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LNG exports rise amid competition and more globally integrated market

BP Energy Outlook shows positive path for LNG even in various evolving transition outcomes

Global liquefied natural gas volumes are set to expand substantially, leading to a more competitive, globally integrated gas market.

LNG trade is forecast to more than double, reaching almost 900 billion cubic metres in 2040 up from around 400 Bcm in 2017, according to the Energy Outlook 2019 of UK major BP.

Exporters

"Much of the Outlook is described with reference to the 'Evolving Transition' scenario. But that does not imply that the probability of this scenario is higher than the others," said BP.

The increase in LNG exports is led by North America, followed by the Middle East, Africa and Russia.

As the LNG market matures, the US and Qatar emerge as the main centres of LNG exports, accounting for around 40 percent of all shipments by 2040.

"Asia remains the dominant market for LNG imports, although the pattern of imports within Asia shifts, with China, India and 'Other Asia' overtaking the more established markets of Japan and Korea, and accounting for around half of all LNG imports by 2040," the report forecasts.

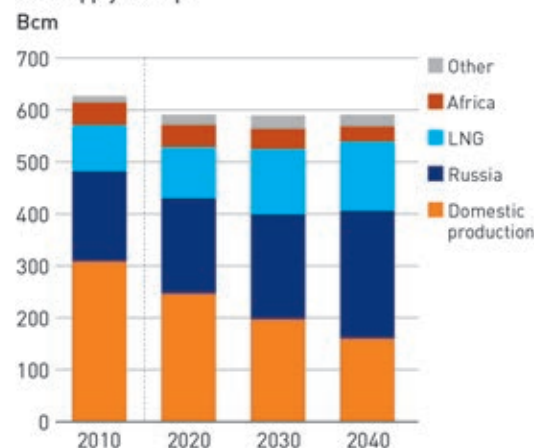
The UK company said that Europe remained a key market, both as a "balancing market" for LNG supplies and a key hub of gas-on-gas competition between LNG and pipeline gas.

Profile

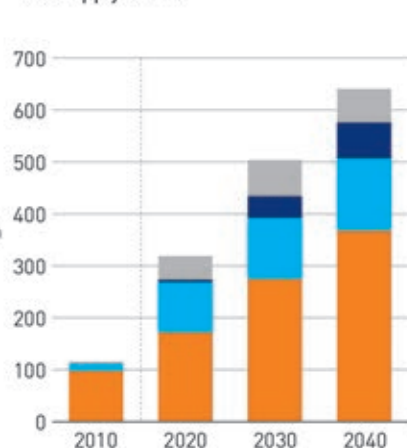
According to the Outlook, the precise profile of LNG volume growth will depend on the timing and availability of the new investments needed to finance the considerable expansion.

"The cyclical nature of LNG investments means there is a risk that the development of the LNG market will continue to be associated with periods of volatility," noted the report.

Gas supply: Europe



Gas supply: China



Natural gas supply in growing European and Chinese markets

The report found that the increase in LNG supplies would lead to greater competition between LNG and pipeline gas, especially in Europe and China - two of the largest importers of gas.

"In the Evolving Transition (ET) scenario, European gas production declines by 40 percent, causing Europe's import dependency to increase to around three-quarters in 2040," said BP.

Infrastructure

"Europe's existing infrastructure means it has the capacity to increase substantially its imports of either LNG or pipeline gas, especially from Russia," it added.

"The greater ease of transportation means pipeline gas has a marked cost advantage over LNG; the main constraint on pipeline imports is concerns about Europe's dependency on Russia for gas," it added.

In the ET scenario, the development of a globally integrated gas market eases these concerns, allowing Russia to increase slightly its share of European gas demand.

"In China, despite sizeable increases in domestic production, demand growth outstrips supply, causing import dependency to rise to over 40 percent by 2040," said the report.

"Around half of these additional imports are met by incremental pipeline capacity from Russia and other CIS countries, and the remainder from LNG," it added.

Considerations

"As in Europe, as well as pure cost considerations, China's choice of gas supply may also depend on the energy security implications of different sources of supply," stated the report.

The Outlook believes that natural gas will grow strongly, with broad-based demand, low-cost supplies and increasing global availability.

The market growth is aided by the increasing supplies of LNG.

"Natural gas grows at an average rate of 1.7 percent per annum - increasing nearly 50 percent by 2040 - the only source of energy, along with renewables, whose share in primary energy increases over the Outlook," said the report.

"Growth in gas demand is widespread, increasing in almost every country and region considered in the report," it added.

BP found that the increase will be driven in broadly equal amounts by use in power and industry. Transport records the fastest growth, albeit with small volumes.

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Subscription

Print & online **£655/€810/US\$1050**

Online only **£595/€795/US\$950**

See website for more details
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Printed by: Rabarbar s.c.,
Polna 44,
41-710 Ruda Śląska,
Poland

Global gas production is led by the US and Middle East (Qatar and Iran) - who together account for almost 50 percent of the growth in gas production to 2040, supported by strong increases in output in both China and Russia.

Trading

"The importance of gas trade continues to grow over the Outlook period, driven by robust expansion of LNG supplies which account for more than 15 percent of total gas demand in 2040, overtaking inter-regional pipeline shipments in the late 2020s," according to BP.

The report said that the growth in gas demand is driven by use in industry and power, with the use of gas varying across countries and regions.

In the Evolving Transition scenario, the use of gas in industry accelerates over the period to 2040, while the growth of gas in the power sector slows.

The increased industrial demand for gas is largely driven by developing economies as they continue to industrialize, especially in regions with large gas resources such as the Middle East and Africa.

US boost

Coal-to-gas switching, especially in China, also supports gas demand in industry.

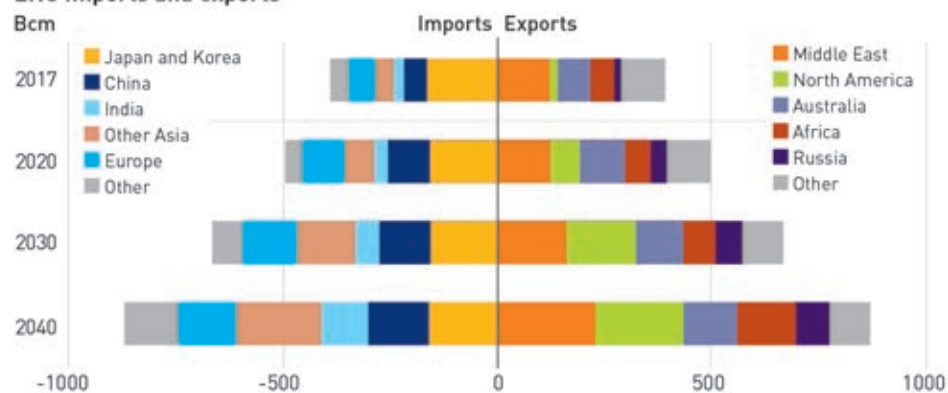
"The additional gas absorbed by the power sector is driven by the overall growth of power demand, with the share of natural gas in the global power sector remaining relatively stable at around 20 percent," said the report.

"Among the major gas producers, only North America experiences an increase in the share of gas at the expense of coal," it

added.

"Although

LNG imports and exports



LNG import and export shipments on a regional basis

the use of gas within transport grows rapidly, it remains small relative to industry and power," according to the Outlook.

"The speed and pattern of growth in gas demand, particularly in the non-OECD, is dependent on the pace at which the required supporting infrastructure is built: this is a key source of uncertainty concerning the Outlook for natural gas," it stated.

Overall the Outlook came to the conclusion that the transition to a lower-carbon fuel mix will continue, led by natural gas and renewables.

These energy sources in leading the transition will gain in importance relative to oil and coal.

Natural gas and renewables account for almost 85 percent of the growth in primary energy, with their importance increasing relative to all other sources of energy.

Sources

Renewable energy is the fastest growing source of energy at 7.1 percent per annum, contributing half of the growth in global energy, with its share in primary energy increasing from 4 percent today to around 15 percent by 2040.

Natural gas grows much faster than either oil or coal, overtaking coal to be the second largest source of global energy and converging on oil by the end of the Outlook.

"Oil (0.3 percent per annum) increases during the

first half of the Outlook, although much slower than in the past, before plateauing in the 2030s," said the report.

Coal consumption is broadly flat at just 0.1 percent per annum of decline, though its importance in the global energy system will put it at its lowest level since before the industrial revolution.

The Outlook found that oil demand is uncertain but crude looks set to play a major role in global energy out to 2040.

Uncertainty

Although the precise outlook is uncertain, the world looks set to consume significant amounts of oil, crude plus Natural Gas Liquids (NGLs), for several decades, requiring substantial investment.

The Outlook considers a range of scenarios for oil demand, with the timing of the peak in demand varying from the next few years to beyond 2040.

Despite these differences, the scenarios share two common features.

"First, all the scenarios suggest that oil will continue to play a significant role in the global energy system in 2040, with the level of oil demand in 2040 ranging from around 80 million barrels per day to 130 million barrels per day," said the report.

"Second, significant levels of investment are required for there to be sufficient supplies of oil to meet demand in 2040," it added.

The report explained that if future investment was limited to developing existing fields and there was no investment in new production areas, global production would decline at an average rate of around 4.5 percent per annum, implying global oil supply would be only around 35 Mb/d in 2040.

"Closing the gap between this supply profile and any of the demand scenarios in the Outlook would require many trillions of dollars of investment over the next 20 years," said the report. ■

The speed and pattern of growth in gas demand... is dependent on the pace at which the required supporting infrastructure is built



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Crucial role of LNG is adapted to tackling poor air quality and climate change in years ahead

LNG is the expanding gas supply source with an expected annual growth rate of 4 percent through 2035

There has been a growing recognition of the crucial role of liquefied natural gas as the world tackles poor air quality and climate change with countries seeking more LNG volumes, especially in Asia.

Asian LNG imports exceed expectations again in 2018, absorbing continued supply growth while near-term increases in supply are expected to be absorbed by Asia as well as Europe, according to the annual LNG Outlook of Royal Dutch Shell.

The report noted that there was also a continued need for investment in liquefaction and export plants to meet long-term demand for LNG.

Volumes

During the past year there had been 1,400 spot cargo deliveries as additional volumes were needed worldwide to supplement long-term contract commitments.

“Demand for energy will continue to rise to meet the lighting, heating, cooling and transport needs of a growing global population,” said

energy is produced, delivered and used,” it added.

“The Paris Agreement has set out a political framework for reducing emissions. And, while countries are concerned with how to deliver their Nationally Determined Contributions, they are also concerned with better air quality for their increasingly urban populations,” stated the Anglo-Dutch company.

Policies

Projections to 2035 estimate that more than 70 percent of energy demand growth will be met by gas and renewables combined, with gas supplying more than 40 percent of the additional demand.

China, India and other major importers are putting policies in place which drive preference for gas over coal.

“Gas emits between 45 percent and 55 percent lower greenhouse gas emissions than coal when used to generate electricity,” said the report.

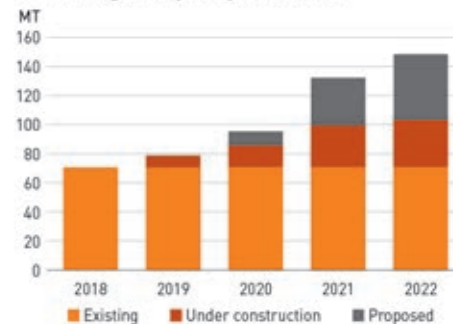
“Coal to gas switching has led to a 78 percent improvement in Beijing’s winter air quality over the last five years,” it noted.

“Blue skies are not the only benefit of the measures China has taken to improve air quality in Beijing. There has been a calculated annual reduction of 176 million tonnes of carbon dioxide in Beijing and surrounding areas,” said Shell.

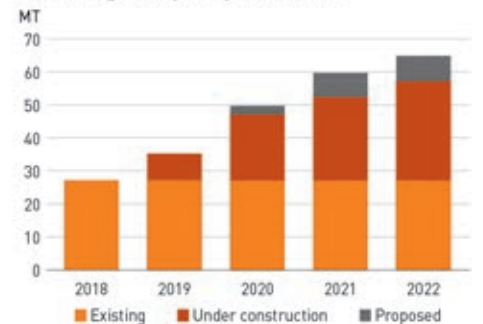
The Outlook forecast that LNG would continue to be the fastest-growing gas supply source, with an expected

compound annual growth rate of 4 percent a year between now and 2035.

China Regas capacity additions



India Regas capacity additions



China and India have been building up their import capability

compound annual growth rate of 4 percent a year between now and 2035.

Leaders

“We expect growth in LNG demand to continue around the world, led by Asia and Europe,” said the report.

The company explained that LNG provided flexible supply to meet the seasonal and short-term demand requirements of an importer, providing greater security of supply.

The fuel is also a reliable partner for renewables because it can quickly compensate for dips in solar or wind power supply and rapidly respond to sudden increases in demand.

The number of LNG importing countries continues to increase, reaching 42 in 2018, with Panama and Bangladesh turning to LNG imports for reliable, affordable and cleaner energy.

The use of LNG in transport is growing, especially in the heavy-duty transport sector.

Europe is predicted to have more than 280,000 LNG trucks on its roads by 2030. China already has over 300,000 LNG-fuelled trucks and buses on the road.

Strength

A look back at the 2018 global LNG market shows continuing strength with delivered volumes reaching 319 million tonnes, enough to power around 643 million homes.

LNG trade increased by 27 million tonnes with the growth supported by 70 percent of the liquefaction capacity additions sanctioned between 2011 and 2015 coming online.

Japan remains the world’s largest

LNG importer, followed by China, which eclipsed South Korea for the second year in a row.

China’s strong demand for energy continues with gas the fastest-growing fuel source, accounting for more than 40 billion cubic metres of growth.

China has become the world’s largest gas importer, with LNG imports doubling over the last two years to add to its pipeline deliveries from Central Asia and elsewhere.

Demand

This Chinese demand has been driven by industrial use (up 44 percent) and residential and commercial use (up 38 percent).

More than half of this gas demand growth was met by LNG.

India is also using LNG to meet its increasing needs for a secure energy supply. Domestic gas production dropped and the resulting increase in demand for imported gas was met by LNG (up 10 percent year on year).

LNG’s share of India’s total gas supply mix exceeded 50 percent for the first time in 2018.

“Marine LNG also continues to grow strongly. There are currently 143 LNG fuelled ships in operation and 135 on order,” said the report.

“During the past year there have been announcements from across the marine sector supporting new LNG ship building and infrastructure development,” it added.

Contracted

Shell also explained that encouragingly for the long-term health of the global

Projections to 2035 estimate that more than 70 percent of energy demand growth will be met by gas and renewables combined...

Shell.

“At the same time, there is an Coal to gas switching has led to a 78 percent improvement in Beijing’s winter air quality over the last five years, increasing need to significantly reduce carbon emissions by changing the way



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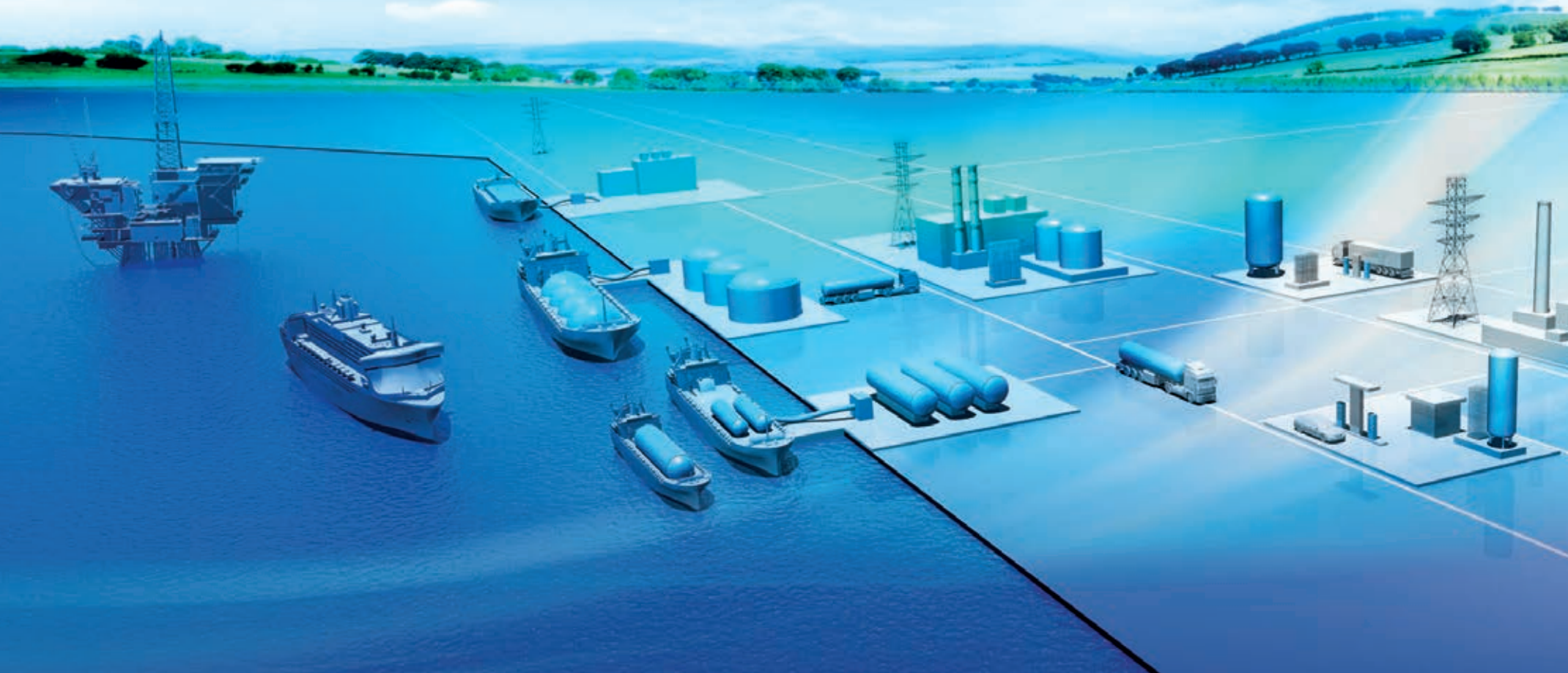
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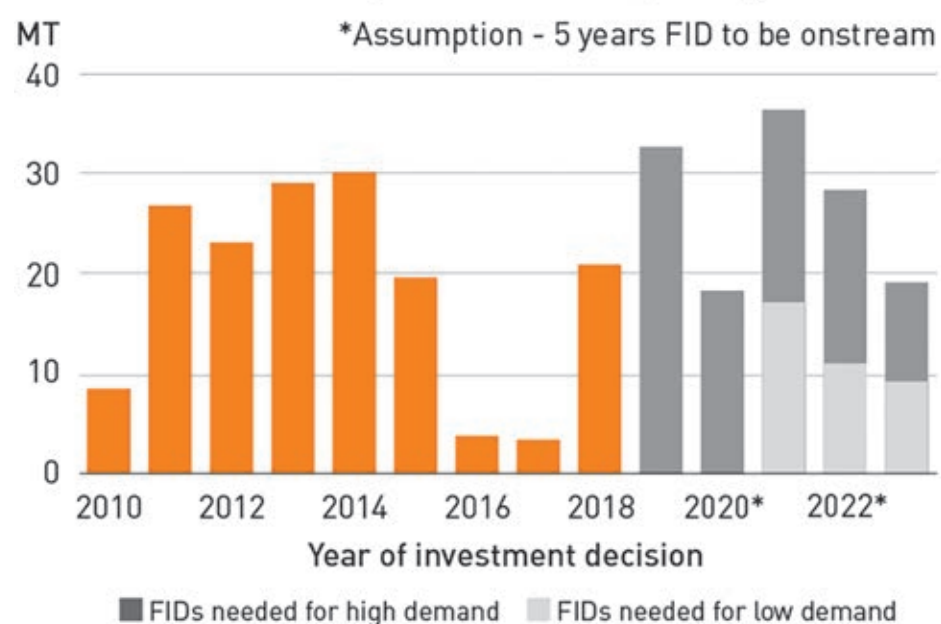
LNG Power Plant

