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40 pages essential LNG news!
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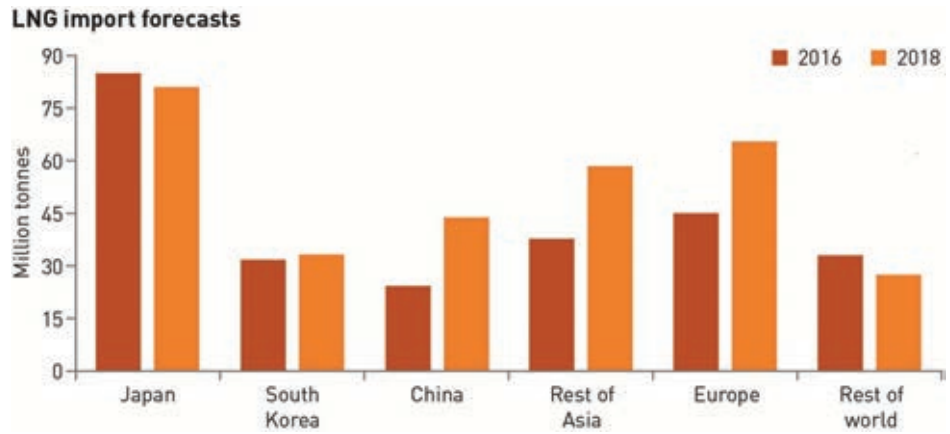
Slow pace of investments may lead to balanced LNG market by 2025

As Australian surge is complete, the worldwide surplus was likely to be smaller than expected in years ahead

Liquefied natural gas producers around the world are once again considering new investments in liquefaction and regasification ventures as expectations of an over-supply recede in the face of continued demand from China and other nations.

Since it normally takes more than four years from a final investment decision to producing the first cargoes, there is still seen to be a shortage of FIDs in the pipeline if there is going to be sufficient volumes available in the mid-2020s.



How LNG import volumes have evolved in the past two years

Projects

Previous forecasts for a global glut were based on the market being swamped by eight new Australian LNG projects, plus at least four in the United States, as well as a handful of others in countries such as Mozambique in southeast Africa.

Chinese consumption has changed the dynamics of the market and it is now the world's second-biggest LNG buyer, behind Japan, and its demand has continued to grow rapidly, with first-quarter imports by almost 60 percent from 2017 at 12.4 million tonnes following last year's record imports of over 38MT.

The Beijing government's policy to replace coal with natural gas for uses such as residential heating and some industries is expected to continue to drive growth in LNG imports, though some moderation in the rate is likely in coming years between surges in economic growth.

However, Asian countries are also stepping up LNG imports, including new buyers such as Bangladesh and Pakistan and with others in the region such as Sri Lanka and the Philippines also likely to add to future LNG demand.

At the height of the LNG construction boom of the past decade, forecasts of a surplus of as much as 50 million tonnes per annum around the start of the 2020s were not uncommon.

While a surplus is still expected by most analysts, size estimates have been shrinking, and if China continues to increase its demand at current rates, the surplus could disappear.

Speakers at a recent Australian conference in Adelaide, said the worldwide surplus was likely to be as little as 10MT in the early years of the 2020s.

Analysts said that in a total market of more than 350MT a year, such a small surplus really amounts to a market that is more or less in balance.

Surplus

They add that by 2025 the market was likely to switch to an annual shortfall of about 50MT as not enough projects are progressing towards FIDs over the next two years.

In 2017, just one LNG project reached FID, that being the relatively small Coral floating LNG development in Mozambique.

There is also a dearth of shovel-ready projects that can be approved and developed in time for 2025, with the best prospects in the United States, Canada and East Africa.

In Australia, the likelihood of a new greenfield development is slim, given the massive capital costs of developing increasingly remote fields.

There is instead the possibility of expanding existing operations, with the likely best bet being Woodside Petroleum's plan to use the Scarborough field off the Western Australian coast to feed a new train at its Pluto LNG plant.

For the rest of Australia, the industry seems to be concentrating on developing new fields to replace ones that are depleting, thus allowing the existing 80 million tonnes of capacity to continue operating.

The evaporation of the expected LNG surplus may also have implications for pricing and contracting in the industry.

LNG buyers have led the charge in recent years to end long-term, restrictive contracts linked to crude oil prices in favour of shorter-term or even spot deals with prices linked to LNG indexes or other natural gas prices, such as the U.S. benchmark Henry Hub.

The buyers did this because they believed the balance of market power was shifting in their favour. They may now find resurgent producers kicking them back and demanding higher prices in order to guarantee supplies.

Balance sheets

Natural gas producers with strong balance sheets likely will drive the next wave of investment in liquefaction terminals and export projects, according

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to US investment bank Goldman Sachs.

Its review of the global gas markets, focused on the likely role of exploration and production companies in financing new LNG capacity.

Many consuming companies may lack the risk appetite for long-term fuel supply agreements, but producers may be better placed to mitigate the risks.

"Moreover, natural gas has the more attractive long-term demand outlook of all fossil fuels, and producers are likely to respond by allocating it some of their growth capital," explained Goldman.

"In our view, a greater willingness to take on price risk should reduce the historical dependency on long-term contracts and leave producers firmly in the driving seat," it said.

Whereas a consumer could be exposed to one sector, such as power generation in one region, with limited visibility on long-term demand, E&P companies are exposed to all end-use sectors and regions.

The bank report argued that E&P companies benefit from the "diversification of risk to the extent that a negative demand shock in one market, whether from a change in regulation or in the business cycle, can be offset by a positive shock in another region".

Diversification

Its report cited an example that included four of the largest companies in each sector, indicating that the average market capitalization of an E&P company was an order of magnitude larger than that of a utility.

A minority offtake from a new LNG Train was seen as being a bigger commitment for a major utility than a full Train is for a major E&P company.

In addition, natural gas was regarded as having a more attractive long-term demand outlook for all fossil fuels, with demand increasing by around 1.7 percent a year to 2035, about four times faster than oil.

"We believe producers are likely to respond by allocating a greater share of their growth capital to gas production, including LNG," said the Goldman report.

Larger majors such as Royal Dutch Shell and BP are expected to increase their natural gas portfolios through LNG projects.

Mozambique

Anadarko Petroleum Corp. is another company advancing with contracts for the proposed onshore Mozambique LNG export project.

The US company is helped by the fact that "regional price spreads are significantly higher" in LNG relative to other commodities," added the report.

The latest wave of global LNG projects should be online by mid-2020. Projects sanctioned later this year, which may include the Shell-led LNG Canada project in British Columbia, could be completed after a hiatus in new liquefaction capacity of two to three years.

"On that basis, we expect large E&Ps to drive the next wave of investment in the months ahead," stated the report.

At the same time, the larger Japanese engineering companies, among the most experienced in the LNG liquefaction plant construction sector, are expecting more work.

Chiyoda Corp has set its construction order target for fiscal 2018 at 800 billion yen ($7.2Bln), 2.6 times that of the previous year.

Texas

Among its projects are the transformation of the Golden Pass LNG import terminal in Texas into an export facility planned by Qatar Petroleum, ConocoPhillips and ExxonMobil Corp.

It is also involved in the Mozambique onshore LNG development led by Anadarko, and also involving Japan's Mitsui & Co.

Another Japanese engineering company, JGC Corp., has set its fiscal 2018 construction order target at 1 trillion yen, among the highest in its history.

Shell's LNG Canada began issuing preliminary construction orders for the plant with JGC chosen along with Fluor Corp of the US. The FID is expected by the end of 2018.

JGC also has a preliminary offer for plant construction at the Jordan Cove project in the northwest US state of Oregon being developed by the Canadian infrastructure company, Pembina Pipeline Corp. of Calgary. ■

US regulator forecasts change in global market dynamics in contracting and risk management

CFTC expects US LNG exports to benefit from fast growth and competitive price advantages

The US Commodity Futures Trading Commission (CFTC) issued a report in May 2018 assessing the market impacts due to the US transitioning from being a net importer to a net exporter of LNG.

The CFTC came up with several main findings, including that global LNG trade growth is expected to continue with US LNG exports benefiting from "a rapid growth rate and a competitive price advantage".

It also noted that rising US LNG exports are affecting global market dynamics, including contracting and risk-management practices in CFTC regulated markets.

Pressure

Additionally, LNG export growth on the Gulf Coast and elsewhere may put upward pressure on domestic natural gas prices and expose a hitherto relatively isolated North American market to outside market influences.

"In aggregate, US LNG export plants in operation and under construction have a capacity of 10 billion cubic feet per day, which is about 13 percent of US dry production," said the CFTC in the report's executive summary.

"Aside from limited pipeline gas traded with Canada and Mexico, US natural gas has been relatively insulated from international market dynamics," it said.

"Increasing exports of LNG from the US may mean that the domestic market will be influenced more by global forces," added the report.

Futures

Natural gas is one of the major derivatives markets under CFTC regulation.

CFTC-regulated exchanges list approximately 180 futures and options contracts with open interest.

The reference natural gas futures trade on the New York Mercantile Exchange is the Henry Hub contract and currently has open interest of around 1.5 million contracts, with trading in the average range of 200,000 to 500,000 lots per day with a peak of over 1 million lots on January 12, 2018.

"Besides the reference contract, natural gas futures include financial, basis, and spread contracts. These contracts together have an open interest of 18 million, second only to the 3-month Eurodollar," explained the CFTC.

The regulator noted that it was rare for a new market to spring into existence in a sector as large and mature as natural gas.

"The amount of capital to be invested and the consequences will have a profound impact," stated the CFTC.

Opinions

"Thus, there is no shortage of opinions from market observers about what the future holds," it added.

Market forces resulting from growth in US LNG exports

"Much of the financial trading in natural gas is 'basis' trading, reflecting the need to hedge differences between the reference Henry Hub futures contract and the myriad of production, aggregation and demand hubs (market centers)," the report explained.

"LNG transportation via ships has changed the dynamic that natural gas at the receipt point (production source) of the pipeline can only serve the downstream delivery location (demand sink) of the pipeline by opening up new international markets with the consequent global pricing influence,' it said.

LNG was previously known as a fuel traditionally produced by local distribution companies for use as peak storage to provide supplemental gas supply on the coldest winter days.

There are over 110 small-scale LNG plants operating in the US with the vast majority owned and operated by state-regulated utilities.

The US also imports LNG to supply natural gas to New England where peak demand exceeds pipeline capacity.

Shale effect

LNG provides about 8 percent of New England's annual supply. However, with the development of shale production, LNG imports into New England have declined over time.

LNG annual imports at the Distrigas terminal in Massachusetts, the Everett facility, through November 2017 were 66 percent less than a decade ago.

US utility Exelon Generation in April 2018 signed an agreement to purchase the Everett terminal, the oldest such facility operating in the US, from the North American subsidiary of French utility Engie.

The Everett terminal, for example, has connections with two interstate pipeline systems, as well as a local gas utility's distribution system.

Everett was the first domestic LNG import facility to receive 1,000 cargoes and reached that landmark in 2010.

All of these segments have seen development and investment, with notable improvements in efficiency.

Output

Shale production of natural gas has fundamentally altered the market in the US, providing LNG exporters a significant competitive advantage.

LNG shipping has also seen significant developments and improvements in efficiency:

- Between 2012 and 2016 charter rates for advanced LNG ships has declined from over $150,000/day to $33,500/day.
- The global fleet of LNG tankers has expanded rapidly, with 31 new tankers added in 2016, bringing the total fleet to 478 vessels, double the number of 10 years ago.

The regasification sector has also seen improvements in efficiency as a result of the expanding use of Floating Storage and Regasification Units (FSRUs).

These units are cheaper and faster to build than land-based regasification units and can be re-deployed to other areas if needed.

Factors

All of these factors have helped increase global LNG trade, and this trend is likely to continue in the future.

The US transitioned from being a net

"Increasing exports of LNG from the US may mean that the domestic market will be influenced more by global forces," added the report.

FERC ESTIMATES THE COST OF THE FOUR SEGMENTS IN THE VALUE CHAIN ARE:	
Exploration & Production:	$0.90/MMBtu +/- $0.30
Liquefaction:	$1.10/MMBtu +/- $0.20
Shipping:	$1.15/MMBtu +/- $0.65
Storage & Regasification:	$0.50/MMBtu +/- $0.10
Total Cost:	**$3.65/MMBtu +/- $1.25**

FERC estimates of costs in four segments of value chain

importer to a net exporter of LNG in 2016 with the commencement of Cheniere's Sabine Pass terminal in Cameron Parish, Louisiana.

In March 2018, Dominion Energy's Cove Point Terminal in Calvert County, Maryland, began exporting, which brought the aggregate US export capacity in operation to 3.7 billion cubic feet per day.

Within 20 years, EIA forecasts that US LNG exports will grow to 14 Bcf/day, while BP forecasts a more bullish 19 Bcf/day.

Liquefaction facilities for LNG exports require significant capital: Cheniere is investing over $17 billion at Sabine Pass for Trains 1-5 and has another plant in Corpus Christi, Texas under construction.

A major driver of US LNG export projections is the low natural gas prices resulting from shale production.

Advances

The shale revolution began in earnest in 2008 stimulating significant increases in production of oil and natural gas in the country.

The revolution is the product of advances in oil and natural gas production technology, notably horizontal drilling and hydraulic fracturing.

In addition to these developments, high global oil prices also played a role in spurring investment in shale production.

"The seven US shale regions produce the bulk of current US supply, with Marcellus and Utica basins (Appalachian) accounting for about one-third of the US total dry production," the CFTC noted.

"Shale gas is projected to account for 42 Bcf/day in new supply by 2035, which is 33 percent of global supply growth," it added.

Demand

Worldwide natural gas demand is forecast to grow at 1.6 percent per annum and is the only hydrocarbon with a growing share of global energy supply. The biggest demand will come from Asian economies, followed by Europe.

"Projections show that much of this demand growth is in regions with insufficient domestic production and infrastructure, and LNG imports into these regions are expected to meet the shortfall," said the CFTC.

"One industry analysis forecasts that global LNG trade will double over the next two decades, after increasing four-fold over the past 20 years," it stated.

Key drivers for demand growth include:

- Global gross domestic product (GDP) is forecast to grow 3.4 percent per annum, almost doubling in the next 20 years.
- Economic growth in countries with insufficient energy resources and related pipeline and storage infrastructure. Many Asian markets rely solely on LNG for their natural gas needs. In China, growth in gas consumption (5.4 percent per annum, 36 Bcf/day by 2035) is expected to outstrip domestic production, such that the share of imported gas in total consumption is expected to rise to nearly 40 percent by 2035, up from 30 percent in 2015.
- Push for cleaner energy: environmentally, natural gas is the cleanest hydrocarbon, emitting 30 percent less CO2 per Btu than fuel oil.
- Japanese demand has grown as a result of the shut-down of nuclear plants after the Fukushima disaster.
- European demand for LNG is also increasing due to energy security concerns. The EU receives 39 percent of its natural gas from Russia and diversity of supply through LNG imports support strategic objectives of diversity of energy supplies. In 2017, the Cheniere's Sabine Pass Louisiana plant exported LNG to Italy, Spain, Lithuania, and Poland among other EU countries.
- Electric power generation is the sector with the largest projected increase in gas consumption. BP estimates that two-thirds of the increase in global energy consumption over the next 20 years will be for power generation. Several European countries have policies encouraging the closure of nuclear power plants, increasing demand for power generation.
- Finally, as discussed earlier, developments and investments in all segments of the LNG value chain, from natural gas production to LNG storage and regasification, have made LNG trade more economic and hence helped increase demand.

Prices

Historically, global LNG prices were indexed to oil prices. With the shale revolution starting about a decade ago, US natural gas prices declined significantly and became significantly lower than oil prices on a per million British thermal units (MMBtu) basis.

"This price advantage of natural gas versus oil created a competitive advantage for US companies to export to global buyers. This business can be thought of as an arbitrage between low domestic prices and high global prices, although it is not an inexpensive opportunity to exploit," said the CFTC.

"The decline in oil prices over the last few years has reduced, but not eliminated, the competitive advantage of US natural gas-indexed LNG, and illustrates the risks inherent in such investments," it added.

"In addition to pricing advantages, note that well-functioning and liquid physical and derivatives markets also play a part in enabling LNG exports by providing buyers effective means to procure gas and hedge their exposures," said the report.

"Qatar is the largest exporter of LNG followed by Australia. Current LNG exports from the US are very low relative to total global supply, but it is expected to grow significantly over the next 20 years," it added.

BP estimates that by 2035 the US will be exporting 19 Bcf/day, or 25 percent of global trade. The Energy Information Administration projects 14 Bcf/day of US LNG exports with most of that growth coming in the next three or four years.

The CFTC noted that LNG exports from the US could be affected by growth and investments by other LNG exporters. Qatar recently announced plans to increase LNG production by 30 percent by 2024, ending a moratorium of its North Field resources in the Persian Gulf that had been in place since 2005.

"In addition, changes in global LNG market practices may influence US exports, as could developments in the natural gas production sector. The net result of these uncertainties is that the realized exports of LNG from the US could vary widely from the estimates," stated the CFTC.

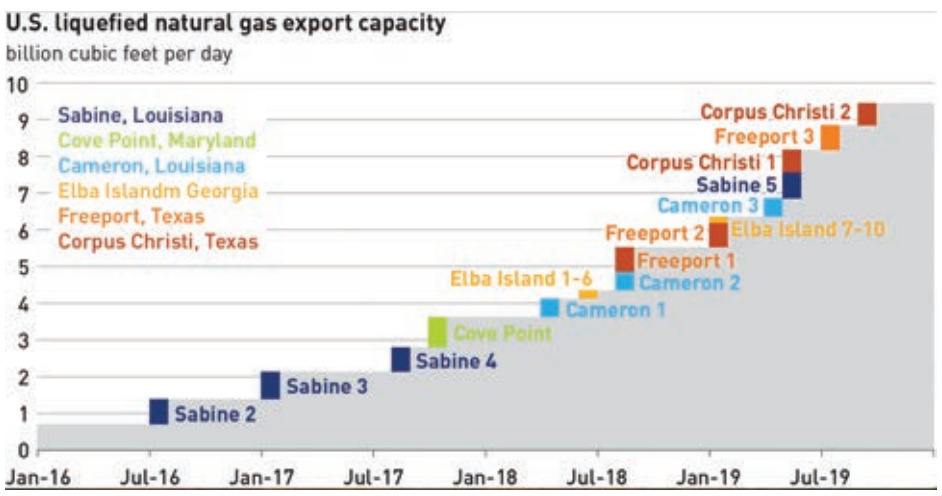
Mechanism

Recently, there has been a trend towards indexing LNG prices to natural gas benchmarks with less reliance on global oil benchmark escalation clauses for physical LNG delivery contracts.

The entry of the US as a substantial exporter of LNG will further this trend. The International Gas Union has said that the share of European import contracts indexed to oil has decreased from over 90 percent to less than 40 percent in 10 years and newer contracts are much more likely to be indexed to natural gas.

"The same trend holds to a lesser degree in Asia. This change towards gas-indexed pricing for LNG may put pressure on US LNG exports, because US natural gas has less of a pricing advantage against other natural gas supplies than it does against oil," said the report.

Another contract practice change is the trend towards shorter term contracts. An EIA compilation of survey data from the International Group of LNG Importers (GIIGNL) showed spot and short-term



Rising liquefaction plant output through 2019 (Source: EIA)

deals had grown five-fold from a 5 percent market share in 2000 to over 25 percent in 2015.

