a report from the International Energy Agency. Swiss challenges on the natural gas front come from its position as a major transit point for European gas pipelines and the nation also has more than 80 small gas utilities and the highest gas prices in the world. Switzerland currently has the lowest carbon-intensity of its energy supply among all countries of the IEA because of the largely carbon-free electricity sector dominated by hydropower and nuclear generation. However, with the country's 2017 decision to gradually phase-out nuclear power, the IEA has warned that Switzerland faces a considerable energy-sector transition in the coming decades. "Filling the gap left by nuclear power station closures while maintaining low-carbon generation and high standards of supply security will be challenging," stated the IEA review of Switzerland's energy policies. The IEA noted that the Swiss should try and keep up with evolving European natural gas market legislation and to better regulate its gas market. The Swiss government had stated that it was considering a further opening of the gas market and that the legal uncertainties would be addressed by a new Gas Supply Law. The Swiss gas market is dispersed. It has 86 gas utilities, which are mainly owned by cantons and municipalities and which enjoy local monopoly status, similar to the electricity utilities. Natural gas prices are high in Switzerland. In 2017, Swiss industries paid an average of US$60.6 per megawatt hour (MWh), of which 26 percent was taxes. "This was significantly higher than any other IEA member country. In Finland, the second most-expensive country for industrial consumers, the price was 24 percent lower," said the IEA. The IEA has recommended that the Swiss establish clear market rules for the gas market, including third-party access, consumer choice and seek alignment with EU legislation while establishing an independent and strong gas regulator. It should also facilitate completion and market accessibility of the reverse flow of the Transitgas pipeline, thereby contributing to market integration and improving the security of gas supply for Switzerland and Europe.

The IEA stated that Switzerland will be increasingly relying on imports of power and natural gas from its European neighbours to meet demand, especially during the winter months when low water levels impact production from hydro plants. "Natural gas accounts for a small share of Switzerland's energy system, but the importance of gas has increased for several decades," the IEA noted. "It covers 12.5 percent of the total primary energy supply, which is the third-largest share after oil and nuclear," noted the IEA report. "Most of the gas is consumed in the residential, industry and commercial sectors, and the fuel accounts for the third-largest share of the total final consumption. "Without any domestic production, Switzerland needs to ensure its gas supply through imports," said the report. Total gas imports were 3.7 billion cubic metres in 2017, of which 76 percent came from Germany. Remaining shares were imported from the Netherlands (12 percent), France (10 percent) and Italy (3 percent, only to the Swiss canton of Ticino). Germany has been the largest gas supplier to Switzerland since 1990, and its share in the total supply has increased over recent decades. However, Germany is dependent on gas imports, about half of which come from the Russia and Gazprom. About one-third of total Swiss gas imports have originated from Russia since 2014, although Swiss companies do not have any direct contractual relation with Gazprom. "A licence for trial gas exploration in Lake Geneva was awarded to a private company in 2014," added the IEA. "However, all exploration is based on cantonal law in Switzerland, and the concerned neighbouring canton of Vaud introduced a moratorium on gas exploration and gas fracking," said the report. Switzerland has domestic production of biogas, mainly through fermentation of sludge and other organic matter. However, biogas injected into the natural gas network amounted to just 0.8 percent of the country's natural gas imports.

TECHNIPFMC, the energy and LNG engineering company, has agreed an initial services contract for a US LNG export plant proposed for the west side of the Calcasieu Ship Channel near Johnson Bayou in Louisiana as part of the next wave of facilities planned for the Gulf Coast. A company called Commonwealth LNG has signed up TechnipFMC for its planned liquefaction plant with capacity for 8.4 million tonnes per annum. Commonwealth added that it had also signed an agreement with Lloyd Engineering for a marine facility and turning basin design. "With the Maritime Pilots Institute in Covington, Louisiana, the group completed simulations and then subsequently prepared a draft Water Suitability Assessment," said Commonwealth in reference to a stage in the permit process. Commonwealth said that TechnipFMC and Lloyd Engineering are working collaboratively with US LNG and energy consultants CH-IV, who will manage the development of the formal Federal Energy Regulatory Commission (FERC) application for the facility with six liquefaction Trains. Commonwealth stated that it intends to file its formal application with the FERC in March 2019.

"The strength of our team lies not only in the diverse LNG experience of our executive management, but also with the industry-leading partners we have chosen for this development," said Commonwealth's Chief Executive Paul Varello. "Commonwealth will achieve its goal of being the low-cost provider for the next wave of US LNG liquefaction projects," added Varello. The Commonwealth project would consist of eight separate sets of facilities, including a 3.7-mile-long natural gas receiving pipeline, extending from existing pipelines, according to pre-filing statements. There would also be four gas

pre-treatment units and small-scale liquefaction Trains and storage tanks. The adjacent electric plant would be powered by an 80-megawatt gas turbine and there would be boil-off gas handling systems and other utilities. The marine berth would have the size to accommodate LNG carriers with capacity up to 215,000 cubic metres. The Commonwealth project developers had also said earlier in 2018 that the Japanese bank Sumitomo Mitsui Banking Corp. would act as its financial advisor to help raise capital and advance the venture.

TOTAL, the French energy major, said it was in talks with several Indian companies to supply LNG volumes and was looking at the developing natural gas fuel market for vehicles. Total Chairman and Chief Executive Patrick Pouyanne said the company was very interested in investing in downstream sectors in India. "We are in discussion with many players," said Pouyanne. These are said to include the Adani Group and its stakes in the new Mundra LNG import terminal on the West Coast and an East Coast terminal in Odisha state. He said Total was interested in selling LNG to India as well as retailing to consumers and wishes to do that through partnerships with local companies, including the Adani Group. Adani Gas, its subsidiary, is developing compressed natural gas (CNG) stations for the transport sector in India that could interest Total, which is already a gas fuel market leader in the US through its stake in California-based Clean Energy Fuel Corp. In regard to Indian LNG, Total had previously held a 26 percent stake in the Hazira LNG import terminal near Mumbai, operated by Royal Dutch Shell. However, the French company agreed to sell the Hazira stake to Shell while remaining a supplier of some LNG volumes to the facility. As part of the Hazira stake sale Total signed an agreement to supply 500,000 tonnes per annum for the Indian market over five years from its global volumes of more than 40 million tonnes per annum.

Total has stakes in LNG production ventures worldwide, including the recently started Ichthys LNG plant in

Australia and the Yamal liquefaction facility in Russia. Analysts said the French company was keen to invest in the gas market in India and finds the Adani Group a suitable vehicle as it owns downstream and midstream infrastructure, including stakes in Indian West and East Coast LNG import terminals. Adani has been seeking a major partner for its East Coast LNG terminal at Dhamra port on the Bay of Bengal in the state of Odisha, formerly known as Orissa. The Dhamra terminal when completed will serve city-gas and power projects as well as industrial customers. Natural gas from the proposed Dhamra facility will be an important supply source to the Urja Ganga Pipelines Project for national infrastructure being pushed forward by Prime Minister Narendra Modi to boost East Coast city-gas connections. The pipeline expansion venture involves laying an additional 2,540 kilometres of pipelines in five eastern states to provide gas for 40 districts and 2,600 towns and villages.

US regulators have started the pre-filing environmental review process for the Pointe LNG liquefaction project proposed for the East Bank of the Mississippi River in Plaquemines Parish in Louisiana, which would be the second riverbank export facility planned for south of New Orleans. Pointe LNG has asked the Federal Energy Regulatory Commission for permits for a project on a site comprising about 600 acres of leased property with more than 6,500 feet of river frontage. The project has a proposed in-service date of the second quarter of 2025 and would consist of three LNG liquefaction Trains, each with a nameplate capacity of 2 million tonnes per annum and with connections to major regional pipelines. The project calls for the construction of two 36-inch-diameter gas supply laterals to interconnect with the nearby existing pipeline infrastructure. One pipeline is proposed to be built to enter the facility from the north, connecting with High Point Gas Transmission's system. The second pipeline would enter the facility from the south and connect with the Tennessee Gas Pipeline system. "We believe that beginning the Commission's review of this proposal prior to the receipt of your application will greatly improve our ability to identify issues early and address them in our environmental document," said the FERC in its letter to Pointe LNG. Two US Gulf Coast energy veterans, former Duke Energy executive Jim Lindsay and former tanker captain Tom Burgess, filed their request to the FERC in September and have now received their reply. "As stated in your letter, Pointe LNG plans to construct an LNG facility on the East Bank of the Mississippi River at a site which encompasses the previously planned Mississippi River LNG Project," stated the FERC. The FERC was referring to the fact that the Pointe LNG project site includes a 250-acre area where Parallax Energy, a company led by former BG Group executive Martin Houston, had proposed in 2015 to build a riverbank project. As founding partners in an original Mississippi River LNG venture, Lindsay and Burgess had sold the project to Houston and his then partner Cheniere Energy, whose Chief Executive at the time had been Charif Souki.

"Your letter also stated that Pointe LNG intends to file an application no later than November 2019," noted the FERC. "When Pointe LNG files its application with the Commission, we will evaluate the progress made during the pre-filing process, based in part on your success in resolving the issues raised during scoping," explained the regulator. "Once we determine that your application is ready for processing, we will establish a schedule for completion of the environmental document and for the issuance of all other federal authorizations," it added. A second export project is planned by another company, Venture Global, for the same area of Louisiana but on the opposite bank of the Mississippi. Venture Global is proposing its Plaquemines LNG plant to be constructed on 630 acres near river mile-marker 55 on the West Side of the Mississippi, 30 miles south of New Orleans. Lyndsey and Burgess bring a lot of energy industry experience to their Pointe LNG venture. As a former tanker captain, Burgess also holds an unlimited licence as a Master and First Class Pilot, issued by the US Coast Guard. Company co-founder Lindsay has worked in LNG, natural gas storage and midstream asset development with Duke Energy Marketing & Trading, now Spectra Energy, and where he had been a vice president.

WOODSIDE Petroleum, the operator of two LNG export plants in Western Australia, posted a 26 percent rise in third-quarter LNG revenue of US$881 million compared with US$697M in the same three months of 2017 as it benefited from higher prices and its stake in the new Wheatstone liquefaction and export plant. Woodside said it delivered its 5,000th North West Shelf LNG cargo from Dampier in Western Australia during the third quarter as its Wheatstone stake boosted volumes and it planned domestic and overseas expansion. The company said it delivered production of 23.1 million barrels of oil equivalent and total sales revenue of US$1.29 billion versus US$1.01Bln in the year-ago quarter. Woodside said its realised LNG prices for North West Shelf cargoes averaged US$8.40 per million British thermal units, US$9.90 per MMBtu for Pluto shipments and US$10.40 for its volumes from the Wheatstone plant, operated by Chevron Corp. In its continuing cargo marketing activities, Woodside's Singapore office signed an accord with Uniper Global Commodities of Germany for the supply of up to 600,000 tonnes of LNG per annum for a period of four years from 2019. "The LNG would be supplied from Woodside's portfolio to markets in Europe and Asia," said Woodside. Quarterly highlights also included the start of the concept definition procedure phase for Browse Basin natural gas resources to be processed through the North West Shelf plant that has been in operation since 1989. Woodside also selected Bechtel Inc. of the US as the preferred engineering, procurement and construction contractor for the concept definition work for Train 2 of its Pluto LNG plant in Western Australia.

In its overseas operations, the Perth-based company submitted the evaluation report to the Government of Senegal in West Africa for the SNE field Development-Phase 1. Its Asian activities saw further success in its exploration activities offshore Myanmar. The company's latest drilling encountered a significant gas column in the Shwe Yee Htun-2 appraisal well. "Production at Wheatstone LNG continued ahead of plan, underpinning a 13.8 percent rise in output compared with the corresponding quarter in 2017," said Woodside Chief Executive. "Sales revenue increased 25.4 percent over the same period to US$1,157 million on the back of higher prices, although sales volumes were tempered slightly by the timing of Woodside equity sales," explained the CEO. "During the quarter we made excellent progress on our near-term growth projects at Greater Western Flank Phase 2 and Greater Enfield and further demonstrated our capability to successfully execute our next phase of development in the Burrup Hub," said Coleman. "In September, the Browse Joint Venture confirmed the Browse to North West Shelf development concept," he added. "Contracts have now been awarded for the concept definition engineering design of the floating production, storage and offloading unit (FPSO) facilities and for the pipeline survey," he stated. "We have also selected our preferred execution contractor for the proposed expansion of the Pluto LNG facility. Work will now include refining the concept and costs for Pluto Train 2, in preparation for the entry into front-end engineering and design, targeted for the first quarter of 2019," said the CEO. "Looking ahead in Senegal, we are on schedule to submit the SNE Field Development and Exploitation Plan and expect to assume operatorship of the development in the fourth quarter," added Coleman. ■

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Future of LNG import market amid growing demand in Latin America and the Caribbean

Law firm Baker Botts gives overview of the significant diversity in region's natural gas economies

In the past 10 years, Latin America and the Caribbean have seen significant growth in the number of LNG import terminals being constructed and commencing operations in these regions.

Prior to that time, only three LNG import terminals were operating in Latin America: the AES Andres terminal in the Dominican Republic, the Ecoeléctrica Peñuelas terminal in Puerto Rico, and the Altamira terminal in Mexico.

Starting in 2008, however, the number of terminals increased significantly.

More terminals

In Mexico, the Energía Costa Azul and Manzanillo projects came online in 2008 and 2012.

Then, in Argentina, Bahia Blanca GasPort and GNL Escobar GasPort came online in 2008 and 2011.

In Brazil, the Pecem Port, Guanabara Bay and Bahia LNG terminals came online between 2008 and 2013. In Chile, GNL Quintero and GNL Mejillones came online during the same period.

The purpose of this paper is to analyse the current dynamics of LNG imports and facilities in the region on a country-by-country basis and to provide views on their likely trajectory in the near-term future.

The results of this analysis show a dynamic interaction between LNG imports and other factors including changes in domestic gas production, gas pipeline imports, hydro power generation levels, seasonal gas demand, and other factors.

Gas-fired power plants are now widespread in Latin America and many new projects are in the works.

LNG import projects have moved forward more recently, or are currently in the works. In late 2016, a new LNG terminal in Cartagena de Indias, Colombia, commenced operations.

LNG-to-power

Meanwhile, two LNG-to-power projects are under construction in Latin America, with the AES Colón project in Panama and the Porto de Sergipe 1500 megawatt (MW) project in Brazil.

Jamaica is also moving forward with LNG-to-power, having completed the Bogue, St. James project and now constructing the Jamalco LNG-to-power project, and a third project is under development.

Other potential projects are also being considered throughout Latin America, including an LNG import terminal in the port of Pajaritos in Mexico, the Energía del Pacífico LNG-to-power project in El Salvador, the Aguirre Offshore GasPort in Puerto Rico, the Buenaventura import project on the Pacific coast of Colombia, the Alunorte and the Novo Tempo and Porto de Acu projects in Brazil.