LNG Small Scale Terminal Plant

LNG Bunkering Station

LNG Peak Shaving Plant

Investment in liquefaction capacity



Spending is forecast to increase for LNG production projects

LNG market, the average length of contracts signed more than doubled from around six years in 2017 to about 13 years in 2018.

Meanwhile, the total contracted volume more than doubled to almost 600 million tonnes in 2018.

On the supply side, Australian LNG exports caught up with those of long-time leading supplier Qatar towards the end of 2018 and are expected to rise by 10 million tonnes in 2019.

Both countries are well-positioned to supply rapidly developing economies

across Asia with gas they need to improve air quality by displacing coal-fired power and heating.

“The continued surge in Chinese LNG imports has helped improve air quality in some of its biggest cities over the last few years. China’s success in making the air cleaner for millions of people shows the critical role that natural gas can play in providing more and cleaner energy to the world,” said Maarten Wetselaar, Integrated Gas and New Energies Director at Shell.

Picking up

“We saw Asian LNG demand growth exceed expectations again in 2018 and we expect this strong growth to continue. Investment in new supply projects is picking up, but more will be needed soon,” he said in presenting the Outlook.

LNG has played an important role in the global energy system over the last few decades, as an increasing number of countries have turned to natural gas to meet their growing energy needs. LNG trade increased from

100MT in 2000 to 319MT in 2018. Projects typically require long-term sales agreements to secure financing. From 2014 through 2017, LNG buyers had increasingly been looking to sign shorter, smaller and more flexible contracts.

Shell had warned in its 2018 LNG Outlook that this mismatch between suppliers and buyer needs would have to be resolved to enable developers to go ahead with new projects.

Looking out to 2019, 35MT of additional LNG supply is expected. This supply growth is expected to be absorbed by both Europe and Asia.

Last year saw final investment decisions on 21MT of new capacity compared to a total of 7MT over the last two years combined.

A rebound in new long-term LNG contracting in 2018 could revive investment in liquefaction projects.

“There is potential for a supply shortage developing in the mid-2020s, unless more LNG production project commitments are made soon,” the report concluded. ■

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For the Record

AIR PRODUCTS, the world's leading liquefied natural gas technology and equipment company, has signed an agreement to provide its proprietary LNG technology, equipment, and related process license to the Golden Pass project being developed by Qatar Petroleum and ExxonMobil in Texas. Air Products will supply its proprietary AP-C3MR natural gas liquefaction technology and equipment, and three of its MCR Main Cryogenic Heat Exchangers, to be installed at the heart of the proprietary propane pre-cooled mixed refrigerant liquefaction process for the three-Train facility. The Lehigh Valley, Pennsylvania-based company said its technology will be integral in producing around 16 million tonnes per annum of LNG when the plant starts up in 2024. "Air Products is very honored to be selected for the Golden Pass project involving ExxonMobil and Qatar Petroleum," said Samir Serhan, Executive Vice President at Air Products. "Our company has a long and successful history of serving the needs of the LNG industry and we intend to remain the leader in LNG equipment and liquefaction technology," added Serhan. Air Products said it believed that the use of LNG continues to increase around the world with strong energy demands in growing economies.

"We have brought together an exceptional team to implement this project, with Air Products supplying the liquefaction technology and equipment that will drive our facility," said Sean Ryan, President of Golden Pass LNG. "We are pleased to partner with the industry leader in LNG exchanger technology to bring clean energy from Texas to power the world," stated Ryan. Air Products LNG heat exchangers and related equipment for the Golden Pass project will be manufactured at its Port Manatee, Florida facility. The company opened its Port Manatee facility in January 2014. In October 2018, Air Products dedicated a new LNG equipment test facility and held a ground-breaking for a facility manufacturing expansion project at the site. "We are committed to always providing the best-in-class equipment and technology to the LNG industry, to never

missing a delivery and to exceeding all customer expectations in terms of performance and efficiency," said Air Products. "We want customers in the LNG market around the world to know that we are prepared and not limited in our manufacturing capability when new LNG plant opportunities are announced and developed," it declared.

ANADARKO Petroleum Corp. of the US said the joint venture partners developing the onshore LNG export project with feed-gas assets from the Rovuma Basin in Mozambique have signed yet another Sale and Purchase Agreement and this time with a subsidiary of stakeholder Bharat Petroleum Corp. of India. The accord is for the delivery of 1 million tonnes per annum of LNG over a period of 15 years. "In addition to Bharat Petroleum being an upstream equity co-venturer in the Mozambique LNG project, we are also pleased to have them as one of our foundation customers," said Mitch Ingram, Anadarko Executive Vice President for international activities. "With this agreement, Mozambique LNG now has executed more than 8.5 MTPA of SPAs," added Ingram. "India's role in the global LNG market will continue to grow with Mozambique LNG being a natural supplier, given its geographic proximity and the 30 percent stake that Indian state-owned interests have in Mozambique LNG," he stated. Other sales agreements have a global spread and have been with companies from China, Japan and Europe. The stakeholders in the Anadarko-controlled Area 1 licence in the southeast African nation also include Japanese trading house Mitsui and Co. and three Indian companies Bharat Petroleum, ONGC Videsh and Oil India Ltd., as well as Thailand's national energy company PTTEP and the Mozambique state-owned oil and gas firm ENH.

The project shareholders are also in the countdown period for a final investment decision expected in the first half of 2019. Anadarko's Mozambique project will be the African nation's first onshore development, initially consisting of two liquefaction Trains with total nameplate capacity of 12.88 MTPA to support the development of the Golfinho-Atum gas fields located entirely within Offshore Area 1. Other customers for the Anadarko project are Japanese utilities Tohoku Electric and Tokyo Gas, European utilities, Centrica of the UK and

Electricite de France and China National Offshore Oil Corp. Two other projects are planned in Mozambique from the separate Area 4 licence resources held by Italian energy company Eni and partners. These include the Coral floating LNG joint venture with capacity of around 3.4 MTPA already under construction and scheduled to come on stream in 2022. The Area 4 onshore Mamba LNG project is also 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. (PetroChina) 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.

BAKER HUGHES-GE, the US energy services and equipment company, said it was awarded the contract to supply turbomachinery for the construction of the Golden Pass LNG export facility in Texas following the recent decision by Qatar Petroleum and ExxonMobil to go ahead with the venture. The project is expected to produce just under 16 million tonnes per annum of LNG and BH-GE said it would supply equipment for three LNG trains, including six gas turbines and 12 centrifugal compressors. "We are proud to be working with Golden Pass on this innovative LNG project," said Rod Christie, President and Chief Executive for Turbomachinery & Process Solutions at BH-GE. "This builds on our 30-year-plus track record of delivering high-availability and reliable LNG technology, with low total cost of operations," added Christie. BH-GE will supply its competitive MS7001 EA, the most utilized large industrial gas turbine available in the LNG market and with 77 units in operation in 13 countries. Sean Ryan, President of the Golden Pass project company, said the facility would be one of the premier LNG exporters in North America.

"To accomplish that, we have to be reliable and cost competitive, and BH-GE's long history of delivering first class, large-scale LNG projects was a clear fit to help us deliver on our goal," stated Ryan. The Golden Pass export plant site is located on the Sabine-Neches Waterway in Texas. Originally designed as an import facility before the shale-gas revolution, Golden Pass will be

reconfigured at a cost of more than \$10 billion to export LNG cargos and the construction of the plant is expected to create about 9,000 jobs over the five-year construction period. It is 70 percent-owned by Qatar Petroleum while ExxonMobil owns 30 percent of the venture. An engineering consortium comprising McDermott and Zachry Group of the US and Japan's Chiyoda Corp. has been awarded the contract to build the plant.

BP, the UK major, said it produced its first natural gas from the second stage of its West Nile Delta development offshore Egypt, helping to give the Arab nation additional resources as it once again builds up its LNG export volumes. The BP project, which produces gas from the Giza and Fayoum fields, was developed as a deepwater, long-distance tie-back to an existing onshore plant. The successful start up is the second in a string of new upstream major projects expected to be brought on line in 2019 for BP. "This important project start-up benefitted from the excellent working relationship between BP and the Egyptian government," said Bob Dudley, BP Chief Executive. "We simply could not have delivered it successfully without the steadfast support of the Minister of Petroleum, his excellent team and the entire government," added Dudley. When fully onstream in 2019, combined production from all three phases of the West Nile Delta project is expected to reach up to 1.4 billion cubic feet of gas per day, equivalent to about 20 percent of Egypt's current gas production. All the gas produced will be fed into the national gas grid. Egypt had suffered a gas crisis during and after the "Arab Spring" social upheavals in North Africa and the Middle East in 2014. This led to the diversion of natural gas supplies away from LNG production to meet growing domestic demand and to avoid power cuts. However, Egyptian gas resources have soared since Italian energy company Eni brought the Zohr field in the East Med on stream in 2017. Before then Egypt had been forced to import LNG from 2015 in two floating storage and regasification units deployed at the port of Ain Sokhna on the Gulf of Suez. The Egyptians have now halted LNG imports and are seeking to build up exports of LNG from their facilities at Idku and Damietta, east of the port of Alexandria.

The Idku LNG export plant has been on stream again since 2017 under the

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operatorship of Royal Dutch Shell, which acquired original operator BG Group. The Damietta plant is currently idle but the resolution of a legal dispute between the owners and the Egyptian government has put its relaunch back on the agenda. The facility 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 (UFG), a joint venture between Spain's Gas Natural, now known as Naturgy, and Eni. The remaining 20 percent belongs to EGAS and Egyptian General Petroleum Co. The latest BP West Nile Delta development includes a total of five gas fields across the North Alexandria and West Mediterranean Deepwater offshore concession blocks. It was originally planned as two separate projects, but BP and its partners realized the opportunity to deliver it in three stages, accelerating delivery of gas production commitments to Egypt. Stage one of the Egyptian project, which started producing in 2017, included gas production from the first two fields, Taurus and Libra. The Giza and Fayoum development, which includes eight wells, is currently producing around 400 million cubic feet of gas per day and is expected to ramp up to a maximum rate of around 700 million cubic feet of gas per day. BP said the third stage of the West Nile Delta project will develop the Raven field. Production is expected in late 2019.

CHEVRON, the US major whose assets include with two large liquefied natural gas plants in Western Australia, said it signed a sales and purchase agreement with GS Caltex Corp. for the delivery of LNG to South Korea from Chevron's global supply portfolio. As a joint venture between Chevron and South Korean energy company GS Energy, GS Caltex has signed a long-term agreement and will begin receiving LNG in October 2019. Chevron's President of Global Gas, Hugh Connett, stated the agreement is another indication of the significance of the long-standing relationship between Chevron and GS Caltex. "We're proud of our partnership with GS Caltex and we welcome this opportunity to build on that relationship by supplying LNG to South Korea's growing market," said Connett. Chevron has an existing LNG SPA with GS Caltex executed in 2009. Chevron's plants include the onshore Wheatstone LNG plant in the Pilbara region of Western Australia, the newest facility

that brought its second Train on stream in June 2018.

Wheatstone Train 2 is the last of five LNG production units built by Chevron and its joint venture partners in the state of Western Australia over the past 10 years at a combined cost of more than US\$85 billion. The US major also operates the Gorgon plant on Barrow Island in Western Australia. Wheatstone, with a total capacity of 8.9 million tonnes per annum, was the eighth LNG project to be completed in Australia when it came on stream. Chevron's partners in Wheatstone are Kuwait Foreign Petroleum Exploration Company, Australia's Woodside Petroleum, Kyushu Electric Power Co, and a joint venture part-owned by the world's biggest LNG buyer, Japan's Jera Co. Inc. The Gorgon plant is owned by Chevron and the Australian subsidiaries of Royal Dutch Shell and ExxonMobil with Japanese utilities Osaka Gas, Tokyo Gas and Jera owning micro stakes.

CHINA National Petroleum Corp., the world's third-largest energy company, plans to build 23 new natural gas storage facilities and expand 10 existing ones to help the nation have flexibility in its network for LNG imports and pipeline gas. CNPC, the company with a stake in the Yamal LNG project in Russia and in Mozambique LNG in southeast Africa, said the new storage would give additional working gas capacity exceeding 15 billion cubic metres by 2030. The move aims to help meet the rising demand for natural gas in China to help economic expansion and the increasing replacement of coal by natural gas to reduce pollution, especially during winter in the northern cities. The CNPC natural gas storage plans were outlined in a statement on February 17 published by the Xinhua news agency. CNPC is the largest natural gas producer and supplier in China, providing more than 71 percent of China's gas supply and operating 76 percent of China's gas pipeline. It is also the largest oil and gas pipeline contractor and operator with a natural gas pipeline network of more than 53,000 kilometres. However, natural gas storage capacity is regarded as inadequate to provide for peak supply needs, given the size of the national gas network. CNPC, the parent company of PetroChina, said that part of its plans was to build six regional gas storage centres across China. The most suitable regions for underground storage are in areas where more depleted gas

wells could be used. China currently operates 25 storage facilities with total designed working capacity of 18.9 Bcm and working volume of 11.7 Bcm, more than double the capacity that existed in 2015. This is still inadequate at less than 5 percent of the total gas consumed compared with 20 percent in the US.

Most of the facilities in operation were built using depleted gas wells. Only a few use salt caverns which require higher building costs and take much longer to construct. CNPC said it was gradually establishing a diversified gas supply system to satisfy the increasing demand for gas. The PetroChina unit operates three LNG terminals, two in the northeast at Tangshan in Hebei Province and Dalian in Liaoning province. The third LNG facility is in the east at Rudong in Jiangsu province. The country aims to make natural gas consumption account for around 10 percent of the country's energy mix by 2020 and 15 percent by 2030. China's natural gas consumption surged in 2018, rising by 18 percent to 280.3 Bcm, according to the National Development and Reform

Commission. Chinese LNG imports rose by 38 percent in 2018 as shipments surged in the final two months of the year. The LNG imports totaled 53.81 million tonnes compared with just over 39MT in 2017. The imports of LNG had risen at a slower pace in 2018 than in 2017 when they increased by 46 percent from the previous year when shipments had amounted to just over 27MT. In addition to its 19 onshore LNG terminals, China also deployed a floating storage and regasification unit in 2018, the 170,000 cubic metres capacity "Hoegh Esperanza", at Tianjin port in northeast China to serve Beijing. Analysts said the Chinese government had largely succeeded in its pledge to ensure abundant natural gas supplies and stable prices in the 2018-2019 winter season, though more storage capacity would have improved the management of gas distribution.

CHIYODA Corp., the Japanese engineering company with seven large-scale recent, current and future liquefaction contracts, has posted operational losses related to several LNG

projects, including the Cameron LNG export plant in Louisiana being constructed in a joint venture with US firm McDermott International. McDermott issued a statement after Chiyoda outlined losses on Cameron LNG and the Tangguh project in Indonesia. McDermott said it would also be taking a hit on the Cameron engineering contract joint venture. "Losses are mainly due to an increase in incremental construction costs for the Cameron LNG project," said Chiyoda in its fiscal third-quarter earnings report. In the financial results, Chiyoda posted an operating loss in the third fiscal quarter of 107.79 billion yen, due to "significantly increased construction costs for ongoing LNG projects" and cited the Cameron LNG project of Sempra Energy and the Tangguh LNG expansion in Indonesia being built for operator BP of the UK. Chiyoda, McDermott and the US Zachry Group have additionally just been awarded an engineering, procurement and construction contract for the Golden Pass export plant in Texas by Qatar Petroleum and ExxonMobil. "The

company expects a deterioration of cash flow and new financing may be required early in the next fiscal year," stated Chiyoda. "In addition, Chiyoda is implementing countermeasures to reduce costs, obtaining change orders, reviewing settlement conditions from ongoing projects including the Cameron LNG project, as well as making efforts to improve its cash flow," said the Japanese company.