This growth is the result of several key factors:

- The growth in LNG contracts with destination flexibility, which has facilitated diversions to higher priced markets.
- The increase in the number of exporters and importers, which has increased the complexity of the industry and introduced new permutations and linkages between buyers and sellers. In 2016, 29 countries (including re-exporters) exported spot volumes to 35 end-markets. This compares to six spot exporters and eight spot importers in 2000.
- The lack of domestic production or pipeline imports in Japan, South Korea and Taiwan, which has pushed these countries and others to rely on the spot market to cope with any sudden changes in demand like the Fukushima crisis.
- The decline in competitiveness of LNG relative to coal in some countries and shale gas (North America) that has freed up volumes to be re-directed elsewhere.
- The large disparity between prices in different basins from 2010 to 2014, which made arbitrage an important and lucrative monetization strategy.
- The faster development timeline and lower initial capital costs of FSRUs compared to onshore regasification, which allow new countries to enter the LNG market.
- The large growth in the LNG fleet, especially vessels ordered without a long-term charter, which has allowed low-cost inter-basin deliveries.

Along with the increase in LNG demand, the increase in spot trading has increased the demand for derivatives. Asian LNG derivatives volumes quadrupled in 2017 on strong demand for physical LNG in China.

In 2017, reports show that exchanges such as the Intercontinental Exchange and the Chicago Mercantile Exchange cleared 50,236 lots of LNG swaps

contracts linked to the S&P Global Platts Japan Korea Marker index, up from 12,717 lots the previous year.

Additionally, the increased demand allowed for a surge in Asian LNG prices to a three-year record of more than $11 per million British thermal units at the end of 2017.

"Overall, the shift towards shorter contracts is likely to be driven more by demand than supply. However, it may benefit US LNG exports to certain markets, depending on geographic accessibility," said the CFTC.

Over time, estimates are that both US production and LNG exports will increase. In 2017, Cheniere's Sabine Pass terminal exported 209 cargoes totaling 706 Bcf, which was 2.6 percent of US dry gas production.

"By 2022, EIA projects US dry gas production to increase by 30 percent. Factoring in plant utilization and netting LNG imports, expectations are that net LNG exports will be approximately 11 percent of US dry production by 2025," added the report.

"Production estimates for 2040 are in the range of 114-118 Bcf/day. Estimates of LNG exports vary even more widely, with estimates ranging from 6 to 29 Bcf/day," it stated.

"For the purpose of this report, a reasonable range of estimates for LNG exports appears to be between 9-20 percent of US production of natural gas," said the report.

Some conclusions

"The shale revolution had reshaped the energy industry and given rise to US exports of oil and natural gas. The glut of US shale supply has coincided with a global shift to natural gas from other fossil fuels.

"Exporting US natural gas to countries other than Canada and Mexico requires that it be liquefied for transport by ocean-going tankers.

"The combination of global demand growth and US price-competitive, reliable supply has led to significant investments in LNG that in turn are impacting energy markets," said the report.

"Global LNG trade has increased sharply over the last decade, and there are strong indications that this trend will continue. The US LNG industry has already made significant investments in LNG export capacity and further increases are underway.

"Under current market conditions, US exports enjoy a competitive advantage that is also expected to continue for the foreseeable future. As a result, estimates are that the US will become one of the largest exporters of LNG," it added.

"However, exports from the US will likely face competitive pressures, ranging from low oil prices, to competitive responses by other exporters," said the CFTC.

"One example of this is the global move to gas-indexed LNG pricing; since natural gas in producing countries is typically cheaper than oil (on a per MMBtu basis), this puts competitive pressure on US exports.

Increase

"As US LNG exports increase, some studies suggest that domestic natural gas prices could increase. Estimates of this impact vary widely, from negligible to 9-20 percent over time. The biggest variable in determining the magnitude of this potential impact is the production response from domestic natural gas producers," it explained.

"Over time, US production has become more efficient and if this trend continues, LNG exports will have a lower impact on domestic prices.

"Given the magnitude of US exports, there is also the potential that domestic natural gas markets could become subject to global supply-demand dynamics with the potential for increased volatility," said the report.

"The LNG market is evolving to shorter contract durations and more spot transactions. These factors point to an increased need for derivatives markets for hedging, and recent experience supports this point.

"Additionally, as gas-indexed contracts become more prevalent, and US exports increase, it is very likely that trading in US derivatives markets will increase as a result, especially by overseas traders," the CFTC concluded. ■

For the Record

ABU DHABI National Oil Company (Adnoc), the leading energy group in the United Arab Emirates and a long-standing LNG exporter, plans to expand by investing $45 billion with partners in various downstream projects in the next five years as it also boosts natural gas production. The plans were unveiled in Abu Dhabi at the Adnoc Downstream Investment Forum. "The unprecedented investment programme will underpin a new downstream strategy to significantly expand Adnoc's refining and petrochemical operations at Ruwais in the UAE, and involve highly targeted overseas investments to secure greater market access," said Adnoc. Adnoc's existing and sizeable downstream portfolio comprises eight companies processing 10.5 billion standard cubic feet of gas per day, and with a refining capacity of 922,000 barrels per day of condensate and crude. They also produce some 40 million tons per year of refined products. The UAE is one of the oldest LNG producers from the Das Island plant offshore Abu Dhabi consisting of three Trains that process an average of 8 million tonnes of LNG per annum from associated and non-associated gases. The Das Island LNG plant, commissioned in 1977, is run by Adgas, a subsidiary of Adnoc and mainly supplies Japan. The UAE is also an LNG importer at facilities in Dubai and Ruwais to help meet its own domestic gas needs. Moves are also under way to boost Abu Dhabi's gas production and the emirate in January 2018 awarded the two front-end engineering and design contracts for its planned offshore sour gas mega-project, consisting of the Hail, Ghasha and Dalma fields. The Hail-Ghasha-Dalma project is forecast to produce about 1 billion cubic feet of sour gas per day when completed.

"Building on the existing strengths and competitive advantages of the Ruwais Industrial Complex, Adnoc will create the world's largest and most advanced integrated refining and petrochemicals complex," said Adnoc. Ahmed Al Jaber, UAE Minister of State and Adnoc Group Chief Executive, said that given the projected increase in demand for petrochemicals and higher value refined products, the company was repositioning itself to become a leading global downstream player. "We will invest significantly in Ruwais and open up attractive partnership and co-investment opportunities along our extended value chain to create a powerful new downstream engine and springboard for growth that will benefit our country, our company and our partners," said Al Jaber. "Importantly, the expansion plans for Ruwais will also support Abu Dhabi and the UAE's economic development and diversification, create high-skilled jobs and enhance the country's status as a globally attractive destination for energy investments," he added. "The unique competitive advantages and world-scale of Ruwais, combined with a $45 billion investment plan and our ambitious smart growth strategy, create a unique opportunity for Adnoc to redefine the global refining and petrochemicals landscape," stated Al Jaber. The infrastructure requirements for the sour gas venture alone include a minimum of 11 offshore artificial islands to be designed and constructed. The project, in the northwest offshore area of the UAE, could meet 20 percent of domestic gas demand by the second half of the next decade.

AIR PRODUCTS, the US maker of equipment for liquefied natural gas production and for industrial gas plants, said it had completed the acquisition of the Coal Gasification Technology licensing business from Shell Global Solutions. The US company said it also formed a strategic alliance with Shell for residue gasification technology to refinery complexes. "The acquisition includes Shell's associated patent portfolios for solids (coal and biomass) gasification and sharing of patent rights for residue and biomass gasification," said Air Production without releasing financial details of the transaction. "These moves extend Air Products' offerings in synthesis gas (syngas) to provide turn-key sale-of-gas gasification facilities for solids (coal and biomass) and liquids (refinery residues). In its business model, Air Products finances, builds, owns, operates and maintains the gas production plant, enabling customers to focus their attention and capital on their primary business. Air Products now has immediate access to Shell's proven technology and a successful business, with that technology already in place at nearly 200 gasification systems delivering syngas around the world," said Seifi Ghasemi Chairman, President and Chief Executive of Air Products.

"Beyond a strong operating base, we now have a robust technological foundation that builds on our core focus supplying the full range of industrial gases to our customers," he stated. The company explained that gasification technologies offer a way to take varied lower-value feedstocks and convert them in a lower-emission manner into syngas. Air Products added that Shell has been at the forefront of gasification research and innovation over the past 50 years, with reports showing 170 Shell gasification process (SGP) and 34 coal gasifiers built, and currently, 96 SGP and 24 Shell coal gasification process gasifiers in operation worldwide. "The core value of this acquisition is the ability to build on more than 40 years of Air Products' gasification experience and the opportunity to fully explore sale-of-gas outsourcing options to produce and supply syngas for customers planning to use gasification," said Ghasemi. "This is a great fit for us as Shell's strong track record in reliability and efficiency complements our own sale-of-gas offerings, which have the highest reliability levels," added the CEO. The company stated that the acquisition of Shell's gasification process capabilities will further support previously announced projects by Air Products such as a project at Changzhi in the Shanxi province of China.

ALASKA LNG, the project to export the state's North Slope natural gas resources to Asia, has reached an agreement with BP of the UK and Alaska Gasline Development Corp. on feed-gas supplies, including price and volume. The parties anticipate finalizing a long-term gas sales agreement in 2018 for AGDC to purchase BP Alaska's share of 30 trillion cubic feet of gas from the Prudhoe Bay and Point Thomson units. BP operates the Prudhoe Bay field, the largest oil and gas field in North America and owns a 26 percent share of Prudhoe Bay as well as a 32 percent share of the nearby Point Thomson field. "BP has a long history in Alaska and Prudhoe Bay," said Bob Dudley, BP Chief Executive. "We are very pleased to be part of the State's vision to bring Alaskan natural gas to new and expanding markets globally. We think this is good for the State, good for BP and good for the environment," stated Dudley. AGDC represents the state within the Alaska LNG project and the company pointed out that the BP feed-gas deal that will enable a pipeline to deliver the gas from the north to a liquefaction plant in south-central Alaska is a boost for the venture. It comes six months after President Donald Trump and Chinese President Xi Jinping witnessed the signing in Beijing of a five-party joint development agreement to monetize Alaska's natural gas with financial backing from China.

AGDC and the state signed a joint development agreement in November 2017 with three Chinese companies, China Petroleum & Chemical Corp., also known as Sinopec, as well as the financial institutions, the Bank of China and China Investment Corp. "This (BP) gas sales agreement is a significant factor in progressing the Alaska LNG project," said AGDC President Keith Meyer. "We have secured the customers, we have progressed on the pipeline build with regulators and the finance community and now we have a commitment that there will be gas to sell and put through the pipeline," added Meyer. "I look forward to continued negotiations to secure supply from other North Slope producers," he stated, in reference to companies such as ExxonMobil Corp. and ConocoPhillips. Alaska Governor Bill Walker thanked BP for its commitment to the project that aims to produce an initial 20 million tonnes of LNG for export and to also supply the domestic market. "This agreement means Alaskans are one step closer to cleaner air, more jobs and more affordable energy to power homes and businesses," said Walker. "Having BP, one of our long-time partners on this project, commit its share of the gas for sale underscores the progress we continue to make as we work toward building a stronger Alaska," added Walker. Janet Weiss, BP Alaska President, said the Alaska LNG project "has made significant progress" over the past year and BP was pleased to sign the agreement. "This is an important project for the future of the Alaska oil and gas industry," stated Weiss.

ANADARKO Petroleum has named former BG Group executive Mitch Ingram as Executive Vice President for International, Deepwater and Exploration to lead the US company's overseas operations and project management, including the Mozambique LNG joint venture in southeast Africa. The company also announced that Ernie Leyendecker, who previously held the post, was retiring after more than 30

years in the oil and natural gas industry. Anadarko, whose headquarters are in The Woodlands, near Houston in Texas, has received approval for the development plan for the onshore liquefaction plant and related facilities in Mozambique to be constructed on the Afungi Peninsula at Cabo Delgado in the northeast of the country. Ingram, from Scotland, joined Anadarko in 2015 as its Global Head of LNG from BG where he had served as Executive Vice President of the technical division and worked on the Queensland Curtis LNG export project in Australia, now owned by Royal Dutch Shell. "Since joining Anadarko in 2015, Mitch has been an invaluable member of the company's executive management, as he established a deep and experienced global LNG team that is now approaching a Final Investment Decision in Mozambique," said Anadarko Chairman, President and Chief Executive Al Walker. "His strong leadership, technical and organizational skills will enable us to continue being a respected exploration company that combines exceptional geoscience knowledge with peer-leading technology advancements," added Walker.

The Anadarko CEO also thanked Ernie Leyendecker for his service to the company. "Ernie added value serving in a number of positions during his career with Anadarko in the areas of worldwide exploration, engineering and planning. He will be missed, and we wish him the best in his retirement," said Walker. Anadarko is proceeding with development of the Golfinho-Atum natural gas discoveries with its partners in the licence for offshore Area 1 of the Rovuma Basin. The project will be the African nation's first onshore development, initially consisting of two Trains with total nameplate capacity of almost 12.9 million tonnes per annum. Anadarko has a 26.5 percent stake in the Mozambique Area 1 and Japanese trading house Mitsui holds 20 percent. Three Indian companies, Bharat Petro Resources, ONGC Videsh and Oil India Ltd., hold a further 30 percent. The other stakeholders are the Thai energy company PTT Exploration & Production and the Mozambique state-owned oil and gas firm ENH. Anadarko said that the foundation project paves the way for significant future expansion of up to 50 MTPA from other fields in offshore Area 1. Anadarko disclosed on February 2018 that it had signed its supply agreement with French utility Electricite de France (EDF) for a period of 15 years. The US company said the accord was signed on behalf of the Area 1 licence shareholders and would amount to 1.2 MTPA of LNG. The EDF deal takes portfolio sales for the project to more than 5 MTPA.

AUSTRALIAN energy executives have said at a conference in Adelaide that it would be more economic to ship natural gas as LNG from the West Coast to the East Coast rather than build a trans-Australia pipeline. Santos Chief Executive Kevin Gallagher said at the annual conference of the Australian Petroleum Production and Exploration Association that a West-East pipeline would be the least viable option for tackling regional natural gas supply shortfalls. Gallagher's company has stakes in the Gladstone LNG plant in Queensland, which it also operates, and in the ConocoPhillips-run Darwin plant in the Northern Territory as well as the ExxonMobil-operated Papua New Guinea plant and expansion project. He was speaking as his own company was the subject of a $10.4-billion takeover offer made by a subsidiary of US equity firm EIG Global Energy Partners. "The one that would be the bottom of the list would be a pipeline from the West Coast to the east Coast," he said. A government-led feasibility study is examining the potential of a West-East natural gas pipeline to supply eastern and southern markets with Western Australia's abundant supplies as an alternative to domestic LNG shipments. A gas pipeline from Western Australia's Pilbara region to the Eastern states has won the backing of many because of gas shortages and higher prices in East Coast states such as Queensland and New South Wales. One outline plan is for a pipeline to be laid from the northwest of Western Australia along a 1,500 kilometres route to link with existing processing and storage facilities at the town of Moomba in the northeast region of the state of South Australia and 770 kilometres north of the state capital of Adelaide. At the same time, several plans are being developed for LNG regasfication facilities near cities such as Sydney to handle West-East LNG shipments.

"You can actually ship Australian gas round to the East Coast a hell of a lot cheaper than building a pipeline from the Pilbara to say, Moomba," said Gallagher. "I just don't see how the economics of it will ever work," stated the CEO. Using Western Australia's domestic gas reservation policy as an example, the Santos CEO told the conference that the industry should be prepared to accept a form of domestic reservation when developing onshore gas in the Northern Territory, for example, where a ban on fracking has just been lifted. He warned that a too formal gas reservation policy would make large-scale development uneconomic. "However, industry should be open to discussions with government, gas users, unions and communities about sensible ways to make available an agreed portion of Northern Territory gas for the domestic market," he said. Meanwhile, Santos issued yet another note on May 16 on the Harbour Energy takeover proposal in relation to one of its largest shareholders, the ENN Group of China. It cited the Chinese company as saying that no agreement had been reached between Harbour and ENN in relation to the transfer of its shares. Santos confirmed that the strategic agreement between Santos, ENN and Chinese equity fund Hony Capital, who hold a combined 15 percent of Santos, remained in effect. "This requires ENN and Hony to procure the exercise of voting and disposal rights attaching to their Santos shares in accordance with a majority recommendation of the Santos Board in relation to a third-party change of control proposal" said Santos. "Santos continues to advise that its shareholders take no action in relation to the Harbour proposal at this time," it added.

BANGLADESH, the world's newest liquefied natural gas importer with a floating regasification and storage unit provided by Excelerate Energy of the US at Moheshkhali Island on the Bay of Bengal, has signed an LNG supply agreement with the Sultanate of Oman. Oman Trading International (OTI), a subsidiary of Oman Oil Co, said it had signed a 10-year accord to sell LNG to Bangladesh state-owned energy company PetroBangla to supplement the Asian nation's main supplies from Qatar. The arrival of the FSRU, the "Excellence", in April 2018 set in motion the first of two Bangladesh import projects with the Moheshkhali Island venture co-developed by PetroBangla, Excelerate and the International Finance Corporation, part of World Bank Group. The "Excellence" will enable Bangladesh to import around 3.5 million tonnes per annum of LNG. An onshore gas pipeline connects the FSRU to Chittagong, the Bay of Bengal port and the country's second-largest city after the capital Dhaka. Regular supplies will come from Qatar under a 15-year supply agreement with Bangladesh for volumes of 2.5 MTPA. Under the Oman deal, PetroBangla will receive 1 MTPA of LNG once the Asian nation completes the installation of its second LNG import facility in 2019.

"This marks an import milestone in the relationship between Oman and Bangaldesh," said Chief Executive Talal Al Awfi of the Omani trading company OTI. "Oman already exports oil products to Bangladesh and we are pleased to sign this strategic long-term supply agreement," added Al Awfi. "We also look forward to expanding our footprint in Bangladesh's growing market" said the CEO. In addition to trading crude, petroleum products and chemicals, OTI commenced its LNG trading business in 2016 after the amalgamation of the Sultanate's two liquefaction plants, Oman LNG and Qalhat LNG. The country's three liquefaction Trains are now under the Oman LNG flag and the facilities near Sur on the Arabian Peninsula are expected to be at full capacity in 2018 after suffering several years of domestic gas shortages. The Omani government has now allocated Oman LNG with supplies from various gas fields, including the large Khazzan field brought on stream by BP of the UK in 2017. Said Al Maawali, Vice President of LNG and Business Development at OTI, said Oman was delighted to have signed its Bangladesh contract. "OTI is keen to collaborate with governments and partners who have a strategic and cultural fit with us in order to expand our LNG business globally," said Al Maawali. "Bangladesh is an important market for OTI and we are pleased to have PetroBangla as a strategic partner in the LNG sector," he added.

BP, the UK energy major, has entered into a 20-year sales and purchase agreement for the supply of 2 million tonnes per annum from a plant under development at Calcasieu Pass in Louisiana. The developer of the liquefaction plant is Venture Global, a company also building a second export facility on the Mississippi River at Plaquemines Parish. Under the BP agreement, the cargoes will be purchased on a free-on-board basis, whereby BP will provide its own shipping, from the Calcasieu Pass plant, expected to start operations in 2022. Venture Global's Calcasieu Pass facility will be on a 1,000-acre site located at the intersection of the

Calcasieu Ship Channel and the Gulf of Mexico and will produce 10 MTPA. Venture Global's second plant at Plaquemines is proposed for 630 acres of land near river mile-marker 55 on the west side of the Mississippi, 30 miles south of New Orleans. The Mississippi River project will produce 20 MTPA of LNG and will also include small-scale liquefaction Trains, four LNG storage tanks and three marine loading berths.