Consumption

In Chile, there is the Talcahuano import project, the Shell-Mitsui project near Vallenar and the GNL Penco and Central El Campesino LNG-to-power project.

It is not surprising, then, that natural gas consumption in Latin America is growing, and in fact in recent years has outpaced gas production.

Gas consumption in Latin America increased from 202.1 billion cubic metres in 2006 to 261.4 Bcm in 2016, an increase of 59.3 Bcm.

At the same time, gas production also increased, but at a slower rate, from 211.4 Bcm in 2006 to 224.2 Bcm in 2016, for a net increase of only 12.8 Bcm. These changes from 2006 to 2016 are noteworthy.

Latin America in 2006 produced 9.3 Bcm more gas than it consumed, but by 2016, the region was consuming 37.2 Bcm more than it was producing.

This increase in consumption is being driven in part by increased industrial and residential uses of natural gas but, more importantly, by a seemingly insatiable hunger in Latin America for more and cleaner power.

Gas-fired power plants are now widespread in Latin America and, as noted above, many new projects are in the works.

The gap between gas consumption and gas production has not gone unanswered. Gas pipeline imports from the United States to Mexico have skyrocketed, with 38.4 Bcm moving south across the border in 2016.

Pipeline issue

Gas pipeline exports and imports have also been significant throughout South America, with Bolivia exporting 10.4 Bcm to Brazil and 5.8 Bcm to Argentina in 2016.

LNG imports have also played a key role. In 2016, 21.4 Bcm of LNG was imported into Latin America. On global terms, that seems relatively small, as it comprises only 6 percent of the global demand for LNG.

But on a more local scale, the impact is significant: 21.4 Bcm of LNG is roughly 750 tera Btus (TBtus) or, assuming 3.3 TBtu cargoes, approximately 227 cargoes per year. In the context of the economies of the countries in Latin America, that is not an insignificant number.

Those LNG imports and the LNG import facilities that support them are the subject of this paper.

Mexico

Looking at the impact of gas pipeline imports, Mexico is the largest natural gas producer, consumer and importer in Latin America, with 47.2 Bcm of production, 89.5 Bcm of consumption, 38.4 Bcm of gas pipeline imports and 5.9 Bcm of LNG imports in 2016.

The quantity of gas pipeline imports from the US are particularly notable, having increased more than four times since 2010.

Much of Mexico's great appetite for gas is in the power sector. Natural gas is Mexico's largest source of energy for generating power, providing 54 percent of Mexico's power generation as of 2015.

Some of the natural gas growth has been from fuel-switching to clean natural gas, as over 4.3 gigawatts (GW) of fuel oil burning power plants have been replaced with gas-fired power plants in recent years.

The future looks the same and significant additions of new gas-fired capacity are expected, with Mexico's national energy ministry (SENER) projecting 24.9 GW of new gas-fired capacity between 2016 and 2029.

Mexico has three LNG terminals: Altamira, Manzanillo and Energía Costa

Figure 1: Map of Existing and Proposed LNG Terminals in Latin America

Region of growth for LNG terminals, gas-to-power projects and trans-shipments

Azul. The first two are reportedly quite active, operating between 80 percent and 100 percent of their capacity, while the third, Energia Costa Azul, is instead looking to develop liquefaction and export capabilities.

Locations

Much of the high utilization of Altamira and Manzanillo is due to location. They are sited in regions where gas pipelines in Mexico to the United States are not yet sufficient to satisfy local gas demand.

A fourth LNG terminal is reportedly in the works. According to CFEnergia, the marketing arm of Mexico's state power utility Comisión Federal de Electricidad (CFE), it plans to launch a tender in the near future to charter, for 3 to 5 years, a floating storage regasification unit (FSRU) to be stationed in the port of Pajaritos in Coatzacoalcos, Mexico.

It is looking to supply between 2.5 and 4.5 million tonnes per annum of LNG through the new terminal. This appears to be a temporary solution, until additional gas pipelines can be constructed.

The future of the LNG import industry in Mexico hinges, then, on one key factor: natural gas pipeline development.

The question is not whether there will be enough gas supply coming from US shale production but whether there will be enough pipelines to get it from the border to the local market in Mexico.

In the short term, the answer is no, there will not be enough pipelines, and that is driving utilization of the Altamira and Manzanillo terminals and the proposed tender for a fourth terminal in the port of Pajaritos.

In the long-term, the answer will depend on Mexico's ability to attract outside investment in the sector.

In this light, and in light of the expected increases in natural gas demand in Mexico over the next 10 years, it appears likely that the Manzanillo and Altamira terminals will remain active, the proposed port of Pajaritos will likely be developed and one or two other temporary import terminals may be added during this period.

Dominican Republic

The Dominican Republic has one LNG import terminal. That terminal, known as AES Andres, has been in operation for nearly 15 years and fuels a 319 MW gas-fired power plant.

Other LNG import terminals have been proposed in the Dominican Republic but have not been developed and constructed. These include the proposed Complejo GNL del Este terminal announced in 2012 for development in San Pedro de Marcorís.

More recently, the Andres terminal has been expanded to offer LNG deliveries in ISO containers and LNG trans-shipment services for customers seeking to reload LNG onto smaller scale vessels at the terminal.

Through these services, AES aims to give countries in the region access to clean-burning natural gas, as a substitution for dirtier and often more expensive fuel oil and diesel.

Other proposals have been announced for ISO container deliveries or LNG trans-shipment services in the Caribbean.

AES has announced plans to make available the same services at its Colón LNG terminal in Panama, once it is constructed and operational.

Curacao has also ventured into the trans-shipment space, having proposed in 2016 the development of an LNG receiving and trans-shipment terminal to operate in connection with an existing refinery, but that development has stalled.

Trans-shipments

ISO containers are currently being used by Crowley Fuel's subsidiary Carib Energy (USA) to transport LNG from the US mainland to Puerto Rico, to support a major pharmaceutical company's energy needs in Puerto Rico.

LNG deliveries via ISO containers and LNG trans-shipment services remain a niche LNG development in Latin America but present new opportunities to deliver LNG to smaller economies in the Caribbean, Central America and the northern coast of South America where customers would not otherwise have access to LNG.

Both ISO container deliveries and LNG trans-shipment services have a higher per unit cost than standard full-scale LNG cargoes, and those higher costs can be worth the price in some applications when competing with other more expensive, dirtier, or less reliable fuels and fuel supplies.

To date, however, and despite many proposals for ISO container and trans-shipment services in the Caribbean, few signed transactions have been announced.

To the extent oil prices rise relative to gas prices or countries in the Caribbean region adopt cleaner energy mandates, the use of ISO containers for transporting LNG and the procurement of LNG trans-shipment services in the Caribbean should increase significantly.

The development of LNG trans-shipment services, to the extent it gains traction, will add new complexities to the operations agreements for multi-customer LNG terminals where the services are provided.

For single-customer LNG terminals, it will be relatively easy to add the services through an amendment to the terminal use agreement (TUA) between the terminal owner and operator, but in the case of multi-customer terminals with LNG pooling arrangements, further details will need to be included to address how LNG will be allocated between customers in a way that supports trans-shipments.

For example, for situations where a customer would typically be required to lend LNG from its cargo deliveries to other customers under a required LNG pooling arrangement, the TUA and operations coordination agreement (OCA) may need to include exceptions for a customer that is unloading a standard full-size cargo and that is scheduled to reload a smaller trans-shipment cargo shortly thereafter.

This would allow the customer to retain sufficient quantities of LNG in its own inventory to be able to load the smaller trans-shipment cargo.

Shipping

Alternately, the TUA and OCA may need to allow such customer to borrow LNG from other customers, under terms and conditions to be agreed by the parties, to ensure the customer has enough LNG to load its smaller trans-shipment cargo.

New and existing LNG import terminal developers seeking to add ISO container deliveries and trans-shipment services to their terminal will need to ensure that these transactions comply with local regulations.

These include regulations governing the export of natural gas, as well as any applicable environmental, marine or other regulations.

In the Dominican Republic, it appears likely that the ISO container deliveries and trans-shipment services at the Andres terminal will gain momentum and broaden the reach of LNG in the region.

The Dominican Republic is located in a relatively central location in the Caribbean and, provided the economics of ISO container deliveries and trans-shipment deliveries are satisfactory, Andres terminal appears well-positioned to grow in its development in both areas.

Jamaica

Jamaica is active in the LNG space, with one LNG-to-power project in operation, another under construction, and a third under development. The first is in Bogue, St James, Jamaica, where Jamaica Public Service Company (JPS) converted its 120 MW power plant to run on natural gas.

The New Fortress Energy has chartered the "Golar Arctic" FSRU to serve as an LNG import terminal.

The second project, now under construction, is the Jamalco 94 MW combined heat and power plant to be powered by LNG, which, together with a second phase proposed to be constructed, will total 200 MW.

The Jamalco power plant is being constructed by New Fortress Energy. The third project is a proposed 230 MW LNG-fueled power plant for the Alpart refinery.

According to its Finance Ministry, Jamaica sees its investment in LNG as an important step in providing affordable electricity in place of more expensive oil.

Will Jamaica's ambitious LNG investments serve as a model to other countries in the region?

One imprecise but somewhat useful tool is to compare the GDP of Jamaica to the GDPs of its neighbors.

For example, the GDPs of Central American countries like Guatemala, Honduras and El Salvador all exceed the GDP of Jamaica, suggesting they may have the capacity to support one or more LNG project, if Jamaica with its lower GDP has the capacity for such projects.

Of course, the analysis is much more complex, and requires the consideration of factors such as current power demand, expected power demand growth, existing and projected renewable generation capacity, regulatory frameworks, laws promoting cleaner energy sources, and general investment climate. Still, the opportunity is there. ■

Part 2 of the analysis will be published in the January 2019 LNG Journal

This article is based on extracts from the paper entitled:"The Dynamic Role and Future of LNG Imports in Latin America and the Caribbean" by David Jetter, Partner, Baker Botts LLP and was presented at recent conferences.

LNG export plant configurations and processing methods will have a huge impact on efficiency

Deepak Bawa, project manager in LNG and energy projects, considers OSMR liquefaction technology and others

We are in a market where an industry which is just over 50 years old is growing at a very fast pace and its future looks bright. Liquefied natural gas trade has quadrupled over the last two decades and is expected to double over the next two.

This significant growth can largely be attributed to increases in new LNG supply, driven primarily by projects in Australia and the United States bringing new capacity on line.

Expansion

With additional trains at Australia Pacific LNG, Gorgon LNG, and higher production from existing trains, Australia added 11.9 million tonnes of production in 2017. USs production gains of 10.2MT were driven entirely by Sabine Pass LNG, which added two new trains in 2017.

Qatar remains the world's leading exporter of LNG, with 2017 liquefaction reaching 81MT. In 2017, unlike 2016, increases in world trade occurred without new major entrants to the global LNG market.

The Asia-Pacific region continued to be a core driver in global demand, with China alone adding 12.7MT of imports last year, the largest ever annual growth by a single country.

As of March 2018, global nominal liquefaction capacity reached 369 million tonnes per annum (MTPA), with 32.2 MTPA of liquefaction capacity added between January 2017 and March 2018.

As part of this, the first floating liquefaction (FLNG) project came online in Malaysia, with additional FLNG projects set to come online in 2018 and beyond.

This growth is expected to continue, with 92 MTPA of liquefaction capacity under construction as of March 2018, and a further 875.5 MTPA of proposed capacity in the pipeline.

Efficiencies

Plant configuration can have as large or larger an impact on the effective efficiency of a given LNG installation.

Plant configuration in this context refers to driver selection (steam turbine, industrial frame gas turbine, aero-derivative gas turbine, motor), waste heat integration (process heating duty oil/water coils, combined cycle steam systems), application of liquid expanders, application of LNG product flash gas as a heat sink, number of refrigerant stages selected, cooling medium (air vs. water) and to some extent where the system boundaries are drawn (i.e. including or excluding infrastructure utility loads).

Setting aside the hyperbole, some generalizations can be made:

- The difference in efficiency between facilities with the greatest and the least efficiency is not numerically large, representing only a few percent of the feed-gas supply to an LNG plant regardless. The best achievable LNG plant efficiencies run in the range of 92-94 percent, while the lowest run in the range of 88-90 percent;
- While these differences are small numerically, considering the large gas flow rates into an LNG facility they are significant on an absolute basis;
- Mixed refrigerants are generally more efficient for liquefaction than pure component refrigerants, as the natural gas cooling curve can be more closely approximated. Depending on the composition of the natural gas and the number of refrigeration stages selected this difference can be minor or it can be more significant
- Pre-cooled liquefaction arrangements are generally more efficient than arrangements using a single refrigerant. It is challenging to maintain close approach to the natural gas cooling curve over the entire range of ambient down to -160°C (-260°F) with a single refrigerant selection
- Nitrogen expansion processes are some of the least efficient
- Gas turbine plants deliver their greatest efficiency when the gas turbines are run at full capacity;
- Aero-derivative gas turbine drivers are more efficient than industrial gas turbine drives (again in most cases, as some of the newer generation industrial machines deliver efficiencies as high as or higher than those of competing aero machines)
- Newer generation gas turbines are more efficient than earlier generation machines
- Addition of waste heat recovery can greatly increase the overall gas turbine cycle efficiency. A common industrial frame gas turbine efficiency is on the order of 32-34%. Adding "light duty" process heating recovery can push this up to 36-38%. Aero-derivative & high efficiency industrial machines provide efficiencies in the range of 40-45%, while in corporation of combined cycle can push delivered efficiencies up to the range of 50% and higher
- Motor drives introduce additional inefficiencies. Instead of direct coupling a gas turbine to a compressor, the gas turbine drives a generator, which then drives a motor, which drives the compressor. Some of the additional inherent added inefficiencies induced by the generator and motor can be recovered if the power plant efficiency is high enough
- Steam turbine driven LNG plants, while highly reliable, are among the least efficient.

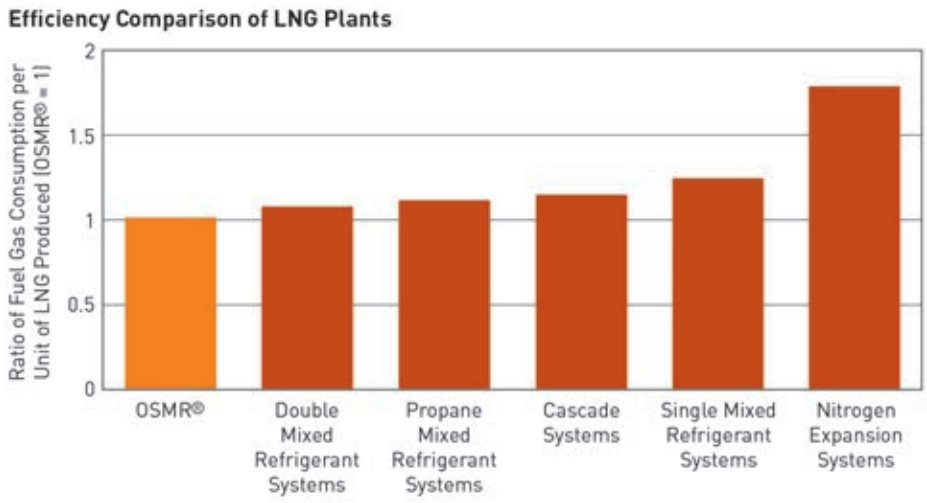

Figure 1: How various processing systems operate in liquefaction facilities

Engineering and design

The liquefaction unit accounts for approximately 50 % of the total capital costs of 1-2 billion US$ for a baseload LNG plant. The type of liquefaction process, in combination with the rotating equipment and ambient cooling system, affects the capacity and availability of the entire LNG system so it is essential that the best process is selected.