One of Chiyoda's main shareholders is the trading house, Mitsubishi Corp. Chiyoda has also been involved in several other LNG projects, including Ichthys LNG in Australia for Inpex Corp. and its partners and the Yamal LNG in Russia for Novatek, Total and Chinese stakeholders. "Furthermore the company has been actively involved in front-end engineering and design work (FEED) for the Qatar expansion project, and FEED and engineering, procurement and construction (EPC) proposal preparation work for Nigeria LNG Train 7," explained Chiyoda. Chiyoda's partner in Cameron LNG, McDermott, said it would be posting a fourth-quarter charge estimated at



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around \$168M. “The charge is due to unfavorable labor productivity, and increases in subcontract, commissioning and construction management costs,” said the US company. McDermott noted that the Cameron LNG project, currently under construction in Hackberry, in Louisiana, was a world-scale facility incorporating proven technology and designed to produce nearly 14 million tonnes per annum of LNG. “Operationally, the project is on track to reach a major milestone with feed-gas being introduced into the facility later this quarter,” said McDermott. “Construction continues to progress well. The gas turbine solo run was completed ahead of schedule, cold circulation of hot oil in Train 1 was completed during the quarter and flare ignition testing was successfully completed on all flares,” added the US company. “All of these are crucial steps in the commissioning of Train 1,” stated McDermott in its Cameron project update. McDermott said it expected to report its fourth-quarter results on February 25 with the charge included.

EGYPT has two Egyptian liquefaction plants located near the port of Alexandra that will remain low-cost options for East Mediterranean natural gas producers such as Egypt itself, Israel and the island of Cyprus looking to export LNG and to use the existing capacity for 12.7 million tonnes per annum. Egypt is seeking to build up exports of LNG from their facilities at Idku and Damietta and future LNG production was discussed at a three-day energy conference in Cairo held at the Egypt International Exhibition Centre. The Idku LNG export plant first came on stream in 2005 and has capacity to export up to 7.2 million tonnes per annum from two liquefaction Trains. It has two storage tabs with a combined capacity of 280,000 cubic metres. Idku has been on stream again since 2017 under the operatorship of Royal Dutch Shell, which acquired original operator BG Group. The Damietta plant is still idle but the resolution of a legal dispute between the owners and the Egyptian government has now been resolved. The facility has capacity of 5.5 MTPA of output and has two storage tanks each of 150,000 cubic metres capacity. Damietta is owned by Union Fenosa Gas, a joint venture between Spain’s Gas Natural, now known as Naturgy, and Eni. They hold 80 percent of the shares and the remaining 20 percent belongs to Egyptian Natural Gas Holdings Co. (EGAS) and Egyptian General

Petroleum Co. The head of Shell in Egypt, Gasser Hanter, played down the idea of any remaining political obstacles to bringing feed-gas supplies to Egypt from countries such as Israel or Cyprus. He pointed to Egypt’s hosting of an East Mediterranean Gas Forum in January 2019 that brought together governmental representatives from the region and recent commercial agreements. “I think we’re in the normal project development stage. You just have to go through the project development process,” said Hanter.

In recent months Israel has agreed to send pipeline exports to Egypt, while Cyprus has reached a provisional deal for sending pipeline supplies from its Aphrodite gas field. Hanter said the economics of Egypt’s LNG export plants remained compelling. “Partly, this was because the Egyptian plants had been built in a different commercial environment, and costs had since risen,” he said. “If you want to build something similar to that today, you’re looking at a large number of billions of dollars,” added Hanter. Noble Energy, the US company with natural gas assets in the East Med offshore Israel, signed multiple infrastructure agreements in September 2018 to support delivery of natural gas from the Israeli Leviathan and Tamar fields to Egypt. Noble said the accords were significant steps forward in supplying natural gas to regional customers through existing infrastructure. The US company’s partners in the Tamar and Leviathan fields are subsidiaries of Israel’s Delek Group. Noble operates the Leviathan and Tamar fields with just under a 40 percent holding. Tamar has been on stream since 2013 and supplies Israel and customers in Jordan, while the Leviathan field is scheduled to come on stream in 2019. Noble said that its agreements would secure capacity to deliver natural gas to Egyptian company Dolphinus from the Leviathan field while also allowing for interruptible sales from Tamar into Egypt. Noble said it was acquiring an effective 39 percent equity interest with Middle East partners in the Eastern Mediterranean Gas Company (EMG), which owns the EMG pipeline. The EMG Pipeline is 90 kilometres in length and is located primarily offshore, connecting the Israel pipeline network from Ashkelon to the Egyptian pipeline network near El Arish.

GAZPROM, the Russian natural gas company, and China National Petroleum

Corp. have held talks about pipeline supplies from Russia that would eventually challenge LNG shipments and Gazprom now expects the pipeline gas to start flowing by the start of December 2019. The talks were in Beijing between the Gazprom delegation, headed by Chairman Alexey Miller, and a group of CNPC executives led by Chairman Wang Yilin. Gazprom said the parties reviewed a wide range of issues related to cooperation between the companies, focusing on the ongoing preparations for the start of gas supplies to China via the “Power of Siberia” gas pipeline. “Construction of the ‘Power of Siberia’ pipeline is going ahead of schedule, and Gazprom will start delivering gas to China well in advance, as early as December 1, 2019,” said Gazprom’s Miller. Gazprom and CNPC signed the 30-year Sales and Purchase Agreement for Russian gas in May 2014 to be supplied via the eastern route, the Power of Siberia gas pipeline, and would amount in volumes of 38 billion cubic metres per annum. Gazprom said particular attention at the meeting was paid to the planned deliveries of Russian gas to China from the Far East and via the western route. It was noted that in 2018 China became the world’s largest natural gas importer with its imports, combining pipeline gas and LNG, totaling 125.7 billion cubic metres, a 31 percent increase on 2017.

CNPC’s Russian pipeline contracts with Gazprom are in addition to its stake in the latest Russian LNG export project, the Yamal plant on the Arctic coast of Siberia. Yamal is operated by the second-largest Russian natural gas company, Novatek. “This Chinese growth in imports was achieved primarily because China is currently unable to satisfy its rising gas demand using the existing gas pipelines,” said Gazprom, in reference to pipelines from Central Asian republics such as Turkmenistan. Gazprom said the “Power of Siberia” pipeline was around 95 percent complete with about 2,000 kilometres now installed and connected in the linear section running from Chayandinskoye, the gas fields centre in the Russian Far East, to the Chinese border in the Amur Region. The eastern route for Russian gas exports to China has additionally involved establishing major gas production centres. Prior to being fed into “Power of Siberia” pipeline natural gas will undergo treatment, producing valuable petrochemical and other components. For that purpose,

Gazprom is building the Amur Gas Processing Plant, the largest such plant in Russia and second-biggest in the world. Gazprom said that Miller and Wang also used the latest talks in Beijing to discuss their collaboration in the areas of gas-fired power generation, use of natural gas as a vehicle fuel and underground gas storage.

GERMAN LNG Terminal, the joint venture company developing the European nation’s first regasification facility at Brunsbuettel on the Elbe River near the port of Hamburg said it had reached another long-term commercial capacity agreement. “The parties agreed on the commitment of a substantial part of the terminal capacity. Negotiations with other interested parties are ongoing,” said the company. It explained that as a result of strong market demand, it would apply for permits with a total terminal capacity of 8 billion cubic metres per annum of natural gas, or 6 million tonnes of LNG. The Brunsbuettel project is a joint venture involving two Dutch companies, natural gas operator Gasunie, global storage company Vopak as well as German energy firm Oiltanking GmbH, a subsidiary of the Marquard & Bahls AG of Hamburg. RWE, one of Europe’s leading energy companies and utilities based in the German city of Essen, has already booked “a considerable part” of the capacity from the planned terminal. RWE said its contract follows a successful 2018 “open season” in which market interest was tested for the facility planning at the time to import around 4 MTPA LNG. Now the capacity has increased by 50 percent. Rolf Brouwer, Managing Director of German LNG Terminal, said the project was strongly moving forward. “This additional commercial agreement demonstrates that the market has confidence in the prospects of LNG in Germany,” he said without disclosing the name of the counterparty.

“The added value of the proposed multi-services terminal we offer to the market has been recognised and adopted by the global LNG community,” he added. “The German federal government has clearly recognised the benefits of LNG and, accordingly, has stipulated in its coalition treaty to develop LNG infrastructure in Germany,” stated Brouwer. The company said that it was hopeful that a final investment decision would be taken in 2019, construction work would begin in 2020 and commercial

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operations are scheduled for 2022. “The terminal will contribute to energy diversification in Germany and will support the introduction of LNG as a cleaner fuel alternative in maritime and road transport, lowering the environmental impact of both shipping and heavy goods vehicles transport,” said the joint venture. “The terminal will combine a variety of services such as unloading and loading of LNG ships, temporary storage of LNG, regasification and send out into the German natural

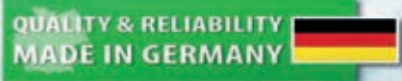
gas network and LNG distribution by trucks,” it added. The developers said preparations for the terminal’s permitting approval process are well under way and a scoping meeting took place at the end of January. “At this meeting approving authorities, environmental organisations, experts and further relevant third parties discussed with German LNG Terminal the subject, scope and method of the necessary environmental impact assessment with regard to water and emissions legislation

as part of the overall planning approval process,” the company explained.

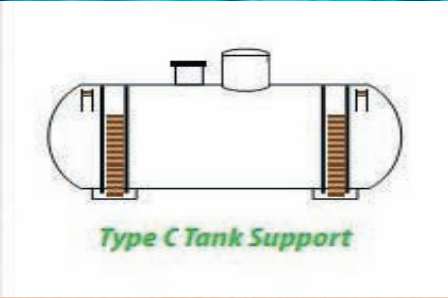
INDIAN liquefied natural gas imports fell in January by 11.6 percent with cargoes arriving at a slower pace from the main suppliers in Qatar and West Africa as the nation prepared to start commissioning the first import terminal on the East Coast. The shipments to India’s three main import terminals at Dahej, Hazira and Dabhol near the West Coast port of Mumbai in January fell to

1.57 million tonnes (2.13 billion cubic metres) compared with 1.78MT (2.41 Bcm) in January 2018. Indian Oil Corp., the refining and fuel marketing company, has started commissioning India’s first import terminal on the East Coast near the city of Chennai. State-owned Indian Oil has a cargo delivered from Ras Laffan in Qatar on February 26. The new terminal is located at Kamarajar Port in the southeast state of Tamil Nadu and is one of several being planned on the East Coast to redress the gas supply balance. India’s cumulative April-January imports for the current 10 months of the fiscal year to date were up by 5.6 percent year-on-year at 16.90MT compared with 16.01MT in the previous fiscal year, according to the figures from the Indian Ministry of Petroleum and Natural Gas. The monthly costs of the shipments in January were around \$800 million, little changed from the same month a year ago.

However, the costs of the cargoes for the 10 months from April 2018 to January 2019 were projected to be around \$8.3 billion compared with \$6.1Bln in the previous fiscal year to date. Domestic natural gas production increased by 5.4 percent to 2.84 Bcm in January 2019 compared with 2.69 Bcm in the same month a year ago. Gas output for the 10 months to January was up 0.4 percent to 27.49 Bcm versus 27.38 Bcm in the 10 months of the previous fiscal year. The new Indian import facility at the East Coast port of Kamarajar, formerly one of India’s main coal ports and previously called Ennore, will have annual capacity of 5 million tonnes per annum once commercial operations begin. Kamarajar is located about 25 kilometres north of Chennai Port and initially the imports will supply natural gas to industry in the Manali area, including Madras Fertilizers Ltd., Chennai Petroleum Corp. and Tamil Nadu Petroproducts.







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INDONESIA, the Asian liquefied natural gas producing country, has signed an agreement to receive LNG shipments from the Mozambique export project in the southeast African nation being developed by Anadarko Petroleum of the US. Anadarko said the joint venture partners developing the onshore LNG export project with feed-gas assets from the Rovuma Basin in Mozambique have signed a Sale and Purchase Agreement with Pertamina, the state-owned Indonesian energy company. The sales agreement is for 1 million tonnes per annum of LNG for a period of 20 years.

Indonesia is itself currently the world's sixth-largest LNG exporter and last year shipped almost 19 million tonnes from its two main export plants at Bontang and Tangguh. However, in recent years the Indonesians have been supplying LNG to their own domestic market as natural gas demand has increased. Indonesia operates several floating storage and regasification units to increase natural gas supplies in strategic areas. "Indonesia is expected to be one of the fastest growing natural gas markets in Asia and Pertamina will play a key role in meeting Indonesia's long-term energy needs," said Mitch Ingram, Anadarko Executive Vice President for international activities. "The Anadarko-led Mozambique LNG project is well positioned to make a sanctioning decision in the first half of this year, as we remain on track to complete the project financing process, secure the necessary approvals, and have executed a sufficient volume of long-term SPAs, which now total more than 9.5 MTPA," added Ingram. "We are extremely pleased and grateful to Pertamina for selecting Mozambique LNG to be part of its long-term energy portfolio," he stated. Anadarko is developing Mozambique's first onshore LNG facility consisting of two initial LNG trains with a total nameplate capacity of 12.88 MTPA to support the development of the Golfinho-Atum field located entirely within offshore Area 1.

Earlier in February the Mozambique project had signed a deal with a subsidiary of stakeholder Bharat Petroleum Corp. of India to deliver 1 MTPA of LNG over a period of 15 years. Other sales agreements have a global spread and have been with companies from China, Japan and Europe. The stakeholders in the Anadarko-controlled Area 1 licence in the southeast African nation also include Japanese trading house Mitsui and Co. and three Indian companies, Bharat Petro Resources, ONGC Videsh and Oil India Ltd., as well as Thailand's national energy company PTTEP and the Mozambique state-owned oil and gas firm ENH. The Anadarko-led Mozambique project will be the African nation's first onshore development, initially consisting of two liquefaction Trains. Other customers for the Anadarko project include the Japanese utilities Tohoku Electric and Tokyo Gas, European utilities, Centrica of the UK and Electricite de France and China National Offshore Oil Corp. Two other projects are planned in Mozambique from the Area 4

licence resources held by Italian energy company Eni and partners. These include the Coral floating LNG joint venture with capacity of around 3.4 MTPA already under construction and scheduled to come on stream in 2022. The Area 4 onshore Mamba LNG project is also 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.

(PetroChina) 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.

INTERCONTINENTAL Exchange, the operator of global platforms and clearing houses for energy and commodities, reported record trading in the continental European natural gas Dutch Title Transfer Facility (TTF)

contract and in the Japan-Korea Marker contract used for North Asian LNG cargo pricing. ICE said in a statement that Dutch TTF futures hit an open interest (OI) record of 1.04 million lots in January 2019. "TTF futures and options combined achieved monthly volume of 952.4 terawatt hours (TWh) in January," said ICE. The Dutch TTF is a virtual trading point for natural gas in the Netherlands, set up by natural gas network company Gasunie in 2003. Since then the Dutch TTF has become a leading continental

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European benchmark and trading hub for spot, forward and futures gas trades. It has grown in importance as the UK prepares to leave the European Union. “Average daily volume (ADV) and OI in TTF futures and options combined are up 103 percent and 64 percent respectively in January 2019, versus January 2018,” said the trading platform operator. ICE said the JKM LNG futures, part of price discovery by Platts, a subsidiary of US company S&P Global Inc., formerly McGraw Hill Financial, traded a record 25,605 lots in January, an increase of 22 percent compared with the previous record of 20,916 lots set in November 2018.

The JKM LNG hit an OI record on February 4, 2019, of 26,928 lots. Average daily volume and OI in JKM LNG are up 176 percent and 123 percent, respectively, in January 2019, versus January 2018. ICE added that as previously announced it will launch its JKM LNG Average Price Options on March 4, 2019, subject to the satisfactory conclusion of applicable regulatory processes. “Europe’s vast energy infrastructure and geographical location allow it to provide a unique role as a balancing market for LNG,” explained ICE. “The TTF and the UK National Balancing Point are the two most liquid European natural gas benchmarks and, with its continued record trading activity, TTF is transforming into a global natural gas benchmark,” said Gordon Bennett, Managing Director, Utility Markets at Intercontinental Exchange. “JKM LNG is one of the fastest growing natural gas benchmarks and has established itself as the most liquid Asian natural gas benchmark,” added Bennett.

JAPANESE liquefied natural gas imports dropped by 8.7 percent in January as more coal and nuclear power

generation offset the need for LNG cargoes, though the cost of the LNG rose by more than 15 percent compared with a year ago. Shipments to Japan in January amounted to 7.54 million tonnes compared with 8.26MT in January 2018. The December 2018 imports had amounted to 7.25MT compared with 7.95MT in December 2017. Nine of Japan’s nuclear power plants, which numbered 54 on line before the Fukushima disaster in 2011, have restarted to reduce LNG needs. A rise in January thermal coal imports also helped offset the drop in LNG cargoes. Coal shipments rose 7 percent in January compared with the year-ago period to 10.67MT. The cost of the January 2019 cargoes came in at 479.22 billion yen (\$4.32Bln), a rise of 15.3 percent from the 416.29Bln yen (\$3.75Bln) the cargoes cost in the same month a year ago. The Ministry of Finance data for January showed that Asian LNG shipments from nations such as Malaysia and Indonesia, Papua New Guinea and Brunei dropped 25.8 percent to 1.91MT. Imports from the Middle East region fell 23.7 percent year-on-year, with shipments from countries like Qatar, the United Arab Emirates and Oman totalling 1.48MT in January 2019.

