

In this issue:

- 1 **Australia adopts greater Asia role by capturing US volumes for China**
Growing liquefaction capacity and US-China dispute benefits Australian cargo exports

- 3 **IEA sees energy dominance strategy now in full flow for US led by LNG and domestic gas use**
Paris-based body reports that US energy landscape has been transformed and carbon emissions have dropped

- 6 **A round-up of latest events, company and industry news**
For the Record

- 24 **US gives its own international energy outlook and sees pipeline gas and LNG among leading streams**
World natural gas consumption will increase more than 40 percent from now to 2050

- 26 **Opportunities open for huge Argentine shale gas reserves as quest begins for onshore LNG**
Liliana Diaz, Managing Director of FTI Consulting, analyses future of Argentine shale and energy investment

- 28 **Japanese class society says LNG represents central strand of its rules for cargo and fuel**
Hayato Suga offers a progress report on the class rules that will enable safe use of LNG, hydrogen and other energy sources

- 30 **World Carrier Fleet: Details of LNG vessels**

- 39 **Tables of import and export LNG terminals and plants worldwide**

Australia adopts greater Asia role by capturing US volumes for China

Growing liquefaction capacity and US-China dispute benefits Australian cargo exports

Australia's liquefied natural gas exports are forecast to increase from 75 million tonnes in 2018-2019 to 81MT in 2020-2021, as the last two projects in Australia's recent wave of LNG investment ramp up output and China increases its actual demand and the US trade dispute sees the Chinese favouring Australia for volume replacement.

LNG export prices charged by Australia are also forecast to decline slightly in the next year and in the following 12 months due to an appreciating exchange rate and easing of oil-linked contract prices at which most Australian LNG is sold.

Divergence

An Australian government report just published noted that LNG prices in Asia were continuing to diverge as the market develops.

"In Asia, 70 percent of LNG traded in 2018 was sold on long-term contracts, where the price of LNG is linked to the price of oil by a time lag of several months. The majority of the remaining 30 percent was sold on the spot market (at least 70 percent and probably far more) or by short-term contract," explained the report.

LNG spot prices in Asia have continued to diverge from long-term oil-linked contract prices over the past few months and in August 2019, LNG spot prices were at their lowest level on record, averaging US\$4.30 per million British thermal units (MMBtu), or A\$6.00 a gigajoule, while an indicative oil-linked contract price was around S\$10.80 per MMBtu (A\$15.10/GJ)," added the report.

The Australian analysis concludes that the fall in spot prices has been driven by a combination of growing supply capacity and weak demand from major consumers in Asia.

On the supply side, the ramp up of new capacity in the US, Australia and



Evolution of LNG prices in Asia region and oil-linked divergence

Russia has added to downward pressure on prices.

"Growth in China's LNG purchases has slowed and the imports of Japan and South Korea, the world's largest and third-largest LNG buyers respectively, have declined," said the report.

In contrast to LNG spot prices, long-term oil-linked contract prices have increased in recent months.

"While there is no single oil-linked contract price in Asia, but rather a patchwork of different contractual pricing arrangements agreed at different points in time, indicative figures suggest that the differential between spot and long-term contract prices is at its widest level on record," stated the report.

Decoupling

The Australian report said the one key question is what the implications are for the decoupling between long-term contract and spot prices, especially if the decoupling endures for a sustained period.

"Buyers are reportedly reducing purchases on long-term contracts as their contractual flexibility permits (exercising so-called 'downward tolerance'), and increasing purchases of spot cargoes," said the report.

Buyers are also pushing to have contract prices lowered during the price

reviews that are built into long-term supply agreements.

Arbitration

"Japanese utility Osaka Gas is in arbitration with Exxon Mobil's PNG LNG project after the parties failed to settle on a price during price review negotiations," added the report.

Longer term, low spot prices relative to oil-linked prices may encourage buyers to push for shorter, more flexible contracts and gas-based pricing as opposed to oil-linked pricing.

The differential between LNG spot and long-term prices to narrow LNG spot prices, which are driven by supply-demand fundamentals (as opposed to oil-linked contract prices), are expected to recover from their current record low levels over the period to 2021.

In 2019 and 2020, the recovery is expected to be modest, as additions to world supply capacity either outpace or keep pace with demand growth.

The Australian view is that LNG spot prices are forecast to average US\$5.40 per MMBtu in 2019 and US\$6.30 per MMBtu in 2020.

In 2021, the pace of recovery is expected to accelerate. LNG spot prices are forecast to recover to US\$8.10 per MMBtu.

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Supply growth looks likely to slow dramatically in the early 2020s, as the ramp up of new capacity in the US, Australia and Russia draws to a close.

Demand is consequently expected to begin closing the gap on global production capacity in 2021.

Meanwhile, LNG contract prices in Asia are forecast to gradually decline over the outlook period to 2021, tracking the fall in oil prices.

LNG trade has grown rapidly over the past few years, driven by surging demand in Asia and the ramp up of new projects commissioned between 2009 and 2015.

“China was the second-largest LNG buyer in the world in 2018, importing 51MT of LNG. The imports continued to increase rapidly in the first eight months of 2019, up 15 percent on the same period a year earlier,” the report noted.

Clean-up

Strong growth in China's gas consumption is expected to continue over the outlook period, driven by China's efforts to reduce air pollution and the Chinese blue skies policy.

China is aiming to raise the share of gas in the overall energy mix from 7.0 percent in 2017 to a target range of 8.3 percent to 10 percent in 2020, and to 15 percent in 2030.

In 2021, China's gas consumption is forecast to reach 364 Bcm, up from around 280 Bcm in 2018.

LNG is expected to play a major role in servicing rising Chinese gas demand with China's LNG imports forecast to reach 72MT in 2021.

While both domestic production and pipeline imports are forecast to grow, they are not expected to keep pace with rising domestic demand.

China is targeting domestic gas production of 207 Bcm in 2020, up 30 percent from around 160 Bcm in 2018.

Difficulties

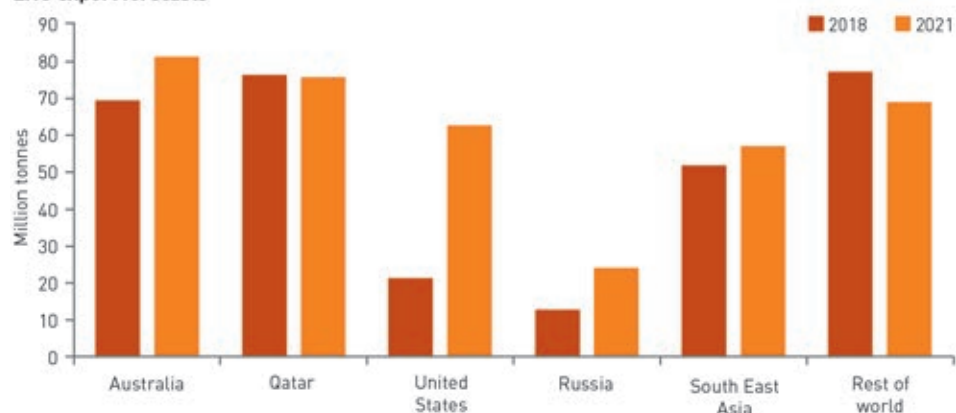
However, China faces difficulties in lifting domestic output, including challenging geology, and could fall short of its 2020 production target.

“China's pipeline gas imports are also expected to increase over the next few years,” said the report.

“Both the Central Asia-China Gas Pipeline expansion and the ‘Power of Siberia’ pipeline from Russia to northern-eastern China are scheduled for completion in late 2019,” it added.

“The impact of China's decision to increase tariffs on US LNG from 10 percent

LNG export forecasts



LNG shipments are set to increase among most supplier regions

a year ago to 25 percent from 1 June 2019 has had an impact,” stated the report.

“China has purchased more LNG from other sources, while US LNG exports have been directed to other markets. The effect of tariffs on short-term LNG prices appears to have been minimal, or has been swamped by other factors, such as rapidly increasing supply capacity in LNG markets,” explained the report.

“Australia has accounted for the majority of the increase in China's imports since China imposed tariffs on US LNG in September 2018,” added the Australians.

Effects

“However, it is difficult to attribute this increase directly to the effect of tariffs, given China's rapidly growing LNG demand and the ramp up of new Australian projects (such as Wheatstone and Ichthys) over the same period,” it said.

“The impact of China lifting tariffs on imports of US LNG to 25 percent from June 2019 will become clearer in coming months, as data for the second half of 2019 becomes available,” said the report.

“It is possible that trade flows will continue to reorganise around increased tariffs, with few apparent effects on the total market,” it added.

Tariffs may also mean that China has to bring in more LNG from higher cost, non-US sources. If non US-origin LNG is more costly for China to import, then tariffs could potentially have the effect of reducing China's LNG purchases,” said the report.

“A longer-term risk is that escalating trade tensions discourage or delay final investment decisions (FIDs) for a second wave of US LNG projects,” it suggested.

“Some US LNG developers are reportedly holding off on FIDs, with US-China trade tensions one consideration. Trade tensions may also deter China, which is expected to become the world's largest LNG buyer in the early 2020s,

from investing in new US LNG projects,” it said.

Japan issues

One other issue in the Asian market, is the future direction of Japanese LNG imports and its nuclear restarts programme.

Japan's LNG imports fell by 9 percent year-on-year in the first eight months of 2019, due to a relatively mild winter at the start of the year and increased nuclear power generation.

Japan's LNG imports are forecast to fall by 6MT over the outlook period to 75MT in 2021.

“Overall energy demand in Japan is expected to decline slightly. At the same time, LNG is expected to face increasing competition in the electricity generation sector from both nuclear and renewable power generation,” said the report.

“Nine of Japan's 42 nuclear reactors had gained approval to restart and seven were in operation. Further nuclear restarts appear likely over the next five years,” added the report.

“Eighteen reactors have applications to restart with the Nuclear Regulation Authority, and at least three reactors are likely to restart before the end of 2021,” it added.

“However, several possible eventualities are complicating the outlook for nuclear energy in Japan, and could see Japan import more LNG than what is forecast,” explained the report.

“In April, Japan's Nuclear Regulation Authority stated that it would order the shutdown of any nuclear reactors that have not met deadlines to implement counter-terrorism measures. A number of reactors are at risk of missing these deadlines over the outlook period (to 2021),” it said.

“In addition, ongoing public opposition to nuclear energy in Japan could delay the restart of more nuclear power reactors,” concluded the report. ■

IEA sees energy dominance strategy now in full flow for US led by LNG and domestic gas use

Paris-based body reports that US energy landscape has been transformed and carbon emissions have dropped

Given that the shale revolution has made the United States not only the world's top producer of oil and gas but also a major exporter of LNG, the US approach to energy policy making has shifted from a scarcity mindset that emphasised energy security to one that is attempting to maximise the benefits of energy abundance.

The Paris-based International Energy Agency last issued a report on the US in 2014 and now the landscape has been transformed.

Build-out

Since then the Federal Energy Regulatory Commission has been authorizing the build-out of LNG export plants and six are now onstream and shipping cargoes to global markets

They are Cheniere Energy Sabine Pass in Louisiana (2016), Cove Point LNG Dominion Energy in Maryland (2017), Cheniere's Corpus Christi in Texas (2018), Semptra's Cameron Hackberry plant (2019), Freeport LNG in Texas (2019) and Kinder Morgan's Elba Island plant in Georgia (2019).

"Current US government policy centres on the concept of 'energy dominance', which reflects a strategy to maximise energy production, benefit from larger energy exports, be a global leader in energy technologies and keep consumer energy bills in check," said the IEA.

It emphasized that a central implementing plank of the energy dominance strategy is to eliminate regulatory hurdles to expanding US energy production and boosting the competitiveness of the US energy industry.

"To this end, the administration has undertaken a strategy to revisit or rescind a number of environmental regulations applicable to broad segments of the energy sector, including the power, transport and upstream sectors," said the report.

Strategy

As part of the energy dominance strategy, the US administration has made several key regulatory moves.

It has repealed and replaced the Clean Power Plan to cut carbon dioxide (CO₂)

emissions from the power sector; is revising Corporate Average Fuel Economy standards for automobiles; ended a moratorium on new coal leases on federal lands; rescinded regulations on hydraulic fracturing on federal lands; and plans to lower regulatory requirements to cut methane emissions from oil and gas production.

In 2017, the US also announced its intention to withdraw from the Paris Agreement on climate change, effective in 2020.

Still, US carbon-dioxide emissions have fallen across all sectors - notably the power sector - in the past decade.

The EIA acknowledged the US progress, while pointing out that while emissions are expected to continue to decline over the coming decade, there remains a risk that, over time, the trend could be reversed.

Congress moves

The energy dominance agenda also includes a focus on expanding US energy exports as seen in the liquefaction plants that have come on stream and the number of future LNG export projects planned for along the US Gulf Coast.

US investment in LNG to supply other nations with clean energy is running into the high tens of billions over the next five or six years when the country is expected to become the No. 1 global LNG exporter.

Since the last IEA in-depth review, the US Congress lifted a ban on crude oil exports at the end of 2015.

Moreover, the Department of Energy streamlined the government's approach to LNG export approvals in 2014, helping to support the US becoming a major global supplier of LNG and a net exporter of natural gas.

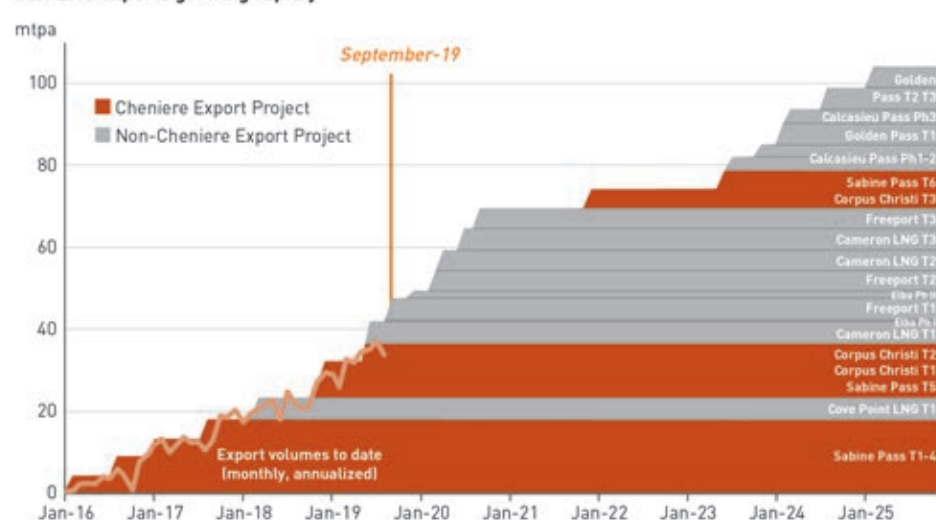
"The administration is also supportive of coal exports, though coal export infrastructure is limited, especially from the West Coast," said the IEA report.

"However, future production growth and exports depend on a complementary buildout of oil and gas pipelines," it added.

While private companies decide on whether to develop new energy infrastructure, the government plays an instrumental role in permitting.

"Energy infrastructure projects often

U.S. LNG exports growing rapidly



US LNG output is growing led by Cheniere Energy's two plants

require approvals from various federal, state and local authorities," said the report.

"Though the government has made efforts to streamline federal licensing for energy infrastructure, there remain cases of midstream infrastructure struggling to keep pace with shale production growth due to permitting setbacks, local opposition and court challenges," it explained.

"Timely siting of gas pipelines will also benefit efforts to reduce associated gas flaring rates from oil production," noted the report.

Innovation

The US is a global leader in energy-related research, development and demonstration (RD&D), and places a high value on innovation in the energy space.

"Federal government efforts to finance and support energy innovation are largely led by the DOE, including through its 17 national labs, which are considered world-class energy research and development centres," said the IEA.

"Current focus areas for DOE research include battery storage, small modular nuclear reactors, and carbon capture, utilisation and storage," it added.

"With the growth in variable renewable electricity generation, greater deployment of electric vehicles, and increased extreme weather events and cyberthreats, research into modernising and strengthening the power grid is also becoming a more important focus area," stated the report.

The United States is also engaged in energy RD&D internationally, including

by participating in most of the IEA Technology Collaboration Programmes and as a founding member of the Clean Energy Ministerial.

In line with US global leadership in clean energy technology innovation, these and other international collaborations are expected to receive continued support.

Power transition

The fuel mix of US power generation is undergoing a considerable transition.

Coal power, which produced nearly half of total electricity generation in 2008, has declined in the last decade to less than a third of the power mix.

One of the main drivers for this development has been the shale gas boom, which has made natural gas-fired generators more cost-competitive than coal power plants.

"Natural gas-fired electricity production increased by over 60 percent in 10 years and now exceeds coal's share in the power mix," said the report.

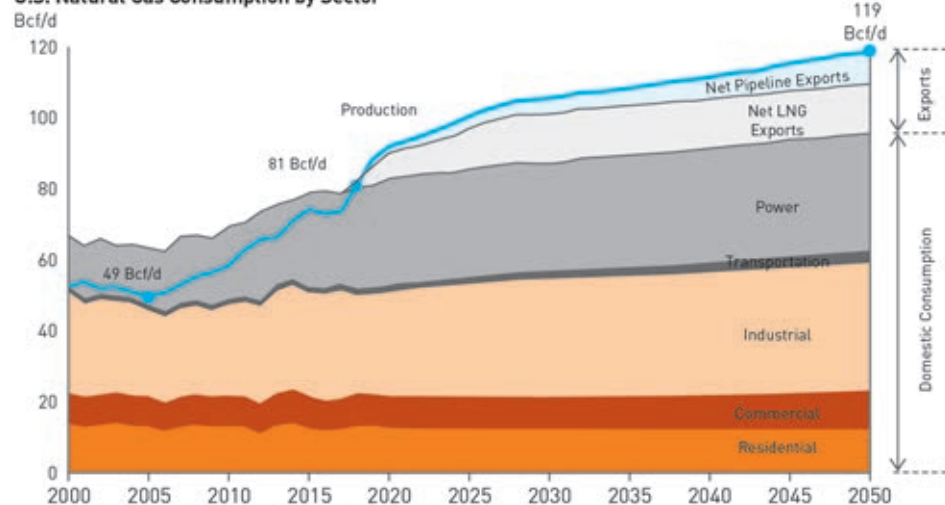
"Meanwhile, renewable electricity has seen rapid growth as well, driven by reduced costs and policy support," said the IEA overview.

Competitive

"Nuclear, which has been the most stable power source over the last decade, is challenged by cheap gas power and new renewable sources in some markets, and it struggles to remain cost-competitive," said the report.

As the US power mix shifts, and as more variable renewables are introduced into the system, bolstered by state policy

U.S. Natural Gas Consumption by Sector



Source: U.S. Energy Information Administration, Annual Energy Outlook 2019 ("Reference" case outlooks)

Domestic natural gas use in US versus LNG and pipeline exports

goals, the question of smoothly and cost-effectively connecting new generation sources to the grid has already become more salient, and will grow increasingly pressing in the coming years," stated the IEA.

Considering that the US has a complex electricity system with a mix of competitive markets, vertically integrated markets, and private and publicly owned assets, regulatory responses to ensure a

smooth transition of the power sector will vary across US regions.

In particular, grid operators are increasingly integrating flexibility resources such as storage, demand response, transmission planning and capacity

markets into market designs to safely accommodate larger shares of variable renewable sources such as wind and solar into the electricity system.

For natural gas, the US president is authorised to declare and respond to a natural gas supply emergency.

Provisions include authorities for emergency purchases and emergency allocations to protect high-priority users of natural gas.

"The shale revolution has significantly changed the role of natural gas in the country's energy mix, especially increasing its share in electricity generation," said the IEA.

"In this context, co-ordination between the electricity and the natural gas systems takes on special importance when dealing with gas supply disruptions, but also electricity blackouts," it added.

"The US has for many years maintained a robust system that assesses and manages grid reliability to avoid power shortages," explained the IEA.

Extreme events

"Yet in the face of rising extreme weather events, new cybersecurity threats, a growing share of variable generation, and retirement of older coal and nuclear

plants (due in part to lower wholesale natural gas power prices), the US has recently entered into a renewed debate on power sector reliability and resilience," it added.

The IEA key recommendations to the US are:

- ♦ Set effective and streamlined regulations to enable the US to remain a global leader in emissions reduction and clean technologies.
- ♦ Evaluate the allocation of decision-making authority for the permitting and siting of natural gas pipeline projects in order to identify possible ways to shorten lead times and reduce uncertainty for investors.
- ♦ Provide adequate support to international collaboration efforts of US national laboratories and DOE RD&D programmes to maintain global leadership on energy technology innovation.
- ♦ Conduct regular and comprehensive assessments of risks and vulnerabilities to foster preparedness, and maintain reliability and resilience in the face of new Challenges. ■

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For the Record

AIR PRODUCTS, the US maker of LNG processing equipment and a leading industrial gases provider and plant developer, said it would invest \$250 million in a project in Jiangsu Province in China as part of its gasification growth strategy and would also boost its Chinese merchant supply capability. The Air Products investment would be in a joint venture with a subsidiary of Jiangsu Debang Chemical Industrial Group Co. to build, own and operate a coal-to-syngas processing facility at the Xuwei National Petrochemical Park in Lianyungang City. Air Products said it would own 80 percent of the joint venture and Debang Group would hold 20 percent. The joint venture will own and operate the air separation unit, gasification and purification assets under a 20-year contract for a fixed monthly fee, supplying syngas to support Debang Group's 350,000 tons-per-year chemicals facilities. The latest Air Products project in China is expected to be onstream in 2023. The Lehigh Valley, Pennsylvania-based company conducts its industrial gases business alongside its provision of LNG equipment products such as the LNG main cryogenic heat exchangers and its proprietary propane pre-cooled mixed refrigerant liquefaction process. Most of the worldwide LNG production comes from Air Products technology and the company provides key equipment for the natural gas liquefaction process for large export plants, small and mid-sized plants and floating LNG facilities.