The choice of liquefaction processes has become increasingly diverse in recent years. A number of designs have focused on new concepts, such as smaller and floating liquefaction trains. Air Products' liquefaction processes accounted for nearly 80 percent of existing plants in 2016, the AP-C3MR™ process held the greatest share at 47 percent, followed by the AP-X® (15 percent) and AP-C3MR/SplitMR® (14 percent) processes.

Air Products processes account for 68.2 MTPA (59 percent) of the 114.6 MTPA of capacity under construction as of January 2017.

Cameron LNG and Yamal LNG have selected the AP-C3MR™ process, while Cove Point, Freeport LNG, Gorgon LNG, Ichthys LNG, and Tangguh LNG T3 use the AP-C3MR/SplitMR® design. PFLNG Satu uses the AP-N™ process.

Large-scale

The large-scale AP-X® process has thus far been used exclusively in Qatari projects. Air Products is therefore expected to retain its leading position.

However, the ConocoPhillips Optimized Cascade® process will see strong growth with eight trains (35.9 MTPA of capacity) under construction as of January 2017.

Sixty percent of the 35.3 MTPA of new capacity that came online since January 2016 utilizes the Optimized Cascade® process.

As a result of its suitability to dry gas, the process has been the top choice for coal-seam-gas (CSG) projects in Australia as well as some projects in the US, given their pipeline-quality dry gas feedstock.

Other and increasingly smaller-scale processes make up a limited portion of existing and under-construction capacity but may see an increase in market share

going forward. The use of these processes may allow developers to begin constructing liquefaction trains offsite, which in turn may help to reduce costs.

Build-out

In North America, multiple projects have been proposed based on small-scale modular liquefaction processes, such as IPSMR® (Chart Industries), OSMR (LNG Limited), and PRICO® (Black & Veatch).

The 2.5 MTPA Elba Island LNG project in the US, which began onsite construction in 2016, will utilize Shell's Movable Modular Liquefaction System (MMLS) process.

♦ **The Propane pre-cooled/Mixed Refrigerant process:** The process uses propane as pre-cooling medium and a mixed refrigerant (nitrogen, methane, ethane and propane) as liquefaction medium. A GE-7EA driven compression train pumps around MR, which is partly condensed against air and four stages of propane cooling. The vapor and liquid refrigerant fraction as subsequently auto-cooled and expanded, such as to achieve matching cooling curves in a spoolwound main cryogenic heat exchanger of maximum proven size. The natural gas is liquefied in this heat exchanger. A four-stage propane cycle provides the pre-cooling for the MR and the natural gas. The propane compressor is also driven by a GE-7EA gas turbine. Moreover, to further enhance LNG production a Shell patented endflash system has been used.

♦ **The Cascade process:** The Cascade process is a multiple refrigerant system wherein the lowest boiling temperature stage of each refrigerant is used in turn to condense the next refrigerant. The process in this comparison study uses pure refrigerants in the consecutive cooling steps, viz. propane and ethylene, both in closed, three stage cycles and finally methane in a four stage open cycle. Core-in-kettle type heat exchangers and plate-fin heat exchangers are used for cooling of the natural gas and for cold recovery. The use of these exchanger types allows very low temperature approaches.

♦ **A version of the Dual Mixed Refrigerant (DMR) process:** The Dual mixed Refrigerant process uses a mixture of methane, ethane, propane and butane as precooling medium. The compressed mixture is fully condensed against air and subsequently auto-cooled and expanded to provide refrigeration duty. The expansion can be performed at one, two or three pressure levels. In the comparison study a three stage pre-cooling cycle was selected. A GE-7EA type driver plus 6 MW helper power and two maximum size spoolwound heat exchangers are used in the pre-cooling circuit. Alternatively plate-fin heat exchangers in cold boxes can be used. The liquefaction circuit and nitrogen rejection system resemble to a large extent the liquefaction circuit of the C3/MR process.

♦ **A version of the Single Mixed Refrigerant (SMR) process:** In the Single Mixed Refrigerant Process shown here, one refrigerant provides the total cooling from ambient to LNG temperatures at one pressure level. Two GE-7EA driven compressor strings, operating in parallel, each with 6 MW helper power are used to pump around the refrigerant that contains components ranging from nitrogen to pentane. One compressor string consists of an axial compressor followed by a centrifugal compressor. The refrigerant partially condenses in the inter-stage and discharge air coolers. The compressed vapor refrigerant fraction is combined with the pumped liquid fractions in the inlet of plate-fin heat exchangers, where the mixture is auto-cooled and expanded such as to achieve matching cooling curves. The natural gas is pre-cooled and liquefied in the same heat exchangers. A large number of parallel exchangers is distributed over a number of cold boxes. Alternatively a number of spoolwound heat exchangers can be used. The endflash system employed is identical to the endflash system used for the C3/MR process.

♦ **The pre-cooled Nitrogen Expansion process:** The Nitrogen Expansion process uses Propane as precooling medium and Nitrogen as liquefaction refrigerant. A GE-7EA driven axial compressor pumps around Nitrogen that is pre-cooled against propane. The nitrogen is subsequently auto-cooled and expanded via three turbo-expander sets, such as to achieve a good match of the cooling curves in the cryogenic heat exchangers. A plate-fin type was selected here, but a spoolwound heat exchanger could have been used as well. A four-stage propane cycle provides the precooling for the nitrogen and the natural gas. A GE-5C gas turbine to drives this compressor with a helper motor. An advanced nitrogen rejection system, identical to the one used for C3/MR is used.

♦ **The Ammonia pre-cooled/Mixed Refrigerant process:** OSMR process combines several well-proven, existing technologies into one integrated system. The single mixed refrigerant (SMR) liquefaction process is at the heart of the OSMR process, which optimizes the SMR process with ammonia pre-cooling. Use of ammonia as a pre-cooling refrigerant, having superior refrigeration properties to propane, allows for smaller condensers, exchangers, and general plant size. Gas turbine waste heat steam generation (combined cycle providing motive power to the ammonia refrigeration system). A closed loop ammonia refrigeration circuit, driven by steam recovered from waste heat mentioned above, pre-cools the mixed refrigerant and directly cools inlet air to the gas turbines.

OSMR for Magnolia LNG project seen as innovation for a changing: An Australian based company is seeking to establish a concept of mid-scale, low cost, efficient, reliable and repeatable natural gas liquefaction projects for the world's energy market. The market entry project has been identified as a 4 x 2 MTPA liquefaction facility (8 MTPA total) on the US Gulf Coast in Lake Charles, Louisiana.

As an emerging LNG proponent (as opposed to the major established national and international energy companies historically building and operating LNG facilities), they recognized it would be challenging to compete for project opportunities without bringing specific advantages to the table.

Four key principles were established to deliver the necessary advantages - industry leading capital cost; optimized plant energy efficiency; shortened development and construction schedules; and an overall smaller environmental impact footprint including reduced carbon emissions relative to other LNG technologies.

Without clear advantages such as these, investors and LNG buyers would simply stay with the established LNG producers.

A simplified process schematic is shown below. Pipeline feed-gas from the US gas grid is pretreated to remove sulfur, carbon dioxide and any trace mercury, dehydrated, and processed to remove heavy hydrocarbons that could potentially freeze in the liquefaction process.

The feed-gas is pre-cooled with a single component refrigerant, then liquefied with a mixed component refrigerant selected to closely mimic the cooling curve of the natural gas to achieve best efficiency. The pre-coolant refrigerant also serves as a means to pre-cool the mixed refrigerant to further enhance the efficiency. The high pressure product LNG is then flashed into storage for export.

Elements of OSMR Technology that differentiate it from other technologies are as follows:

Selection of Pre-Cooling Refrigerant: Larger base load LNG facilities have historically utilized pre-cooling refrigerant as a means to optimize the process.

Propane has been the universal selection as it represents an efficient refrigerant well suited for large industrial applications and, importantly, could be extracted from the feed-gas of remote location facilities. US Gulf Coast pipeline feed-gas facilities (as well as coal seam gas plants in Queensland, Australia) have little or no propane in the feed-gas, necessitating the import of pre-cooling refrigerant.

Selection

Anhydrous ammonia (R717) was selected over the traditional propane for a number of reasons (below). Ammonia is commonly used as a primary refrigerant across many applications and industries requiring high cooling duties including cold storage, food and drink processing, ice production and skating rinks as well as in ammonia production facilities themselves.

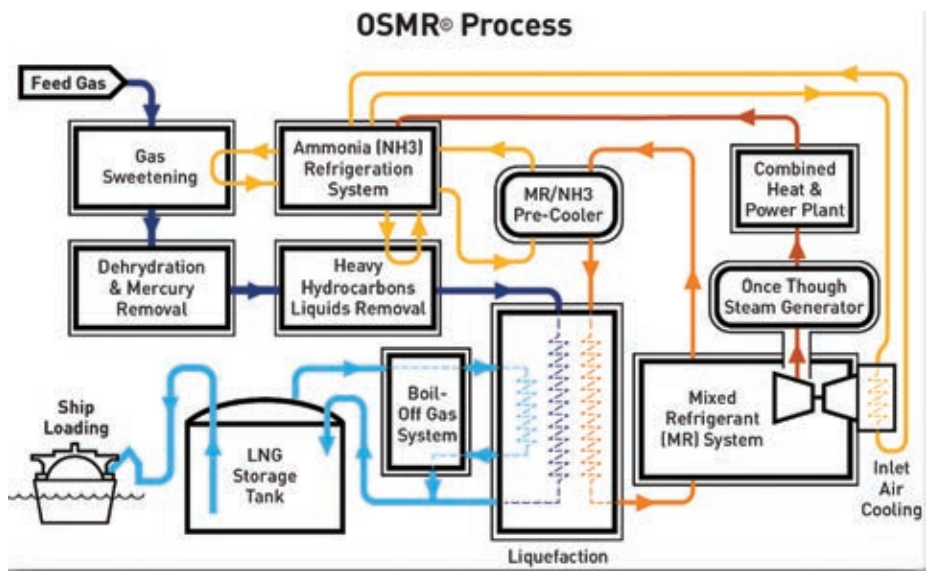

Figure 2: LNG Limited has targeted a nominal train design capacity of 2 MTPA

	Ammonia	Propane
Mass Heat Capacity	1	0.80
Mass Flow	1	3.94
Discharge Volume Flow	1	1.15
Suction Volume Flow	1	1.25
Compressor Power	1	1.02
Condenser Duty	1	1.00
Condenser Area (UA)	1	2.00

Figure 3: A comparison of ammonia and propane refrigerants in usage

NASA also selected ammonia refrigeration to provide cooling duties for the International Space Station. Supportive characteristics of ammonia refrigerant include:

- Readily available and relatively inexpensive refrigerant;
- Equipment costs are low; like propane, ammonia refrigeration systems require only carbon steel and not expensive alloys
- With lower swept volumes ammonia refrigeration plants provide a smaller equipment and piping, reducing capital costs;
- Ammonia is a highly efficient refrigerant; a side-by-side comparison of Ammonia and Propane refrigeration circuits delivering the same cooling load is shown below:

Refrigerant

Ammonia is classified as a natural refrigerant; it is environmentally friendly and naturally occurring with a life cycle in the atmosphere of less than one week. It has a Global Warming Potential of Zero and an Ozone Depletion Potential of Zero:

- The relatively high efficiency of ammonia refrigeration also reduces indirect environmental emissions as less energy is necessary to deliver the required cooling duty. The use of natural refrigerants is endorsed by prominent environmental stewardship groups;
- Industry experience with ammonia refrigeration systems is extensive, and there are well established regulatory frameworks in place. For LNG projects in the United States, the Federal Energy Regulatory Commission (FERC) hold primary responsibility, support by cooperating agencies including the Environmental Protection Agency (EPA) and the Office of Safety and Health Administration (OSHA). There are over 7,000 ammonia processes in the US covered under the EPA Risk Management Program, including more than 2,000 ammonia refrigeration facilities. Similarly in Australia, the Hazardous Industries and Chemicals Branch (HICB) regulates the use of ammonia in LNG plant designs;
- Ammonia is an inherently safe refrigerant choice, as evident by its wide use for industrial cooling duties. The toxicity of anhydrous ammonia in relatively low concentrations must be managed (by comparison, propane is a simple asphyxiant) but it provides a number of advantages including:
  - Ammonia is not readily flammable – in most situations ammonia can be considered effectively non-flammable
  - Ammonia is not readily explosive
  - Ammonia is lighter than air, so as it warms it tends to rise and naturally dissipate
  - Detection of releases in relatively low concentrations is rapid and reliable
  - Mitigation of ammonia releases is reliable and effective through the use of simplewater sprays due to ammonia high affinity to, and solubility in, water.

Key Advantages

Mid-scale, OSMR liquefaction process contributes

- Lower capital cost
- Shorter development and construction
- Improved energy efficiency
- Smaller Footprint
- Improved reliability and turndown
- Lower carbon emissions

LNG Limited has targeted a nominal train design capacity of 2 MTPA, with conceptual designs demonstrated in the range of 1-3 MTPA. Each train incorporates two identical independent cold box exchangers, each chilled by an independent closed loop mixed refrigerant (MR) supply. Each of the dual MR loops has its own gas turbine driven compressor.

The two parallel MR circuits within each LNG train generate excellent turndown characteristics, while plant reliability also greatly improves since each LNG train can still achieve 50 percent capacity when one MR circuit is offline.

Inlet air chilling plays an important role in the OSMR process. The higher the ambient conditions, the lower the gas turbine power, which results in lower LNG production. Pre-chilling the air to the gas turbines allows for improved and consistent gas turbine power in various ambient conditions, increasing LNG production through changing seasons.

System

Using ammonia to pre-cool the MR and feed-gas ahead of the cold box increases plant capacity even further, with little additional fuel use fundamental to the overall OSMR configuration.

The ammonia pre-cooling system itself is largely powered by a combined-cycle steam system supplemented by auxiliary boilers for start-up and control. This arrangement maximize the use of the gas turbines' available waste heat and contributes significantly to the overall process energy efficiency.

With an innovative and patented boil-off gas handling system, boil-off gas is lightly compressed, re-liquefied in the cold box and then passed through the liquid methane separator before it is delivered as LNG to the storage tank.

This system enables recovery and re-liquefaction of low temperature boil-off gas while minimizing compression losses that are commonly seen in other liquefaction designs.