US shipments of LNG amounted to 267,000 tonnes, a rise of 36 percent on the same month last year. Japan imported 2.49MT of US cargoes in 2018 and that figure will rise in 2019 as the nation will be importing more cargoes. These will come from the Cheniere Energy-owned Sabine Pass plant in Louisiana and the Cove Point plant in Maryland operated by Dominion Energy, as well as the newest Cameron LNG plant in Louisiana set to start operations under Sempra Energy and with Japanese shareholders. Monthly Russian shipments from the Sakhalin Island plant in the Far East declined 7.6 percent in January to 617,000 tonnes. The balance of imports from other countries amounted to 3.26MT, with most volumes coming from Australia, backed by shipments from African nations and the spot market. Japanese LNG imports had declined by 0.9 percent in 2018. The 2018 imports amounted to 82.85MT versus 83.63MT received in 2017. Japan’s 2018 import bill was 20.8 percent higher than in 2017 at 4,730Bln yen (\$43.14Bln), according to the Finance Ministry. Japan had paid 19.3 percent more in 2017 with an LNG bill of 3,915Bln yen (\$35.58Bln).

JGC Corp. of Japan, one of the leading global energy engineering companies, has

posted lower sales and income in the third quarter of its fiscal year as it prepared to take on the LNG Canada liquefaction and export project in British Columbia. JGC, which has recently been working on the Ichthys LNG venture in Australia and the Russian Yamal project, reported disappointing results, though better than those of its Japanese peer Chiyoda Corp. Fiscal third-quarter sales for JGC amounted to 424.6 billion yen (\$3.85Bln), down 20 percent from 531.0Bln yen in the prior-year quarter. Operating income was also down in the third quarter at 15.2Bln yen (\$137.7 million) from 21.6Bln yen (\$195.7M) in the fiscal 2017 quarter. “Due to the drop in the amount of backlog up to the last fiscal year, there was a reduction in both revenue and profit on a year-on-year basis, but profit items are in line with the full-year forecast,” JGC explained. JGC was awarded the contract with Fluor Corp. of the US for the LNG Canada project to be located at a brownfield site near the town of Kitimat. Experienced player JGC, is also working on the Coral floating LNG venture offshore Mozambique for Italian energy company Eni and partners after being a contractor on the world’s first FLNG project for Petronas offshore Malaysia. “The total engineering segment, because of the reduction in the amount of backlog, has suffered lower revenue and profits when compared with the same period in the previous year,” admitted JGC. JGC also pointed out that its consolidated balance sheets showed little change from those at the end of the last fiscal year.

Total assets remain almost unchanged from the previous recorded amount of 686.3 billion yen. “The account balance was 120.8Bln yen in cash and bank deposit, and together with short term investment balance on loans receivable, this shows a total cash and cash equivalent of 140.8Bln yen which represents a decrease of 94.5Bln yen from the balance at the beginning of the year,” JGC stated. “The major reasons for the decrease were the payment conditions for equipment costs for projects in Algeria, the advance payments made for the Ichthys LNG project and short-term debt repayments,” it explained. “In addition, we have joint venture accounts which amount to 102.1 billion yen according to our interest base, but which are not booked on our balance sheets,” said the company. JGC added that it was pleased to receive the LNG Canada project contract in British Columbia. “With the

award of a large-scale LNG plant construction project in Canada, the total cumulative value of new contracts for the period to the end of the third quarter reached 878.1Bln yen (\$7.9Bln),” said JGC. “We intend to focus strongly on obtaining new contracts to reach our full-year forecast of 1 trillion yen (\$9.0Bln) in orders,” it said. The LNG Canada joint venture is led by Royal Dutch Shell with other participants being the Asian companies Petronas of Malaysia, PetroChina, Mitsubishi Corp. of Japan and Korea Gas Corp. JGC and Fluor have been retained for the first two Trains at LNG Canada and the joint venture is also planning third and fourth Trains.

KOSMOS Energy, a main partner in the BP-led floating liquefied natural gas projects offshore Senegal and Mauritania in West Africa, has announced key management changes as its FLNG proposals move forward. Kosmas said that its Chief Exploration Officer and founding partner Brian F. Maxted had decided to retire. The Dallas, Texas-based company said that Maxted would remain on the Board and continue to serve as a special advisor on matters related to exploration. Kosmos named his successor as Tracey Henderson who joined Kosmos in 2004. The company said Henderson had served as a key member of the technical team responsible for the discovery of the Jubilee field in Ghana, the Greater Tortue-Ahmeyim field in Mauritania and Senegal and the Yakaar field in Senegal. Kosmos and BP decided in December 2018 to proceed with investing in the cross-border Greater Tortue and Ahmeyim gas fields to produce LNG with the governments of Mauritania and Senegal. The Greater Tortue-Ahmeyim project first phase will produce gas from a deepwater subsea system and transfer it to an FLNG hull at a nearshore hub located on the Mauritania-Senegal maritime border. The first of several FLNG facilities is designed to produce around 2.5 million tonnes per annum of LNG from recoverable gas in the fields estimated to be around 15 trillion cubic feet.

Kosmos Chairman and Chief Executive Andrew G. Inglis credited outgoing Chief Exploration Officer Maxted with giving the company its success. “On behalf of the entire Board and all Kosmos employees worldwide, I would like to thank Brian for his dedication to Kosmos since its founding and the excellent record of exploration

Diary of events

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21-23 May 2019
Vancouver, Canada
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June Iberia Gas & LNG Conference

10-11 June 2019
Palacio Municipal de Congresos
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success he has delivered,” stated Inglis. “His vision, thoughtful leadership, and passion for both the art and science of exploration have built a strong capability in the company that will serve Kosmos well in the future,” added Inglis. “I am pleased that Tracey is taking over as Chief Exploration Officer. She embodies all of the exploration leadership attributes that have made Kosmos successful,” said Inglis. Reflecting on his time with the company, Maxted said he was very proud of what Kosmos had achieved since it was founded in 2003. “With a strong leadership team in place, world-class portfolio of assets, and differentiated strategy, I am confident the company will thrive in the years to come and look forward in my non-executive capacity to being a part of its successful future,” added Maxted. First natural gas from the Mauritania-Senegal FLNG project is expected in the first half of 2022. After a competitive tender process involving all partners, BP has also been selected as the buyer of the LNG offtake from the Greater Tortue-Ahmeyim first phase. While the partners were moving

forward with the first phase, Inglis noted that they were also planning subsequent phases to expand liquefaction capacity to around 10 MTPA.

NOBLE ENERGY, the US exploration and production company with interests offshore the East Mediterranean and Equatorial Guinea, reported higher annual sales and said the first phase of the Leviathan project offshore Israel was on track. Noble also said the Leviathan venture had sales agreements in place for more than 1 billion cubic feet per day equivalent. It additionally executed gas sales agreements for up to 700 million cubic feet per day of natural gas to customers in Egypt from the existing Israeli Tamar natural gas field and the Leviathan field. The Leviathan field was 75 percent complete in the overall development project and the first phase is scheduled to come on stream at the end of 2019. Some of the Israeli natural gas is expected to be used in Egypt for liquefied natural gas exports or to boost domestic supplies, clearing the way for LNG shipments. The Houston, Texas-based

company also said it had negotiated accord in the form of a Heads of Agreement to progress with development of natural gas from the Alen field offshore Equatorial Guinea. Some of the gas will be processed at the LNG plant on Bioko Island. Noble posted annual sales volumes worth \$4.46 billion compared with 4.06Bln in 2017. Fourth-quarter sales were lower at \$1.05Bln versus \$1.14Bln in the prior-year quarter. Noble returned more than \$500M to shareholders, including \$295M through the company’s share repurchase and \$208M in a share dividend.

“We strengthened the company’s balance sheet by paying down \$609M in Noble Energy debt,” said the company. Noble reported a fourth-quarter loss of \$824 compared with a profit of \$494M in the same quarter of 2017. Its annual net losses dropped to \$66M from \$1.11Bln in 2017. “Noble made significant strides in 2018 as the company continued to preserve returns over volume growth across our global portfolio,” said David L. Stover, Noble Chairman and Chief Executive. “This was evidenced in the

second half of the year as we moderated our US onshore activity to protect margins,” he said. “Offshore Israel, we are nearing the start-up of the world-class Leviathan project, which is scheduled to deliver first gas by the end of 2019,” stated Stover. “In addition, we executed pipeline agreements that will enhance our delivery of natural gas to the region,” said the CEO. Noble’s sales volumes for the fourth quarter were 350 thousand barrels of oil equivalent per day, driven primarily by production in the US onshore DJ and Delaware Basins in Colorado and Texas respectively. The company’s US onshore assets produced 72 percent of sales volumes, Equatorial Guinea represented 17 percent and Israel comprised 11 percent.

NOVATEK, the Russian natural gas company whose Yamal LNG plant started operations just over a year ago, is making progress with its second venture planned for the Gydan Peninsula in the Arctic region with the awarding of another equipment contract. Novatek said its Arctic LNG II project and the German

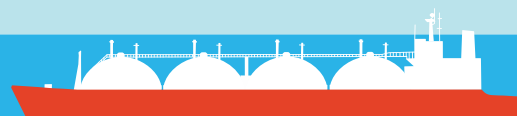
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power equipment-maker Siemens signed a contract on compressors for three liquefaction Trains planned for the new plant. The scope of supply under the contract includes three feed-gas compressors and six boil-off gas compressors. The document also provides for Siemens localizing the equipment fabrication for the project's third train in Russia. "Siemens and Novatek have a successful working relationship as they supplied gas turbine generators and boil-off gas compressors for our Yamal LNG plant," said Alexander Fridman, the company's first deputy Chairman. "Our next project, Arctic LNG II, will utilize new technological solutions and employ domestic manufacturers," he added. "The supply contract envisages new prospects for localizing the compressor equipment fabrication for the LNG industry, which is consistent with our strategic aim of creating and developing an LNG Center of Excellence in Russia," explained Fridman. Saipem, the Italian energy and LNG engineering company, was awarded one of the first main construction contacts in December 2018 with

Renaissance, a Turkish oil and gas services company.

That contract is worth around \$2.5 billion and involves the design and construction of the platform-based Arctic II venture. Novatek is following up on its Yamal project started in December 2017 with its main partner Total of France and Chinese stakeholders, including China National Petroleum Corp. The Arctic II venture will have three Trains, each with a capacity to produce around 6.6 million tonnes per annum. The Trains will be installed on Gravity Based Structures (GBSs) made of concrete and including LNG storage facilities totalling 687,000 cubic metres capacity. There will be three 30-metre high concrete GBSs on a surface area of 330 metres by 52 metres. These concrete GBSs will be fabricated in two dry docks in a Novatek-provided facility in the Russian port of Murmansk. Subsequently, they will be towed and installed in Gydan. Novatek recently inaugurated the third LNG Train at the Yamal plant as the facility started to be ramped up to its full planned capacity of 16.5 MTPA.

OLT OFFSHORE LNG Toscana, the Italian floating storage and regasification unit deployed offshore Tuscany, is working at almost 100 percent of its capacity less than a year after the implementation of new allocation mechanisms via auction. The company operates the "FSRU Toscana", moored 22 kilometres off the coast between the cities of Livorno and Pisa and connected to the Italian national gas transmission grid through a 36.5km pipeline from the shore to the mainland operated by Snam Rete Gas. OLT Offshore is providing national peak-shaving services for the sixth consecutive year and is now contributing more to Italian energy security and diversification of its supply sources. "Thanks to the new allocation mechanism, from October 2018, 38 out of 41 slots available in the 2018-2019 gas year have been allocated, coming from six different countries, for a total of about 5,848,343 cubic metres of capacity allocated, equivalent to about 92 percent of the annual regasification capacity of the terminal," explained the company. OLT Offshore added that through the

introduction of the regasification and storage bundled service, which allowed the allocation of the regas capacity via auction, and then through the replacement of the previous allocation mechanism with an auction system, Italy was able to receive LNG from all over the world. "Indeed, this new capacity allocation procedure is able to interpret the market's requests, especially in the short term," said OLT Offshore.

"The new path undertaken demonstrates how OLT's business flexibility, combined with the operative adaptability of the terminal, has made 'FSRU Toscana' an anchor for Italy's security of supply," it stated. Since operations began in 2013, the FSRU has handled cargoes from 10 different countries, Algeria, Cameroon, Egypt, Equatorial Guinea, Nigeria, Norway, Peru, Qatar, Trinidad & Tobago and the United States. Re-loaded cargoes are also received from other European terminals such as Rotterdam and those in Spain. OLT Offshore said from the engineering and technological point of view it was ready to implement a small-scale LNG

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service linked to the fuel market. At full capacity, OLT Offshore's terminal can regasify 3.75 billion cubic metres per annum of natural gas, the equivalent of 2.77 million tonnes a year of LNG, or around 4 percent of Italy's annual needs. The import facility is jointly owned by Italy's Iren group, Germany's Uniper and a small stake is held by Golar LNG of Norway. The Toscana terminal is one of three operated by Italy. A second is the onshore and long-established Panigaglia terminal near Genoa, in operation since 1969. It is owned by Snam Rete. Italy's third import facility is the Porto Levante offshore gravity based structure, known as Adriatic LNG. It has been in operation on the east coast since 2009 and its main shareholders are Qatar Petroleum and ExxonMobil.

ORIGIN ENERGY, a stakeholder in the Australia Pacific LNG plant with ConocoPhillips and China's Sinopec, said it agreed to sell its Ironbark gas project in Queensland to the APLNG project to provide additional feed-gas. Origin, which holds about 37.5 per cent of the coal-seam-gas-to-LNG joint venture, said the sale price was A\$231 million (US\$164.4M) and that it would remain responsible for the development of Ironbark due to its role as an upstream operator for APLNG. Ironbark is located in Queensland's Surat Basin and Origin announced in August 2018 that it had entered the front-end engineering and design phase for the project while also assessing alternative strategic options. The Ironbark project could produce CSG from 800 new gas wells in the next 30 years in addition to the nearly 10,000 wells Origin is drilling with ConocoPhillips as feed-gas supply for the APLNG plant. The Ironbark project is expected to have a revised multi-stage field development plan initially targeting a sweet spot known as the Undulla Nose in the North West sector of the field. "The sale represents the best way for Origin to maximise value from Ironbark," said Origin Chief Executive Frank Calabria. "APLNG is able to realise additional value from the asset by utilising its existing nearby gas and water processing infrastructure to efficiently bring the gas to market," explained Calabria. "Origin will derive value from the development of the Ironbark asset through its investment in APLNG," he added.

Based on the sale price, Origin said it expected to book a non-cash post-tax impairment of A\$34 million in the 2019

fiscal half-year financial statements. "The net impact to statutory profit will be offset by a A\$68 million benefit to tax expense," said the Sydney-based company. Origin owns 37.5 percent of APLNG, the same shareholding as ConocoPhillips while Sinopec has a 25 percent stake. The CSG for the plant on Curtis Island, near the port of Gladstone, is transported from the Bowen and Surat basins of central Queensland by a 530 kilometres pipeline. The APLMNG plant, which shipped its first cargo in January 2016, has two LNG processing Trains, each with nameplate production capacity of 4.5 million tonnes per annum. There are two 20-year supply agreements in place for the LNG. One is with Sinopec for 7.6 MTPA and one with Japanese utility Kansai Electric for 1 MTPA.

PIERIDAE Energy, developer of the German-backed Goldboro LNG export project in the Canadian province of Nova Scotia, has entered into agreements for a private placement of shares with a group of banks and brokers and two other transactions to raise some funding. The Calgary-based company, headed by Chief Executive Alfred Sorensen, is on the venture list of the Toronto Stock Exchange for small commodities companies. The placement is for 7.5 million common shares priced at C\$2 each for gross proceeds of up to C\$15.0 million (US\$11.35M), plus a further C\$5M in a non-brokered offering, while an Alberta bank plans to make a C\$10M strategic investment for a total of C\$30M (US\$22.7M) in transactions. Pieridae proposes to produce 10 million tonnes per annum of LNG at the planned Nova Scotia plant. The final investment decision for the LNG venture is now expected by June 2019. German utility Uniper is one of the Goldboro project's customers and Pieridae has also received confirmation of eligibility in principle for up to US\$1.5 billion of untied loan guarantees from the German federal government. The company has additionally signed a 20-year supply agreement with Uniper for 5 MTPA of its production and has embarked on a strategy of securing feed-gas resources for liquefaction. "The company anticipates using the net proceeds of the Offering for working capital and general corporate purposes. The Offering is expected to close on or about February 28, 2019," said a statement. "It continues to pursue preparatory work in relation to a final investment decision for the Goldboro

LNG facility, including the procurement of additional natural gas prone properties, and gas exploration and development activities," it added.

