LNG journal
The World's Leading LNG publication

40 pages essential LNG news!

September 2016

In this issue:

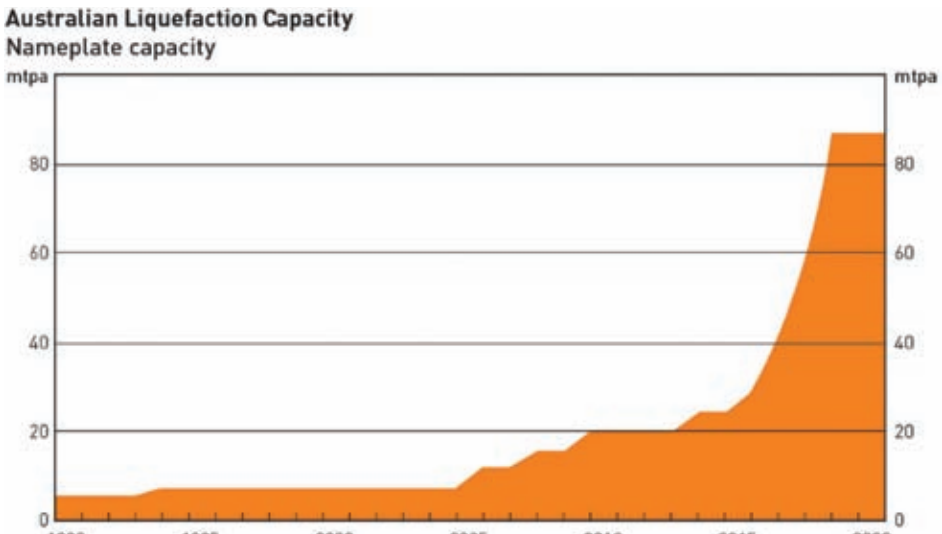
LNG imports to Japan to decline as China and India deliveries fill gap

Latest Australian forecasts remain upbeat on Asia-Pacific LNG and global market

Australian LNG imports to Japan have remained relatively steady year-on-year, with shipments to Japanese terminals estimated to have increased by about 10 percent, though the delivery totals may level off in the future.

"Japan is a mature market and there is limited upside potential for its imports over the next 18 months," according to a report from the Australian government.

More than two-thirds of Japan's LNG imports are for use in electricity generation, where the share of gas has been challenged by lower cost energy sources, such as coal, and the restart of some nuclear capacity.



Australian historical LNG production and forecast through 2020

Position

"As a result, Japan's LNG imports are forecast to decline by 3 percent in 2016 to 82 million tonnes and a further 3 percent to 80 million tonnes in 2017. Nonetheless, Japan is expected to remain the largest importer of LNG," the report said.

World LNG imports are forecast to increase by 8 percent to 259 million tonnes in 2016, as increasing demand from Europe and the rest of the Asia-Pacific region offsets declining demand from Japan.

LNG imports are forecast to increase 11 percent in 2017 to 288MT. The increase in demand will largely be driven by Asia and led by China, which is expected to remain the world's third-largest consumer of LNG in 2017, behind Japan and South Korea.

That's as global LNG supply capacity is forecast to increase 12 percent in 2016 to 289MT, driven predominantly by increasing exports from Australia and the United States.

Other relatively smaller suppliers are also forecast to contribute to growth in global LNG supply including Angola, with the recent re-start of Angola LNG, which will add 5.2MT to annual capacity.

The US started to deliver new supply in early 2016 and the second Train coming on stream at Sabine Pass takes the current US capacity of the Louisiana facility up to 9 MTPA.

LNG supply capacity around the world is forecast to increase by a further 14 percent in 2017, to 328 MTPA, with the US and Australia expected to continue to drive the increase.

Expansions

Towards the end of 2017, the third and fourth Trains at Sabine Pass, each with a capacity of 4.5 MTPA, are scheduled to be completed.

This will bring the facility's capacity to 18MT. This will make it the largest operational facility in the US for some time to come.

The Cove Point export plant in the US state of Maryland is expected to be completed in 2017, with a single-Train capacity of 5.3 MTPA.

After overtaking Malaysia in 2015, Australia's position as the world's second-largest LNG exporter is expected to be reinforced over the next 18 months as new coal-seam-gas-to-LNG capacity in Queensland contributes to a doubling in exports.

"While LNG contract prices are forecast to increase, in line with higher forecast oil prices, they are expected to diverge from spot prices as LNG supply growth outpaces growth in demand, putting downward pressure on spot prices," the Australians suggested.

On the issue of the LNG market, Australia forecast that average prices for cargoes delivered to Japan, Australia's largest market, declined 11 percent in early 2016 relative to the previous quarter to around US$6.50 per gigajoule, the equivalent of US$6.15 per million British thermal units.

Effects

"The decline reflects the lagged effect of the decline in oil prices during the December quarter 2015 on LNG contract prices," it said.

Average prices for LNG delivered into Australia's other major export markets also declined. Shipments to South Korea and China declined by 7 percent to US$6.86 a gigajoule ($6.50 per MMBtu) and 5 percent to US$6.30 a gigajoule respectively.

The average North East Asian spot price remained low over the March

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quarter at around US$4.86 a gigajoule ($4.60 per MMBtu) because of increased LNG supply availability.

"LNG spot prices are forecast to remain low over the remainder of 2016 as the development of new capacity ensures the market remains well supplied," the report said.

The recent increase in oil prices is expected to put upward pressure on LNG contract prices over the remainder of 2016, resulting in a forecast divergence between contract and spot prices into 2017.

A forecast increase in the Brent crude oil price to US$55 a barrel in 2017 will contribute to higher contracted LNG prices.

"Conversely, spot prices are forecast to remain low as new LNG supply is added in the United States and Australia," it added.

Koreans

In 2016, South Korea's overall LNG imports are forecast to increase by 6 per cent to 36MT, returning to 2014 levels after declining in 2015.

The increase in LNG imports reflects an assumed return to normal weather conditions (milder temperatures were registered in 2015, reducing gas consumption), lower LNG prices, and the start-up of new contracts such as with Gladstone LNG (GLNG).

These factors are expected to continue to support growth in South Korea's imports into 2017, which are forecast to increase by a further 5 percent.

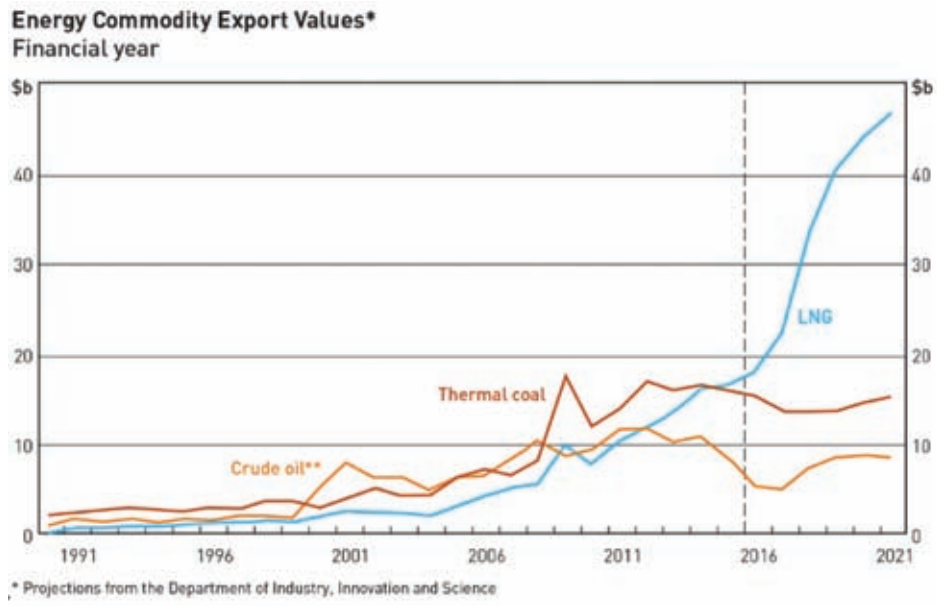
LNG imports to China in the March quarter are estimated to have increased 12 percent relative to the previous year, with imports from Australia estimated to have increased 85 per cent over the same period, as contracts commenced from Australia Pacific LNG (APLNG) and Gorgon.

China's LNG imports are expected to continue to increase over the remainder of 2016 and throughout 2017, driven by increased gas consumption in the electricity generation, industrial, and commercial and residential sectors.

The Chinese government has been promoting the use of gas in electricity generation and the transport sector as part of its efforts to diversify the energy mix.

Market

Reflecting this, China's LNG imports are forecast to increase 43 percent to 26MT in 2016 and a further 22 percent to 32MT in 2017.



How Australian LNG has gained ground in export value

Given the expected demand for gas in China, LNG imports are forecast to grow alongside domestic production and pipeline imports.

India's LNG imports are forecast to increase by around 19 percent in 2016 before increasing a further 45 percent in 2017, due to increasing energy consumption and declining LNG spot prices.

The price sensitivity of India's demand and lower prices, following the recent revision of the contract between Qatar's RasGas and India's Petronet, are expected to support increasing LNG imports.

Australia said its quarterly natural gas production is estimated to have increased 8 percent to around 20 billion cubic metres, due to the ramp up of CSG output to support sales from new LNG export plants in Queensland.

The country's gas production is estimated to have increased 25 percent in 2015–16 to reach 83 Bcm.

Gas output

In 2016–17, Australia's gas production is forecast to increase 33 percent to 110 Bcm as LNG export capacity continues to increase.

"Earnings from Australia's LNG exports are expected to be largely driven by higher volumes over the next 18 months as new capacity is completed," the report added.

Australian export earnings are estimated to have increased 1.8 per cent in 2015-16 to $17Bln, reflecting higher LNG volumes. In 2016–17, export values are forecast to increase 47 per cent to $25Bln.

Australia's total quarterly exports increased 11 percent on the previous three months to nearly 10MT, reflecting the full operation of the first trains at Australia Pacific LNG (4.5MT) and GLNG (3.9MT), and the start-up of Gorgon.

These Trains also boosted overall exports in 2015–16, which are estimated to have increased by 51 percent to 38MT.

New destinations

Around 27 percent of exports from Queensland were destined for non-traditional markets including Singapore and Mexico.

The West Australian-based Gorgon project, which sources gas from the Gorgon and Jansz-lo gas fields, shipped its first cargo from Train 1 in late March.

"However, it was forced to shut down operations for around two months due to problems associated with the start-up. Despite the delay, Train 1 is expected to reach full capacity of 5.3 million tonnes by the end of 2016," the report said.

"Nearly half of Australia's LNG export capacity under construction is expected to be completed by mid-2017, bringing total operational capacity to around 65MT.

"This will support a forecast 42 percent increase in exports, to 54MT in 2016–17. The second and third Trains at Gorgon are expected to be completed by mid-2017, bringing the project's total capacity to 15.6 MTPA.

"Gorgon will be the second-largest operational LNG development in Australia, after the North West Shelf development in Western Australia, which has a capacity of 16.3 MTPA," the report added.

In the eastern market, the additional Trains of the APLNG and GLNG projects were coming on stream to give more respective capacities of 4.5 and 3.9 MTPA. ■

Rio Grande LNG / Image courtesy of NextDecade, LLC

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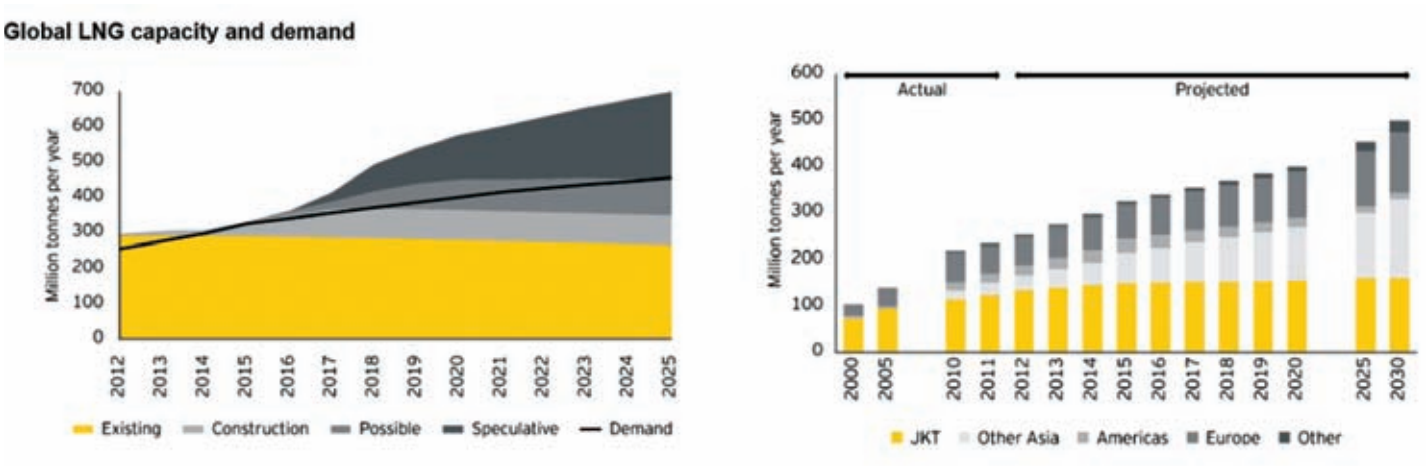
Floating LNG projects will be viable in long run by applying innovations and improvements

Tim Highfield, Head of Process & Facilities Engineering, and Tim Stringer, Head of Field Development Economics, IO Oil & Gas Consulting

Floating LNG projects at the start of 2016 were offering the oil and gas industry great opportunities. Now even these ventures have joined much of the energy sector in the downturn.

Reports of FLNG project suspensions and delays increased as the year progressed and included the Pacific Exploration & Production terminating a tolling agreement for what was expected to be the world's first floating liquefaction, regasification and storage unit to be located in Colombian waters.



Actual and possible production and projected demand around the world through 2025 and beyond

Malaysia

Most notably Petronas then suspended one of two planned FLNG production ventures planned for offshore Malaysia.

Such an about turn would lead us to question whether FLNG faced an uncertain future and whether it was the panacea it was originally seen to be.

These developments are set against a background of a major new wave of supply. Global LNG trade grew in 2015 to 250 million tonnes compared with 246MT the previous year.

On the supply side, worldwide gas resources are abundant with proven gas reserves estimated at 6,606 trillion cubic feet (187.1 Tcm), according to the latest reliable forecasts.

These resources support an impressive list of liquefaction projects at various stages of development or planning and are ready to satisfy LNG demand growth.

The two major waves of LNG supply will come from projects being built in Australia since 2015 onwards and from the US

There is currently over 140 MTPA of LNG liquefaction capacity under construction.

The two major waves of LNG supply will come from projects being built in Australia since 2015 onwards and from the US, including Sabine Pass in Louisiana and followed by a second tranche in 2018 and 2019.

Looking beyond these projects, the likely next wave of LNG supplies will come from East Africa, Russia and Western Canada, but will not hit the markets before 2020.

Buyers

Demand centres will be China, India and new South-East Asian importers such as Malaysia, Singapore, Indonesia, Thailand and Pakistan, rather than the traditional buyers in Japan, Korea and Taiwan, with smaller areas of growth coming from the Middle East importers (Egypt, Jordan) and South America.

In addition, Europe is expected to receive more LNG, with volumes increasing back to levels before the Fukushima disaster boosted Japanese demand.

Rather than being driven by gas demand growth, the available supplies from new and existing sources will come to this market in the absence of better alternatives. In the European flexible market, LNG supplies are also welcome as a strategic alternative and counterweight to pipeline gas.

So, even given the uncertainties on project start-ups and actual utilisation of the US export liquefaction plants, it seems that the market will be in oversupply for the next three to five years at the least.

This may seem like an age to a commodity trader but is a relatively short period in the world of major upstream developments - so it is likely that several FLNG projects will be sanctioned before the end of the decade.

The key to FLNG being truly viable for the long run is applying innovative approaches to the business models being used, which in turn requires FLNG projects to be considered in a truly holistic manner.

For example, there are currently several FLNG vessels in construction/conversion, including Golar's GoFLNG vessels, Shell's Prelude and Petronas's PFLNG1 (now "PFLNG Satu") and PFLNG2.

It could be argued that because these are the first projects to market no one really understands the full commercial and economic implications, nor the full operational issues in trying to achieve liquefaction on a floating vessel.

Opportunity

FLNG clearly represents an opportunity to monetise gas assets which previously would have struggled economically using traditional techniques.

Alternatively FLNG could be used to recover associated gas from oil fields rather than reinjecting or flaring, which can have adverse environmental consequences.

In this scenario, FLNG may offer a different way forward to potentially monetise the associated gas and enhance the revenue from an oil field and reduce the environmental impact.

LNG pricing may help to make FLNG work in some cases as we are likely to see the return of regional price variations as demand in Asia continues to build.

The recent significantly lower prices of Brent crude oil and the main gas indices, coupled with the anticipation of abundant supply, have eroded the Asian premium that had been a feature of the LNG market since the Fukushima disaster.

Expectation

This has come about on the expectation alone of the increased supply from the US and with just the beginnings of the Pacific new supply. On this basis, LNG prices have largely converged in 2016 with shipping costs being the only differentiator.

Future price forecasts show the Asian long-term LNG price tracking the crude price at around a 13 percent slope.

Whilst the absolute data of where the oil price will rebound to is a much debated topic, indeed IO believes there is a scenario where $100 a barrel may not be seen within this period.

The data trends highlight a divided market until the end of the decade - with the European price floor being partially set by the cost of exporting US gas and

the Asian price being set by the steady growth in oil prices.

When this situation starts to change, and European prices become once again disconnected with the US floor from 2025 onwards as they start to compete for the marginal LNG cargoes in the world, then those brave enough to invest now in the longer term FLNG projects will likely be easily back in the money.

Approach

For IO, the heart of considering FLNG is thinking differently, in a holistic approach, looking at project economics in conjunction with the reservoirs and assets and the application of technologies.

The oil and gas industry is constantly evolving and searching for new technologies that can improve efficiency and bring certainty to projects.

It could be argued that FLNG is a natural evolution from the offshore cryogenic gas processing for LPG removal that occurs on ConocoPhillips' Belanak FPSO since Belanak itself is an evolution from conventional oil and gas processing FPSOs.

Whilst FLNG is itself unproven, the technologies that underpin it are established. Ultimately, developing FLNG is a process of applying existing technologies and putting them to use in a new and uncertain environment.

Processes

The FLNG process uses proven onshore technologies in liquefaction: PFLNG1 and PFLNG2 both use Air Products' AP-N™ technology, Shell uses its propriety dual mix refrigerant (DMR) process on Prelude, and Golar uses Black & Veatch's patented PRICO technology.

The key challenge for FLNG therefore is moving liquefaction from the static onshore application onto a floating vessel, to operate it directly above the LNG storage and on the same vessel as the living quarters. Adapting the liquefaction processes to accommodate vessel motion with the distribution of fluids in the cryogenic exchangers is a particular challenge that needs to be overcome.

Operating directly over storage tanks is "business as normal" on FPSOs but for

liquefaction this has the added risk of cryogenic LNG spills damaging the carbon steel hull resulting in LNG releases. The LNG storage tanks for Prelude and Petronas's vessels use a novel two-row membrane arrangement to counter the sloshing from vessel motions; this is an evolution in tank and hull design. Additional risk is also introduced with side-by-side LNG offloading, which entails LNG carriers manoeuvring alongside the FLNG hull with the subsequent risk of collisions.