"We are delighted that BP, one of the world's leading international oil and gas companies, has committed to purchase 2 MTPA from our Calcasieu Pass LNG export facility, bringing our total contracted quantity under binding 20-year SPAs to 6 MTPA," said joint chief executives Mike Sabel and Bob Pender. "BP joins Venture Global's other world-class LNG partners, including Shell, Edison S.p.A.(Italy) and Galp (Portugal)," they added. "As we finalize our arrangements for Calcasieu Pass and proceed towards financing, we have now begun to execute binding commitments for our Plaquemines project, which will also supply low-cost, long-term LNG to our global customers," they said. Portuguese energy company Galp Energia was the most recent signatory before BP of a 20-year SPA for FOB cargo volumes of 1 MTPA from the Calcasieu Pass plant. Portugal's sole import terminal at Sines, owned by Galp and located south of Lisbon, has already received US cargoes from the Sabine Pass plant in Louisiana, operated by Cheniere Energy. The second Venture Global project at Plaquemines on the Mississippi additionally involves the development of its Gator Express Pipeline venture. Gator Express involves two local natural gas supply pipelines that would connect the LNG plant to the existing interstate natural gas grid.

CAMERON LNG, the existing US import terminal at Hackberry in Louisiana being transformed into an export plant, is expected to have three processing Trains in operation in 2019 after resolving scheduling issues with the contractors. Owner Sempra Energy, the California-based utility, settled a dispute

with the contractors, Chicago Bridge & Iron (CB&I), including financial claims relating to contract completions in the aftermath of Hurricane Harvey. The engineering, procurement and construction (EPC) contract was signed in 2014 with CB&I, now merged with McDermott International, for a cost of around $10 billion. "We continue to believe this agreement puts both the contractor and Sempra in a stronger position to meet the current schedule," said Chief Executive Jeff Martin in a conference call about first-quarter earnings. The LNG project is a joint venture led by Sempra and also now involving French energy major Total after it acquired the stake of French utility Engie. The Japanese companies Mitsui & Co., Mitsubishi Corp. and the Nippon Yusen Kabushiki Kaisha (NYK Line) shipping company are also shareholders. The new agreement to bring Cameron LNG onstream provides incentive bonus payments related to completion and waivers any schedule-related damages from the original contract.

Sempra is also transforming its Costa Azul LNG facility on the Pacific coast of Mexico into an export plant, though is scaling back its plans. The Sempra Mexican subsidiary, Infraestructura Energetica Nova (IEnova), is now looking at a small-scale plant with 2.5 million tonnes per annum of output by around 2023 instead of a larger plant constructed later with up to 12 MTPA of capacity and closer to the size of Cameron LNG. Across the southern border, Sempra's IEnova subsidiary is also developing a marine terminal near the LNG facility north of Ensenada in Baja California state. It would be IEnova's fourth refined product terminal in Mexico. A third LNG export is also advancing in the US under Sempra's proposals along the Sabine-Neches Waterway at Port Arthur in southeast Texas with Australian company Woodside Petroleum as one of its partners. The San Diego, California-based company is also looking to its newly expanded presence in Texas to boost future earnings. Sempra in March 2018 closed a transaction to acquire Energy Future Holdings Corp., the indirect owner of 80 percent of Texas-based Oncor Electric Delivery Co. In the coming year CEO Martin said he expected the Oncor business to account for between $320 million and $360M of earnings. Sempra reported first-quarter earnings of $347M compared with $441M in the same three months of 2017. The company's Southern California Gas Company, the main provider of natural gas to the south of the West Coast state, posted earnings for the three months of $225M, an increase from the $203M in the year-ago quarter.

CHEVRON Corp. Australian Managing Director Nigel Hearne has called for the sharing of LNG infrastructure among the major operators of four world-class liquefaction plants in Western Australia to improve energy economics and profitability. Speaking at the Adelaide conference organized by the Australian Petroleum Production and Exploration Association, Chevron's Hearne outlined a concept for the sharing by rival gas producers of LNG infrastructure while continuing to competitively develop the many offshore gas fields. Hearne's company is operator of the Gorgon LNG plant on Barrow Island and the Wheatstone plant near Onslow in the Pilbara region of Western Australia with other major shareholders including Royal Dutch Shell, Woodside Petroleum, ExxonMobil and Japanese utilities. The US major's two plants have cost a combined A$90 billion (US$68Bln) to construct and develop and Hearne sees his proposal as a case of project economics. The two other liquefaction plants in Western Australia, the North West Shelf facility and Pluto LNG, are operated by Woodside and Chevron is not among the stakeholders. Hearne said he could imagine an interconnected Carnarvon Basin where a multi-user offshore pipeline brought gas from the undeveloped Scarborough, Thebe and Exmouth fields to the North West Shelf, Pluto and Wheatstone LNG production facilities. "Something like this would enable gas from offshore fields to flow to where it is needed, and when it is needed via an onshore interconnector across the Burrup Peninsula," he told the annual gathering of the Australian oil and gas industry attended by 2,000 people. "Combining this with existing pipelines to shore that interconnect with the Dampier-Bunbury natural gas pipeline, the opportunities for system optimisation and value creation are mind boggling," stated Hearne.

Hearne called the pipeline concept a Trans-Carnarvon Basin Trunkline. "If we get it right, it optimises development of potentially stranded resources and has superior economics over individual or 'point-to-point' concepts, keeping LNG and domestic gas plants full for longer and helping secure Australia's energy future," he said. His concept could see Chevron gas processed at the Woodside-operated North West Shelf and Pluto LNG facilities and the gas of others processed at Chevron's Wheatstone plant. "There's room for all the resource in all the plants. There's a very efficient way to do that if we collaborate to do so. We're almost agnostic as to where the gas goes," said Hearne. The Chevron executive compared the concept to how the airport operates. "If you're flying into Perth you don't have the Virgin Australia airport and the Qantas airport you have one airport," he said. "I don't mind if Chevron gas goes through a different plant as long as you can get access to lift your equity LNG and tie it to your customer base," added Hearne. The APPEA and its conference bring together the industry to help promote the development of the oil and gas resources in a manner that maximises the return to the industry and community. While supportive of the Chevron concept, Woodside Chief Executive Peter Coleman said that the taxation system and the financial structures of companies in Australia did not encourage such cooperation. "The current tax structures just don't encourage it, it's going to take some time to work through that," Coleman told the conference. "But it shouldn't stop us working on it at all," added Coleman. Coleman said that getting producers to work to the same timeline also presented a challenge, given that Woodside was already working on a plan to pipe gas onshore from the undeveloped Scarborough field to its Pluto LNG plant.

DNV GL, the European classification society and the Finnish Meyer Turku Shipyard signed a contract to class Royal Caribbean International's new class of vessels mainly powered by liquefied natural gas. The contract covers two vessels with delivery scheduled for 2022 and 2024. "It is a proud day for DNV GL to have been entrusted with the classification of the first vessels of the new Icon Class," said Knut Ørbeck-Nilssen, Chief Executive of DNV GL's maritime division. "These ships are set to push the envelope of what we can expect from a modern cruise vessel in terms of environmental performance, and we are looking forward to supporting Royal Caribbean and Meyer Turku to realise a successful delivery," added Knut Ørbeck-Nilssen. DNV GL, one of Europe's largest class societies, was created from the 2013 takeover by Norway's class society Det Norske Veritas of the Hamburg-based society, Germanisher Lloyd. "LNG is envisioned as the primary fuel for the new vessels, which would dramatically reduce or even eliminate emission of nitrogen oxide (NOX), sulphur oxide (SOX) and particulates, as well as cutting carbon dioxide (CO2)," said DNV GL.

"The Icon Class will also introduce fuel cell technology, which in combination with hull air lubrication means that the ships could potentially be some of the most fuel-efficient cruise vessels ever constructed," explained the class society. Paal Johansen, Global Cruise Ship Director of DNV GL, said the Royal Caribbean contract was a huge win. "This signing shows that Royal Caribbean trusts us to deliver on their most ambitious project yet, and it is a testament to the strong relationship between Meyer Turku, our local office in Finland and our wider network of cruise experts," said Johansen. "Following on from the delivery of the 'Symphony of the Seas', the largest cruise ship ever built, we look forward to continuing to deliver on our promise to provide the best service and deep technical expertise," he stated. DNV GL added that the final concept for the first vessel was currently being discussed and the concept design phase is expected to start soon. "The initial building phase of the first ship will begin next year, with keel laying planned for October 2019," said DNV GL.

DORIS Engineering, the French energy contracts company with global operations, said it completed a study for Western Gas, an Australian operator based in Perth and developing the Equus natural gas field offshore Western Australia. Doris said Western Gas has a time-scale on the project located on the North West Shelf to have first gas by 2023. The gas could come ashore near one of the three world-class onshore LNG liquefaction plants in the area as well as associated domestic gas plants. "The Paris and Perth teams successfully interfaced with Western Gas which allowed Doris Engineering to demonstrate its strong capabilities in performing screening and concept selection studies for subsea developments," said Doris, whose project experience stretches back to the 1970s in the UK North Sea. Benoit Lamoureux,

Doris Managing Director for the Asia-Pacific region, said Western Gas has been able to take advantage of the French company's strong track record in field development studies. "We engaged with Western Gas locally and delivered a fit-for-purpose study that met Western Gas's expectations and needs," said Lamoureux. "We look forward to continuing our working relation with Western Gas and wish them the best for Equus," he added. Andrew Leibovitch, Chief Executive of privately-held Western Gas, said he was appreciative of the efforts of the Doris team. "Doris's work was of high quality and we will definitely consider their engineering support in the future," added Leibovitch.

Western Gas is the owner and operator of the Equus Gas project and is seeking a project development partner. "Thanks to Doris, Western Gas was able to investigate alternative options for developing the Equus field, which allowed us to move forward with our base case and consequently issue a Request for Proposals (RFP) to secure a local partner," said Leibovitch. "Project development services being sought by Western Gas embrace full field development, including drilling, subsea, offshore processing and a gas pipeline to shore," he stated. "We have resized the project to match the discovered gas resource and to meet gas customers' needs for long-term secure contracts and innovative pricing," he added. "We're now moving forward to secure a project partner and bring this gas to market," said the CEO. Western Gas acquired the Equus Gas project from the New York-based US energy company Hess in November 2017. Hess had previously considered seeking a third-party LNG production arrangement with Woodside Petroleum, operator of the North West Shelf LNG plant for its offshore natural gas assets in Western Australia. The Australian company noted that more than US$1.5 billion has been spent on exploration, appraisal, engineering and development planning for the Equus field. The project comprises an independently certified resource of

2 trillion cubic feet of gas and 42 million barrels of condensate. "The resource is sufficient to supply one quarter of Western Australian domestic gas demand or two tonnes of LNG a year for 20 years," said Western Gas.

EGYPT is planning LNG production from feed-gas transported to its existing liquefaction plants near Alexandria via a pipeline linked to the Aphrodite natural gas offshore Cyprus as part of an East Mediterranean project costing up to an initial $1 billion. Egyptian Petroleum Minister Tarek El Molla said at a news conference in Cairo with Cyprus Energy Minister Yiorgos Lakkotrypis that gas belonging to the Greek-speaking half of Cyprus would be used in part for domestic consumption and in part for export for Egypt's LNG output. Egypt has rapidly increased its own production of natural gas in the past 12 months and hopes to become a hub for exporting to Europe after making a series of big discoveries in recent years in the East Med and the Nile Delta. The Arab nation is aiming to halt LNG imports by the end of 2018 because of the huge volumes provided for the domestic market, particularly from the Zohr field in Egyptian waters of the East Med discovered and developed by Italian company Eni. The resumption of small-scale Egyptian LNG production has already started at its Idku LNG liquefaction plant near Alexandria. A second facility is at Damietta. Molla said Egypt was negotiating an agreement with Cyprus for a pipeline to transport gas from the Aphrodite field to its LNG facilities. The Aphrodite field was discovered in 2011 by Noble Energy of the US and has estimated reserves of at least 4.5 trillion cubic feet.

Cypriot Energy Minister Lakkotrypis said his island nation expected to sign a final agreement on the pipeline as soon as possible. The Aphrodite natural gas discovery had previously been the subject of plans for Cyprus to build its own onshore liquefaction plant at Vasilikos. Currently Cyprus's 15,000 square kilometre Exclusive Economic Zone (EEZ) has 13 exploration blocks located to the south of the island. Some estimates suggest that Cyprus could be sitting on over 40 Tcf of natural gas and it is likely that a significant portion of energy will be exported, bringing in revenue and helping economic growth. Molla said that Egyptian domestic gas production had increased to 5.7 billion cubic feet per day in March 2018 as a result of new production coming online, up from 5.5 Bcf/d in February. A total of 20 wells are expected to be drilled in the Egyptian Zohr field by the end of 2019 by operator Eni. Eni has just started up the second production unit of the Zohr project, which will increase installed capacity by 400 million standard cubic feet per day.

FLUXYS of Belgium, the operator of the Zeebrugge LNG terminal as well as the Belgian natural gas network and gas trading operations, has carried out its first trans-shipment operation before it starts its business of handling cargoes from the Yamal liquefaction plant in the Russian Arctic region from 2019. Fluxys said the terminal performed its first direct ship-to-ship transfer on May 2. The Belgian company signed an agreement as far back as 2015 to handle carriers for unloading and re-loading enroute from the Yamal plant at Sabetta in Siberia and which started operations in December 2017. The Arctic plant is owned by Russian natural gas company Novatek, France's Total and China National Petroleum Corp. During the first direct ship-to-ship transfer at Zeebrugge, the 172,000 cubic metres capacity Arctic carrier "Eduard Toll" transferred to a conventional vessel, the 170,200 cubic metres capacity "Pskov". The "Edouard Toll" is part of the fleet of custom-built and strengthened Arctic LNG vessels to serve the production facility in Siberia. There have already been trans-shipment operations in 2018 for Yamal cargoes at the French Montoir-de-Bretagne on the Atlantic Coast and the Dutch Gate terminal in Rotterdam.

However, the Fluxys terminal is now formally part of the logistical chain after the trial to enable supplies from the Yamal Peninsula to reach Europe, Asian-Pacific countries and South America. This will enable LNG to flow even when winter navigation is closed on the Arctic Ocean's Northern Sea Route to Asia. "The Zeebrugge LNG terminal has been preparing for direct ship-to-ship trans-shipment operations since commissioning of the second jetty at the facility in late 2016," said Fluxys. The Zeebrugge facility and Yamal Trade have signed a 20-year agreement for up to 107 trans-shipments per year. The agreement will operate fully from 2019 when a fifth storage tank will be commissioned at Zeebrugge. "This will make trans-shipment arrangements more flexible as LNG storage allows for ship-storage-ship transfers not requiring both LNG carriers to be moored at the terminal simultaneously," explained Fluxys.

INDIA attracted 110 bids for its first open-acreage round for oil and natural gas exploration and production licences for 55 blocks onshore and offshore as the nation also continued to build its LNG import volumes to meet rising demand and to expand energy infrastructure. Nine Indian-based companies submitted the bids for 55 blocks offered. The bids were for 92 onshore blocks and 18 offshore blocks, according to the Indian Ministry of Petroleum and Natural Gas. The Ministry said it would endeavour to award the blocks by June 2018 so as to expedite the start of exploration activities. The participating companies included five Indian public-sector operators, Oil and Natural Gas Corp. (India), Oil India Ltd., Gas Authority of India, IndianOil Corp. Ltd (IOCL) and Bharat Petroleum. Four private companies took part. They were named as Vedanta, Selan, Hindustan Oil Company and Sun Petro. "The response to the OALP Bid Round has been overwhelming compared to the last round of E&P auctions under the previous regulatory regime in 2009-2010," said the Ministry. "Policy reforms have improved the ease of doing business by introducing a transparent regulatory framework," it added. Out of 55 blocks on offer 46 blocks are onshore and eight blocks are in shallow water and one block in deep water. These 55 blocks are spread across 10 sedimentary basins covering 60,000 square kilometres, namely: Assam-Arakan (19), Mumbai Offshore (2), Cambay (11), Rajasthan (9), Krishna-Godavari (5), Cauvery (3), Kutch (2), Saurashtra (2), Himalayan Foreland (1) and Ganga (1) basins.

The latest Indian bidding followed a decision by BP of the UK and India's Reliance Industries to develop the second phase of a $6-billion deepwater natural gas project to open new Indian production when the nation is also increasing its LNG imports and expanding its regasification and pipeline infrastructure. BP and Reliance in April 2018 sanctioned what they call a "satellite cluster" project in natural gas fields in the Krishna Godavari Dhirubhai Block 6 offshore the East Coast of India. The project covers more than 19,000 square miles offshore the state of Andhra Pradesh in the Bay of Bengal. The KG-D6 block was Reliance's first offshore gas field development and its first underwater discovery. It was also India's largest deposit of natural gas when first found in 2002. Imports of LNG by India for the month of March jumped 16.8 percent compared with the year-ago period and were more than 7 percent up on the previous fiscal year as shipments were received from traditional supplying nations such as Qatar and Nigeria and newest supplier the United States. Cargo deliveries to India's three main import terminals at Dahej, Hazira and Dhabol near the West Coast port of Mumbai amounted in March to 1.86 million tonnes of LNG. India is trying to expand its domestic production. Its gross output of natural gas for the month of March 2018 was 2.78 Bcm versus 2.75 Bcm in the same month of 2017, a rise of 1.18 percent. The cumulative domestic natural gas output for fiscal 2017-2018 was 2.35 percent higher at 32.64 Bcm versus 31.89 Bcm in the previous fiscal year.

JAPAN is pushing ahead with development of LNG bunkering infrastructure Four Japanese companies have formed two joint ventures to develop the LNG fuel market in the nation's ports, similar to operations started in the northwest European ports of Rotterdam in the Netherlands and Zeebrugge in Belgium. Japanese utility Chubu Electric Power has joined with two shipping companies, Kawasaki Kisen Kaisha (K-Line) and Nippon Yusen Kabushiki Kaisha (NYK-Line) as well as trading group Toyota Tsusho to establish the bunkering joint ventures after months of talks. "The four companies have been in joint discussions on the commercialization of the LNG bunkering business in the Chubu (central region) of Japan," said a statement. "The companies have now agreed to launch the business and on May 10 established two joint ventures to run LNG bunkering," they added. "Going forward, each of the four companies will utilize the expertise and strengths that they each possess to propel the ship-to-ship bunkering," stated the companies. They noted that LNG was expected to become an important alternative to heavy fuel oil due to its low emission rate of air polluting substances and greenhouse gases. The Japanese ventures come at a time when the International Maritime Organization is leading global efforts for stricter reductions in harmful emissions from

ships. Ship owners and operators are choosing LNG fuel over traditional marine fuels in response to stricter sulfur and nitrogen-oxide emissions regulations, including the IMO's implementation of a global 0.5 percent sulfur cap from 2020.

Emission Control Areas have also been formed around the ports and shipping lanes of Northwest Europe, North America and the Caribbean. One of the Japanese LNG maritime fueling joint ventures will be called the Central LNG Marine Fuel Japan Corp. and the other will be known as the Central LNG Shipping Japan Corp. Japanese companies, including NYK Line, already have a presence in the fast developing European bunkering market. The Japanese businesses are likely to be modelled on the one operated by French utility Engie with NYK Line and the trading house Mitsubishi Corp. Engie and its partners use the LNG bunkering vessel "Engie Zeebrugge", a 5,000 cubic metres capacity fueling ship, to fulfil current and future contracts in the area of the ports of Rotterdam and Zeebrugge. The "Engie Zeebrugge" carried out its first bunkering operation at Zeebrugge in April 2017 and has since bunkered many other vessels. Engie, Mitsubishi and NYK have set up a marketing company called Gas4Sea to develop the LNG fuel market in Northwest Europe. The "Engie Zeebrugge" was built at the Hanjin Heavy Industries and Construction Co. shipyard in the port of Busan in South Korea and delivered in February 2017. Other similar vessels are on order. The vessel regularly takes on LNG at Zeebrugge where carriers deliver shipments from Qatar and elsewhere and where docking is also provided for small-scale tankers supplying the regional market on a break-bulk basis.