The syndicate of Canadian banks and brokers are co-led by KES 7 Capital Inc., National Bank Financial Inc. and Laurentian Bank Securities Inc., with KES 7 and NBF acting as joint book runners. In addition, Pieridae has granted the agents an over-allotment option, exercisable for a period of 30 days from closing, to sell additional shares representing 20 percent of the base offering at the offering price should there be demand. Pieridae said that placement there may also be a C\$5M share sale of common shares to insiders and other investors. "Certain directors and executive officers of Pieridae are expected to subscribe for common shares in the non-brokered offering, either directly or indirectly," said the company. Participating in the brokered private placement, and subject to normal course closing provisions, Alberta Investment Management Corp. (AIMCo) has agreed to make a strategic investment in Pieridae on behalf of certain of its clients. AIMCo has agreed to purchase 5M common shares at C\$2.00 for an additional C\$10M. "AIMCo continues to provide Pieridae with exceptional financial support in this very difficult commodity price environment," said Pieridae CEO Sorensen. "The investment from AIMCo and others will provide us with additional financial flexibility as we move toward a final investment decision," he added. Pieridae in early February 2019 ratified an agreement was First Nations negotiated with the Assembly of Nova Scotia Mi'kmaq Chiefs. Energy projects such as pipelines and industrial or energy plants are obliged under Canadian laws to recognise the land rights of original peoples in Canada who have spent decades establishing treaty and Aboriginal rights and working on implementation of their rights. This agreement established the framework under which the Mi'kmaq of Nova Scotia will benefit economically from the development, construction and operation of the Goldboro LNG Project.

SANTOS, the Australian operator of the Gladstone liquefied natural gas plant in Queensland and a stakeholder in export plants in Darwin and Papua New Guinea, returned a solid annual net profit and boosted sales by 18 percent. "The full-year results demonstrate delivery of our

strategy to drive sustainable shareholder value by establishing a low-cost, high-performance operating model that generates strong cash flows through the oil price cycle," stated Santos Chief Executive Kevin Gallagher. Santos said underlying profit after tax more than doubled to a record US\$727 million from US\$318M in 2017 and the Adelaide-based company said it was on a firm path to grow production and reserves. Net profits amounted to US\$630M versus a loss of US\$360M in 2017. Sales rose by 18 percent to US\$3.66Bln from US\$3.10Bln in 2017. Gallagher said the recent completion of the acquisition of Australian company Quadrant Energy and its West Coast assets would provide a significant boost in Santos's production in 2019. Gallagher also praised the development efforts tied to the performance of the Gladstone LNG plant it operates in Queensland and whose other shareholders are Petronas of Malaysia, Korea Gas Corp. and French major Total.

"At GLNG, our low-cost, efficient operations continue to support a development plan to unlock more gas over time," said Gallagher. "In 2018, we drilled a record 305 wells, 77 percent higher than 2017," he added. "During the year the 480-well Roma East field development was sanctioned with 121 wells drilled by year-end and the Scotia CF1 field project delivered one year ahead of schedule and 16 percent under budget," stated the CEO. "In Northern Australia, Darwin LNG remains an important and strategic infrastructure project for the future development of onshore and offshore resources. Plant performance in 2018 was again strong with LNG production higher than 2017," he added. "The Barossa project is being progressed as the lead candidate to backfill Darwin LNG with a final investment decision targeted by late 2019 or early 2020," explained Gallagher. He said that the Papua New Guinea plant had a record daily production rate equivalent to 9.2 million tonnes per annum from the two Trains in the second half of the year. This followed upgrading work on the plant. "PNG LNG expansion opportunities continue to be progressed with provisional results from the Muruk-2 appraisal well indicating the objective Toro reservoir is likely hydrocarbon bearing," added Gallagher.

SANTOS said it reached an agreement to align the company's interests, under Santos operatorship across four exploration permits in the Bonaparte

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Basin offshore Northern Australia adjacent to large existing natural gas resources set to be developed for liquefaction and export. Santos explained that its position in the Bonaparte Basin already includes an 11.5 percent interest in the Bayu-Undan gas-condensate field and in the onshore Darwin LNG plant, as well as having a 25 percent interest in the Barossa gas field. A Barossa field project is currently in its front-end engineering and design stage and is the leading candidate to backfill the Darwin LNG export plant, operated by ConocoPhillips since 2006 in the Northern Territory and in which Santos is a shareholder. Santos has signed an agreement with Beach Energy of Australia that will see the companies become 50-50 joint venture partners across four licences NT/P82, NT/P85, NT/P84 and WA-454-P. Santos will operate all four permits. Santos added that the NT/P82 and NT/P85 permits are located immediately to the south of the Barossa project area, where Santos acquired the 4,347 square kilometres Bethany 3D seismic survey in 2018. The other two permits are close to the Petrel, Tern and Frigate field complex in the Petrel sub-basin, where separate agreements with Europe-based Neptune Energy see Santos move to 100 percent operated interest in the Tern and Frigate fields and a 40.25 percent interest in the Petrel field, subject to final approvals.

“This alignment of equity and operatorship will allow for a more strategic approach to the next phase of exploration in the region,” said Santos Chief Executive Kevin Gallagher. “It also reinforces Santos’ significant exploration and existing substantial resource position in offshore Northern Australia and is a good example of industry collaboration aimed at doing things smarter,” added Gallagher. “We continue to chase material resource opportunities offshore Northern Australia to support our established infrastructure position at Darwin, with an eye to both export and domestic markets,” stated the CEO. “The next step for these permits is to evaluate new and existing seismic data to build inventory and define potential targets for drilling within the next few years,” said Gallagher. The CEO added that permits NT/P82 and NT/P85, which are located immediately south of our Barossa project, will be a key focus for this work. The Barossa gas field development would extend the operating life of the Darwin LNG plant for more than 20 years.

The Darwin plant exports around 3.5 million tonnes per annum of LNG from a single liquefaction Train to Japanese utilities Tokyo Electric Power Co. and Tokyo Gas.

SHANGHAI Petroleum and Natural Gas Exchange said natural gas transactions reached a record high last year as demand jumped because of gas replacing coal in the general energy mix and as the northern cities adopted policies to reduce pollution. The volume of natural gas traded on the Shanghai platform amounted to 60.46 billion cubic metres in 2018. The Shanghai Exchange said the total deals involving natural gas transported by pipelines came to 55.54 Bcm while the volume of LNG contracts amounted to 3.33 million tonnes for the whole year. China's pipeline natural gas imports from Central Asia and Myanmar have increased, though not at the same pace as soaring LNG import which in 2018 jumped by 38 percent and amounted to 53.81MT compared with just over 39MT in 2017, second only to Japan and its 82.85MT total for 2018. According to data from the General Administration of Customs, China imported 90.39MT of natural gas in 2018 by both pipeline and as LNG, which was 31.9 percent higher than a year ago.

The Shanghai Exchange was inaugurated in November 2016 after a year-long trial operation as part of natural gas and energy reforms in China. China National Offshore Oil Corp. sold imported LNG for the first time on the exchange in April 2018 for forward delivery. CNOOC put 90,000 tonnes of LNG on sale and 11 companies made 21 successful initial bids for volumes of between 500-12,000 tonnes, paying around \$10.40 per million British thermal units for delivery in July. The aim of the exchange was to make non-residential natural gas trading an open market with daily pricing based on real trades. By the end of 2018, it had 2,242 members, up 40 percent from a year ago. Analysts said the Chinese government largely succeeded in its pledge to ensure abundant natural gas supplies and stable prices in the 2018-2019 winter season as previous large-scale coal use was being replaced as far as possible by natural gas to improve air quality. China's National Development and Reform Commission has also begun work on expanding the gas pipeline network, improving gas storage and making arrangements each year to meet peak demand.

STEELHEAD LNG has stopped work on the Kwispaa LNG project in Sarita Bay on Vancouver Island's west coast, casting doubt on the future of the joint venture that found little encouragement among officials and politicians in the Pacific coast province of British Columbia. Steelhead LNG spokesman Matt Skinner said the decision to cease work on the Kwispaa project has come down to economics. “Given the current environment in BC, investors really need a greater degree of certainty before investing in a project such as ours,” he said. “We’ve paused work on Kwispaa for now and are evaluating,” added Skinner. Steelhead and its Kwispaa LNG unit had set up a venture with a native partner, the Huu-ay-aht First Nation. The Huu-ay-aht said they were “deeply disappointed” by the halt in the project. “We are saddened by the decision of Steelhead LNG. The Huu-ay-aht First Nation is a self-governing, modern treaty Nation and we will continue to pursue our vision of establishing a healthy, prosperous and self-sustaining community,” said a statement from the First Nation's leaders.

Steelhead had proposed a near-shore export plant on Vancouver Island, backed by a pipeline to bring feed-gas from the Chetwynd area of northeast BC to Sarita Bay on First Nation-owned land. The company had been planning to submit environmental assessment applications for the liquefaction and pipeline projects with combined estimated costs of C\$18 billion (UD\$13.5Bln). A final investment decision was scheduled for 2020. The construction phase would have taken approximately four years and the plant and pipeline were scheduled to come on stream by 2024. The liquefaction plant was planned with initial capacity of 12 million tonnes per annum of LNG, requiring 1.9 billion cubic feet per day of feed-gas. Steelhead is a private firm based in Vancouver and has held a gas export license from the Canadian National Energy Board since 2016. The licence still gives the Kwispaa project 10 years, until 2026, to complete construction and start export deliveries.

TEEKAY LNG Partners, the carrier fleet operator, posted a more than 14 percent increase in total cash flow from vessel operations of \$150.1 million in the fourth quarter and \$515.3M for all of fiscal 2018 as it forecast rising income from the company's stake in the Bahrain LNG import project in the Gulf. Teekay is

one of four shareholders in the Bahrain LNG joint venture, scheduled to become operational this year. The company said earnings were positively impacted by the deliveries of 12 LNG carrier newbuilds to the Partnership's consolidated fleet and equity shares in vessels between October 2017 and December 2018. “Once again this quarter, our cash flows and adjusted earnings were up significantly over the prior quarter as the Partnership's LNG segment grew and certain existing vessels commenced new contracts at firm rates,” said Mark Kremin, President and Chief Executive of the Teekay Gas Group. “This segment continued its expansion in early-2019 with the delivery of two additional newbuilding LNG carriers, including the ‘Yamal Spirit’, which was delivered on January 31,” added the CEO. Kremin explained that with a full financing facility now in place, the Partnership has completed all of the necessary financings to take delivery of its entire newbuilding orderbook which, at its peak, amounted to around \$3 billion. “We expect our LNG segment results to be significantly higher in 2019 primarily due to the delivery of 15 newbuilding LNG carriers during 2018 and throughout 2019 as well as the start-up of the Bahrain LNG regasification terminal in 2019,” stated Kremin.

Bahrain is completing the construction of its first LNG import facility at a location about 5 kilometres from the existing breakwater at the Khalifa Bin Salman Port. The facility will also include a floating storage unit (FSU) and a regasification platform. The Bahrain LNG consortium comprises four companies, the Gulf state's National Oil & Gas Authority (30 percent), Teekay LNG (30 percent), South Korea's Samsung C&T (20 percent) and the Gulf Investment Corporation (20 percent). In an overview of its shipping activities, Teekay said the “Torben Spirit” commenced its minimum three-year charter in January 2019 at a charter rate in excess of \$100,000 per day for the duration of the contract. Among carrier newbuild deliveries during the fourth quarter, the Partnership took delivery of one M-Type, Electronically Controlled, Gas Injection (MEGI) LNG carrier newbuilding, the “Sean Spirit”, which immediately commenced its seven-year charter contract with BP Gas Marketing. Teekay also has a 20 percent stake in another carrier, the “Pan Africa”, which immediately commenced its 20-year charter contract in January with Royal

There is new energy in the heart of the Mediterranean

OLT Offshore LNG Toscana, which shares are divided among two important operators in the energy sector, Uniper Global Commodities (formerly E.ON Global Commodities) and Iren, is the company which manages the floating storage and regasification unit "FSRU Toscana". The Terminal is technologically innovative and well-advanced. It guarantees the maximum standards in terms of environmental sustainability and safety. "FSRU Toscana" is permanently moored off the Italian coast - between Livorno and Pisa - in the heart of the Mediterranean Sea. The Terminal has a regasification capacity of 3.75 billion Standard cubic meters per year and an LNG storage capacity of 137,100 cubic meters. The operational flexibility and the design of the Terminal allow SSLNG reloading opportunities available in future.

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Dutch Shell. Another MEGI-powered carrier, the “Yamal Spirit”, has started its 15-year charter with Yamal Trade of Russia.

US natural gas supply flows to meet the winter season peak demand in New England has been helped by the Northeast Gateway deepwater LNG import facility using floating storage and regasification units in Massachusetts Bay offshore Boston. The Northeast Gateway is owned and operated by Excelerate Energy, the US specialist in floating LNG import projects. In addition to the New England facility, Excelerate has established more than a dozen LNG import facilities in nations in South America, the Middle East and Asia. Excelerate said its Northeast Gateway reached a peak send-out flow rate of more than 800,000 million cubic metres per day of LNG on February 1, 2019, during the recent freezing weather in the region. The company said this was a first for the terminal and was completed by two of Excelerate’s FSRUs, the “Exemplar” and the “Express”, discharging in parallel through the company’s proprietary offshore buoys. Excelerate explained that during the coldest days of the year, demand for natural gas from residential customers rises in New England. Historically, during these times, as natural gas deliverability becomes constrained in natural gas pipelines, power generators have to burn fuels such as oil. “This year, LNG imports from the Northeast Gateway facility have complimented the system by supplying energy during this peak demand, allowing generators to continue burning natural gas,” stated Excelerate. At a flow rate of 800,000 million British thermal units per day, this represents approximately the average gas demand of power generators in the region during the recent January-February winter cold periods.

“Excelerate’s Northeast Gateway has helped New England prepare for the winter months by supplying natural gas to meet the increased energy demand of the region,” said Excelerate’s Managing Director Steven Kobos. “Deliveries of LNG directly into the Algonquin pipeline system helps to bring much-needed market stability and fuel security to the Northeast,” added Kobos. The Northeast Gateway was first set up and commissioned more than 10 year ago about 20 kilometres offshore Boston. The terminal consists of a dual submerged

turret-loading buoy system which allows for the connection of the FSRUs that have been specifically designed to meet the conditions of the North Atlantic. FSRUs act, in all aspects, like a land-based terminal and have the onboard capability to vaporize LNG and deliver natural gas directly into the existing subsea HubLine pipeline operated by Enbridge Inc.’s Algonquin Gas Transmission. Excelerate has established more than a dozen LNG import facilities for FSRUs around the world and the most recent was in the Asian nation of Bangladesh in 2018. The Moheshkhali Island venture was co-developed by Excelerate, national energy company PetroBangla and the International Finance Corporation, part of World Bank Group. The deployment of Excelerate’s vessel, the “Excellence”, enabled Bangladesh to have the means to import around 3.5 million tonnes per annum of LNG.

US regulators are moving forward with the Pointe LNG project proposed for the East Bank of the Mississippi River, which would be the second riverbank export facility planned for south of New Orleans. The Federal Energy Regulatory Commission said it was preparing an environmental impact statement (EIS) that would discuss the effects of the Pointe LNG plant and associated pipelines to be sited near river mile 46 of the Mississippi in Plaquemines Parish, Louisiana. Pointe LNG had asked the FERC for permits in September 2018 for 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. The people behind the Pointe venture are two US Gulf Coast energy veterans, former Duke Energy executive Jim Lindsay and former tanker captain Tom Burgess. The project site includes a 250-acre area where Parallax Energy, a company started 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. A second export project is currently planned by another company, Venture Global, for the same area of Louisiana but on the opposite bank of the Mississippi. Venture Global is proposing that its Plaquemines LNG plant is constructed on 630 acres near river mile-marker 55 on the West Side of the Mississippi, 30 miles south of New Orleans. The FERC said it issued a notice on February 5 to open up the scoping process for Pointe LNG when Commission staff will gather input from the public and interested state and federal agencies. “By this notice, the Commission requests public comments on the scope of the issues to address. To ensure that your comments are timely and properly recorded, please submit them so that the Commission receives them in Washington, DC on or before 5:00pm Eastern Time on March 7, 2019,” said the FERC. “You can make a difference by submitting your specific comments or concerns about the project. Your comments should focus on the potential environmental effects, reasonable alternatives and measures to avoid or lessen environmental impacts,” stated the regulator.

WILLIAMS, the US pipeline company, said its Transcontinental Gas Pipe Line (Transco) interstate system delivered a record amount of natural gas in January to distribution companies, power generators and LNG exporters because of successful expansions and the trend will continue in 2019 and 2020. Transco delivered a record 15.68 million dekatherms (MMdt) on January 21 and the new peak-day mark surpassed the previous high that was set on January 5 last year. In addition to being a major supplier to the growing LNG export industry, Transco provides natural gas to markets in 12 Southeast and Atlantic Seaboard states, including America’s biggest metropolitan areas. The pipeline system, extending almost 1,800 miles from South Texas to New York City, also established a new three-day market area delivery record, averaging 15.30 MMdt from January 30 to February 1, 2019. Williams, based in Tulsa, Oklahoma, said

the natural gas delivery records were the result of additional firm transportation capacity created by multiple fully-contracted Transco expansions completed in 2018 and early 2019.

The abundant US natural gas supplies are being delivered into domestic markets when required as well as to liquefaction and LNG export plants. The LNG plants are set to double in number from three operational facilities to six by the end of 2019. Williams said its pipeline expansions included the Gulf Connector, Atlantic Sunrise and the Garden State Phase II projects. The company said that together, these expansions added more than 2.3 MMdt of firm transportation capacity to the existing pipeline system. Construction is expected to commence on five additional Transco projects in 2019. These are for the Rivervale South to Market system, Hillabee Phase 2, the Northeast Supply Enhancement and the Gateway and Southeastern Trail projects, collectively creating approximately 1.15 MMdt of additional pipeline capacity in 2019 and 2020. “The recent frigid conditions across the country are an important reminder of the vital role transmission pipelines play in delivering the natural gas necessary to keep millions of Americans safe and secure, especially during winter periods of peak demand,” said Alan Armstrong, President and Chief Executive of Williams. “The incremental capacity from the fully-contracted Transco expansion projects placed into service in 2018 and early 2019 reflects an increase of about 16 percent in Transco’s design capacity,” he added. “This has helped position us to meet the growing demand needs of our customers,” stated Armstrong.