Loading

However, the cryogenic arms are an evolution of those that have been used onshore on liquefaction and regasification plants for several decades which minimises a large technology risk.

For FPSOs the risk of ship collisions is significantly reduced by using tandem offloading or offloading buoys, which increase the distance between the FPSO and the tanker. However, these technologies aren't yet proven for LNG offloading.

With all the technological challenges, why are the operators pushing ahead with FLNG? FLNG projects, just like all projects, are sanctioned for a number of reasons including stakeholder demands, a need for production, fulfilment of contracts and security of supply.

Prelude is being created in response to a number of challenges such as the remote location of the field and the very particular challenges of working in Australia. Other onshore projects in the country, such as Gorgon LNG, suffered from cost over-runs and delays.

The use of FLNG technology allows some of the in-country challenges to be circumvented by allowing more productive and cost-effective workers to be used for construction, and adds much needed certainty with regards to cost and schedule; Australia's labour costs are on a par with Norway (35 percent above the US Gulf Coast) with only 65-70 percent of the productivity of equivalent workers on the US Gulf Coast.

However, FLNG is not likely to be immune to cost over-runs and delays as projects in the major Korean yards have encountered both most notably with ENI's Goliat FPSO.

FLNG has now suffered its first major project delay during construction with Petronas's suspension of PFLNG2.

Whilst this wasn't due to cost over-runs or labour issues, it does highlight the fragility of FLNG project economics with Petronas suspending the project to reduce their overall spend on capital projects.

Start-up

PFLNG2 was originally reported to be due to start-up in 2018 and initially planned to be utilised on the deepwater Rotan gas field, about 80 miles offshore of Sabah, Malaysia.

Importantly, once the technology was proven, Petronas was aiming to move both "PFLNG Satu" and PFLNG2 to a number of locations to exploit other remote stranded gas fields in Malaysia's domestic waters.

Interestingly, Petronas has also indicated that it will consider leasing FLNG units to other companies to help them unlock their own stranded gas resources.

FLNG will not be the panacea that some might hope, but is likely that FLNG will bring significant benefits if approached on a case-by-case basis. Perhaps most strikingly, the adoption of FLNG will reduce operators' reliance on local workforces with varying levels of skill and reduce the amount of onshore infrastructure that must be developed to support a project. As such, the technology could bring much needed certainty to projects where it is suitable.

For companies like Shell and Petronas, FLNG may involve a degree of financial risk. However, every wave of transformation requires pioneers, and whatever the performance of Prelude and PFLNG1, there will be important lessons for the entire industry.

Ultimately, if oil and gas is to remain competitive over the coming decades, particularly with an unpredictable oil (and hence gas) price, it must look to continually innovate and improve.

Moving technologies from their traditional locale into new frontiers is an important part of the industry's evolution.

As such FLNG may or may not be a success but, regardless, it is an exciting and hugely positive step in the right direction. ■

For the Record

AKER SOLUTIONS, the Norwegian energy and LNG project engineering company, said the markets were challenging and projects are being postponed across the industry, though cost cuts are driving down break-even levels, which may allow some major developments to be sanctioned in the next 12-18 months. Aker's outlook was contained in its second-quarter earnings and follows two large orders announced in June and July 2016, including for the biggest natural gas development in the Eastern Mediterranean, the Zohr field offshore Egypt. The company, listed on the Oslo stock exchange, said second-quarter sales amounted to 7 billion Norwegian crowns ($830M) compared with 8Bln crowns in the same quarter of 2015. Gross earnings were put at 563M crowns compared with 547M crowns in the year-ago quarter, though earnings per share plunged 50 percent to 0.37 crown versus 0.73 crown a year earlier Aker's order backlog was 35Bln crowns compared with 44Bln a year ago. In addition to the Egyptian contract, Aker also secured a contract from Japan's Idemitsu Oil and Gas Co. to provide engineering services for the development of oil and natural gas resources in the Nam Con Son basin offshore Vietnam. "While offshore Norway is largely expected to remain subdued, there are signs that the region may start to see a gradual recovery from 2017," Aker said. "Aker Solutions' greatest growth potential is outside of Norway, where the company has been expanding. Tendering activity remains steady and totals about 35Bln Norwegian crowns. The company said it was well-placed in key growth regions of the global deepwater and subsea markets to provide the capabilities and technology to tackle the challenges of lowering costs and improving recovery rates. In the shadow of extensive industry challenges, we continued to deliver on operational improvements and our streamlining process," said Luis Araujo, Chief Executive of Aker Solutions. "We have maintained steady margins and delivered strong execution. Our healthy backlog and solid finances will stand us well now and when the market recovers," Araujo stated. Aker said on June 14 it won an order to supply key equipment for the development of Egypt's largest offshore natural gas discovery being developed by Italian operator Eni as a gas hub for the East Med and possibly ending the nation's need for LNG imports. Aker said the Egyptian contract would see the delivery of its longest-ever umbilicals system for the Zohr gas field offshore the Egyptian city of Alexandria. Umbilicals play an important role in offshore and subsea oil and gas developments. They contain electric cables and other connections to the surface to enable the development and control of subsea wells. Eni was given the go-ahead in February 2016 by the Egyptian Ministry of Petroleum and Mineral Resources to develop the Zohr field. The Eni discovery will go some way to satisfying Egypt's domestic natural gas needs, while possibly helping to revitalize its two LNG export plants and allowing the end of LNG imports. The Egyptians stopped producing LNG three years ago as natural gas supplies were diverted by the state energy companies to satisfy pipeline high demand in the domestic market.

AMEC Foster Wheeler, the London-based energy engineering company, was awarded a contract by a unit of Spain's main LNG terminal operator Enagas to revamp a key underground natural gas storage facility in waters off the Bay of Biscay. Gaviota is one of two underground storage caverns held off Spain's northwest coast by Enagas, the national transmission and LNG network operator, which also has a growing portfolio of overseas assets. Amec FW said the award was made by the Enagas subsidiary, Enagas Transporte SAU, an international leader in the development and maintenance of gas infrastructure and the operation and management of complex gas networks. "The Gaviota plant is part of Enagas's strategic infrastructure, supporting Spain's natural gas market," Amec FW said. The UK company said it would assess the current capacity of the facility to meet new European standards and any requirements for improvement. The study, to be completed in 2016, follows multiple project deliveries by Amec FW for Enagas in both Spain and Mexico over the past 22 years. "We know the importance of this facility for Enagas. Natural gas is one of the cleanest sources of energy and a sustainable means to meet energy demand," said Roberto Penno, Amec FW Group President for Asia, the Middle East and Southern Europe. "We are delighted that Enagas has once again chosen us for this work, enhancing our long partnership to provide solutions that will add business value while minimizing the environmental impacts," Penno added. Enagas has Spanish import and regasification facilities at Barcelona, Cartagena, Huelva, Bilbao and El Musel. It also has LNG import facility stakes in Chile and Mexico and is a major pipeline project company in Peru.

ANGOLA LNG, the troubled liquefaction plant in southwest Africa operated by Chevron Corp., has formally re-launched after a two-year shutdown with the arrival of a cargo in Brazil. The plant resumed production after undergoing an overhaul and extensive repairs and is now delivering shipments sold by international tender. The 160,500 cubic metres capacity carrier "Sonangol Benguela" is unloading the cargo at the Brazilian import facility at Pecem, operated by Petrobras in the northeast state of Ceara. Production at the Angola facility had originally been scheduled to re-start in December 2015. However, modifications and repairs at the plant near the town of Soyo ran behind schedule. The single-Train plant, located near the Congo River estuary in the north of the country, has a capacity of 5.2 million tonnes per annum and can process 1.1 billion cubic feet of natural gas per day. In April 2014, the plant experienced a failure in the flare blow-down piping system, resulting in an extended plant closure. It cost an initial $10 billion to build and is a joint venture involving Chevron with partners including the Angolan energy company Sonangol, BP of the UK, Italy's Eni and France's Total. The restart of operations at the LNG plant in May came after Angolan President Jose Eduardo dos Santos appointed his daughter Isabel dos Santos as head of state-owned Sonangol. Angola, which is vying with Nigeria to be Sub-Saharan Africa's leading oil producer, said in April it would restructure Sonangol to "increase efficiency and profitability". The Soyo facility was the world's first LNG plant built to be supplied solely with associated gas, whereby the natural gas is a by-product of crude oil production. Feed-gas for the plant originates from multiple fields and operators offshore Angola. Production is continuing and Angola LNG expects to load further LNG and liquefied petroleum gas cargoes as part of the plant commissioning and testing process. Full handover and commercial operation of the plant from ALNG's engineering contractor Bechtel of the US is expected to take place soon. The Angola liquefaction venture was first sanctioned in December, 2007, along with the Chevron-backed LNG import terminal near Pascagoula, Mississippi, in the US, to where much of the African LNG was originally destined to be delivered. However, the US shale-gas boom altered the world LNG trading landscape and most of the Angolan LNG cargoes are being sold where the owners can place them at the best price.

BECKER MARINE Systems of Germany said it was operating a successful service that had gone beyond the test phase in supplying regular power from liquefied natural gas to a cruise ship during its regular stop-overs in the Port of Hamburg. The LNG power barge is named "Hummel", German for bumblebee, and entered service in the port a year ago. Becker Marine's subsidiary, Hybrid Port Energy, operates the barge with the objective of supplying environmentally-friendly maritime energy to ships. The "Hummel" mainly supplies the "AIDAsol" cruise ship, owned by Germany's Aida Cruises, specializing in voyages around northwest Europe. "The low-emission power supplied to 'AIDAsol' by the "Hummel" LNG Hybrid Barge at the Port of Hamburg continues to work perfectly," said Becker. "Hybrid Port Energy is delighted that the cruise ship now receives eight hours of uninterrupted supply during layovers. Contrary to reports published elsewhere, 'Hummel' is working smoothly and at full capacity," said Henning Kuhlmann, Managing Director of Becker Marine Systems. "The LNG Hybrid Barge provided over eight hours of green electricity to 'AIDAsol' on each of its previous two layovers at the HafenCity Terminal, on May 22 and June 23, 2016, respectively. We are extremely satisfied with our record of more than 40 MWh of power over the longest possible period from the morning to the evening, which is equivalent to an entire supply cycle for 'AIDAsol' in Hamburg." added Kuhlmann. "By October 2016, 'AIDAsol' will have called in at the HafenCity Terminal 15 times in total, receiving environmentally-friendly power from the

LNG Hybrid Barge during its layover. Last year already, its first cruise season, the floating power plant used its LNG systems to supply power during 11 layovers. "The inflexible restrictions remain a source of annoyance. The fact that we are still speaking of a test phase despite all the progress we have made in just one year of operation has less to do with our technical capabilities and is more a result of the restrictions imposed on us," said Kuhlmann. "This July, for instance, the alternative system of a landside power plant will be subjected to a general certification procedure according to the International Electronic Consortium standard, conducted by the classification society Bureau Veritas. Although all components on the barge are already certified, including the transfer station, the ship-to-land cabling and the cable mobile, all of the components will now require another inspection together with 'AIDAsol' before faultless power supply by the LNG Hybrid Barge can be certified. "At the moment there are two different landside power supply systems available in Hamburg," added Kuhlmann. "So it would be fantastic to see larger numbers of cruise ships converting to this modern technology and making a valuable contribution to improving the air quality at the Port of Hamburg," he stated.

LNG CANADA, the project being developed in British Columbia by Royal Dutch Shell and leading Asian energy partners, has further delayed its final investment decision originally scheduled for the end of 2016 amid the oil price slump and hostility to the hydrocarbon industry displayed by the federal government in Ottawa of Justin Trudeau. Shell's partners in the LNG Canada venture are three of the largest Asian companies involved in LNG, Korea Gas Corp., PetroChina and Japan's Mitsubishi Corp. Canada's National Energy Board as recently as January 2016 awarded its first 40-year LNG export licence to the Shell-led venture. Shell said while pushing back its FID that LNG Canada remained a promising opportunity with strong support from stakeholders and the Haisla First Nations and other native North American tribes in Canada. "It has achieved critical regulatory approvals, has important commercial and engineering contracts in place to design and build the project and through its pipeline partner Coastal Gas Link, has received necessary environmental approvals and First Nations support along the pipeline right-of-way," the statement said. The oil price slump since 2014 has altered the economics of the industry worldwide and has led to the cancelation or postponement of many projects in Canada and elsewhere. The building of the liquefaction plant was to have started soon at the industrial site acquired by Shell near the town of Kitimat on the Pacific coast of BC. The first phase plan was for two LNG processing Trains, each with the capacity to produce 6.5 million tonnes per annum, with an option to add two more Trains. "Our project has benefitted from the overwhelming support of the BC Government, First Nations - in particular the Haisla, and the Kitimat community," said Andy Calitz, Chief Executive LNG Canada. "We could not have advanced the project thus far without it," Calitz added. "I can't say enough about how valuable this support has been and how important it will be as we look at a range of options to move the project forward towards a positive FID by the joint venture participants," said Calitz, "Through their efforts to build a strong LNG sector for Canada, and a critical, cleaner energy alternative for the world, the governments of British Columbia and Canada have developed sound fiscal and regulatory frameworks for success," Shell added. "However, in the context of global industry challenges, including capital constraints, the LNG Canada joint venture participants have determined they need more time prior to taking a final investment decision. At this time, we cannot confirm when this decision will be made."

CANADIAN support has boosted the export project belonging to Indonesian billionaire Sukanto Tanoto and his Singapore Pacific Oil and Gas company. The Squamish First Nation has approved the pipeline to supply the feed-gas for the liquefaction plant aiming to ship cargoes to China. Tanoto and his Pacific Oil and Gas company are building their liquefaction and export project called Woodfibre LNG at the site of an old pulp mill near the town of Squamish, north of Vancouver. The facility earlier in 2016 became the first LNG export project in the province of British Columbia to receive its full environmental approval from the federal ministry in Ottawa. The export facility will produce 2.1 million tonnes per annum of LNG and the engineering and construction work has been awarded to US engineering company KBR. It has already signed a contract to supply China's Guangzhou Gas Group with 1 MTPA of LNG over 25 years, starting in 2020. The Squamish First Nation has now approved the Eagle Mountain-Woodfibre Gas Pipeline Project, an expansion of Canadian company FortisBC's existing Vancouver Island natural gas transportation system, to provide natural gas services to the Woodfibre LNG plant. The project includes building about 47 kilometres of pipeline between Coquitlam in BC and the Woodfibre liquefaction plant. "The agreement comes from Squamish Nation's independent environmental review of the project, which began more than two years ago," Woodfibre said. "As part of the agreement, the Squamish Nation approved the use of the Mount Mulligan location near Squamish for FortisBC's natural gas compressor station," it added. "The decision follows the Squamish National Council's approval of an environmental assessment agreement and Environmental Certificate for the Woodfibre LNG project on October 14, 2015," Woodfibre noted.

DELEK Group of Israel and Noble Energy of the US are ready to sign a firm agreement to receive front-end engineering design services for the initial phase of the Leviathan natural gas project, the largest current energy venture in the Eastern Mediterranean. The FEED contract concerns the Leviathan production platform that will have capacity starting at 1.2 billion cubic feet of natural gas per day and be expandable to 2.1 Bcf/d. The Leviathan field offshore Israel has estimated recoverable natural gas resources of around 22 trillion cubic feet. Delek said the partnership had authorized Noble Energy Mediterranean Ltd., the operating company for the Leviathan project, to enter into an agreement valued at $120 million for the platform FEED under the Israeli government-approved development plan. "It should be noted that the Leviathan partners are working to close other agreements for the purchase of equipment and services related to the development plan and they expect to sign off on them in the near future," Delek said. "In this way, the Leviathan partners are continuing to work to complete the required actions in order to obtain a final investment decision (FID), based on the development plan in the fourth quarter of 2016 and for that purpose are advancing negotiations at various stages with potential customers, both in the local market and for export, to sign contracts," Delek added. "Based on the planned timetable, receipt of the FID within the said timeframe will allow commencement of gas production from the Leviathan project in the fourth quarter of 2019," Delek said. On June 14, Noble Energy and Delek and its subsidiaries said the Israeli government had approved the development plan for Leviathan. The plan contemplates a subsea system that connects production wells to a fixed platform located offshore with tie-in onshore in the northern part of Israel. Leviathan is expected to provide a second source of supply and entry point into Israel's domestic natural gas transport system, while also delivering exports to regional countries such as Egypt and Jordan.

DNV GL, the Norwegian-German classification society, has provided a report to the European Union with recommendations on how to remove barriers to wider adoption of liquefied natural gas as a marine fuel. All of the EU's 28 member states have to submit national policy frameworks by November 2016 for the implementation of the EU alternative fuels directive and the DNV GL report will help decision makers. "As air emission requirements are becoming more stringent, one possible solution for reduced emissions is to use LNG as fuel for shipping," said DNV GL. "However, take-up of LNG as ship fuel in Europe is still at an early stage," it added. "Two key barriers to take-up of LNG as ship fuel are the gaps in the legislative or regulatory framework, and the lack of harmonized standards. "DNV GL has undertaken an analysis and evaluation identifying the remaining gaps for completing an EU-wide framework for marine LNG distribution, bunkering and other uses," the class society explained. The report is part of the high profile "study on the completion of an EU framework on LNG-fuelled ships and its relevant fuel provision infrastructure" commissioned by the European Commission, Directorate-General for Mobility and Transport. "DNV GL's assessment of the existing rules, standards and guidelines shows that from a legal point of view, there are no remaining major showstoppers for the use of LNG as fuel - for seagoing vessels and inland waterway vessels - nor for the deployment of LNG bunker facilities,"

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says Martin Layfield, global segment leader of the Gas Value Chain, DNV GL Oil & Gas. "In November member states will have to submit their national policy frameworks using the report's recommendations," he added. "DNV GL has advised the EU to implement a low/moderate harmonization scenario as the most workable policy option which will enable member states to transpose the directive on alternative fuels with a 'light touch'. This will reduce effort in implementation, delays and administrative burden while still enabling standardization," Layfield explained. Liv Hovem, regional manager DNV GL Oil & Gas, said the next three decades will see substantial increase in energy and LNG demand. "At the same time, a big part of the world expects the energy to be greener, more reliable and more affordable," Hovem said. "This is what we refer to as the energy 'trilemma'. Natural gas has a key role to play in the future energy mix and Europe will continue to be a significant import hub for LNG," she added. DNV GL is already driving "harmonization" in the EU through a Recommended Practice for LNG bunkering and steering co-operation through the recently launched LNG intelligence portal. The class society also recently published a "Recommended Practice for Development and Operation of LNG Bunkering Facilities", the first industry guidance on securing a high level of safety, integrity and reliability in the design and operations of LNG bunkering facilities. DNV GL additionally contributed to the EU report on "Creating Awareness on LNG Risks and Opportunities", with consultants Price Waterhouse Cooper.