As part of its new activities in China, Air Products said it would also be the exclusive purchaser of merchant liquid products from the joint venture facility, establishing a strong supply position to serve the high-growth chemical, optoelectronics and general manufacturing industries in the Lianyungang area and key surrounding cities north of Jiangsu and south of Shandong in Eastern China. "This new project furthers our gasification growth strategy in the Xuwei National Petroleum Park - one of seven national integrated oil refining and petrochemical parks in China - while also creating new merchant supply

capability for us to serve a high density manufacturing base in the region," said Seifi Ghasemi, Chairman, President and Chief Executive of Air Products. "We are honored to form this joint venture with Debang Group to own and operate the gasification facilities and supply the syngas that will enable Debang to produce needed ammonia and other products for their customers," added Ghasemi. Zhao Xiang Hai, the Chairman of Debang Group, said the project was an important step in accelerating the pace of scientific and technological innovation and eliminating outdated production capacity in China. "This project received strong support from the municipal government and the Xuwei Park's management committee, and we believe this is only the beginning," said Zhao. "We look forward to our strong collaboration with Air Products providing quality, value, and high efficiency through this strategic project," he added. Air Products is involved in other gasification ventures in China. The company most recently announced the completion of an asset buyback and long-term gas supply agreement for Jinmei Huayu's coal-to-clean fuels project in Jincheng City in Shanxi Province. Other Air Products large-scale, multi-billion-dollar gasification projects include the Lu'An, Jiutai and Yankuang Group ventures in China as well as the Jazan plant in Saudi Arabia.

BRITTANY FERRIES, the French line that links the UK with Spain and France, has celebrated the launch of its cruise-ferry "Galicia" and the start of work on another LNG-powered vessel, the "Salamanca", at the Avic Weihai shipyard in Shandong in eastern China. The newbuilds are part of the Breton company's 550 million euros (\$607M) fleet renewal programme. Its very first LNG-powered ship, the "Honfleur", is currently under construction at the Flensburg shipyard in Germany and will enter service on the route from Portsmouth in the UK to Caen in France in 2020. The "Honfleur" and the "Salamanca" will be joined a year later by a third LNG-fueled sister ship to be named "Santoña". "While 'Galicia' will be fitted with funnel exhaust gas cleaning systems, 'Salamanca' and 'Santoña' will be amongst the first ferries of their type to be powered by LNG, offering significant environmental advantages over traditional marine fuels, burning more efficiently and producing no sulfur, virtually no particulates and 95

percent less nitrogen dioxide," said Brittany Ferries. "The 215-metre long hull of 'Galicia' was majestically floated out at a traditional Chinese ship-launching ceremony," said the company. "Then, alongside in the building dock the very first steel was cut for fleet mate 'Salamanca', marking the beginning of the ship's construction," it added.

When complete, the two ships will serve Brittany Ferries' long-haul routes connecting Portsmouth to Santander and Bilbao in northern Spain, with "Galicia" due to enter service in late 2020 followed by "Salamanca" in the Spring of 2022. "It gives me great pleasure to be here in China to celebrate the launch of 'Galicia' and the start of work on 'Salamanca'," said Brittany Ferries Chief Executive Christophe Mathieu at the ceremony. "Our customers rightly expect our fleet to be modern, comfortable and efficient, with the promise of minimal environmental impact from operations and we can only achieve this aim with the very best, innovative new ships," added Mathieu. "The 'Galicia' and 'Salamanca' are perfectly suited to our long-haul Spanish operations, and will allow us to further enhance our service to holidaymakers and hauliers taking advantage of these routes," stated the CEO. Mathieu also mentioned the uncertainty facing the company over Brexit, as a long-time and popular ferry company for British passengers and freight. "As a French company operating ferries between the UK, France, Spain and Ireland, we are, for sure, concerned by the current political uncertainty in Europe," he said. "But we are certain of the course that Brittany Ferries will follow in the years to come. And these brand new ships are tangible evidence - in steel - of our confidence and optimism looking ahead," added Mathieu. The three 42,200-tonne "E-Flexer" class ships will be among the biggest in the fleet of Brittany Ferries, measuring 215 metres long, with around three kilometres of space for cars and lorries. Brittany Ferries currently has 11 ships carrying between 2.5 million and 2.7M passengers each year travelling in approximately 900,000 cars. Freight trucks number 210,000 annually and there is one freight-only route linking Bilbao in Spain with Poole in the UK. The company's services cover 11 ports: Spain's Bilbao and Santander, the UK's Portsmouth, Poole and Plymouth, the Irish port of Cork and the French ports of Caen, Cherbourg, Le Havre, Saint-Malo and Roscoff.

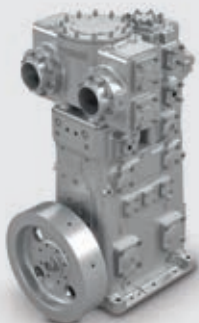
CHART INDUSTRIES, the US LNG equipment maker, said it received full notice to proceed for the production of cold boxes and brazed aluminum heat-exchangers for Venture Global's Calcasieu Pass liquefied natural gas export project. Calcasieu Pass will produce more than 10 million tonnes per annum of LNG and is expected to come on stream in 2022, along with associated facilities, including the TransCameron Pipeline. Arlington, Virginia-based Venture Global is also advancing with the Plaquemines LNG export venture sited near river mile-marker 55 on the west side of the Mississippi River, 30 miles south of New Orleans. Chart noted that this week Venture Global announced the final investment decision and the closing of the project financing for its Calcasieu Pass facility in Cameron Parish, Louisiana. At the end of March 2019, Chart booked the full equipment order of \$135 million for the Calcasieu project from Baker Hughes-GE. BH-GE had been awarded a contract and granted notice to proceed on the construction of a comprehensive LNG technology solution for the Calcasieu Pass project.

Chart will deliver the equipment on a multi-year schedule in conjunction with BH-GE and Kiewit. "We are proud to be part of Venture Global's unique and innovative Calcasieu Pass project and overall LNG model," stated Jill Evanko, Chart's President and Chief Executive. "In conjunction with our strong partners on this project, we will provide the highest quality cold boxes and heat exchangers on schedule from our Wisconsin and Louisiana facilities," added Evanko. Venture Global is controlled by former investment banker Michael Sabel and lawyer Robert Pender, who act as joint chief executives. They are additionally making progress with a third project, the Delta plant with a site also on the Mississippi River. The Delta liquefaction facility and its associated pipeline would have output capacity of 24 MTPA. The proposed Delta and Plaquemines plants are stand-alone projects with no shared facilities and are under different development schedules.

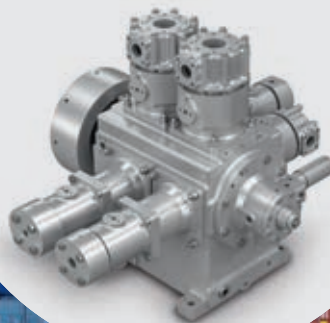
CLOUGH, the Australian engineering and construction company, said it had won the contract to build the loadout line trestle off Kitimat in British Columbia for the Royal Dutch Shell-led LNG Canada project. Clough, an experienced LNG industry participant following the

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build-out that made Australia the global No. 1 exporter, said its project team would initially be based in Clough's office in Calgary in Canada's Alberta province. The Calgary team would carry out the design phase of the contract followed by mobilisation to the Kitimat site, which would commence in due course for the construction phase. "We are extremely pleased by the award of this scope," said Clough Chief Executive Peter Bennett. "This project award also represents Clough's first major international marine contract since 2010," added Bennett. The LNG Canada project is estimated to cost C\$40 billion (US\$31.2Bln), making it the biggest ever energy investment in Canada. The project EPC contractors are Fluor Corp. of the US and JGC Corp. of Japan. The first phase of the LNG Canada project will be built on a 400 hectares site in the industrial area of Kitimat, located about 650 kilometres north of Vancouver.

It will comprise two LNG liquefaction Trains, each with 7 million tonnes per annum of output and two LNG storage tanks, each of 225,000 cubic metres capacity in addition to other facilities. The province of BC previously had at least a dozen large-scale projects backed by the world's leading energy companies, then policies pushed by the federal government in Ottawa since 2015 made projects uneconomic and coincided with an oil price slump. Shell and its four partners, Mitsubishi Corp. of Japan, Malaysian energy company Petronas, Chinese major PetroChina and Korea Gas Corp., agreed in October 2018 to start immediate construction at the brownfield site near Kitimat that had been an energy products terminal before being acquired by Shell in 2011. One other large-scale venture in the province is still advancing. That is the Kitimat LNG venture proposed for Bish Cove near Kitimat by US major Chevron Corp. and Woodside Petroleum of Australia. Both LNG Canada and Kitimat LNG are backed by the majority of the Haisla First Nation of native North Americans on whose traditional lands the plants are being constructed.

CME GROUP, the Global commodities exchange operator, said it would launch a futures contract for liquefied natural gas linked to physically delivered volumes from the Sabine Pass export plant of Cheniere Energy. The contract called the US LNG Export future is to start trading on October 14

and will have 24 delivery months. This means that a market participant in October 2019 could buy an August 2021 LNG cargo and trade it up until the delivery date. The launch of the latest LNG derivative comes as US exports are growing and shipments from the Gulf Coast and Maryland already account for 10 percent of the global market. CME said its product would help buyers to manage risk, giving them exposure to the fastest growing source of LNG supply while at the same time shedding light on physical and future prices. The contract will be based for now on Cheniere Energy's exports from Sabine Pass and will be expanded to include other US plants. "The Freeport LNG terminal and additional facilities will be included in future delivery months," said CME, the former Chicago Mercantile Exchange. "The new LNG futures contract expands CME's already robust suite of global natural gas futures and options and will complement the world's leading gas benchmark Henry Hub Natural Gas futures," stated CME. The exchange said that it would work very closely with commercial customers and industry participants in the LNG market. "This contract is structured to align with the complex logistics of the LNG markets, including a unique monthly physical settlement on the US Gulf Coast," said Peter Keavey, CME Group Global Head of Energy. "At a time when the United States is poised to become a significant source of freely traded LNG cargoes, we believe CME's LNG and Henry Hub natural gas futures will help the industry to more effectively and efficiently manage price risk around the world," Keavey explained.

He said that as Sabine Pass was the first LNG export plant in the lower 48 states and the source of large-scale shipments it was fitting that Cheniere's facility should be the first location for the derivative. Anatol Feygin, Chief Commercial Officer and Executive Vice President for Cheniere, said this Sabine Pass futures contract will allow for enhanced short-term price discovery and risk management for the US Gulf Coast market. "These are important commercial evolutions for our customers and for the broader global natural gas market," added Feygin. Global LNG demand is forecast to increase by 4 percent annually after reaching a record 432 billion cubic metres in 2018, driven by growth in the Asia Pacific region. "As the world's largest buyer of LNG, we

believe diverse risk management tools bring more transparency to the marketplace and we welcome CME Group's launch of physically delivered LNG futures," said Kazunori Kasai, Chief Executive of JERA Global Markets, which buys LNG and other resources for the largest utilities in Japan. "We expect CME's US LNG Export futures contract will have a positive impact on the procurement and price discovery of LNG in Asia, as well as in the US," added Kasai. CME said that the US LNG Export futures will be available for trading on CME Globex, for submission for clearing through CME ClearPort and would be subject to the rules and regulations of the New York Mercantile Exchange. A number of other contracts have been launched in the past two years related to LNG and LNG shipping as supply of the fuel and its infrastructure have expanded. The CME and the Intercontinental Exchange have launched futures and options priced against the Japanese Korea Marker which has been published by US commodity pricing agency S&P Global Platts for a decade and has become a benchmark for Asian LNG prices. Most of the world's LNG is bought under bilateral contracts, some lasting as long as 20 years and linked to oil prices. However, the remaining 20 percent or so is traded on the spot market.

CONOCOPHILLIPS and Australian and Japanese energy companies have signed accords linked to legislation implemented by Australia for a treaty with the tiny southeast Asian nation of Timor-Leste to establish their maritime boundaries in the Timor Sea off northwest Australia. The treaty establishes permanent maritime boundaries between Australia and Timor-Este, previously known as East Timor, and a stable legal framework for the development of gas and oil resources as well as the operating Darwin LNG plant and the future Sunrise LNG project. The Australian Government said it had been working with the former Portuguese colony, briefly occupied by Indonesia, and offshore petroleum operators on transitional arrangements that provide commercial certainty and security for all parties. Australia said it was now ready to partner with Timor-Leste, independent since 1999, to jointly develop a major gas field known as Greater Sunrise for the benefit of both countries. "Greater Sunrise will provide

new opportunities for income, and commercial and industrial development in Timor-Leste, and is an important part of Timor-Leste's economic future," said the Australians. ConocoPhillips and several other companies, including Adelaide-based Santos, said they were delighted to sign the accord supporting the continued stable framework for petroleum activities in the Timor Sea. They signed along with the other Bayu-Undan joint venture partners agreeing to the Bayu-Undan natural gas project operating in Timor-Leste's exclusive maritime jurisdiction under terms equivalent to previous arrangements. "We are delighted to have been part of this historic achievement which marks the next chapter in Timor-Leste's economic independence and development," said Santos Chief Executive Kevin Gallagher. "And what better time to reach and celebrate this milestone than the 20th anniversary of the day when the people of Timor-Leste voted resoundingly for independence," added Gallagher.

Santos and ConocoPhillips said the transition agreements bring the certainty and stability needed for ongoing operations at Bayu-Undan and a clear pathway for future resource development in the waters of Timor-Leste. "The ratification of the Maritime Boundary Treaty is a significant milestone for Timor-Leste in their journey to sovereignty in the Timor Sea," said ConocoPhillips Australia President Chris Wilson. "We congratulate Timor-Leste Prime Minister Taur Matan Ruak and his government, particularly the Autoridade Nacional do Petróleo e Minerais, for their role in developing the complex regulatory framework that will provide continued stability for Bayu-Undan," added Wilson. "The Bayu-Undan joint venture partners have had the privilege of developing the Bayu-Undan project together with Timor-Leste and are proud of the benefits the project has delivered to the people of Timor-Leste over the past 15 years," explained the ConocoPhillips executive. The Bayu-Undan upstream facilities now fall entirely within Timor-Leste's jurisdiction, while the Bayu-Undan to Darwin Pipeline, including the small portion within Timor-Leste's sovereign waters, will be subject to Australia's exclusive jurisdiction. ConocoPhillips holds almost 57 percent of the licence for the Bayu-Undan gas field and Santos has an 11.5 percent interest in the field

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and a similar stake in Darwin LNG plant in operation since 2006. Other shareholders include Japanese energy company Inpex Corp. with 11.4 percent, Italy's Eni with 11.0 percent and Tokyo-Timor Sea Resources with 9.2 percent. Tokyo-Timor Sea Resources is a venture formed by Tokyo Gas and Japanese energy and utility company JERA Co. Inc. The Sunrise LNG project was previously led by Woodside Petroleum of Australia and could now move forward. Timor-Este is now the majority licence owner of the Sunrise gas field operated by Woodside after it completed the purchase of stakes from Royal Dutch Shell and ConocoPhillips earlier in 2019. The Timorese national oil company paid Shell US\$300 million for a 26.6 percent interest in the Sunrise field. ConocoPhillips received \$US350 million for its 30 percent stake, while Japanese utility Osaka Gas still owns a 10 percent stake. The Sunrise gas and condensate fields in the Timor Sea had remained undeveloped due to the border dispute.

CRYO SHIPPING, the Norway-based company, said it was accelerating its development of liquefied natural gas as a marine fuel by offering more varied services, including LNG on a spot basis. Cryo Shipping intends to give Nordic fuel market participants a range of options including truck-to-ship and ship-to-ship refueling or specialist extra services such as tank cool-down by nitrogen or LNG, inerting, degassing and the renting of equipment such as cryogenic couplings and hoses for transfers. “The company will supply the industry with clean fuel at the market’s most competitive and flexible terms, driving the bunker market in the right direction,” said Cryo Shipping in a statement. The company carried out its first LNG truck-to-ship bunkering operation in May 2018 at the Swedish port of Malmo where it supplied fuel to the LNG-powered cement carrier “Greenland”. “We receive a lot of interest and inquiries for LNG bunkering from shipowners and charterers and hope our presence in the bunker market will have positive impact on the appetite for investment in LNG-fuelled ships,” explained Cryo Shipping Managing Director Nicholai H. Olsen. Olsen noted that in his view the LNG bunkering market has until now been very small and regional with a lack of commercial flexibility, transparency and competition.

Cryo Shipping is run by Olsen and

business partner Are Magnussen and they say they intend to bring a new approach and spirit to the LNG bunker market inspired by their backgrounds in the shipping and oil and gas industries. “Cryo Shipping’s strategy is to align their supplies with the business model of each individual client, and make LNG available in any port where it’s most cost effective,” explained Olsen. “The company is also offering spot bunkering without any long-term commitments, and this has been perceived extremely positively in the market,” he added. Cryo Shipping believes the LNG bunkering market has to become more dynamic with new players challenging traditional and established suppliers. “To be green and lean is key to delivering a good product and to building a successful business that our customers will appreciate,” said Olsen and Magnussen.

DOMINION ENERGY Cove Point LNG, the owner of the export plant on Chesapeake Bay, has been given permission by regulators to start-up its Eastern Market Access Project to provide additional pipeline natural gas to the Washington DC region as well as LNG customers in Japan and India. The Federal Energy Regulatory Commission said that Dominion could now place the project in service after it was completed at a cost of \$147.3 million. Dominion Cove Point will be able to provide an additional 284 million cubic feet per day under the Eastern Market Access upgrade for customers in Washington. “This authorization is based on our review of Dominion Energy’s request, its recent construction status reports, and our August 27, 2019 field inspection,” added the FERC. “Additionally, Dominion Energy has committed to complete restoration of the Charles Station area in the fall of 2019,” stated the regulator. Washington Gas Light Co. (WGL) and Mattawoman Energy had originally signed on as customers for the capacity, but Mattawoman later dropped out as a project customer. The project upgraded the Loudoun compressor station and the Loudoun Metering and Regulating Station, both in Loudoun County, Virginia.

Modifications and upgrades were also made at the existing Pleasant Valley Compressor Station in Fairfax County, Virginia. The Eastern Market Access Project had received a favourable environmental assessment in 2017. The FERC found that the benefits that the

Eastern Market Access Project would provide to the market outweighed any adverse economic effects on existing shippers, other pipelines and their captive customers, and on landowners and surrounding communities. In an earlier notice, the FERC said that Cove Point LNG had exported 30 LNG cargoes in the first half of 2019 after shipping its first cargo in March 2018. Japanese trading house Sumitomo Corp. and Indian state-owned gas utility Gas Authority of India each have 20-year take-or-pay contracts for liquefaction capacity at Cove Point. Sumitomo has, in turn, signed 20-year deals to sell most of its supplies to Japanese utilities, Tokyo Gas and Kansai Electric.

GASUM said the liquefied natural gas fuel filling station network in the Nordic countries was growing as the Finnish energy company opened its third station in Sweden and plans to enter the road transport fuel market in Norway. Gasum said the new Swedish station offers LNG and liquefied biogas for heavy-duty vehicles in the town of Orebro, where Gasum also has a biogas plant. The Finnish natural gas company has set itself a 2019 goal of expanding its filling station network for heavy-duty vehicles to 20 stations, with 12 of the stations located in Sweden. Gasum hopes to have a network for 50 liquefied gas filling stations for all vehicles by the early 2020s. “Heavy road transport is increasing and today represents around 30 percent of carbon-dioxide emissions in the EU road transport sector,” Gasum claimed. “Replacing traditional fuels with alternative low-emission fuel options is quickly becoming the norm throughout the road transport sector, as well as in other industries,” Gasum noted.

The company said customer demand for cleaner fuels for heavy-duty vehicles is increasing rapidly, which is why Gasum, together with its partners, was focusing on developing the gas infrastructure and filling station network in the region. “For logistics (trucking) companies, LNG and LBG are a necessity in the transition to a carbon neutral future. At the same time, they enable significant savings in fuel costs,” said Mikael Antonsson, a transport director at Gasum Sweden. According to recent European Union legislation, the average CO2 emissions of new trucks needs to be 15 percent lower by 2025 compared with 2019 and at least 30 percent lower by 2030. Furthermore, Sweden has set a

national target to reduce CO2 emissions from domestic traffic by at least 70 percent by 2030. “With the use of LNG, CO2 emissions can be reduced by approximately 20 percent compared to traditional fuels and with LBG the reduction is as much as 85 percent,” said Gasum.

HOGLUND MARINE Solutions of Norway has been awarded a contract by shipping company Bergen Tankers to deliver a cargo-handling system for the LNG bunkering vessel “Bergen LNG”. “As part of a long-term charter with Shell Gasnor, the vessel will be the first LNG bunkering vessel to operate in Norway and will be retrofitted from an existing fuel oil bunkering ship,” explained Hoglund. “Previously known as ‘Oslo Tank’, the ‘Bergen LNG’ vessel will operate in Bergen harbour from the fourth quarter of 2020 and will serve future LNG-powered cruise ships in the Hurtigruten and Havila coastal routes,” added Hoglund. Hoglund said it would supply both hardware and automation solutions to ensure safe and efficient operations, including an IMO Type C cargo tank, cargo pumps, bunker manifolds, custody transfer system, and a ship-to-ship transfer system. “Hoglund has worked on several of the world’s current LNG bunkering vessels, and each project has demonstrated how specialist expertise is needed to integrate and control the systems of these vessels safely and reliably,” said Peter Morsbach, the Director of Projects at Hoglund. “Retrofits should be an easy way for an owner to benefit from the shift to alternative fuels, but there are complications that can stand in the way that require more than the standard one-size-fits-all solution to overcome,” he explained.