WOODSIDE Petroleum Chief Executive Peter Coleman said that after the company’s strong performance in the past year it was looking forward to sanctioning more than US\$30 billion of new liquefied natural gas projects. After a year that marked the delivery of the 5,000th LNG cargo from the North West Shelf plant in Western Australia, Coleman said 2020 would see the company embark on two new liquefaction, export and domestic gas ventures. Woodside said that its Browse Basin plans to provide additional feed-gas for the North West Shelf LNG plant would cost around \$US20.5Bln and the Scarborough gas field project, including the expansion of Pluto LNG, would cost about \$US11Bln. The Australian



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company would retain 30.6 percent of Browse and the 50 percent of the Scarborough venture so that its investments would amount to about US\$12Bln. However, Coleman stated that the costs would not be fixed until the current front-end engineering and design contracts were completed. “I don’t want the market to run away from me if the price goes up,” said Coleman. “You know these contractors don’t need much of a signal in pricing for their costs to go up,” he stated. The Scarborough and Browse projects together would produce about 16 million tonnes per annum of LNG, starting in 2024 and 2026 respectively.

Coleman added that another issue that had to be settled was whose feed-gas would keep the North West Shelf LNG plant running at full capacity from 2022 before the Browse Basin gas arrives in 2026. The CEO noted in his briefing on the past year’s activities that Woodside’s net profit increased 28 percent year-on-year, driven by robust operational performance and improved market conditions. “The company generated free cash flow of \$1.52Bln, up 83 percent on

2017. This has supported our strong financial liquidity throughout the year and positions us well to deliver our growth projects,” he stated. “Our plans for the Burrup Hub (Browse and Scarborough) will more than double Woodside’s equity LNG production by 2027, providing long-term gas supplies for both domestic and export markets,” he added. “After increasing our equity in Scarborough to 75 percent in early 2018, we assumed operatorship and have awarded engineering contracts for the upstream development. We have selected an expansion concept for Pluto LNG and begun engineering work on the second production Train,” he explained. “At the same time, we have progressed our proposal to process the Browse resources through the North West Shelf Project’s Karratha Gas Plant, achieving a landmark preliminary tolling agreement between the two joint ventures,” added the CEO.

YEMEN and its Oil Minister said plans had been set in motion to resume production of liquefied natural gas at the

Gulf of Aden liquefaction and export facility that has been halted since mid-April 2015 because of the conflict. The closure of the Balhaf plant with 6.7 million tonnes per annum of production from two Trains has affected cargo deliveries, mainly to South Korea. The Yemen LNG plant had been an indicator of the impending conflict after it first stopped production and evacuated foreign workers in January 2015. The plant had continued production over a period of about two years from 2013 amid unscheduled shutdowns because of attacks on its feed-gas pipeline by saboteurs. It briefly re-opened in 2015 and managed to export 1.52 million tonnes before shutting down in April 2015 for a longer term for security reasons. In addition to supplying the South Koreans under long-term contracts the plant had also started shipping spot cargoes in 2014 and 2015 to countries such as India, Japan and China. French energy company Total is operator of the facility and its other shareholders are the Yemeni state energy company, Hunt Oil of the US and three South Korean companies, Korea Gas

Corp., SK Innovations and Hyundai Corp.

The government of Abd-Rabbu Mansour Hadi, backed by its allies Saudi Arabia and the United Arab Emirates, controls the southern port city of Aden and areas holding Yemen’s oil and gas fields. The opposition Houthi group, backed by Iran, controls the capital Sanaa and an oil terminal at Ras Issa on the western coast. Yemen’s oil output has also plunged since 2015 when the Saudi-led military coalition intervened in Yemen’s war to try to restore Hadi’s government. The Hadi government’s Oil Minister Aws Abdullah al-Awd has now said that he aims to restart LNG production and boost oil output. Yemen produced an average of 50,000 barrels per day in 2018 compared with around 127,000 barrels per day in 2014. During 2018 it managed to export some quantities of oil. “Our country has been affected by the war for the past three years, but thank God, now things are coming back. Hopefully 2019 will be good for Yemen,” said the Oil Minister. “In 2020, we hope to be exporting our LNG production to customers in Asia,” he added. ■



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Australia has other LNG issues to tackle after overtaking Qatar for No. 1 global producer spot

Graeme Bethune, Chief Executive of consultants EnergyQuest, gives the regional market view from Adelaide

The shipment of cargoes from the two-Train, Inpex-operated Ichthys project in Darwin in the Northern Territory and the start-up of the Shell-led Prelude floating LNG venture offshore northwest Australia concluded the second chapter of the nation's LNG development boom.

This had commenced a decade ago with the sanctioning of Chevron Corp.'s Gorgon project.

Landmark

Australia's overtaking of Qatar to become for the first time the world's largest LNG exporter in November 2018 was a landmark moment and a sign of things to come.

The country's LNG journey has not always been smooth, with delays and cost over-runs.

However, the west coast projects, offshore Western Australia and the

Northern Territory, all based on conventional gas, are doing what they were planned to do, exporting LNG to North Asia at nameplate capacity or above.

The biggest market for west coast LNG is Japan, the destination for 58 percent of west coast LNG exports, followed by China (19 percent) and Korea (10 percent).

Development on the west coast has been achieved with little disruption to the domestic gas market.

Indeed, the domestic gas reservation policy of the Western Australian Government has ensured that domestic gas prices remain low and supply is plentiful, even if this has been at additional cost to the LNG projects.

Decline

Beyond the production boost from Ichthys and Prelude, the west coast faces the



Dr. Graeme Bethune, Chief Executive of EnergyQuest, says the East Coast Australia LNG market has more challenges than the plants on the West Coast

prospect of natural decline from two long-running LNG projects, the Woodside-operated North West Shelf (NWS) and the ConocoPhillips Darwin LNG projects.

However, both operators are working hard to forestall the coming decline.

In the case of Darwin LNG, the development of the Barossa gas field directly north of Darwin is currently in front-end engineering and design (FEED) and would extend the operating life of the project for more than 20 years.

Similarly, Woodside is advancing development of the Scarborough and Browse gas fields to expand their Pluto LNG project and maintain NWS production.

East's 'irrational exuberance'

Unfortunately, the story is less rosy for the three Australian east coast LNG projects, all of which are based on coal seam gas (CSG), known internationally as coal bed methane.

Despite the plants having combined nameplate capacity of 25.3 MTPA and with potential to exceed nameplate, the plants are operating below capacity, achieving only an average 82 percent in 2018.

There is simply insufficient gas to run the plants at capacity and also supply the needs of the domestic market.

As recently as the mid-2000s, the east coast was looking at having to import gas by pipeline from Papua New Guinea (PNG).

However, the PNG project was forestalled by the stubbornly high costs.

To make matters worse, fields in Victoria's offshore Gippsland Basin, a mainstay of gas in that State since the 1960s and having produced 8 Trillion cubic feet (Tcf) to date, have begun to decline too.

Outlook

EnergyQuest has recently undertaken a comprehensive review of the outlook for Australian east coast gas demand, supply and prices out to 2036.

This has included a deep dive into the CSG resource base, which now makes up nearly 90 percent of east coast Proved and Probable (2P) reserves.

The bad news is that there is significant CSG reserves risk. The CSG LNG projects were sanctioned on 2P reserves, not 1P (Proved) reserves that underpin conventional LNG projects.

The reserves risk is already evident.

According to estimates published by the Queensland Government, Queensland 2P CSG reserves peaked in June 2015 at 40.3 trillion cubic feet.

Three years later, by June 2018, 2P reserves were down to 33.1 Tcf, a drop of 7.2 Tcf after only 3.4 Tcf of production.

Further reserves risk remains. We estimate that as at the end of 2017, 44 percent of 2P reserves were booked in permits with no or only limited production history.

Implications

What are the implications for LNG? Rather than Queensland exports ultimately rising to 25 MTPA capacity, current export levels are likely to be as

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good as it gets. Gladstone LNG has already negotiated down its offtake contracts from 7.2 MTPA to 6.0 MTPA and is yet to reach even this level.

With dwindling production from southern gas fields, the political pressure on the LNG producers to divert gas to the domestic market is likely to intensify.

Queensland CSG supplied 25 percent of east coast demand in 2018 and this is likely to increase.

However, there are limits to how much gas can be diverted domestically without breaking international contracts.

The ConocoPhillips-Origin Energy Australia Pacific LNG project is largely contracted to Chinese and Japanese buyers.

The same applies to the first train of QCLNG. However, Shell's interest in the QCLNG second train (4.25 MTPA capacity) is 97.5 percent, with the offtake largely contracted to other Shell entities.

Indications are that Shell is willing and able to divert gas into the local market rather than into this train if market conditions are favourable.

The company has established a new local operation, Shell Energy Australia,

marketing domestic gas. However, there may be limits to what degree Queensland CSG can meet demand in Sydney and Melbourne, a distance of 2,800 km and 3,760 km respectively.

The cost of moving substantial gas volumes these distances via pipelines is expensive in Australia and will require significant infrastructure investment, which is likely to be risky given the uncertainties over long-term Queensland CSG production and east coast gas demand.

Imports issue

Accordingly, attention is also moving to LNG imports, most likely into Melbourne and Sydney.

There are now five import proposals but the most advanced are AGL's proposal to import LNG into Crib Point near Melbourne and the proposal by the JERA-backed Australian Industrial Energy to import LNG into Port Kembla near Sydney.

Each project could import up to 2 MTPA. Such projects can offer long-term contracts, address gas infrastructure constraints with supply close to demand centres, and are particularly well suited to meeting peaking

demand. Subject to government approvals, these two import projects could be operating early next decade. So, what is the medium-term outlook for Australian LNG exports? Notwithstanding the challenges on the east coast, Australia is likely to remain one of the world's largest LNG exporters.

Notwithstanding delays and cost increases, the west coast LNG projects are performing well.

In aggregate Western Australia and the Northern Territory already export more LNG than any single country except Qatar. It is increasingly likely that the natural decline from the legacy NWS and Darwin LNG projects will be surpassed by new field developments.

Successful development of these projects would underpin continuing west coast production of around 60 MTPA.

The growth in Queensland CSG production is remarkable, growing from virtually nothing two decades ago to 1.3 Tcf in 2018.

However, the industry over-reached by building three projects of six trains. Queensland is likely to remain a

significant LNG exporter, one of the world's largest, but with more like four trains fully utilised, reducing medium-term exports to around 17 MTPA, and partly offset by LNG imports.

Building six LNG trains in Queensland using CSG was bold and visionary but ultimately a bridge too far.

The likely reduction in east coast exports together with imports has implications for Asia-Pacific LNG trade generally.

Exports of 17 MTPA would be 4 MTPA below current Gladstone exports, reducing regional LNG supply.

Two import projects of 2 MTPA each would increase regional demand by 4 MTPA. The total impact on regional LNG availability could be around 8 MTPA.

This is a material volume of LNG, which provides an opportunity for other regional suppliers. ■

Dr Graeme Bethune is Chief Executive Officer of EnergyQuest, (www.energyquest.com.au), an Australian-based consultancy, specialising in energy market analysis and strategy.



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Mid-scale LNG export plant in Port of Brownsville will help address rising global natural gas demand

Jonathan Mosher and Shawn Hoffart of Black & Veatch in Kansas and Larry Snyder of Annova LNG, Houston, Texas

Annova LNG and its engineering partners are making progress with the project to source natural gas from the South Texas and Permian Basin regions and to export shipments to international markets as early as 2024.

Annova announced in October 2018 that the joint venture of Black & Veatch Corp. and Kiewit Energy Group Inc. had been awarded the engineering, procurement, and construction contract.

Six trains

The greenfield LNG facility to be located in Brownsville will consist of six liquefaction trains, each using Black & Veatch's proven PRICO® single-mixed refrigeration technology to nominally liquefy 6 million tonnes per annum of LNG.

Annova LNG will operate in three parallel stages. Each stage will treat and liquefying 2 MTPA of LNG.

Each stage will include one gas conditioning train which includes an amine system for carbon-dioxide removal and dehydration units for water removal.

The gas conditioning infrastructure is followed by two parallel 1 MTPA liquefaction trains and common facilities for heavies-handling and LNG expansion per stage.

The LNG will be stored on site in two single-containment LNG tanks of 160,000 cubic meters working capacity to accommodate a flexible offtake schedule.

This specific implementation of the PRICO® liquefaction process utilizes a single bodied two-stage electric

motor driven compressor in each train.

The compressor single body design minimizes complexity of piping, maintenance, and controls while saving on capital cost and space.

Impacts

Considering local environmental impacts, Annova LNG has elected to employ electrical motor drivers as opposed to gas-fired turbine drives to minimize local emission sources.

South Texas Elective Cooperative's highly dependable electrical infrastructure allows such a unique opportunity.

Annova LNG continued to gain momentum by recently securing 405 MW of electricity from Magic Valley Electric Cooperative, a member of the South Texas Electric Cooperative.

With this agreement in place, Magic Valley Electric Cooperative will become the sole power provider to the plant. Annova LNG will be the electric provider's largest customer.

As the treated natural gas flows through the refrigerant cores to be cooled, it is withdrawn at the mid-way point at an intermediate temperature.

The heavy hydrocarbons contained in the feed gas can then be extracted to prevent freezing at lower temperatures in the refrigerant exchanger. Optimization of the recovery of light hydrocarbons entrained in the resulting heavy hydrocarbon steam is a critical design factor to maximize LNG production.

This heavies stream is sent to a stabilizer where the resulting vapor is recovered within the process while the condensed heavies are sent to storage. These heavy hydrocarbons or natural gas liquids (NGLs) can then be used internally as fuel.

Produced high pressure LNG from liquefaction undergoes isentropic expansion through parallel LNG expanders to maximize production as the LNG is reduced to atmospheric pressure for storage.

Boil-off gas (BOG) is produced during LNG expansion, heavies stabilization, heat leak into the LNG storage tanks, and vapor displacement during LNG carrier loading.

The BOG compressor is a two-stage, single-body machine with interstage cooling. An advantage of using electric motor driven refrigerant compressors is that there is not a large consumer of fuel gas.

Advantages

Therefore, during normal operation, BOG throughout the facility is recovered, compressed, and returned to the refrigerant exchanger to be recondensed as LNG, thus reducing operational loss and air emissions.

The marine transfer facilities will operate up to three liquid loading arms to facilitate the loading of 138,000 cubic metres capacity to 180,000 cubic metres capacity LNG carriers that can be received, loaded and discharged within a 24-hour period.

The carriers will arrive at Annova LNG's marine berth via the Brownsville ship channel and remain moored in a new dredge berth area parallel to the channel centerline during loading.

Additionally, the berth will include a turning basin to allow maneuverability of vessels arriving and departing.

Approximately two LNG carriers per week will be dispatched when the plant is operating at full capacity. However, the actual number per week will depend on the capacity of the specific vessels and the off-take agreements.

The Port of Brownsville has significant advantages for a project of this caliber.

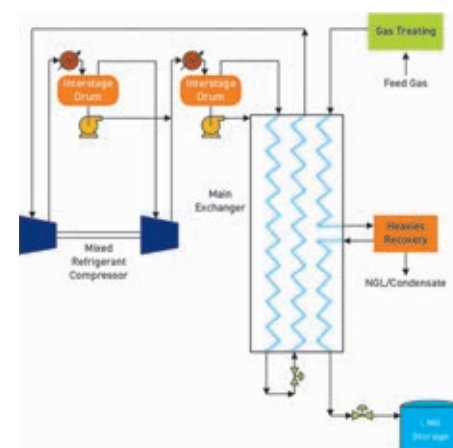


Figure 2: PRICO process for Single-Mixed Refrigerant

The existing deep-draft shipping channel will greatly reduce construction cost and schedule.

Proximity to the Panama Canal will allow quick, efficient seaborne transportation to a multitude of international markets. The South Texas Gulf Coast provides access to an extensive, pre-existing natural gas and electric power supply networks.

Annova's unique access to diversified, low-cost feed gas in Texas differentiates it amongst other US LNG projects. Its feed-gas connector is in Agua Dulce, Texas, which provides access to 10 existing interstate and intrastate pipelines that provide gas locally from the Eagle Ford, the Permian Basin, Katy Hub and Houston Ship Channel.

This competitive advantage allows Annova to offer one of the best free-on-board (FOB) LNG prices, with a lower commodity multiplier than other US Gulf Coast projects.

Annova is a unique project that offers numerous benefits to local and international communities. This planned facility will fortify the south Texas economic future by employing approximately 165 full-time plant workers in the Brownsville community with an average base wage of \$70,000.

Income

At its peak, construction will require 1,200 personnel, with an average of 700 on-site jobs over the 44-month construction period and a total of \$324 million in direct labor income.