DOMINION, the US energy and utility company has filed a report with regulators on the progress of the Cove Point LNG export project in Chesapeake Bay in the state of Maryland, scheduled to come on stream in late 2017. Dominion told the Federal Energy Regulatory Commission that construction work in transforming the existing importer into an export plant was now 38 percent complete. The latest report to FERC followed an order issued in April 2016 by the US Department of Energy denying a request from the Sierra Club environmental group for a rehearing of an authorization for Cove Point LNG to export more than 5 million tonnes per annum of LNG over a 20-year period. The primary component of the export project is the addition of one liquefaction Train. The Train will be sited within the 130-acre site of the existing import terminal that already has jetty facilities. The Cove Point project, along with the Elba Island LNG venture near Savannah in Georgia, are the only two plants planned for the US east coast, though several small-scale fuel facilities are proposed for the state of Florida. Like Cove Point, Elba Island is an existing import terminal being transformed into an export plant. The Cove Point plant will ship around 5.25 MTPA of LNG when it comes on stream. Dominion has fully subscribed the capacity of the project with 20-year service agreements with a Japanese joint venture comprising Sumitomo Corp., one of the world's leading trading companies, and the utility Tokyo Gas Co. Another company which will have liquefaction capacity is Gas Authority of India, the national transmission company and a leading LNG player in the Asian nation. The US subsidiary of IHI International Corp. of Japan and Kiewit Corp. of Omaha, Nebraska, are the engineering, procurement and construction contractors for the liquefaction facilities. The LNG subsidiary of Dominion will be held by Dominion Midstream. This is a separate company set up by the parent, Dominion Resources, to own all of the equity interest in Dominion Cove Point LNG.

DRIFTWOOD LNG, a US export development company owned by former Cheniere Energy Chief Executive Chafir Souki and ex-BG Group LNG chief Martin Houston, has filed its resource report with US regulators for a proposed export facility on the US Gulf Coast to produce 26 million tonnes per annum. Driftwood is a subsidiary of Tellurian LNG, founded by Souki, after he was fired by Cheniere, and by Houston who had been planning his own export ventures with a company called Parallax Energy. The Souki-Houston export facility is proposed for the west bank of the Calcasieu River near Carlyss in Calcasieu Parish, Louisiana, along with a related 96-mile pipeline project, according to their filing with Federal Energy Regulatory Commission. "The projected strong overseas market demand for natural gas presents compelling economics that substantiate the need for the liquefaction and transport of LNG served by the facility," they told the FERC. "LNG exported from the facility will remain price-competitive compared to other US-based LNG supply sources by using economies of scale to produce LNG with existing, proven, and efficient liquefaction technologies," they added. Driftwood said it expected to file its formal permitting application to the FERC in March 2017. Under the planning schedule put forward by Driftwood, construction of the plant could start as early as the second quarter of 2018. The first of five liquefaction Trains to be constructed will be on stream by 2022 and the building project for all the facilities will last until 2025. The FERC filing is signed by Houston with his title given as President of Driftwood LNG. The Driftwood project plans to have four storage tanks on site, each with a capacity of around 175,000 cubic metres. Driftwood is aiming to match the capacity of Cheniere's Sabine Pass LNG plant, whose development was masterminded by Souki only for him to leave the company under a cloud before the plant started shipping its first cargoes in February 2016.

ELENGY, the French liquefied natural gas terminal operator, said it was studying the construction of additional truck-loading facilities at the Montoir-de-Bretagne import terminal on the Atlantic Coast and has invited expressions of interest in capacity by July 29. "Depending on its configuration, the new facility could at least double the current capacity of 70 loading operations per week," said Elengy, a subsidiary of French utility and energy company Engie. "This facility would be in operation by the winter of 2017," Elengy stated. The move comes as European import terminals have been opting for value-adding trucking facilities to transport LNG fuel to the retail and wholesale markets. Elengy added that it was "willing to discuss this new facility with any interested company". It said discussions could include the proposed capacity and deadline, and any related matter. "A decision is to be taken in the second half of 2016. Interested parties are then invited to express their interest before July 25, 2016," Elengy said. The Montoir-de-Bretagne LNG import terminal has been in operation in the Loire River estuary in Western France since 1980. Elengy's first terminal at Fos Tonkin, near the Mediterranean city of Marseilles, opened in 1972 to receive

cargoes from Algeria. A second import terminal for the Marseille area has been in operation at Fos Cavaou since 2010. Elengy launched LNG truck-loading at Montoir for the retail market in 2013. The truck-loading service is in constant growth and capacity was increased in 2015 when more than 1,100 trucks received LNG. The other facilities benefitting from the truck-loading market as well as the French terminals include the UK Isle of Grain facility, the largest in Europe, and Rotterdam's Gate LNG and the Zeebrugge facility in Belgium.

ENI, the Italian energy company, said its Chief Executive Claudio Descalzi has held talks in Algeria and signed an agreement on the extension of oil and natural gas production licenses as the North African nation aims to boost production of liquefied natural gas and pipeline gas to Europe. The Eni licences cover the key Rhourde Oulad Djemma (ROD) fields, its satellite fields and three fields in Block 403. Eni's exploration and production activities are concentrated in the Bir Rebaa region and Block 403 in the Algerian desert. Blocks 403a and 403d are located in the prolific Berkine sub-basin in southeast Algeria. Nine fields are included in these two blocks. The Italian company said that supplies of Algerian natural gas to Italy last year totalled more than 7.5 billion cubic metres, mostly from the Trans-Mediterranean pipeline linking the two countries. However, only 20,000 tonnes of LNG was delivered to Italy in 2015, less than one full Med-sized carrier cargo. Algeria exported a total of 12.13 million tonnes of LNG in 2015, up from 10.8MT in 2013. The main LNG customers of state-owned energy company Sonatrach were France with 3.29 million tonnes of imports, followed by Turkey with 2.81MT and Spain with 2.74MT. In November 2014, Algeria inaugurated its newest LNG production Train near to the existing Arzew liquefaction plant on the Mediterranean coast. The new Train at Arzew, located 385 kilometres (240 miles) west of the capital Algiers, follows completion of another at the North

African country's second plant at Skikda, giving it a combined boost of 9.2 million tonnes per annum of additional liquefaction capacity. Together the two Trains give Sonatrach, which was the world's first cargo exporter in 1964, renewed traction for LNG production amid continued feed-gas shortages and insecurity outside the main cities. During his meeting in Algiers, Eni's CEO Descalzi and Sonatrach Chairman and CEO Amine Mazouzi signed an agreement on "particularly important assets as their discovery led to the establishment in 1995" of the first strong partnership between Eni and Sonatrach. Descalzi also held talks with the Algerian Minister of Energy Noureddine Bouterfa. "The renewal of the partnership between Eni and Sonatrach, enshrined in the agreement, will bring about an ambitious programme of activities that will include advanced techniques for hydrocarbon recovery," they said. In additional to producing LNG at its two plants, Algeria has three natural gas export pipelines to Europe, two transporting natural gas to Spain and the one linked to Italy. The Italian Pipeline Enrico Mattei (GEM) came online in 1983 and runs 1,025 miles from Algeria to Italy via Tunisia.

EUROPEAN liquefied natural gas terminal operators will hold their fourth-quarter assembly meeting at the Reganosa LNG import facility in the Port of Ferrol in the Galicia region of northwest Spain to discuss market strategies. The Gas LNG Europe (GLE) industry association gathering in the first week of October will comprises representatives of 16 European terminals and including a cross-section of the Atlantic Basin LNG trade. Spain is the country with the largest number of LNG terminals in Europe, with six operating and a seventh at El Musel in Gijón, also in the northwest, current mothballed because of the economic slowdown. The shareholders in the hosting Reganosa LNG import terminal include the Government of Galicia, Grupo Tojeiro and Algerian state energy company Sonatrach. Reganosa LNG will also take the opportunity to outline its own business development ideas. "For Reganosa this will be an opportunity to present its activity and its development potential, linked to LNG promotion as marine fuel and its strategic location," the Spanish terminal owner said. "It's located at the Finisterre Corridor, through which pass more than 40,000 ships per year, and is close to the Navantia shipyard, a European leader in repairing gas vessels.," Reganosa said. The terminal also runs one of the most successful LNG trucking operations for the retail and wholesale markets in the northwest Spanish peninsula where natural gas expansion has been through satellite plants and other small-scale operations. "During this meeting the partners will discuss issues related to the strategies they should follow to promote LNG and its future as a fuel," the company added. The GLE itself is a body committed to promoting the development of transparent and non-discriminatory access for LNG to the European Union internal market, underpinned by a stable and predictable regulatory framework. Reganosa said that the GLE assembly, which will also include the presence of its Executive Committee, will additionally involve several presentations and workshops, as well as opportunities to hold bilateral and networking meetings.

FINLAND is progressing with LNG use. The LNG-powered icebreaker "Polaris", the first of its kind in the world, has undergone sea trials after taking on fuel in a truck-to-ship bunkering operation organized by Norwegian company Skangas at Vuosaari harbour in Finland. The icebreaker is powered by both diesel and LNG, which will enable its compliances with new ship propulsion emission regulations in Northwest Europe. "This is the world's first LNG-powered icebreaker and LNG is excellently suited for use as a marine fuel as it's a great alternative to oil, and being environmentally friendly is one of its strengths," said Skangas Sales and Marketing Director Tommy Mattila. "Once Finland's first LNG terminal is opened in August, the vessel can also be bunkered directly from the terminal, or bunkering can take place from road tankers at ports around the country," Mattila explained. Norway-based Skangas is a unit of Finland's natural gas company Gasum and is building a leading position in small-scale LNG supplies and bunkering in the North Sea and Baltic regions. Jarkko Toivola, head of the Winter Navigation Unit at the Finnish Transport Agency, said the "Polaris" will provide a major increase in security for Finland's winter navigation. "We're determined to ensure the efficient and reliable year-round operability of shipping for Finland's businesses," said Toivola. The "Polaris" was built at the Arctech Helsinki Shipyard. The main purpose of the dual-fuel vessel is icebreaking and assisting vessels in ice conditions at sea. Designed for a 50-year service life it will operate for Finland's state-owned Arctia Shipping. Arctia already has eight ice-breaking ships in its fleet. The shipping company's business is the provision of icebreaking services and charters. According to Arctech, the LNG-fueled "Polaris" will be able to move continuously through ice that is up to 1.6 metres thick. It can also break a 25-metre wide channel in 1.2 metre-thick ice at speed of 6 knots, as well as to reach 9-11 knots of average assistance speed in the Baltic Sea. In open water, the ship's service speed is a minimum 16 knots. While the main purpose for the vessel is icebreaking, it will independently be able to perform oil spill response operations and emergency towing under demanding conditions. "Polaris represents a new generation of Baltic Sea icebreakers. The special hull design and propulsion arrangement coupled with high power ensure the best icebreaking capacity in the Baltic Sea as well as excellent manoeuvrability," said Esko Mustamäki, Managing Director of Arctech's Helsinki yard.

FRANCE has a new operating import terminal after the Dunkirk facility received its first commissioning cargo on July 8, transported from the Nigerian liquefaction plant at Bonny Island on the Niger delta to the Channel port on board the carrier "Madrid Sprit". The 138,000 cubic metres capacity "Madrid Sprit", operated by Teekay LNG. The Dunkirk facility was developed by Electricte de France (EdF). Other shareholders in the project include French energy major Total and Belgian LNG terminal owner and network operator Fluxys, owner of the Belgian Zeebrugge LNG terminal. The Dunkirk terminal itself cost 1 billion euros ($1.13Bln) to build and is managed by the subsidiary company Dunkerque LNG. The facilities were connected to the natural gas transmission network by France's GRTgaz at the end of 2015. The first of two commissioning cargoes ensure that France's fourth LNG import facility, the first in the north of the country, will be ready for scheduled start-up of commercial operations. France's other three terminals are operated by Engie subsidiary Elengy with two of them located in the south near Marseille and one on the Atlantic coast at Montoir-de-Bretagne. Elengy's first terminal at Fos Tonkin, near Marseille, opened in 1972 to receive cargoes from Algeria. A second import terminal for the Marseille area has been in operation at Fos Cavaou since 2010. The Dunkirk terminal is capable of handling the largest LNG carriers with more than 260,000 cubic metres capacity. The regas facility has three LNG storage tanks of 190,000 cubic metres capacity each. The commissioning of the latest onshore European import terminal at Dunkirk follows the start of Poland's first facility at Swinoujscie on the Baltic coast in December 2015. That terminal received several commissioning cargoes from Qatar in December 2015 and early 2016.

FREEPORT LNG has seen the way opened for third-party feed-gas to arrive at the liquefaction plant in Quintana Island in Texas. The US Federal Energy Regulatory Commission has given a permit for an extension of the Gulf South Pipeline that will allow Japanese and European customers of Freeport to transport their feed-gas. The FERC issued an order authorizing the construction of the Gulf South Pipeline Company's extension called the Coastal Bend Header Project. The pipeline will provide 1.42 billion cubic feet per day of firm gas transportation to the existing Freeport import terminal currently being transformed into an export plant. Freeport LNG customers who have already signed agreements for the pipeline capacity on the Coastal Bend Header Project include BP of the UK, Germany's Uniper Global Commodities (previously E.ON) and subsidiaries of Japanese utilities Chubu Electric and Osaka Gas. US energy tycoon Michael Smith is Chief Executive of Freeport and the project is on schedule to ship its first LNG cargo by the end of 2018. Gulf South owns and operates around 7,240 miles of pipeline facilities extending from Texas through Louisiana, Mississippi, Alabama, and Florida. Gulf South estimates the total cost of the Coastal Bend Header Project will be around $545 million. Each of the three Trains in the first phase of construction at Freeport will produce just over 5 million tonnes per annum of LNG and 13.4 MTPA of the more than 15 MTPA of output has been contracted under use-or-pay liquefaction tolling agreements. A fourth production Train is also planned. Construction work on the additional Train is expected to begin in 2017 and to be operational in 2021.

GASLOG Ltd, the Monaco-based LNG fleet operator with 22 ships owned and operated, has signed a seven-year time charter party with France's Total Gas & Power Chartering for a vessel currently being built at Hyundai Heavy Industries in South Korea. GasLog said the newbuild, known as "Hull 2801", is scheduled to be delivered by HHI in 2018. Greek-owned GasLog has its own 12 fully-owned LNG ships, six newbuilds on order and four LNG carriers operating under its technical management for third parties. Total's charter will begin in mid-2018 at a date to be finalized. A further option period of three years has been granted at the charterer's option. The charter begins at the same time as the scheduled start-up of the Yamal LNG project in Russia. Total is a shareholder in the Yamal venture and will require more shipping capacity as some of the cargoes will be trans-shipped from European terminals. "Following the successful charter of this vessel, all of GasLog's six remaining newbuild vessels have firm, long-term charters of between seven and 10 years," the company said. "The daily charter rate is in line with GasLog's average long-term charter rate and the gross contracted revenue from the contract is approximately $190 million over the seven-year firm period," GasLog added. Once the newbuild vessel is delivered and chartered to Total, GasLog's New York Stock Exchange-listed affiliate, GasLog Partners, has the right to acquire "Hull 2801". "Securing a seven-year charter on this vessel extends GasLog Partners' dropdown pipeline of future vessels from 12 to 13," GasLog explained. Paul Wogan, Chief Executive, GasLog said he was delighted to place the newbuild on charter with Total. "Total is both a leading and growing player in the global LNG industry and this meets our objective of broadening GasLog's long-term customer base," Wogan added. "The charter rate is consistent with long-term industry averages, demonstrating the resilience of long term charter rates against the volatility of the short term market," he said.

GAZPROM, the Russian natural gas giant and China National Petroleum Corp. (CNPC), the state-owned Chinese company with a stake in the Russian Yamal LNG project, have held talks in Beijing on the supply of more pipeline gas to the Chinese and greater cooperation on LNG and storage. The supply increase was discussed at a meeting between Gazprom Chairman Alexei Miller and Wang Yilin, his counterpart at CNPC. Miller also held talks with Zhang Gaoli, the vice premier of the state council of China. Gazprom said gas exports by Russia via the western route and eastern routes to China were discussed as well as cooperation in underground gas storage and power generation. "Zhang encouraged both countries to put energy cooperation on gas supplies, storage and LNG as a priority, ensuring the construction of major energy projects including the Russia natural gas pipelines," a Chinese statement said. The western route would source natural gas from resources in Russia's Western Siberia region while the eastern route would bring in gas from Russian projects in the Far East, to include Sakhalin Island where an LNG production plant is located. In 2014, Gazprom and CNPC signed the agreement for gas to be supplied via the eastern route and in 2015 an accord was signed for the western route, known as the "Power of Siberia" gas pipeline. Gazprom envisages supplying about 30 billion cubic metres a year from the western route, on which work has yet to start, and 38 Bcm per year from the eastern route that could see deliveries begin as early as 2018. China still needs to complete its end of the pipeline to connect to Russia's Eastern Siberia and the Far East network that currently terminates in Vladivostok. Miller said Russia attached "great importance" to energy cooperation with China, especially on natural gas. CNPC is a shareholder with France's Total and Novatek, the rival Russian natural gas company to Gazprom, in the Yamal LNG export project in Arctic Russia. Novatek owns 50.1 percent of Yamal LNG. CNPC and the French company each hold 20 percent of the project, while Chinese funding is underpinning the construction of the liquefaction plant and export terminal. The LNG venture is located in the Yamal Peninsula deep in the Russian Arctic, a region that is ice-bound for seven to nine months of the year. More than 200 wells will be drilled for that project involving three liquefaction Trains, each with a capacity to produce 5.5 million tonnes per annum of LNG. To ensure its stability, the plant will be supported by tens of thousands of piles driven some 20 metres into the permafrost. Over the next couple of years until 2018, the port of Sabetta is taking delivery of 150 modules representing 450,000 metric tonnes of equipment.

HYUNDAI Heavy Industries-Engine and Machinery Division of South Korea and shipowner Ilshin have signed a shipbuilding contract for a 50,000 dead-weight tonnage bulk carrier with liquefied natural gas propulsion provided by Germany's MAN Group. The vessel will be powered by a MAN B&W 6G50ME-C9.5-GI engine and be built by HHI. The Korean yard has opted to supply MAN's M-type, electronically-controlled, gas-injection (ME-GI)-powered LNG propulsion system. MAN has its headquarters in Augsburg, southern Germany, and is part of the Volkswagen Group. The ME-GI dual-fuel engine represents many years of development work for MAN and gives shipowners and operators the option of using either LNG or heavy fuel oil. South Korean steelmaker POSCO has already agreed to charter the newbuilding upon delivery, and will use the vessel to transport limestone for its operations. POSCO will deliver the LNG fuel tank, which will be made of high manganese steel as an alternative material to the currently widely used nickel alloy. HHI said the bulk carrier would be delivered in late 2017 to service a shipping contract between Ilshin Shipping and POSCO. The ship, which would be jointly classed by the Korean Register of Shipping and the UK's Lloyd's Register, would transport limestone from Korea's Gangwon province to POSCO's steel plant at Gwangyang, where an LNG import terminal is also located. The vessel has been designed as a dual-fuel propulsion ship, capable of using both LNG and heavy fuel oil. The International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) stipulates that only nickel alloys, stainless steel, steel with 9 percent nickel content, and aluminium alloys can be used to construct LNG fuel tanks. "POSCO has developed high-quality manganese steel for cryogenic applications, making it a better choice than other materials permitted by the IGC Code," MAN explained. Just two years ago, shipowners were reluctant to convert to LNG bunkering due to the high LNG prices in Asia. However, oil and gas prices have since declined dramatically, and there is growing awareness of the need to reduce emissions. In November 2015, Helsinki-based ESL Shipping ordered the first LNG-fueled bulk carriers, which are expected to be delivered after the Ilshin vessel. The two ESL LNG-fueled vessels will be constructed by the Chinese Qingshan Shipyard of Sinotrans & CSC, located on the shore line of the Yangtze at Qingshan. Deltamarin, a Finnish ship design, offshore engineering and construction group, based in the Finnish port of Turku, said the contract with the Qingshan Shipyard covers basic and detail design, procurement handling and site assistance for the two vessels.