JAPANESE liquefied natural gas imports dropped 14.7 percent in April as shipments from Asia, the Middle East and the spot market fell and thermal coal purchases were preferred to LNG for power generation as the nation reined in its energy spending. The LNG imports amounted to 5.60 million tonnes in April

compared with 6.57MT in April 2017, according to the preliminary trade figures from the Japanese Finance Ministry. Japan's LNG purchase in March had amounted to 7.93MT compared with 8.14MT in the same month the previous year. LNG shipments fell as imports of thermal coal for power generation increased by 6.7 percent during April to 8.74MT. The cost of the LNG shipments also dropped year-on-year by 4 percent on lower volumes. The April imports cost 295.89 billion yen ($2.66Bln) compared with 308.26Bln yen ($2.77Bln) in April 2017. The cost of the shipments had jumped by around 12 percent in March to 413.43 billion yen ($3.85Bln) compared with 368.74Bln yen ($3.43Bln) in March 2017. Japan's nuclear power plants, numbering more than 50, were largely still offline in April with only four currently operating. The Ministry data for April showed that Asian shipments from nations such as Malaysia and Indonesia, Papua New Guinea and Brunei plunged by 39 percent from April 2017 to 1.31MT.

Imports from the Middle East region dropped 8.4 percent with shipments from countries like Qatar, the United Arab Emirates and Oman totalling 1.23MT in April. Russian monthly shipments from the Sakhalin Island plant in the Far East were little changed from the same month last year at 469,000 tonnes. Imports from the US were markedly down in April to just 70,000 tonnes from the Cheniere Energy-owned Sabine Pass plant in Louisiana versus 129,000 tonnes in March. The balance of imports from other nations in the preliminary figures for April amounted to 2.02MT versus 3.14MT in March with most volumes coming from Australia, as well as some shipments from Africa and the spot market. Japan had ended the year with an LNG import tally in 2017 of 83.63MT, just 0.4 percent higher than the 2016 total but with high costs. Japan paid 19.3 percent more in 2017 for its LNG with 3,915 billion yen ($35.58Bln) of expenditure versus 3,281Bln yen ($29.81Bln) in 2016 for its 83.34MT.

Analysts forecast that annual Japanese imports will edge lower over the next few years to offset high oil prices.

JGC CORP., the leading Japanese LNG engineering and construction company, said it had formed a US strategic partnership with a Texas-based, privately-held US company to offer joint engineering, procurement and construction services for projects. JGC, whose headquarters are in Yokohama, said its agreement was with S&B Engineers and Constructors Ltd, whose offices are in Houston. The Japanese company is a world leader in building liquefaction plants and has worked on the leading plants worldwide, most recently in constructing the Gorgon and Ichthys LNG plants in Australia and the Yamal LNG facility in Arctic Russia. S&B Engineers is a family-owned company led by President and Chairman James G. Slaughter Jr., the son of co-founder, James G. Slaughter. The company has served the chemicals and midstream energy businesses in the Gulf Coast region for more than 50 years. "Leveraging the experience and complementary expertise of both companies, the partnership covers a full range of lifecycle services for the oil and gas, petrochemicals and chemicals markets," said JGC. The two companies said they would focus on winning preliminary feasibility studies, front-end engineering and design, as well as EPC and project management contracts. JGC and S&B have previously worked on several EPC projects on the US Gulf Coast. "Joining efforts in the US market will position both companies to better serve clients by offering a partnership that draws on JGC's global engineering and procurement expertise and S&B's direct-hire construction and local procurement capabilities," said Takehito Hidaka, President of JGC America.

"We look forward to collaborating with S&B and providing a competitive and valuable choice for our clients," added Hidaka. James Brookshire, Chief Executive of S&B and the grandson of the founder and son of the current Chairman, noted that both JGC and S&B would benefit from the deal. "This framework agreement for future collaboration is a major step for us moving forward. We share very similar safety, business, and ethical cultures and together we form the preeminent lump sum EPC contractor in the region," stated Brookshire. It is JGC's second cooperation agreement in the past month. In April, it signed a cooperation deal with a major shipyard in northeast China to seek contracts for floating and modular LNG projects. JGC's accord was with China Offshore Oil Engineering Co., based in the Chinese port of Tianjin, and includes construction of FLNG production hulls and Floating Production, Storage and Offloading Facilities for oil and gas. The Japanese-Chinese FLNG and modular project alliance is for an initial period of five years and is in the form of a strategic co-operation agreement. COOEC constructed the core modules for JGC for the Yamal liquefaction plant located near the port of Sabetta in Arctic Russia as part of a contract awarded in 2014 and worth $1.64 billion.

KOSMOS Energy, the US company based in Dallas with plans for floating LNG projects offshore the West African states of Senegal and Mauritania, saw its net losses widen in the first quarter as it continued to develop its joint venture with BP of the UK. Exploration and production company Kosmos said it generated a net loss of $50.2 million compared with losses of $28.8M in the same three months of 2017 as it also pursued projects in other African nations such as Ghana and Equatorial Guinea. Kosmos said its main highlight in the quarter was the February signing by the governments of Mauritania and Senegal of an Inter-Governmental Cooperation Agreement (ICA) which enables the development of the cross-border Tortue natural gas field to continue moving forward. "With this agreement in place and all front-end engineering and design contracts now awarded by the operator (BP), Kosmos expects a final investment decision for the Greater Tortue project around the end of 2018 and is aiming for first gas in late 2021," said the US company. Golar LNG, the Bermuda-based fleet operator and project company, signed a preliminary charter agreement in April 2018 on the provision of a floating LNG production hull for the FLNG. Golar will proceed with front-end engineering design on behalf of BP's two project companies, BP Mauritania Investments and BP Senegal Investments in their capacity as block operators.

The agreements commit the parties to negotiate future commercial terms for the development of the first phase of the Greater Tortue-Ahmeyin natural gas field on the offshore maritime border between Mauritania and Senegal. Kosmos has estimated that the Greater Tortue Complex has resources for LNG production of around 25 trillion cubic feet of feed-gas and an additional 15 Tcf is contained in nearby fields. "Kosmos is off to a good start in 2018 across all three areas of our business," said Andrew G. Inglis, Chairman and Chief Executive. "The Tortue gas development, which represents the next phase of major production growth for Kosmos, continues to move forward at pace with all FEED contracts now awarded and a clear path to FID around year end," added Inglis. "In addition, we have a balanced exploration portfolio with multiple, visible opportunities in proven, emerging, and frontier basins, including two exploration wells offshore Suriname this year," stated the CEO. "Strong and growing production from our high-margin assets in Ghana and Equatorial Guinea continues to generate significant free cash flow, underpinning our solid financial position," added Inglis. The first gas from the Kosmos-BP FLNG Train 1 is scheduled for 2021 and the start of the second FLNG Train is set for 2023. Golar will again use the Singapore-based Keppel Shipyard, which successfully delivered the first LNG carrier converted into an FLNG hull, the "Hilli Episeyo", now deployed and in production offshore the West African state of Cameroon. US company Black and Veatch Corp. would provide its liquefaction processing technology for the FLNG hull. TechnipFMC, the French-US energy engineering company, was awarded a FEED contract by BP, also in April, for a floating production storage and offloading unit that will be part of the Senegal-Mauritania FLNG production infrastructure. TechnipFMC said its agreement with BP was expected to lead to an engineering, procurement, construction and installation contract at a later stage.

LNG CANADA, the largest export project proposed for the Pacific Coast province of British Columbia, could hold a ground-breaking ceremony before the end of 2018 as the joint venture led by Royal Dutch Shell gets back on track. The Chief Executive of LNG Canada, Andy Calitz, said the investor group had been making steady progress in the 22 months since plans were suspended to construct the export facility and liquefaction plant near the town of Kitimat. Calitz said a wide range of stakeholders such as equipment suppliers, engineering consultants, Indigenous leaders and local mayors have been following LNG Canada's efforts to relaunch the venture since the final investment decision was postponed in July 2016. "At that time when they asked the inevitable question, our answer was, 'We will be in construction in 2018.' I reaffirm that commitment," said Calitz at the Canada

Gas and LNG conference in Vancouver. He said Shell and its three partners in LNG Canada are keen on exporting from Kitimat to Asian markets. "External market conditions in terms of oil prices, free cash flow, energy prices and just the supply-demand balance didn't make sense in July, 2016," the CEO added. Shell Canada President Michael Crothers had said earlier that management was "cautiously optimistic" about going ahead with the start of building. Shell holds a 50 percent stake in the project, PetroChina has 20 percent and Korea Gas Corp. and Japan's Mitsubishi Corp. each own 15 percent. The BC provincial government has given LNG Canada until November 2018 to accept an incentives offer to build the facility. If it were to move forward, LNG Canada would export up to 3.7 billion cubic feet per day of the Canadian gas glut to Asian markets

Energy project construction companies JGC Corp. of Japan and Fluor Corp. of the US were awarded an engineering, procurement and construction order in April 2018 to design and build the plant. The BC government has offered incentives amounting to US$4.8 billion in provincial income, sales and carbon tax cuts to build the facility. However, LNG Canada has yet to give a specific date for a construction ceremony in regard to the November deadline. The liquefaction plant is proposed for a coastal brownfield site acquired several years ago near Kitimat and is expected to cost around US$11Bln using modular construction methods. Additional costs will include feed-gas supplies and an investment in the multibillion-dollar TransCanada pipeline project, the Coastal GasLink. LNG Canada already holds a 40-year export licence from the National Energy Board for exports of domestic gas overseas, though further final permits are required, including one from the federal government. While BC province itself formerly had 20 LNG export ventures on the table, there are now only two others moving forward, the small-scale Woodfibre LNG venture at Squamish in BC and the Steelhead LNG venture on Vancouver Island. The Canadian federal government had given conditional approval to the large-scale Pacific NorthWest LNG project proposed by Malaysian energy company Petronas. However, Petronas cancelled the project, mainly because of the economics when oil prices were lower.

MARATHON Oil Corp. and its partners said they signed an agreement with the Government of Equatorial Guinea and third parties to establish the framework for processing natural gas volumes at the onshore liquefaction plant at Punta Europa on Bioko Island. The accord for the LNG plant on third-part volumes also applies to the Alba Plant for liquefied petroleum gas. "With the Punta Europa facilities becoming a hub for the potential development of local and regional natural gas, the project will sustain the operating rates of the Alba Gas Plant and prolong the life of the EG LNG plant, both of which are proven integrated gas assets with high reliability and low capital demands," said Marathon. The Equatorial Guinea LNG plant began production in May 2007 and its single processing Train currently produces 3.7 million tonnes per annum.

The shareholders of EG LNG's holding company include Marathon, Sonagas and Japan's Mitsui & Co. and Marubeni Corp. The US company holds a 60 percent equity interest in the LNG plant. EG LNG was contracted to Royal Dutch Shell under a 17-year agreement inherited from BG Group of the UK. BG originally signed that deal to ship the LNG cargoes to the Lake Charles import terminal in the US state of Louisiana before the shale-gas expansion turned the US into an exporter. The Equatorial Guinea national energy company is a stakeholder in the Marathon plant and is also currently backing a separate floating LNG export venture offshore the West African nation involving companies such as Ophir Energy of the UK and Golar LNG. The existing onshore LNG processing facilities require only minor modifications to accommodate the third-party gas. New volumes from the third party are anticipated to be available from after 2020.

MITSUI & Co., the Japanese trading house and stakeholder in the Mozambique onshore LNG project led by Anadarko Petroleum of the US, said it expected a final investment decision on the joint venture by the end of the year. "The FID on the Mozambique Area 1 project during this financial year is in our sights," said Mitsui Chief Executive Tatsuo Yasunaga at a Tokyo meeting. "Spending on the 2 trillion yen ($18 billion) project will start in the following financial year," added Yasunaga. The Anadarko-led Mozambique LNG project will be the African nation's first onshore development, initially consisting of two Trains with total nameplate capacity of almost 13 million tonnes per annum. Anadarko has a 26.5 percent stake in the Mozambique Area 1 licence area of the Rovuma Basin and Mitsui is a main shareholder with 20 percent, held with the Japan Oil, Gas and Metals National Corporation (Jogmec), the Japanese state-run strategic investment company. Three Indian companies, Bharat Petro Resources, ONGC Videsh and Oil India Ltd., hold a further 30 percent combined.

The other stakeholders are the Thai energy company PTT Exploration & Production and the Mozambique state-owned oil and gas firm ENH. Mitsui and its partners have previously said the foundation project paves the way for significant future expansion of up to 50 MTPA from other fields in offshore Area 1. The liquefaction and export plant will be constructed near the port of Pemba in the northeast Cabo Delgado Province and will have an initial 30-year lifespan. The Mozambique joint venture is continuing to sell LNG volumes and most recently signed up French utility Electricite de France (EDF) as a buyer for a period of 15 years. The sales accord signed on behalf of the Area 1 licence shareholders would amount to 1.2 MTPA of LNG. The EDF deal takes portfolio sales for the project to more than 5 MTPA. The stakeholders in another licence area of the Rovuma Basin, Area 4, led by Italian energy company Eni, are also advancing with their separate floating production project called South Coral FLNG.

NOVATEK, the independent Russian natural gas company and majority owner of the Yamal LNG plant, said it aimed to create an LNG shipping subsidiary called Maritime Arctic Transport as part of its strategy to build a second Arctic liquefaction plant and to produce total volumes of more than 50 million tonnes per annum. "Novatek's long-term development strategy envisages a significant growth in LNG production from the company's vast hydrocarbon resource base located on the Yamal and Gydan peninsulas in the Arctic zone of more than 55 million tonnes per annum by 2030," said Novatek Chairman Leonid Mikhelson. "Therefore, establishing an efficient Northern Sea Route shipping

model is one of our key priorities to realize our long-term strategy," explained Mikhelson. "Creating our own shipping company fully supports this goal and will optimize transport cost and ensure a well-balanced, centralized management structure to improve the competitiveness of Novatek's Arctic projects," he stated. The Yamal project's shareholders in addition to Novatek are French energy major Total, China National Petroleum Corp. and the Chinese equity firm, the Silk Road Fund. Novatek has yet to release details about its planned LNG shipping company, including where the vessels would come from and who would operate them.

Russian shipping line Sovcomflot is currently one of the companies serving the Yamal project and in December 2017 shipped the first cargo from the port of Sabetta on the carrier "Christophe de Margerie", the world's first ice-breaking LNG carrier. The vessel was designed specifically to serve the Yamal project and transport LNG all year round in the difficult ice conditions around Ob Bay and the Kara Sea. The "Christophe de Margerie" was built as a prototype for a series of 15 gas carriers. Some of the vessels, with 174,000 cubic metre capacity, have already been delivered and others are still under construction at Daewoo Shipbuilding & Marine Engineering in South Korea. Other than Sovcomflot's vessel, the "Christophe de Margerie", the rest were ordered by Mitsui OSK Lines, Teekay LNG and Dynagas LNG, together with their Chinese state-owned shipping company partners. The "Christophe de Margerie" and the ice-breaking series of ships can traverse the Northern Sea Route westward from Sabetta all-the-year-round and eastward for six months of the year, from July to December. Previously, the Northern Hemisphere summer navigation window on the Northern Sea Route was limited to only four months with ice-breaker support.

PEMBINA Pipeline Corp., the Canadian energy infrastructure company, said it was making more progress with a range of natural gas projects in North America, including the Jordan Cove LNG export plant and its affiliated Pacific Connector Gas Pipeline planned for the northwest US state of Oregon. Pembina gave its latest project update as it posted record first-quarter profits of C$330 million (US$257M), a rise of 57 percent compared with C$210M earned in the same three months a year ago. Quarterly revenue soared to C$1.83 billion (US$1.42Bln) versus C$1.48Bln in the year-ago quarter. The company closed its acquisition in October 2017 of Canadian company Veresen Inc., inheriting the US Jordan Cove LNG project and is pushing ahead with it as the acquisition of its Canadian peer fed through to earnings. "Pembina continues to progress its proposed liquefied natural gas export terminal in Coos Bay, Oregon, and the related Pacific Connector Gas Pipeline that will transport natural gas from the Malin Hub in southern Oregon to the export terminal," stated Pembina in its earnings statement. Jordan Cove officially filed its application with the US Federal Energy Regulatory Commission in September 2017 with the company expecting an outcome during the second half of 2018. Jordan Cove if approved would be constructed at Coos Bay in Oregon to produce 7.8 million tonnes per annum of LNG for export to Asian markets. The Canadian company said it was continuing to evaluate a steady stream of development opportunities to grow the business even further.

"The previously announced open season for the Alliance Pipeline Ltd. expansion and the announcement of our Phase VI pipeline expansion are two exciting new additions to Pembina's portfolio of growth projects," said the company. "This portfolio already includes our Phase IV and V Peace Pipeline expansions, a west coast propane export facility, the proposed Jordan Cove LNG Project and Veresen Midstream's North Central Liquids Hub and the Duvernay infrastructure development," it added. Michael Dilger, Pembina's President and Chief Executive, said the Calgary-based company had seen "another great start to a new year" with Pembina once again setting record quarterly results. "Amidst a backdrop of political and economic uncertainty within Canada and abroad, Pembina remains focused on delivering exceptional financial and operational results, growing the business and building out our value-chain to provide our customers with enhanced market access," stated Dilger. Pembina is also continuing the development of its liquefied petroleum gas export terminal on Watson Island, near the port of Prince Rupert in British Columbia. It said the Prince Rupert Terminal is expected to be in service by mid-2020, subject to regulatory and environmental approvals. The Canadian Pacific port had previously been favoured by several LNG project developers who failed to push ahead with their ventures because of various economic and regulatory challenges.

PETROCHINA plans to expand the Tangshan LNG import terminal that supplies the capital Beijing to become the largest of the nation's network of 18 terminals, while the company will also start building work soon on its fourth regasfication facility. The PetroChina plans coincided with its sale of a one-third stake in Tangshan LNG to Beijing Blue Sky Holdings for 1 billion yuan ($157 million), according to a Hong Kong stock exchange statement. The Tangshan receiving terminal consists of port facilities and handling capacity for up to 10 million tonnes per annum of LNG. PetroChina and Beijing Blue Sky will each add two 160,000 cubic metres capacity storage tanks to double the site's storage capacity to 1.28 million cubic metres. The PetroChina terminal is located in the Caofeidian Industrial Zone of Tangshan City and the company has two other facilities in eastern China, the Rudong terminal in Jiangsu province near Nantong and the Dalian terminal on the Liaodong Peninsula of northeast China. The Tangshan terminal consists of a port and handling capacity of 10 million tonnes per annum as well as an inter-connecting pipeline to the national network.

It is a key supplier of pipeline gas to the Beijing region from the cargoes it receives from Qatar and Australia. Another terminal supplying Beijing is the Tianjin facility, owned by Sinopec. The three PetroChina terminals have a combined annual receiving capacity of 19 MTPA, though on average they only run at around 40 percent of capacity except in the peak winter months. PetroChina is also aiming to start building its fourth terminal by mid-2018 in Shenzhen in southeast China after several delays due to land and regulatory issues. Beijing is the world's second-largest gas-consuming city after Moscow and receives just less than 10 percent of all the gas consumed by China. The Tangshan expansion is one of several being undertaken by PetroChina and other energy companies such as China National Offshore Oil Corp., which operates eight terminals. The increased capacities are aimed at boosting storage as gas demand from Beijing and nearby northern cities continues to grow during winter because of the cold weather and the replacement of coal by gas to reduce pollution. The Chinese government has additionally been encouraging energy companies to build more underground storage for pipeline gas and above-ground tanks for LNG.