“Unlike a newbuild, which belongs to the yard until delivery, a retrofitted vessel is the property of the owner throughout its refitting,” added Morsbach. “At Hoglund, we support the owner by drawing upon our dedicated expertise and vast experience to ensure an in-time delivery, installation of our solutions and overall integration of loose ends,” he stated. Ingemar Tonder Presthus, the Technical & Marine Manager at Bergen Tankers, said that a retrofit was a complex technical challenge from both a hardware and software engineering point of view. “Hoglund was an ideal choice, based on their track record fitting automation systems for LNG bunker vessels and

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other vessel types elsewhere in the world, and their ability to execute a retrofit quickly,” he added.

HIRANANDANI Group of India, with plans to deploy a floating storage and regasification unit within months for LNG imports at Jaigarh port, south of Mumbai, has signed a cooperation accord with Russian company Novatek, operator of the Yamal LNG plant in Siberia and developer of the Arctic LNG II project. Novatek said the memorandum of understanding envisaged cooperation in LNG supplies to India on a long-term basis, joint investment in future Indian LNG terminals planned by Hiranandani and in Russian LNG projects. The family-controlled Hiranandani conglomerate and Novatek said they also planned to establish a joint venture to market LNG and natural gas to end-customers in India, Bangladesh and other markets. The Indian company's FSRU is expected to start commercial operations at Jaigarh port in the fourth quarter of 2019, a year behind schedule. Chief Executive Darshan Hiranandani said recently the Indian project was on track and in addition to the FSRU includes related infrastructure and a pipeline of 60 kilometres. “India is one of the largest and fastest growing LNG markets, and will be one of the main sources of future growth in global demand for natural gas,” said Novatek Chairman Leonid Mikhelson after the accord was signed with Hiranandani at an economic forum in the Russian Far East city of Vladivostok. “It is an important step towards entering the end-customer market in India, which is of great interest to Novatek taking into account our strategic plans to implement new LNG projects and significantly increase our LNG production volumes,” added Mikhelson. The Hiranandani Group's H-Energy subsidiary will operate the Jaigarh terminal with annual capacity of 4 million tonnes per annum of LNG and with re-loading capabilities. Hiranandani is one of the largest Indian companies with its main offices in Mumbai and Dubai in the United Arab Emirates. While it started as a property investment business it has broadened its interests into other areas such as energy and power. H-Energy CEO Darshan Hiranandani said he was “excited” to partner with Novatek in Arctic LNG II and to participate in and bring supplies to downstream customers in India and Bangladesh.

“This will be through its terminals in

Jaigarh, Kakinada and Haldia and through its two pipelines, Jaigarh to Mangalore and Kannai-Chatta to Shrirampur. This will ensure a safe, reliable and economic supply chain from the gas fields to the burner tip,” explained Darshan Hiranandani. The Indian FSRU charter to H-Energy is for a period of five years and the ship will arrive at the LNG jetty at Jaigarh just before the start-up. Most of the onshore infrastructure work has almost been completed by Engineers India Ltd (EIL), a project construction company. H-Energy said the West Coast facility would be of great benefit to Maharashtra state by providing clean fuel for transportation and for city-gas use. “The LNG terminal will offer storage, regasification, re-loading, bunkering and truck-loading facilities to cater to the growing energy demand of Indian industries,” said the company. When operational, the regasified LNG will be supplied to customers through the pipeline connected to national gas grids at the city of Dabhol. The facility would be the fifth LNG import terminal located near Mumbai, with three of them located at Hazira, Dahej and Dabhol for use by importers Shell, Petronet LNG and Gas Authority of India respectively. A fourth is mechanically completed at Mundra. It is owned by Gujarat State Petroleum and the Adani Group, though has yet to be fully commissioned. However, there is only one LNG terminal for the whole East Coast of India with about half-a-dozen others planned. Indian Prime Minister Narendra Modi inaugurated the first East Coast facility in March 2019 at Kamarajar Port in Tamil Nadu. The Kamarajar facility is owned by Indian Oil Corp., the refining and fuel marketing company, and has 5 MTPA of import capacity and two tanks each with storage of 180,000 cubic metres. Novatek also signed an LNG fuel transport agreement in Vladivostok with Petronet LNG, operator of the Dahej terminal north of Mumbai and the Kochi terminal in the southwest state of Kerala. The Novatek-Petronet accord is on future LNG projects and the joint marketing of LNG as motor fuel in India, including joint investment in developing a network of filling stations and a fleet of LNG-fueled trucks.

INDIA is on track for another import terminal on the East Coast. H-Energy and Kakinada Seaports signed an agreement for an LNG regasification and reloading terminal to be sited at Kakinada port in Andhra Pradesh, which

would be only the second such facility on the East Coast of India. Kakinada Seaports controls the concession for the Kakinada Deep Water Port under an agreement with the government of Andhra Pradesh. “H-Energy shall develop an LNG hub at the Kakinada Port catering to the needs of domestic customers in the state of Andhra Pradesh and shall supply LNG through small LNG vessels to H-energy’s proposed Kukrahati LNG terminal in the state of West Bengal and neighboring countries like Bangladesh and Myanmar,” explained H-Energy. Darshan Hiranandani, Chief Executive of H-Energy, said the company was excited to partner with Kakinada Seaports for this East Coast project. “We believe that Kakinada with its existing breakwater and deep draft combined with its close proximity to various natural gas pipelines makes this an efficient and successful project for our customers, our partners, and ourselves,” said the CEO. “The PSA along with its associated agreements envisages a long-term association between the two organizations contributing towards India’s growth story, especially, the vision of the Government to promote a gas-based clean economy,” he added. Depending on the timing, the Kakinada terminal could be only the second on the East Coast of India after the start-up in March 2019 of the first facility at Kamarajar Port in Tamil Nadu.

INDIAN liquefied natural gas imports increased for a fourth month of the current fiscal year as volumes received rose more than 9 percent with supplies coming from countries such as Angola in southwest Africa and traditional suppliers such as Qatar. LNG imports during July came to 2.02 million tonnes (2.73 billion cubic metres) which was 9.1 percent higher than 1.85MT delivered in the same month of 2018. The main operating terminals on India’s West Coast are at Dahej, Hazira and Dabhol, near Mumbai, and there is one East Coast terminal at Kamarajar, 25 kilometres north of Chennai Port in Tamil Nadu. The cumulative LNG imports for the first four months of the fiscal year from April to July came to 7.88MT (10.65 Bcm), an increase of 6.6 percent compared with the 7.39MT received in the first four months of last year, according to the Ministry of Petroleum and Natural Gas. The July imports cost around \$800 million versus

\$900M in July 2018. In the first four months of the fiscal year, the shipments have cost \$3.1 billion compared with \$3.4Bln in the same period last year. Indian natural gas production during July edged 0.2 percent higher to 2.71 Bcm versus 2.04 Bcm in the same month of 2018. Production of natural gas from April to July came to 10.74 Bcm, down 0.3 percent from the 10.78 logged in the April-July period last year. Of the 30 or so cargoes delivered in July, Angola was a main supplier. The 160,400 cubic metres capacity carrier “Cubal” unloaded a cargo on July 1 at the Hazira terminal from the Angola plant at Soyo in southwest Africa.

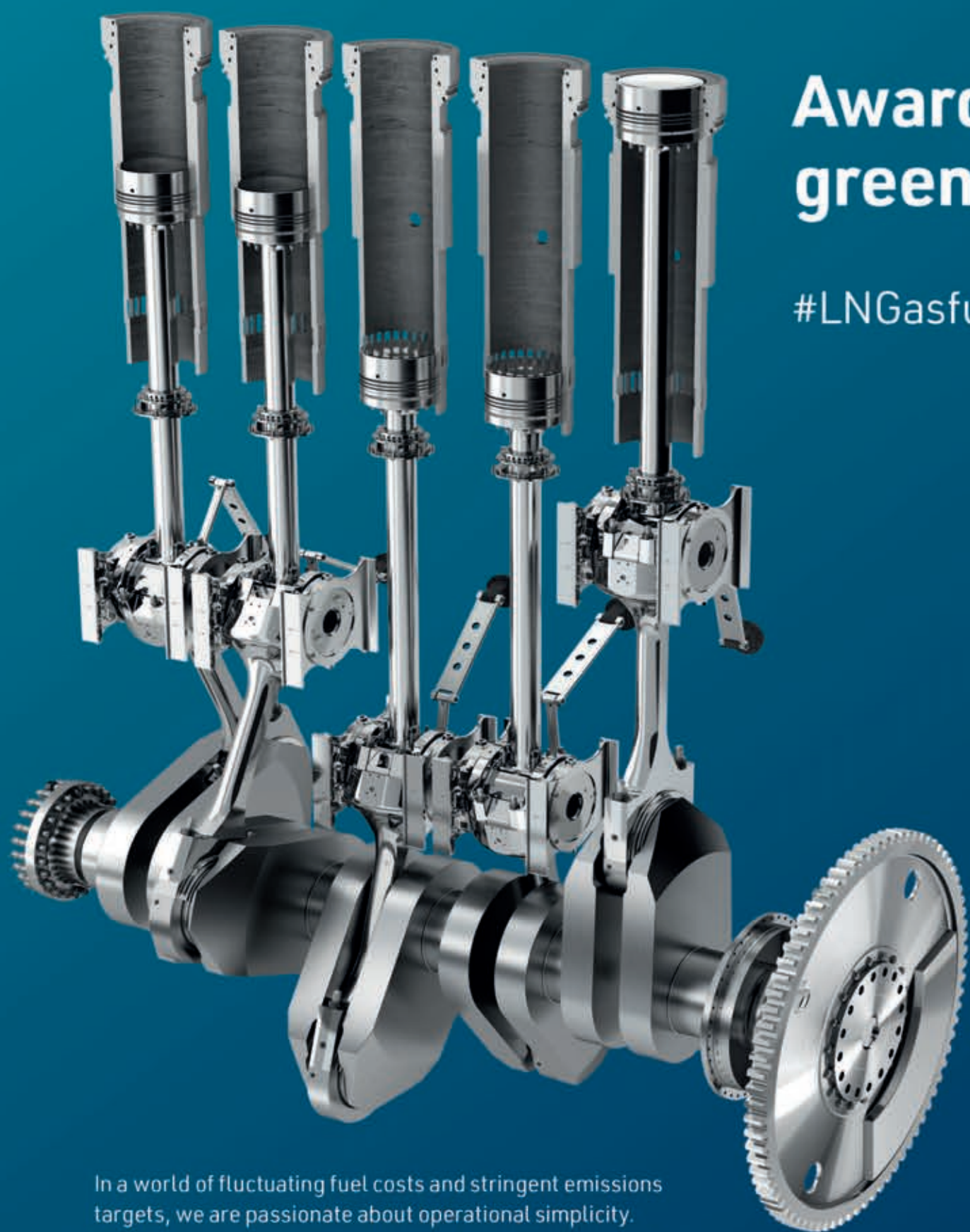
The 160,500 cubic metres capacity vessel “Sonangol Benguela” delivered a shipment on July 16 to the Dahej terminal north of Mumbai from the Angolan plant. The 160,400 cubic metres capacity vessel “Malanje” unloaded another Angolan cargo on July 24 at the Dahej terminal. Analysts noted that India could easily import and use double its current capacity were it not for its lack of infrastructure. On the terminal development front, Japanese company Toyo Engineering has been awarded a contract to construct another import terminal near Kodinar, north of Mumbai. This will be the seventh regasification facility on the West Coast when completed. The facility will be located at Chhara port in Kodinar, part of the Gir Somnath district, and will have 5 million tonnes per annum of capacity.

KNUTSEN OAS Shipping, the Norwegian LNG and tanker fleet owner with more than 30 vessels, has chosen Dutch-based AkzoNobel to supply marine coatings for its latest newbuilds from the South Korean shipyard of Hyundai Heavy Industries. Two more Knutsen vessels have received hull coatings from AkzoNobel’s high-performance Intershield 300 and Intersleek foul-release products. AkzoNobel, the global paint and coatings supplier whose brands include Dulux paints, said another two recent newbuilt Knutsen LNG carriers received the coatings. They are the “Adriano Knutsen”, which has already left the shipyard, and the “Rias Baixas Knutsen” whose delivery is imminent. The Knutsen LNG fleet now numbers 13 vessels with delivery of the newbuilds. “Knutsen has used Intershield 300 on our vessels for a long time,” said Oliver Smith, Project Manager of the shipping

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company. “The reason Knutsen applied Intershield 300 on our new LNGs is because we knew that in the long term, we were able to benefit from the lower maintenance cost,” explained Smith. “When we have inspected the ballast tanks every five years for our vessels in service having Intershield 300, the number of repairs has been very minimal,” Smith added.

Intersleek was the industry’s first biocide-free foul release coating when it was released in 1996 and provides complete fouling prevention to the hulls of vessels prior to and after dry-docking. “We’re delighted that our high-performing marine coatings were selected for Knutsen’s latest LNG vessels and proud that our experience and capability in coatings for LNG continues to be recognized,” said Jean-Michel Gauthier, Director of AkzoNobel’s Marine and Protective Coatings business. Knutsen’s Smith said that the fuel consumption after five years as compared to year one (initial application of Intersleek) is maintained. “This high performance also keeps future dry-docking costs down. After five years in service, the vessel had to only have one full finish coat applied instead of having to apply a full scheme,” said Smith. “Knutsen has experienced the formation of green slime due to short lay-up and waiting periods. However, after sailing to the next port of call, the green slime was completely released, saving on any hull cleaning services at the port,” he added.

LAKE CHARLES LNG, the export project being pursued by pipeline and midstream company Energy Transfer and Royal Dutch Shell, has filed with regulators for an extension to mid-December 2025 for the venture to be completed and a final decision to go-ahead is expected by year-end. The

previous order from the Federal Energy Regulatory Commission had authorized the deadline of 16th December 2020 to place the facilities into service. The Lake Charles project request also states that a final investment decision could occur as early as the end of 2020. Energy Transfer and Shell plan to move towards a potential FID while starting to seek engineering, procurement and construction (EPC) companies. A tender for expressions of interest was issued in May 2019. The long-standing Lake Charles project had received a draft environmental impact statement from the FERC in September 2015 for a liquefaction plant to produce 16.5 million tonnes per annum of LNG. Shell gained its stake in the Lake Charles facility’s reserved capacity from its takeover in 2015 of BG Group of the UK. The export project will include the construction of three liquefaction Trains and will use the existing LNG storage and marine berthing facilities owned by Equity Transfer since its takeover of Southern Union Co. in 2013 for more than \$5 billion.

The proposed Lake Charles liquefaction plant was first awarded a permit by the Department of Energy in August 2013 to ship cargoes to countries without a US Free Trade Agreement. Now the volumes for that permit have been increased. Before the shale-gas boom Lake Charles was one of the centres of US LNG imports, with BG bringing in cargoes from nations such as Trinidad and Equatorial Guinea. BG and Energy Transfer had previously scheduled a commercial start-up for the plant as an export venture in 2019. The 440-acre site is located close to the Henry Hub with access to many of the largest natural gas production areas in the US through Energy Transfer’s existing and new pipelines like the Trunkline Gas System. The Trunkline Gas System

amounts to a 2,200-mile pipeline that interconnects with more than a dozen inter-state and intra-state pipelines to ship feed-gas to Lake Charles LNG and other projects along the Gulf Coast. Energy Transfer began in 1995 as a small intra-state natural gas pipeline operator and is now one of the largest energy infrastructure firms in the US.

LNG CANADA, the export project led by Royal Dutch Shell and four Asian partners and proposed for the town of Kitimat, has been granted a small production volumes change by the British Columbia Environmental Assessment Office. The BC environment body has formally accepted an application from LNG Canada Development Inc. for an amendment to the environmental assessment certificate for the export terminal project. Under the previous certificate issued in August 2016, up to four liquefaction Trains are planned along with gas treatment with a maximum total combined production of LNG that does not exceed 26 million tonnes per annum. “LNG Canada has maintained a consistent estimate of the amount of the LNG production throughout the project design and engineering and will be required to report to the relevant regulators the volume of LNG as a natural gas equivalent produced and exported from British Columbia and Canada for compliance purposes, under the terms of its existing provincial and federal permits,” explained the regulator. Based on this existing annual volume limit, LNG Canada requests that the BC regulator amends the project description that refers to the “million tonnes” measurement and replace it with the equivalent total represented as a volumetric measure of 38.05 billion cubic metres of natural gas. “This value is the volume approved by the National Energy Board and is based on a projected annual production profile once four LNG trains are in production,” it added.

The revised language is therefore requested to be “a maximum total combined production of LNG that does not exceed 38.05 Bcm per annum” (28.15 MTPA) of LNG. “This will result in consistent references across the Federal Licence to Export and the provincial reporting requirements during operations (as a volumetric measurement),” said the new certificate. The LNG Canada project is the largest private sector investment in Canada's

history with spending of C\$40 billion (US\$30.2Bln). Shell and its four partners, Mitsubishi Corp. of Japan, Malaysian energy company Petronas, Chinese major PetroChina and Korea Gas Corp., agreed in October 2018 to start immediate construction at the brownfield site near Kitimat that had been an energy products terminal before being acquired by Shell in 2011. A US\$5-billion pipeline of 670 kilometres is being developed to bring the feed-gas from the Montney shale basin in northeast BC to the Pacific Coast.

MITSUBISHI Heavy Industries has held a naming ceremony for its latest liquefied natural gas carrier newbuild ordered by Japanese trading house Mitsui & Co. to deliver shipments to Japan from the Sempra Energy-operated Cameron LNG export plant in Louisiana. The 177,000 cubic metres capacity vessel with Moss-type enclosed tanks was named “Marvel Heron” at the Mitsubishi Shipbuilding Co. yard in Nagasaki. “The newest carrier achieves significant improvements in both LNG carrying capacity and fuel performance through adoption of a more efficient hull structure and an innovative hybrid propulsion system,” said Mitsubishi. “After completion, the “Marvel Heron” will go into service primarily transporting LNG for the Cameron LNG project in which Mitsui is a participating partner,” added Mitsubishi. Mitsui Director and Executive Managing Officer Yoshio Kometani led the naming ceremony and Mrs Kometani oversaw the ceremonial cutting of the ropes. The “Marvel Heron” is the second LNG carrier of its type built by Yokohama-based Mitsubishi for Mitsui after the previous delivery of the “Marvel Crane”. The "Marvel Crane" delivered the first cargo from the Cameron LNG plant on June 18 to the French terminal at Dunkirk on the Channel coast. Both ships are 297.5 metres in length, 48.94m wide and with a depth of 27.5m and drafts of 11.4m. The deadweight capacity is approximately 79,000 tons.

“The new vessels are equipped with apple-shaped tanks refined from MOSS-type spherical tanks, which are known for their outstanding reliability,” said Mitsubishi. “This innovative tank structure results in increased LNG carrying capacity while keeping the ship's beam within the parameters of passage through the newly expanded Panama Canal,” explained the company.

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Singapore International Energy Week
29 October - 1 November 2019
Marina Bay Sands, Singapore
www.siew.sg

November

EAGC – European Annual Gas Conference 2019
5 - 7 November 2019
2 Rue Scribe, Paris, 75009, France
www.theeagc.com/conference

December
The CWC 20th Annual World LNG Summit & Awards Evening
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NATURGY ENERGY Group, the Spanish utility with major US and Russian liquefied natural gas supply contracts as well as global gas and power businesses, has launched a system allowing onshore connection and loading of LNG from a carrier without the need for facilities at the destination port. The Naturgy device has been registered as “LNGonWheels” and it has obtained a patent from the Spanish Patent and Trademark Office. The Spanish utility said LNGonWheels is an alternative solution to the problems of LNG supply in those areas where either there are no storage and distribution facilities for the fuel or the construction of such infrastructure is not economic. “Naturgy’s LNGonWheels solution consists of a device designed to transport tanks with a new module (the patent core) that allows the connection and loading of these tanks from an LNG vessel,” explained the company. The technology has been granted a patent as a “liquefied natural gas transport and distribution system” and is registered with the number ES-2672254 B2. “This patent recognizes the inventive activity of the LNGonWheels methodology itself, which consists of unloading LNG from a vessel to a tanker truck-barge which moves to land and subsequently returns once the fuel has been distributed to the end-user,” said Naturgy. The tanker truck can then again be sent ashore on the barge to restart the process. Naturgy’s Head of LNG Projects Engineering & Technology, José Miguel Moreno, said the system will have positive impacts for the environment by bringing areas with difficult access into the logistic chains with maritime LNG supplies.

Moreno added that the system also allows more polluting fuels such as diesel or fuel oil to be replaced by cleaner LNG and regasified natural gas. Naturgy is one of the companies that have signed 20-year agreements for US cargoes from Cheniere Energy’s Sabine Pass and Corpus Christi plants and is also a main contract holder for cargoes from the Yamal LNG plant in Arctic Russia operated by natural gas company Novatek. The US and Russian volumes were booked under Naturgy’s previous name, Gas Natural Fenosa. The Spanish company’s diverse LNG supply portfolio also includes shipments from nations such as Algeria, Qatar and Nigeria. The company additionally owns a small fleet of LNG carriers. The LNGonWheels solution has been devised by the Naturgy team of professionals who created DirectLinkLNG, subsequently developed by the technical team to the level of obtaining “Approval in Principle” from the American Bureau of Shipping, the US classification society. “This latest solution reinforces Naturgy’s innovative position in LNG, opening markets where until now it has not been possible to distribute LNG and allowing any type of end-user to access all the economic, energy and environmental advantages of using natural gas,” stated Naturgy.