Achieving high efficiency improves both the economics and environment performance of a liquefaction facility. In real terms, for an 8 MTPA capacity facility, improving the overall process efficiency by only two percentage points, from 92 percent typical for large base load trains to 94 percent expected for Magnolia (6 percent retainage expected) reduces the annual fuel consumption costs by nearly US$30 million (based on US$3.00/mm Btu feed-gas value).

It also reduces the CO2 greenhouse gas emissions by 1.1 billion lbs/year and reduces NOx emissions as well. ■

About the Author

Deepak Bawa is a Project Manager in the Oil & Gas field who is currently working with SNC-Lavalin in Houston, Texas, and has more than 15 years of experience in LNG, Petrochemicals, Chemical plants & Heavy Engineering projects with companies like KBR, Technip -FMC, IHI E&C and UOP-A Honeywell.

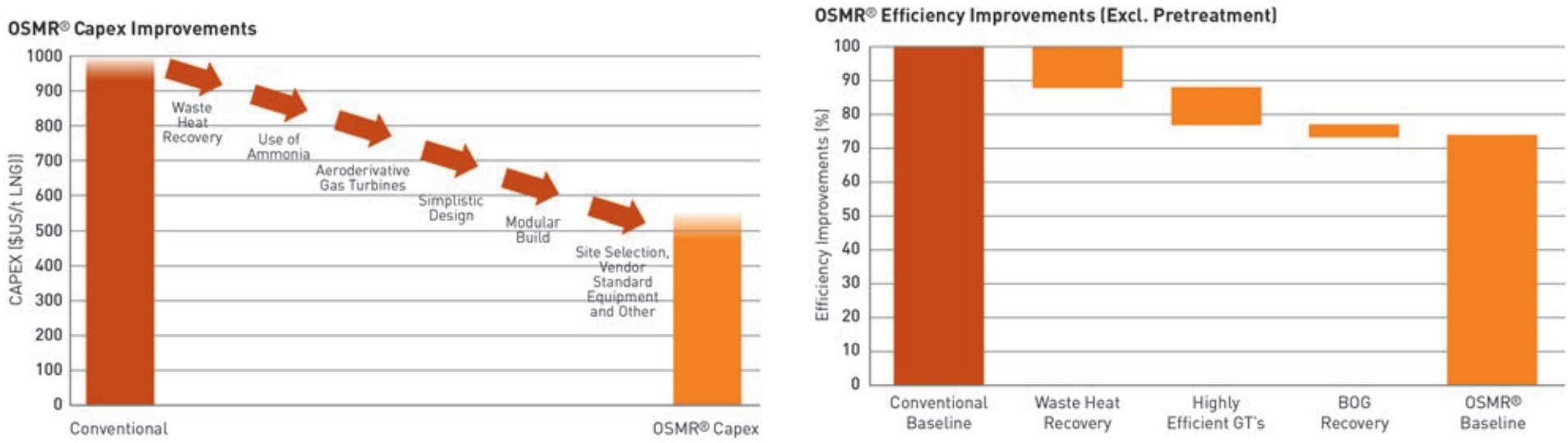

Figure 4: How the OSMR system rates in terms of capital expenditure (left) and efficiency (right)

World LNG Carrier Fleet

LNG carrier	Capacity m^3	Owned or Ordered by	Builder	Delivery Date	Flag	Power Plant	Cargo System	No. of tanks	Ship built for Export plant
Aamira	266,000	QGTC	Samsung	Dec-10	Liberia	DRL	TZ Mk. III	5	Qatargas IV
Abadi	135,000	Brunei Gas Carriers	Mitsubishi Nagasaki	Jun-02	Brunei	S	Moss	5	Brunei LNG
Abalamabie	174,900	Bonny Gas	Samsung	June-16	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
Adam LNG	162,000	Oman LNG	Hyundai	Dec-14	Marshall Is.	DFDE	TZ Mk. III	4	Oman LNG
Al Aamriya	210,100	J5 Consortium	Daewoo	Feb-08	Marshall Is.	DRL	GT NO 96	4	Qatargas
Al Areesh	151,700	Teekay LNG	Daewoo	Jan-07	Qatar	S	GT NO 96	4	Ras Gas II
Al Bahiya	210,185	QGTC	Samsung	Oct-09	Liberia	DRL	TZ Mk. III	5	Qatar-Atlantic
Al Biddah	135,275	J4 Consortium	Kawasaki Sakaide	Nov-99	Japan	S	Moss	5	Qatargas
Al Daayen	151,700	Teekay LNG	Daewoo	Apr-07	Qatar	S	GT NO 96	4	RasGas II
Al Dafna	266,000	QGTC	Samsung	Oct-09	Marshall Is.	LR DRL	GT NO 96	4	Qatar-Atlantic
Al Deebel	145,000	Peninsular LNG	Samsung	Dec-05	Bahamas	S	TZ Mk. III	4	Qatargas
Al Gattara	216,200	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Al Ghariya	210,100	ProNav	Daewoo	Feb-08	Bahamas	DRL	GT No. 96	4	Qatargas
Al Gharaffa	216,200	OSG/Nakilat	Hyundai	Jan-08	Marshall Is.	DRL	TZ Mk. III	4	Various
Al Ghashamiya	216,000	QGTC	Samsung	Mar-09	Liberia	DRL	TZ Mk. III	4	Qatar-Atlantic Basin
Al Ghuwairiya	261,700	QGTC	Daewoo	Aug-08	Marshall Is.	DRL	GT NO. 96	5	Qatar-Atl'c Basin
Al Hamla	216,000	OSG	Samsung	Feb-08	Marshall Is.	DRL	TZ Mk. III	4	QatarGas
Al Hamra	137,000	National Gas Shipping	Kvaerner-Masa	Jan-97	Liberia	S	Moss	4	ADGAS
Al Huwaila	217,000	Teekay	Samsung	May-08	Bahamas	DRL	TZ Mk. III	4	RasGas III
Al Jasra	137,100	J4 Consortium	Mitsubishi Nagasaki	Jul-00	Japan	S	Moss	5	Qatargas
Al Jassasiya	145,700	Maran-Nakilat	Daewoo	May-07	Greece	S	GT No 96	4	RasGas
Al Kharaitiyat	216,200	QGTC	Hyundai	May-09	Liberia	DRL	TZ Mk. III	4	Qatargas III
Al Kharaana	210,000	QGTC	Daewoo	Oct-09	Marshall Is.	DRL	GT NO 96	4	Qatargas IV
Al Kharsaah	217,000	Teekay	Samsung	May-08	Bahamas	DRL	TZ Mk. III	4	RasGas III
Al Khattiya	210,000	QGTC	DSME	Oct-09	Marshall Is.	DRL	GT No. 96	4	Qatargas IV
Al Khaznah	135,500	National Gas Shipping	Mitsui Chiba	Jun-94	Liberia	S	Moss	5	ADGAS
Al Khor	137,350	J4 Consortium	Mitsubishi Nagasaki	Dec-96	Japan	S	Moss	5	Qatargas
Al Khuwair	217,000	Teekay LNG	Samsung	Jul-08	Korea	DRL	TZ Mk. III	4	RasGas
Al Mafyar	266,000	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Al Marrouna	151,700	Teekay	Daewoo	Nov-07	Bahamas	S	GT NO 96		Ras Gas I
Al Mayeda	266,000	QGTC	Samsung	Jan-09	Liberia	DRL	TZ Mk. III	5	Qatar-US/Var.
Al Nuaman	210,000	QGTC	DSME	Dec-09	Marshall Is.	DRL	GT No. 96	4	Qatargas IV
Al Oraiq	210,000	J5 Consortium	Daewoo	Apr-08	Marshall Is.	DRL	GT No. 96	4	Various
Al Rayyan	135,360	J4 Consortium	Kawasaki Sakaide	Mar-97	Japan	S	Moss	5	Qatargas
Al Rekayyat	216,200	QGTC	Hyundai	Jun-09	Bahamas	DRL	TZ Mk.III	4	Qatar-Atlantic
Al Ruwais	210,100	ProNav	Daewoo	Nov-07	Germany	DRL	GT NO 96	4	Qatargas II
Al Sadd	210,100	QGTC	Daewoo	Mar-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Al Safliya	210,100	ProNav	Daewoo	Dec-07	Bahamas	DRL	GT NO 96	4	Qatargas II
Al Sahla	216,200	J5	Hyundai	Jun-08	Japan	DRL	TZ Mk. III	4	Ras Gas III
Al Samriya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GT NO. 96	5	Qatargas II
Al Sheehaniya	210,100	QGTC	Daewoo	Feb-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Al Shamal	217,000	Teekay LNG	Samsung	Jun-08	Qatar	DRL	TZ Mk. III	4	RasGas
Al Thakhira	145,000	Peninsular LNG	Samsung	Sep-05	Bahamas	S	TZ Mk. III	4	Qatargas
Al Thumama	216,000	J5 Consortium	Hyundai	Apr-08	Japan	DRL	TZ Mk. III	4	Rasgas
Al Utouriya	215,000	J5	Hyundai	Sep-08	Panama	DRL	TZ Mk. III	4	RasGas
Al Utourma	215,000	J5	Hyundai	Sep-08	Panama	DRL	TZ Mk. III	4	Ras Gas III
Al Wajbah	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-97	Japan	S	Moss	5	Qatargas
Al Wakrah	135,360	J4 Consortium	Kawasaki Sakaide	Dec-98	Japan	S	Moss	5	Qatargas
Al Zhubarah	137,570	J4 Consortium	Mitsui Chiba	Dec-96	Japan	S	Moss	5	Qatargas
Alto Acrux	147,000	LNG Marine Transport	Mitsubishi	Mar-08	Bahamas	S	Moss	4	Various
Amali	148,000	Brunei-Shell	DSME	Jul-11	Brunei	DFDE	GT No. 96	4	Brunei LNG
Amanl	154,800	Brunei-Shell	Hyundai	Nov-14	Brunei	DFDE	TZ Mk. III	4	Brunei LNG
Aman Bintulu	18,928	Perbadanan / NYK Line	NKK Tsu	Oct-93	Malaysia	S	TZ Mk. III	3	Petronas
Aman Hakata	18,800	Perbadanan / NYK Line	NKK Tsu	Nov-98	Malaysia	S	TZ Mk. III	3	Petronas
Aman Sendai	18,928	Perbadanan / NYK Line	NKK Tsu	May-97	Malaysia	S	TZ Mk. III	3	Petronas
Arctic Aurora	160,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Various
Arctic Discoverer	140,000	K Line	Mitsui Chiba	Jan-06	Bahamas	S	Moss	4	Various
Arctic Lady	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Apr-86	Norway	S	Moss	4	Various
Arctic Princess	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Jan-06	Norway	S	Moss	4	Various
Arctic Sun	89,880	Arctic LNG Shipping	IHI Chita	Dec-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Arctic Voyager	140,000	K Line	Kawasaki	Jul-06	Bahamas	S	Moss	4	Statoil
Arkat	148,000	Brunei-Shell	DSME	Feb-11	Brunei	DFDE	GT. No. 96	4	Brunei LNG
Arwa Spirit	165,000	Teekay LNG	Samsung	Sep-08	Marshall Is.	DFDE	TZ Mk. III	4	Various
Aseem	154,850	K Line-Petronet	Samsung	Nov-09	Malta	S	GT No 96	4	Qatar-India
Asia Endeavour	160,000	Chevron	Samsung	Dec-14	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Energy	160,000	Chevron	Samsung	Sept-14	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Excellence	160,000	Chevron	Samsung	Sept-13	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Venture	160,000	Chevron	Samsung	Sept-17	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Vision	160,000	Chevron	Samsung	June-14	Bahamas	DFDE	TZ Mk. III	4	Various
Barcelona Knutsen	173,400	Knutsen	Daewoo	May-10	N.I.S.	DFDE	GT NO 96	4	Various
Bebatic	75,060	Brunei Shell Tankers	Atlantique	Oct-72	Brunei	S	TZ Mk. I	6	Brunei LNG
Beidou Star	172,000	MOL	Hudong	Oct-15	Hong Kong	DRL	GT NO. 96	4	Various
Berge Arzew	138,088	BW Gas	Daewoo	Jul-04	Norway	S	GT NO 96	4	Sonatrach
Boris Vilkitsky	172,000	Dynagas	Daewoo	Oct-17	Cyprus	DFDE	GT No. 96	4	Various
BW GDF-Suez Boston	138,059	BW Gas	Daewoo	Jan-03	Norway	S	GT NO 96	4	Suez LN