SOUTH KOREA said it would develop advanced LNG bunkering technology with two of the nation's research institutes. The project is aimed at the gas re-fueling market to increase the number of vessels that can be supplied in Korean ports. The Korean Ministry of Oceans and Fisheries has launched the LNG bunkering venture with the state research institutes, the Korea Research Institute of Ships & Ocean Engineering and the Korea Marine Equipment Research Institute. The government has been seeking to develop the emerging marine transport sector for LNG fuel to comply with the International Maritime Organization's sulfur cap on all maritime fuel set to be enforced from 2020. "The number of LNG-fueled ships is expected to rise under the strengthened international regulations on the sulfur cap," the Ministry said. "Unlike Bunker C fuel oil, LNG needs to be transferred at extremely low temperatures, which requires the development of new technology and facilities," added the Ministry.

The Ministry noted that LNG-powered ships are considered an ecologically-friendly option for new clean fuel

Diary of events

June

27th World Gas Conference
25-29 June 2018
Washington Convention Center
801 Mount Vernon Place Northwest
Washington, DC 20001, USA
http://wgc2018.com

September

Gastech
17-20 September, 2018
Fira Gran Via Conference Centre
Barcelona, Spain
www.gastechevent.com

regulations under the IMO restrictions and Emission Control Areas set up in Europe and North America. However, shipping companies are being challenged by the high cost of implementing new fuel equipment or retrofits. The Ministry stated it would improve LNG bunkering infrastructure as it also plans to place the first order for LNG-powered vessels by August and establish bunkering facilities in the major ports in Busan and Ulsan. "South Korean shipyards have outstanding expertise in building LNG carriers and bunkering shuttles, but they are still in the early stages when it comes to LNG-powered ships and related bunkering infrastructure," said the Ministry.

SOUTH KOREA will place its first government-backed orders for vessels powered by liquefied natural gas by August to support a more environmentally-friendly shipping sector and to develop associated industries as well as more LNG bunkering facilities in its ports. The Ministry of Oceans and Fisheries said it was firstly considering backing orders for two 200,000-ton bulk carriers to sail between South Korea and Australia. The government has been seeking to develop the emerging LNG-fueled shipping sector to comply with the International Maritime Organization's sulfur cap of 0.5 percent on marine fuel content set to be enforced from 2020. LNG-powered ships are considered one of the options to meet strengthened regulations, but the high cost of the ships have posed challenges for ship owners. Currently only one LNG-powered vessel is operating in South Korea and the Ministry is leading plans for up to 200 orders to be made for ships with LNG capability, including dual-fuel vessels, over the next three years. South Korea's orders are seen by the government as a way of helping its shipping and shipbuilding industries to recover from a slump in global demand and losses that forced restructuring at the largest companies.

It is part of a five-year plan to rebuild its shipping industry while also meeting tighter global anti-pollution regulations in regions such as Europe and North America where Emission Control Areas have been established around ports. Its shipping support programmes include the establishment of the Korea Ocean Business Corporation that will seek a "win-win approaches between the shipping and shipbuilding industries and ship owners and shippers". South Korea's three largest shipyards, Daewoo Shipbuilding and Marine Engineering, Hyundai Heavy Industries and Samsung Heavy Industries have been forced to undergo rescue programmes worth some $10.3 billion since 2016. The ministry said it would also begin a test programme to replace towing vessels, which use fuel oil or diesel, with LNG-powered ships and expand incentives and subsidies for its shipping lines. Its pending orders will by supported by developing infrastructure for LNG bunkering in major ports such as Busan and Ulsan and to build a shipping facility at the LNG terminal in Tong-Yeong on the southwestern coast.

TECHNIP-FMC, the energy and liquefied natural gas engineering company, posted mixed first-quarter results amid continued progress on the Yamal LNG project in Russia and as front-end engineering and design activity increased in the sector. The company's current projects include the Yamal venture in Arctic Russia, where the build-out of the production plant is continuing and it gave an update in its earnings report. "Construction and commissioning of Trains Two and Three is progressing well. Train Two is on track for start-up before year-end," said TechnipFMC. TechnipFMC's second major project is the Mozambique floating LNG venture being developed for offshore the southeast African country by Italian energy company Eni and called Coral South FLNG. It said that first steel had been cut for the turret of the Coral South floating production vessel at the shipyard in Singapore and the procurement of the other main equipment was progressing well. TechnipFMC overall first-quarter net income was $95.1 million versus a loss of $18.7M in the same three months of last year. Revenues for the three months amounted to $3.12 billion compared with $3.38Bln in the same three months of 2017, a drop of 7.8 percent. The orders backlog also fell 12.7 percent to $14.01Bln from $16.05Bln in the same 2017 quarter. However, inbound orders more than doubled to $3.48Bln, up on the 2017 quarterly total of $1.58Bln.

"Our solid first quarter results reflect continued strength in operational execution as well as the benefits of merger synergies," said TechnipFMC Chief Executive Doug Pferdehirt in reference to the completion of the amalgamation of France's Technip with FMC Technologies of the US. "Despite lower revenue, total company adjusted EBITDA margin was unchanged year-over-year. Market conditions for key businesses also continue to improve," added the CEO. "Looking forward, FEED activity was also robust in the period and points to an inflection in the downstream market," said Pferdehirt. "In particular, increased front-end and commercial activity in the LNG market is providing greater visibility into new project sanctioning," he added. "This market dynamic is very compelling for TechnipFMC given our leadership positions in both onshore and offshore liquefaction," stated the CEO. Technip's inbound orders for the quarter included $1.2 billion for the Subsea division. "Subsea orders have now exceeded revenues in three of the last four quarters. Market penetration of our integrated business model continues to gain momentum as evidenced by the award of three integrated (iEPCI) projects in the quarter," said the company. "One of these awards - for Energean's Karish and Tanin development (offshore Israel) - is our largest and most comprehensive integrated award to date. The project fully integrates the entire subsea scope with that of the host production facility, leveraging the unique capabilities we have across our portfolio," it added. TechnipFMC's Onshore-Offshore division reported first-quarter revenue of $1.57Bln. "Revenue declined 10.8 percent from the prior-year quarter. Revenue was lower as we moved closer to completion on major projects, including Yamal LNG," said the company. "This was partially offset by increased project activity in both the Europe, Middle East, India and Africa (EMIA) and Asia Pacific regions," it stated.

TELLURIAN Inc., the developer of the Driftwood LNG export plant in Louisiana and associated infrastructure and resources such as pipelines and natural gas production, said it expected

to identify its joint venture partners soon as more than 20 companies had shown an interest. The company founded by former Cheniere Energy Chief Executive Charif Souki also said that it ended the first quarter with around $112.5 million of cash and cash equivalents and remained debt free. "We have a strong balance sheet consisting of $280M in assets, of which $91M represents our proved natural gas properties," said Tellurian in its earnings statement. Tellurian said it was making progress with its proposal to construct a global natural gas business underpinned by a liquefaction plant with output of around 27.6 million tonnes per annum. Leading LNG engineering contractor Bechtel is the engineering, procurement and construction contractor for Driftwood LNG and has also made a $50 million investment in the company. Among its quarterly highlights, Tellurian hired investment bank Goldman Sachs and French bank Societe Generale Americas to serve as financial advisors to help raise the $24 billion needed to bring its plans to fruition.

Tellurian also conducted non-binding open seasons through its subsidiaries to secure prospective shippers on two newly proposed pipelines, the Haynesville Global Access Pipeline and the Permian Global Access Pipeline. "The pipelines are part of Tellurian's previously announced proposed pipeline network, the development of which is expected to represent an approximately $7Bln investment in US infrastructure and to create approximately 15,000 jobs in Texas and Louisiana," stated the company. In its earnings, Tellurian noted that it had generated $6M in revenue from LNG marketing and around $1M from natural gas sales. "There are more than 20 companies conducting detailed analysis in our data room for Driftwood Holdings and we expect to be able to identify our partners soon," said President and Chief Executive Meg Gentle. "We intend to begin construction of the Driftwood LNG terminal in 2019," added Gentle. A Federal Energy Regulatory Commission authorization is expected by January 2019, the Driftwood project final investment decision will be taken in the first half of 2019 with construction pencilled in for the same time-frame and for commercial operations to start in 2023.

TOKYO GAS, the largest Japanese LNG importer after Jera Co. Inc., received its first cargo in May 2018 from the Cove Point export plant in Maryland where Japanese and Indian utilities have 20-year tolling agreement. "The Negishi import terminal in Yokohama city, Kanagawa prefecture, received the shipment," said Tokyo Gas. The cargo was delivered on board the vessel "LNG Sakura", operated by NYK Line. The ship passed through the Panama Canal on April 28 after sailing down the US Atlantic Coast from the Cove Point facility on Chesapeake Bay. "The LNG is derived from shale gas and is the first such delivery under a long-term tolling contract to be unloaded at a Japanese terminal," added the utility. Tokyo Gas has a joint venture agreement at Cove Point with Japanese trading house Sumitomo Corp. whereby the two companies will share volumes made from feed-gas purchased and transported to Cove Point by pipeline.

"At this project, Tokyo Gas is responsible for the liquefaction process for consignments and LNG sales through the joint venture company, ST Cove Point Co., with Sumitomo. The venture will liquefy natural gas to make about 2.3 million tonnes per annum of LNG. We will purchase approximately 1.4 million tons per year and this time the shipment amounted to 70,000 tonnes," said the utility. Tokyo Gas said that with the Cove Point volumes it now had total contracts and long-term sales agreement in six countries and with 13 projects. "With the procurement of LNG from this project, Tokyo Gas is achieving a diversification of suppliers and contracts for our LNG network. Going forward, we will actively pursue further diversification and expansion of suppliers, according to our 2020 Vision, based on price and supply stability as well as flexibility," stated Tokyo Gas.

TOTAL, the French energy major, has signed an accord with the Government of Oman to develop an LNG fuel supplies hub for the maritime industry with bunkering infrastructure and a small-scale production plant at Sohar port. Total said its agreement with the Sultanate Oman was in the form of a memorandum of understanding covering both upstream and downstream businesses, including the development of onshore natural gas fields. Total and Royal Dutch Shell plan to bring on stream several natural gas discoveries located in the Greater Barik area on onshore Block 6 in Oman with respective shares of 25 percent and 75 percent. The Greater Barik project has a production target of around 500 million cubic feet per day and potential to reach 1 bcf/d at a later stage. Total said it would use its equity gas entitlement as feedstock to develop in Oman a regional hub for LNG bunkering services to supply LNG as a fuel to ships. Oman is a major anchorage and stop-over point for tankers and other vessels on trade routes between the Middle East, Asia and Europe. Total said its LNG hub project would involve a small-scale modular liquefaction plant to be built in Oman's Sohar port. The plant will comprise a processing Train with capacity of around 1 million tonnes per annum and will offer the flexibility for expansion as required by the development of the LNG bunkering market.

"We are pleased to sign this MoU with the Sultanate of Oman that will give us access to new gas resources and the opportunity to develop an integrated gas project," stated Arnaud Breuillac, President Exploration & Production at Total. "We will bring our expertise in LNG and will introduce access to a new gas market for the Sultanate," added Breuillac. "Developing an LNG bunkering service will generate in-country value and job opportunities, and will support industry diversification through fostering the shipping activity in Oman," stated the Total executive. Total is a long-standing participant in the Omani energy industry and is a shareholder in Oman LNG, along with other companies, including Shell and Japan's Mitsubishi Corp. and Mitsui & Co. BP of the UK helped boost Oman's natural gas output and LNG production in 2017 when it brought on stream the Khazzan gas field. The country's three existing LNG liquefaction Trains at the facilities near Sur are expected to be at full capacity for the whole of 2018 after suffering several years of domestic gas shortages. The Omani government allocates Oman LNG supplies from various gas fields and the Khazzan field production has ended all future feed-gas concerns. The three Omani processing Trains are now almost at full capacity of 10.5 MTPA. Additionally, in January 2018, Oman LNG signed a sales and purchase agreement with BP to supply shipments to the UK company's Singapore-based trading unit. Oman LNG said the agreement was for free-on-board cargoes over a period of seven years. Under that accord, BP will lift 1.1 MTPA of LNG, equivalent to around 18 cargoes a year, or about 126 over the period.

TOTAL, the French energy major, has entered a strategic agreement with US company Clean Energy Fuels Corp., the California-based supplier of LNG and compressed natural gas fuel for the trucking industry. Total has agreed to purchase up to 50.8 million shares of Clean Energy's common stock for $83.4 million, to become Clean Energy's largest stockholder with ownership of 25 percent of Clean Energy's outstanding shares. Clean Energy, based in Newport Beach and listed on the Nasdaq stock exchange, is a leading provider of natural gas fuel for transportation in North America and has a network of filling stations completed in 2017 from southern California to the Canadian border. The US company has around 550 fuel stations across the country and in Canada as it continues with its growth strategy for LNG, compressed natural gas fuel and biogas fuel distribution. The transaction has to be approved by regulators and Clean Energy shareholders, who will meet on June 8 to vote on the deal. Clean Energy, with support from Total, also plans to launch a truck-leasing programme that is intended to place thousands of new natural gas-fueled, heavy-duty trucks on the road to use Clean Energy fuel stations. "As presently contemplated, this programme will allow fleets to begin driving heavy-duty trucks with the cleanest engine in the world at no increased cost compared to the diesel alternative," the two companies said. Total stated that it would provide up to $100 million of credit support for the leasing programme, which the companies expect to launch in the third quarter of 2018.

"Customers and regulators around the world are demanding cleaner transportation alternatives, particularly in the heavy-duty market," said Patrick Pouyanne, Chairman and Chief Executive of Total. "Natural gas can become the fuel of choice. Total believes there is a strong development opportunity in the natural gas for transportation market in particular in the United States which benefits from unique giant low-cost gas resources. Total is looking forward to partnering with Clean Energy to accelerate the remarkable innovation capacities of this company," stated the Total CEO. Total is

one of the leading energy majors in the LNG value chain and has access to volumes in the US and around the world. "There couldn't be a better endorsement for the future of natural gas heavy-duty trucking in North America than for Total, one of the largest energy companies in the world, to step up with this investment," said Andrew J. Littlefair, CEO and President of Clean Energy. "Being a European-based company, Total is all too aware of the opportunity to transition to cleaner alternative fuels," added Littlefair. "Launching the financing programme should expedite the adoption of natural gas as the most environmentally friendly fuel for the trucking industry," said the Clean Energy CEO. Clean Energy posted revenues for 2017 of $341.6 million, a 15.2 percent decrease from the $402.7M reported for 2016. The company delivered 86.4M gallons of natural gas fuel in the fourth quarter of 2017 in the form of LNG and CNG, a 2.7 percent increase from 84.1M gallons in the same three months of 2016.

US COAST GUARD officers have given a positive report to regulators after conducting a waterway suitability assessment for the Canadian-led Jordan Cove LNG export plant proposed for Coos Bay in the northwest state of Oregon. Coast Guard personnel recommended to the US Federal Energy Regulatory Commission that the waterway should be considered suitable for LNG marine traffic associated with the venture of Pembina Pipeline Corp., based in Calgary in the Canadian province of Alberta. Pembina continues to advance with the Coos Bay facility and its related Pacific Connector Gas Pipeline that will transport natural gas from the Malin Hub in southern Oregon to the liquefaction plant. The company closed its acquisition in October 2017 of another Canadian operator Veresen Inc., inheriting the Jordan Cove venture. Jordan Cove officially filed its application with the FERC in September 2017 with the company expecting an outcome during the second half of 2018. Jordan Cove if approved would produce 7.8 million tonnes per annum of LNG for export to Asian markets. "Based upon this review, the Captain of the Port Sector Columbia River recommended to the FERC that the waterway in its current state be considered suitable for LNG marine traffic associated with this project," said the Coast Guard. The Coast Guard report pointed out that since January 2018 the Sector Columbia River personnel had worked with Pembina Pipeline and with state and local police and fire brigade as well as port and community stakeholders to assess the safety and security issues associated with LNG carriers traveling into Coos Bay.

"We continue working with local officials and the port community to ensure that every measure is taken to ensure the excellent safety record of the marine transport of LNG is continued if an LNG terminal is built in Coos Bay," said Capt. William Timmons, head of the Sector Columbia River. "At this point, the waterway can accommodate the types of vessels associated with the proposed Jordan Cove LNG facility," he added. "We are working together to make sure that any resource issues are resolved through the Emergency Response Planning Process," stated Timmons. The Coast Guard said it would continue working with the FERC on the development of an Environmental Impact Statement that addresses the effects of the proposed safety and security measures along the waterway. If Jordan Cove is given the go-ahead by the FERC, Pembina would be required to submit Emergency Response and Transit Management plans that identify the resources necessary to support the Waterways Suitability Analysis and facility operation. "The applicant will also have to document its cost sharing arrangements with the affected communities for project related expenses," said the Coast Guard. Pembina is also continuing the development of its liquefied petroleum gas export terminal on Watson Island, near the port of Prince Rupert in the Canadian British Columbia. The Prince Rupert Terminal is expected to be in service by mid-2020, subject to regulatory and environmental approvals. The Canadian Pacific port had previously been favoured by several LNG project developers who failed to push ahead with their ventures because of various economic and regulatory challenges.

US LNG and energy engineering company KBR said it was awarded a design contract by Japanese oil and gas company Inpex for the Abadi LNG production venture onshore Indonesia using feed-gas from the Arafura Sea. The Houston, Texas-based company said that under the terms KBR would provide a cost competitive, pre-front-end engineering and design package. "The pre-FEED will be performed entirely from KBR's Jakarta office in Indonesia," said the company. "KBR will provide services including site master plan development, scope of work for the FEED phase as well as an engineering, procurement and construction schedule and cost estimate," explained KBR. The Abadi project will use feed-gas from the Masela block operated by Inpex under the supervision of Indonesian regulators, called the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas). The Masela block is located in the western Pacific Ocean overlying the continental shelf between Australia and Indonesia. The original Inpex plan with partner Royal Dutch Shell was to produce 7.5 million tonnes per annum of LNG from a floating production hull, similar to Prelude FLNG offshore Australia. The Abadi project is owned 65 percent by Inpex and 35 percent by Shell, though the Indonesian government has control of the production sharing agreement.

The Indonesians propose that a 370-mile pipeline will be built to connect the Abadi gas field resources to a liquefaction plant on Aru Island. Inpex is currently completing the Ichthys LNG project in Australia's Northern Territory for exports to Japanese utilities. "This work is expected to be performed within approximately six months, with KBR performing studies to establish configuration of the LNG process plant, supporting utilities, and product storage and export facilities," it added. Due to the remote location of the plant in Eastern Indonesia, KBR said it would deploy its logistics teams to provide solutions for efficient management of construction personnel, materials and equipment. "KBR is a world leader in designing and building LNG facilities and we have a proven record of delivering reliable and tested solutions in a price and schedule driven market," said Jay Ibrahim, a KBR regional president. "KBR's partnership with Indonesia spans more than 40 years and we are proud to participate in this significant national strategic project," stated Ibrahim. "We are committed to developing and enhancing the local engineering industry capabilities in Indonesia," he added.

VENTURE Global, the developer of two US liquefied natural gas export plants in the state of Louisiana, said it secured a 20-year sales agreement with Portuguese energy company Galp Energia for volumes of one million tonnes per annum. The US company said Galp would purchase LNG on a free-on-board basis (FOB) basis, whereby the Portuguese supply the ships, starting in 2022 from its proposed Calcasieu Pass export facility that is still subject to a final investment decision. "This agreement fits Galp's global strategy by securing a balanced and competitive long-term sourcing for its international natural gas activities, contributing to the development of efficient and environmentally sustainable energy solutions," said the Portuguese company. The Portuguese LNG import terminal at Sines, owned by Galp and located south of Lisbon, has already received US cargoes from the Sabine Pass plant in Louisiana, operated by Cheniere Energy. The Venture Global Calcasieu Pass facility is to be located on a 1,000-acre site at the intersection of the Calcasieu Ship Channel and the waters of the Gulf of Mexico. Calcasieu Pass will produce 10 MTPA of LNG.