NEW FORTRESS Energy has closed its first issuance of a fully committed \$180 million bond facility through a subsidiary to pursue its growing liquefied natural gas and power activities in the Caribbean region. New Fortress, the owner of LNG facilities in Florida and in Jamaica, said its NFE South Power Holdings unit arranged the transaction through NCB Capital Markets of Barbados. Under the facility, the New Fortress unit issued \$136.3M of 8.25 percent secured long-term fixed-rate bonds due in 2034 and up to \$43.7M of 11 percent unsecured fixed-rate bonds due in 2036. Some \$117M of bonds were sold and New Fortress has a commitment from NCB Capital to purchase the outstanding bonds upon completion in the first quarter of 2020 of construction of New Fortress’s combined heat and power facility at Clarendon in Jamaica. Net proceeds from the bond sale will be used to complete the construction of the power plant and to reimburse shareholder advances made by New Fortress. The New Fortress company is led by Wes Edens, co-founder of the private equity group Fortress

Investment. Among his other activities, Edens is also co-owner of the English Premier League soccer club Aston Villa whose most high-profile fan is Prince William, elder son of the late Princess Diana and second in the line of succession to the British throne. New Fortress made its debut on the Nasdaq global exchange in January 2019 after an initial public offering. Its main corporate focus now is introducing LNG to markets that lack access to the fuel.

In addition to its 100,000 gallons per day liquefaction plant in Miami, it operates a floating LNG terminal in Montego Bay, Jamaica, along with a fuel-handling facility in the US territory of Puerto Rico. The Miami facility began operations in April 2016 and enables the company to produce LNG for export in intermodal ISO containers to the Caribbean and to small-scale customers in southern Florida. “We are very pleased to partner with NCB Capital and the investment community in the Caribbean for the financing of the region’s first large scale gas-fired, co-generation power plant,” said Edens, the New Fortress Chairman and Chief Executive. “We wanted to enhance our great partnership with Jamaica by giving investors a stake in this historic achievement by the country,” added Edens. “Jamaica continues to be a model for the Caribbean, and we’re looking forward to turning on the plant in the coming months,” stated the CEO. NCB Capital said it decided to partner with New Fortress because of the work that they have been doing across the Caribbean region in bringing in cleaner and cheaper energy. “Liquefied natural gas is a cleaner and more efficient source of energy, and one of its major customers, the Jamalco Alumina plant, is a significant player in the mining industry which is a major contributor to Jamaican GDP,” said Steven Gooden, CEO NCB Capital. “Lower energy costs bode well for us as consumers and the economy as a whole,” added Gooden.

NOVATEK, the Russian natural gas company and its partners in the Arctic LNG project on the Gydan Peninsula have decided to go ahead with the joint venture with the partners signing final investment decision documents. The cost of the Arctic LNG project, matching Novatek’s Yamal LNG plant in Northern Siberia, is estimated at more than \$20 billion and includes Russian, French, Japanese and Chinese investors. The

FID signing took place at an economics conference in the Russian Far East city of Vladivostok. The joint venture participants in addition to Novatek include French energy major Total, a shareholder in Novatek. The Asian investors are two Chinese majors, China’s National Petroleum Corp. and China National Offshore Oil Corp., Japanese state body, Japan Oil, Gas and Metals National Corp. (Jogmec) and Japanese trading house Mitsu & Co. “This is an important project for Russia and follows our strategy to create capacities for LNG production,” said Russian Energy Minister Alexander Novak. In addition to Novatek’s existing Yamal project, the Russian state-backed natural gas giant Gazprom operates the Sakhalin LNG export plant. The Arctic LNG joint venture proposes constructing three LNG Trains each with output of 6.6 million tonnes per annum using gravity-based structure platforms made of concrete. The shareholdings of the various participants are: Novatek 60 percent and the four other partners, Total, CNPC, CNOOC and the Mitsui-Jogmec each with 10 percent. Total and CNPC are shareholders in the existing Yamal LNG plant.

Total additionally owns a 19.4 percent stake in the Novatek company so its 10 percent direct stake in Novatek’s second plant gives it 21.6 percent of the Arctic project. Novatek is making fast progress with Arctic LNG by signing equipment and engineering contracts for the liquefaction plant. TechnipFMC, the Franco-US energy and LNG engineering company, has been awarded the engineering, procurement and construction contract for Arctic LNG. TechnipFMC said the consolidated contract value to TechnipFMC was \$7.6 billion. Contracts have also been signed with turbo-machinery provider Siemens of Germany and the oil and gas engineering firm, Saipem of Italy. The Arctic LNG shareholders envisage putting the plant on stream by 2013. The GBS-based liquefaction Trains will also have other facilities including LNG storage totaling 687,000 cubic metres capacity. Arctic LNG output will be delivered to international markets by a fleet of ice-class LNG carriers. The vessels will be able to use the Northern Sea Route and a trans-shipment terminal in Kamchatka for cargoes destined for Asia and one close to the port of Murmansk for those cargoes destined for Europe.



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NYK LINE of Japan said it signed a new long-term charter contract to supply a liquefied natural gas carrier to French energy major Total. NYK said the deal for the newbuild vessel was signed with the French company's Total Gas & Power Chartering Ltd. for one of its LNG carriers. The vessel is currently under construction at the South Korean shipyard of Samsung Heavy Industries. The carrier with 174,000 cubic metres capacity is scheduled for delivery in 2021. It will be equipped with a Winterthur Gas & Diesel (WinGD) dual-fuel slow-speed diesel engine. "The LNG carrier will be equipped with a WinGD-made dual-fuel slow-speed diesel engine (X-DF diesel engine) that has superior fuel-consumption efficiency and can operate on marine gas oil or boil-off gas stored in the cargo tank," said NYK.

"The carrier will also feature a reliquefaction system that can use surplus boil-off gas effectively," added the Japanese firm. NYK already has three LNG carriers under construction at Samsung committed to Total on charter after signing deals in October and December 2018. All four vessels committed to Total are set for delivery in 2021. "The cargo tanks will be the membrane-type that will make use of advanced insulating materials to suppress the boil-off rate - the percentage of gas volume that vaporizes during navigation - and realize superior efficiency and economical LNG transportation," stated NYK.

PAPUA NEW GUINEA said it would honour a natural gas agreement with French energy major Total signed with a previous government for the Oceania nation's liquefied natural gas expansion projects after securing some concessions and is now likely to proceed with finalizing a second feed-gas accord. The decision removes uncertainty over the plan that arose after new Prime Minister James Marape came to power in May 2019 promising to win more benefits from the international oil and gas companies backing the expansion. The Papua LNG gas agreement is one of two accords needed for Total and its partners, including Exxon Mobil Corp. and Australian-listed Oil Search Ltd and others, to go ahead with the expansion proposals. "The government has now cleared Total to proceed full steam ahead with the implementation of the Papua Gas Project," said Petroleum Minister Kereka Kua in a statement. Peter

Botten, the Managing Director of Oil Search whose headquarters are in PNG, said he was happy with the outcome despite the project delays.

"We are pleased that the PNG Cabinet (National Executive Council), has completed its review of the Papua LNG Gas Agreement and has validated the agreement as executed on 9 April 2019," stated Botten. "The next step for the proposed integrated three LNG Train development is the finalization of the P'nyang Gas Agreement," he added. Botten explained that once this final step is completed the Petroleum Retention License 15 in the Gulf Province of PNG and the PRL 3 licence in the Western highlands, as well as the overall LNG joint ventures, can proceed into the front-end engineering and design phase of these "nationally important" developments. Doubts about the gas deal escalated in August when the government suddenly called for talks to revise the agreement. The minister Kua said Total had made some concessions, promising to prepare a detailed plan outlining how much local equipment and services would be used in the project and to negotiate with any third parties wanting access to the project's gas pipelines. Total would also be willing to negotiate for PNG to take a stake in the pipelines after the state

QATAR Petroleum said its decision to self-finance the North Field natural gas and Ras Laffan LNG expansion, to tender for contractors and drill appraisal wells before offering partnerships was part of its strategy to show the value of its assets. The Qatari energy major said a recently drilled appraisal well in the North Field produced double the yield that was expected, a potentially good omen for what lies ahead. "It means we have a great project with great reserves, and the North Field is very prolific," said Saad Sherida al-Kaabi, Qatar's Minister of State for Energy Affairs and President and Chief Executive of Qatar Petroleum in a published interview. Qatar said it had short-listed several international energy majors for a stake in its expanded North Field project, though the Qatar Petroleum CEO said the company may still choose to go it alone unless the prospective partners offer it significant value. Invitations to bid were sent out in August 2019 and the result is due to be announced in the first quarter of 2020. "We like the partnership model for its many benefits. But because we don't need the partners, what's going out is basically

a set of criteria that we have, to demonstrate to us what added value we get for Qatar if you come in," explained al-Kaabi. "Maybe they can give us something outside," he said, referring to LNG assets overseas. The Qatar Petroleum CEO declined to say how large were the stakes being offered to partners to own nor which energy majors had been short-listed.

However, over the past 18 months the Qataris have been invited to join upstream ventures around the world with companies such as ExxonMobil, Royal Dutch Shell, French major Total and Eni of Italy. Qatar Petroleum has already awarded front-end engineering and design contracts for the North Field expansion project's offshore pipelines and topsides facilities to liquefy and export an additional 33 million tonnes per annum of LNG. The contracts are expected to take 12 months to complete. The scope includes FEED for eight unmanned wellhead platform topsides, four 38-inch trunk lines and four 28-inch intrafield lines. The scope of the onshore expansion at the Ras Laffan production complex involves an additional four Trains, each with 7.8 MTPA of output. This would take nameplate output up to 110 MTPA from 77 MTPA when the expansion is completed by around 2024. The Qatari expansion amounts to more in volume than the LNG currently produced individually by nations such as Malaysia and Indonesia. Qatar's new onshore facilities will receive about 4.6 billion standard cubic feet per day of feed gas from the southern sector of Qatar's North Field gas reserves in the Gulf. Qatar has the southern portion of the North Field in Gulf waters and the other part is under the jurisdiction of neighbouring Iran. The company has also issued an invitation to tender for the reservation of ship construction capacity mainly in South Korea for an initial 60 new LNG carriers to transport its volumes from the expansion at Ras Laffan and other projects such as its Golden Pass facility in the US Gulf Coast.

QATAR PETROLEUM and Belgian company Fluxys LNG have signed a long-term agreement for more future Qatari access to the Zeebrugge import terminal and its gas pipeline gateway to Northwest Europe. Under the agreement, the Qatar Petroleum unit Qatar Terminal Ltd (subscribed to unloading slots at the facility from the expiry of the current long-term unloading contracts in 2023

and taking them through to 2044. The accord was signed during a ceremony held in Brussels attended by Saad Sherida Al-Kaabi, Qatar's Minister of State for Energy Affairs and the President and Chief Executive of Qatar Petroleum. The CEO and Chairman of Fluxys Belgium, Pascal De Buck, represented the Zeebrugge terminal. Marie-Christine Marghem, the Belgian Federal Minister of Energy, Environment and Sustainable Development, also attended the signing of the LNG agreement. The long-term services deal for the Qataris is the outcome of a subscription window held from 30 April to 24 May 2019 for services at the Zeebrugge terminal upon expiry of existing contracts from 2023. During the subscription window, the market was offered unloading slots and additional storage services at the facility over subsequent periods up to 2044. The Zeebrugge terminal was commissioned in 1987 and has been gradually expanded, with a fifth 180,000 cubic metres capacity storage tank currently under construction.

The expansion means that Zeebrugge has become a central crossroads for North-West Europe's gas network. "We are delighted to sign this agreement to extend and expand our existing long-term partnership with Fluxys for decades to come," said Qatar Petroleum's Al-Kaabi. "We believe this will further support our customers in Belgium and Europe in general, by providing them access to reliable LNG supplies from Qatar and allowing them to maximize the utilization of such supplies," he added. "Qatar Petroleum has long invested in and anchored LNG receiving terminal capacity in Europe, a key LNG market, as part of our supply destination portfolio diversification strategy," stated Al-Kaabi. Fluxys Belgium CEO De Buck said the agreement further extended his company's long-standing cooperation with Qatar. "The agreement secures long-term activity at the Zeebrugge terminal and further strengthens the facility's position as a versatile LNG gateway into Europe, offering customers optimum destination flexibility," added De Buck. "Ample pipe gas take away capacity from the terminal is readily available for delivery throughout North-West Europe as well as a range of options for downstream small-scale LNG distribution," he stated.

ROYAL VOPAK, the Dutch global storage and terminals company and co-owner of the Gate liquefied natural gas

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import facility in Rotterdam, has purchased a stake in the floating LNG terminal in the Colombian Caribbean port of Cartagena. Vopak said it bought 49 percent of Colombian company Sociedad Portuaria el Cayao (SPEC) in Cartagena, owner of the terminal which has been in service since 2016. The value of the transaction was not disclosed. The Dutch company also owns 60 percent of the Mexican Gulf Coast onshore LNG import terminal at Altamira. The Colombian facility consists of an LNG jetty, onshore infrastructure and 9.2 kilometres of gas pipeline connecting to the national gas grid. A chartered floating storage and regasification unit (FSRU) is receiving the LNG and sending the gas to shore. The SPEC company holds long-term supply contracts with three local gas-fired power plants.

The FSRU, the 170,050 cubic metres capacity vessel “Hoegh Grace”, is on charter from Norwegian fleet owner Hoegh LNG. The majority shareholder in the terminal company will remain the South American utility Promigas with 51 percent. “We are very much looking forward to this partnership with Promigas and to enter into the growing Colombian LNG market,” said Eelco Hoekstra, Chairman and Chief Executive of Vopak. “This is another growth step in our LNG portfolio and it fits very well in our ambitions to grow and diversify our service offering in LNG,” added Hoekstra. Promigas is a private company in the natural gas sector in Latin America with 45 years of experience providing access to natural gas.

SEMPRA ENERGY, the California-based utility and owner of the Cameron LNG export plant in Louisiana, said its Mexican subsidiary had reached agreement with the regulators in Mexico on two key natural gas pipelines supplying cross-border US supplies. The Sempra unit, Infraestructura Energética Nova (IEnova), and the Mexican Federal Power Commission (CFE) said pricing was finalized on the Guaymas-El Oro pipeline and the Sur de Texas-Tuxpan marine pipeline crossing the Gulf of Mexico, which is a joint venture with Canadian company TC Energy Corp. “Sempra Energy is pleased that IEnova was able to reach a mutually agreeable resolution to the contracts with CFE on these important pipelines,” stated Sempra. “The Sur de Texas-Tuxpan and

Guaymas-El Oro pipelines are among Mexico's most important infrastructure projects, bringing more reliable supplies of clean US natural gas to Mexico to help meet the growing energy needs of the country for generations to come,” added Sempra. The Mexican CFE reached new contract terms with pipeline companies to allow the start of commercial operations, which had been delayed by disagreements. Contracts had already been signed but the government found that they were unfavourable for Mexico. The CFE in July filed arbitration requests with the developers of seven stalled pipelines in an attempt to amend the “force majeure” clauses of the 25-year firm capacity agreements built into the original contracts.

Among the pipelines in the agreement is the 2.6 billion cubic feet per day Sur de Texas-Tuxpan pipe, a crucial outlet for Texas natural gas and fundamental to reliable gas service in the southeast of Mexico. The marine pipeline from Texas to Mexico was built at a cost of \$2.5 billion and is owned by Sempra's IEnova and TC Energy. The Sur de Texas-Tuxpan pipeline is inter-connected to the Valley Crossing Pipeline completed by Enbridge Inc., another Canadian company based in Calgary. The 168-mile Valley Crossing pipeline runs from the Agua Dulce hub in Texas to the Gulf of Mexico east of the port of Brownsville. Its transport capacity is half the average daily production of the entire Eagle Ford shale basin and will account for more than 10 percent of the average daily production for the entire state of Texas. Analysts say that Mexico's present overall natural gas market needs are around 8 Bcf per day with about 5.5 Bcf a day coming from the US, and much of that from Texas. The new terms for the US-Mexico pipelines include fixed natural gas transport fees, longer contract terms, new “force majeure” clauses and an end to further arbitration requests. In addition to the Sur de Texas-Tuxpan pipeline and IEnova's Guaymas-El Oro pipeline, contracts were also agreed for three other pipelines, Tuxpan-Tula (TC Energy), Tula-Villa de Reyes (TC Energy) and Samalayuca-Sásabe (Grupo Carso). Two pipelines that have yet to reach agreement are La Laguna-Aguascalientes and Villa de Reyes-Aguascalientes-Guadalajara, owned by the Fermaca company. Mexico's monthly natural gas price index in July averaged \$2.624 per million British thermal units as more expected US

pipelines move the price into closer alignment with the US Henry Hub and New York Mercantile Exchange benchmarks.

SOUTH KOREA said the nation's shipbuilders are maintaining their competitive edge over China and Japan in orders so far this year for high-value ships such as liquefied natural gas carriers and very large crude carriers as the merger of Hyundai Heavy Industries and Daewoo Shipbuilding and Marine Engineering remains on track. The Ministry of Trade, Industry and Energy said South Korea won 24 of the 27 orders placed for LNG carriers so far this year from January to August and 10 of the 17 orders placed for VLCCs in the same period. The volume of ships built by South Korean shipyards in the first eight months came to 6.76 million compensated gross tons (CGTs), up 14 percent from the same period one year earlier. The Koreans also retained the top position in global shipbuilding orders in August for a fourth straight month. Government data showed that Korean shipyards won orders in August totaling 735,000 compensated gross tons which was more than 70 percent of orders placed worldwide. In the first eight months of the year, South Korean shipyards logged orders worth 4.64 million CGTs. The Ministry did that while the figure accounts for 34.9 percent of total global orders placed during the period, it falls short of the 5.02 million CGTs worth of overall orders clinched by Chinese shipbuilders.

However, South Korea was ahead of China in terms of the value of the orders. The Ministry said South Korean shipyards logged orders worth US\$11.3 billion in the January-August period, US\$370 million more than China. At the same time South Korea's Hyundai Heavy is still pursuing its proposed merger with rival Daewoo Shipbuilding as part of consolidation plans for the nation's key industry. Hyundai Heavy fought off court efforts by labor unions and some shareholders to prevent the company being split into two ahead of the merger with Daweoo. Hyundai Heavy was subsequently split into two companies in June 2019 ahead of the merger. The two Hyundai units are Korea Shipbuilding & Offshore Engineering (KSOE) Co. and a reorganized Hyundai Heavy. Hyundai Heavy signed a formal deal in March 2019 with the state-run Korea Development Bank (KDB) to buy DSME.

The bank is driving the Hyundai Heavy-DSME merger as the largest shareholder of DSME with a controlling 55.7 percent stake. Hyundai Heavy is facing competition reviews from the Korea Fair Trade Commission, the European Union, Japan and China on merging with DSME. It filed an application for a corporate merger with the Korea Fair Trade Commission on July 1. The commission's review period is up to 120 business days. In China, the Chinese shipbuilding industry is also pushing for a merge between China State Shipping Corp. (CSSC) and China Shipbuilding Industry Corp. (CSIC), two of the largest yard operators.

SOVCOMFLOT, the Russian shipping line with 16 LNG carriers and an overall fleet of 142 vessels, said one of its LNG-powered Aframax crude oil tankers successfully completed a commercial voyage along the Northern Sea Route (NSR) from Russia to Asia. The vessel crossed the NSR as part of a commercial voyage from the Russian port of Murmansk to China, carrying a cargo of crude oil. The company said the “Korolev Prospect” became the first crude carrier with LNG as fuel to complete the voyage from Cape Zhelaniya, the site of an Arctic weather station in Northern Russia, to Cape Dezhnev, the eastern most mainland point of the Russian Far East. Sovcomflot said the NSR voyage by the 113,232 deadweight-ton “Korolev Prospect” took seven days and six hours to complete, during which the tanker covered a distance of 2,118 nautical miles at an average speed of 12.2 knots. “Both the ice conditions and weather we encountered during the voyage were quite favorable, which allowed the vessel to travel the full length of the route independently without icebreaker assistance,” said Oleg Shishkin, the tanker's master. “A well-prepared passage plan allowed us to avoid meeting massive icebergs in the Vilkitski Strait and then we avoided ice concentrated in the Long Strait by taking a new route to the north of Wrangel Island,” he explained.

Sovcomflot was the world's first shipping line to begin operating large-tonnage oil tankers of Aframax size (deadweight around 114,000 tonnes) using LNG as their primary fuel. Sovcomflot's current fleet includes six such tankers. These vessels are mainly used for exporting Russian oil across the

Baltic Sea and the North Sea. In addition, Sovcomflot has five more LNG-fuelled tankers under construction, following orders placed at the Zvezda shipbuilding complex at Primorsky Krai in the Russian Far East. In addition to oil, Sovcomflot has a growing fleet of LNG carriers involved in gas projects in Russia and around the world. Its LNG shipping operations include delivering cargoes from the Sakhalin plant in the Far East, the Yamal project in Siberia and the Tangguh LNG facility in Indonesia. The company noted that during the voyage, the crew of “Korolev Prospect” was increased to include an ice advisor, Vasily Yermakov, one of the most experienced ice captains in the Russian company’s fleet. The “Korolev Prospect” was delivered in February 2019. The ship has a length of 250 metres, breadth of 44 metres and an ice-class of 1A for the hull.

STABILIS ENERGY Inc., the provider and distributor of liquefied natural gas as a fuel for customers in North America, has extended its reach into Mexico with the completion of an acquisition and a key joint venture program. Stabilis, based in Houston, has completed the acquisition of the privately-held company Diversenergy and its subsidiaries to create one of the leading LNG fuel marketing and distribution companies in Mexico. The US company provides LNG as a replacement fuel for heavy-horsepower users of diesel and crude-based fuel in the oil industry. The company opened its 120,000 gallons per day LNG production facility in George West, Texas, in January 2015 to service industrial and oilfield customers in Texas and the greater Gulf Coast region. In broadening its Mexican fuel activities beyond the acquisition, Stabilis said it completed the formation of a joint venture with CryoMex Investment Group. CryoMex is led by Grupo CLISA, a Monterrey, Mexico-based developer and operator of energy businesses in the natural gas, electricity, thermal coal and petroleum coke sectors. The Mexican joint venture will be called Energía Superior Gas Natural and would also involve Grupo CLISA, a marketer of natural gas, electricity, thermal coal and petroleum coke.