JBIC, the Japan Bank for International Cooperation and the nation's import-export credit agency, will provide $1.20 billion in financing with other banks for the construction of Train 3 at the Tangguh LNG project, operated by UK major BP in the Papua Barat province in Indonesia. Japan's financing arrangement follows the recent final investment decision on Train three taken by the shareholders in the production sharing agreement who also include eight Japanese energy companies and Indonesian stakeholders. The JBIC said it was co-financing the project with other financial institutions, including Japanese banks, under the "overseas development assistance financing" programme. The additional processing Train will increase capacity by 3.80 million tonnes per annum to a total of 11.40 MTPA. Most of the Train 3 output has been booked by Indonesia's state electricity company, Perusahaan Listrik Negara, and the balance of over 1 MTPA will be supplied to Japanese power utility Kansai Electric Power Co. "The Government of Japan continues to emphasize the strategic importance of LNG," the JBIC said. "Resource prices are sluggish and there is stagnation as regards investment in medium-term and long-term LNG

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development, geographically close to Japan, which is a concern. That is why the JBIC is supporting the expansion of the LNG project, which already has proven production to contribute to the stable supply of Japan's LNG," the bank added. The Tangguh liquefaction facility began production in 2008 and the current expansion project also includes two offshore platforms, 13 new production wells, a new LNG jetty and supporting infrastructure. The start-up of production for the third Tangguh Train is expected in 2020. Awards for the project's engineering, procurement and construction contracts are expected before the end of the third quarter of 2016. Several Indonesian companies are also part of the production share agreement along with the Japanese. Japan's PSC partners include Inpex Corp., Mitsubishi Corp., JX Nippon Oil & Gas Exploration, Mitsui & Co., LNG Japan Corp., Sumitomo Corp., Sojitz Corp., and Japan Oil, Gas and Metals National Corp.

KEPPEL CORP. of Singapore said it entered into an agreement with a subsidiary of Royal Dutch Shell to form a joint venture company, establishing a Singaporean liquefied natural gas bunkering business in the port of the Asian city state. Keppel, owner of shipbuilding and marine businesses in Singapore, said the aim of the venture with Shell will be to supply LNG bunkering and related services to ships. Shell's Singapore-based unit Shell Eastern Petroleum will hold a 50 percent stake and an equal shareholding will be owned by Keppel subsidiary KS Investments. The Maritime and Port Authority (MPA) of Singapore had previously selected Keppel and Singapore company Pavilion Energy to hold LNG bunker supply licenses. The Keppel licence was to be shared with BG Group and Shell has now assumed that role after its takeover of BG. The port selected the two winning bidders from a field of 12. LNG supply is set to begin alongside the start of the port's LNG bunkering pilot programme in 2017. The port's other LNG supplier for bunkering, Pavilion, is a subsidiary of Singapore's

wealth fund Temasek. The MPA said recently it was extending and enhancing its offering to shipowners to promote the use of LNG and cleaner traditional fuels for shipping in Singaporean waters. The Maritime Singapore Green Initiative was launched by the MPA back in 2011 and has already received strong support from the maritime industry. The MPA said ships calling at the Port are opting for cleaner fuel and more than 3,700 vessel calls have switched to marine fuel with sulphur content not exceeding 1 percent. Singapore currently has one LNG import facility, located on Jurong Island, consisting of two jetties that handle the largest carriers, three storage tanks of 180,000 cubic metres capacity and regasification equipment. The city state is carrying out a feasibility study on using additional floating LNG import facilities as it builds up its infrastructure as a regional LNG trading and bunkering hub. Singapore's government has already singled out two sites where Floating Storage and Regasification Units can be berthed, either at a quayside or offshore. The Jurong Island terminal began operations in May 2013 and will be expanded from the current capacity to import 6 million tonnes per annum to 11 MTPA by 2018. Plans for a second onshore terminal are also being examined.

NATIONAL GRID, the UK transmission operator and owner of the Isle of Grain liquefied natural gas import terminal near London, was positive on LNG market development, though said the future of shale gas in the country was still undecided. Producing UK shale-gas could be even more environmentally-friendly than LNG that has to be produced elsewhere and imported by ship. This shale gas would be greener in terms of overall lifecycle carbon emissions than liquefying gas in the Middle East, shipping it several thousand miles to the UK and regasifying it. National Grid's latest report called "UK Future Energy Scenarios" has just been published and it contains projections on the nation's energy resources weighted against various levels of economic success. The company's licence conditions as a major power and gas supplier require the submission of the future energy report each year to the UK energy regulator, Ofgem. The report also commented on the likely supply balance for the UK between pipeline natural gas and LNG. Both will offset the ongoing decline of the UK's North Sea output. "In all scenarios we assume that there will be at least a minimum flow from both LNG imports and continental pipeline gas. In the short term, the minimum levels for LNG are defined by the global LNG availability and the recent history for UK LNG deliveries. Indications are that LNG availability is likely to be high, at least until the early 2020s. New liquefaction projects have come on line this year, including four in Australia and the first US export terminal, Sabine Pass. There is much speculation as to how much LNG will flow from the US to European markets where it will compete with LNG from Qatar, as well as gas from Norway and Russia," the report said. "For continental imports, through the IUK and BBL interconnectors, the minimum supply has been defined by contractual volumes and our assessment of any additional flows which could be expected under the conditions in the scenarios," it added. "In all scenarios there is enough infrastructure capacity for the generic import to be all LNG or all continental gas without the need for any new capacity to be built," it added. National Grid said its "Consumer Power" natural gas demand scenario is in the middle of the range of market outcomes from 2020 onwards. "Our projection for UK Continental Shelf production in Consumer Power is at the top of our range, peaking at 36 billion cubic metres in 2018. The same drivers that make UKCS development attractive apply to shale gas as well. As a result, Consumer Power has our highest level of shale gas development. Production starts in 2021 and reaches a level of 32 Bcm per year by 2031," the report added. Under the "Gone Green" scenario no shale gas is produced in the UK by 2040. National Grid noted the progress of shale-gas exploration and production applications. Two applications to drill and hydraulically fracture (frack) were rejected by local planning authorities in the north-west of England, but subsequently appealed. Elsewhere, planning applications to frack have currently been submitted in Nottinghamshire, and an application has been approved in North Yorkshire. The Government has continued to support shale gas development with a number of changes to acts and regulations. A new planning process was announced that is designed to speed up shale-gas planning applications.

NOVATEK, the second-largest Russian natural gas company after Gazprom and developer of the Yamal LNG project in the Arctic region of Russia, has supplied its first spot cargo as a marketing exercise sourced from the Trinidad liquefaction plant in the Caribbean and shipped to a customer in Chile. The Russian company said its Novatek Gas & Power unit supplied the cargo from the Atlantic LNG plant at Point Fortin in Trinidad to the Quintero import terminal, owned by Spain's Enagas and two Chilean companies. "This first LNG cargo is an important milestone for Novatek to enter the global LNG market," said Deputy Chairman and Commercial Director Lev Feodosyev. "After the launch of the first Train of the Yamal LNG project we will enter the LNG market with our own volumes, and gaining spot trading experience is important for us," stated Feodosyev. The LNG project is currently under construction in the Yamal Peninsula and when completed the first phase will comprise three liquefaction Trains each producing 5.5 million tonnes per annum for total output of 16.5 MTPA. Feed-gas for the venture, whose lead engineer is France's Technip, comes from the South-Tambeyskoye field, where reserves are estimated at 926 billion cubic metres of natural gas. The $27-billion Russian Yamal venture's funding had been affected by international financial sanctions against Moscow over the Ukraine issue, though Chinese and Russian banks come up with the loans.

PARKER Bestobell Marine of the UK, a leading supplier of cryogenic valves for liquefied natural gas carriers, received an order from Daewoo Shipbuilding and Marine Engineering of South Korea to supply its valves for the next three vessels being built on behalf of Canadian shipping company Teekay Corp. These three new LNG vessels are part of a series of eight ships being built by DSME for the Teekay LNG fleet. Parker Bestobell had received orders for globe and check valves for the previous five vessels and this latest order completes the series for the UK company whose valves division is based in Sheffield, northern England. "We are delighted that DSME has specified our cryogenic valves for all eight vessels," said Duncan Gaskin, Parker Bestobell Marine's Market Development Manager. "We have a strong working relationship with DSME with a firm commitment to delivering our high-quality valves on time and in line with their production schedules. This is a very important consideration for DSME's LNG new build projects," Gaskin added. Parker Bestobell has a longstanding relationship with DSME and has supplied many ship sets of valves to the Korean shipyard over a 16-year period and particularly in the last two years. Recently the UK company received a second major order from DSME to supply globe and check valves for the series of vessels for the Yamal LNG project in Arctic Russia, which will total 15 ships.

RASGAS of Qatar has signed an agreement to supply 3 million tonnes per annum of LNG to Electricte de France (EDF) at the new French import terminal at the Channel port of Dunkirk. Under the agreement, RasGas will start its deliveries in 2017 under a medium-term contract. The agreement was signed by RasGas Chief Executive Hamad Mubarak al-Muhannadi and Marc Benayoun, EDF Group Senior Executive. This agreement complements three existing long-term Sales and Purchase Agreements between RasGas ventures and EDF group subsidiaries for the delivery of up to 4.6 MTPA to Edison in Italy and up 3.5 MTPA to EDF Trading in Belgium. "This latest agreement is an excellent example of RasGas' continued commitment to developing and executing opportunities that respond to our customer's needs," said Al-Muhannadi. "We are proud that, together with EDF, we have played a significant role in continuing to provide a safe and reliable supply of energy to the homes, businesses and communities of Europe," the RasGas CEO stated. EdF's Benayoun said the agreement with RasGas reflected the French company's growing interest in the LNG markets. "The group is proud to add this significant contract to its global LNG portfolio and to reach a new important milestone in the excellent relationship with RasGas, who already delivers LNG cargoes to the group under long-term contracts in both Rovigo (Italy) and Zeebrugge (Belgium) terminals," the EDF executive said. The Dunkirk facility was developed by EdF with other shareholders including French energy major Total and Belgian LNG terminal owner and network operator Fluxys, owner of the Zeebrugge terminal.

RWE, the German power and energy trading company, said it signed a medium-term sales agreement to receive 1.1 million per annum of LNG from Qatar in deliveries to Northwest Europe. The RWE Supply & Trading (RWEST) unit and Qatargas, the largest of the Gulf state's two LNG production companies, the other being RasGas, said the Sale and Purchase Agreement would last for a period of seven-and-a-half years. "RWE is a leading global energy company and among the leading energy traders and gas supply companies in Europe," said RWEST's Chief Executive Markus Krebber. The RWE-Qatargas agreement is significant in that it takes volumes previously aimed at the Asian market and re-directs them to Europe at higher prices, analysts said. "Our company has a strong commitment in building significant partnerships with major global energy companies and with the Middle East being one of our key regions for development, the partnership with Qatargas is of particular significance for us," said the CEO of the company based in the German city of Essen. Saad Sherida Al-Kaabi, President and CEO of Qatargas parent, Qatar Petroleum, said the agreement underscored Qatar's commitment to building new partnerships with leading global companies. "We hope Qatargas LNG will contribute to enhance Europe's energy supplies and energy security," stated Al-Kaabi. Andree Stracke, Chief Commercial Officer at RWEST added that the Qatargas deal enhanced the diversity of RWE's European gas portfolio. "This agreement is the result of several years of close co-operation between Qatargas and RWEST which has culminated in a contract which provides flexibility for both companies," Stracke added. The LNG will be supplied from Qatargas 3, a joint venture between Qatar Petroleum, US major ConocoPhillips and Japanese Trading House Mitsui & Co. Ltd. Qatargas said its chartered Q-Flex LNG vessels will deliver the cargoes to RWEST in Northwest Europe. "Qatargas is delighted to announce a seven-and-a-half year deal with RWEST, a global utility leader," said Khalid Bin Khalifa Al-Thani, Chief Executive of Qatargas, "I am particularly pleased to welcome another European partner to our expanding client portfolio, thereby reinforcing Qatargas' position as the leading supplier of safe and reliable LNG to Europe, and indeed the whole world," Al-Thani stated. Qatar Petroleum subsidiaries Qatargas and RasGas have 14 LNG Trains in production at the Ras Laffan complex, including six of the world's largest, enabling Qatar to produce 77 MTPA. Of this total, Qatargas has 43 MTPA of deliveries to make and RasGas produces around 37 MTPA for its customers.

SAIPEM, the Italian LNG and energy engineering company, was awarded contracts worth $1.7 billion for developing the world-class Zohr natural gas field offshore Egypt that will form the Arab nation's East Mediterranean Gas Hub and will affect the region's LNG market. "The most significant contract relates to the field development project for the 'supergiant' Zohr gas field," said Saipem. Italian energy company Eni was given the go-ahead in February 2016 by the Egyptian Ministry of Petroleum and Mineral Resources to develop the Zohr field discovered in its Shorouk block licence area. The Eni discovery will go some way to satisfying Egypt's domestic natural gas needs, while possibly helping to revitalize its two liquefied natural gas export plants. Eni said the Zohr development plan envisages the start of production by the end of 2017, just two years after the discovery, with a progressive ramp up of output. Eni holds 100 percent of the Shorouk licence and operations are also being conducted by

Diary of events

2016

European Autumn Gas Conference
Nov 15-17, 2016
World Forum, The Hague
The Netherlands
www.theeagc.com

2017

Gastech Conference and Exhibition
April 4-7, 2017
Makuhari Messe International Convention Complex, Chiba City, Japan
www.gastechevent.com

LNG 2nd International Summit
April 24-25, 2017
Cannes, France
http://lngsummit.org

Flame Natural Gas & LNG Conference
May 2017 (dates to be confirmed)
Hotel Okura, Amsterdam, the Netherlands
https://energy.knect365.com/flame-conference

Petrobel, a joint venture between Eni and Egyptian state energy company Egyptian General Petroleum Corp. Petrobel has awarded Saipem an Engineering, Procurement, Construction and Installation (EPCI) contract for the accelerated start-up of the Zohr gas field. Saipem said the scope of the subsea work entails work on six gas wells and the installation of the umbilical systems. It also includes the installation of a 26-inch gas export trunkline and 14-inch and 8-inch service trunklines, as well as EPCI work for the field development in deep water of up to 1,700 metres. "In order to ensure that the accelerated development schedule is met, Saipem will mobilize a highly capable fleet of vessels to carry out offshore operations, consisting of the ultra-deepwater last generation pipelayer 'Castorone', the semisubmersible pipelayer 'Castoro Sei', the trench/pipelay barge 'Castoro 10', and other specialized vessels," Saipem explained. "We are very pleased to have been selected for the important objective of delivering first gas from Zohr before the end of 2017," said Saipem Chief Executive Stefano Cao. "We will mobilize a fleet of vessels with last-generation capabilities, and leverage on our proven expertise and consolidated presence in the area, in order to ensure our clients achieve their targets," Cau stated. The Zohr gas field was discovered by Eni in August 2015, using the drillship "Saipem 10000", which is still operating in the area. Saipem has worked on the subsea sections of many LNG projects worldwide and is a leader in drilling services, as well as in EPC, the installation of pipelines and complex projects in harsh conditions. The Egyptians stopped producing LNG about three years ago as natural gas supplies were diverted by the state energy companies to satisfy pipeline high demand in the domestic market. Even the existing gas resources were not sufficient and the Egyptians had begun importing LNG when the Eni discovery was made. Egypt has two Floating Storage and Regasification Units deployed at the port of Ain Sokhna

in the Gulf of Suez. However, the Zohr natural gas in addition to solving Egypt's domestic supply needs, could eventually help restart production at the two Egyptian liquefaction plants at Damietta and Idku on the coast near the city of Alexandria. The Egyptians turned from exporters of LNG to importers in April 2015 to satisfy their natural gas consumption, which has increased by an annual average of 7 percent over the previous 10 years.

SKANGAS, the Norwegian-based LNG operator a unit of Finnish natural gas company Gasum, has begun commissioning the first Finnish import terminal at the port of Pori. The small-scale LNG carrier "Coral Energy", operated by Dutch shipping line Anthony Veder, loaded the commissioning cargo at the Belgian Zeebrugge LNG terminal and delivered it to Pori, the port in southwest Finland, on July 10. "With the 'Coral Energy' LNG carrier now having arrived safely in Finland, we'll be able to begin LNG deliveries on the agreed schedule," said Gasum Chief Executive and Chairman of the Skangas board Johanna Lamminen. "I'm very pleased with the progress made with our strategy, and we're strengthening our position as the leading LNG player in the Nordic countries," added Lamminen. Finland's first LNG import facility is classed as small-scale with one storage tank of 30,000 cubic metres capacity, as well as loading docks, process units, a flare system and three loading bays for road tankers. The Pori facility will serve the growing needs of the natural gas market in Finland outside the gas pipeline network. Skangas plans deliveries from Pori to industrial customers who are outside the gas pipeline network as well as for maritime and heavy-duty road transport users. "Access to natural gas is an important competitiveness factor for current industrial operators in the area as well as for the Port of Pori, including Porin Prosessivoima, Huntsman Pigments and Additives and Norilsk Nickel Harjavalta," the company said. In addition to the Pori terminal another is planned by 2018 at the

Finnish port of Tornio. Small-scale LNG carriers will supply the two Finish terminals with break-bulk cargoes. Skangas said the Pori project's total investment amounted to 81 million euros ($90M) and 23M euros was provided by the Finnish Ministry for Employment and the Economy. "Finland's energy market will be diversified from September 2016 when the first commercial deliveries of LNG to customers take place," it said.

SINGAPORE's Maritime and Port Authority is extending and enhancing its offering to shipowners to promote the use of liquefied natural gas and cleaner traditional fuels in Singaporean waters. The Maritime Singapore Green Initiative (MSGI) was launched by the MPA back in 2011 and has already received strong support from the maritime industry. "From 1st July, Green Ship Programme incentives will be extended to ships using LNG as part of Singapore's longer term efforts to encourage LNG as a sustainable alternative fuel source. In addition, the sulphur oxides limit under the GPP will be reduced further to 0.5 percent for ships calling at our port to enjoy a flat rate of 25 percent concession in port dues for the use of low sulphur fuel during their entire port stay. Similar concession is also extended to ships using LNG in the Port of Singapore," the MPA said. The MPA said ships calling at the Port are opting for cleaner fuel and more than 3,700 vessel calls have switched to marine fuel with sulphur content not exceeding 1 percent. "The extension of the MSGI Programme is a strong demonstration of our commitment towards an environmentally friendly and sustainable global hub port," said Andrew Tan, Chief Executive of the MPA. "We hope that the enhancement to the MSGI will incentivise the maritime industry to continue with their efforts to provide safe, efficient and sustainable shipping, notwithstanding the challenging economic environment," Tan added. Singapore currently has one LNG import facility, located on Jurong Island, consisting of two jetties that handle the largest carriers, three storage tanks of 180,000 cubic metres capacity and regasification equipment. The city state is carrying out a feasibility study on using additional floating LNG import facilities as it builds up its infrastructure as a regional LNG trading and bunkering hub. Singapore's government has already singled out two sites where Floating Storage and Regasification Units can be berthed, either at a quayside or offshore. The Jurong Island terminal began operations in May 2013 and will be expanded from the current capacity to import 6 million tonnes per annum to 11 MTPA by 2018. Plans for a second onshore terminal are also being examined.