BW GDF Suez Everett	138,028	BW Gas	Daewoo	Jun-03	Norway	S	GT NO 96	4	Suez LNG
BW Integrity	170,000	BW Gas	Samsung	May-17	Singapore	DFDE	TZ Mk. III	4	FSRU
BW Pavilion Leeara	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	TZ Mk. III	4	Various
BW Pavilion Vanda	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	TZ Mk. III	4	Various
BW Singapore	170,000	BW Gas	Samsung	May-15	Singapore	DFDE	TZ Mk. III	4	FSRU
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
Bilbao Knutsen	138,000	Knutsen / Marpetrol	IZAR Sestao	Jan-04	Spain	S	GT NO 96	4	Atlantic LNG
Bilis	77,730	Brunei Shell Tankers	La Seyne	Mar-75	Brunei	S	GT NO 82	5	Brunei LNG
Bishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-15	Panama	S	Moss	4	Australia-Japan
British Diamond	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. II	4	Indonesia-Various
British Emerald	155,000	BP Shipping	Hyundai	Jun-07	UK	DFDE	TZ Mk. III	4	Tangguh LNG
British Innovator	138,200	BP Shipping	Samsung	Jul-03	Isle of Man	S	TZ Mk. III	4	Various
British Merchant	138,000	BP Shipping	Samsung	Apr-03	Isle of Man	S	TZ Mk. III	4	Various
British Ruby	155,000	BP Shipping	Hyundai	Jan-08	U.K.	DFDE	TZ Mk. III	4	Various
British Sapphire	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. III	4	Tangguh
British Trader	138,000	BP Shipping	Samsung	Dec-02	Isle of Man	S	TZ Mk. III	4	Engas
Broog	135,466	J4 Consortium	Mitsui Chiba	May-98	Japan	S	Moss	5	Qatargas
Bu Samara	266,000	QGTC	Samsung	Dec-08	Qatar	DRL	TZ Mk. III	5	Qatargas
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
BW Suez Brussels	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
Cadiz Knutsen	138,826	Knutsen / Marpetrol	IZAR Puerto Real	Jun-04	Spain	S	GT NO 96	4	Engas
Castillo de Santisteban	173,600	Elcano	STX	Aug-10	Malta	S	GT NO. 96		Various
Castillo de Villalba	138,000	Elcano	IZAR	Nov-03	Spain	S	GT NO 96	4	Sonatrach
Catalunya Spirit	138,000	Teekay LNG Partners	IZAR Sestao	Mar-03	Liberia	S	GT NO 96	4	Atlantic LNG
Celestine River	145,000	KLNG	Kawasaki	Dec-07	Bahamas	S	Moss		Various
Cesi Beihai	174,100	MOL-China LNG	Hudong	June-17	Hong Kong	S	GT No 96	4	Australia-China
Cesi Gladstone	174,100	MOL-China LNG	Hudong	Oct-16	Hong Kong	S	GT No 96	4	Australia-China
Cesi Lianyungang	174,100	MOL-China LNG	Hudong	June-18	Hong Kong	S	GT No 96	4	Australia-China
Cesi Qingdao	174,100	MOL-China LNG	Hudong	Nov-16	Hong Kong	S	GT No 96	4	Australia-China
Cesi Tianjin	174,100	MOL-China LNG	Hudong	Sept-17	Hong Kong	S	GT No 96	4	Australia-China
Challenger FSRU	263,000	MOL LNG	Daewoo	Oct-17	St Kitts	DFDE	GT No. 96	4	Various
Cheikh Bouamama	75,500	Skikda LNG Transport	USC	Jul-08	Bahamas	S	TZ Mk. III	4	Sonatrach
Cheikh El Mokrani	75,500	Med LNG Corp	USC	Jun-07	Bahamas	S	TZ Mk. III	4	Sonatrach
Christophe de Margerie	172,600	SCF	Daewoo	Nov-16	Cyprus	DFDE	GT NO 96	4	Various
Clean Energy	150,000	Dynagas	Hyundai	Mar-07	Marshall Is.	S	TZ Mk. III	4	Various
Clean Force	150,000	Dynagas	Hyundai	Jan-08	Marshall Is.	S	TZ Mk. III	4	Various
Clean Ocean	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Planet	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Vision	160,000	Dynagas	Hyundai	Jun-15	Marshall Is.	DFDE	TZ Mk. III	4	Various
Cool Explorer	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Runner	160,000	Thenamaris	Samsung	May-14	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Voyager	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Corcovado LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Creole Spirit	174,000	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	NO. 96 GW	4	Cheniere
Cubal	160,400	Mitsui/NYK/Teekay	Samsung	Jan-12	Bahamas	DFDE	TZ Mk. III	4	Various
Cygnus Passage	145,400	Cygnus LNG	Mitsubishi	Feb-09	Panama	S	Moss	4	Various
Dapeng Moon	147,000	China Ships	Hudong	Jul-09	China	S	GT NO 96	4	Various
Dapeng Star	147,000	China Ships	Hudong	Nov-09	China	S	GT NO 96	4	Various
Dapeng Sun	147,000	China Ships	Hudong	Jul-07	China	S	GT NO 96	4	Woodside Energy
Disha	136,000	Petronet LNG Ltd.	Daewoo	Jan-04	Malta	S	GT NO 96	4	Qatargas
Doha	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-99	Japan	S	Moss	5	Qatargas
Duhail	210,100	ProNav	Daewoo	Jan-08	Germany	DRL	GT NO 96	4	Various
Dukhan	135,000	J4 Consortium	Mitsui Chiba	Oct-04	Japan	S	Moss	4	Qatargas
Dwiputra	127,385	Humpuss Consortium	Mitsubishi Nagasaki	Mar-94	Bahamas	S	Moss	4	Pertamina
Ebisu	147,547	Golar LNG	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
Eduard Toll	172,000	Teekay-CLNG	Daewoo	Dec-17	Bahamas	MEGI-DF	GT No. 96	4	Various
Ejnan	145,000	4J	Samsung	Jan-07	Bahamas	S	TZ Mk. III		RasGas
Ekaputra	136,400	Humpuss Consortium	Mitsubishi Nagasaki	Jan-90	Liberia	S	Moss	5	Pertamina
Energy Advance	145,000	Tokyo LNG Tankers	Kawasaki Sakaide	Mar-05	Japan	S	Moss	4	Darwin
Energy Atlantic	159,924	Alpha	STX Jinhae	Sep-15	Malta	DFDE	No. 96	4	Various
Energy Confidence	155,000	Tokyo LNG Tankers	Kawasaki	Apr-09	Panama	S	Moss	4	Various
Energy Frontier	147,600	Tokyo LNG Tankers	Kawasaki Sakaide	Sep-03	Japan	S	Moss	4	Darwin
Energy Glory	165,000	Tokyo LNG Tankers	JMU	Sept-18	Japan	S	Moss	4	Various
Energy Horizon	177,000	Tokyo LNG Tankers	Kawasaki	Jul-11	Japan	S	Moss	4	Pluto LNG
Energy Navigator	147,000	Tokyo LNG Tankers	Kawasaki Sakaide	May-08	Japan	S	Moss	4	Various
Energy Progress	145,000	MOL	Kawasaki	Nov-06	Japan	S	Moss	4	Bayu Undan LNG
Esshu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-14	Panama	S	Moss	4	Australia-Japan
Excalibur	138,200	Exmar/ Excelerate	Daewoo	Oct-02	Belgium	S	GT NO 96	4	Various
Excel	138,106	Exmar/ MOL	Daewoo	Sep-03	Belgium	S	GT NO 96	4	Various
Excelerate	138,000	Exmar/Excelerate	Daewoo	Oct-06	Belgium	S	GT NO 96	4	Various
Excellence	138,000	GKFF Ltd.	Daewoo	May-05	Belgium	S	GT NO 96	4	Excelerate Energy
Excelsior	138,000	Exmar	Daewoo	Jan-05	Belgium	S	GT NO 96	4	Various
Exemplar	150,900	Excelerate	Daewoo	Jun-10	Belgium	S	GT NO 96	4	Various
Expedient	151,000	Excelerate	Daewoo	Nov-09	Belgium	S	GT NO 96	4	Various
Experience RV	174,000	Exmar/Excelerate	Daewoo	Jul-14	Marshall Is.	DFDE	GT NO 96		Various
Explorer	150,900	Exmar/Excelerate	Daewoo	Mar-08	Belgium	S	GT NO 96	4	Excelerate
Express	151,000	Exmar/Excelerate	Daewoo	May-09	Belgium	S	GT NO 96	4	Various
Exquisite	150,900	Excelerate	Daewoo	Sep-09	Belgium	S	GT NO 96	4	Various
Fedor Litke	172,636	Dynagas	Daewoo	Nov-17	Cyprus	DFDE	GT No. 96	4	Various
Flex Endeavour	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	NO. 96 GW	4	Various
Flex Enterprise	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	NO. 96 GW	4	Various
Flex Rainbow	174,000	Flex LNG	Samsung	July-18	Marshall Is.	MEGI-DF	NO. 96 GW	4	Various

Fraiha	210,100	J5 Consortium	Daewoo	Sep-08	Marshall Is.	DRL	GT NO 96	4	Qatargas
FSRU Independence	170,000	Hoegh	Hyundai	Feb-14	NIS	DFDE	TZ Mk. III	4	Various
FSRU Lampung	170,000	Hoegh	Hyundai	May-14	Indonesia	DFDE	TZ Mk. III	4	Various
Fuji LNG	147,895	TMSC Gas	Kawasaki	Jun-04	Malta	S	Moss	4	Various
Fuwairit	138,000	Peninsular LNG	Samsung	Jan-04	Bahamas	S	TZ Mk. III	4	RasGas II
Galea	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
Galicia Spirit	140,620	Teekay LNG Partners	Daewoo	Jul-04	Liberia	S	GT NO 96	4	Engas
Gaselys	153,500	GdF/NYK	Atlantique	Mar-07	France	DFDE	CS 1	4	Engas
Gallina	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
GasLog Chelsea	153,000	GasLog	Hanjin Korea	Dec-09	Panama	TFDE	TZ Mk. III	4	Various
Gaslog Geneva	174,000	GasLog	Samsung	Sept-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
Gaslog Gibraltar	174,000	GasLog	Samsung	Oct-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
Gaslog Glasgow	174,000	GasLog	Samsung	Jun-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
Gaslog Greece	174,000	GasLog	Samsung	Mar-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
GasLog Salem	165,000	GasLog	Samsung	Apr-15	Liberia	TFDE	TZ Mk. III	4	Various
GasLog Santiago	155,000	GasLog	Samsung	Mar-13	Liberia	TFDE	TZ Mk. III	4	Various
GasLog Saratoga	155,000	GasLog	Samsung	Dec-14	Bermuda	TFDE	TZ Mk. III	4	Various
Gaslog Savannah	155,000	GasLog	Samsung	May-10	Bermuda	DFDE	TZ Mk. III	4	Various
GasLog Seattle	155,000	GasLog	Samsung	Oct-13	Bermuda	TFDE	TZ Mk. III	4	Various
GasLog Shanghai	155,000	GasLog	Samsung	Jan-13	Liberia	TFDE	TZ Mk. III	4	Various
Gaslog Singapore	155,000	GasLog	Samsung	Jul-10	Bermuda	DFDE	TZ Mk. III	4	Various
Gaslog Skagen	155,000	GasLog	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Gaslog Sydney	155,000	GasLog	Samsung	May-13	Bermuda	DFDE	TZ Mk. III	4	Various
GDF-Suez Global Energy	74,000	Gaz de France	Chantiers	Dec-06	France	DFDE	CS1	4	Sonatrach
GDF-Suez Cape Ann	145,000	Hoegh LNG/MOL	Samsung	May-10	Liberia	DFDE	TZ Mk. III	4	Various
GDF-Suez Neptune	145,000	Hoegh LNG/MOL	Samsung	Dec-09	Liberia	DFDE	TZ Mk. III	4	Various
GDF-Suez Point Fortin	154,200	LNG Japan	Imabari/Koyo	Feb-10	Panama	DFDE	TZ Mk. III	4	Various
Gemmata	138,100	Shell Shipping	Mitsubishi Nagasaki	Mar-04	Singapore	S	Moss	5	Shell
Ghasha	137,510	National Gas Shipping	Mitsui	Jun-95	Liberia	S	Moss	5	ADGAS
Gigira Laitebo	177,000	MOL-Itochu	Hyundai	Feb-09	Panama	DFDE	TZ Mk. III	4	Various
Golar Arctic	140,645	Golar LNG	Daewoo	Dec-03	Marshall Is.	S	GT NO 96	4	Shell Spot
Golar Bear	160,000	Golar	Samsung	Mar-14	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Celsius	160,000	Golar LNG	Samsung	Sep-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Crystal	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Eskimo (FSRU)	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Freeze	125,850	Golar LNG	HDW	Feb-77	UK	S	Moss	5	Various
Golar Glacier	162,000	Golar LNG	Hyundai	Sep-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Golar Grand	145,880	Golar LNG	Daewoo	2006	IoM		GT NO 96	4	Various
Golar Ice	160,000	Golar LNG	Samsung	Feb-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Igloo (FSRU)	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Kelvin	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Maria	145,950	Golar LNG	Daewoo	2006	Marshall Is.		GT NO 96	4	Various
Golar Mazo	135,225	Golar LNG/CPP	Mitsubishi	Jan-00	Liberia	S	Moss	5	Pertamina
Golar Penguin	160,000	Golar LNG	Samsung	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Golar Seal	160,000	Golar LNG	Samsung	Aug-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Singapore (FSRU)	160,000	Golar LNG	Samsung	June-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Snow	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Tundra (FSRU)	160,000	Golar LNG	Samsung	Dec-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Viking	140,000	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	Moss	4	Various
Golar Winter	138,250	Golar LNG	Daewoo	Apr-04	Marshall Is.	S	GT NO 96	4	Petrobras
Grace Acacia	150,000	Algaet Shipping	Hyundai	Jan-07	Japan	S	TK MK III	4	Various
Grace Barleria	150,000	Swallowtail Ship	Hyundai	Oct-07	Japan	S	TZ Mk. III	4	Various
Grace Cosmos	150,000	AGH Shipping	Hyundai	Mar-08	Japan	S	TZ Mk. III	4	Various
Grace Dahlia	177,000	Tokyo Gas	Kawasaki	Oct-13	Japan	S	Moss	4	Various
Gracilis	138,830	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	TZ Mk III	4	Shell BG
Granatina	140,645	Shell Shipping	Daewoo	Dec-03	Singapore	S	GT NO 96	4	Shell
Grand Aniva	147,200	Sovcomflot/NYK	Mitsubishi	Jan-08	Japan	S	Moss	4	Various
Grand Elena	147,200	Sovcomflot/NYK	Mitsubishi	Oct-07	Japan	S	Moss	4	Various
Grand Mereya	147,200	Primorsk/MOL/K Line	Chiba	May-08	Japan	S	Moss	4	Sakhalin II
Hanjin Muscat	138,200	Hanjin Shipping	Hanjin	Jul-99	Panama	S	GT NO 96	4	Oman Gas
Hanjin Pyeong Taek	130,600	Hanjin Shipping	Hanjin	Sep-95	Panama	S	GT NO 96	4	Pertamina
Hanjin Ras Laffan	138,214	Hanjin Shipping	Hanjin	Jul-00	Panama	S	GT NO 96	4	QatarGas
Hanjin Sur	138,333	Hanjin Shipping	Hanjin	Jan-00	Panama	S	GT NO 96	4	Oman Gas
Hispania Spirit	140,500	Teekay LNG Partners	Daewoo	Sep-02	Spain	S	GT NO 96	4	Atlantic LNG
Hoegh Esperanza FSRU	170,000	Hoegh	Hyundai	April-18	Norway	DFDE	GTT MIII	4	Various
Hoegh Gallant FSRU	170,050	Hoegh LNG	Hyundai	May-14	Marshall Is.	DFDE	TZ Mk. III	4	chartered
Hoegh Giant FSRU	170,050	Hoegh LNG	Hyundai	Jan-18	Marshall Is.	DFDE	TZ Mk. III	4	various
Hoegh Grace FSRU	170,050	Hoegh LNG	Hyundai	May-15	Marshall Is.	DFDE	TZ Mk. III	4	various
Hyundai Aquapia	135,000	Hyundai MM	Hyundai	Mar-00	Panama	S	Moss	4	Oman Gas
Hyundai	135,000	Hyundai MM	Hyundai	Jan-00	Panama	S	Moss	4	RasGas
Hyundai Ecopia	145,000	Hyundai	Hyundai	Nov-08	Panama	S	TZ Mk. III	4	Various
Hyundai Greenpia	125,000	Hyundai MM	Hyundai	Nov-96	Panama	S	Moss	4	Pertamina
Hyundai Oceanpia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	Oman Gas
Hyundai Technopia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	RasGas
Hyundai Utopia	125,182	Hyundai MM	Hyundai	Jun-94	Panama	S	Moss	4	Pertamina
Iberica Knutsen	138,000	Knutsen OAS	Daewoo	Aug-06	Norway	S	GT 96	4	Gas Natural
Ibra LNG	147,100	Oman Gas	Samsung	Jun-06	Panama	S	TK Mk. III	4	Oman LNG
Ibri LNG	145,000	Oman Gas	Mitsubishi	Jul-06	Panama	S	TK Mk. III	4	Oman LNG
Ish	137,540	National Gas Shipping	Mitsubishi Nagasaki	Nov-95	Liberia	S	Moss	5	ADGAS
K Acacia	138,017	Korea Line	Daewoo	Jan-00	Panama	S	GT NO 96	4	Oman Gas
K Freesia	135,256	Korea Line	Daewoo	Jun-00	Panama	S	GT NO 96	4	RasGas
K Jasmine	145,700	Korea Line	Daewoo	Mar-08	Panama	S	GT NO 96	4	Kogas offtake