“Stabilis is pleased to announce the acquisition of Diversenergy,” said Jim Reddinger, President and Chief Executive of Stabilis. We see significant

growth opportunities in the large and expanding market for LNG and compressed natural gas fuel in Mexico,” added Reddinger. “We welcome Diversenergy to the Stabilis team and look forward to working together to bring clean, low cost, and abundant natural gas to our customers in Mexico,” stated the Stabilis CEO. Reddinger explained that Stabilis could not have asked for better joint venture partners than Grupo CLISA. “Their existing partnerships with international companies to build and operate assets in Mexico demonstrate their ability to execute effectively and with integrity,” said Reddinger. The Stabilis-Diversenergy transaction was structured as an equity purchase with Diversenergy’s owners receiving cash and Stabilis common stock. Financial terms of the deal were not disclosed. Lee Kellough, former CEO of Diversenergy, will serve as President of the Stabilis Mexican subsidiary and Senior Vice President of Stabilis. “We are confident that this transaction creates a solid platform for Stabilis to become a leader in the LNG and CNG markets in Mexico,” said Diversenergy’s new CEO Kellough. “We believe that we have the right combination of people, equipment, and relationships to capitalize on the substantial growth opportunities we see throughout Mexico,” he added.

TECHNIPFMC, the Franco-US energy and LNG engineering company, said it had decided to spin off its European-based engineering and construction operations into a separate business, leaving the Houston-based half of the firm as a technology-focused equipment supplier to the oil and gas sector. “The transaction is expected to be structured as a spin-off of TechnipFMC’s Onshore-Offshore segment to be headquartered in Paris, France,” explained TechnipFMC. “The separation is expected to be completed in the first half of 2020, subject to customary conditions, consultations and regulatory approvals, at which time all outstanding (spin-off) shares will be distributed to existing TechnipFMC shareholders,” it added. The 2017 merger of Technip of France and FMC Technologies of the US was valued at \$20 billion and created a new subsea leader as well as establishing TechnipFMC as a fully-integrated subsea provider. At the same time, the company’s onshore-offshore business has been delivering landmark LNG projects such as the Yamal

liquefaction plant in Russia for natural gas company Novatek. TechnipFMC was also awarded the engineering, procurement and construction contract by Novatek in July 2019 for the Arctic LNG II project proposed for the Russian Gydan Peninsula of northern Siberia. TechnipFMC said the consolidated contract value to TechnipFMC for Arctic LNG II was \$7.6 billion. That Arctic development will produce almost 20 million tonnes per annum of LNG from three liquefaction Trains to be installed on three gravity-based structure platforms. TechnipFMC is also working on LNG projects in the US and other nations such as Mozambique in southeast Africa, while it is among the main floating LNG engineering companies in the world. Although the 2017 Technip-FMC Technologies merger was deemed by the company as successful, Chief Executive Doug Pferdehirt said the spin-off would improve flexibility and allow the new companies to unlock other opportunities. “The strategic rationale is compelling,” said CEO Pferdehirt in a statement. “When you over-integrate, the customer sometimes sees you as being greedy. That doesn’t work very well. We’re a humble company, and like to integrate where it makes clear, commercial sense,” he explained.

Pferdehirt will remain CEO for the upstream-focused company, which will concentrate on subsea technologies and services. The Houston-based upstream operator will have a workforce of about 22,000 people. TechnipFMC said that Catherine MacGregor, who joined the company in July 2019 after more than two decades at energy services firm Schlumberger NV, would be the CEO of the engineering and construction services spin-off, including LNG projects and activities. When operating by next year as an independent company, the spin-off would pursue new opportunities in LNG and broaden its market focus to include biofuels and alternative energy projects. “We are confident that the separation would allow both businesses to thrive independently within their sectors, enabling each to unlock significant additional value,” stated Pferdehirt. With approximately 15,000 employees, the LNG and energy spin-off would be one of the largest engineering players in the sector. The spin-off for LNG and energy engineering would be incorporated in the Netherlands with its headquarters in Paris and would

remain listed on the Euronext Paris stock exchange. Bruno Vibert will serve as Chief Financial Officer and Marco Villa will be the Chief Operating Officer of the spin-off. The standalone company headed by Pferdehirt, would have Maryann Mannen as Executive Vice President and Chief Financial Officer. It will remain incorporated in the UK with headquarters in Houston and listed on both the New York Stock Exchange and Euronext Paris exchange. “The successful completion of the planned spin-off is subject to general market conditions, regulatory approvals and consultation of employee representatives, where applicable and final board approval,” stated TechnipFMC.

US natural gas resources are growing. The US Potential Gas Committee (PGC), a body made up of more than 800 experienced volunteer geoscientists and engineers and the American Gas Association (AGA), have announced that the nation has a 3,374 trillion cubic feet (Tcf) natural gas resource base, boosted by expanding shale-gas reserves in key basins. The declaration of the US resource base comes as a result of the PGC’s latest biennial assessment of natural gas reserves as of the end of 2018. The AGA said that this is the highest resource evaluation in the Committee’s 54-year history, exceeding the 2016 assessment by about 20 percent, which was previously the largest ever two-year increase. Since its establishment in the 1960s, the PGC has been the only group that assesses the future supply of natural gas in the US. The AGA stated that any declared realistic plan to continue towards a cleaner energy future would have to be based on natural gas. The natural gas resources also underpin future US liquefied natural gas exports and domestic gas usage while increasing national wealth as America eventually becomes the No. 1 LNG supplier nation.

“This report verifies that our nation has more natural gas than at any point in our history, ensuring that American families and businesses can rely on this clean, affordable source of energy for many generations,” said AGA President and Chief Executive Karen Harbert. “The United States continues to set new natural gas supply records because of technological improvements and continued learning in gas exploration and production,” added Harbert. “That

same spirit of innovation drives the entire natural gas industry from the companies that transport and deliver natural gas, to the entrepreneurs that develop new technologies that are making natural gas cleaner and more accessible,” stated the AGA CEO. The increase resulted from reassessments of shale-gas resources in the Atlantic and Mid-Continent areas and conventional and tight gas in the Mid-Continent and Rocky Mountain areas. “Natural gas has transformed the American economy and energy future for the better,” said Harbert. “Any realistic plan to continue towards a cleaner energy future will have natural gas as a foundation,” she declared.

WESTERN GAS of Australia said its Equus project in Western Australia was on track for first gas in 2024 following the completion of the upstream and LNG development plans as the company seeks a partner and starts financing activities. Western Gas, a privately held company led by Executive Director Andrew Leibovitch said it had appointed US investment bank Goldman Sachs to advise on finding a partner for the venture with an estimated cost of more than US\$3 billion. The Equus gas project involves the development of 11 gas and condensate fields located in the Carnarvon Basin, about 200 kilometres offshore from the town of Onslow, near where the Chevron-operated Wheatstone LNG plant is located. Western Gas acquired the Equus project from the New York-based US energy company Hess Corp. 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. Western Gas now wants to develop the field using a 2 million tonnes a year floating LNG facility. The venture would be a rival to the existing Prelude FLNG plant in the nearby Browse Basin operated by Royal Dutch Shell. “Equus is at the right stage of development where the introduction of an experienced and financially capable partner can help progress the project to first gas and realize the value of the greater Equus area,” said Executive Director Leibovitch.

US engineering companies McDermott and Baker Hughes-GE have provided pre-front-end engineering and design support. Leibovitch said that the

engineering and design process undertaken by McDermott and Baker Hughes-GE had “delivered a globally competitive, mid-scale LNG development plan” for the Equus fields. “The upstream LNG development plan comprises three production wells tied back to a floating production storage and offtake (FPSO) facility, a 160 km dry gas export pipeline to a nearshore 2 MTPA floating LNG (FLNG) facility and an onshore pipeline connection,” explained Leibovitch. “The design-to-install contracting model brought together the best upstream technology and installation techniques with a low capex, modular FLNG facility to deliver a bankable and globally competitive LNG supply,” he added. He stated that engineering and design would now focus on development of proposals for the subsea, FPSO, pipeline and FLNG work packages. “The partnering process together with the preparation of the project work packages will deliver Western Gas with the financial, project delivery and operational expertise to drive Equus into production in 2024,” he stated. Leibovitch added that 100 percent project ownership differentiated Equus from other regional LNG projects. “With no joint venture misalignment, Western Gas has full control of project design, delivery and partnering across the value chain,” he said.

WOODSIDE Petroleum, the LNG operator at two plants in Western Australia and with upstream assets in southeast Asia and in the Atlantic Margin, has signed an agreement to invest in Perth-based Blue Ocean Seismic Services to boost exploration and production activities. “The company is developing an innovative solution that has the potential to make ocean bottom seismic data acquisition cheaper and more accessible,” said Woodside. The shares agreement was signed with parent company Blue Ocean Monitoring Ltd. Seismic data is critical for understanding geological formations and the nature of hydrocarbon resources that may be contained within them. “Current methods use remotely operated vehicles to place nodes on the ocean floor that capture and record soundwaves,” said Woodside whose main E&P activities are offshore Australia, Myanmar and Senegal in West Africa. The concept was jointly developed by Woodside and Blue Ocean Seismic Services and focuses on using Autonomous Underwater Vehicles

(AUVs) in place of remotely operated vehicles. The AUVs are small submarines that are pre-programmed to self-deploy to the ocean floor and reposition multiple times. Woodside said this method will improve efficiencies, lower costs and reduce people’s exposure to health and safety risks.

“Subject to satisfaction of conditions precedent, Woodside will take a 35 percent shareholding in Blue Ocean Seismic Services,” said the company, which did not disclose the value of the transaction. Woodside Executive Vice President for Sustainability Shaun Gregory noted the agreement continued Woodside’s support of Western Australian technology companies. “The use of AUVs is a priority in our technology strategy, and has global applications. We see ocean bottom monitoring playing an important role in helping us to understand more complex geological settings,” said Gregory. Simon Illingworth, Blue Ocean Monitoring’s Group Managing Director, said he had enjoyed working with Woodside over the last two years on this technology. “Woodside is committed to investing in innovative technologies in the oil and gas industry, while striving to continuously improve safety,” added Illingworth. “We look forward to continuing to develop this promising technology with Woodside’s support,” he stated. The current technical activities are focusing on small sea trials ahead of the first seismic test in early 2020.

WOODSIDE, a shareholder in the Kitimat LNG export project in the Canadian province of British Columbia with US major Chevron Corp., said at a conference in Abu Dhabi that the Perth, Australia-based company would be interested in selling part of its Kitimat stake to a third party. Woodside Chief Executive Peter Coleman said his company would be willing to reduce its current stake of 50 percent. Chevron holds the other 50 percent stake in Kitimat LNG and the operatorship of the associated feed-gas reserves and Coleman said Woodside did not like holding such a large share in any project when it was not the operator. “From a capital management and risk management point of view we would rather hold less equity,” said Coleman. “In a major project where we are operating, we would like to be between 40 percent and 60 percent equity. It kind of makes sense,” explained Coleman. “When you’re non-operator, anywhere between

20 percent and 40 percent is the right number,” added the Woodside CEO whose company is operator of two LNG export plants in Western Australia, the North West Shelf facility and Pluto LNG. Chevron as operator of the Canadian Kitimat project is continuing to progress with the joint venture first proposed with Apache Corp. for Bish Cove in British Columbia. Chevron in July 2019 had a project amendment request accepted by provincial regulators for a redesigned project and an increase in export capacity to 18 million tonnes per annum. Chevron, the operator of two LNG export plants in Western Australia, saw Woodside come on board as a shareholder in the Kitimat project when the Australian company purchased assets from Apache in 2014, including stakes in Chevron’s Wheatstone LNG in Australia and the Kitimat venture in BC.

Chevron and Woodside have recently submitted their new detailed project plan to the provincial regulators with proposals for a plant design with an initial three LNG processing Trains instead of two. The British Columbia BC Environmental Assessment Office said on 11th July 2019 that it had formally accepted an amendment request from the Kitimat LNG operating general partnership for an amendment to the Environmental Assessment Certificate for the plant. Chevron and Woodside are cooperating for the Kitimat project with the Haisla First Nation on whose traditional land the project at Bish Cove will be constructed. Feed-gas for the Kitimat liquefaction plant will come from the large upstream shale-gas resources in the 322,000 net acres it has in the Horn River and Liard Basins of northeast BC. Chevron will then transport the gas on the proposed Pacific Trail Pipeline to the site at Bish Cove. The re-launching of the Bish Cove project follows a final investment decision made in October 2018 by the Royal Dutch Shell-led LNG Canada joint venture. Both plant sites are almost adjacent and are located about 650 kilometres north of the province’s largest city, Vancouver. Shell and its Asian partners, including PetroChina, Petronas of Malaysia, Japan’s Mitsubishi and Korea Gas Corp. have started work at the brownfield site, also near Kitimat, and which had been an energy products terminal before being acquired by Shell in 2011 when the Chevron project was already progressing nearby. ■



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US gives its own international energy outlook and sees pipeline gas and LNG among leading streams

World natural gas consumption will increase more than 40 percent from now to 2050

The United States will remain the world's largest natural gas producer throughout the period through 2050, reaching 43 trillion cubic feet per annum, a nearly 50 percent increase with US shale-gas resources continuing to expand in the Appalachian region and in formations in and around Texas.

According to the International Energy Outlook 2019 of the US government, Middle East natural gas production increases 15 Tcf from 2018 to 2050, reaching 37 Tcf per annum in 2050, about a 70 percent increase.

Surge

After 2030, countries in the Middle East increase production of low-cost, abundant hydrocarbon resources to meet growing demand worldwide.

"Natural gas production in Russia is forecast to increase about 40 percent during the projection period, reaching 34 Tcf in 2050 and most of the increase is exported to Asia and Europe," said the US Outlook.

Canada also continues to produce relatively large amounts of natural gas per annum, reaching 6.8 Tcf in 2050, a nearly

Co-operation and Development countries outpacing growth in the OECD, grouping the 36 wealthiest countries.

The US report said that global natural gas consumption increases by 2050 to a total of nearly 200 quadrillion British thermal units (Btu).

Industrial use

"Natural gas use accelerates the most in countries outside of the OECD to meet demand from increased industrial activity, natural gas-fired electricity generation and transportation fueled by LNG," said the report.

"Natural gas consumption in non-OECD countries grows from about 70 quadrillion Btu in 2018 to 120 quadrillion Btu in 2050, a 70 percent increase," added the Outlook.

Despite strong growth in LNG trade, natural gas pipeline flows continue to account for most of the inter-regional natural gas trade during the projection period as pipeline infrastructure is further developed.

"Non-OECD Europe and Eurasia (primarily Russia) remains the largest net exporter of natural gas in

2050, followed by the Middle East. During this time, OECD Europe

increases its dependence on Russian pipeline natural gas, and non-OECD Asia imports a growing amount of LNG," explained the US Outlook.

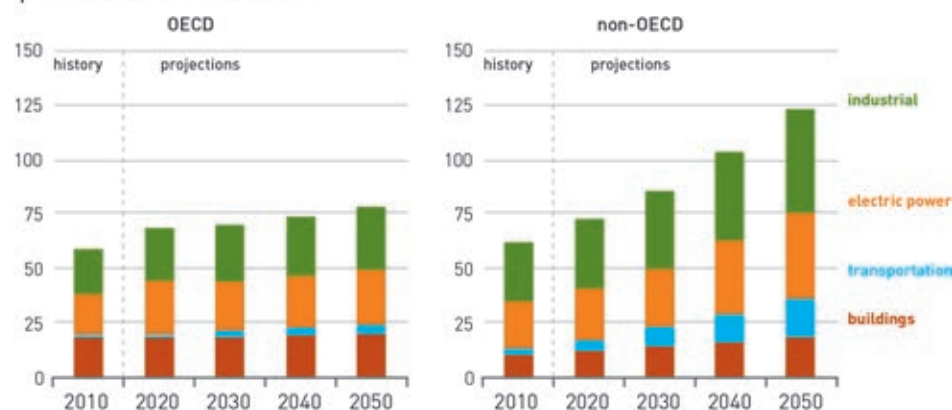
"The Americas grow as a net exporter of natural

gas, driven mostly by LNG shipments from the US to countries outside the region" stated the report.

Consumption

"During this time, the non-OECD share of

Natural gas consumption by sector
quadrillion British thermal units



How global natural gas use is developing in industry and power sectors

global natural gas consumption increases from about 51 percent to 61 percent," it added.

"In OECD countries, natural gas consumption increases 17 percent between 2018 and 2050, reaching 78 quadrillion Btu," said the report.

Most of this growth is forecast in the non-OECD industrial sector

"In non-OECD countries, industrial sector natural gas consumption increases nearly 50 percent, from 32 quadrillion Btu in 2018 to 46 quadrillion Btu in 2050," said the report.

"Chemical and primary metals manufacturing, as well as oil and natural gas extraction, account for most of the growing demand," it added.

Natural gas consumption for electricity generation in non-OECD countries increases more than 60 percent, at 1.5 percent per year, accounting for part of the 2.2 percent per year growth in electricity demand in those countries.

Consumption of natural gas in the

transportation sector remains the smallest of the end-use sectors throughout the projection period, and yet this sector shows relatively strong growth in non-OECD countries. Increases in demand are driven mostly by LNG use to move freight by truck and rail.

"Lease and plant fuel consumption of natural gas increases nearly 60 percent from 2018 to 2050, from 9 quadrillion Btu in 2018 to more than 14 quadrillion Btu in 2050," it said.

Lease-and-plant

Lease and plant fuel is natural gas used in well, field, and lease operations and as fuel in natural gas processing facilities.

"Energy requirements to power drilling operations, natural gas processing, and LNG liquefaction and regasification cause higher natural gas demand," the report forecast.

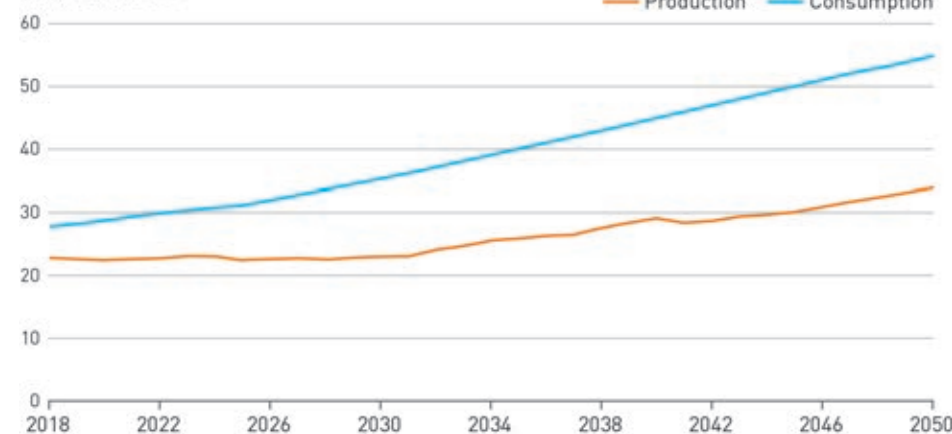
From 2018 to 2050, the US, Canada, and the Middle East represent about half of the natural gas consumption associated

Natural gas use accelerates the most in countries outside of the OECD to meet demand

20 percent increase from 2018.

World natural gas consumption increases more than 40 percent from 2018 to 2050, with growth in non-Organization for Economic

Natural gas consumption and production, Asia
trillion cubic feet



Nations of Asia will continue to import natural gas to meet their needs

with oil and natural gas extraction activities.

“Liquefaction facilities consume an increasing share of lease and plant fuel demand as LNG terminal build-out occurs in the US, the Middle East, Russia, and other exporting regions,” it added.

Movements

In addition to lease and plant fuel, considerable quantities of natural gas are required to fuel the movement of natural gas through pipelines at compressor stations, amounting to 3.0 quadrillion British thermal units (quads) in 2018 and 3.6 quads in 2050.

The US report noted that China has the largest increase in absolute natural gas-related CO₂ emission levels because natural gas is increasingly used for power generation and in transportation.

On a percentage basis, the largest growth in natural gas-related CO₂ emissions from 2018 to 2050 is in India, although it starts from a low level.

“As India’s economy grows, natural gas use increases along with other fuels, and maintains its share at 6% of total energy consumed,” said the US report.

“In OECD Europe, natural gas-related CO₂ emissions begin moderately increasing after 2030 as natural gas-fired capacity begins to replace retiring nuclear generation, putting upward pressure on overall emission levels and increasing the carbon intensity of their fuel mixes,” it added.

Coal issue

World coal-related CO₂ emissions grow 0.4 percent per year annually from 2018 to 2050, compared with their historical growth rate of 2.1 percent per year from 1990 to 2018.

“China shifts from coal to natural gas, nuclear power, and renewable energy during the projection period,” said the report.

“This shift is a departure from historical trends and has a major effect on global energy-related CO₂ emissions because of the size of China’s economy,” it added.

The US stated that the decline in China’s coal-related CO₂ emissions is more than offset by growth in India’s coal-related emissions.

“India has significant coal resources, which it uses to meet its rapidly expanding electricity and industrial demand. Coal-related emissions in India remain much lower than in China through 2050,” said the report.

World energy-related CO₂ emissions grow at an average rate of 0.6 percent per year between 2018 and 2050, compared with the average growth rate of 1.8 percent per year from 1990 to 2018.

Efficiency

“In the near term, energy-related CO₂ emission growth is slowed by increases in energy efficiency and a gradual shift from coal toward natural gas and renewable energy sources,” it added.