STONEPEAK Infrastructure Partners, the New York-based equity fund, has made its second major liquefied natural gas investment by starting a joint venture with Golar LNG, the LNG fleet owner and project developer after previously taking a stake in Magnolia LNG in Louisiana. Stonepeak is making an initial commitment of $290 million in new funding for the venture called Golar Power that will focus Floating Storage and Regasification Units (FSRUs) linked to gas-fired power projects for new and existing LNG importers. Golar's US-listed shares rose to $17.88, or 13 percent, their highest since early March 2016 after the Stonepeak-Golar agreement was signed. In April, Golar was downgraded and its shares tumbled after negotiations between energy services company Schlumberger and Ophir Energy of the UK ended and Schlumberger's intended purchase of a stake in the Fortuna Floating LNG production project offshore Equatorial Guinea, in which Golar is the midstream partner, was cancelled. The UK-owned Nordic investment bank Clarksons Platou Securities AS acted as Golar's sole financial advisor in the Golar Power deal. Golar Power's initial assets will include an FSRU under construction, two LNG carriers that can be converted and the right to invest as much as 25 percent in the Sergipe Power project Golar is involved in and located in northern Brazil. The joint venture will also have a one-year option to acquire two additional LNG carriers from Golar. Stonepeak said it could invest up to $500 million in the Golar Power venture in the coming years after taking a stake in the US Magnolia LNG export project of Australian developer LNG Ltd. Magnolia LNG proposes to produce an initial 8 million tonnes per annum at a liquefaction plant near Lake Charles on the US Gulf Coast, though progress in that venture has been delayed because of a lack of firm offtake agreements. Luke Taylor, senior managing director at Stonepeak, said the US equity fund's initial investment includes $11M in cash to acquire a 50 percent stake in the partnership, $100M in preference shares on the deal's close and a commitment for $75M in additional equity. "We are excited to partner with the leading player in the LNG downstream market and see compelling opportunities in this market to build and operate long-term LNG and power infrastructure with high quality counterparties," said Taylor.

TECHNIP, the French energy and LNG engineering company, and US peer FMC Technologies said their pending merger passed its anti-trust review in the US, satisfying one of the conditions of the transaction. "The merger transaction between the companies has received an early decision from the United States antitrust regulators under the Hart-Scott-Rodino," the statement said. "As previously announced on May 19, 2016, FMC Technologies and Technip will combine to create a global leader that will drive change by redefining the production and transformation of oil and gas," Technip-FMC added. Combining Technip and Houston-based FMC in a $13-billion transaction brings together the largest provider of subsea equipment in the industry and gives valuable back-up services to Floating LNG specialist Technip. The merger comes at a time when costs can be shared by energy industry service providers amid a slump in oil prices that has led customers to postpone or reduce investments in new projects. Doug Pferdehirt, President and Chief Operating Officer of FMC, will serve as the Chief Executive of Technip-FMC. John Gremp, current Chairman and CEI of FMC is retiring, while Thierry Pilenko, Technip Chairman and CEO, will serve as Executive Chairman of Technip FMC. "Conclusion of the antitrust review in the United States under the HSR Act satisfies one of the closing conditions of the transaction, which remains subject to other closing conditions, including approval of Technip and FMC Technologies shareholders, the conclusion of the antitrust review in other countries and other regulatory approvals," they stated. Shareholders of Technip will get two shares in the new company for every Technip share held, while FMC investors will get one share. The companies already work together and in March 2015 announced a joint venture for offshore fields, called Forsys Subsea, as they sought to cut costs. Technip is a leader in FLNG project engineering. It is responsible for the topsides of the "PFLNG Satu" which will be the first LNG production vessel to enter service in 2016 offshore Malaysia. It is also involved as a joint venture engineering partner with South Korea's Samsung Heavy Industries in the Australian Prelude FLNG venture of Royal Dutch Shell.

WOODSIDE, the largest Australian liquefied natural gas plant operator, said it was proceeding with the Greater Enfield project along with joint venture partner, Japan's Mitsui Exploration and Production. Although the Greater Enfield venture is targeting oil, it will help underpin long-term earnings for Woodside and its North West Shelf and Pluto LNG plants as well as the Wheatstone LNG project under construction and the proposed Browse Floating LNG venture, all in Western Australia. Located 60 kilometres off Exmouth in Western Australia within Commonwealth waters, the project will develop the Laverda Canyon, Norton and Cimatti oil accumulations. The investment is around US$1.9 billion, with Woodside contributing US$1.1Bln and first oil expected in mid-2019. These reserves will be produced via a 31km subsea tie-back to the Ngujima-Yin floating production storage and offloading (FPSO) facility, located over the Vincent oil field. Woodside CEO Peter Coleman said that monetizing Greater Enfield was made possible by breakthroughs in the development concept, technology and contracting. Woodside has 60 percent of the project and Mitsui 40 percent. "We have achieved investment spend at the low end of our guidance range by leveraging the latest technologies and using existing FPSO infrastructure. This allows us to accelerate the development of previously stranded resources. Greater Enfield is a demonstration of our phased and sustainable approach to growth," Coleman stated. The Greater Enfield Project requires development of six subsea production wells and six water injection wells. Production will be supported by subsea multiphase booster pumps in the Laverda area and gas lift in the Cimatti area. The project is targeting development of gross reserves of 69 million barrels of oil equivalent. Woodside reserves will increase by 41 MMboe in conjunction with the approval of the project for development. ■

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GULF OF MEXICO, USA

European regasification usage forecasts and developments point to market improvement

The views of market expert, Richard Baylis, speaking as Global Head of LNG at Uniper

Over the first 20 years European regasification capacity grew to 50 billion cubic metres a year. Then it stalled for approximately a decade before exploding to 200 Bcm/y over the last 13 years.

Several factors drove this last expansion: liberalisation, efficient combined-cycle gas-fired power plants, declining North Sea production and liquefaction capacity growth.

However, the 2008 global recession and the 2011 Fukushima disaster meant that European regas utilisation rates dropped dramatically from - 50 percent in 2000-2010, to just 15 percent in 2014.

Turning

Now the market is turning. With the wave of new liquefaction capacity and Asian demand cooling, Uniper forecast utilisation rates of 50 percent.

According to Richard Baylis, speaking earlier in 2016 as Global Head of LNG at Uniper, the most attractive terminals, with access to the hubs, will become congested, regasification capacity will trade at a premium and capacity holders will recover some of their recent losses.

So are we entering a new, brighter future for European regas? Uniper's Baylis believes that we are.

Europe's first sizeable LNG regasification terminal (ignoring the small but pioneering terminal at Canvey Island near London) opened in Barcelona in 1969, with a capacity of 10.5 Bcm/y.

Over the next 20 years, regasification capacity in Europe expanded steadily, reaching 50Bcm/y by 1990, with over 80 percent of capacity in Spain and France and the remaining capacity split between Belgium and Italy.

During this period, the capacity was developed by the national, state-owned gas companies to meet the growing demand for gas in their own country.

Capacity growth then stalled for a little over a decade years, with virtually no increase in capacity, until significant expansion was experienced from 2003 onwards.

Expansion

- The European market was being liberalised, breaking up the old national, and nationalised monopolies, allowing competition for supply to end-customers and creating the traded wholesale markets that we know today.
- A large expansion in the use of gas for power generation. Previously gas had been seen as a premium fuel, not to be used for power generation, but this changed with the development of high efficiency CCGTs, environment pressures and the large increase in global reserves.
- A forecast decline in indigenous North Sea production combined with a need for security of supply through supply diversification
- A growth in LNG liquefaction capacity, particularly in Qatar, which needed sales outlets. An example being the South Hook regasification plant in the UK, which was built by Qatargas and ExxonMobil as part of a dedicated LNG supply chain for the Qatargas 2 project.
- Installed capacity quadrupled over the next 13 years, increasing from 51bcm/y in 2003 to 205 Bcm/y by 2016. The largest expansion was experienced in the UK, which was moving to become a net importer of natural gas and offered access to the most liberalised and liquid market in Europe. It took five years for the UK to go from zero LNG import capacity to being second to pioneer Spain
- Currently 10 European countries have regasification capacity - in descending order of capacity, Spain, UK, France, Italy, Netherlands, Belgium, Portugal, Poland, Greece and Lithuania.

There was market disruption in and after 2008 and a period of under-utilization.

Support

"The global recession in 2008 caused, for the first time, a contraction of gas demand in Europe - both directly through a reduction in end-user gas demand, and indirectly through the collapse in the carbon price, resulting in coal generation becoming cheaper than gas," Baylis said.

"Further, through government support mechanisms, renewables was experiencing massive growth. Together, this pushed gas down the merit order - instead of running base-load, CCGTs became the marginal balancing plants, some even not being used at all. "Europe no longer needed the planned LNG imports. But many utilities had already tied themselves into long term LNG supply contracts and were facing losses, which triggered renegotiations and price reviews, often resolved in lengthy arbitrations," he added.

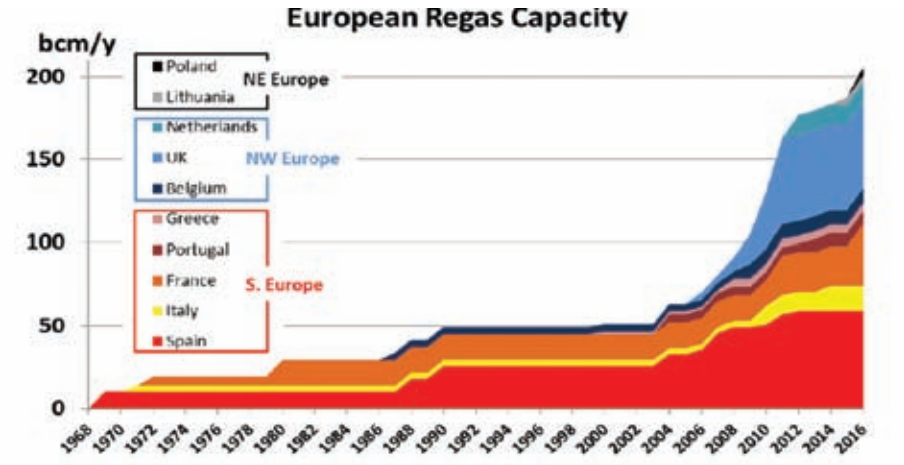

Figure 1: Regasification capacity in Europe expanded steadily

The lack of demand from other global markets meant that although utilisation of regasification capacity dropped slightly, it was not as marked as might have been expected.

But then the Fukushima disaster occurred in 2011, resulting in a shutdown of Japanese nuclear capacity and an increase in Japanese demand of around 20 Bcm/y of LNG. Further, the demand from developing markets, including China, was growing rapidly - LNG imports into China increased by around 20 Bcm from 2008 to 2013.

Pricing

"As a result, the global LNG price increased significantly, with Japan-Korea Marker price increasing from $10 per million British thermal units to $18 MMBtu during 2011. European prices barely moved, in comparison," Baylis explained

It was not just flexible, un-contracted LNG that was immediately directed to Asia.

"Many European buyers agreed with their suppliers to divert contracted volumes, with the profits being shared, or reloaded volumes, as the number of regasification terminals offering a reloading service expanded.

"Utilisation rates of European regasification terminals dropped dramatically, from an average of 40-50 percent in the period 2000-2010, to just 15 percent in 2014.

"At most facilities, the challenge now was one of managing the minimum stock levels, and efforts were put into reducing the level of boil-off, to minimise the amount of expensive LNG that needed to be delivered," he said. "Capacity holders competed hard to attract LNG cargoes and, with such low utilisations, were prepared to offer very flexible terms to LNG suppliers. A number of flexible LNG supply deals were closed, including by Uniper as E.ON, but the volumes that were delivered were a small proportion of the maximum contract capacities."

Production

In 2014, global LNG liquefaction capacity stood at 400 Bcm/y (285 MTPA). However, there is an additional 180 Bcm/y (130 MTPA) of capacity that has recently been commissioned or is under construction, most of which is split equally between Australia and the US. This capacity will be on-line by 2020.

"With the global recovery stalling, China's economic growth significantly slowing and Japanese nuclear plants beginning to return to service, there is expected to be a glut of LNG looking for a home. Just put this additional 180 Bcm/y capacity into perspective to the additional 20 Bcm/y of Japanese demand following Fukushima and its effect on the global LNG market," he explained.

Now the JKM has fallen back to close to parity with European gas prices, and the Pacific-Atlantic spread has all but disappeared.

The European markets are now looking an attractive proposition again, with their open access and potential for significant switching from coal to gas-fired generation.

"In Uniper we believe that over 50 percent of this additional volume will find its way into Europe - either directly, or displacing other swing suppliers which are currently delivering into Asia. We have already started to see flows to Europe picking up during 2015, but that is just the start," Baylis said in his previously published paper.

"As a result, we forecast that by 2017-2018, we could see some of the European regasification terminals, particularly those providing access to the more liquid north-west European markets, becoming congested, bearing in mind that congestion will happen before reaching full capacity utilisation," the executive stated.

"With Uniper's regasification capacity positions at Isle of Grain, UK and Gate, Netherlands, we have seen a huge interest in 2016 in access to our regasification capacity - from Atlantic and Middle East producers, Asian utilities who are concerned they may have over-contracted in the US, and traders.

"It's important to differentiate between the different markets within Europe, when choosing where to secure capacity. A supplier needs to have confidence that they will be able to sell at a fair market price, with good breadth (in terms of number of potential counterparties) and depth (in terms of the volumes that can be sold) in the market. Liquidity is vital, and any small saving that could be made from choosing what appears to be a cheaper terminal or perceived higher valuation can by wiped out if the LNG cannot be sold, or only at a discount to market," Baylis said.

In this respect, he noted that the TTF and NBP are way out in front of the other markets. For many years, NBP was the most liquid hub, but recently TTF has just taken the lead.

Liquidities at Zeebrugge (Belgium), PEGN & TRS (France) and PSV (Italy) are only around 5 percent of TTF or NBP.

Liquidity at the Spanish AOC is even lower. And, as importantly, much of the liquidity on these smaller markets is concentrated in the prompt, which very much limits the possibility to forward sell cargoes ahead of delivery.

Market liquidity

TTF and NBP have liquidity on the curve, several years forward. Of course liquidity and tradability at other European and non-European terminals are even much further behind.

"Another consideration is the new small-scale opportunities, to supply into the ship bunkering and road transport. This is a small, but fast growing market,

and most of the European regasification terminals have, or are developing, the capability to load onto small barges and trucks," Baylis said.

"Regasification capacity provides the holder with an option to sell LNG into the European market, there is no obligation to delivery LNG - unlike a firm DES sale.

"If the supplier later identifies a better opportunity in another market, there is no requirement to renegotiate the LNG sale, likely involving a sharing of the up-side. With the Pacific-Atlantic spread currently flat, this option is closer to the money, and becoming increasingly valuable.

"Over the next few years, as the regasification terminals become increasingly congested, we can see the north-west Europe DES price being increasingly discounted to European hub price - likely by more than the LRMC (i.e. fixed plus variable costs) until either LNG demand grows in other developing markets, or new regasification capacity is built," he said.

Brighter future

"European regasification owners and capacity holders have had it tough over the last 5 years. Just as much of the new capacity came on-line, the market changed - the economic recession, growth in China and the Fukushima disaster. Utilisation rates dropped way below what had been expected, and the companies have been saddled with fixed costs," the executive explained.

"But the market is now turning, and with the huge wave of new liquefaction capacity and Asian demand cooling, we forecast a significant increase in utilisation rates – to above the pre-2008 average level of 40-50 percent. And the most attractive terminals, with access to the liquid north-west," he said.

"European hubs, will become congested. The regasification capacity will be at a premium, and in this part of the business cycle the owners and capacity holders can expect to cover more than fixed costs, recovering some of the losses in the last five years," Baylis forecast.

"So are we entering a new, brighter future for European regas? Uniper believes that we are," he stated. ■

The article is based on extracts from a presentation made by Richard Baylis, Global Head of LNG at Uniper

Turning unitized natural gas fields into LNG output with solid multi-party agreements

Philip Weems and Nina Howell of international law firm King & Spalding

Natural gas produced from unitized reservoirs supplies six operating LNG export projects - PNG in Papua New Guinea, Tangguh in Indonesia, Snøhvit in Norway, Darwin in Australia, Gorgon in Australia, and Bontang in Indonesia.

Australia's Wheatstone LNG project which is under construction will process unitized gas, and at least two planned export projects will process gas from a unitized field, including Mozambique LNG.

Approximately 1 trillion cubic feet (Tcf) of feed-gas is required to produce 0.8 million tons per annum (MTPA) of LNG for 20 years.

Processing

Hence, a single Train of 5 MTPA capacity will require a gas-field size of approximately 6-7 Tcf. Most (large-scale, onshore) LNG export projects are comprised of two or more Trains, and therefore need to be supported by reservoirs which hold at least 12 Tcf of feed-gas.

It follows that any unitized gas field that supports a (large-scale, onshore) export project will have reserves of more than 12 Tcf.

Existing global LNG export projects generally fall within one of the following five project structures: (i) tolling; (ii) buy-sell; (iii) inside the concession; (iv) unincorporated joint venture; and (v) fully-integrated - depending largely on the commercial objectives of the LNG project sponsors (together with a range of other factors).

These various project structures in turn accommodate different ownership models - ranging from complete symmetry between the ownership of the upstream interests (i.e. the participating interests in the concession) and the LNG export project (i.e. the liquefaction trains and associated infrastructure) to complete separation between the ownership of the upstream interests and ownership of the LNG export project.

Unitization and Unit Operating Agreement (UUOA): Unitization is the process whereby a straddling oil or gas reservoir is jointly developed by the interest owners in the adjacent contract groups, on the basis that it is more efficient and economical than separate developments.

The agreement between the parties in the adjacent contract groups is typically called a unitization and unit operating agreement - UUOA - and sets out the commercial and operational provisions for the joint development of the unit.

In 2006, the Association of International Petroleum Negotiators (AIPN) produced a model form Unitization and Unit Operating Agreement, which serves as the starting point for many unitization negotiations.

It is likely to be the case that many of the provisions that are typically found in a UUOA, such as creation of the unit and the manner in which the unit will be operated, can be negotiated without the need to consider their impact on the wider LNG export project.

However, other provisions that are typically found in a UUOA will need to take into account the wider LNG project to ensure that the upstream component of the LNG supply chain goes hand-in-hand with the associated LNG export project and does not impact its viability.

These provisions will need to take into account the chosen structure of the LNG project and the ownership model.

Specific issues when negotiating a UUOA connected to an LNG export project need to be considered.

UUOA scope

Typically UUOAs are limited to upstream matters. However, in the case where the UUOA is connected to an LNG export project and there is common ownership between the parties to the UUOA and the participants in the LNG project, the question arises whether the UUOA should, and can, extend beyond the development of the unit reservoir to cover the development, ownership and operation of the LNG project itself.