Additionally, during the life of this

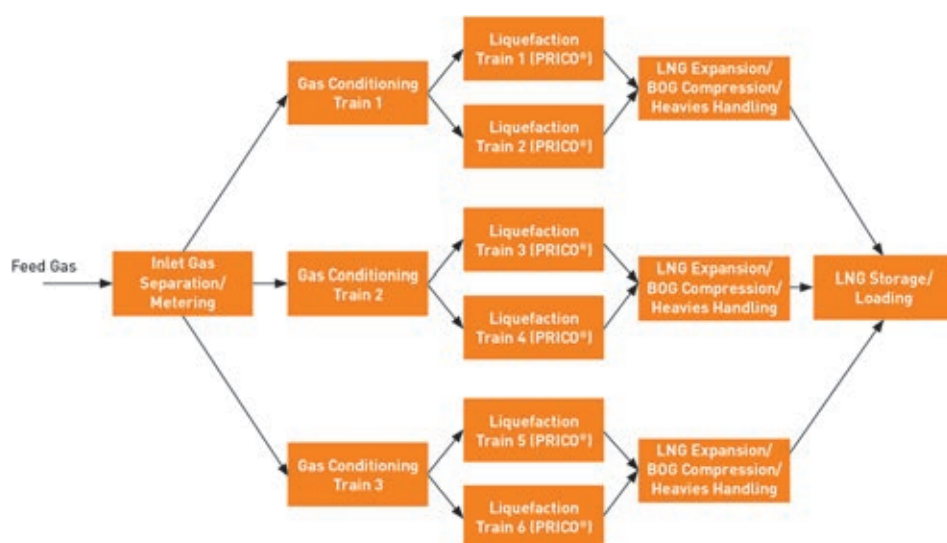


Figure 1: Annova LNG's three-stage PRICO® liquefaction process

project from construction through operation, Annova expects to provide thousands of direct and indirect jobs beyond the local community.

The company's project will support an average of 2,753 direct, indirect and induced Texas jobs each year of the terminal's construction, with a total of \$1.1 billion in labor income.

To meet the increasing needs of international markets, Annova, Black & Veatch and Kiewit have designed a facility that allows for a rapid and efficient time to market.

Annova plans to complete all LNG trains within five years of the final investment decision.

This decisive schedule leverages the straightforward PRICO® technology of Black & Veatch and extensive modularization expertise of Kiewit.

Footprint

In addition, the highly optimized train capacity using PRICO® technology minimizes both equipment count and footprint.

Furthermore, the project can

accelerate the schedule through fabrication and transportation of modules from around the world at competitive rates.

This Gulf Coast area equips this project with a reliable, experienced hydrocarbon work force to support this time to market effort.

Flexible

The multi-train approach combined with the abundance of low-priced natural gas will provide affordable LNG with high reliability and quality.

The triple parallel stage arrangement with two parallel liquefaction trains per stage contributes to a greater operational flexibility.

The patented technology allows for rapid startup and shutdown and is proven reliable in operations with an expected availability of more than 95 percent throughout the year.

The operational flexibility will provide the international marketplace with customized LNG purchasing agreements that meet that needs of many prospective consumers and further the position of the

US as a critical exporter of a vital energy source. The 1.0 MTPA trains cater to customers who are buying in 1.0 MTPA increments.

The Annova project is backed by a world-class equity ownership group, Exelon Corp.

Exelon is a Fortune 100 US utility with an investment grade credit rating and an US rating history of more than 200 years.

Exelon owns and operates the Everett LNG terminal in Boston, which has been in operation for more than 45 years and is the largest LNG import facility in the US.

Black & Veatch is one of the most respected engineering organizations in the world with roots dating back to 1915 and over 110 offices around the globe.

The US company also has more than 50 years of LNG experience.

Kiewit Energy is one of North America's largest and most respected engineering and construction organizations, with roots dating back to 1884.

Kiewit recently completed the

construction of the Cove Point LNG export facility in the state of Maryland.

As regards Annova's permit progress, the Federal Energy Regulatory Commission (FERC) issued Annova with a positive draft Environmental Impact Statement (EIS) in December 2018.

In the draft EIS, FERC concluded that the environmental impacts from the project would be less than significant if the mitigations recommended by both the draft EIS and Annova LNG were implemented.

The final EIS is expected to be issued in April 2019. Upon final authorization from FERC, Annova expects the FID to occur in late 2019. ■

The article was written by Jonathan Mosher, Process Engineer, and Shawn Hoffart, LNG Technology Manager, of Black & Veatch of Overland Park in Kansas USA and Larry Snyder, Senior Vice President of Engineering for Annova LNG in Houston, Texas.

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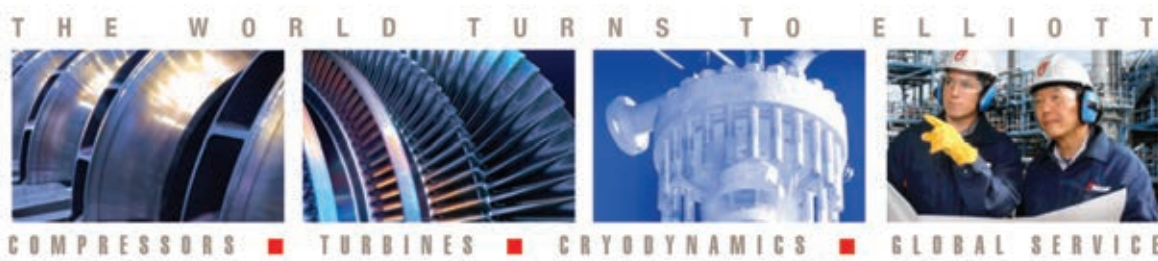
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LNG projects are being reshaped on construction and finance fronts and this also influences trading

David Strickland, Partner, with Chris Peponis and Michael Yates of London-based law firm White & Case

As recently as a decade ago, participation in the global liquefied natural gas market was dominated by a handful of large multinational and state-owned energy companies.

The market owed its genesis to the need of such energy companies to establish a path to gas-monetization for their “stranded” or “low production-cost” gas assets.

The end-users of the LNG were similarly limited in number, tending to be confined to gas and power utilities with inadequate domestic gas reserves to service their local markets, and large individual gas consumers who were without access to robust domestic gas distribution infrastructure.

It was this finite number of market participants, in conjunction with the limited liquidity in the market, which led to consumer-specific projects, with “point-to-point” supply contracts with “destination clauses”, on largely bespoke terms.

Participants

The limited number of market participants also meant that LNG producers and sellers intimately knew their consumers, and the contractual arrangements between them reflected this closeness, providing for conciliatory “meet and discuss” language rather than draconian liquidated damages regimes.

The LNG project sponsors also knew their contractors well and constructed LNG facilities using the same or very similar procurement strategies as other capital projects, without critically analyzing the potential differences of large-scale construction projects like LNG facilities.

There were occasional disputes, however, these arrangements and this LNG “community” seldom enforced the more burdensome contractual protections they had built into their agreements.

Since the turn of the century, the market has evolved and we are now seeing a dramatic increase in the number and diversity of participants. No longer are LNG producing companies limited to those monetizing their own gas reserves in jurisdictions with greater reserves

than their domestic markets could be reasonably anticipated to consume (such as Qatar and Australia).

Additionally, certain high profile construction failures have created a backdrop whereby LNG project sponsors are re-evaluating the procurement strategies for construction in the next wave of LNG projects.

Changing tides

Globally, we have seen unparalleled growth in the demand for ecologically sustainable development in all energy-consuming sectors, and with it, a push to use natural gas as less carbon-intensive bridging fuel, until renewables are able to provide a viable alternative to fossil fuels.

The growing demand for natural gas, spurred on by advances in technology, have enhanced the ability to economically develop gas, and have propelled a “new wave” of LNG development. This demand is derived from the emergence of a more diverse pool of LNG buyers and end-users who are seeking to reduce their carbon footprint in order to attract environmentally aware consumers.

In North America, the shift towards natural gas is clearly evident when one looks at the recent success of fracking and the “shale revolution”. The impact it has had on global gas trade has been unprecedented.

The conversion of regasification facilities into liquefaction facilities has enabled some of the cheapest gas molecules in the world to find their way to new markets, displacing “conventional” power generation such as lignite.

Geopolitics

In North-East Europe, geopolitical motivation combined with a desire for energy independence has resulted in the development of LNG importation infrastructure, including Lithuania’s aptly-named “FSRU Independence” and Poland’s Swinoujscie LNG Terminal, notwithstanding both countries’ geographic proximity to some of the world’s largest known gas reserves, in Russia.

In Northwest Europe, self-imposed



Lithuania’s ‘FSRU Independence’ made possible East Europe’s imports

restrictions on production from the Groningen field in the Netherlands, combined with a finite ability of Norway to service the ever-increasing gas demand of the United Kingdom has seen an increase in the dependence, and utilization, of European LNG regasification infrastructure.

Asia continues to be the largest consumer of LNG, despite the demand profiles from the countries that comprise the region changing drastically.

Respectfully setting aside the Fukushima tragedy, Japan’s and Korea’s once exponential growth has slowed, being replaced by the emergence of Chinese and Indian demand as they look to move away from lignite and other carbon-intensive energy generation.

Old and new tensions

New market entrants are increasingly gas-price arbitrage opportunists, like the merchant tollers in the United States. Unlike their predecessors, these merchant tollers have a limited, if not non-existent, market capitalization, and rely almost exclusively on project financing, rather than balance sheet financing, to develop their projects.

As is the case with any industry that is dependent on project financing, risk adverse lenders heavily influence the way in which parties are able to contract with each other.

Accordingly, the lenders to these projects refuse to warehouse the inter-

commodity risk between the gas-linked prices needed to procure the gas and the Brent-linked pricing under which LNG used to be sold, necessitating innovation in the pricing mechanisms employed in long-term sale and purchase agreements.

Emulation

When we recently entered a “buyers’ market”, many thought that “destination clauses”, take-or-pay obligations, and twenty-year termed supply agreements were a thing of the past.

As LNG continues to race towards becoming a truly fungible commodity, the long-term contracts and aforementioned structures employed to underpin initial investments in LNG projects appear antiquated to some.

Those that question the emulation of such contracts and structures emphasize the difference in investment criteria employed by multinational energy companies compared to those of commercial financiers that are willing to finance such projects on a non-recourse basis.

The market, however, has seen both parties demand a similar level of assurance for return on investment, resulting in a very limited distinction between their respective willingness to invest in projects.

The bankable revenue streams that lenders have become accustomed, long-term supply contacts, on a take-or-pay basis, still underpin almost every LNG project that has taken a positive

financial investment decision to date.

A number of the primary consumer markets in Asia, and more recently the entire European Union by regulators and competition authorities, are pushing towards liberalization of LNG SPAs.

Changed to fit

As customary sale and purchase arrangements are being pulled and stretched to fit changing LNG markets and transactions, tensions are also rising within established relationships.

Failures to deliver or take, sometimes to take advantage of other commercial opportunities are showing the established contractual sanctions may be insufficient under the circumstances of the new, changed markets.

An industry that has become accustomed to price reopener arbitrations is now also becoming used to formal resolution of disputes arising from, among other things, failures to deliver and take LNG or to meet quality or technical specifications.

Many assumed during the recent market downturn that such tensions would yield a significant amount of formal disputes desiring to break the long term SPAs in place. This never materialized in large quantities however.

Perhaps this is the result of the value of relationship and context prevailing over the possibility of striking a better deal, or perhaps it is just a matter of time before such disputes arise.

In our opinion, whereas markets, regulations and commercial influences change quickly, the long-term contracts and financing arrangements, which have been assembled with such care over long periods, will not.

Such contracts were typically made

under common laws such as those of England and Wales or New York and these will have been chosen by the parties for, among other things, their resistance to change.

The previous generations' long-term arrangements may be seen to limit the pursuit of new opportunities, but their very nature means that they are unlikely to be easily undone.

EPC contract evolution

Mega-projects almost universally have experienced significant cost overruns and schedule delays, including several recent high profile LNG export projects. Many will argue the root cause of mega-project issues is as varied as the projects themselves.

We believe that the failure to allocate risks appropriately is a primary reason for such mega-project failures.

Fundamentally, as and between an LNG project sponsor and an LNG construction contractor, construction risks are best housed with the party who can better control such risk.

However, when two parties disagree on the level of the risk or the costs associated with such risk, such fundamental principle can yield to outcomes that place risk on a party who actually has less control of such risk.

In the past, many LNG project sponsors would disagree with a LNG construction contractor's proposed premium to house any number of risks. Project sponsors are intrinsically optimistic about their development opportunity.

Such optimism sometimes yields a skewed view on risks. In addition, many project sponsors fail to understand how construction risks change as a project

grows from a large, but manageable, project to a truly mega-project status.

Magnified

Each issue becomes magnified due to the increased size, whether it is the impact of labor productivity, defective materials or even something as simple as ingress/egress inefficiencies for the project site.

Historically, many sponsors consciously decided to avoid risk premiums on the front-end of a project and instead actively manage such issues should the issue later arise during construction.

Such premium avoidance allowed the project to move forward commercially, but often opened the project to possibilities of significant cost overruns or schedule delays, amongst other material risks.

Of course, if such issues never arose, the premium avoidance would be seen as the correct commercial decision.

However, as more and more mega-projects (including LNG export projects) have experienced significant cost overruns and schedule delays, we believe LNG project sponsors are actively re-evaluating the appropriate risk allocations by looking towards success stories.

US methods

The first wave of US LNG export projects have been, in comparison to other projects worldwide, seen as successful mega-projects, largely coming in on time and on budget.

Even for those US LNG export projects who have suffered delays, US LNG construction costs are still objectively some of the most economical, on a \$/tonne basis, in the world.

Experts focus on a number of differentiating factors, often pointing out that the first US LNG export facilities were each originally LNG import facilities being turned around to LNG export facilities.

The vast majority of US LNG export projects also relied on project financing, with limited or no-recourse against the project sponsors. More than anything else, we believe these financing arrangements are the key differentiator for these projects.

With limited or no-recourse against a LNG project sponsor, lenders require meaningful assurances that an EPC contractor will be responsible for completing a fully functional LNG facility for a certain price and by a

certain date. In order to achieve such assurances, project-financed EPC contracts contain an assumption of significant construction risks by the EPC contractor (including labor availability and productivity), are largely lump sum pricing (with significant limitations on the EPC contractor's right to seek price and schedule adjustments), set forth clear guaranteed delivery dates, and contain robust LNG production guarantees (including a "wrap" of the underlying process technologies).

Such terms necessarily increase risk premiums charged by a contractor.

Sponsors

While US LNG project sponsors needed to consider the minimum requirements of its lenders, US LNG project sponsors must remain price-competitive in a global LNG market.

US LNG project sponsors were no different from balance sheet sponsors. They both desired to keep the risk premiums as low as possible to ensure the projects move forward. In order to find the middle ground between necessary project assurances and project costs, US LNG project sponsors were forced to properly allocate risk between the sponsor and contractor, which is exactly how construction contracts should be handled.

We believe such allocation yielded countless positive project execution decisions, and is a central reason for the US LNG projects success.

Stated another way, lenders involvement in the first wave of US LNG projects created a project development dynamic whereby risks are fundamentally housed by the party who could better control such risks.

The LNG project sponsor community appears to agree. Over the past few years, regardless of whether a project is using third party financing, we have seen a significant shift towards risk allocations previously only used in non-recourse, lender-financed EPC contracts.

Conclusion

It is irrefutable that there are significant exogenous forces reshaping the way LNG projects are both constructed and financed, which is in turn influencing the way it is traded. It is a brave new world for LNG traders, developers and buyers alike. As any true capitalist will tell you - where there is change there is money. ■

Asian spot price



Price range for spot LNG cargoes in Asia and how market has been evolving

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Nakilat strategy evolves amid joint ventures with Maran Gas and Excelerate in niche FSRU market

Qatar line broadens activities while offering repair and installations services at Nakilat-Keppel shipyard

Qatari-owned shipping and maritime services company Nakilat continues to be the essential transportation link in Qatar's liquefied natural gas supply chain.

The company, founded in 2004, plays a vital role in connecting large-scale LNG exports to global markets.

Listed on the Qatar Stock Exchange a year after it was founded, Nakilat received its first LNG carrier delivery in the same year.

Forefront

From thereon, the company followed through its long-term business strategy to establish itself at the forefront of the energy transportation sector.

Capitalizing on Qatar's abundant natural gas resources, Nakilat seized the opportunity to further strengthen its ship management capabilities, driven by its vision to be a leading shipping and maritime services company.

Over the last few years, Nakilat has taken on more ship management responsibilities and grown from being a traditional ship owner.

The company first started ship management in early 2012 with four vet large gas carriers (VLGCs) and four Q-Flex LNG carriers.

Nakilat wrapped up the first phase of its fleet management transition in August 2017, taking 10 LNG carriers previously managed by Shell to its ship management arm, Nakilat Shipping Qatar Limited (NSQL).

The process was one of the largest management transitions of vessels to be carried out within a period of one year.

Extensive

The entire process involved carrying out extensive planning, technical expertise and synergy between all parties involved. Nakilat steadily built on its resources to consolidate its ship management and operations in-house to optimize operations and further strengthen its existing synergy with its main and long-term charterer Qatargas.

Nakilat expanded its joint venture partnership in March 2018 with the major shipping company and Greek-

owned Maran Ventures Inc. to include two additional LNG vessels.

This new agreement increases the number of LNG vessels jointly-owned by Nakilat and Maran Gas from 13 to 15 vessels.

The vessels are fixed with long-term charters to quality counterparties securing steady, healthy cash flow for the joint venture.

Strategic alliances with renowned partners have been fundamental to the success, and Nakilat is always looking for opportunities to grow its international presence with first-class companies such as Maran Gas.

Nakilat is in an advantageous position, having established strategic long-term charter agreement with the world's largest LNG producer Qatargas, and being located in Qatar.

FSRU market

Despite the growing interest observed among developing countries in the deployment of FSRUs, they remain a niche activity.

Realizing this huge opportunity, Nakilat signed a landmark agreement with Excelerate Energy of the US last year, to establish a joint-venture company and acquire a 55 percent interest in a floating storage regasification unit (FSRU), the first such vessel to join the Nakilat fleet.

This acquisition is pivotal to the State of Qatar, paving way for further outreach to emerging markets ahead of the country's plan to increase LNG production in the near future.

This marked the beginning of Nakilat's penetration into the FSRU market in alignment with its long-term growth and development strategies, further strengthening our international portfolio.