Venture Global's second plant is the Plaquemines project proposed for 630 acres of land near river mile-marker 55 on the west side of the Mississippi, 30 miles south of New Orleans. The Mississippi River project will produce 20 million tonnes per annum of LNG and will also include small-scale liquefaction Trains, four LNG storage tanks and three marine loading berths. Venture Global is currently in the US regulatory process to construct both Louisiana liquefaction plants. "We are very honored that Galp has signed this binding 20-year SPA with our company," said joint the chief executives of Venture Global, Michael Sabel and Robert Pender. "It follows the recent announcements of our binding 20-year sales agreements with Shell North America LNG and Edison S.p.A. (Italy), now totaling 4 MTPA," they noted. "It is a privilege to become a long-term partner with Galp at this key moment as we finalize our arrangements with additional world-class partners for our Calcasieu Pass project," they added. The Venture Global project in Plaquemines Parish on the Mississippi additionally involves the development of its Gator Express Pipeline venture. Gator Express involves two local natural gas supply pipelines that would connect the LNG plant to the existing interstate natural gas grid. ■

Air Products manages project risk in global ventures through its standardization and modularization

Fei Chen and Joe Voda explain the US company's LNG liquefaction offerings of various scales

Execution strategies incorporating standardized and modular solutions with proven liquefaction technology provide LNG plant developers a viable alternative to mitigate project risk, cost and schedule.

Developers of both greenfield and brownfield projects continue to evaluate such solutions when considering individual train sizes in the small and mid-scale range.

There are many factors to consider when evaluating the merits associated with standardized and modularized execution strategies to include production, process technology and project specific criteria.

There has been a renewed interest in small and mid-scale projects across the LNG industry. In the past, most LNG plants were designed to achieve economies of scale by employing the largest equipment that was proven at the time.

As the LNG industry continues to change, these factors are no longer the sole consideration of project developers. Most large and easily-accessible gas fields have already been developed. Many of the remaining undeveloped gas fields are smaller, offshore or remote. Additionally, energy price volatility has made traditional, large volume, long-term contracts increasingly difficult to secure.

Volumes

Finally, requirements for transportation fuel and energy peak shaving applications typically require smaller volumes with fluctuating demand profiles. As a result, the financial viability of new projects faces increased challenges, and project developers are looking for innovative solutions to meet the new market requirements.

As smaller plants do not benefit from the same economies of scale as larger plants, the primary focus has shifted towards low total installed capital. In addition, developers desire execution strategies that shorten their project schedules and accelerate time to on-stream to quickly monetize stranded gas. However, to be economically viable, a small-scale LNG plant must still minimize downtime, maintain maintenance intervals, and maximize production similar to a large plant.

To accommodate these new market requirements, standardized liquefaction cycle and equipment configurations amenable to modularization have become highly desirable. The solutions described in this article may be applied to liquefying natural gas across a wide range of processing capacities but are specifically suitable for small and mid-scale train sizes.

Tradeoffs to consider

Liquefaction process cycles, proven or new, as well as equipment technology advancements developed with specific consideration for standardization and modularization, can play an important role in reducing CAPEX and schedule while also improving OPEX.

Nonetheless, there are tradeoffs that require consideration when developing standardized and modularized products.

Standard process and plant designs can reduce engineering time and manufacturing schedule while also achieving targeted plant availability through the use of proven designs. However, site specific conditions such as feed gas composition pressure, type of cooling medium and temperature can impact the reusability of the design.

In addition, the standardization approach may be different for plants of varying sizes or markets with careful evaluation necessary to determine whether to standardize individual equipment items, process modules or the entire plant.

Typically, standardization is inversely related to train size, with smaller train sizes achieving higher levels of standardization. Although standardizing the entire liquefaction unit may be less attractive for large trains, standardization of key equipment can still provide a benefit.

Modular design construction may reduce field labor costs and help mitigate construction and schedule risk, but the benefits may be partially offset by the extra structure associated with modules and the need to transport large modules from building yards to project sites.

Therefore, the optimal level of standardization and the right balance between a modular or stick-built approach requires careful evaluation.

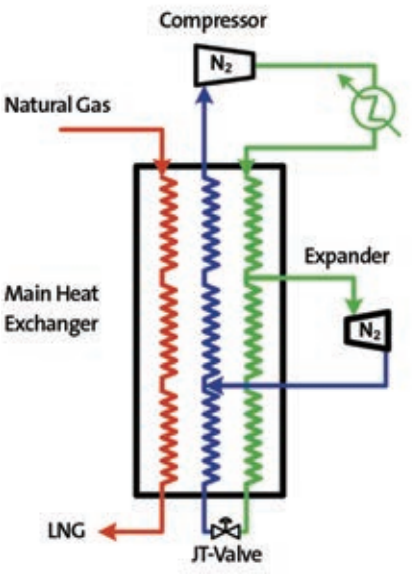


Figure 1: Simple N2 Recycle Process

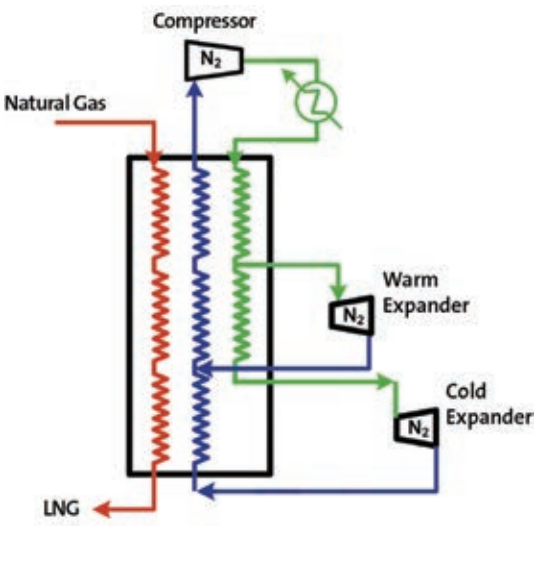


Figure 2: Two-stage N2 Expander cycle

Standardized small scale

Low CAPEX and simple operation are often the most important considerations for small plant capacities (100 to 500 ton per day range). Standard designs using the simple to operate nitrogen refrigeration cycle (Nitrogen Recycle Process) using one nitrogen expander and one JT valve (Figure 1) is typically the most economic option.

The addition of a second expander (Figure 2) is a consideration when production approaches the upper limit of the range, as this improves the efficiency of a simple nitrogen expander cycle with a moderate increase in CAPEX.

The adoption of modular construction strategies for liquefaction plants in the 100 to 500 TPD range appears to be increasing.

Now, a small-scale plant may be developed by erecting multiple yard-built modules with inter-connecting piping and cables. There may be modules for gas receiving, pre-treatment, liquefaction, cooling and other peripheral equipment.

The liquefaction module is the core of the LNG plant and is further composed of two fully skidded sub-modules: a cold box module and a nitrogen compression/ expansion module (Figure 3).

The cold box typically contains a liquefaction heat exchanger and process valves with the option for a heavy hydrocarbon rejection drum.

The nitrogen compression / expansion module includes a nitrogen recycle compressor, one or more nitrogen expanders and potentially integrated coolers.

Each individual expander may be configured as a compander or be loaded on a common bull gear with the nitrogen compressor stages.

The goal is to achieve a high level of standardization for the individual equipment as well as the liquefaction modules while also retaining sufficient flexibility to accommodate project specific variables when needed with limited adjustment to the process and equipment design.

For example, with no or minor changes, the equipment and module design can work with electric motor or gas turbine drive and air cooled or water-cooled applications while remaining adaptable to varying feed gas compositions and design codes.

The nitrogen recycle process is an established refrigeration technology with significant industry references and relatively low capital expenditure.

This process is quick to start up and shut down and is easy to ramp up or down production. If desired, stable operation below 50 percent turndown from nameplate capacity is achievable.

Since nitrogen is used as the only refrigeration component, it is safe and environmentally friendly, and minimizes

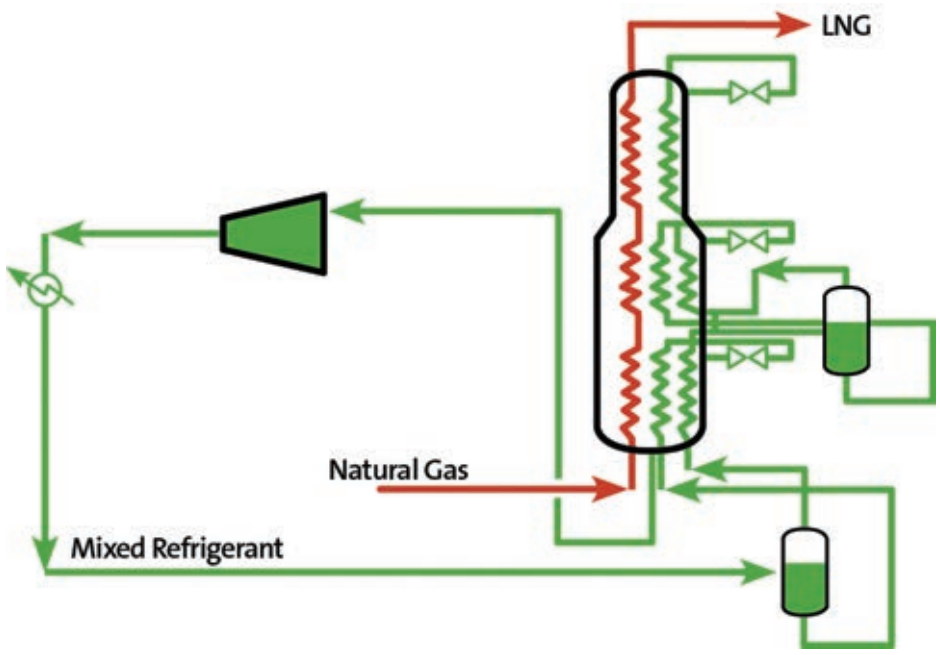


Figure 5: SMR Cycle

the cost and on-site management of the refrigerant.

For mid-scale LNG plants where efficiency is a consideration in the process selection, the single mixed refrigerant (SMR) process is often justified.

The SMR process requires fewer pieces of rotating equipment and is well proven in the small to mid-scale LNG range. Typically, the refrigerant consists of a mixture of hydrocarbons and nitrogen optimized to achieve the best efficiency (Figure 5).

For plants developed using SMR technology, standardization may focus more on the equipment level, including the mixed refrigerant compressor and the main cryogenic heat exchanger (Figure 6).

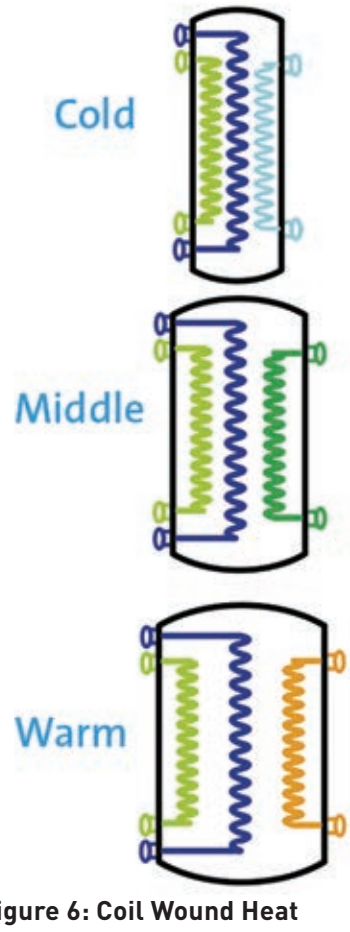


Figure 6: Coil Wound Heat Exchanger (CWHE) used as the Main Cryogenic Heat Exchanger (MCHE)

The equipment may be designed to handle relatively large ranges for capacity, cooling medium type and temperature.

However, when it comes to variation in feed gas composition among different projects, flexibility in the overall process cycle design must also be considered as the difference in heavy hydrocarbon (HHC) concentration and light components (e.g. nitrogen) concentration in the feed gas may require the application of different impurity removal technologies to avoid freezing in the equipment and meet the LNG product specifications.

The standardized MCHE design (Figure 6) needs to be adaptable to multiple cycle configurations to retain the necessary flexibility to meet each project's specific requirements for heavy hydrocarbon removal and nitrogen rejection.

If the feed gas contains very low HHC and nitrogen concentrations, the SMR liquefaction cycle can be configured to have only the three sections (cold, middle, and warm) of the MCHE in a row (Figure 7, base configuration).

In this configuration, the feed gas is first cleaned up to remove acid gases and water, and then cooled and liquefied in the MCHE prior to being sent into the LNG storage tank.

If the feed gas contains a high HHC concentration and needs to reject nitrogen, an HHC removal TSA and an HHC stripping column may be integrated collectively with the warm section of the standard MCHE design to ensure both alkane HHCs and aromatic HHCs are effectively removed, and a nitrogen stripping column may be placed downstream of the cold section of the MCHE to reject nitrogen (Figure 8).

Depending on the project criteria, the

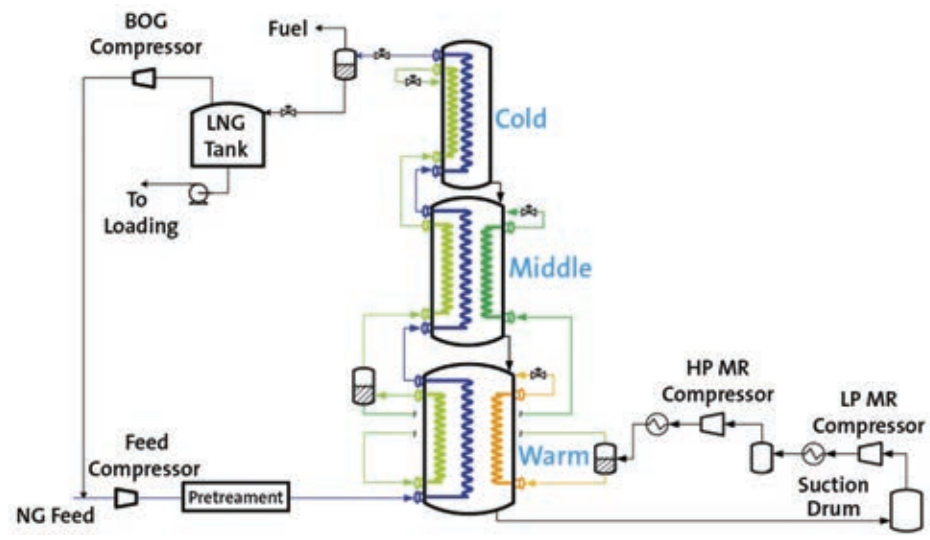


Figure 7: SMR cycle with standard MCHE, base configuration

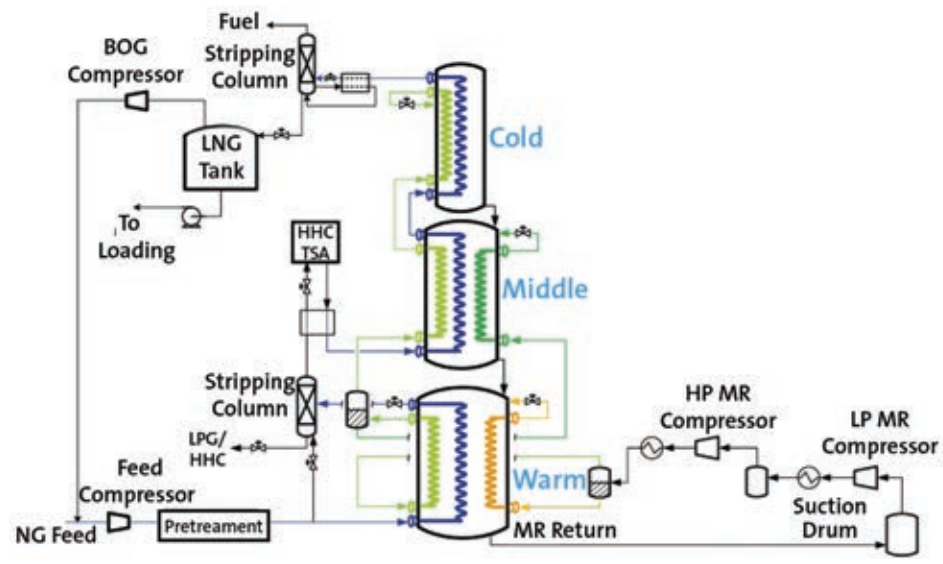


Figure 8: SMR cycle with standard MCHE, integrated HHC removal TSA and nitrogen stripper

standardized solutions should also have the flexibility to be integrated into the contractor's preferred execution strategy whether it be modularized or field erected.

For example, the three sections of the MCHE may be contained in three separate shells to allow for ease of transportation and more flexibility in optimizing overall module and piping design. On the other hand, the three sections of the MCHE can be placed into a common shell to reduce inter-connecting piping and plot space.

Overall, the goal is to achieve a high level of standardization for the individual equipment to support modular or field erection strategies while retaining the

Ningxia China 1000 TPD SMR trains

LNG Train in Indonesia

Figure 10: Modularized or field erected mid-scale LNG trains

Figure 11: Mid-scale 1350 TPD SMR train

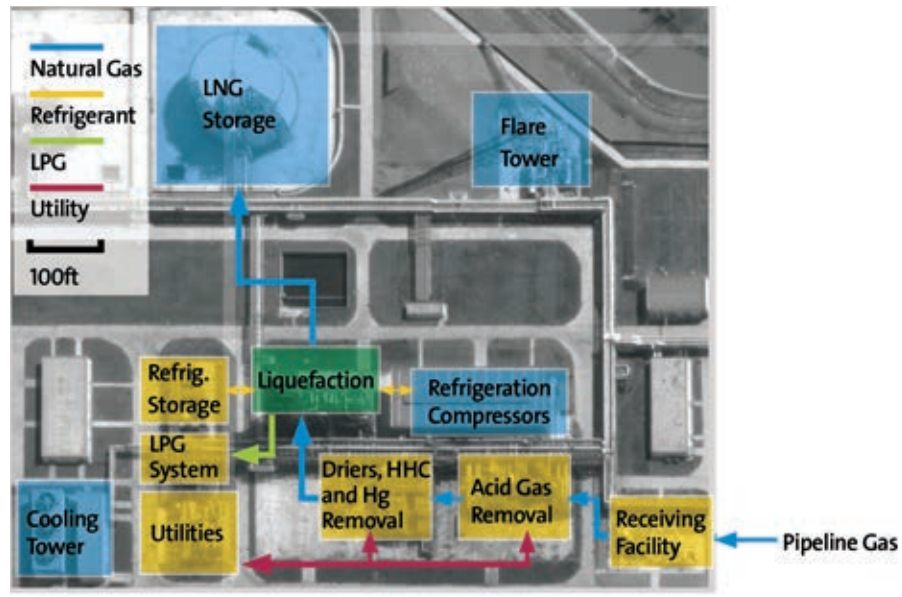


Figure 12: Typical mid-scale LNG plant flow diagram and facility layout

necessary flexibility to integrate various impurity removal schemes for higher efficiency and robust operation.

Similar to the requirement for small-scale LNG, the standard design for the MR compressor and the MCHE should work with electric motor or gas turbine drive and air cooled or water cooled at most global locations. The coil would type of MCHE is proven to be well suited for standardization with the benefits of this type of heat exchanger summarized in Table 1.

Standardization - from equipment level to plant level: In addition to standardization at the equipment level and process module level, it is often beneficial to achieve a certain degree of standardization at the plant level.

Figure 12 shows a typical plant layout superimposed with a process flow diagram for a mid-scale LNG plant. Material and energy flows are categorized into natural gas, refrigerant, LPG (liquid petroleum gas) and utility.

The feed gas from a pipeline goes through the receiving facility and meter station before entering the acid gas removal unit, the dryer, the HHC removal unit, and the mercury removal unit and arrives at the liquefaction system where it is cooled and liquefied to produce LNG. The heavy end of the feed gas is processed to make LPG product and stored in the LPG storage system.