The unitization agreement for Tangguh LNG, PNG LNG and Snøhvit LNG all encompass aspects of the LNG project.

The ability for the UUOA to cover the LNG project is likely to depend on a number factors including the prevailing legal and fiscal regime in the host country, and taxation.

Hammerfest LNG in Northern Norway is connected to the Snøhvit field and is one of six operating plants with gas produced from unitized reservoirs

Further, if the LNG project is being project financed and the lenders require that the LNG plant facilities are owned by a distinct special purpose vehicle it may not be possible for the parties to the UUOA to own the LNG project in the manner they likely own the upstream unit (i.e. as an unincorporated joint venture).

As more floating LNG (FLNG) projects are developed for liquefaction, it will be interesting to see whether the FLNG project will be encompassed within the UUOA.

Depending on the chosen project financing structure for the particular FLNG project, arrangements for the funding, development and use of the FLNG vessel may lend themselves to being incorporated within the UUOA.

Redetermination of Tract Participations and Adjustments: Many provisions of a commercial nature that are typically addressed in a UUOA, such as redetermination of the Tract Participations and the resulting adjustment of the Group's share of unit gas, may require particular scrutiny where the UUOA is connected to an LNG export project.

This is in order to ensure that the commercial objectives of the LNG project participants are achieved across the LNG chain, and that the UUOA does not inadvertently create risks for the LNG project participants.

Each Group which is a party to the UUOA is entitled to its "Tract Participation" (i.e. equity) share of unit gas produced under the UUOA.

If the initial Tract Participations are subsequently redetermined it is likely to have significant economic implications for the Groups.

One issue to consider where there is common ownership is whether a change in the Group's share of unit gas (as a result of a redetermination of Tract Participations) should cause an equivalent change in the ownership of the LNG project.

Consideration

A further consideration is whether an expansion of the LNG project (by further liquefaction Trains) should give the parties a right to call for a redetermination of the Tract Participations so that the parties have certainty about their equity interest (and therefore financial commitments) prior to committing to the expansion.

When the Tract Participations are redetermined an adjustment is then required so that each Group receives its revised (not prior) Tract Participation share of unit gas.

In the context of an LNG export project, adjustment of unit gas may be harder to implement due to the parties having committed their share of LNG to buyers under long-term LNG sale and purchase agreements.

The issue will generally fall away where the two Groups are jointly selling their LNG. If one Group is required to pay the other Group a cash payment in lieu of volumes the parties will need to agree on the netback LNG price to calculate the cash payment, as well as the

period over which the netback LNG price will be calculated.

Unit Operating Committee Voting Thresholds: The parties to the UUOA should give particular attention to the voting thresholds for matters that affect the wider LNG project to ensure that the LNG project is not adversely constrained due to a failure to achieve the requisite threshold under the UUOA.

For example, if the expansion of the LNG project requires approval of a new unit development plan under the UUOA it may not be prudent for the unit development plan to require unanimous approval because any one party to the UUOA could effectively veto the expansion of the LNG project.

Default and Withdrawal: There is often a tendency for the parties negotiating a UUOA to focus on the key commercial provisions, and perhaps to pay less attention to issues such as a transfer of interest, consequences of default or withdrawal from the UUOA.

In the case where the UUOA is connected to an LNG export project matters such as default or withdrawal under the UUOA may have implications for the wider project, and therefore it is extremely important that these issues get due attention.

If, for example, a party transfers its interest under the UUOA, or withdraws from the UUOA, should that party be required to also transfer its interest in, or withdraw from, the UUOA?

Many UUOAs provide that as a remedy of last resort the defaulting party will forfeit its interest in the UUOA (and the associated joint operating agreement and petroleum contract).

In the case where the defaulting party is also a participant in the LNG project, the parties will need to consider how forfeiture under the UUOA may impact the wider LNG project ■

The authors

Philip Weems is a partner and Nina Howell is a counsel at King & Spalding

Development and patent progress of ZR-LNG liquefaction process from UK firm Gasconsult

G.W. Howe, G.F. Skinner and A.D. Maunder of Gasconsult Ltd, London, UK

The fall in the oil price and the knock on impact on LNG prices, together with the upcoming availability of new LNG supplies from projects under construction has cast doubts over the viability of many planned LNG facilities.

In the current era of lower energy prices it is likely that there will be a paradigm shift in criteria used to structure LNG projects.

Potentially these will become more capital expenditure-driven with a need for phased project development to mitigate financial risk. Innovative design and project execution strategies will also be required to meet the challenging investment return hurdles of the current era.

Background

Gasconsult first developed liquefaction technology in the early 2000s when oil prices ranged from $30-50 per barrel.

In that era of low energy prices the company was seeking to develop a simple low cost process suitable for floating mid-scale application.

This resulted in development of the ZR-LNG (Zero Refrigerant LNG) process which was patented in the UK in 2012.

Patents have subsequently been awarded in China and Japan and are pending in Australia, Canada, Europe, India, South Korea, Malaysia, Mexico and the USA.

ZR-LNG offers a highly differentiated liquefaction solution. Unlike conventional processes it uses no external refrigerants, using instead the natural gas feed as the refrigerant medium in an optimised system of expanders. The process comprises only two compressor packages and seven major equipment items.

This has capital cost benefits plus various operations advantages including enhanced safety. Power demand is equivalent or lower than the single mixed refrigerant processes and25-30 percent lower than the more sophisticated of the dual expander nitrogen schemes.

Possibilities

Single Train capacities exceeding 2 million tonnes/y are possible facilitating phased project development and lower initial capital requirements, yet still allowing progressive build out of significant LNG capacity.

Refrigeration is effected in two expander circuits, a warm circuit indicated in red and a low temperature circuit shown in blue.

Chilled gases from expanders CX1 and CX2 are routed to the cold box for cooling duty and then returned to the expanders by the recycle compressor CP1.

Flash gas is recaptured to the system by a small cryo suction compressor CP2 and routed through the cold box for cooling duty before feeding the suction of the recycle compressor.

Boil-off gas from LNG storage can be re-introduced into the suction of compressor CP2.

The ZR-LNG methane cycle is similar in concept to nitrogen expander schemes.

However it enjoys a fundamental advantage as methane has a higher specific heat than nitrogen. This significantly reduces circulating gas flows which in turn reduces power consumption and pipe sizes.

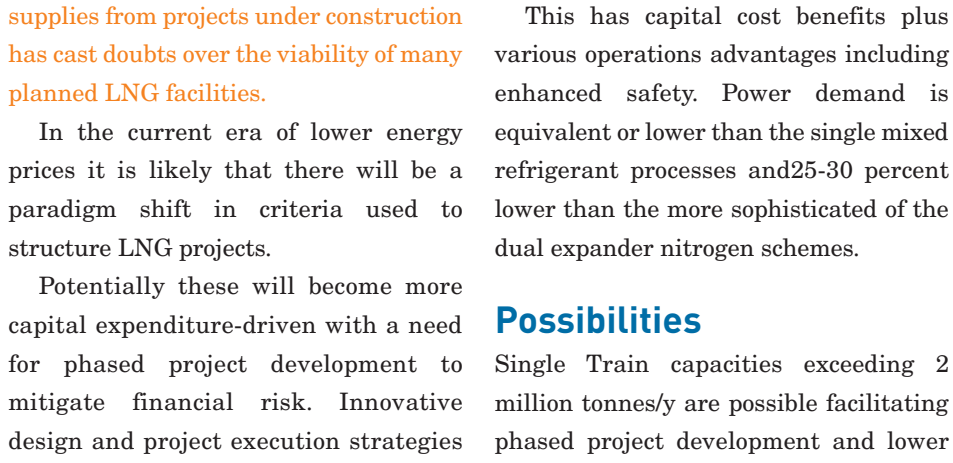

Figure 1: A simplified schematic of the ZR-LNG process

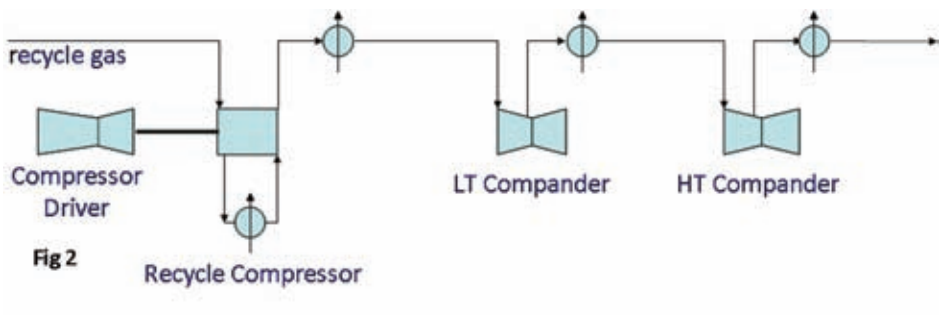

Figure 2: The expanders are configured as companders and operate in a series with the recycle gas compressor

A patented feature of ZR-LNG is that partial liquefaction takes place in the low temperature expander CX2 - this very efficiently converts latent heat directly into mechanical work and also permits a reduction in heat transfer area and cost of the main heat exchanger HX1.

An optional liquid turbine TU1 in the LNG run down line also improves efficiency by providing a significant chilling effect.

These features, together with the optimised distribution of flows, temperatures and pressures in the expander circuits makes for a highly energy efficient system, around 300kWh/tonne of LNG in temperate climates.

Technical validation

Since the introduction of ZR-LNG, Gasconsult has held numerous discussions with industry players including most of the oil majors, all leading E&C companies and major equipment vendors.

All equipment in the ZR-LNG process is fully proven in operation and the process steps are well established in dozens of cryogenic gas processing plants. BP and 3 engineering companies (under non-disclosure agreements) have reviewed the design, from HYSYS simulations through key process and detail design parameters.

All confirmed the feasibility of the process and the key performance parameters.

Leading equipment vendors have confirmed the mechanical design/ configuration viability and that all equipment operates within a window of proven operating experience.

Work performed in conjunction with GE Oil & Gas established economically matched rotating equipment configurations around various gas turbine drivers for single train capacities in the range 0.9 million tonnes/y to 2.2 million tonnes/y.

Power demand

The simulated overall process power demand in these cases is around 310 -315 kWh/t, depending on the individual machine characteristics.

Recognising that LNG plants have traditionally been constructed on a lump sum turnkey basis requiring performance guarantees Gasconsult has performed substantial analysis on

ZR-LNG around its robustness and sensitivity to important parameters of the design.

Calculations revealed the following:

- A doubling of vendor recommended pressure drops across the cold box and inter-coolers increased the power demand by only 8kWh/tonne.
- Increasing the cold box approach temperature from 3°C to 5°C increased power demand by only 7kWh/tonne.
- Feed gases containing up to 4 to 5 mol% N2 can be processed while staying within the current 40-50 percent maximum N2 content of the gas turbine fuel gas. The N2 content of the product is well below 1 percent.
- With 5 percent N2 in the feed the increase in overall kWh/t is typically < 20 kWh/tonne LNG. No nitrogen column is required.

Design development

Patent applications have been made for a number of variants of ZR-LNG developed to further improve capital and operating costs.

Integrated Pressure Liquefaction (IPL): Recognising that ZR-LNG, along with all liquefaction processes, is negatively impacted at low feed-gas pressures IPL was developed to enhance liquefaction efficiency without the need for a separate feed-gas compression facility. ZR-LNG achieves this by routing feed-gas after liquids separation in SP1 back to an inter-stage suction point of the recycle gas compressor, instead of to Zones 2 & 3 of the liquefaction section of the cold box as shown in Figure 1. This provides a higher inlet pressure to the cold box independent of the feed gas pressure, enhancing liquefaction efficiency without need for a separate feed gas compression plant.

Integrated Heavies Removal (IHR): With heavier feed gases above or close to their critical pressure adequate removal of C5+ and aromatics may require a costly upstream NGL unit. Typically this expands the feed-gas to a sub-critical pressure, condenses the heavy material and then recompresses the depleted gas for liquefaction. In its IHR variant ZR-LNG achieves the sub critical conditions required to effect vapour liquid separation using its existing warm circuit gas expander CX1 and recompression is achieved using the existing recycle gas compressor CP1, avoiding additional equipment and saving capital cost, weight and footprint.

Technology advantages

In addition to its simplicity and low power demand further advantages have been identified for ZR-LNG during discussions with industry. Many of these have particular relevance for FLNG schemes; where weight, deck space, operational simplicity and safety are important factors:

- Refrigerant storage, extraction and transfer facilities are eliminated reducing equipment count, capital cost and footprint. For FLNG the freed up deck space can be used to install additional productive liquefaction capacity, potentially enhancing project returns.
- There are no refrigerant logistics issues in remote or offshore locations. Shipments of light and heavy hydrocarbons; and segregated storage to facilitate blending a mixed refrigerant are not required.
- Lean feed-gases are readily handled as no external refrigerants need to be imported.
- Absolute security of refrigerant supply is assured.
- There are no propane or other liquid hydrocarbon refrigerants - a major safety advantage relative to mixed refrigerant schemes, particularly for FLNG.
- The system is motion tolerant as the refrigerant is single phase (always a gas), a positive for FLNG schemes.
- Other than the feed natural gas there are no refrigerant make-up costs to replace losses from plant upsets and/or seal losses.
- There are no refrigerant composition adjustments to maintain cycle efficiency.
- Relative to mixed refrigerant processes there is a shorter start-up time from warm.
- Flaring is reduced relative to mixed refrigerant processes.

Conclusions

For mid-scale operation the ZR-LNG process is well positioned for the current low energy price era.

It has a fundamental simplicity and low equipment count whilst achieving a very attractive power demand without the need for feed-gas pre-cooling or other process complexities.

Unlike some proprietary liquefaction processes no equipment supply is tied to the technology licence and all equipment is available from multiple vendors.

Importantly in this financially challenging era this allows for fully competitive procurement with project cost and schedule benefits. ■

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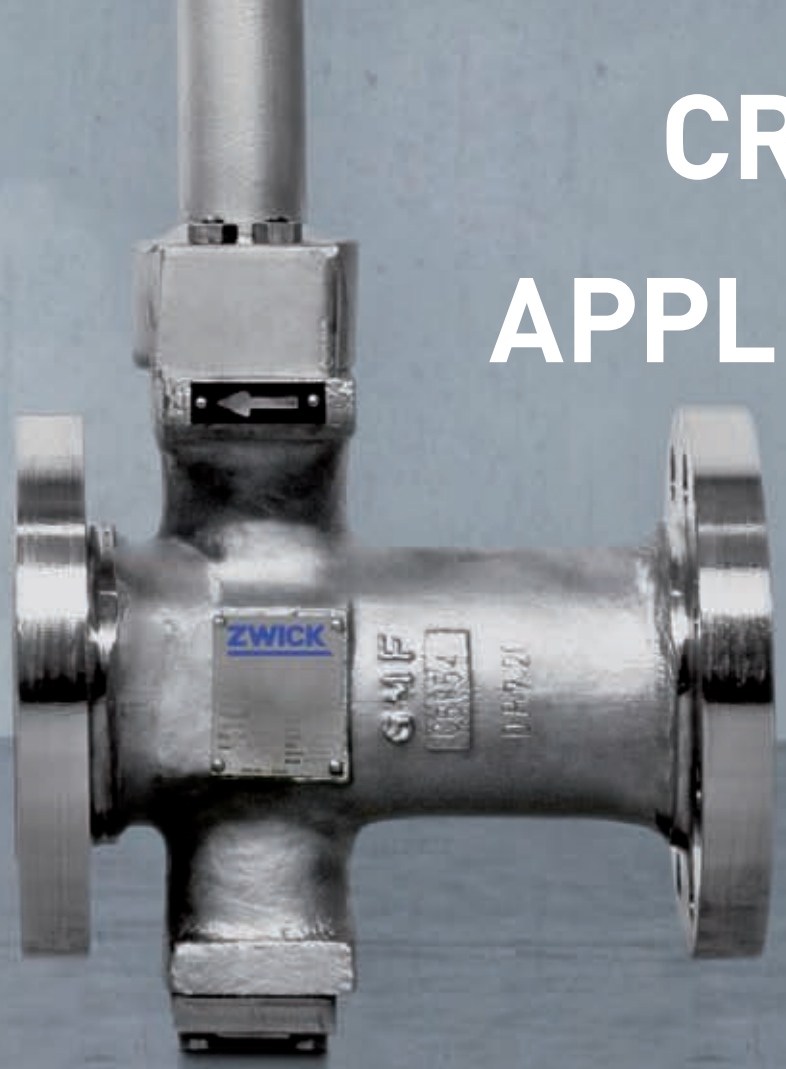