Nakilat has the world's largest LNG fleet, comprising of 65 LNG carriers. The company also jointly owns four large liquefied petroleum gas carriers and one FSRU.

Managing

To date, NSQL manages and operates 18 vessels comprising of 14 LNG (6 Q-Max, 8 Q-Flex) and 4 LPG carriers out of its



The 'Mekaines' carrier is one of Qatar's global fleet that supplies east and west

overall fleet of vessels. The 45 Q-Max and Q-Flex vessels are the only LNG carriers in the world exceeding the capacity of 200,000 cubic meters, the largest vessels of their type supplying clean energy to millions of people worldwide.

Transporting more than 60 percent of Qatar's LNG exports globally, Nakilat has said it strives to provide the world with a strategically important "floating pipeline" of clean energy.

Nakilat's LNG combined carrying capacity has grown to over 9 million cubic meters, accounting for 12 percent of the world's total carrying capacity.

The highly sophisticated vessels ensure safe, environmentally sound and efficient transportation of clean energy to more than 90 terminals across 26 countries worldwide.

N-KOM adds value

Nakilat's world-class Erhama bin Jaber Al Jalahma Shipyard further elevates the country's maritime industry to greater heights, boasting comprehensive ship repair and construction facilities with impressive infrastructure.

As a comprehensive maritime service company, Nakilat partnered with globally renowned strategic allies such as Keppel, Damen and Svitser to transfer expertise and manage the operations at the shipyard, offering a wide spectrum of integrated maritime activities for all kinds of vessels in the Qatari waters.

Since operations began in 2011, Nakilat-Keppel Offshore & Marine (N-KOM) has been one of the Middle East's leading shipyards, with an unrivalled track record in LNG vessel repairs.

Offshore projects

The yard's expertise in handling gas carriers has attracted many LNG vessels for routine docking and membrane repairs at its facility, strategically located within Ras Laffan Port in Qatar, which is home to the world's largest and busiest LNG export terminal.

The shipyard boasts state-of-the-art facilities with three Q-Max sized docks (two graving docks and one floating dock), berthing capacity of 3,150 meters and cryogenic cleanrooms, which make it well-equipped to handle the complexities associated with repairs of modern, sophisticated vessels.

N-KOM has delivered in excess of 900 marine and offshore projects in a safe, reliable and timely manner to clients from around the world.

The yard has additionally completed 191 LNG carrier drydocking and repairs to date, with 29 such projects undertaken in 2018 alone.

The yard has carried out extensive cargo tank membrane repairs for LNG carriers, using its in-house team of Gaztransport & Technigaz (GTT) certified welders to carry out welding works for GTT (Mark III and No. 96) containment

systems. The presence of prominent maritime service providers such as Gaztransport & Technigaz, Goltens, Wartsila, Wilhelmsen Ships Service, Turbo Technik and Cargotec, operating within the shipyard, greatly facilitates the overall repair process, offering convenience to ship owners and managers utilizing the shipyard.

Due to the upcoming Sulphur 2020 Cap and Ballast Water Convention by the International Maritime Organization (IMO), N-KOM is seeing a lot of interest from the market for the installation of scrubbers, fuel systems modification and ballast water treatment systems, to be in compliance with the new regulations that will be enforced soon.

Earlier this year, N-KOM received its first floating storage regasification unit (FSRU) repair project.

Systems

Owned by Excelerate, the FSRU underwent several modifications and retrofitting of new systems, including the installation of a ballast water treatment system.

N-KOM has completed six such BWTS installations for various types of vessels such as LNG and LPG vessels as well as very large crude carriers (VLCCs) to date.

The yard is experienced in carrying out installation of four different BWTS - namely Samsung, OceanSaver, Alfa Laval and Ecochlor respectively.

Exhaust-cleaners

As such, the duration in the yard between the first and second retrofit was observed to be significantly reduced by 43 percent, demonstrating N-KOM's competency and efficiency in handling such complex projects.

In 2018 the shipyard successfully won a competitive bid for the installation of scrubber exhaust-cleaning and Ballast Water Treatment Systems (BWTS) for a series of VLCCs belonging to one of the top tanker operators.

During mid-September 2018, the first VLCC of the series was in the yard for routine dockings and retrofit of an in-line type of Scrubber as well as of a Ballast Water Treatment system.



Qatar's ship services yard expects surge in retrofits of exhaust-cleaning systems

Moving forward, starting from the first quarter of 2019, the second and third VLCC of the series will undergo routine dockings and retrofit of an in-line type of scrubber as well as of a Ballast Water Treatment system.

Although operators' opinions are not fully aligned in terms of how to tackle the air emissions requirements that are coming into force, a number of them that have modern but high fuel consuming vessels are looking at scrubbers as a solution.

The yard expects that the whole 2019 will be a year with strong interest for scrubber retrofits. The yard is also fully prepared for other solutions as required by the owners.

N-KOM will continue to stay abreast of regulatory, market and regional developments and through the proactive deployment of skills, capabilities and leadership will continue to grow the business to meet the customers' needs and be a provider of choice for maritime services.

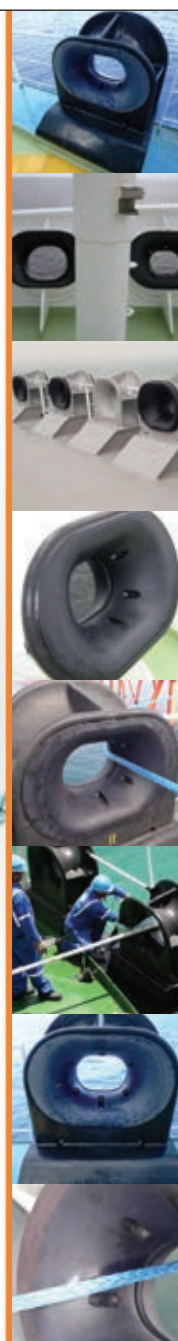


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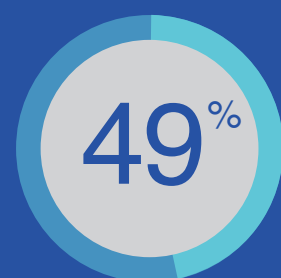
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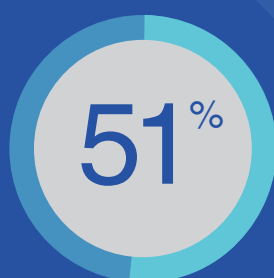
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LNG is transitional fuel sought after as key part of the multi-pathway energy road to 2050

Carlos Guerrero, Global Market Leader of Tankers & Gas Carriers, Bureau Veritas

The momentum behind uptake of liquefied natural gas as a marine fuel is growing. There have been increasing numbers of orders at shipyards for gas-fuelled vessels, bunkering vessels and investment in LNG bunkering infrastructure, all of which will encourage more owners to consider LNG for future projects.

For the most part, LNG's emissions profile is well known. It emits zero sulphur oxides (SOx), virtually zero particulate matter (PM), and compared to existing heavy marine fuel oils, 90 percent less nitrogen oxides (NOx).

Technology

While greenhouse gas (GHG) reductions are less clear cut, academic literature suggests that realistic reductions of 10-20 percent are achievable, with a potential for 25 percent or more as technology develops over the coming years, compared with conventional oil-based fuels.

This is why, today, LNG represents a commercially viable, possible long-term bridging solution to a zero-emissions shipping industry, with immediate local and GHG emission benefits.

It's a step in the right direction for reducing CO2-GHG emissions and the move towards full decarbonisation, as part of a multi-path road.

What most people agree on is that there is no silver bullet when it comes to emissions reductions in shipping. The industry has experienced the evolution of ship propulsion from wind power to gas fuel.

And the transition from one to the next is not sequential. Each propulsion method co-exists alongside each other for a period of time.

At Bureau Veritas, we believe that this trend will continue towards 2030 and 2050, with the industry relying upon a multi-pathway propulsion solution that includes co-existence of traditional fuel oil (residual, distillate), LNG and alternative fuels such as biofuels, hydrogen, ammonia and synthetics.

Decarbonisation

And it's unlikely that these existing and future fuels will operate in isolation.

As we move towards decarbonisation,

the hybrid concept - which is nothing new - is also essential, including turning back to sails to harness wind power and using energy storage devices (batteries, super-capacitors) for electric-hybrid propulsion.

Indeed, despite current concerns around its GHG emissions reductions capability in relation to methane slip, LNG could be, at the very least, a stepping-stone to developing alternative carbon-free and carbon-neutral fuels, such as biofuels, hydrogen, and ammonia, as well as synthetic fuels produced with renewable energy, for example, "green methane".

All these alternative fuels and propulsion solutions need to be considered and explored, which is why Bureau Veritas is working on pilot projects to develop the regulatory framework for these developments.

Although these alternative marine fuels may prove to be long-term zero-emission technology solutions for the shipping industry, today they are not ready and will require huge investments over the coming decades to realise their full potential, both in terms of onboard technology and the fuel distribution network.

Bunkering

The LNG infrastructure that is expanding at pace also represents an additional opportunity for the industry, as longer-term, this same infrastructure can readily be converted for use by similar non-fossil fuels such as (liquefied) biogas (LBG) or synthetic LNG/methane (power-to-gas).

Indeed, LBG bunkering has already commenced in the port of Gothenburg using LNG as the basis.

Moreover, with a fantastic safety track record, LNG provides an important learning tool for how the industry can safely move to alternative gas fuels and decarbonisation.

There is a broad group of stakeholders involved in LNG bunkering safety: IMO, EMSA, IACS, ISO, IAPH and SGMF are all working - together where appropriate - to develop and ensure the strict application of safety guidelines and international standards and, where



The Bureau Veritas-classed LNG bunkering vessel 'ENGIE Zeebrugge'

possible, harmonise rules and standards.

With proper care, appropriate precautions, trained personnel and established procedures, regular LNG bunkering is not significantly more complicated than conventional fuel oil bunkering, and conventional oil pollution is not a risk.

Experience

Establishing a secure and safe LNG bunkering chain underpins the swift uptake of LNG fuel across shipping and small-scale LNG bunker vessels are central to developing that chain.

Bureau Veritas is playing a key role by sharing its experience and supporting the industry in developing safe LNG bunkering arrangements, technology, standards, and operations.

One example is the requirements set out in Rule Note NR 620 LNG Bunkering Ship, which covers the design and installation of the LNG transfer systems from the bunkering ship to the receiving ship, as well as the vapour transfer system from the receiving ship to bunkering ship, including LNG hoses, transfer arms, and auxiliary systems for handling the LNG system.

The NR620 note also sets out further requirements for the design and installation of equipment intended for boil-off gas management on the bunkering ship and the design and installation of the gas piping system of the bunkering ship, with a separate section on safety arrangements.

Classification societies will be at the forefront of aiding owners in their choice of fuel and providing advice through

design, construction, and operation of these gas-fuelled ships. The first purpose-built LNG bunker vessel, the 5,800 cubic metres capacity Zeebrugge-based "ENGIE Zeebrugge" was Bureau Veritas-classed, as well as the 5,800 cubic metres capacity "Coralius", the second LNG bunker vessel to enter service, and Shell's conversion of the small-scale multi-gas carrier "Coral Methane" into an LNG bunker-supply ship.

In terms of newbuilds, Bureau Veritas will class Eesti Gaas's 6,000 cubic metres capacity LNG bunker vessel which will be built at Damen's Yichang shipyard in China.

It will also oversee the construction of two other LNG bunkering ships, the 5,800 cubic metres capacity bunkering vessel which will be chartered to Gazpromneft Marine Bunker Ltd from Shturman Koshelev LLC for operations in the Baltic Sea and Mitsui OSK Line's 12,000 cubic metres capacity vessel being designed and constructed by Sembcorp Marine.

Newbuilds

However, it is not only orders for LNG bunkering vessels that are increasing. LNG-powered vessels now span a variety of vessel types including tankers, cruise ships, ferries, container ships, car carriers, very large ore carriers (VLOCs), and specialised ships such as dredgers and tugs.

And Bureau Veritas has been chosen to class many of them as this sector expands.

For example, three LNG-fuelled escort tugs for operations at Equinor's LNG production plant and export terminal in

northern Norway and the four 174,000 cubic metres capacity LNG carrier newbuildings to deliver trans-shipment cargoes from Russia's export plant Yamal LNG.

Perhaps the highest profile partnership is with France's CMA CGM, which selected Bureau Veritas to class the new series of LNG-fuelled 22,000 TEU container ships that will be built at China State Shipbuilding Corp, with

seven to be delivered in 2020 and two in 2021.

The Winterthur Gas & Diesel (WinGD) 12-cylinder X92DF engines ordered will be rated 63,840 kW at 80 rpm, making them the most powerful gas and dual-fuel engines ever built.

The new ships will each have a bunker capacity of 18,600 cubic metres in a GTT designed Mark III membrane tank.

Bureau Veritas was closely involved in

the feasibility of the design together with the shipbuilding group CSSC and GTT.

Floating projects

In line with increasing demand, availability of LNG is expected to increase through rapidly expanding global LNG production, including new technologies such as floating LNG production (FLNG) units which enable more rapid exploitation of offshore gas fields.

During 2018 the second and third FLNG hulls "Prelude" and "Hilli Episeyo" come on stream to join the Petronas-operated "FLNG Satu" which began operations offshore Malaysia in 2017.

Four more FLNG projects are either under development or at advanced stages of preparation, with several others under consideration.

Rapid growth in flexible floating storage and regasification units (FSRUs) is also increasing the market penetration of LNG and creating infrastructure for imports.

To support this, Bureau Veritas has published Rule NR645, which sets out the requirements to address FSRU technical and operational issues, distinguishing between units that operate as floating terminals for one or more decades and FSRUs required for much shorter periods whose operators may want the option to trade as an LNG carrier.

The rules offer two distinct class notations; the liquefied gas carrier FSRU notation, and the stand-alone (offshore) SRU notation.

While emissions reductions targets for 2020 and 2050 will continue to drive significant changes across the maritime industry, we must accept that there is no "one size fits all" solution.

A range of propulsion solutions needs to be considered and investigated, and it is up to class societies to support the industry in evaluating their viability, as well as developing the regulatory frameworks that ensure their safe operation and uptake.

Combining existing and new fuels and technology will enable us to navigate the multi-pathway future to long-term sustainability for shipping. ■



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Carlos Guerrero
of Bureau Veritas



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 Khatiya	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 Rekeyyat	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
Bahrain Spirit	173,000	Teekay	Daewoo	Sept-18	Bahamas	DFDE	No 96 GW	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
Cape Ann	145,000	Hoegh LNG/MOL	Samsung	May-10	Liberia	DFDE	TZ Mk. III	4	Various
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
Diamond Gas Orchid	165,000	MOL-Jera	MHI-Nagasaki	Aug-18	Japan	S-gas	Moss	4	US-Japan
Diamond Gas Rose	165,000	MOL-Jera	MHI-Nagasaki	Aug-18	Japan	S-gas	Moss	4	US-Japan
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



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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
Galicja 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 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/PPP	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

CARRIER FLEET



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



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Matthew	126,540	Suez LNG Shipping	Newport News	Jun-79	Bahamas	S	TZ Mk. I	6	Atlantic LNG
Megara	173,000	Teekay	Daewoo	Oct-18	Bahama	MEGI-DF	No 96	4	Various
Mekaines	266,000	Nakilat	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	Nakilat	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
Myrina	173,000	Teekay	Daewoo	Sept-18	Bahamas	MEGI-DF	No 96 GW	4	Various
Neo Energy	149,700	Tsakos	Hyundai	Feb-07	Liberia	S	GTT Mk II	4	Various
Neptune	145,000	Hoegh LNG/MOL	Samsung	Dec-09	Liberia	DFDE	TZ Mk. III	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
Noshu Maru	180,000	MOL-Jera	MHI-Nagasaki	Feb-19	Japan	S-gas	Moss	4	US-Japan
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 Eurys	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



Sean Spirit	174,000	Teekay	Hyundai Samho	Feb-19	Bahama	MEGI-DF	No 96	4	Various
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
WilForce	156,000	Teekay LNG	Daewoo	Aug-13	NIS	DFDE	GT NO 96	4	Various
WilPride	156,000	Teekay	Daewoo	June-13	NIS	DFDE	GT NO 96	4	Various
Woodside Cheney	174,000	Maran	Hyundai Samho	Mar-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
Yamal Spirit	174,000	Teekay	Hyundai Samho	Jan-19	Bahama	MEGI-DF	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	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, Zhejiang	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
	Kamarajar (Ennore), Tamil Nadu	Indian Oil, DFC, ICICI Bank	2019	2	360,000
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

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Tanks	Storage Capacity
Japan (continued)	Mizushima	Nippon Oil, Chugoku Electric	2006	2	320,000
	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
	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	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	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

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, Pertamina	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 Mediterranea	ElectroGas	2016
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
	Port Qasim	BW-Mitsui, PGP Consortium	2017
Turkey	Aliaga FSRU, Neptune	Etiki 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
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
	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.	2019	4	2.0
MALAYSIA	Rotan FLNG (Sabah)	Petronas, Murphy Oil	2021	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	2020	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
	Arctic LNG II Siberia	Novatek, Total	2023	3	19.8
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	2	9.0
	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	2019	10	2.5
	Freeport LNG, Texas	Freeport LNG	2019	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 m³
ABU DHABI (UAE)	Das Island (Adgas)	ADNOC, Mitsui, BP, Total	1977 1994	2 1	3.2 2.5	3	240,000
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
		(Mitsubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
		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
		Prelude FLNG Shell, Inpex, Kogas CPC	2019	1	3.5		
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	2000	2	7.1	2	240,000
		Mitsubishi, Mitsui, Partex and Itochu					
		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
	Cheniere Corpus Christi	Texas Cheniere	2018	1	4.5	3	480,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000

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