“In the longer term, broad population

and economic growth leads to increased emissions,” said the report.

“In OECD countries, projected energy-related CO₂ emissions decline slightly (down 0.2 percent annually) through 2050 and are 14 percent lower than their 2005 levels in 2050 even as their economies gradually expand,” it said.

Liquids-related CO₂ emissions grow an average 0.6 percent per year from 2018 to 2050.

“Despite large increases in transportation demand, particularly in

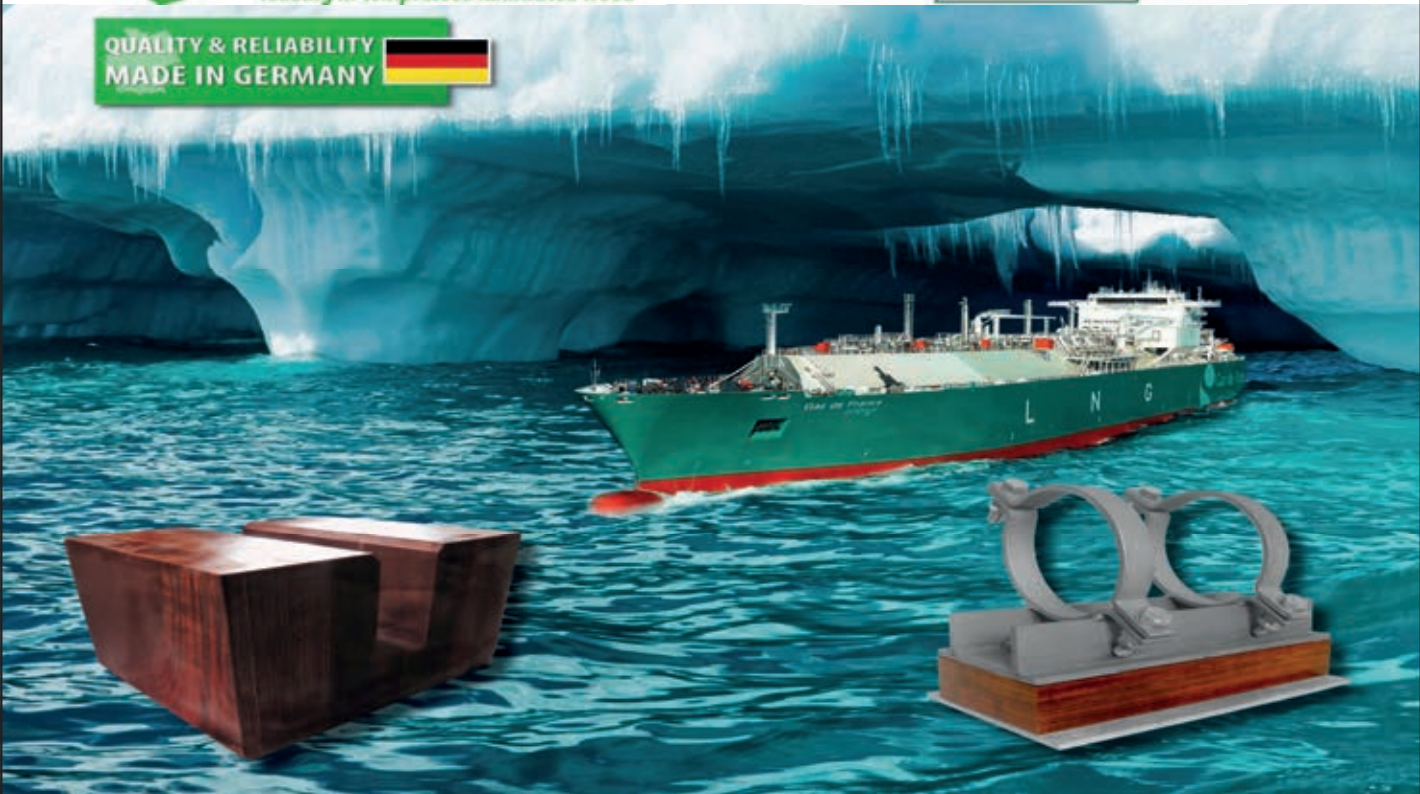
China and India, this change in emissions is lower than the 1.3 percent per year increase in liquids-related CO₂ emissions that occurred from 1990 to 2018,” it said.

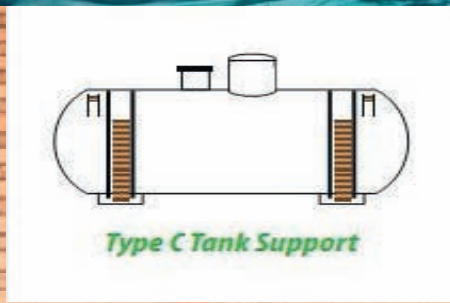
“Natural gas CO₂ emissions increase an average of 1.1% per year between 2018 and 2050. Even though the use of natural gas in electricity generation rises, the related emission growth rates are lower than the 2.2 percent per year increases seen from 1990 to 2018,” it concluded. ■



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Opportunities open for huge Argentine shale gas reserves as quest begins for onshore LNG

Liliana Diaz, Managing Director of FTI Consulting, analyses future of Argentine shale and energy investment

Argentine state-backed energy company YPF sold the country's first LNG shipment from a floating liquefaction facility, "Tango FLNG", and this was quickly followed by its submission to the government of a request to promote development of an onshore LNG liquefaction plant.

The proposals are for a pre-front-end engineering design for a liquefaction plant with 5 million tonnes per annum of LNG capacity and with the option to expand to 10 MTPA. This could also be the blueprint for other plants.

Resources

In that context, developing the country's large reserves of natural gas (both in shale and tight gas reservoirs) presents an opportunity that should transcend political dimensions and overcome short-term pricing woes.

Though President Mauricio Macri's recent commitment to energy sector reform has wobbled of late because of fiscal difficulties and popular discontent, a massive blackout on June 16, 2019, emphasized the need to align the government's priorities with the needs of consumers and energy sector investors.

With this in mind, efforts to consolidate long-term consumer demand and open export venues necessary to sweeten the natural gas investment proposition are afoot.

Recent developments such as difficulties with servicing its sovereign debt have investors concerned that Argentina is backsliding after years of market-oriented reform. Much will be made clearer by the 2019 election due on October 27.

Yet, whoever takes the Argentine helm will be pressed to halt the country's economic downturn and assuage international lenders and investors that are key to kick-starting the economy and the energy industry.

Interest from both state-owned YPF and private investors resulted in a 95 percent unconventional gas production growth from May 2017 to May 2019 (or an 8 percent compounded annual growth rate).

Increased production coupled with lagging demand has seen prices drop to uneconomical levels (below US\$3.50 per million British thermal units (MMBtu).

In February 2019, fiscal troubles led the government to pull-back on its subsidy scheme, undermining development economics and dampening investor interest.

Some producers denounced the move (notably Tecpetrol), while others such as YPF curtailed production soon thereafter.

This juncture comes at a time when the sector cannot afford it, without having a negative impact on hard-won momentum. The gas market is going through a transition, specifically with regards to price formation.

While productivity has improved as a result of increased fracking stages and longer laterals, production costs at the Vaca Muerta shale formation are still too high for international markets.

For the first quarter of 2019, YPF (the big presence in the basin) reported declining costs of \$3.72 per MMBtu, down from \$4.65 per MMBtu a year earlier.

Efficiencies

Further reductions will result in increased efficiency in drilling and completion.

To compete with US production for LNG shipments to Asian and European markets, costs need to be around \$2.5 per MMBtu.

Gustavo Lopetegui, Argentina's Energy Minister, has indicated that he believes the 3,000 drilled wells milestone could constitute an inflection point for the oil and gas sector as a whole.

For now, only about 1,000 wells have been drilled, 300 or so of which have been fracked in the Vaca Muerta Shale.

In addition to reducing production costs, further private investment is sorely needed to overcome the transportation bottlenecks which prevent reaching and broadening consumption markets.

At current capacity, the transportation infrastructure is at its limit. Though in late July, the government launched the tender for a \$2 billion pipeline from Neuquén province, further capacity cannot come soon enough.

VM's development cost benchmark against Permian



Vaca Muerta Shale development costs compared with Permian Basin in US

New infrastructure cannot be financed by the government at the necessary pace.

It is then a question of incentives for investors with the appropriate wherewithal.

Projects

In this regard two key actors are worth mentioning: ExxonMobil and YPF. In June 2019, Exxon announced it would proceed with long-term investments encompassing export infrastructure in its Bajo del Choique-La Invernada for the development of both oil and associated gas.

The June 2019 Tango FLNG debut and future LNG plans will stand the country in good stead.

This newly announced impetus from industry leaders may indicate a turning point, with private investment concluding that conditions are ripe to capture downstream profits, particularly from export markets.

Skeptics might argue it is too soon for optimism given the present political uncertainty, yet the Macri government will have a lot to show in terms of

furthering commercial and legal stability by the time the next presidential term begins.

On one hand, the government is looking to rebalance the domestic market to buttress demand.

On the other, Argentina is entering into international trade agreements that enshrine rights for investors under international law.

We explore these two developments

and their importance in the next paragraphs. Increased production coupled with seasonal fluctuations in residential consumption are a problem for long-term growth prospects in the industry.

Both the government and investors agree that consumer markets need to expand in order to encourage private investment in transportation infrastructure.

The bulk of domestic consumption is in the power sector, which supports about 38 percent of demand (2018).

In the recent past however, the power generation subsector was hampered by price controls that disincentivized investment in installed capacity.

Starting in 2017, the government has slowly introduced a number of reforms to encourage competition (auctioning new thermal and renewable generation capacity) and cost-reflective pricing (through the unfreezing of wholesale and residential rates and a revamp of the market design and price formation mechanism).

Reform efforts are expected to revive the sector and unleash market growth.

Overhaul

While further reforms of the power sector are anticipated, other natural gas consumption sectors could also be revamped, including industrial processing and transportation (constituting 25 percent and 5.7 percent of demand respectively in 2017).

The lion's share of industrial processing covers three activities: refineries (20.1 percent), steelworks (18.9

percent) and chemical and petrochemical production (17.9 percent).

Petrochemicals in particular present an opportunity for growth given government plans to put a gas pipeline up for bidding, the first stage of which will connect from Neuquén province to the Atlantic coast near the petrochemical development pole of Bahía Blanca by 2021.

Indeed, in May 2019 as part of its asset divestment process program, Petrobras announced its intention to sell its 34 percent stake in Compañía MEGA S.A., a petrochemical company at Bahía Blanca highlighting “studies to increase the plants' capacity and gas-supply pipelines are already underway.”

In summary, further domestic market growth is possible. But what about the export market?

For investors, uncertainty is always a major concern. Argentina has experienced economic policy swings and macroeconomic instability in the past decades.

Assurances

As in a Tango dance, Argentina's temper sometimes makes it difficult to keep a flawless rhythm. Investors, however, may find some assurance coming from Argentina's international trade agreements (FTAs).

One notable and recent example is the FTA with Chile, which entered into force on May 1, 2019. Pursuant to its provisions, cross-border trade in services and private investment by each other's nationals will enjoy substantive protections under international law.

Those protections will empower and complement an existing bilateral

agreement requiring both countries to establish domestic regimes to regulate the power and natural gas trade before the end of 2019 and pursuant to which firm exports were authorized by Argentina in August.

Chile question

Furthermore, those protections will be enshrined in an international treaty that neither country can unilaterally breach without triggering independent dispute resolution mechanisms and bringing to bear the importance of a broader commercial relationship.

Yet integration efforts in Latin America's Southern Cone are riddled with great expectations and unmet potential. Argentina in the past exported both power and gas to Chile only to run out of both in the aftermath of the 2001 financial crisis.

The damage from unilateral gas export suspension in 2004 to regional relationships was enormous.

In Chile, a political debate concerning the appropriateness of import dependence from Argentina erupted, and the country decided to peg its energy supply to LNG imports through two LNG regasification facilities.

This time around, however, a greater prize than the Chilean market awaits: Asia. Reaching the Pacific Rim LNG markets is a commercial incentive that might just align both investor and government interests through thick and thin.

Indeed in June 2019 YPF's export of the country's first LNG cargo in the Atlantic evidenced the industry's global aspirations.

Following the U.S. experience, Chile's

regasification terminals could be retrofitted quickly and in a cost-effective manner to liquify Vaca Muerta's natural gas and offer Argentine LNG to energy hungry Asian markets.

Asia Pacific natural gas demand is expected to grow in a sustained fashion on the back of China's thirst for natural gas (China's demand is expected to triple to 710 billion cubic meters by 2040).

As a result of the Argentina-Chile FTA, the entire LNG supply value chain from well-head to port will be vested with both the domestic and international legal protections that will bring much needed security to private investment.

Priorities

This does not mean Argentinean gas supply to Chile will be free from interruption hence forth.

Indeed, domestic supply will always take priority for Argentina, but increasingly making that choice in a

buoyant natural gas regional market will be unnecessary.

In short, a larger export market, including hungry China, may align the incentives for a sustainable commercial proposition, while investors' protections enshrined in an international treaty will help assuage fears of an off-tempo Tango.

Opportunity awaits in the Argentine natural sector. Much like the Tango, it is not straightforward nor for the faint of heart. Yet in the mist of political uncertainty, bellwether investors have pushed ahead.

While further private investment along the value chain will be necessary for large-scale development of vast unconventional resources in Vaca Muerta and beyond, the current government has taken steps to unlock domestic consumption and export markets that will make it attractive.

For those still considering investing in Argentina and its Vaca Muerta, it is time to look more closely and assess the opportunities before the Tango ends. ■

Author:



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Liliana Diaz is a Managing Director at FTI Consulting based in Washington D.C. Dr. Diaz is a member of the Economic Consulting segment. She serves as an expert and advisor for energy companies, investors and sovereigns. Dr.

Diaz is also a specialist in the Latin American region.

Dr. Diaz brings commercial and technical experience in the global energy industry, with a focus in emerging markets. Her expertise encompasses a wide array of energy industries including oil and gas, unconventional fossil fuels, liquefied natural gas (LNG), renewables, power generation and transmission and energy efficiency. For the past ten years, Dr. Diaz has worked in energy related engagements in North America, Latin America, Europe, Asia and the Middle East.

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Japanese class society says LNG represents central strand of its rules for cargo and fuel

Hayato Suga offers a progress report on the class rules that will enable safe use of LNG, hydrogen and other energy sources

As the conversation on alternative fuels continues to unfold ClassNK is focusing on updating the rules that will ensure fast-emerging industry requirements meet safety imperatives, as well as the longer term research needed to reconcile vessel operations with shipping's lower-carbon future.

LNG represents a central strand in ClassNK rule development, both as a cargo and as ship fuel.

The global LNG carrier fleet currently comprises some 600 ships and is expanding.

Newbuilds

In Japan, the major yards such as Mitsubishi, Japan Marine United (JMU) and Kawasaki are working on newbuilds, while their Korean and Chinese counterparts have an expanding orderbook.

What this aggregate statistic doesn't reveal is a structural shift in the fleet.

Traditionally LNG carriers were placed on long-standing charters to support projects between a major energy supplier and set customers.

Recently, however, new players are joining the market to satisfy emerging demand in small-scale LNG distribution to pockets of stranded demand and in bunkering LNG as a marine fuel.

As these new entrants typically have less experience than established carrier operators, our activities in rule development and spreading best practice are more important than ever.

Last year we released revised Guidelines for Liquefied Gas Carrier Structures, considering specifically the case of independent prismatic tanks.

Requirements

The amended text describes the technical requirements for direct strength analysis (DSA) and for fatigue assessments.

DSA specifies a method for calculating yield strength and buckling strength based on net scantling of primary structural members, drawing from in-depth research and experience from other vessel types.

The document also presents assessment methods taking account of



ClassNK approved the design of an LNG-fuelled 200,000 DWT bulk carrier from NYK Line and JMU

the complex interaction of loads between hull structures and cargo tanks which are independent of each other.

The Guidelines specify not only the design loads dominant for each structure, strength analysis methods and corrosion deductions, but the design scenarios in which assessments are required by the IMO IGC Code, therefore covering all structural requirements for gas carriers with independent prismatic tanks.

Strength

The updated guidance outlines strength assessment methods against fatigue cracks caused to vessels by prolonged and repeated loads. The original guidelines assumed some very conservative starting conditions, which resulted in what we now assess to be excessively cautious fatigue life predictions.

Using data on the conditions these vessels encounter in actual operation, we were able to refine our starting assumptions, which led to a more precise calculation methodology for both hull structure and independent cargo tanks and their associated support structures.

Of course, field data has to be treated with caution and supported by fundamental research as it is based on the conditions met during normal safe operation and not behaviour in more extreme circumstances.

Looking further ahead, it is essential to comply with IMO's agenda to reduce international shipping's dependency on fossil fuel as part of a wider

environmental commitment to halve greenhouse gases by 2050.

As the shipping industry pivots to cleaner modes of operation, ship owners are showing greater than ever interest in LNG as a fuel.

As a case in point, ClassNK granted an Approval in Principle (AIP) to the design of an LNG-fuelled 200,000 DWT bulk carrier jointly developed by NYK Line and JMU in July 2018; to Kawasaki Heavy Industries (KHI) for their project on the concept design of an LNG-fuelled 207,000 DWT bulk carrier in January 2019; and to Sanoyas Shipbuilding Corporation for their project on the concept design of an LNG-fuelled wood chip carrier in May 2019.

Despite the additional weight of their LNG fuel tanks and fuel-supply systems, these ships have a larger cargo hold capacity and, by running on LNG, they are expected to satisfy Phase 3 of the IMO's Energy Efficient Design Index (EEDI).

Other fuels

Other than LNG, alternative fuels such as LPG and methyl/ethyl alcohol are also considered to be a viable option for ships.

These alternative fuels have lower flashpoints compared to traditional fuels; therefore particular attention needs to be given to ensuring adequate safety precautions when using low-flashpoint fuels in order to decrease the potential risk of fire and explosions that may arise as a

result of fuel leakage onboard the ship.

International safety requirements for low-flashpoint fuels have been discussed at IMO and as a result, the International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code) has been adopted and enforced.

However, the current code does not address specific regulations for alternative fuels other than LNG.

To promote the design of alternative fuelled ships, we released the Guidelines for Ships Using Low-Flashpoint Fuels (Methyl-Ethyl Alcohol-LPG) which outline safety requirements for other viable alternative fuels besides LNG, based on the latest technology and regulation trends.

The guidelines divide targeted vessels into three categories: ships using methyl/ethyl alcohol as fuel; ships fuelled by LPG; and liquid gas carriers fuelled by LPG.

They take into consideration the properties of each fuel type and ship regulations and indicate safety requirements for the arrangement and installation of the low-flashpoint fuel related systems for minimizing risks to vessels, crew, and the environment.

Fuel methanation has also gathered global attention as a method of technology that may greatly contribute to the reduction of GHG emissions. ClassNK currently participates in a working group for the reduction of CO2 emissions in the international value chain by use of methane synthesized through

methanation technology which combines CO₂ and hydrogen produced from renewable energy sources.

The technology is still relatively new, but if methanation proves to yield positive results in the long run, the supply of synthesized methane may greatly increase as it comes into widespread use.

Next generation

As a low carbon energy source, hydrogen is stirring up excitement as a promising alternative to conventional fuels, as the only waste product discharged at the time of power generation is water. Hydrogen can be burnt directly, like HFO, or used indirectly to power fuel-cells.

In marine applications, the latter option is gaining traction as the technology is proven and efficiency is improving as manufacturers develop and refine the technology. Hydrogen-powered fuel-cells could reach a theoretical efficiency as high as 80 percent.

It should be remembered that hydrogen is a fuel carrier and its overall environment footprint depends on how

cleanly it is produced and transported to where it is needed.

The benefits diminish if fossil fuels power the production process. The dynamics become more interesting, however, if renewable energy sources are employed and a lot of practical research and activity is going on in this area.

Today hydrogen remains more expensive than conventional fuels, but the consensus is that costs will fall as production processes are refined and scaled up in response to growing demand, not just from shipping but more widely across industry.

Therefore, in addition to economically viable and environmentally-friendly methods of production, a secure supply chain will be required to transport hydrogen to where it is needed.

In common with existing fuels, ships are likely to be the most efficient method for transporting large volumes over long distances.

The technology behind the storage and transfer of bulk liquefied hydrogen is not new, with land- and barge-based facilities supporting the space industry

being in place since the 1950s. The same technology and standards can be applied to carriage by sea, albeit with modifications to suit shipborne operations.

Currently, the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) outlines safety requirements for gas carriers like LNG.

However, there are no specific requirements defined in the code applicable for liquid hydrogen carriers that take account of the hazards associated with its handling and transport.

Hydrogen must be kept at temperatures below -253°C in order to maintain its liquid state under atmospheric pressure, presenting an even tougher challenge than LNG.

In response to growing interest in LH₂ transportation, IMO developed Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk - based on proposals from Japan and Australia and subsequent follow up by a specially convened correspondence group.

Utilizing its wealth of technical expertise and extensive experience in gas carrier R&D and ship classification, ClassNK has taken this work further by developing Guidelines for Liquid Hydrogen Carriers based on these interim recommendations and other related international standards.

These guidelines set out the safety requirements, which must be met in the design and construction of such ships to address the hazards arising from the handling of liquid hydrogen.

It should be noted there are some areas where the behaviour of the cargo cannot be determined with absolute certainty.

Seaborne trials will be needed to resolve this to derive the data needed to refine the requirements and develop processes necessary to support large scale commercial shipments.