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World LNG Carrier Fleet

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
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	266,000	QGTC	Samsung	Oct-09	Liberia	DRL	TZ Mk. III	5	Qatar-Atlantic
Al Biddah	135,275	J4 Consortium	Kawasaki Sakaide	Nov-99	Japan	S	Moss	5	Qatargas
Al Daayen	151,700	Teekay LNG	Daewoo	Apr-07	Qatar	S	GT NO 96	4	RasGas II
Al Dafna	266,000	QGTC	Samsung	Oct-09	Marshall Is.	LR DRL	GT NO 96	4	Qatar-Atlantic
Al Deebel	145,000	Peninsular LNG	Samsung	Dec-05	Bahamas	S	TZ Mk. III	4	Qatargas
Al Gattara	216,200	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Al Ghariya	210,100	ProNav	Daewoo	Feb-08	Bahamas	DRL	GT No. 96	4	Qatargas
Al Gharaffa	216,200	OSG/Nakilat	Hyundai	Jan-08	Marshall Is.	DRL	TZ Mk. III	4	Various
Al Ghashamiya	216,000	QGTC	Samsung	Mar-09	Liberia	DRL	TZ Mk. III	4	Qatar-Atlantic Basin
Al Ghuwairiya	261,700	QGTC	Daewoo	Aug-08	Marshall Is.	DRL	GT NO. 96	5	Qatar-Atl'c Basin
Al Hamla	216,000	OSG	Samsung	Feb-08	Marshall Is.	DRL	TZ Mk. III	4	QatarGas
Al Hamra	137,000	National Gas Shipping	Kvaerner-Masa	Jan-97	Liberia	S	Moss	4	ADGAS
Al Huwaila	217,000	Teekay	Samsung	May-08	Bahamas	DRL	TZ Mk. III	4	RasGas III
Al Jasra	137,100	J4 Consortium	Mitsubishi Nagasaki	Jul-00	Japan	S	Moss	5	Qatargas
Al Jassasiya	145,700	Maran-Nakilat	Daewoo	May-07	Greece	S	GT No 96	4	RasGas
Al Kharaitiyat	216,200	QGTC	Hyundai	May-09	Liberia	DRL	TZ Mk. III	4	Qatargas III
Al Kharaana	210,000	QGTC	Daewoo	Oct-09	Marshall Is.	DRL	GT NO 96	4	Qatargas IV
Al Kharsaah	217,000	Teekay	Samsung	May-08	Bahamas	DRL	TZ Mk. III	4	RasGas III
Al Khattiya	210,000	QGTC	DSME	Oct-09	Marshall Is.	DRL	GT No. 96	4	Qatargas IV
Al Khaznah	135,500	National Gas Shipping	Mitsui Chiba	Jun-94	Liberia	S	Moss	5	ADGAS
Al Khor	137,350	J4 Consortium	Mitsubishi Nagasaki	Dec-96	Japan	S	Moss	5	Qatargas
Al Khuwair	217,000	Teekay LNG	Samsung	Jul-08	Korea	DRL	TZ Mk. III	4	RasGas
Al Mafyar	266,000	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Al Marrouna	151,700	Teekay	Daewoo	Nov-07	Bahamas	S	GT NO 96		Ras Gas I
Al Mayeda	266,000	QGTC	Samsung	Jan-09	Liberia	DRL	TZ Mk. III	5	Qatar-US/Var.
Al Nuaman	210,000	QGTC	DSME	Dec-09	Marshall Is.	DRL	GT No. 96	4	Qatargas IV
Al Oraiq	210,000	J5 Consortium	Daewoo	Apr-08	Marshall Is.	DRL	GT No. 96	4	Various
Al Rayyan	135,360	J4 Consortium	Kawasaki Sakaide	Mar-97	Japan	S	Moss	5	Qatargas
Al Rekayyat	216,200	QGTC	Hyundai	Jun-09	Bahamas	DRL	TZ Mk.III	4	Qatar-Atlantic
Al Ruwais	210,100	ProNav	Daewoo	Nov-07	Germany	DRL	GT NO 96	4	Qatargas II
Al Sadd	210,100	QGTC	Daewoo	Mar-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Al Safliya	210,100	ProNav	Daewoo	Dec-07	Bahamas	DRL	GT NO 96	4	Qatargas II
Al Sahla	216,200	J5	Hyundai	Jun-08	Japan	DRL	TZ Mk. III	4	Ras Gas III
Al Samriya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GT NO. 96	5	Qatargas II
Al Sheehaniya	210,100	QGTC	Daewoo	Feb-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Al Shamal	217,000	Teekay LNG	Samsung	Jun-08	Qatar	DRL	TZ Mk. III	4	RasGas
Al Thakhira	145,000	Peninsular LNG	Samsung	Sep-05	Bahamas	S	TZ Mk. III	4	Qatargas
Al Thumama	216,000	J5 Consortium	Hyundai	Apr-08	Japan	DRL	TZ Mk. III	4	Rasgas
Al Utouriya	215,000	J5	Hyundai	Sep-08	Panama	DRL	TZ Mk. III	4	RasGas
Al Utourma	215,000	J5	Hyundai	Sep-08	Panama	DRL	TZ Mk. III	4	Ras Gas III
Al Wajbah	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-97	Japan	S	Moss	5	Qatargas
Al Wakrah	135,360	J4 Consortium	Kawasaki Sakaide	Dec-98	Japan	S	Moss	5	Qatargas
Al Zhubarah	137,570	J4 Consortium	Mitsui Chiba	Dec-96	Japan	S	Moss	5	Qatargas
Alto Acrux	147,000	LNG Marine Transport	Mitsubishi	Mar-08	Bahamas	S	Moss	4	Various
Amali	148,000	Brunei-Shell	DSME	Jul-11	Brunei	DFDE	GT No. 96	4	Brunei LNG
Amanl	154,800	Brunei-Shell	Hyundai	Nov-14	Brunei	DFDE	TZ Mk. III	4	Brunei LNG
Aman Bintulu	18,928	Perbadanan / NYK Line	NKK Tsu	Oct-93	Malaysia	S	TZ Mk. III	3	Petronas
Aman Hakata	18,800	Perbadanan / NYK Line	NKK Tsu	Nov-98	Malaysia	S	TZ Mk. III	3	Petronas
Aman Sendai	18,928	Perbadanan / NYK Line	NKK Tsu	May-97	Malaysia	S	TZ Mk. III	3	Petronas
Arctic Aurora	160,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Various
Arctic Discoverer	140,000	K Line	Mitsui Chiba	Jan-06	Bahamas	S	Moss	4	Various
Arctic Lady	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Apr-86	Norway	S	Moss	4	Various
Arctic Princess	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Jan-06	Norway	S	Moss	4	Various
Arctic Sun	89,880	Arctic LNG Shipping	IHI Chita	Dec-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Arctic Voyager	140,000	K Line	Kawasaki	Jul-06	Bahamas	S	Moss	4	Statoil
Arkat	148,000	Brunei-Shell	DSME	Feb-11	Brunei	DFDE	GT. No. 96	4	Brunei LNG
Arwa Spirit	165,000	Teekay LNG	Samsung	Sep-08	Marshall Is.	DFDE	TZ Mk. III	4	Various
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 Vision	160,000	Chevron	Samsung	June-14	Bahamas	DFDE	TZ Mk. III	4	Various
Barcelona Knutsen	173,400	Knutsen	Daewoo	May-10	N.I.S.	DFDE	GT NO 96	4	Various
Bebatic	75,060	Brunei Shell Tankers	Atlantique	Oct-72	Brunei	S	TZ Mk. I	6	Brunei LNG
Beidou Star	172,000	MOL	Hudong	Oct-15	Hong Kong	DRL	GT NO. 96	4	Various
Berge Arzew	138,088	BW Gas	Daewoo	Jul-04	Norway	S	GT NO 96	4	Sonatrach
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
Bilbao Knutsen	138,000	Knutsen / Marpetrol	IZAR Sestao	Jan-04	Spain	S	GT NO 96	4	Atlantic LNG
Bilis	77,730	Brunei Shell Tankers	La Seyne	Mar-75	Brunei	S	GT NO 82	5	Brunei LNG
Bishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-15	Panama	S	Moss	4	Australia-Japan
British Diamond	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. II	4	Indonesia-Various
British Emerald	155,000	BP Shipping	Hyundai	Jun-07	UK	DFDE	TZ Mk. III	4	Tangguh LNG
British Innovator	138,200	BP Shipping	Samsung	Jul-03	Isle of Man	S	TZ Mk. III	4	Various
British Merchant	138,000	BP Shipping	Samsung	Apr-03	Isle of Man	S	TZ Mk. III	4	Various
British Ruby	155,000	BP Shipping	Hyundai	Jan-08	U.K.	DFDE	TZ Mk. III	4	Various

British Sapphire	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. III	4	Tangguh
British Trader	138,000	BP Shipping	Samsung	Dec-02	Isle of Man	S	TZ Mk. III	4	Engas
Broog	135,466	J4 Consortium	Mitsui Chiba	May-98	Japan	S	Moss	5	Qatargas
Bu Samara	266,000	QGTC	Samsung	Dec-08	Qatar	DRL	TZ Mk. III	5	Qatargas
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
BW Suez Brussels	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
Cadiz Knutsen	138,826	Knutsen / Marpetrol	IZAR Puerto Real	Jun-04	Spain	S	GT NO 96	4	Engas
Castillo de Santisteban	173,600	Elcano	STX	Aug-10	Malta	S	GT NO. 96		Various
Castillo de Villalba	138,000	Elcano	IZAR	Nov-03	Spain	S	GT NO 96	4	Sonatrach
Catalunya Spirit	138,000	Teekay LNG Partners	IZAR Sestao	Mar-03	Liberia	S	GT NO 96	4	Atlantic LNG
Celestine River	145,000	KLNG	Kawasaki	Dec-07	Bahamas	S	Moss		Various
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
Clean Energy	150,000	Dynagas	Hyundai	Mar-07	Marshall Is.	S	TZ Mk. III	4	Various
Clean Force	150,000	Dynagas	Hyundai	Jan-08	Marshall Is.	S	TZ Mk. III	4	Various
Clean Ocean	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Planet	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Vision	160,000	Dynagas	Hyundai	Jun-15	Marshall Is.	DFDE	TZ Mk. III	4	Various
Cool Explorer	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Runner	160,000	Thenamaris	Samsung	May-14	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Voyager	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Corcovado LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Creole Spirit	174,000	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	NO. 96 GW	4	Cheniere
Cubal	160,400	Mitsui/NYK/Teekay	Samsung	Jan-12	Bahamas	DFDE	TZ Mk. III	4	Various
Cygnus Passage	145,400	Cygnus LNG	Mitsubishi	Feb-09	Panama	S	Moss	4	Various
Dapeng Moon	147,000	China Ships	Hudong	Jul-09	China	S	GT NO 96	4	Various
Dapeng Star	147,000	China Ships	Hudong	Nov-09	China	S	GT NO 96	4	Various
Dapeng Sun	147,000	China Ships	Hudong	Jul-07	China	S	GT NO 96	4	Woodside Energy
Disha	136,000	Petronet LNG Ltd.	Daewoo	Jan-04	Malta	S	GT NO 96	4	Qatargas
Doha	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-99	Japan	S	Moss	5	Qatargas
Duhail	210,100	ProNav	Daewoo	Jan-08	Germany	DRL	GT NO 96	4	Various
Dukhan	135,000	J4 Consortium	Mitsui Chiba	Oct-04	Japan	S	Moss	4	Qatargas
Dwiputra	127,385	Humpuss Consortium	Mitsubishi Nagasaki	Mar-94	Bahamas	S	Moss	4	Pertamina
Ebisu	147,547	Golar LNG	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
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 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
Fraiha	210,100	J5 Consortium	Daewoo	Sep-08	Marshall Is.	DRL	GT NO 96	4	Qatargas
FSRU Independence	170,000	Hoegh	Hyundai	Feb-14	NIS	DFDE	TZ Mk. III	4	Various
FSRU Lampung	170,000	Hoegh	Hyundai	May-14	Indonesia	DFDE	TZ Mk. III	4	Various
Fuji LNG	147,895	TMSC Gas	Kawasaki	Jun-04	Malta	S	Moss	4	Various
Fuwairit	138,000	Peninsular LNG	Samsung	Jan-04	Bahamas	S	TZ Mk. III	4	RasGas II
Galea	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
Galicia Spirit	140,620	Teekay LNG Partners	Daewoo	Jul-04	Liberia	S	GT NO 96	4	Engas
Gaselys	153,500	GdF/NYK	Atlantique	Mar-07	France	DFDE	CS 1	4	Engas
Gallina	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
GasLog Chelsea	153,000	GasLog	Hanjin Korea	Dec-09	Panama	TFDE	TZ Mk. III	4	Various
GasLog Salem	165,000	GasLog	Samsung	Apr-15	Liberia	TFDE	TZ Mk. III	4	various
GasLog Santiago	155,000	GasLog	Samsung	Mar-13	Liberia	TFDE	TZ Mk. III	4	Various
GasLog Saratoga	155,000	GasLog	Samsung	Dec-14	Bermuda	TFDE	TZ Mk. III	4	Various
Gaslog Savannah	155,000	GasLog	Samsung	May-10	Bermuda	DFDE	TZ Mk. III	4	Various
GasLog Seattle	155,000	GasLog	Samsung	Oct-13	Bermuda	TFDE	TZ Mk. III	4	Various
GasLog Shanghai	155,000	GasLog	Samsung	Jan-13	Liberia	TFDE	TZ Mk. III	4	Various
Gaslog Singapore	155,000	GasLog	Samsung	Jul-10	Bermuda	DFDE	TZ Mk. III	4	Various
Gaslog Skagen	155,000	GasLog	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Gaslog Sydney	155,000	GasLog	Samsung	May-13	Bermuda	DFDE	TZ Mk. III	4	Various
GDF-Suez Global Energy	74,000	Gaz de France	Chantiers	Dec-06	France	DFDE	CS1	4	Sonatrach
GDF-Suez Cape Ann	145,000	Hoegh LNG/MOL	Samsung	May-10	Liberia	DFDE	TZ Mk. III	4	Various
GDF-Suez Neptune	145,000	Hoegh LNG/MOL	Samsung	Dec-09	Liberia	DFDE	TZ Mk. III	4	Various
GDF-Suez Point Fortin	154,200	LNG Japan	Imabari/Koyo	Feb-10	Panama	DFDE	TZ Mk. III	4	Various
Gemmata	138,100	Shell Shipping	Mitsubishi Nagasaki	Mar-04	Singapore	S	Moss	5	Shell
Ghasha	137,510	National Gas Shipping	Mitsui	Jun-95	Liberia	S	Moss	5	ADGAS
Gigira Laitebo	177,000	MOL-Itochu	Hyundai	Feb-09	Panama	DFDE	TZ Mk. III	4	Various
Golar Arctic	140,645	Golar LNG	Daewoo	Dec-03	Marshall Is.	S	GT NO 96	4	Shell Spot
Golar Bear	160,000	Golar	Samsung	Mar-14	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Celsius	160,000	Golar LNG	Samsung	Sep-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Crystal	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Eskimo (FSRU)	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various