The utility unit provides the heat duty required for front-end system regeneration, while the refrigeration compressors together with the refrigerant storage system and cooling tower provide the cooling duty for the natural gas liquefaction. Each discrete process unit and its equipment can be standardized constructed using a modular or stick built approach.

Standardizing the plant layout can provide additional benefits including the potential for increased reuse of engineering documents such as plot plans, 3D models, civil design, risk and site hazard analysis, and construction strategies.

Conclusion

When exploring options for small or mid-scale LNG train sizes, it is important to understand the objectives for a successful project. The economics of small-scale LNG projects typically benefit from lower capital cost and shorter schedule.

These constitute unique constraints that require project developers to work closely with EPCs and process licensors to identify the best technology and execution strategy.

Innovations in process cycles, equipment design, enriched standardized product portfolio and modularization strategies open doors to achieve project objectives.

Although the planned individual train capacity may be smaller than the typical baseload train, the magnitude of the overall investment itself still warrants appropriate due diligence to guarantee a successful return over the life of the plant. ■

Features	Description	Benefits/Advantages			
		Reduce OPEX	Improved Revenue	Safety	Environmental Friendly
High Availability & Reduced Downtime	CWHE with external containment allows continuous operation even in the unlikely situation of tube leaks thus delaying any necessary repair to a scheduled shutdown.	•	•		
Reduced plugging risk	CWHE design and tubing reduces the probability of plugging/blockage.		•	•	•
High Efficiency	Refrigeration system with multiple cooling streams increases oveall liquefaction efficiency. Closely matched temperature profiles within MCHE provide high performance and efficiency.	•	•		•
High Adaptability	Proprietary thermo data base facilitates a design whereby the selected refrigerant mixture/ components provide flexibility to accommodate fluctuations in feedgas composition. Depending upon plant configuration, refrigerant components can be extracted from feedgas or sourced locally.	•	•		
High Operational Flexibility	Multiple cooling streams increase operational flexibility, especially for fluctuating feedgas composition, daily and seasonal ambient temperature change. Ease of turndown with stability during shortage of feedgas.	•	•		
High Robustness & Reliability	CWHE with tube-in-shell design provides high resistance to thermal stresses/shock and ensures good vapor-liquid distribution.	•		•	•
External Protection	CWHE with external pressure shell provides added measure of protection in the event of an unlikely natural gas leak thus mitigating unnecessary releases into the atmosphere.		•	•	•
Multi-Bundle Design	CWHE multiple bundle design (e.g. pre-cooling, liquefaction, and sub-cooling) can ease transportation constraints.			•	

Table 1: Benefits of Air Pproducts' Mid Scale Coil Wound Heat Exchanger Units (CWHE)

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350+
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3,500+
STRATEGIC & TECHNICAL DELEGATES

64
STRATEGIC SESSIONS

50
TECHNICAL SESSIONS

5
LNG PROCUREMENT & TRADING FORUM SESSIONS

4
ASIA LNG MARKET DELVOPMENT FORUM SESSIONS

8
DIVERSITY IN ENERGY PROGRAMME SESSIONS

7
YOUNG GASTECH SESSIONS

5
VIP PROGRAMME SESSIONS

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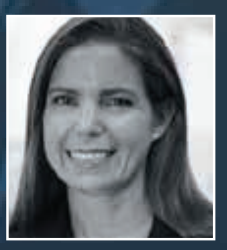

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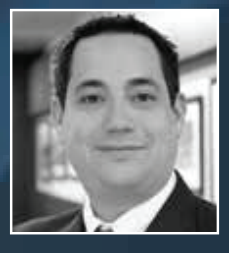

SCOTT MOSSBERRY
LNG Technology Manager
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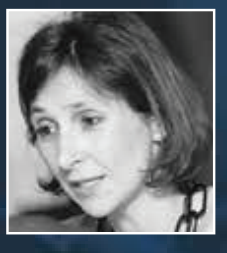

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Chart Industries powers energy future through LNG system incorporating storage to control

Leading US company explains latest design and engineered solution for part of the worldwide liquid gas value chain

Where no gas pipeline or grid infrastructure exists the LNG Virtual Pipeline enables natural gas to be used as a primary fuel for power generation.

In addition, an LNG Virtual Pipeline can provide a secondary back-up and emergency fuel where natural gas pipeline capacity is constrained.

It is a substitute to a physical pipeline whereby the commodity that would typically be conveyed through a physical pipeline is instead transported to the point of use by sea, road, rail or a combination of one or more of the aforementioned.

Six horizontal tanks provide LNG storage at a diamond mine in Canada, providing natural gas as the primary fuel

Volume

In the case of natural gas the product is first liquefied to reduce its overall volume to 1/600th of its gaseous volume and loaded into cryogenic containers for transportation from its source, which can be an import terminal, distribution hub or liquefaction plant, to the point of use.

At the point of use a regasification station, also referred to as an LNG Satellite Station, is the complete system that incorporates LNG storage, vaporization, pressure regulation and control systems to deliver natural gas exactly as if it were from a physical pipeline.

For users who aren't connected to a physical pipeline and looking to switch to natural gas from diesel, oils, liquefied petroleum gas (LPG) and propane, the Virtual Pipeline model simply mimics their current supply solution; liquid fuel is delivered to their site where it is off-loaded and stored for immediate use.

For users who are connected to a grid but are looking to supplement insufficient or unreliable pipeline capacity to meet additional load and seasonal variations or provide emergency fuel back-up during outages, the Virtual Pipeline solution is far more efficient.

It is preferable to diesel or LPG back-up as the enterprise is simply using stored natural gas to augment pipeline natural gas and can utilize the same delivery system.

Applications

Remote locations and islands: Access to reliable energy means empowerment and increased living standards. With 80 percent of the world's population that still have little or no access to electricity living in remote areas the potential for LNG is huge.

Working plants

Society is committed to a low-carbon energy future anyway and regions that rely on imported energy favour LNG because of its relative price stability.

Chart has already made significant contributions to projects that use LNG to fuel small power stations in the Caribbean and on Portugal's Madeira Island.

Using cryogenic ISO containers to transport LNG means it can be delivered from source to site efficiently and safely via different modes, for instance road and sea. A full for empty swap system provides greater cost efficiencies.

Diesel, propane, LPG and oil displacement: Typically the facilities are aimed at medium-scale to large-scale industrial enterprises that aren't connected to the grid and are currently using one of the aforementioned for primary power.

A business switching to LNG will generally make financial savings as well as significantly reducing its environmental footprint.

Chart's recommendation for this particular application is generically referred to as a "Compact" LNG Satellite Station because it's designed and built as a full plug and play solution that can be installed, commissioned and be fully operational inside a couple of days with minimal preparatory civil work required.

Compact stations are modular. Hence capacity can be added in the future according to increased demand. The facilities can also be relocated, which means they can also be used as a temporary solution while a larger capacity installation is being constructed.

Reliability

Peak-shaving and supply curtailment: In 2014 the Northeast US experienced an extended period of severely cold weather that resulted in pipeline natural gas supply to power stations being curtailed.

This year a similar weather front proved to be equally disruptive and spot natural gas prices peaked as high as $175 per million British thermal units (MMBtu) versus a prevailing Henry Hub price of around $3 MMBtu.

In order to avoid penalties for disrupting supply and take advantage of financial inducements for maintaining it, natural gas-fired power stations are investing in back-up systems and LNG is the obvious choice.

Benefits

As described earlier, the power stations are essentially still using natural gas and hence benefit from all the associated advantages including environmental compliance and reduced costs through a combination of factors.

As also demonstrated, the complete Virtual Pipeline solution is already well proven.

Distributed energy: A combination of financial, economic and political considerations is driving the power generation industry towards small-scale gas fired power stations that are quicker to install, less capital intensive and offer a faster return on investment, particularly in North America.

By utilising LNG as a back-up to

Converting a US university campus from ultra-low sulfur diesel to natural gas, to augment pipeline supply during seasonal high use will potentially save it millions of dollars, as well as hugely reducing its carbon footprint

natural gas supply the plants are able to respond quickly to meet peak demand or when increased demand curtails pipeline supply.

In addition the plants can also use the LNG to take advantage of favourable prices as the grid demand swings.

For a nameplate capacity of around 50 megawatts this type of project would typically require an LNG satellite plant with 100,000 gallons of LNG storage (a single Chart shop-built cryogenic tank) that feeds multiple reciprocating engine generator sets with rapid start up.

Temporary power solutions: Applications for temporary power include oil and gas, utility companies, major events (concerts, sporting), construction, mining and disaster relief. It's a burgeoning market and currently dominated by diesel generators but the solution to utilize cleaner-burning natural gas through LNG is already well proven.

Conclusion

With society committed to transitioning to a low-carbon energy future and natural gas supply forecast to be stable and competitively priced for a foreseeable period, there are significant opportunities to extend the use of natural gas, through LNG, to communities and regions where there is no pipeline infrastructure and to augment pipeline supply for peak demand.

Furthermore, the Virtual Pipeline, which takes LNG from its source all the way through to its point of end-use is already a proven, well-established, viable and cost-effective solution for the complete range of power generation opportunities, from temporary through to base-load. ■

American Bureau of Shipping explains the LNG-led solution to an old problem in floating power sector

The rising popularity of floating gas-fired power vessels has the potential for continued growth in the future, says Patrick Janssens, Vice President, Global Gas Solutions, ABS

Bringing electricity to remote locations has always been a challenge for countries with large island territories because laying subsea cables to connect these islands to the mainland grid can be cost prohibitive.

As a result, islands need to be self-sufficient for generating electricity and mobile power generating units, such as a floating power vessel, offer a feasible solution.

ABS Chairman, President and Chief Executive Christopher J. Wiernicki (fourth right) chairing a discussion with the LNG international shipping industry's company leaders coinciding with the Posidonia 2018 Exhibition in Greece in early June. They are: Angelicoussis Shipping Group CEO John Angelicoussis, Executive Chairman of Gaslog Peter Livanos, Chairman of Dynacom Tanker Management George Procopiou; and Chairman Emeritus of Poten and Partners Michael Tusiani. They gathered at the Stavros Niarchos Foundation Cultural Centre.

Infrastructure

Power vessels, also known as vessel-mounted power plants, are power plants installed on marine or offshore vessels such as barges, ships, offshore installations, or mobile offshore units.

They can generate power by use of single or multiple gas turbines, reciprocating diesel or gas engines or boilers. Power vessels with capacity ranging from 100 to 750 MW and beyond can offer a fast and economic solution to providing power to onshore, near-shore or offshore facilities.

In addition to making electricity available in remote locations, power vessels can supply places that have temporarily lost power, such as during severe weather events.

The advantages of power vessels can be extended beyond flexibility and cost effectiveness by using LNG as the fuel.

With gas as a source fuel, these power plants are more environmentally friendly and have a reduced carbon footprint compared to power generators using other fossil fuels as well as reduced emissions of sulfur and nitrogen oxides.

In addition to these environmental advantages, the continued development of shale gas in the United States has positively impacted worldwide natural gas availability and reduced prices. These factors have combined to increase demand for LNG-fueled floating power plants.

Supplies shipped

Fuel for floating power plants has until recently been limited to conventional petroleum products or on a shore connection for supply of natural gas.

However, recent advances in floating storage and regasification technology have made LNG floating power plants safer and more operationally viable.

By eliminating dependence on shore-side gas infrastructure for fuel supply, these technologies have made the floating gas power plant more accessible to regions that lack local supply of natural gas.

To support the increased global demand for power vessels and provide the industry with reliable guidance that enables innovative technologies to flourish, ABS has published the Guide for Power Service for Marine and Offshore Applications.

This comprehensive document covers requirements including design, construction and survey for class review and classification approval of power vessels and is applicable to new construction projects as well as conversion of existing vessels.

Vessels

Power vessels include power barges, power ships, offshore power units and converted vessels for ocean or river service.

The major technical challenges in power vessel development are hull and system design under various environmental and operational conditions, and further integrating these factors with the on-deck power plant.

The new ABS guide addresses the scope and conditions of classification, including hull construction and equipment, machinery, piping and electrical systems, safety systems, power generation, distribution systems and equipment and survey requirements.

ABS recently granted Approval in Principle (AIP) to Hudong-Zhonghua Shipbuilding (Group) Co Ltd, for its LNG Power Vessel.

The vessel is designed in accordance with the applicable requirements of ABS Rules & Guides and IMO Regulations and the vessel concept offers efficient LNG power generation and storage.

This LNG-fueled power supply vessel integrates an LNG receiver, storage, re-gasification, electric power generation and transmission with an LNG storage tank volume of 32,000 cubic metres and 100MW of power generation capacity.

Commitment

Awarding Hudong-Zhonghua Shipbuilding the AIP for the LNG power vessel also demonstrated ABS's commitment to protecting the environment.

"We chose ABS because of their leadership position in evaluating effective energy storage solutions and extensive experience in gas-related projects," said Hudong-Zhonghua Shipbuilding Vice President Jin Yanzi.

"We are delighted to receive this approval from ABS which validates our early design work and helps us advance this concept," added Jin.

ABS has a long track record of industry leadership in gas storage, handling and transportation, offering guidance on LNG floating structures and systems, gas fuel systems and equipment, gas carriers, and regulatory and statutory requirements.

Long standing

Its experience with gas-related assets goes back to "Methane Pioneer", the world's first LNG carrier and has been the classification organization of choice for some of the most advanced gas carriers, and LNG-fueled vessels in service.

The class society attended the Posidonia 2018 Shipping Exhibition in Athens, Greece, in June (photograph) and President and Chief Executive Christopher J. Wiernicki outlined the ABS stance on the LNG shipping sector evolution.

"What we heard is that LNG has a bright future, and this came directly from the owners and operators who have a decisive role in delivering that future," said Wiernicki.

"ABS is a global leader in LNG, and we have a proud record of investing in developing solutions that help the sector deliver on its significant potential," he added.

"LNG has done a lot of the heavy lifting in the shipping industry for more than a decade and the improvements in performance have been dramatic," said the ABS CEO.

"Now we have seen a maturing in the rate of technological change and going forward we will see efficiency gains in how companies use data and digital tools to track the performance of their equipment and assets, and this is where the next big gain will be made across all of shipping not just LNG," he explained

ABS remains a class leader for conventional LNG carriers and maintains the largest global orderbook for the classification of these vessels.

To support the industry in the development of floating storage and regasification units, ABS has also released its "Guide for Building and Classing LNG Regasification Vessels." ■

Gastech 2018 invites LNG and gas industry to Barcelona for exhibition and conference

Event is a multi-streamed conference with over 250 presentations by a list of 350 prominent speakers

Gastech, the leading global exhibition and conference for the international LNG and natural gas industries, will take place in Barcelona, Spain, from September 17-20 and the gathering will be 30th edition.

For more than 45 years the event has been regarded as the most significant meeting place for upstream, midstream and downstream gas and LNG professionals to convene, learn and do business.

Support

The conference and trade exhibition has already received significant support from companies worldwide.

The event has received the Presidency of Honour from His Majesty King Felipe VI of Spain and an official endorsement from the Spanish Secretary of State for Energy.

Hosted by the Spanish Gastech Consortium - Cepsa, Enagas, Gas Natural Fenosa, Reganosa, Repsol and Tecnicas Reunidas, and in partnership with Sedigas, Spain's natural gas association, the event is also supported by the world's leading industry organisations and companies.

"The support it has so far received stands testament to the value of Gastech to the energy community," said Gavin Sutcliffe, Director of the Gastech Governing Body.

"The 2018 programme has been significantly expanded to encourage more debate, discussion and collaboration across the industry," added Sutcliffe.

"Conversations with the wider energy community, as well as from our Gastech Governing Body meetings, have placed strong emphasis on the need for industry collaboration, new strategies and technological advancements," he explained.

"From these conversations and the abstracts selected for the Gastech 2018 conference, we are seeing strong developments across the upstream industry especially in leading innovation and efficiency as the energy industry moves to lower carbon strategies," he stated.

The conference will have 250 presentations by 350 speakers.

It will comprise a Plenary Stage, Strategic and Technical Conferences, a VIP Global Leaders Summit and four Specialist Conferences: Asia LNG Market Development Forum, LNG Trading & Procurement Forum, Diversity in Energy and Young Gastech.

The Conference will be attended by more than 1,200 ministers, government officials, presidents, managing directors, CEOs and chairmen, as well as 3,500 strategic and technical delegates.

Gastech conference director Jenny Kelly also commented: "This year's Gastech is one of the strongest and most informative programmes to date. Speaking at the event will be some of the industry's leading influencers and CEOs.

Her long list includes Saad Sherida al-Kaabi, CEO of Qatar Petroleum; Luca de Meo, president, SEAT; Maarten Wetselaar, integrated gas and new energies director and member of the executive committee, Royal Dutch Shell; Alexander Medvedev, Deputy Chairman of the Management Committee, Gazprom; Lazlo Varro, Chief Economist, International Energy Agency; and Steven L Edwards, Chairman & Chief Executive Officer, Black & Veatch.

Largest

Alongside the conference, the event also features an international exhibition. The hall at 50,000 square metres will make the Gastech exhibition the largest for the gas, LNG and energy industry.

Over 700 companies will showcase their products and services to over 30,000 international gas, LNG and energy professionals.

"With six dedicated industry zones and 16 exhibiting country pavilions, the exhibition is a key marketplace for the industry and where millions of dollars of contracts are negotiated and signed," said Sutcliffe.

He explained that in facilitating the global transition to a lower carbon economy, Gastech will be co-located with the Global Power & Energy Exhibition (GPEX) - a conference and exhibition dedicated to the latest strategies, solutions and technologies needed to adapt to the global energy transition.

Gavin Sutcliffe, Director of the Gastech governing body for next industry gathering in Europe

"As the international energy focus moves towards lower carbon economy there is greater alignment between the gas and power industries," added Sutcliffe.