In 2020-2021, the world's first project for producing and transporting clean hydrogen from Australia to Japan will begin, and ClassNK will join the project to evaluate the safety of Liquefied Hydrogen Carriers from the perspective of a classification society. ■

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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	GTT	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	GTT	4	Nigeria LNG
Adam LNG	162,000	Oman LNG	Hyundai	Dec-14	Marshall Is.	DFDE	GTT	4	Oman LNG
Adriano Knutsen	180,000	Knutsen	Hyundai	Jul-19	Spain	MEGI-DF	GTT	4	charter
Al Aamriya	210,100	J5 Consortium	Daewoo	Feb-08	Marshall Is.	DRL	GTT	4	Qatargas
Al Areesh	151,700	Teekay LNG	Daewoo	Jan-07	Qatar	S	GTT	4	Ras Gas II
Al Bahiya	210,185	QGTC	Samsung	Oct-09	Liberia	DRL	GTT	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	GTT	4	RasGas II
Al Dafna	266,000	QGTC	Samsung	Oct-09	Marshall Is.	LR DRL	GTT	4	Qatar-Atlantic
Al Deebel	145,000	Peninsular LNG	Samsung	Dec-05	Bahamas	S	GTT	4	Qatargas
Al Gattara	216,200	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	GTT	4	Qatargas II
Al Ghariya	210,100	ProNav	Daewoo	Feb-08	Bahamas	DRL	GTT	4	Qatargas
Al Gharaffa	216,200	OSG/Nakilat	Hyundai	Jan-08	Marshall Is.	DRL	GTT	4	Various
Al Ghashamiya	216,000	QGTC	Samsung	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Al Ghuwairiya	261,700	QGTC	Daewoo	Aug-08	Marshall Is.	DRL	GTT	5	Qatar-Atl'c Basin
Al Hamla	216,000	OSG	Samsung	Feb-08	Marshall Is.	DRL	GTT	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	GTT	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	GTT	4	RasGas
Al Kharaitiyat	216,200	QGTC	Hyundai	May-09	Liberia	DRL	GTT	4	Qatargas III
Al Kharaana	210,000	QGTC	Daewoo	Oct-09	Marshall Is.	DRL	GTT	4	Qatargas IV
Al Kharsaah	217,000	Teekay	Samsung	May-08	Bahamas	DRL	GTT	4	RasGas III
Al Khattiya	210,000	QGTC	DSME	Oct-09	Marshall Is.	DRL	GTT	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	GTT	4	RasGas
Al Mafyar	266,000	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	GTT	4	Qatargas II
Al Marrouna	151,700	Teekay	Daewoo	Nov-07	Bahamas	S	GTT		Ras Gas I
Al Mayeda	266,000	QGTC	Samsung	Jan-09	Liberia	DRL	GTT	5	Qatar-US/Var.
Al Nuaman	210,000	QGTC	DSME	Dec-09	Marshall Is.	DRL	GTT	4	Qatargas IV
Al Oraiq	210,000	J5 Consortium	Daewoo	Apr-08	Marshall Is.	DRL	GTT	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	GTT	4	Qatar-Atlantic
Al Ruwais	210,100	ProNav	Daewoo	Nov-07	Germany	DRL	GTT	4	Qatargas II
Al Sadd	210,100	QGTC	Daewoo	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Al Safliya	210,100	ProNav	Daewoo	Dec-07	Bahamas	DRL	GTT	4	Qatargas II
Al Sahla	216,200	J5	Hyundai	Jun-08	Japan	DRL	GTT	4	Ras Gas III
Al Samriya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GTT	5	Qatargas II
Al Sheehaniya	210,100	QGTC	Daewoo	Feb-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Al Shamal	217,000	Teekay LNG	Samsung	Jun-08	Qatar	DRL	GTT	4	RasGas
Al Thakhira	145,000	Peninsular LNG	Samsung	Sep-05	Bahamas	S	GTT	4	Qatargas
Al Thumama	216,000	J5 Consortium	Hyundai	Apr-08	Japan	DRL	GTT	4	Rasgas
Al Utouriya	215,000	J5	Hyundai	Sep-08	Panama	DRL	GTT	4	RasGas
Al Utourma	215,000	J5	Hyundai	Sep-08	Panama	DRL	GTT	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	GTT	4	Brunei LNG
Amanl	154,800	Brunei-Shell	Hyundai	Nov-14	Brunei	DFDE	GTT	4	Brunei LNG
Aman Bintulu	18,928	Perbadanan / NYK Line	NKK Tsu	Oct-93	Malaysia	S	GTT	3	Petronas
Aman Hakata	18,800	Perbadanan / NYK Line	NKK Tsu	Nov-98	Malaysia	S	GTT	3	Petronas
Aman Sendai	18,928	Perbadanan / NYK Line	NKK Tsu	May-97	Malaysia	S	GTT	3	Petronas
Arctic Aurora	160,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	GTT	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	GTT	4	Brunei LNG
Arwa Spirit	165,000	Teekay LNG	Samsung	Sep-08	Marshall Is.	DFDE	GTT	4	Various
Aseem	154,850	K Line-Petronet	Samsung	Nov-09	Malta	S	GTT	4	Qatar-India
Asia Endeavour	160,000	Chevron	Samsung	Dec-14	Bahamas	DFDE	GTT	4	Various
Asia Energy	160,000	Chevron	Samsung	Sept-14	Bahamas	DFDE	GTT	4	Various
Asia Excellence	160,000	Chevron	Samsung	Sept-13	Bahamas	DFDE	GTT	4	Various
Asia Venture	160,000	Chevron	Samsung	Sept-17	Bahamas	DFDE	GTT	4	Various
Asia Vision	160,000	Chevron	Samsung	June-14	Bahamas	DFDE	GTT	4	Various

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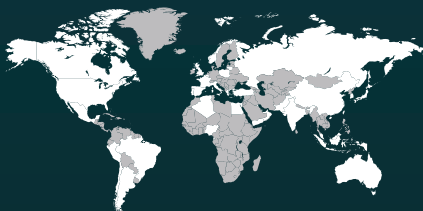
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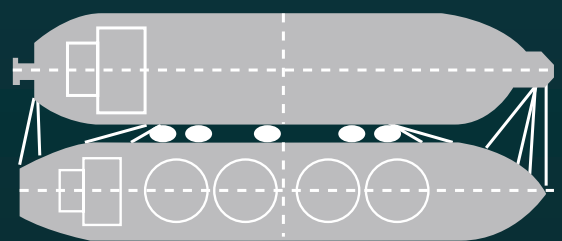
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Bahrain Spirit	173,000	Teekay	Daewoo	Sept-18	Bahamas	DFDE	GTT	4	Various
Barcelona Knutsen	173,400	Knutsen	Daewoo	May-10	N.I.S.	DFDE	GTT	4	Various
Bebatic	75,060	Brunei Shell Tankers	Atlantique	Oct-72	Brunei	S	GTT	6	Brunei LNG
Beidou Star	172,000	MOL	Hudong	Oct-15	Hong Kong	DRL	GTT	4	Various
Berge Arzew	138,088	BW Gas	Daewoo	Jul-04	Norway	S	GTT	4	Sonatrach
Boris Vilkitsky	172,600	Dynagas	Daewoo	Jan-17	Cyprus	DFDE	GTT	4	Yamal LNG
BW GDF-Suez Boston	138,059	BW Gas	Daewoo	Jan-03	Norway	S	GTT	4	Suez LN
BW GDF Suez Everett	138,028	BW Gas	Daewoo	Jun-03	Norway	S	GTT	4	Suez LNG
BW Integrity	170,000	BW Gas	Samsung	May-17	Singapore	DFDE	GTT	4	FSRU
BW Pavilion Leeara	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	GTT	4	Various
BW Pavilion Vanda	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	GTT	4	Various
BW Singapore	170,000	BW Gas	Samsung	May-15	Singapore	DFDE	GTT	4	FSRU
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GTT	4	Yemen-Atlantic
Bilbao Knutsen	138,000	Knutsen / Marpetrol	IZAR Sestao	Jan-04	Spain	S	GTT	4	Atlantic LNG
Billis	77,730	Brunei Shell Tankers	La Seyne	Mar-75	Brunei	S	GTT	5	Brunei LNG
Bishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-15	Panama	S	Moss	4	Australia-Japan
Boris Davydov	172,600	Dynagas	Daewoo	Sept-18	Cyprus	DFDE	GTT	4	Yamal LNG
British Achiever	173,644	BP Shipping	Daewoo	June-18	IOM	MEGI-DF	GTT	4	Various
British Contributor	173,644	BP Shipping	Daewoo	Oct-18	IOM	MEGI-DF	GTT	4	Various
British Diamond	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	GTT	4	Indonesia-Various
British Emerald	155,000	BP Shipping	Hyundai	Jun-07	UK	DFDE	GTT	4	Tangguh LNG
British Innovator	138,200	BP Shipping	Samsung	Jul-03	Isle of Man	S	GTT	4	Various
British Merchant	138,000	BP Shipping	Samsung	Apr-03	Isle of Man	S	GTT	4	Various
British Partner	173,644	BP Shipping	Daewoo	Mar-18	IOM	MEGI-DF	GTT	4	Various
British Ruby	155,000	BP Shipping	Hyundai	Jan-08	U.K.	DFDE	GTT	4	Various
British Sapphire	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	GTT	4	Tangguh
British Trader	138,000	BP Shipping	Samsung	Dec-02	Isle of Man	S	GTT	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	GTT	5	Qatargas
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GTT	4	Yemen-Atlantic
BW Suez Brussels	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GTT	4	Yemen-Atlantic
Cadiz Knutsen	138,826	Knutsen / Marpetrol	IZAR Puerto Real	Jun-04	Spain	S	GTT	4	Engas
Cape Ann	145,000	Hoegh LNG/MOL	Samsung	May-10	Liberia	DFDE	GTT	4	Various
Castillo de Santisteban	173,600	Elcano	STX	Aug-10	Malta	S	GTT		Various
Castillo de Villalba	138,000	Elcano	IZAR	Nov-03	Spain	S	GTT	4	Sonatrach
Catalunya Spirit	138,000	Teekay LNG Partners	IZAR Sestao	Mar-03	Liberia	S	GTT	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	GTT	4	Australia-China
Cesi Gladstone	174,100	MOL-China LNG	Hudong	Oct-16	Hong Kong	S	GTT	4	Australia-China
Cesi Lianyungang	174,100	MOL-China LNG	Hudong	June-18	Hong Kong	S	GTT	4	Australia-China
Cesi Qingdao	174,100	MOL-China LNG	Hudong	Nov-16	Hong Kong	S	GTT	4	Australia-China
Cesi Tianjin	174,100	MOL-China LNG	Hudong	Sept-17	Hong Kong	S	GTT	4	Australia-China
Challenger FSRU	263,000	MOL LNG	Daewoo	Oct-17	St Kitts	DFDE	GTT	4	Various
Cheikh Bouamama	75,500	Skikda LNG Transport	USC	Jul-08	Bahamas	S	GTT	4	Sonatrach
Cheikh El Mokrani	75,500	Med LNG Corp	USC	Jun-07	Bahamas	S	GTT	4	Sonatrach
Christophe de Margerie	172,600	SCF	Daewoo	Nov-16	Cyprus	DFDE	GTT	4	Various
Clean Energy	150,000	Dynagas	Hyundai	Mar-07	Marshall Is.	S	GTT	4	Various
Clean Force	150,000	Dynagas	Hyundai	Jan-08	Marshall Is.	S	GTT	4	Various
Clean Ocean	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	GTT	4	Various
Clean Planet	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	GTT	4	Various
Clean Vision	160,000	Dynagas	Hyundai	Jun-15	Marshall Is.	DFDE	GTT	4	Various
Cool Explorer	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Cool Runner	160,000	Thenamaris	Samsung	May-14	Bermuda	DFDE	GTT	4	Various
Cool Voyager	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Corcovado LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Creole Spirit	174,000	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	GTT	4	Cheniere
Cubal	160,400	Mitsui/NYK/Teekay	Samsung	Jan-12	Bahamas	DFDE	GTT	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	GTT	4	Various
Dapeng Star	147,000	China Ships	Hudong	Nov-09	China	S	GTT	4	Various
Dapeng Sun	147,000	China Ships	Hudong	Jul-07	China	S	GTT	4	Woodside Energy
Diamond Gas Orchid	165,000	MOL-Jera	MHI-Nagasaki	Aug-18	Japan	S-gas	Moss	4	US-Japan
Diamond Gas Rose	165,000	MOL-Jera	MHI-Nagasaki	Aug-18	Japan	S-gas	Moss	4	US-Japan
Disha	136,000	Petronet LNG Ltd.	Daewoo	Jan-04	Malta	S	GTT	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	GTT	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	GTT	4	Various
Ejnan	145,000	4J	Samsung	Jan-07	Bahamas	S	GTT		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	GTT	4	Various
Energy Confidence	155,000	Tokyo LNG Tankers	Kawasaki	Apr-09	Panama	S	Moss	4	Various



Energy Frontier	147,600	Tokyo LNG Tankers	Kawasaki Sakaide	Sep-03	Japan	S	Moss	4	Darwin
Energy Glory	165,000	Tokyo LNG Tankers	JMU	Sept-18	Japan	S	Moss	4	Various
Energy Horizon	177,000	Tokyo LNG Tankers	Kawasaki	Jul-11	Japan	S	Moss	4	Pluto LNG
Energy Liberty	165,000	MOL	JMU Tsu	Oct-18	Japan	TFDE	IHI-SPB	4	Various
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
Enshu Maru	165,257	K Line	Kawasaki	June-18	Japan	S	Moss	4	Various
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	GTT	4	Various
Excel	138,106	Exmar/ MOL	Daewoo	Sep-03	Belgium	S	GTT	4	Various
Excelerate	138,000	Exmar/Excelerate	Daewoo	Oct-06	Belgium	S	GTT	4	Various
Excellence	138,000	GKFF Ltd.	Daewoo	May-05	Belgium	S	GTT	4	Excelerate Energy
Excelsior	138,000	Exmar	Daewoo	Jan-05	Belgium	S	GTT	4	Various
Exemplar	150,900	Excelerate	Daewoo	Jun-10	Belgium	S	GTT	4	Various
Expedient	151,000	Excelerate	Daewoo	Nov-09	Belgium	S	GTT	4	Various
Experience RV	174,000	Exmar/Excelerate	Daewoo	Jul-14	Marshall Is.	DFDE	GTT		Various
Explorer	150,900	Exmar/Excelerate	Daewoo	Mar-08	Belgium	S	GTT	4	Excelerate
Express	151,000	Exmar/Excelerate	Daewoo	May-09	Belgium	S	GTT	4	Various
Exquisite	150,900	Excelerate	Daewoo	Sep-09	Belgium	S	GTT	4	Various
Fedor Litke	172,636	Dynagas	Daewoo	Nov-17	Cyprus	DFDE	GTT	4	Various
Flex Endeavour	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	GTT	4	Various
Flex Enterprise	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	GTT	4	Various
Flex Rainbow	174,000	Flex LNG	Samsung	July-18	Marshall Is.	MEGI-DF	GTT	4	Various
Flex Ranger	174,000	Flex LNG	Samsung	April-18	Marshall Is.	MEGI-DF	GTT	4	Various
Fraiha	210,100	J5 Consortium	Daewoo	Sep-08	Marshall Is.	DRL	GTT	4	Qatargas
FSRU Independence	170,000	Hoegh	Hyundai	Feb-14	NIS	DFDE	GTT	4	Various
FSRU Lampung	170,000	Hoegh	Hyundai	May-14	Indonesia	DFDE	GTT	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	GTT	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	GTT	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	GTT	4	Various
Gaslog Geneva	174,000	GasLog	Samsung	Sept-16	Bermuda	TFDE	GTT	4	Shell charter
Gaslog Genoa	174,000	GasLog	Samsung	Jun-18	Bermuda	TFDE	XDF	4	Various
Gaslog Gibraltar	174,000	GasLog	Samsung	Oct-16	Bermuda	TFDE	GTT	4	Shell charter
Gaslog Glasgow	174,000	GasLog	Samsung	Jun-16	Bermuda	TFDE	GTT	4	Shell charter
Gaslog Gladstone	174,000	GasLog	Samsung	May-19	Bermuda	XDF	GTT	4	Various
Gaslog Greece	174,000	GasLog	Samsung	Mar-16	Bermuda	TFDE	GTT	4	Shell charter
GasLog Hongkong	174,000	GasLog	Hyundai	Jun-18	Bermuda	XDF	GTT	4	Various
GasLog Houston	174,000	GasLog	Hyundai	Jan-18	Bermuda	XDF	GTT	4	Various
GasLog Salem	165,000	GasLog	Samsung	Apr-15	Liberia	TFDE	GTT	4	Various
GasLog Santiago	155,000	GasLog	Samsung	Mar-13	Liberia	TFDE	GTT	4	Various
GasLog Saratoga	155,000	GasLog	Samsung	Dec-14	Bermuda	TFDE	GTT	4	Various
Gaslog Savannah	155,000	GasLog	Samsung	May-10	Bermuda	DFDE	GTT	4	Various
GasLog Seattle	155,000	GasLog	Samsung	Oct-13	Bermuda	TFDE	GTT	4	Various
GasLog Shanghai	155,000	GasLog	Samsung	Jan-13	Liberia	TFDE	GTT	4	Various
Gaslog Singapore	155,000	GasLog	Samsung	Jul-10	Bermuda	DFDE	GTT	4	Various
Gaslog Skagen	155,000	GasLog	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Gaslog Sydney	155,000	GasLog	Samsung	May-13	Bermuda	DFDE	GTT	4	Various
Gaslog Warsaw	174,000	GasLog	Samsung	May-19	Bermuda	TFDE	GTT	4	Various
GDF-Suez Global Energy	74,000	Gaz de France	Chantiers	Dec-06	France	DFDE	CS1	4	Sonatrach
GDF-Suez Point Fortin	154,200	LNG Japan	Imabari/Koyo	Feb-10	Panama	DFDE	GTT	4	Various
Gemmata	138,100	Shell Shipping	Mitsubishi Nagasaki	Mar-04	Singapore	S	Moss	5	Shell
Georgiy Brusilov	172,000	Dynagas	Daewoo	Jun-18	Cyprus	DFDE	GTT	4	Yamal LNG
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	GTT	4	Various
Golar Arctic	140,645	Golar LNG	Daewoo	Dec-03	Marshall Is.	S	GTT	4	Shell Spot
Golar Bear	160,000	Golar	Samsung	Mar-14	Bermuda	TFDE	GTT	4	Various
Golar Celsius	160,000	Golar LNG	Samsung	Sep-13	Bermuda	DFDE	GTT	4	Various
Golar Crystal	160,000	Golar LNG	Samsung	Oct-13	Bermuda	TFDE	GTT	4	Various
Golar Eskimo (FSRU)	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	GTT	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.	TFDE	GTT	4	Various
Golar Grand	145,880	Golar LNG	Daewoo	2006	IoM	S	GTT	4	Various
Golar Ice	160,000	Golar LNG	Samsung	Feb-15	Bermuda	DFDE	GTT	4	Various
Golar Igloo (FSRU)	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Golar Kelvin	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	GTT	4	Various
Golar Maria	145,950	Golar LNG	Daewoo	2006	Marshall Is.	S	GTT	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.	TFDE	GTT	4	Various
Golar Seal	160,000	Golar LNG	Samsung	Aug-13	Bermuda	TFDE	GTT	4	Various
Golar Singapore (FSRU)	160,000	Golar LNG	Samsung	June-15	Bermuda	TFDE	GTT	4	Various

CARRIER FLEET



Golar Snow	160,000	Golar LNG	Samsung	Jan-15	Bermuda	TFDE	GTT	4	Various
Golar Tundra (FSRU)	160,000	Golar LNG	Samsung	Dec-15	Bermuda	TFDE	GTT	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	GTT	4	Petrobras
Grace Acacia	150,000	Algaet Shipping	Hyundai	Jan-07	Japan	S	GTT	4	Various
Grace Barleria	150,000	Swallowtail Ship	Hyundai	Oct-07	Japan	S	GTT	4	Various
Grace Cosmos	150,000	AGH Shipping	Hyundai	Mar-08	Japan	S	GTT	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	GTT	4	Shell BG
Granatina	140,645	Shell Shipping	Daewoo	Dec-03	Singapore	S	GTT	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	GTT	4	Oman Gas
Hanjin Pyeong Taek	130,600	Hanjin Shipping	Hanjin	Sep-95	Panama	S	GTT	4	Pertamina
Hanjin Ras Laffan	138,214	Hanjin Shipping	Hanjin	Jul-00	Panama	S	GTT	4	QatarGas
Hanjin Sur	138,333	Hanjin Shipping	Hanjin	Jan-00	Panama	S	GTT	4	Oman Gas
Hispania Spirit	140,500	Teekay LNG Partners	Daewoo	Sep-02	Spain	S	GTT	4	Atlantic LNG
Hoegh Esperanza FSRU	170,000	Hoegh	Hyundai	April-18	Norway	DFDE	GTT	4	Various
Hoegh Gallant FSRU	170,050	Hoegh LNG	Hyundai	May-14	Marshall Is.	DFDE	GTT	4	chartered
Hoegh Giant FSRU	170,050	Hoegh LNG	Hyundai	Jan-18	Marshall Is.	DFDE	GTT	4	various
Hoegh Grace FSRU	170,050	Hoegh LNG	Hyundai	May-15	Marshall Is.	DFDE	GTT	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	GTT	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	GTT	4	Oman LNG
Ibri LNG	145,000	Oman Gas	Mitsubishi	Jul-06	Panama	S	GTT	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	GTT	4	Oman Gas
K Freesia	135,256	Korea Line	Daewoo	Jun-00	Panama	S	GTT	4	RasGas
Kinisis	173,400	K-Line	Daewoo	Jan-18	Liberia	MEGI-DF	GTT	4	Various
K Jasmine	145,700	Korea Line	Daewoo	Mar-08	Panama	S	GTT	4	Kogas offtake
K Mugungwha	152,000	K Line	Daewoo	Nov-08	Panama	S	GTT	4	Various
Kita LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	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	GTT	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	GTT	5	Various
LNG Abalamabie	174,900	Bonny Gas	Samsung	Nov-16	Bermuda	DFDE	GTT	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	GTT	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	GTT	4	Nigeria LNG
LNG Bonny	177,000	Bonny Gas Transport	Hyundai	Oct-15	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Borno	149,600	NYK Line	Samsung	Aug-07	Japan	S	GTT	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	GTT	4	Nigeria LNG
LNG Fimina	175,000	Bonny Gas Transport	Samsung	Oct-15	Bermuda	DFDE	GTT	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	GTT	4	Nigeria LNG
LNG Jamal	135,330	Osaka Gas/J3 Consortium	Mitsubishi Nagasaki	Oct-00	Japan	S	Moss	5	Oman Gas
LNG Juno	177,300	MOL-Osaka	Mitsubishi	Oct-18	Marshall Is.	DFDE	Moss	4	Freeport LNG/Various
LNG Jupiter	145,000	NYK Line	Kawasaki	Jul-09	Bahamas	S	Moss	4	Various
LNG Jurojin	155,300	MOL	MHI Nagasaki	Nov-15	Japan	S	KM	4	Various
LNG Kano	148,471	BW Gas	Daewoo	Jan-07	Bermuda	S	GTT	4	NLNG
LNG Lagos	177,000	Bonny Gas	Hyundai	Oct-15	Bermuda	DFDE	GTT	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	GTT	4	Sonatrach
LNG Libra	126,400	Hoegh LNG	GD Quincy	Apr-79	Marshall Is.	S	Moss	5	Various