K Mugungwha	152,000	K Line	Daewoo	Nov-08	Panama	S	GT NO 96	4	Various
Kita LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Kotawaka Maru	125,200	J3 Consortium	Kawasaki Sakaide	Jan-84	Japan	S	Moss	5	Darwin
Kumul	172,000	MOL	Hudong	May-16	Hong Kong	DRL	GT NO. 96	4	PNG-Asia
Lalla Fatma N'Soumer	145,000	Algeria Nippon Gas	Kawasaki Sakaide	Dec-04	Bahamas	S	Moss	4	Various
Lijmilya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GT NO. 96	5	Various
LNG Abalamabie	174,900	Bonny Gas	Samsung	Nov-16	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Abuja	126,530	Bonny Gas Transport	GD Quincy	Sep-80	Bahamas	S	Moss	5	Nigeria LNG
LNG Abuja II	174,900	Bonny Gas	Samsung	Oct 16	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Adamawa	141,000	Bonny Gas Transport	Hyundai	Jun-05	Bermuda	S	Moss	4	Various
LNG Akwa Ibom	141,000	Bonny Gas Transport	Hyundai	Nov-04	Bermuda	S	Moss	4	Various
LNG Aquarius	126,300	MOL/LNG Japan	GD Quincy	Jun-77	Marshall Is.	S	Moss	5	Various
LNG Barka	153,000	NYK	Kawasaki	Jan-09	Bahamas	S	Moss	4	Various
LNG Bayelsa	137,500	Bonny Gas Transport	Hyundai	Feb-03	Bermuda	S	Moss	4	Nigeria LNG
LNG Benue	145,700	BW Gas	Daewoo	Mar-06	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Bonny	177,000	Bonny Gas Transport	Hyundai	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Borno	149,600	NYK Line	Samsung	Aug-07	Japan	S	TZ Mk. III	4	Nigeria LNG
LNG Capricorn	126,300	MOL/LNG Japan	GD Quincy	Jun-78	Marshall Is.	S	Moss	5	Pertamina
LNG Cross River	141,000	Bonny Gas Transport	Hyundai	Sep-05	Bermuda	S	Moss	4	Various
LNG Dream	145,000	Osaka Gas	Kawasaki	Sep-06	Japan	S	Moss	4	Woodside Energy
LNG Ebisu	147,500	MOL	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
LNG Edo	126,530	Bonny Gas Transport	GD Quincy	May-80	Bahamas	S	Moss	5	Nigeria LNG
LNG Enugu	145,000	BW Gas	Daewoo	Oct-05	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Fimina	175,000	Bonny Gas Transport	Samsung	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Flora	127,700	J3 Consortium	Kawasaki Sakaide	Mar-93	Japan	S	Moss	4	Pertamina
LNG Fukurokuju	165,000	MOL	Kawasaki	June-15	Japan	S	Moss	4	Various
LNG Gemini	126,300	MOL/LNG Japan	GD Quincy	Sep-78	Marshall Is.	S	Moss	5	Pertamina
LNG Imo	148,300	BW Gas	Daewoo	Jun-08	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Jamal	135,330	Osaka Gas/J3 Consortium	Mitsubishi Nagasaki	Oct-00	Japan	S	Moss	5	Oman Gas
LNG Juno	177,300	MOL-Osaka	Mitsubishi	Oct-18	Marshall Is.	DFDE	Moss	4	Freeport LNG/Various
LNG Jupiter	145,000	NYK Line	Kawasaki	Jul-09	Bahamas	S	Moss	4	Various
LNG Jurojin	155,300	MOL	MHI Nagasaki	Nov-15	Japan	S	KM	4	Various
LNG Kano	148,471	BW Gas	Daewoo	Jan-07	Bermuda	S	GT No. 96	4	NLNG
LNG Lagos	177,000	Bonny Gas	Hyundai	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Leo	126,400	MOL/LNG Japan	GD Quincy	Dec-78	Marshall Is.	S	Moss	5	Pertamina
LNG Lerici	65,000	Exmar	Italcantieri Sestri	Mar-98	Italy	S	GT NO 96	4	Sonatrach
LNG Libra	126,400	Hoegh LNG	GD Quincy	Apr-79	Marshall Is.	S	Moss	5	Various
LNG Lokoja	148,300	BW Gas	Daewoo	Dec-06	Bermuda	S	GT No. 96	4	Nigeria LNG
LNG Mars	155,000	MOL/Osaka Gas	Mitsubishi	Oct-16	Marshall Is.	S	Moss	5	Various
LNG Ogun	148,300	NYK Line	Samsung	Aug-07	Japan	S	TZ Mk. III	4	Nigeria LNG
LNG Ondo	148,300	BW Gas	Daewoo	Sep-07	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Oyo	140,500	BW Gas	Daewoo	Dec-05	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Pioneer	138,000	MOL	Daewoo	Jul-05	Bahamas	S	GT No 96	4	Idku
LNG Port Harcourt	175,000	Bonny Gas	Samsung	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Portovenere	65,000	Exmar	Italcantieri Sestri	Jun-96	Italy	S	GT No 96	4	Sonatrach
LNG River Niger	141,000	Bonny Gas Transport	Hyundai	May-06	Bermuda	S	Moss	4	Various
LNG River Orashi	145,910	BW Gas	Daewoo	Nov-04	Bermuda	S	GT No 96	4	Nigeria LNG
LNG Rivers	137,231	Bonny Gas Transport	Hyundai	Jun-02	Bermuda	S	Moss	4	Nigeria LNG
LNG Saturn	153,000	MOL	MHI	Nov-15	Japan	S	Moss	4	Various
LNG Sokoto	137,231	Bonny Gas Transport	Hyundai	Aug-02	Bermuda	S	Moss	4	Nigeria LNG
LNG Taurus	126,300	MOL/LNG Japan	GD Quincy	Aug-79	Marshall Is.	S	Moss	5	Various
LNG Venus	155,000	Osaka/MOL	MHI	Oct-14	Japan	S	Moss	4	Various
LNG Vesta	127,547	Tokyo Gas Consortium	Mitsubishi Nagasaki	Jun-94	Japan	S	Moss	4	Pertamina
LNG Virgo	126,400	MOL/LNG Japan	GD Quincy	Dec-79	Marshall Is.	S	Moss	5	Pertamina
Lobito	160,400	Mitsui/NYK/Teekay	Samsung	Oct-11	Bahamas	DFDE	TZ Mk. III	4	Various
Lusail	138,000	Peninsular LNG	Samsung	May-05	Bahamas	S	TZ Mk. III	4	Qatar
Macoma	173,400	Teekay	Daewoo	Oct-17	Bahamas	DFDE	GT No. 96	4	Various
Madrid Spirit	138,000	Teekay LNG Partners	IZAR Puerto Real	Jan-05	Spain	S	GT No 96	4	Engas
Magdala	173,400	Teekay	Daewoo	Feb-18	Bahamas	DFDE	GT No 96	4	Various
Magellan Spirit	165,500	Teekay LNG Partners	Samsung	Sep-08	Denmark	DFDE	TZ Mk. III	4	Various
Malanje	160,400	Mitsui/NYK/Teekay	Samsung	Jul-11	Bahamas	DFDE	TZ Mk. III	4	Various
Maran Gas Achilles	174,000	Maran	Hyundai Samho	Feb-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Agamemnon	174,000	Maran	Hyundai Samho	May-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Alexandria	161,870	Maran	Hyundai Samho	Sep-15	Greece	DFDE	TZ Mk. III	4	Various
Maran Gas Amphipolis	173,400	Maran	Daewoo	Aug-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Apollonia	161,870	Maran	Daewoo	Jan-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Asclepius	145,000	Kristen Navigation	Daewoo	Jul-05	Bermuda	S	GT No 96	4	Qatar
Maran Gas Coronis	145,700	Maran	Daewoo	Sep-07	Greece	S	GT No 96	4	Rasgas II
Maran Gas Delphi	159,800	Maran	Daewoo	Feb-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Efessos	159,800	Maran	Daewoo	Jun-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Hector	174,000	Maran	Hyundai Samho	Nov-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Lindos	159,800	Maran	Daewoo	Jun-15	Greece	DFDE	GT No. 96	4	Various
Maran Gas Mystras	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GT No 96	4	Various
Maran Gas Olympias	174,500	Maran	DSME	Feb-17	Greece	DFDE	GT No 96	4	Various
Maran Gas Pericles	174,000	Maran	Hyundai Samho	June-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Posidonia	161,870	Maran	Daewoo	May-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Roxana	173,400	Maran	Daewoo	Jan-17	Greece	DFDE	GT No 96	4	Various
Maran Gas Sparta	161,870	Maran	Hyundai Samho	April-15	Greece	DFDE	G TZ Mk. III	4	Various
Maran Gas Spetses	174,000	Maran	Daewoo	Feb-18	Greece	DFDE	GT No 96	4	Various
Maran Gas Troy	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GT No 96	4	various
Maran Gas Ulysses	174,000	Maran	Hyundai Samho	Jan-17	Greece	DFDE	GT No 96	4	Various
Maria Energy	174,000	Tsakos	Hyundai	Mar-15	Marshall Is.	TFDE	GTT Mk II	4	Various

Marib Spirit	165,000	Teekay LNG	Samsung	May-08	Marshall Is.	DFDE	TZ Mk. III	4	Various
Marvel Eagle	155,000	MOL-Osaka	Kawasaki	Sept-18	Marshall Is.	S	Moss	4	Cameron LNG/Various
Matthew	126,540	Suez LNG Shiping	Newport News	Jun-79	Bahamas	S	TZ Mk. I	6	Atlantic LNG
Mekaines	266,000	Naklilat	Samsung	Mar-09	Liberia	DRL	GT No 96	4	Qatar-Atlantic Basin
Meridian Spirit	165,500	Teekay LNG	Samsung	Jan-10	Denmark	DFDE	TZ Mk. III	4	Various
Mesaimeer	210,100	Naklilat	Hyundai	Mar-09	Liberia	DRL	GT No 96	4	Qatar-Atlantic Basin
Methane Alison Victoria	145,000	GasLog	Samsung	Aug-07	Bermuda	S	TZ III	4	Eq.Guinea LNG
Methane Becki Anne	170,000	GasLog	Samsung	Sep-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Heather Sally	145,000	GasLog	Samsung	Jul-07	Bermuda	S	Tz Mk. III	4	Eq.Guinea LNG
Methane Jane Elizabeth	145,000	GasLog	Samsung	Jun-06	Bermuda	TFDE	TZ Mk. III	4	Engas
Methane Julia Louise	170,000	GasLog	Samsung	Dec-09	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Kari Elin	138,200	Shell	Samsung	Jun-04	Bermuda	S	TZ Mk. III	4	Various
Methane Lake Charles	145,000	Shell	Samsung	Feb-07	Bermuda	S	TZ Mk. III	4	Marathon Oil
Methane Lydon Volney	145,000	Shell	Samsung	Aug-06	Bermuda	S	TZ Mk. III	4	Engas
Methane Mickie Harper	170,000	Shell-GasLog	Samsung	Nov-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Nile Eagle	145,000	Shell-GasLog	Samsung	Dec-07	Bermuda	S	TZ Mk. III	4	Engas
Methane Patricia Camila	170,000	Shell-GasLog	Samsung	Oct-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Princess	138,159	Golar LNG	Daewoo	2003	UK	S	GT No 96	4	Spot BG
Methane Rita Andre	145,000	GasLog	Samsung	Mar-06	Bermuda	S	TZ Mk. III	4	Engas
Methane Shirley Elizabeth	145,000	GasLog	Samsung	Apr-07	Bermuda	S	TZ Mk. III	4	Marathon Oil
Methane Sprit	165,000	Teekay LNG	Samsung	Mar-08	Singapore	DFDE	TZ Mk. III	4	Various
Milaha Qatar	145,000	Milaha	Samsung	Apr-06	Denmark	S	TZ Mk. III	4	Qatar
Milaha Ras Laffan	138,270	Milaha	Samsung	Mar-04	Denmark	S	TZ Mk. III	4	RasGas II
Min Lu	147,000	China Ships	Hudong	Aug-09	China	S	GT No 96	4	Various
Min Rong	147,000	China LNG Ships	Hudong	Feb-09	Hong Kong	S	GT No 96	4	Australia-China
Mourad Didouche	126,130	Hyproc Shipping	Atlantique	Jul-80	Algeria	S	GT No 85	5	Sonatrach
Mozah	266,000	QGTC	Samsung	Aug-08	Qatar	DRL	TZ Mk III	5	Qatargas II
Mraweh	137,000	National Gas Shipping	Kvaerner-Masa	Jun-96	Liberia	S	Moss	4	ADGAS
Mubaraz	137,000	National Gas Shipping	Kvaerner-Masa	Jan-96	Liberia	S	Moss	4	Various
Muraq	210,100	J5-K Line	Daewoo	May-08	Marshall Is.	DRL	GT No 96	4	Qatar-Atlantic Basin
Murex	173,400	Teekay	Daewoo	Oct-17	Bahamas	DFDE	GT No 96	4	Various
Murwab	210,100	J5 Consortium	Daewoo	May-08	Marshall Is.	DRL	GT No. 96	4	Qatargas
Muscat LNG	149,170	Oman Gas/MOL	Kawasaki Sakaide	Mar-04	Japan	S	Moss	4	Oman Gas
Neo Energy	149,700	Tsakos	Hyundai	Feb-07	Liberia	S	GTT Mk II	4	Various
Nizwah LNG	145,000	Oryx LNG Carriers	Kawasaki Sakaide	Dec-05	Japan	S	Moss	4	Oman Gas
Northwest Sanderling	127,525	Australia LNG	Mitsubishi Nagasaki	Jun-89	Australia	S	Moss	4	NWS
Northwest Sandpiper	127,500	Australia LNG	Mitsui Chiba	Feb-93	Australia	S	Moss	4	NWS
Northwest Seaeagle	127,450	Australia LNG	Mitsubishi Nagasaki	Nov-92	Bermuda	S	Moss	4	NWS
Northwest Shearwater	127,500	Australia LNG	Kawasaki Sakaide	Sep-91	Bermuda	S	Moss	4	NWS
Northwest Snipe	127,747	Australia LNG	Mitsui Chiba	Sep-90	Australia	S	Moss	4	NWS
Northwest Stormpetrel	127,600	Australia LNG	Mitsubishi Nagasaki	Dec-94	Australia	S	Moss	4	NWS
Northwest Swallow	127,708	J3 Consortium	Mitsui Chiba	Nov-89	Japan	S	Moss	4	NWS
Northwest Swan	138,000	Australia LNG	Daewoo	Mar-04	Australia	S	GT NO 96	4	NWS
Northwest Swift	127,590	J3 Consortium	Mitsubishi Nagasaki	Sep-89	Japan	S	Moss	4	NWS
Oak Spirit	173,400	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	NO. 96 GW	4	Cheniere
Ob River	150,000	Lance Shipping	Hyundai	Oct-07	Marshall Is.	S	TZ Mk. III	4	Various
Onaiza	210,100	Nakilat	Daewoo	Apr-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Ougarta	171,866	Hyproc Shipping	Hyundai	Mar-17	Algeria	DFDE	GTT Mk III	4	Sonatrach
Pacific Arcadia	147,200	NYK Line	MHI	Oct-14	Bahamas	S	KM	4	Various
Pacific Breeze	182,000	K Line	Kawasaki	Mar-18	Marshall Is.	DFDE	Moss	4	Ichthys LNG
Pacific Enlighten	145,000	LNG MT	Mitsubishi	Mar-09	Japan	S	Moss	4	Various
Pacific Eurus	137,000	LNG Marine Transport	Mitsubishi Nagasaki	Mar-06	Bahamas	S	Moss	4	Darwin
Pacific Mimosa	155,300	NYK Line	MHI	Nov-17	Bahamas	S	Moss	4	Australia-Japan
Pacific Notus	137,006	Pacific LNG Shipping	Mitsubishi Nagasaki	Sep-03	Bahamas	S	Moss	5	Darwin
Palu LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Pan Americas	174,000	Teekay	Hudong	Mar-18	Hong Kong	TFDE	No. 96 GW	4	US-Asia
Pan Asia	174,000	Teekay	Hudong-Zhonghua	July-17	Bahamas	TFDE	NO. 96 GW	4	Cheniere
Pan Europe	174,000	Teekay	Hudong	Sept-18	Hong Kong	TFDE	No. 96 GW	4	US-global
Papua	171,800	MOL-China	Hudong	Jan-15	Hong Kong	DFDE	SSD	4	PNG LNG
Polar Eagle	89,880	Polar LNG	IHI Chita	Jun-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Prachi	173,000	NYK-SCI	Hyundai	Nov-16	Singapore	TFDE	GT No 96	4	Petronet
Provalys	153,500	Gaz de France	Chantiers	Nov-06	France	DFDE	CS1	4	ELNG
Pskov	170,200	SovComFlot	STX	Mar-14	Liberia	DFDE	GT No. 96	4	Various
Puteri Delima	130,400	MISC	Atlantique	Jan-95	Malaysia	S	GT NO 96	4	Petronas
Puteri Delima Satu	137,100	MISC	Mitsui Chiba	Apr-02	Malaysia	S	GT NO 96	4	Petronas
Puteri Firuz	130,400	MISC	Atlantique	May-97	Malaysia	S	GT NO 96	4	Petronas
Puteri Firuz Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-04	Malaysia	S	GT NO 96	4	Petronas
Puteri Intan	130,400	MISC	Atlantique	Aug-94	Malaysia	S	GT NO 96	4	Petronas
Puteri Intan Satu	137,100	MISC	Mitsubishi Nagasaki	Dec-01	Malaysia	S	GT NO 96	4	Petronas
Puteri Mutiera Satu	137,100	MISC	Mitsui Chiba	Apr-05	Malaysia	S	GT NO 96	4	Petronas
Puteri Nilam	130,400	MISC	Atlantique	Jun-95	Malaysia	S	GT NO 96	4	Petronas
Puteri Nilam Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-03	Malaysia	S	GT NO 96	4	Petronas
Puteri Zamrud	130,400	MISC	Atlantique	May-96	Malaysia	S	GT NO 96	4	Petronas
Puteri Zamrud Satu	137,100	MISC	Mitsui Chiba	Apr-87	Malaysia	S	GT NO 96	4	Atlantic LNG
Raahi	136,000	Petronet LNG Ltd	Daewoo	Dec-04	Malta	S	GT NO 96	4	Qatargas
Ramdane Abane	126,130	Hyproc Shipping	Atlantique	Jul-81	Algeria	S	GT NO 85	5	Sonatrach
Rasheeda	266,000	QGTC	Samsung	Jun-10	Liberia	DRL	TZ Mk. III		Various
Ribera del Duero Knutsen	173,400	Knutsen	Daewoo	Nov-10	Nor-NIS	DFDE	GT NO. 96	4	Various
Rioja Knutsen	176,300	Knutsen	Daewoo	Dec-16	Nor-NIS	DFDE	TZ Mk III	4	Various
Salalah LNG	147,000	Oman Gas/MOL	Samsung	Dec-05	Japan	S	TZ Mk. III	4	Oman
SCF Polar	71,500	Sovcomflot	Kockums	Aug-69	Liberia	S	GT NO 82	6	Sonatrach
Seishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Jan-15	Panama	S	Moss	4	Australia-Japan