Golar Freeze	125,850	Golar LNG	HDW	Feb-77	UK	S	Moss	5	Various
Golar Glacier	162,000	Golar LNG	Hyundai	Sep-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Golar Grand	145,880	Golar LNG	Daewoo	2006	IoM		GT NO 96	4	Various
Golar Ice	160,000	Golar LNG	Samsung	Feb-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Igloo (FSRU)	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Kelvin	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Maria	145,950	Golar LNG	Daewoo	2006	Marshall Is.		GT NO 96	4	Various
Golar Mazo	135,225	Golar LNG/CPP	Mitsubishi	Jan-00	Liberia	S	Moss	5	Pertamina
Golar Penguin	160,000	Golar LNG	Samsung	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Golar Seal	160,000	Golar LNG	Samsung	Aug-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Singapore (FSRU)	160,000	Golar LNG	Samsung	June-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Snow	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	various
Golar Tundra (FSRU)	160,000	Golar LNG	Samsung	Dec-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Viking	140,000	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	Moss	4	Various
Golar Winter	138,250	Golar LNG	Daewoo	Apr-04	Marshall Is.	S	GT NO 96	4	Petrobras
Grace Acacia	150,000	Algaet Shipping	Hyundai	Jan-07	Japan	S	TK MK III	4	Various
Grace Barleria	150,000	Swallowtail Ship	Hyundai	Oct-07	Japan	S	TZ Mk. III	4	Various
Grace Cosmos	150,000	AGH Shipping	Hyundai	Mar-08	Japan	S	TZ Mk. III	4	Various
Grace Dahlia	177,000	Tokyo Gas	Kawasaki	Oct-13	Japan	S	Moss	4	Various
Gracilis	138,830	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	TZ Mk III	4	Shell BG
Granatina	140,645	Shell Shipping	Daewoo	Dec-03	Singapore	S	GT NO 96	4	Shell
Grand Aniva	147,200	Sovcomflot/NYK	Mitsubishi	Jan-08	Japan	S	Moss	4	Various
Grand Elena	147,200	Sovcomflot/NYK	Mitsubishi	Oct-07	Japan	S	Moss	4	Various
Grand Mereya	147,200	Primorsk/MOL/K Line	Chiba	May-08	Japan	S	Moss	4	Sakhalin II
Hanjin Muscat	138,200	Hanjin Shipping	Hanjin	Jul-99	Panama	S	GT NO 96	4	Oman Gas
Hanjin Pyeong Taek	130,600	Hanjin Shipping	Hanjin	Sep-95	Panama	S	GT NO 96	4	Pertamina
Hanjin Ras Laffan	138,214	Hanjin Shipping	Hanjin	Jul-00	Panama	S	GT NO 96	4	QatarGas
Hanjin Sur	138,333	Hanjin Shipping	Hanjin	Jan-00	Panama	S	GT NO 96	4	Oman Gas
Hispania Spirit	140,500	Teekay LNG Partners	Daewoo	Sep-02	Spain	S	GT NO 96	4	Atlantic LNG
Hoegh Gallant FSRU	170,050	Hoegh LNG	Hoegh Hyundai	May-14	Marshall Is.	DFDE	TZ Mk. III	4	chartered
Hoegh Grace FSRU	170,050	Hoegh LNG	Hoegh LNG Hyundai	May-15	Marshall Is.	DFDE	TZ Mk. III	4	various
Hyundai Aquapia	135,000	Hyundai MM	Hyundai	Mar-00	Panama	S	Moss	4	Oman Gas
Hyundai	135,000	Hyundai MM	Hyundai	Jan-00	Panama	S	Moss	4	RasGas
Hyundai Ecopia	145,000	Hyundai	Hyundai	Nov-08	Panama	S	TZ Mk. III	4	Various
Hyundai Greenpia	125,000	Hyundai MM	Hyundai	Nov-96	Panama	S	Moss	4	Pertamina
Hyundai Oceanpia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	Oman Gas
Hyundai Technopia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	RasGas
Hyundai Utopia	125,182	Hyundai MM	Hyundai	Jun-94	Panama	S	Moss	4	Pertamina
Iberica Knutsen	138,000	Knutsen OAS	Daewoo	Aug-06	Norway	S	GT 96	4	Gas Natural
Ibra LNG	147,100	Oman Gas	Samsung	Jun-06	Panama	S	TK Mk. III	4	Oman LNG
Ibri LNG	145,000	Oman Gas	Mitsubishi	Jul-06	Panama	S	TK Mk. III	4	Oman LNG
Ish	137,540	National Gas Shipping	Mitsubishi Nagasaki	Nov-95	Liberia	S	Moss	5	ADGAS
K Acacia	138,017	Korea Line	Daewoo	Jan-00	Panama	S	GT NO 96	4	Oman Gas
K Freesia	135,256	Korea Line	Daewoo	Jun-00	Panama	S	GT NO 96	4	RasGas
K Jasmine	145,700	Korea Line	Daewoo	Mar-08	Panama	S	GT NO 96	4	Kogas offtake
K Mugungwha	152,000	K Line	Daewoo	Nov-08	Panama	S	GT NO 96	4	Various
Kita LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Kotawaka Maru	125,200	J3 Consortium	Kawasaki Sakaide	Jan-84	Japan	S	Moss	5	Darwin
Lala Fatma N'Soumer	145,000	Algeria Nippon Gas	Kawasaki Sakaide	Dec-04	Japan	S	Moss	4	Sonatrach
Larbi Ben M'Hidi	129,750	SNTM-Hyproc	La Seyne	Jun-77	Algeria	S	GT NO 85	5	Sonatrach
Lijmilya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GT NO. 96	5	Various
LNG Abuja	126,530	Bonny Gas Transport	GD Quincy	Sep-80	Bahamas	S	Moss	5	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 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 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
Madrid Spirit	138,000	Teekay LNG Partners	IZAR Puerto Real	Jan-05	Spain	S	GT No 96	4	Engas
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 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 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 Sparta	161,870	Maran	Hyundai Samho	April-15	Greece	DFDE	G TZ Mk. III	4	Various
Maran Gas Troy	155,900	Maran Gas	Daewoo	May-15	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
Matthew	126,540	Suez LNG Shiping	Newport News	Jun-79	Bahamas	S	TZ Mk. I	6	Atlantic LNG
Mekaines	266,000	Naklilat	Samsung	Mar-09	Liberia	DRL	GT No 96	4	Qatar-Atlantic Basin
Meridian Spirit	165,500	Teekay LNG	Samsung	Jan-10	Denmark	DFDE	TZ Mk. III	4	Various
Mesaimeer	210,100	Naklilat	Hyundai	Mar-09	Liberia	DRL	GT No 96	4	Qatar-Atlantic Basin
Methane Alison Victoria	145,000	GasLog	Samsung	Aug-07	Bermuda	S	TZ III	4	Eq.Guinea LNG
Methane Becki Anne	170,000	GasLog	Samsung	Sep-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Heather Sally	145,000	GasLog	Samsung	Jul-07	Bermuda	S	Tz Mk. III	4	Eq.Guinea LNG
Methane Jane Elizabeth	145,000	GasLog	Samsung	Jun-06	Bermuda	TFDE	TZ Mk. III	4	Engas
Methane Julia Louise	170,000	GasLog	Samsung	Dec-09	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Kari Elin	138,200	Shell	Samsung	Jun-04	Bermuda	S	TZ Mk. III	4	Various
Methane Lake Charles	145,000	Shell	Samsung	Feb-07	Bermuda	S	TZ Mk. III	4	Marathon Oil
Methane Lydon Volney	145,000	Shell	Samsung	Aug-06	Bermuda	S	TZ Mk. III	4	Engas
Methane Mickie Harper	170,000	Shell-GasLog	Samsung	Nov-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Nile Eagle	145,000	Shell-GasLog	Samsung	Dec-07	Bermuda	S	TZ Mk. III	4	Engas
Methane Patricia Camila	170,000	Shell-GasLog	Samsung	Oct-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Princess	138,159	Golar LNG	Daewoo	2003	UK	S	GT No 96	4	Spot BG
Methane Rita Andre	145,000	GasLog	Samsung	Mar-06	Bermuda	S	TZ Mk. III	4	Engas
Methane Shirley Elizabeth	145,000	GasLog	Samsung	Apr-07	Bermuda	S	TZ Mk. III	4	Marathon Oil
Methane Sprit	165,000	Teekay LNG	Samsung	Mar-08	Singapore	DFDE	TZ Mk. III	4	Various
Methania	131,230	Distrigas	Boelwerf	Oct-78	Belgium	S	GT No 85	5	Sonatrach
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
Mostefa Ben Boulaid	125,260	SNTM-Hyproc	La Ciotat	Aug-76	Algeria	S	TZ Mk. I	6	Sonatrach
Mourad Didouche	126,130	SNTM-Hyproc	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-Atl'c Basin
Murwab	210,100	J5 Consortium	Daewoo	May-08	Marshall Is.	DRL	GT No. 96	4	Qatargas
Muscat LNG	149,170	Oman Gas/MOL	Kawasaki Sakaide	Mar-04	Japan	S	Moss	4	Oman Gas
Neo Energy	149,700	Tsakos	Hyundai	Feb-07	Liberia	S	GTT Mk II	4	Various
Nizwah LNG	145,000	Oryx LNG Carriers	Kawasaki Sakaide	Dec-05	Japan	S	Moss	4	Oman Gas
Northwest Sanderling	127,525	Australia LNG	Mitsubishi Nagasaki	Jun-89	Australia	S	Moss	4	NWS
Northwest Sandpiper	127,500	Australia LNG	Mitsui Chiba	Feb-93	Australia	S	Moss	4	NWS
Northwest Seaeagle	127,450	Australia LNG	Mitsubishi Nagasaki	Nov-92	Bermuda	S	Moss	4	NWS
Northwest Shearwater	127,500	Australia LNG	Kawasaki Sakaide	Sep-91	Bermuda	S	Moss	4	NWS
Northwest Snipe	127,747	Australia LNG	Mitsui Chiba	Sep-90	Australia	S	Moss	4	NWS
Northwest Stormpetrel	127,600	Australia LNG	Mitsubishi Nagasaki	Dec-94	Australia	S	Moss	4	NWS
Northwest Swallow	127,708	J3 Consortium	Mitsui Chiba	Nov-89	Japan	S	Moss	4	NWS
Northwest Swan	138,000	Australia LNG	Daewoo	Mar-04	Australia	S	GT NO 96	4	NWS
Northwest Swift	127,590	J3 Consortium	Mitsubishi Nagasaki	Sep-89	Japan	S	Moss	4	NWS
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
Pacific Arcadia	147,200	NYK Line	MHI	Oct-14	Bahamas	S	KM		Various
Pacific Enlighten	145,000	LNG MT	Mitsubishi	Mar-09	Japan	S	Moss	4	Various
Pacific Eurus	137,000	LNG Marine Transport	Mitsubishi Nagasaki	Mar-06	Bahamas	S	Moss	4	Darwin
Pacific 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
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
Provalys	153,500	Gaz de France	Chantiers	Nov-06	France	DFDE	CS1	4	ELNG
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	SNTM-Hyproc	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
Salalah LNG	147,000	Oman Gas/MOL	Samsung	Dec-05	Japan	S	TZ Mk. III	4	Oman
SCF Polar	71,500	Sovcomflot	Kockums	Aug-69	Liberia	S	GT NO 82	6	Sonatrach
Seishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Jan-15	Panama	S	Moss	4	Australia-Japan
Seri Alam	138,000	MISC	Samsung	Oct-05	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Amanah	145,000	MISC	Samsung	Mar-06	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Anggun	145,000	MISC	Samsung	Nov-06	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Angkasa	145,000	MISC	Samsung	Feb-07	Malaysia	S	TZ Mk. III	4	Petronas
Seri Ayu	145,000	MISC	Samsung	Oct-07	Malaysia	S	TZ Mk. III	4	Various
Seri Bakti	152,300	MISC	Mitsubishi	Mar-07	Malaysia	S	GT NO 96	4	Petronas
Seri Balhaf	152,000	MISC	Mitsubishi	Sep-08	Malaysia	S	GT NO 96	4	Various
Seri Balquis	152,000	MISC	Mitsubishi	Dec-08	Malaysia	S	GT NO 96	4	Various
Seri Begawan	152,300	MISC	Mitsubishi	Dec-07	Malaysia	S	GT NO 96	4	Various
Seri Bijaksana	152,300	MISC	Mitsubishi	Feb-08	Malaysia	S	GT NO 96	4	Petronas
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 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
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
Wakaba Maru	125,000	J3 Consortium	Mitsui Chiba	Apr-85	Japan	S	Moss	5	Pertamina
WilEnergy	125,500	Awilco LNG	Mitsubishi	Oct-83	NIS	S	Moss	5	Various
WilForce	156,000	Teekay LNG	Daewoo	Aug-13	NIS	DFDE	GT NO 96	4	Various
WilGas	125,500	Awilco LNG	Mitsubishi	Jul-84	NIS	S	Moss	5	Various
WilPower	125,500	Awilco LNG	Mitsubishi	Jul-84	NIS	S	Moss	5	Various
Woodside Cheney	174,000	Maran	Hyundai Samho	March-16	Greece	DFDE	GT No 96	4	Various
Woodside Donaldson	165,500	Teekay LNG	Samsung	Dec-09	Singapore	DFDE	TZ Mk. III	4	Various
Woodside Goode	159,800	Maran	Daewoo	Jul-14	Greece	DFDE	GT No. 96	4	Various
Woodside Rogers	155,900	Maran Gas	DSME	Jul-13	Greece	DFDE	GT NO 96	4	Various
Yari LNG	159,983	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Yenisei River	155,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Various
YK Sovereign	127,125	SK Shipping	Hyundai	Dec-94	Panama	S	Moss	4	Pertamina
Zarga	266,000	QGTC	Samsung	Dec-09	Liberia	DRL	TZ Mk. III	5	Qatar-Atlantic
Zekreet	135,420	J4 Consortium	Mitsui Chiba	Dec-98	Japan	S	Moss	5	Qatargas

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

LNG Import Terminals

Explanatory Notes

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

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

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
Belgium	Zeebrugge	Fluxys	1987	4	380,000
Canada	Canaport Saint John	Irving Oil, Repsol	2009	3	480,000
Chile	Quintero	ENAP, Metrogas, Enagas	2009	3	334,000
	Mejillones	Engie, Codelco	2010	1	175,000
China	Beihai LNG, Guangxi	Sinopec	2015	2	320,000
	Dalian	PetroChina	2011	3	480,000
	Dongguan, Guangdong	Jovo Group	2013	2	160 000
	Fujian LNG (Xiuyu)	CNOOC, Fujian I&D Corp.	2008	2	640,000
	Guangdong	CNOOC,BP	2006	3	480,000
	Haikou, Hainan LNG	CNOOC	2014	3	480,000
	Ningbo, Zheijang	CNOOC, Zhejiang Energy	2012	3	480,000
	Qingdao, Shandong	Sinopec	2014	3	480,000
	Rudong	PetroChina	2011	2	320,000
	Shanghai	CNOOC, Shenergy Group	2009	3	495,000
	Shanghai, Mengtougou	Shanghai Gas	2008	3	120 000
	Tangshan, Hebei	PetroChina	2013	3	480,000
	Tianjin FSRU	CNOOC	2014	1	60,000
	Zhuhai, Gaolan	CNOOC	2013	3	480,000
Dominican Republic	Punta Caucedo	AES Andres	2003	1	160 000
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
Greece	Revithoussa	DEPA	2000	2	130,000
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
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	2	400,000
	Senboku I	Osaka Gas	1972	4	180,000
	Senboku II	Osaka Gas	1977	18	1,585,000
	Himeji	Osaka Gas	1984	8	740,000
	Himeji LNG	Kansai Electric	1979	7	520,000
	Yanai	Chugoku Electric	1990	6	480,000
	Niigata	Nihonkai LNG, Tohoku Electric	1984	8	720,000
	Oita	Oita Gas, Kyushu Electric	1990	5	460,000
	Tobata	Kitakyushu LNG	1977	8	480,000
	Fukuoka	Saibu Gas	1993	2	70,000
	Sodeshi	Shizuoka Gas	1996	3	337,200
	Hatsukaichi	Hiroshima Gas	1996	2	170,000
	Kagoshima	Nippon Gas	1996	2	136,000
	Shin-Minato	Sendai City Gas	1997	1	80,000
	Nagasaki	Saibu Gas	2003	1	36,000
	Sakai	Kansai Electric, Cosmo OIl	2006	3	420,000
	Mizushima	Nippon Oil, Chugoku Electric	2006	2	320,000
	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
	Ishikari LNG	Hokkaido Gas, Tokyo Gas	2012	1	180,000
	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
Korea	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
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
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

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
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	3	480,000
Thailand	Map Ta Phut	PTT LNG	2011	2	320,000
Turkey	Marmara Ereglisi	Botas	1994	3	255,000
	Izmir	EgeGaz	2006	2	280,000
USA	Everett	Suez LNG NA	1971	2	155,000
	Lake Charles	Shell, ETE	1982	4	425,000
	Elba Island	Kinder	2001	5	535,000
	Cove Point	Dominion	2003	5	530,000
	Freeport	Freeport LNG Development	2008	2	320,000
	Cameron	Sempra LNG	2009	3	480,000
	Golden Pass, TX	Qatar Petroleum, ExxonMobil	2010	5	775,000
	Pascagoula, MS	Gulf LNG, Kinder	2012	2	320,000
UK	Isle of Grain	National Grid	2005	8	1,000,000
	South Hook	ExxonMobil, Qatar Petroleum,Total	2009	5	775,000
	Dragon LNG, Milford Haven	Shell, Petronas	2009	2	310,000

LNG Import Terminal Projects

Country	Location/Project	Owners/Project Developers	Start up	Storage Tanks	Storage Capacity
China	Swatuo, Guangdong	CNOOC	2016	2	320,000
	Yingkou, Liaoning	CNOOC	2016	2	320,000
	Qidong, Jiangsu	Shell-Guanghui	studies		
	Yuedong LNG, Jieyang, Guangdong	CNOOC	2016	2	320,000
	Tianjin North	Sinopec	2017	2	320,000
Finland	Pori	Gasum Skangass	2016	1	30,000
	Tornio	Gasum, Skangass	2018	1	30,000
India	Ennore	Indian Oil Corp	2016	2	320,000
	Mundra	Gujarat State Petroleum, Adani Group	2016	2	320,000
	FSRU Andhra Pradesh	Engie, Andhra Pradesh Gas	2016	1	135,000
	Pipovav LNG (FSRU), Gujarat	Swan Energy	2016	2	320,000
Indonesia	Labuhan Maringgai	Perusahaan Gas Negara	2016	1	135,000
Japan	Soma, Fukushima	Japan Petroleum	2017	1	230,000
Malaysia	Lahad Datu LNG, Sabah	Petronas	2016	studies	
Philippines	Pagbilao LNG	Energy World Corp.	2016	1	130,000
UAE (FSRU)	Fujairah	Mubadala	2016	1	135,000
UK	Port Meridian, Barrow-in-Furness	Port Meridian Energy Ltd.	2016	1	150,000
Uruguay FSRU	Montevideo	Gas Sayago, Mitsui Osk Lines	2017	1	230,000

LNG FSRU Import Facilities

Country	Location (Project)	Owners	Start up
Argentina	Bahia Blanca GasPort	Excelerate/YPF Repsol	2008
	Escobar GasPort	Excelerate/Enarsa	2011
Brazil	Pecem, FSRU	Petrobras	2009
	Guanabara Bay FSRU	Petrobras	2009
	Salvador, Bahia FSRU	Petrobras	2013
Egypt	Ain Sokhna, Suez	EGAS, Hoegh	2015
	Ain Sokhna, Suez	EGAS, Golar	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertimana	2012
Italy	Livorno	OLT Offshore LNG Toscana	2013
Jordan	Aqaba, Jordan	Golar LNG	2015
Kuwait	Mina Al-Ahmadi	KPC	2009
Lithuania	Klaipeda	Klaipedos Nafta Hoegh LNG	2014
Malaysia	Malacca FSRU	Petronas	2012
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
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	Browse LNG	Woodside, BHP, BP Chevron, Shell, Mitsubishi, Mitsui	2018+	2	10.0
	Ichthys LNG	INPEX, Total	2017	2	8.4
	Prelude FLNG	Shell, Inpex, Kogas CPC	2017	1	3.5
	Sunrise LNG	Woodside, Osaka Gas, ConocoPhillips, Shell	2020+	1	3.5
	Wheatstone LNG	Chevron, Apache, Shell , Kuwait FPEC	2017	2	9.0
CANADA	Aurora LNG BC	CNOOC, Inpex Corp. and JGC Corp.	2020	4	24.0
	Bear Head LNG, Nova Scotia	LNG Ltd.	2020	4	8.0
	Canaport LNG, New Brunswick	Repsol Irving Oil	2020	studies	
	Cedar 1, 2, 3, Kitimat area	LNG Export Ltd (Haisla)	2020	studies	
	Douglas Channel LNG Bish Cove	Exmar, EDF, ltaGas, Idemitsu	2018	1	1.0
	GNL Quebec, Saquenay	Freestone Capital and Breyer Capital	2020	4	10.0
	Goldboro LNG, Nova Scotia	Pieridae Energy	2020	2	10.0
	Grassy Point LNG	Woodside Petroleum	2020	studies	
	Kitimat LNG, BC	Woodside, Chevron	2020	2	10.0
	LNG Canada, BC	Shell, Mitsubishi, Kogas, PetroChina	2020	2	12.0
	Melford LNG project, Nova Scotia	H-Energy Hiranandani Group	Studies		
	Pacific Northwest LNG, BC	Petronas, Japex, Sinopec, Indian Oil, Brunei Petroleum	2019	2	12.0
	Shell Prince Rupert LNG,BC	Shell	2020	3	21.0
	Steelhead LNG, Bamfield	Steelhead LNG Corp	2020	2	12.00
	Vancouver Tilbury	WesPac Midstream	2020	1	3.25
EQ.GUINEA	Equatorial Guinea Fortuna FLNG	Ophir and Golar LNG	2019	1	2.0
INDONESIA	Abadi FLNG	Inpex, Shell	2019	2	7.5
	Sengkang LNG	Energy World Corp.	2016	4	2.0
MALAYSIA	Bintulu Train 9	Petronas	2016	1	3.6
	Kanowit FLNG (Sarawak)	Petronas	2016	1	1.2
	Rotan FLNG (Sabah)	Petronas	2017	1	1.5
MOZAMBIQUE	Area 1 Onshore	Anadarko Petroleum and partners	2018	2	10
	Area 4 Onshore	Eni and partners	2020	2	10
	Area 4 FLNG	Eni and partners	2019	1	2.5
NIGERIA	NLNG Train 7	NNPC, Shell, BP, Total	2020+	1	8.4
	Olokola LNG	NNPC, Chevron, Shell	2020+	4	20.0
PAPUA NEW GUINEA	Elk-Antelope LNG	Total, InterOil, Oil Search, Petromin	Studies		
RUSSIA	Shtokman LNG Murmansk	Gazprom, Statoil, Total	2020	4	20.0
	Yamal LNG Siberia	Novatek, Gazprom, Total	2018	3	16.5
	Sakhalin II expansion	Gazprom, Shell, Mitsui, Mitsubishi	2020	studies	
	Vladisvostok LNG	Gazprom, Itochu, various	2020	2	10.0
USA	Alaska LNG Nikiski	ExxonMobil, BP, ConocoPhillips, Alaska State	2020	3	20.0
	Annova LNG, Brownsville	Exelon Corp.	2020	6	6.0
	Cameron LNG, Louisiana	Sempra	2018	5	24.92
	Corpus Christi Liquefaction, Texas	Cheniere	2019	5	22.5
	Cove Point LNG, Maryland	Dominion	2018	1	5.25
	Delfin LNG Louisiana	Delfin, Hoegh	2020	3	9.0
	Freeport LNG, Texas	Freeport LNG	2018	4	20.4
	Golden Pass, Texas	Qatar Petroleum, ExxonMobil	2020	3	15.6
	Jordan Cove Energy	Veresen Inc.	2020	2	6.8
	Lake Charles, Louisiana	Shell, ETE	2019	3	15.0
	Live Oak LNG	Parallax	2020	1	5.0
	Louisiana LNG Energy (Mississippi R.)	Parallax, Cheniere	2020	3	6.0
	Magnolia LNG	Louisiana LNG Ltd.	2019	4	8.0
	Oregon LNG	Leucadia Corp.	2020	2	9.6
	Port Arthur LNG	Sempra	2020	2	10.0
	Rio Grande LNG	NextDecade	2020	6	27.0
	Sabine Pass LNG, Louisiana	Cheniere	2016-19	5	22.5
	Southern LNG	Kinder Morgan	2019	4	2.0
	Texas LNG Brownsville	Chandra, Meyer, Samsung, others	2020	2	4.0
	VG LNG (Cameron Parish)	Venture Global	2019	10	10.0
	VG LNG (Plaquemines)	Venture Global	2019	10	20

LNG Exporters

Country	Location/Project	Shareholders	Start up	Liquefaction		Storage	
				Trains	capacity (nominal) mtpa	No. of tanks	Total capacity m^3
ABU DHABI (UAE)	Das Island (Adgas)	ADNOC, Mitsui, BP, Total	1977	2	3.2	3	240,000
			1994	1	2.5		
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mistubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
	Darwin	Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
	Gladstone LNG	Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
	Gorgon LNG	Chevron, Shell, ExxonMobil	2016	3	15. 6	2	360,000
	Pluto LNG	Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
	QCLNG	Shell, CNOOC	2014	2	8.0	2	280,000
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Engie, 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
LIBYA	Marsa el Brega	Sirte Oil (NOC/Shell upgrading)	1970	2	(2.5)	2	96,000
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
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 Island	Statoil, Total, GDF-Suez, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG Mitsubishi, Mitsui, Partex and Itochu	2000	2	7.1	2	240,000
		Oman Govt.,Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
PAPUA NEW GUINEA	PNG LNG	ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-TI	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, Suez, 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	1	4.5	5	800,000
	Kenai - Alaska	ConocoPhilips, Marathon Oil	1969	2	1.3	3	108,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000

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