"The co-location of both events will provide a meeting place for the gas and power communities who form the central core of the energy transition to enhance the integrated energy dialogue and promote collaborative opportunities," he stated. ■

For more information and to book your space please go to http://www.gastechevent.com

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

BW GDF-Suez Boston	138,059	BW Gas	Daewoo	Jan-03	Norway	S	GT NO 96	4	Suez LN
BW GDF Suez Everett	138,028	BW Gas	Daewoo	Jun-03	Norway	S	GT NO 96	4	Suez LNG
BW Integrity	170,000	BW Gas	Samsung	May-17	Singapore	DFDE	TZ Mk. III	4	FSRU
BW Pavilion Leeara	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	TZ Mk. III	4	Various
BW Pavilion Vanda	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	TZ Mk. III	4	Various
BW Singapore	170 000	BW Gas	Samsung	May-15	Singapore	DFDE	TZ Mk. III	4	FSRU
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
Bilbao Knutsen	138,000	Knutsen / Marpetrol	IZAR Sestao	Jan-04	Spain	S	GT NO 96	4	Atlantic LNG
Bilis	77,730	Brunei Shell Tankers	La Seyne	Mar-75	Brunei	S	GT NO 82	5	Brunei LNG
Bishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-15	Panama	S	Moss	4	Australia-Japan
British Diamond	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. II	4	Indonesia-Various
British Emerald	155,000	BP Shipping	Hyundai	Jun-07	UK	DFDE	TZ Mk. III	4	Tangguh LNG
British Innovator	138,200	BP Shipping	Samsung	Jul-03	Isle of Man	S	TZ Mk. III	4	Various
British Merchant	138,000	BP Shipping	Samsung	Apr-03	Isle of Man	S	TZ Mk. III	4	Various
British Ruby	155,000	BP Shipping	Hyundai	Jan-08	U.K.	DFDE	TZ Mk. III	4	Various
British Sapphire	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. III	4	Tangguh
British Trader	138,000	BP Shipping	Samsung	Dec-02	Isle of Man	S	TZ Mk. III	4	Engas
Broog	135,466	J4 Consortium	Mitsui Chiba	May-98	Japan	S	Moss	5	Qatargas
Bu Samara	266,000	QGTC	Samsung	Dec-08	Qatar	DRL	TZ Mk. III	5	Qatargas
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
BW Suez Brussels	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
Cadiz Knutsen	138,826	Knutsen / Marpetrol	IZAR Puerto Real	Jun-04	Spain	S	GT NO 96	4	Engas
Castillo de Santisteban	173,600	Elcano	STX	Aug-10	Malta	S	GT NO. 96		Various
Castillo de Villalba	138,000	Elcano	IZAR	Nov-03	Spain	S	GT NO 96	4	Sonatrach
Catalunya Spirit	138,000	Teekay LNG Partners	IZAR Sestao	Mar-03	Liberia	S	GT NO 96	4	Atlantic LNG
Celestine River	145,000	KLNG	Kawasaki	Dec-07	Bahamas	S	Moss		Various
Cesi Beihai	174,100	MOL-China LNG	Hudong	June-17	Hong Kong	S	GT No 96	4	Australia-China
Cesi Gladstone	174,100	MOL-China LNG	Hudong	Oct-16	Hong Kong	S	GT No 96	4	Australia-China
Cesi Qingdao	174,100	MOL-China LNG	Hudong	Nov-16	Hong Kong	S	GT No 96	4	Australia-China
Cesi Tianjin	174,100	MOL-China LNG	Hudong	Sept-17	Hong Kong	S	GT No 96	4	Australia-China
Challenger FSRU	263,000	MOL LNG	Daewoo	Oct-17	St Kitts	DFDE	GT No. 96	4	Various
Cheikh Bouamama	75,500	Skikda LNG Transport	USC	Jul-08	Bahamas	S	TZ Mk. III	4	Sonatrach
Cheikh El Mokrani	75,500	Med LNG Corp	USC	Jun-07	Bahamas	S	TZ Mk. III	4	Sonatrach
Christophe de Margerie	172,600	SCF	Daewoo	Nov-16	Cyprus	DFDE	GT NO 96	4	Various
Clean Energy	150,000	Dynagas	Hyundai	Mar-07	Marshall Is.	S	TZ Mk. III	4	Various
Clean Force	150,000	Dynagas	Hyundai	Jan-08	Marshall Is.	S	TZ Mk. III	4	Various
Clean Ocean	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Planet	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Vision	160,000	Dynagas	Hyundai	Jun-15	Marshall Is.	DFDE	TZ Mk. III	4	Various
Cool Explorer	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Runner	160,000	Thenamaris	Samsung	May-14	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Voyager	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Corcovado LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Creole Spirit	174,000	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	NO. 96 GW	4	Cheniere
Cubal	160,400	Mitsui/NYK/Teekay	Samsung	Jan-12	Bahamas	DFDE	TZ Mk. III	4	Various
Cygnus Passage	145,400	Cygnus LNG	Mitsubishi	Feb-09	Panama	S	Moss	4	Various
Dapeng Moon	147,000	China Ships	Hudong	Jul-09	China	S	GT NO 96	4	Various
Dapeng Star	147,000	China Ships	Hudong	Nov-09	China	S	GT NO 96	4	Various
Dapeng Sun	147,000	China Ships	Hudong	Jul-07	China	S	GT NO 96	4	Woodside Energy
Disha	136,000	Petronet LNG Ltd.	Daewoo	Jan-04	Malta	S	GT NO 96	4	Qatargas
Doha	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-99	Japan	S	Moss	5	Qatargas
Duhail	210,100	ProNav	Daewoo	Jan-08	Germany	DRL	GT NO 96	4	Various
Dukhan	135,000	J4 Consortium	Mitsui Chiba	Oct-04	Japan	S	Moss	4	Qatargas
Dwiputra	127,385	Humpuss Consortium	Mitsubishi Nagasaki	Mar-94	Bahamas	S	Moss	4	Pertamina
Ebisu	147,547	Golar LNG	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
Eduard Toll	172,000	Teekay-CLNG	Daewoo	Dec-17	Bahamas	MEGI-DF	GT No. 96	4	Various
Ejnan	145,000	4J	Samsung	Jan-07	Bahamas	S	TZ Mk. III		RasGas
Ekaputra	136,400	Humpuss Consortium	Mitsubishi Nagasaki	Jan-90	Liberia	S	Moss	5	Pertamina
Energy Advance	145,000	Tokyo LNG Tankers	Kawasaki Sakaide	Mar-05	Japan	S	Moss	4	Darwin
Energy Atlantic	159,924	Alpha	STX Jinhae	Sep-15	Malta	DFDE	No. 96	4	Various
Energy Confidence	155,000	Tokyo LNG Tankers	Kawasaki	Apr-09	Panama	S	Moss	4	Various
Energy Frontier	147,600	Tokyo LNG Tankers	Kawasaki Sakaide	Sep-03	Japan	S	Moss	4	Darwin
Energy Horizon	177,000	Tokyo LNG Tankers	Kawasaki	Jul-11	Japan	S	Moss	4	Pluto LNG
Energy Navigator	147,000	Tokyo LNG Tankers	Kawasaki Sakaide	May-08	Japan	S	Moss	4	Various
Energy Progress	145,000	MOL	Kawasaki	Nov-06	Japan	S	Moss	4	Bayu Undan LNG
Esshu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-14	Panama	S	Moss	4	Australia-Japan
Excalibur	138,200	Exmar/ Excelerate	Daewoo	Oct-02	Belgium	S	GT NO 96	4	Various
Excel	138,106	Exmar/ MOL	Daewoo	Sep-03	Belgium	S	GT NO 96	4	Various
Excelerate	138,000	Exmar/Excelerate	Daewoo	Oct-06	Belgium	S	GT NO 96	4	Various
Excellence	138,000	GKFF Ltd.	Daewoo	May-05	Belgium	S	GT NO 96	4	Excelerate Energy
Excelsior	138,000	Exmar	Daewoo	Jan-05	Belgium	S	GT NO 96	4	Various
Exemplar	150,900	Excelerate	Daewoo	Jun-10	Belgium	S	GT NO 96	4	Various
Expedient	151,000	Excelerate	Daewoo	Nov-09	Belgium	S	GT NO 96	4	Various
Experience RV	174,000	Exmar/Excelerate	Daewoo	Jul-14	Marshall Is.	DFDE	GT NO 96		Various
Explorer	150,900	Exmar/Excelerate	Daewoo	Mar-08	Belgium	S	GT NO 96	4	Excelerate
Express	151,000	Exmar/Excelerate	Daewoo	May-09	Belgium	S	GT NO 96	4	Various
Exquisite	150,900	Excelerate	Daewoo	Sep-09	Belgium	S	GT NO 96	4	Various
Fedor Litke	172,636	Dynagas	Daewoo	Nov-17	Cyprus	DFDE	GT No. 96	4	Various
Flex Endeavour	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	NO. 96 GW	4	Various
Flex Enterprise	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	NO. 96 GW	4	Various

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

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

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

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

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

LNG Import Terminals

Explanatory Notes

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

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

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
Belgium	Zeebrugge	Fluxys	1987	4	380,000
Canada	Canaport Saint John	Irving Oil, Repsol	2009	3	480,000
Chile	Quintero	ENAP, Metrogas, Enagas	2009	3	334,000
	Mejillones	Engie, Codelco	2010	1	175,000
China	Beihai LNG, Guangxi	Sinopec	2015	4	640,000
	Dalian	PetroChina	2011	3	480,000
	Dongguan, Guangdong	Jovo Group	2013	2	160 000
	Fujian LNG (Xiuyu)	CNOOC, Fujian I&D Corp.	2008	2	640,000
	Guangdong	CNOOC,BP	2006	3	480,000
	Haikou, Hainan LNG	CNOOC	2014	3	480,000
	Ningbo, Zheijang	CNOOC, Zhejiang Energy	2012	3	480,000
	Qidong, Jiangsu	Guanghui Energy	2018	1	60,000
	Qingdao, Shandong	Sinopec	2014	3	480,000
	Rudong	PetroChina	2011	3	530,000
	Shanghai	CNOOC, Shenergy Group	2009	3	495,000
	Shanghai, Mengtougou	Shanghai Gas	2008	3	120 000
	Shenzen, Diefu	CNOOC	2016	2	320,000
	Tangshan, Hebei	PetroChina	2013	3	480,000
	Tianjin North	Sinopec	2017	2	320,000
	Yuedong, Guangdong	CNOOC	2016	2	320,000
	Zhoushan Zhejiang	Enn Group	2018	2	320,000
	Zhuhai, Gaolan	CNOOC	2013	3	480,000
Dominican Republic	Punta Caucedo	AES Andres	2003	1	160 000
Finland	Pori	Gasum Skangas	2016	1	30,000
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	3	225,000
India	Dabhol	GAIL, NTPC (Ratnagiri Gas & Power)	2009	3	480,000
	Dahej	Petronet LNG	2004	4	592,000
	Hazira	Shell India, Total	2005	2	320,000
	Kochi, Kerala	Petronet LNG	2013	2	320,000
Indonesia	Arun	Pertamina	2015	5	507,000
Italy	Panigaglia	Snam	1969	2	100,000
	Porto Levante (offshore GBS)	ExxonMobil, Qatar Petroleum, Edison Gas	2009	2	250,000
Japan	Negishi	Tokyo Gas	1969	14	1,180,000
	Sodegaura	Tokyo Gas	1973	35	2,660,000
	Ohgishima	Tokyo Gas	1998	4	850,000
	Higashi-Ohgishima	Tokyo Electric	1984	9	540,000
	Futtsu	Tokyo Electric	1985	10	1,110,000
	Yokkaichi LNG	Chubu Electric	1988	4	320,000
	Kawagoe	Chubu Electric	1997	6	840,000
	Yokkaichi Works	Toho Gas	1991	2	160,000
	Chita LNG Joint	Toho Gas, Chubu Electric	1978	4	300,000
	Chita LNG	Toho Gas, Chubu Electric	1983	7	640,000
	Chita - Midorihama	Toho Gas	2001	3	600,000
	Senboku I	Osaka Gas	1972	4	180,000
	Senboku II	Osaka Gas	1977	18	1,585,000
	Himeji	Osaka Gas	1984	8	740,000
	Himeji LNG	Kansai Electric	1979	7	520,000
	Yanai	Chugoku Electric	1990	6	480,000
	Niigata	Nihonkai LNG, Tohoku Electric	1984	8	720,000
	Oita	Oita Gas, Kyushu Electric	1990	5	460,000
	Tobata	Kitakyushu LNG	1977	8	480,000
	Fukuoka	Saibu Gas	1993	2	70,000
	Sodeshi	Shizuoka Gas	1996	3	337,200
	Hatsukaichi	Hiroshima Gas	1996	2	170,000
	Kagoshima	Nippon Gas	1996	2	136,000
	Shin-Minato	Sendai City Gas	1997	1	80,000
	Nagasaki	Saibu Gas	2003	1	36,000
	Sakai	Kansai Electric, Cosmo OII	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, Hokkaido Electric	2012	2	380,000
	Okinawa	Okinawa Electric Power	2012	2	280,000
	Naoetsu	Inpex	2013	2	360,000

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
Japan (continued)	Joetsu	Chubu	2011	3	540,000
	Hachinohe LNG	Nippon Oil	2015	2	280,000
	Hitachi LNG	Tokyo Gas	2015	1	230,000
	Soma Fukushima	Japan Petroleum Exploration	2017	1	225,000
Korea	Boryyeong	GS Energy, SK E&S	2017	3	200,000
	Incheon	Kogas	1996	20	2,880,000
	Kwangyang	POSCO	2005	4	530,000
	Pyeong-Taek	Kogas	1986	23	3,360,000
	Samcheok	Kogas	2014	3	600,000
	Tong-Yeong	Kogas	2002	17	2,620,000
Malaysia	Pengerang Johor	Petronas Gas	2017	2	400,000
Mexico	Altamira	Vopak, Enagas	2006	2	300,000
	Energia Costa Azul	Sempra LNG	2008	2	320,000
	Manzanillo	Samsung, Kogas, Mitsui	2012	2	300,000
Netherlands	Gate LNG	Gasunie, Royal Vopak	2011	3	540,000
Phillipines	Pagbilao LNG	Energy World Corp.	2017	1	130,000
Poland	Swinoujscie	Baltic Gaz System	2015	2	320,000
Portugal	Sines	REN Atlantico	2004	3	390,000
Puerto Rico	Penuelas	EcoElectrica	2000	1	160,000
Singapore	Singapore	Singapore Energy Authority	2013	3	540,000
Spain	Barcelona	Enagas	1969	8	840,000
	Huelva	Enagas	1988	5	610,000
	Cartagena	Enagas	1989	5	587,000
	Bilbao	Enagas, EVE	2003	3	450,000
	Sagunto	GNF, Osaka Gas, Oman Oil	2006	4	600,000
	Reganosa, Ferrol	Galicia, Sonatrach, Tojeiro	2006	2	300,000
	El Musel, Gijón,	Enagas	2013	2	300,000
Taiwan	Yung-An	CPC	1990	6	690,000
	Tai-Chung	CPC	2009	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	Shenzhen	CNPC Yudean Power	2021	2	120,000
	Yangjiang	CNPC Yudean Power	2023	2	120,000
Finland	Tornio	Gasum Skangas	2018	1	30,000
Gibraltar	Gasnor	Shell	2018	1	5,000
India	Ennore	Indian Oil Corp	2018	2	320,000
	Mundra	Gujarat State Petroleum, Adani Group	2018	2	320,000
	FSRU Andhra Pradesh	Engie, Andhra Pradesh Gas	2018	1	135,000
	Pipovav LNG (FSRU), Gujarat	Swan Energy	2018	2	320,000
	Andhra Pradesh	Hindustan LNG, Andhra Pradesh	studies	1	135,000
Indonesia	Labuhan Maringgai	Perusahaan Gas Negara	2018	1	135,000
Malaysia	Lahad Datu LNG, Sabah	Petronas	2018	studies	
Panama	Costa Norte	AES	2018	1	130,000
UK	Port Meridian, Barrow-in-Furness	Port Meridian Energy Ltd.	2020	1	150,000
Uruguay FSRU	Montevideo	Gas Sayago, Mitsui Osk Lines	2019	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
Colombia	Cartagena FSRU	Promigas, Sociedad Portuaria El Cayao	2016
Egypt	Ain Sokhna, Suez	EGAS, Hoegh	2015
	Ain Sokhna, Suez	EGAS, BW Gas	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertimana	2012
Italy	Livorno	OLT Offshore LNG Toscana	2013
Jordan	Aqaba, Jordan	Golar LNG	2015
Kuwait	Mina Al-Ahmadi	KPC	2009
Lithuania	Klaipeda	Klaipedos Nafta Hoegh LNG	2014
Malaysia	Malacca FSRU	Petronas	2012
Malta	FSU Armada Mediterrana	ElectroGas	2016
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
	Port Qasim	BW-Mitsui, PGP Consortium	2017
Turkey	Aliaga FSRU, Neptune	Etki LNG	2016
	Dortyol FSRU Challenger	Botas	2018
UAE	Ruwais, Abu Dhabi	Gasco (UAE)	2016
	Jebel Ali Port, Dubai	DSA (UAE)	2010
UK	Teesside GasPort	Excelerate	2007

LNG Export Projects

Country	Location/Project	Project Developers	Planned Start Up	Number of Trains	Capacity In MTPA
AUSTRALIA	Browse LNG	Woodside, BHP, BP Chevron, Shell, Mitsubishi, Mitsui	2021+	2	10.0
	Ichthys LNG	INPEX, Total	2018	2	8.4
	Prelude FLNG	Shell, Inpex, Kogas CPC	2018	1	3.5
CANADA	Bear Head LNG, Nova Scotia	LNG Ltd.	2024	4	8.0
	GNL Quebec, Saquenay	Freestone Capital and Breyer Capital	2024	4	10.0
	Goldboro LNG, Nova Scotia	Pieridae Energy	2024	2	10.0
	Kitimat LNG, BC	Woodside, Chevron	2024	2	10.0
	LNG Canada, BC	Shell, Mitsubishi, Kogas, PetroChina	2024	2	12.0
	Melford LNG project, Nova Scotia	H-Energy Hiranandani Group	Studies		
	Kwispaa FLNG, Vancouver	Steelhead LNG	2024	4	12.0
	Vancouver Tilbury	WesPac Midstream	2021	1	3.25
	Woodfibre LNG, Squamish	Pacific Oil & Gas Co	2020	2	2.1
EQ.GUINEA	Equatorial Guinea Fortuna FLNG	Ophir, Golar LNG, Schlumberger, GEPetrol	2019	1	2.0
INDONESIA	Sengkang LNG	Energy World Corp.	2018	4	2.0
MALAYSIA	Rotan FLNG (Sabah)	Petronas, Murphy Oil	2019	1	1.5
MOZAMBIQUE	Area 1 Onshore	Anadarko Petroleum and partners	2021	2	10
	Area 4 Onshore	Eni and partners	2021	2	10
	Area 4 FLNG	Eni and partners	2019	1	2.5
NIGERIA	NLNG Train 7	NNPC, Shell, BP, Total	2020+	1	8.4
PAPUA NEW GUINEA	Elk-Antelope LNG	Total, ExxonMobil Oil Search, Petromin	Studies		
RUSSIA	Sakhalin II expansion	Gazprom, Shell, Mitsui, Mitsubishi	2021	studies	
	Vladisvostok LNG	Gazprom, Itochu, various	2021	2	10.0
USA	Alaska LNG Nikiski	Alaska Gasline Development Corp.	2022	3	20.0
	Annova LNG, Brownsville	Exelon Corp.	2021	6	6.0
	Cameron LNG, Louisiana	Sempra, Total, Mitsui, Mitsubishi	2019	3	14.95
	Commonwealth LNG, Louisiana	Commonwealth LNG LLP	2022	8	9.0
	Corpus Christi Liquefaction, Texas	Cheniere	2019	5	22.5
	Delfin LNG, Louisiana	Delfin, Hoegh	2021	3	9.0
	Driftwood LNG, Louisiana	Tellurian Investments	2022	6	26.0
	Elba Island, Georgia	Kinder Morgan, EIG Energy	2018	10	2.5
	Freeport LNG, Texas	Freeport LNG	2018	4	20.4
	Golden Pass, Texas	Qatar Petroleum, ExxonMobil	2021	3	15.6
	Jordan Cove, Coos Bay	Pembina Corp.	2024	2	7.8
	Lake Charles, Louisiana	Shell, ETE	2024	3	15.0
	Magnolia LNG	Louisiana LNG Ltd.	2021	4	8.0
	Port Arthur LNG	Sempra	2021	2	10.0
	Rio Grande LNG	NextDecade	2021	6	27.0
	Sabine Pass LNG, Louisiana	Cheniere	2018-19	2	9.0
	Texas LNG Brownsville	Chandra, Meyer, Samsung, others	2021	2	4.0
	VG LNG (Cameron Parish)	Venture Global	2021	5	10.0
	VG LNG (Plaquemines)	Venture Global	2021	10	20.0

LNG Exporters

Country	Location/Project	Shareholders	Start up	Liquefaction		Storage	
				Trains	capacity (nominal) mtpa	No. of tanks	Total capacity m^3
ABU DHABI (UAE)	Das Island (Adgas)	ADNOC, Mitsui, BP, Total	1977	2	3.2	3	240,000
			1994	1	2.5		
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mistubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
	Darwin	Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
	Gladstone LNG	Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
	Gorgon LNG	Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
	Pluto LNG	Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
	QCLNG	Shell, CNOOC	2014	2	8.0	2	280,000
	Wheatstone LNG	Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
CAMEROON	Hilli Episeyo FLNG	Kribi Perenco	2018	1	1.2	1	125,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Total, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya 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
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5		
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	4	18.0	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000

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