Seri Alam	138,000	MISC	Samsung	Oct-05	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Amanah	145,000	MISC	Samsung	Mar-06	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Anggun	145,000	MISC	Samsung	Nov-06	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Angkasa	145,000	MISC	Samsung	Feb-07	Malaysia	S	TZ Mk. III	4	Petronas
Seri Ayu	145,000	MISC	Samsung	Oct-07	Malaysia	S	TZ Mk. III	4	Various
Seri Bakti	152,300	MISC	Mitsubishi	Mar-07	Malaysia	S	GT NO 96	4	Petronas
Seri Balhaf	152,000	MISC	Mitsubishi	Sep-08	Malaysia	S	GT NO 96	4	Various
Seri Balquis	152,000	MISC	Mitsubishi	Dec-08	Malaysia	S	GT NO 96	4	Various
Seri Begawan	152,300	MISC	Mitsubishi	Dec-07	Malaysia	S	GT NO 96	4	Various
Seri Bijaksana	152,300	MISC	Mitsubishi	Feb-08	Malaysia	S	GT NO 96	4	Petronas
Seri Camar	150,200	MISC	Hyundai	Feb-18	Malaysia	S	Moss	4	Petronas
Seri Camellia	150,000	MISC	Hyundai	Nov-16	Malaysia	S	Moss	4	Petronas
Seri Cemara	150,200	MISC	Hyundai	Apr-18	Malaysia	S	Moss	4	Petronas
Seri Cempak	150,200	MISC	Hyundai	Feb-18	Malaysia	S	Moss	4	Petronas
Seri Cenderawasih	150,000	MISC	Hyundai	Jan-17	Malaysia	S	Moss	4	Petronas
Sestao Knutsen	138,000	Knutsen	IZAR Sestao	Jan-07	Spain	S	GT NO 96	4	Atlantic LNG
Sevilla Knutsen	173,400	Knutsen	Daewoo	Jun-10	N.I.S.	DFDE	GT NO 96	4	Various
Shahamah	135,500	National Gas Shipping	Kawasaki Sakaide	Oct-94	Liberia	S	Moss	5	ADGAS
Shangra	266,000	QGTC	Samsung	Nov-09	Liberia	DRL	TZ Mk. III	5	Qatargas IV
Shen Hai	147,100	China LNG	Hudong Zhonghua	Sep-12	China	AB/CC Steam	GT NO 96	4	Various
Simaisma	147,700	Maran Gas Maritime	Daewoo	Jul-06	Greece	S	GT No 96	4	Qatar
SK Audace	180,000	SK-Marubeni	Samsung	Jul-17	Panama	DFDE	TZ Mk. III	4	Various
SK Splendor	138,375	SK Shipping	Samsung	Mar-00	Panama	S	TZ Mk. III	4	Oman Gas
SK Stellar	138,375	SK Shipping	Samsung	Dec-00	Panama	S	TZ Mk. III	4	RasGas
SK Summit	138,000	SK Shipping	Daewoo	Aug-99	Panama	S	GT NO 96	4	RasGas
SK Sunrise	138,306	I. S. Carriers	Samsung	Sep-03	Panama	S	TZ Mk. III	4	RasGas
SK Supreme	138,200	SK Shipping	Samsung	Jan-00	Panama	S	TZ Mk. III	4	RasGas
Sohar LNG	137,250	Oman Gas/ MOL	Mitsubishi Nagasaki	Oct-01	Malta	S	Moss	5	Oman Gas
Solaris	155,000	GasLog	Samsung	Jul-14	Bermuda	TFDE	TZ Mk. III	4	Various
Sonangol Benguela	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GT No. 96	4	Angola LNG
Sonangol Etosha	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GT No. 96	4	Angola LNG
Sonangol Sambizanga	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GT No. 96	4	Angola LNG
Southern Cross	172,000	MOL	Hudong	May-15	Hong Kong	DRL	GT NO. 96	4	Various
Soyo	160,400	Mitsui/NYK/Teekay	Samsung	May-11	Bahamas	DFDE	TZ Mk. III	4	Various
Spirit of Hela	177,000	MOL	Hyundai	Oct-09	Panama	DFDE	TZ Mk. III	4	Various
Stena Blue Sky	145,700	Stena	Daewoo	Jan-06	Panama	S	GT No 96	4	Various
Stena Clear Sky	171,800	Stena	Daewoo	Sep-10	Panama	DFDE	GT NO 96	4	Various
Stena Crystal Sky	171,800	Stena	Daewoo	Jul-10	Panama	DFDE	GT NO 96	4	Various
STX Kolt	145,700	STX Panocean	Korea Hanjin	Nov-08	Panama	DFDE	TZ Mk. III	4	Various
Suez Point Fortin	154,200	Trinity LNG	Koyo Japan	Nov-09	Panama	S	TZ Mk. III	4	Yemen LNG
Taitar No. 1	145,000	NYK Line	Mitsubishi	Oct-09	Liberia	S	Moss	4	Various
Taitar No. 3	145,000	NYK Line	Mitsubishi	Jan-10	Liberia	S	Moss	4	Various
Taitar No. 4	145,000	NYK	Mitsubishi	Jan-10	Liberia	S	Moss	4	Various
Tangguh Batur	145,700	Sovcomflot/NYK	Daewoo	Dec-08	Cyprus	S	GT NO 96		Tangguh
Tangguh Foja	155,000	K Line	Samsung	Jul-08	Panama	DFDE	TZ Mk. III	4	Tangguh LNG
Tangguh Hiri	155,000	Teekay LNG	Hyundai	Nov-08	IOM	DFDE	TZ Mk. III	4	Tangguh
Tangguh Jaya	145,700	K Line	Samsung	Nov-08	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Palung	155,000	K Line	Samsung	Mar-09	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Sago	155,000	Teekay LNG	Hyundai	Mar-09	IOM	DFDE	TZ Mk. III	4	Tangguh LNG
Tangguh Towuti	145,700	Sovcomflot/NYK	Daewoo	Oct-08	Cyprus	S	GT NO 96	4	Tangguh
Tembek	216,200	OSG/Nakilat	Samsung	Sep-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Tenaga Satu	130,000	MISC	Dunkerque	Sep-82	Malaysia	S	GT NO 88	5	Petronas
Tessala	171,866	Hyproc Shipping	Hyundai	Dec-16	Algeria	DFDE	GTT Mk III	4	Sonatrach
Torben Spirit	173,000	Teekay	Daewoo	Feb-17	Bahama	MEGI-DF	No 96 GW	4	Various
Trinity Arrow	154,900	K Line	Imabari Shipbuilding	Mar-08	Panama	S	TZ Mk. III	4	Various
Umm Al Amad	210,100	J5	Daewoo	Aug-08	Marshall Is.	DRL	GT NO 96	4	Ras Gas III
Umm Al Ashtan	137,000	National Gas Shipping	Kvaerner- Masa	May-97	Liberia	S	Moss	4	ADGAS
Umm Bab	145,000	Kristen Navigation	Daewoo	Nov-05	Bermuda	S	GT NO 96	4	Qatargas
Umm Slaal	266,000	QGTC	Samsung	Nov-08	Qatar	DRL	TZ Mk. III	5	Qatargas
Valencia Knutsen	173,400	Knutsen	Daewoo	Sep-10	Nor-NIS	DFDE	GT NO. 96	4	Various
Velikiy Novgorod	170,200	SovComFlot	STX	Feb-14	Liberia	DFDE	GT No. 96	4	Various
Vladimir Rusanov	172,000	MOL-China Shipping	Daewoo	Mar-18	Hong Kong	DFDE	GT No 96	4	Yamal
Vladimir Viz	172,000	MOL-China Shipping	Daewoo	Sept-18	Hong Kong	DFDE	GT No 96	4	Yamal
Wakaba Maru	125,000	J3 Consortium	Mitsui Chiba	Apr-85	Japan	S	Moss	5	Pertamina
WilEnergy	125,500	Awilco LNG	Mitsubishi	Oct-83	NIS	S	Moss	5	Various
WilForce	156,000	Teekay LNG	Daewoo	Aug-13	NIS	DFDE	GT NO 96	4	Various
WilGas	125,500	Awilco LNG	Mitsubishi	Jul-84	NIS	S	Moss	5	Various
WilPower	125,500	Awilco LNG	Mitsubishi	Jul-84	NIS	S	Moss	5	Various
Woodside Cheney	174,000	Maran	Hyundai Samho	March-16	Greece	DFDE	GT No 96	4	Various
Woodside Donaldson	165,500	Teekay LNG	Samsung	Dec-09	Singapore	DFDE	TZ Mk. III	4	Various
Woodside Goode	159,800	Maran	Daewoo	Jul-14	Greece	DFDE	GT No. 96	4	Various
Woodside Reeswithers	173,400	Maran	Daewoo	Nov-16	Greece	DFDE	GT No 96	4	Various
Woodside Rogers	155,900	Maran Gas	DSME	Jul-13	Greece	DFDE	GT NO 96	4	Various
Yari LNG	159,983	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Yenisei River	155,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Various
YK Sovereign	127,125	SK Shipping	Hyundai	Dec-94	Panama	S	Moss	4	Pertamina
Zarga	266,000	QGTC	Samsung	Dec-09	Liberia	DRL	TZ Mk. III	5	Qatar-Atlantic
Zekreet	135,420	J4 Consortium	Mitsui Chiba	Dec-98	Japan	S	Moss	5	Qatargas

Any observations, additions or suggested revisions to the LNG journal World LNG Carrier Fleet list should be sent to editor@lngjournal.com

LNG Import Terminals

Explanatory Notes

- The tables do not include the following types of LNG facilities :
  - Small marine satellite terminals receiving LNG from liquefaction plants in their own country (such as exist in Norway) or which receive LNG transhipped from nearby reception terminals in their own country (such as in Japan)
  - Satellite LNG storage facilities that receive LNG transported only by road or rail
- Expansions of LNG reception terminals are only shown if they involve new storage tanks
- Where there is a blank in the table the information is uncertain or unknown.

Any comments on the tables, and corrections / additional information from terminal shareholders and project developers would be most welcome, and should be sent to John McKay e-mail editor@lngjournal.com

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
Belgium	Zeebrugge	Fluxys	1987	4	380,000
Canada	Canaport Saint John	Irving Oil, Repsol	2009	3	480,000
Chile	Quintero	ENAP, Metrogas, Enagas	2009	3	334,000
	Mejillones	Engie, Codelco	2010	1	175,000
China	Beihai LNG, Guangxi	Sinopec	2015	4	640,000
	Dalian	PetroChina	2011	3	480,000
	Dapeng ND Guangdong	CNOOC	2018	4	640,000
	Dongguan, Guangdong	Jovo Group	2013	2	160 000
	Fujian LNG (Xiuyu)	CNOOC, Fujian I&D Corp.	2008	2	640,000
	Guangdong	CNOOC,BP	2006	3	480,000
	Haikou, Hainan LNG	CNOOC	2014	3	480,000
	Ningbo, Zheijang	CNOOC, Zhejiang Energy	2012	3	480,000
	Qidong, Jiangsu	Guanghui Energy	2018	1	60,000
	Qingdao, Shandong	Sinopec	2014	3	480,000
	Rudong	PetroChina	2011	3	530,000
	Shanghai	CNOOC, Shenergy Group	2009	3	495,000
	Shanghai, Mengtougou	Shanghai Gas	2008	3	120 000
	Shenzen, Diefu	CNOOC	2016	2	320,000
	Tangshan, Hebei	PetroChina	2013	3	480,000
	Tianjin North	Sinopec	2017	2	320,000
	Yuedong, Guangdong	CNOOC	2016	2	320,000
	Zhoushan Zhejiang	Enn Group	2018	2	320,000
	Zhuhai, Gaolan	CNOOC	2013	3	480,000
Dominican Republic	Punta Caucedo	AES Andres	2003	1	160 000
Finland	Pori	Gasum Skangas	2016	1	30,000
	Tornio	Gasum Skangas	2018	1	30,000
France	Fos Tonkin	Elengy	1972	3	150,000
	Montoir-de-Bretagne	Elengy	1980	3	360,000
	Fos Cavaou	Engie, Total	2010	3	330,000
	Dunkirk LNG	EDF, Fluxys, Total	2016	3	570,000
Gibraltar	Gasnor	Shell	2018	1	5,000
Greece	Revithoussa	DEPA	2000	3	225,000
India	Dabhol	GAIL, NTPC (Ratnagiri Gas & Power)	2009	3	480,000
	Dahej	Petronet LNG	2004	4	592,000
	Hazira	Shell India, Total	2005	2	320,000
	Kochi, Kerala	Petronet LNG	2013	2	320,000
	Mundra	Gujarat State Petroleum, Adani Group	2018	2	320,000
Indonesia	Arun	Pertamina	2015	5	507,000
Italy	Panigaglia	Snam	1969	2	100,000
	Porto Levante (offshore GBS)	ExxonMobil, Qatar Petroleum, Edison Gas	2009	2	250,000
Japan	Negishi	Tokyo Gas	1969	14	1,180,000
	Sodegaura	Tokyo Gas	1973	35	2,660,000
	Ohgishima	Tokyo Gas	1998	4	850,000
	Higashi-Ohgishima	Tokyo Electric	1984	9	540,000
	Futtsu	Tokyo Electric	1985	10	1,110,000
	Yokkaichi LNG	Chubu Electric	1988	4	320,000
	Kawagoe	Chubu Electric	1997	6	840,000
	Yokkaichi Works	Toho Gas	1991	2	160,000
	Chita LNG Joint	Toho Gas, Chubu Electric	1978	4	300,000
	Chita LNG	Toho Gas, Chubu Electric	1983	7	640,000
	Chita - Midorihama	Toho Gas	2001	3	600,000
	Senboku I	Osaka Gas	1972	4	180,000
	Senboku II	Osaka Gas	1977	18	1,585,000
	Himeji	Osaka Gas	1984	8	740,000
	Himeji LNG	Kansai Electric	1979	7	520,000
	Yanai	Chugoku Electric	1990	6	480,000
	Niigata	Nihonkai LNG, Tohoku Electric	1984	8	720,000
	Oita	Oita Gas, Kyushu Electric	1990	5	460,000
	Tobata	Kitakyushu LNG	1977	8	480,000
	Fukuoka	Saibu Gas	1993	2	70,000
	Sodeshi	Shizuoka Gas	1996	3	337,200
	Hatsukaichi	Hiroshima Gas	1996	2	170,000
	Kagoshima	Nippon Gas	1996	2	136,000
	Shin-Minato	Sendai City Gas	1997	1	80,000
	Nagasaki	Saibu Gas	2003	1	36,000
	Sakai	Kansai Electric, Cosmo Oil	2006	3	420,000
	Mizushima	Nippon Oil, Chugoku Electric	2006	2	320,000

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
Japan (continued)	Ishikari LNG	Hokkaido Gas, Hokkaido Electric	2012	2	380,000
	Okinawa	Okinawa Electric Power	2012	2	280,000
	Naoetsu	Inpex	2013	2	360,000
	Joetsu	Chubu	2011	3	540,000
	Hachinohe LNG	Nippon Oil	2015	2	280,000
	Hitachi LNG	Tokyo Gas	2015	1	230,000
	Soma Fukushima	Japan Petroleum Exploration	2017	1	225,000
Korea	Boryyeong	GS Energy, SK E&S	2017	3	200,000
	Incheon	Kogas	1996	20	2,880,000
	Kwangyang	POSCO	2005	4	530,000
	Pyeong-Taek	Kogas	1986	23	3,360,000
	Samcheok	Kogas	2014	3	600,000
	Tong-Yeong	Kogas	2002	17	2,620,000
Malaysia	Pengerang Johor	Petronas Gas	2017	2	400,000
Mexico	Altamira	Vopak, Enagas	2006	2	300,000
	Energia Costa Azul	Sempra LNG	2008	2	320,000
	Manzanillo	Samsung, Kogas, Mitsui	2012	2	300,000
Netherlands	Gate LNG	Gasunie, Royal Vopak	2011	3	540,000
Panama	Costa Norte	AES	2018	1	130,000
Phillipines	Pagbilao LNG	Energy World Corp.	2017	1	130,000
Poland	Swinoujscie	Baltic Gaz System	2015	2	320,000
Portugal	Sines	REN Atlantico	2004	3	390,000
Puerto Rico	Penuelas	EcoElectrica	2000	1	160,000
Singapore	Singapore	Singapore Energy Authority	2013	3	540,000
Spain	Barcelona	Enagas	1969	8	840,000
	Huelva	Enagas	1988	5	610,000
	Cartagena	Enagas	1989	5	587,000
	Bilbao	Enagas, EVE	2003	3	450,000
	Sagunto	GNF, Osaka Gas, Oman Oil	2006	4	600,000
	Reganosa, Ferrol	Galicia, Sonatrach, Tojeiro	2006	2	300,000
	El Musel, Gijón,	Enagas	2013	2	300,000
Taiwan	Yung-An	CPC	1990	6	690,000
	Tai-Chung	CPC	2009	5	800,000
Thailand	Map Ta Phut	PTT LNG	2011	2	320,000
Turkey	Marmara Ereglisi	Botas	1994	3	255,000
	Izmir	EgeGaz	2006	2	280,000
USA	Everett	Suez LNG NA	1971	2	155,000
	Lake Charles	Shell, ETE	1982	4	425,000
	Elba Island	Kinder	2001	5	535,000
	Cove Point	Dominion	2003	5	530,000
	Freeport	Freeport LNG Development	2008	2	320,000
	Cameron	Sempra LNG	2009	3	480,000
	Golden Pass, TX	Qatar Petroleum, ExxonMobil	2010	5	775,000
	Pascagoula, MS	Gulf LNG, Kinder	2012	2	320,000
UK	Isle of Grain	National Grid	2005	8	1,000,000
	South Hook	ExxonMobil, Qatar Petroleum,Total	2009	5	775,000
	Dragon LNG, Milford Haven	Shell, Petronas	2009	2	310,000

LNG Import Terminal Projects

Country	Location/Project	Owners/Project Developers	Start up	Storage Tanks	Storage Capacity
China	Shenzhen	CNPC Yudean Power	2021	2	120,000
	Yangjiang	CNPC Yudean Power	2023	2	120,000
	Zhangzhou Fujian	CNOOC	2022	2	160,000
India	Ennore	Indian Oil Corp	2019	2	320,000
	FSRU Andhra Pradesh	Andhra Pradesh Gas	2019	1	135,000
	Pipovav LNG (FSRU), Gujarat	Swan Energy	2019	2	320,000
	Andhra Pradesh	Hindustan LNG, Andhra Pradesh	studies	1	135,000
UK	Port Meridian, Barrow-in-Furness	Port Meridian Energy Ltd.	2020	1	150,000

LNG FSRU Import Facilities

Country	Location (Project)	Owners	Start up
Argentina	Bahia Blanca GasPort	Excelerate/YPF Repsol	2008
	Escobar GasPort	Excelerate/Enarsa	2011
Bangladesh	Moheshkhali	Excelerate, PetroBangla	2018
Brazil	Pecem, FSRU	Petrobras	2009
	Guanabara Bay FSRU	Petrobras	2009
	Salvador, Bahia FSRU	Petrobras	2013
China	Tianjin FSRU	CNOOC, Hoegh, various	2013
Colombia	Cartagena FSRU	Promigas, Sociedad Portuaria El Cayao	2016
Egypt	Ain Sokhna, Suez	EGAS, Hoegh	2015
	Ain Sokhna, Suez	EGAS, BW Gas	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertimana	2012
Italy	Livorno	OLT Offshore LNG Toscana	2013
Jordan	Aqaba, Jordan	Golar LNG	2015
Kuwait	Mina Al-Ahmadi	KPC	2009
Lithuania	Klaipeda	Klaipedos Nafta Hoegh LNG	2014
Malaysia	Malacca FSRU	Petronas	2012
Malta	FSU Armada Mediterrana	ElectroGas	2016
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
	Port Qasim	BW-Mitsui, PGP Consortium	2017
Turkey	Aliaga FSRU, Neptune	Etki LNG	2016
	Dortyol FSRU Challenger	Botas	2018
UAE	Ruwais, Abu Dhabi	Gasco (UAE)	2016
	Jebel Ali Port, Dubai	DSA (UAE)	2010
UK	Teesside GasPort	Excelerate	2007

LNG Export Projects

Country	Location/Project	Project Developers	Planned Start Up	Number of Trains	Capacity In MTPA
AUSTRALIA	Pluto LNG expansion	Woodside	2021+	2	10.0
	Prelude FLNG	Shell, Inpex, Kogas CPC	2018	1	3.5
CANADA	Bear Head LNG, Nova Scotia	LNG Ltd.	2024	4	8.0
	Goldboro LNG, Nova Scotia	Pieridae Energy	2024	2	10.0
	Kitimat LNG, BC	Woodside, Chevron	2024	2	10.0
	LNG Canada, BC	Shell, Mitsubishi, Kogas, PetroChina, Petronas	2024	2	12.0
	Melford LNG project, Nova Scotia	H-Energy Hiranandani Group	Studies		
	Kwispaa FLNG, Vancouver	Steelhead LNG	2024	4	12.0
	Vancouver Tilbury	WesPac Midstream	2021	1	3.25
	Woodfibre LNG, Squamish	Pacific Oil & Gas Co	2020	2	2.1
EQ.GUINEA	Equatorial Guinea Fortuna FLNG	Ophir, Golar LNG, GEPetrol	2020+	1	2.0
INDONESIA	Sengkang LNG	Energy World Corp.	2018	4	2.0
MALAYSIA	Rotan FLNG (Sabah)	Petronas, Murphy Oil	2019	1	1.5
MOZAMBIQUE	Area 1 Onshore	Anadarko Petroleum and partners	2023+	2	10.0
	Area 4 Onshore	Eni and partners	2023+	2	10.0
	Area 4 FLNG	Eni and partners	2019	1	2.5
NIGERIA	NLNG Train 7	NNPC, Shell, Eni, Total	2022+	1	7.0
PAPUA NEW GUINEA	Elk-Antelope LNG	Total, ExxonMobil Oil Search, Petromin	Studies		
RUSSIA	Sakhalin II expansion	Gazprom, Shell, Mitsui, Mitsubishi	2021	studies	
	Vladisvostok LNG	Gazprom, Itochu, various	2023+	2	10.0
USA	Alaska LNG Nikiski	Alaska Gasline Development Corp.	2023+	3	20.0
	Annova LNG, Brownsville	Exelon Corp.	2023+	6	6.0
	Cameron LNG, Louisiana	Sempra, Total, Mitsui, Mitsubishi	2019	3	14.95
	Commonwealth LNG, Louisiana	Commonwealth LNG LLP	2022	8	9.0
	Corpus Christi Liquefaction, Texas	Cheniere	2019	5	22.5
	Delfin LNG, Louisiana	Delfin, Hoegh	2021	3	9.0
	Driftwood LNG, Louisiana	Tellurian Investments	2022	6	26.0
	Elba Island, Georgia	Kinder Morgan, EIG Energy	2018	10	2.5
	Freeport LNG, Texas	Freeport LNG	2018	4	20.4
	Galveston Bay LNG	NextDecade	2023+	6	27.0
	Golden Pass, Texas	Qatar Petroleum, ExxonMobil	2021	3	15.6
	Jordan Cove, Coos Bay	Pembina Corp.	2024	2	7.8
	Lake Charles, Louisiana	Shell, ETE	2024	3	15.0
	Magnolia LNG	Louisiana LNG Ltd.	2023+	4	8.0
	Port Arthur LNG	Sempra	2023+	2	10.0
	Rio Grande LNG	NextDecade	2023+	6	27.0
	Sabine Pass LNG, Louisiana	Cheniere	2018-19	2	9.0
	Texas LNG Brownsville	Chandra, Meyer, Samsung, others	2023+	2	4.0
	VG LNG (Cameron Parish)	Venture Global	2021	5	10.0
	VG LNG (Plaquemines)	Venture Global	2021	10	20.0

LNG Exporters

Country	Location/Project	Shareholders	Start up	Liquefaction		Storage	
				Trains	capacity (nominal) mtpa	No. of tanks	Total capacity m^3
ABU DHABI (UAE)	Das Island (Adgas)	ADNOC, Mitsui, BP, Total	1977	2	3.2	3	240,000
			1994	1	2.5		
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mistubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
	Darwin	Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
	Gladstone LNG	Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
	Gorgon LNG	Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
	Pluto LNG	Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
	QCLNG	Shell, CNOOC	2014	2	8.0	2	280,000
	Wheatstone LNG	Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
	Ichthys LNG	Inpex Corp., Total	2018	2	8.9	2	330,000
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
CAMEROON	Hilli Episeyo FLNG	Kribi Perenco	2018	1	1.2	1	125,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Total, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya	Equinor, Total, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG Mitsubishi, Mitsui, Partex and Itochu	2000	2	7.1	2	240,000
		Oman Govt.,Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
PAPUA NEW GUINEA	PNG LNG	ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-TI	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5	4	640,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	5	22.5	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000

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