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LNG Lokoja	148,300	BW Gas	Daewoo	Dec-06	Bermuda	S	GTT	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	GTT	4	Nigeria LNG
LNG Ondo	148,300	BW Gas	Daewoo	Sep-07	Bermuda	S	GTT	4	Nigeria LNG
LNG Oyo	140,500	BW Gas	Daewoo	Dec-05	Bermuda	S	GTT	4	Nigeria LNG
LNG Pioneer	138,000	MOL	Daewoo	Jul-05	Bahamas	S	GTT	4	Idku
LNG Port Harcourt	175,000	Bonny Gas	Samsung	Oct-15	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Portovenere	65,000	Exmar	Italcantieri Sestri	Jun-96	Italy	S	GTT	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	GTT	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 Schneeweisschen	180,000	MOL-Itochu	Daewoo	Aug-18	Panama	XDF	GTT	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	GTT	4	Various
Lusail	138,000	Peninsular LNG	Samsung	May-05	Bahamas	S	GTT	4	Qatar
Macoma	173,400	Teekay	Daewoo	Oct-17	Bahamas	DFDE	GTT	4	Various
Madrid Spirit	138,000	Teekay LNG Partners	IZAR Puerto Real	Jan-05	Spain	S	GTT	4	Engas
Magdala	173,400	Teekay	Daewoo	Feb-18	Bahamas	DFDE	GTT	4	Various
Magellan Spirit	165,500	Teekay LNG Partners	Samsung	Sep-08	Denmark	DFDE	GTT	4	Various
Malanje	160,400	Mitsui/NYK/Teekay	Samsung	Jul-11	Bahamas	DFDE	GTT	4	Various
Maran Gas Achilles	174,000	Maran	Hyundai Samho	Feb-16	Greece	DFDE	GTT	4	Various
Maran Gas Agamemnon	174,000	Maran	Hyundai Samho	May-16	Greece	DFDE	GTT	4	Various
Maran Gas Alexandria	161,870	Maran	Hyundai Samho	Sep-15	Greece	DFDE	GTT	4	Various
Maran Gas Amphipolis	173,400	Maran	Daewoo	Aug-16	Greece	DFDE	GTT	4	Various
Maran Gas Apollonia	161,870	Maran	Daewoo	Jan-14	Greece	DFDE	GTT	4	Various
Maran Gas Asclepius	145,000	Kristen Navigation	Daewoo	Jul-05	Bermuda	S	GTT	4	Qatar
Maran Gas Coronis	145,700	Maran	Daewoo	Sep-07	Greece	S	GTT	4	Rasgas II
Maran Gas Delphi	159,800	Maran	Daewoo	Feb-14	Greece	DFDE	GTT	4	Various
Maran Gas Efessos	159,800	Maran	Daewoo	Jun-14	Greece	DFDE	GTT	4	Various
Maran Gas Hector	174,000	Maran	Hyundai Samho	Nov-16	Greece	DFDE	GTT	4	Various
Maran Gas Lindos	159,800	Maran	Daewoo	Jun-15	Greece	DFDE	GTT	4	Various
Maran Gas Mystras	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GTT	4	Various
Maran Gas Olympias	174,500	Maran	DSME	Feb-17	Greece	DFDE	GTT	4	Various
Maran Gas Pericles	174,000	Maran	Hyundai Samho	June-16	Greece	DFDE	GTT	4	Various
Maran Gas Posidonia	161,870	Maran	Daewoo	May-14	Greece	DFDE	GTT	4	Various
Maran Gas Roxana	173,400	Maran	Daewoo	Jan-17	Greece	DFDE	GTT	4	Various
Maran Gas Sparta	161,870	Maran	Hyundai Samho	April-15	Greece	DFDE	GTT	4	Various
Maran Gas Spetses	174,000	Maran	Daewoo	Feb-18	Greece	DFDE	GTT	4	Various
Maran Gas Troy	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GTT	4	various
Maran Gas Ulysses	174,000	Maran	Hyundai Samho	Jan-17	Greece	DFDE	GTT	4	Various
Maria Energy	174,000	Tsakos	Hyundai	Mar-15	Marshall Is.	TFDE	GTT	4	Various
Marib Spirit	165,000	Teekay LNG	Samsung	May-08	Marshall Is.	DFDE	GTT	4	Various
Marvel Crane	177,000	NYK-Mitsui	Mitsubishi	Mar-19	Singapore	S	Moss	4	US/Various
Marvel Eagle	155,000	MOL-Osaka	Kawasaki	Sept-18	Marshall Is.	S	Moss	4	Cameron LNG/Various
Marvel Falcon	174,000	NYK-Mitsui	Samsung	Dec-18	Singapore	XDF	GTT	4	Cameron LNG/Various
Marvel Hawk	174,000	NYK-Mitsui	Samsung	Dec-18	Singapore	XDF	GTT	4	Cameron LNG/Various
Marvel Kite	174,000	NYK-Mitsui	Samsung	Dec-18	Singapore	XDF	GTT	4	Various
Matthew	126,540	Suez LNG Shipping	Newport News	Jun-79	Bahamas	S	GTT	6	Atlantic LNG
Megara	173,000	Teekay	Daewoo	Oct-18	Bahama	MEGI-DF	GTT	4	Various
Mekaines	266,000	Nakilat	Samsung	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Meridian Spirit	165,500	Teekay LNG	Samsung	Jan-10	Denmark	DFDE	GTT	4	Various
Mesaimeer	210,100	Nakilat	Hyundai	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Methane Alison Victoria	145,000	GasLog	Samsung	Aug-07	Bermuda	S	GTT	4	Eq. Guinea LNG
Methane Becki Anne	170,000	GasLog	Samsung	Sep-10	Bermuda	TFDE	GTT	4	Various
Methane Heather Sally	145,000	GasLog	Samsung	Jul-07	Bermuda	S	GTT	4	Eq. Guinea LNG
Methane Jane Elizabeth	145,000	GasLog	Samsung	Jun-06	Bermuda	TFDE	GTT	4	Engas
Methane Julia Louise	170,000	GasLog	Samsung	Dec-09	Bermuda	TFDE	GTT	4	Various
Methane Kari Elin	138,200	Shell	Samsung	Jun-04	Bermuda	S	GTT	4	Various
Methane Lake Charles	145,000	Shell	Samsung	Feb-07	Bermuda	S	GTT	4	Marathon Oil
Methane Lydon Volney	145,000	Shell	Samsung	Aug-06	Bermuda	S	GTT	4	Engas
Methane Mickie Harper	170,000	Shell-GasLog	Samsung	Nov-10	Bermuda	TFDE	GTT	4	Various
Methane Nile Eagle	145,000	Shell-GasLog	Samsung	Dec-07	Bermuda	S	GTT	4	Engas
Methane Patricia Camila	170,000	Shell-GasLog	Samsung	Oct-10	Bermuda	TFDE	GTT	4	Various
Methane Princess	138,159	Golar LNG	Daewoo	2003	UK	S	GTT	4	Spot BG
Methane Rita Andre	145,000	GasLog	Samsung	Mar-06	Bermuda	S	GTT	4	Engas
Methane Shirley Elizabeth	145,000	GasLog	Samsung	Apr-07	Bermuda	S	GTT	4	Marathon Oil
Methane Sprit	165,000	Teekay LNG	Samsung	Mar-08	Singapore	DFDE	GTT	4	Various
Milaha Qatar	145,000	Milaha	Samsung	Apr-06	Denmark	S	GTT	4	Qatar
Milaha Ras Laffan	138,270	Milaha	Samsung	Mar-04	Denmark	S	GTT	4	RasGas II

CARRIER FLEET



Min Lu	147,000	China Ships	Hudong	Aug-09	China	S	GTT	4	Various
Min Rong	147,000	China LNG Ships	Hudong	Feb-09	Hong Kong	S	GTT	4	Australia-China
Mourad Didouche	126,130	Hyproc Shipping	Atlantique	Jul-80	Algeria	S	GTT	5	Sonatrach
Mozah	266,000	QGTC	Samsung	Aug-08	Qatar	DRL	GTT	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	GTT	4	Qatar-Atlantic Basin
Murex	173,400	Teekay	Daewoo	Oct-17	Bahamas	DFDE	GTT	4	Various
Murwab	210,100	J5 Consortium	Daewoo	May-08	Marshall Is.	DRL	GTT	4	Qatargas
Muscat LNG	149,170	Oman Gas/MOL	Kawasaki Sakaide	Mar-04	Japan	S	Moss	4	Oman Gas
Myrina	173,000	Teekay	Daewoo	Sept-18	Bahamas	MEGI-DF	GTT	4	Various
Neo Energy	149,700	Tsakos	Hyundai	Feb-07	Liberia	S	GTT	4	Various
Neptune	145,000	Hoegh LNG/MOL	Samsung	Dec-09	Liberia	DFDE	GTT	4	Various
Nikolay Yevgenov	172,600	Teekay	Daewoo	Oct-18	Bahamas	MEGI-DF	GTT	4	Various
Nikolay Zubkov	172,600	Dynagas	Daewoo	Nov-18	Cyprus	DFDE	GTT	4	Yamal LNG
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	GTT	4	NWS
Northwest Swift	127,590	J3 Consortium	Mitsubishi Nagasaki	Sep-89	Japan	S	Moss	4	NWS
Noshu Maru	180,000	MOL-Jera	MHI-Nagasaki	Feb-19	Japan	S-gas	Moss	4	US-Japan
Oak Spirit	173,400	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	GTT	4	Cheniere
Ob River	150,000	Lance Shipping	Hyundai	Oct-07	Marshall Is.	S	GTT	4	Various
Oceanic Breeze	155,300	K-Line	Mitsubishi-Nagasaki	June-18	Japan	S	Moss	4	Darwin-Japan
Onaiza	210,100	Nakilat	Daewoo	Apr-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Ougarta	171,866	Hyproc Shipping	Hyundai	Mar-17	Algeria	DFDE	GTT	4	Sonatrach
Pacific Arcadia	147,200	NYK Line	MHI	Oct-14	Bahamas	S	KM	4	Various
Pacific Breeze	182,000	K Line	Kawasaki	Mar-18	Marshall Is.	DFDE	Moss	4	Ichthys LNG
Pacific Enlighten	145,000	LNG MT	Mitsubishi	Mar-09	Japan	S	Moss	4	Various
Pacific Eurus	137,000	LNG Marine Transport	Mitsubishi Nagasaki	Mar-06	Bahamas	S	Moss	4	Darwin
Pacific Mimosa	155,300	NYK Line	MHI	Nov-17	Bahamas	S	Moss	4	Australia-Japan
Pacific Notus	137,006	Pacific LNG Shipping	Mitsubishi Nagasaki	Sep-03	Bahamas	S	Moss	5	Darwin
Palu LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Pan Americas	174,000	Teekay	Hudong	Mar-18	Hong Kong	TFDE	GTT	4	US-Asia
Pan Asia	174,000	Teekay	Hudong-Zhonghua	July-17	Bahamas	TFDE	GTT	4	Cheniere
Pan Europe	174,000	Teekay	Hudong	Sept-18	Hong Kong	TFDE	GTT	4	US-global
Papua	171,800	MOL-China	Hudong	Jan-15	Hong Kong	DFDE	SSD	4	PNG LNG
Patris	173,400	K-Line	Daewoo	Feb-18	Liberia	MEGI-DF	GTT	4	Various
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	GTT	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	GTT	4	Various
Puteri Delima	130,400	MISC	Atlantique	Jan-95	Malaysia	S	GTT	4	Petronas
Puteri Delima Satu	137,100	MISC	Mitsui Chiba	Apr-02	Malaysia	S	GTT	4	Petronas
Puteri Firuz	130,400	MISC	Atlantique	May-97	Malaysia	S	GTT	4	Petronas
Puteri Firuz Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-04	Malaysia	S	GTT	4	Petronas
Puteri Intan	130,400	MISC	Atlantique	Aug-94	Malaysia	S	GTT	4	Petronas
Puteri Intan Satu	137,100	MISC	Mitsubishi Nagasaki	Dec-01	Malaysia	S	GTT	4	Petronas
Puteri Mutiera Satu	137,100	MISC	Mitsui Chiba	Apr-05	Malaysia	S	GTT	4	Petronas
Puteri Nilam	130,400	MISC	Atlantique	Jun-95	Malaysia	S	GTT	4	Petronas
Puteri Nilam Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-03	Malaysia	S	GTT	4	Petronas
Puteri Zamrud	130,400	MISC	Atlantique	May-96	Malaysia	S	GTT	4	Petronas
Puteri Zamrud Satu	137,100	MISC	Mitsui Chiba	Apr-87	Malaysia	S	GTT	4	Atlantic LNG
Raahi	136,000	Petronet LNG Ltd	Daewoo	Dec-04	Malta	S	GTT	4	Qatargas
Ramdane Abane	126,130	Hyproc Shipping	Atlantique	Jul-81	Algeria	S	GTT	5	Sonatrach
Rasheeda	266,000	QGTC	Samsung	Jun-10	Liberia	DRL	GTT		Various
Rias Baixas Knutsen	180,000	Knutsen	Hyundai	Aug-19	Spain	MEGI-DF	GTT	4	Various
Ribera del Duero Knutsen	173,400	Knutsen	Daewoo	Nov-10	Nor-NIS	DFDE	GTT	4	Various
Rioja Knutsen	176,300	Knutsen	Daewoo	Dec-16	Nor-NIS	DFDE	GTT	4	Various
Rudolf Samoylovich	172,652	Teekay-CLNG	Daewoo	Oct-18	Bahamas	MEGI-DF	GTT	4	Various
Salalah LNG	147,000	Oman Gas/MOL	Samsung	Dec-05	Japan	S	GTT	4	Oman
SCF Polar	71,500	Sovcomflot	Kockums	Aug-69	Liberia	S	GTT	6	Sonatrach
Sean Spirit	174,000	Teekay	Hyundai Samho	Feb-19	Bahama	MEGI-DF	GTT	4	Various
Seishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Jan-15	Panama	S	Moss	4	Australia-Japan
Seri Alam	138,000	MISC	Samsung	Oct-05	Malaysia	S	GTT	4	Yemen LNG
Seri Amanah	145,000	MISC	Samsung	Mar-06	Malaysia	S	GTT	4	Yemen LNG
Seri Anggun	145,000	MISC	Samsung	Nov-06	Malaysia	S	GTT	4	Yemen LNG
Seri Angkasa	145,000	MISC	Samsung	Feb-07	Malaysia	S	GTT	4	Petronas
Seri Ayu	145,000	MISC	Samsung	Oct-07	Malaysia	S	GTT	4	Various



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Seri Bakti	152,300	MISC	Mitsubishi	Mar-07	Malaysia	S	GTT	4	Petronas
Seri Balhaf	152,000	MISC	Mitsubishi	Sep-08	Malaysia	S	GTT	4	Various
Seri Balquis	152,000	MISC	Mitsubishi	Dec-08	Malaysia	S	GTT	4	Various
Seri Begawan	152,300	MISC	Mitsubishi	Dec-07	Malaysia	S	GTT	4	Various
Seri Bijaksana	152,300	MISC	Mitsubishi	Feb-08	Malaysia	S	GTT	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	GTT	4	Atlantic LNG
Sevilla Knutsen	173,400	Knutsen	Daewoo	Jun-10	N.I.S.	DFDE	GTT	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	GTT	5	Qatargas IV
Shen Hai	147,100	China LNG	Hudong Zhonghua	Sep-12	China	AB/CC Steam	GTT	4	Various
Simaisma	147,700	Maran Gas Maritime	Daewoo	Jul-06	Greece	S	GTT	4	Qatar
SK Audace	180,000	SK-Marubeni	Samsung	Jul-17	Panama	XDF	GTT	4	Various
SK Resolute	180,000	SK-Marubeni	Samsung	Jun-18	Panama	XDF	GTT	4	Various
SK Splendor	138,375	SK Shipping	Samsung	Mar-00	Panama	S	GTT	4	Oman Gas
SK Stellar	138,375	SK Shipping	Samsung	Dec-00	Panama	S	GTT	4	RasGas
SK Summit	138,000	SK Shipping	Daewoo	Aug-99	Panama	S	GTT	4	RasGas
SK Sunrise	138,306	I. S. Carriers	Samsung	Sep-03	Panama	S	GTT	4	RasGas
SK Supreme	138,200	SK Shipping	Samsung	Jan-00	Panama	S	GTT	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	GTT	4	Various
Sonangol Benguela	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GTT	4	Angola LNG
Sonangol Etosha	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GTT	4	Angola LNG
Sonangol Sambizanga	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GTT	4	Angola LNG
Southern Cross	172,000	MOL	Hudong	May-15	Hong Kong	DRL	GTT	4	Various
Soyo	160,400	Mitsui/NYK/Teekay	Samsung	May-11	Bahamas	DFDE	GTT	4	Various
Spirit of Hela	177,000	MOL	Hyundai	Oct-09	Panama	DFDE	GTT	4	Various
Stena Blue Sky	145,700	Stena	Daewoo	Jan-06	Panama	S	GTT	4	Various
Stena Clear Sky	171,800	Stena	Daewoo	Sep-10	Panama	DFDE	GTT	4	Various
Stena Crystal Sky	171,800	Stena	Daewoo	Jul-10	Panama	DFDE	GTT	4	Various
STX Kolt	145,700	STX Panocean	Korea Hanjin	Nov-08	Panama	DFDE	GTT	4	Various
Suez Point Fortin	154,200	Trinity LNG	Koyo Japan	Nov-09	Panama	S	GTT	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	GTT		Tangguh
Tangguh Foja	155,000	K Line	Samsung	Jul-08	Panama	DFDE	GTT	4	Tangguh LNG
Tangguh Hiri	155,000	Teekay LNG	Hyundai	Nov-08	IOM	DFDE	GTT	4	Tangguh
Tangguh Jaya	145,700	K Line	Samsung	Nov-08	Panama	DFDE	GTT	4	Tangguh
Tangguh Palung	155,000	K Line	Samsung	Mar-09	Panama	DFDE	GTT	4	Tangguh
Tangguh Sago	155,000	Teekay LNG	Hyundai	Mar-09	IOM	DFDE	GTT	4	Tangguh LNG
Tangguh Towuti	145,700	Sovcomflot/NYK	Daewoo	Oct-08	Cyprus	S	GTT	4	Tangguh
Tembek	216,200	OSG/Nakilat	Samsung	Sep-07	Marshall Is.	DRL	GTT	4	Qatargas II
Tenaga Satu	130,000	MISC	Dunkerque	Sep-82	Malaysia	S	GTT	5	Petronas
Tessala	171,866	Hyproc Shipping	Hyundai	Dec-16	Algeria	DFDE	GTT	4	Sonatrach
Torben Spirit	173,000	Teekay	Daewoo	Feb-17	Bahama	MEGI-DF	GTT	4	Various
Trinity Arrow	154,900	K Line	Imabari Shipbuilding	Mar-08	Panama	S	GTT	4	Various
Umm Al Amad	210,100	J5	Daewoo	Aug-08	Marshall Is.	DRL	GTT	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	GTT	4	Qatargas
Umm Slaal	266,000	QGTC	Samsung	Nov-08	Qatar	DRL	GTT	5	Qatargas
Valencia Knutsen	173,400	Knutsen	Daewoo	Sep-10	Nor-NIS	DFDE	GTT	4	Various
Velikiy Novgorod	170,200	SovComFlot	STX	Feb-14	Liberia	DFDE	GTT	4	Various
Vladimir Rusanov	172,000	MOL-China Shipping	Daewoo	Mar-18	Hong Kong	DFDE	GTT	4	Yamal
Vladimir Viz	172,000	MOL-China Shipping	Daewoo	Sept-18	Hong Kong	DFDE	GTT	4	Yamal
Vladimir Voronin	172,600	Teekay	Daewoo	Jun-19	Bahamas	MEGI-DF	GTT	4	Various
Wakaba Maru	125,000	J3 Consortium	Mitsui Chiba	Apr-85	Japan	S	Moss	5	Pertamina
WilForce	156,000	Teekay LNG	Daewoo	Aug-13	NIS	DFDE	GTT	4	Various
WilPride	156,000	Teekay	Daewoo	June-13	NIS	DFDE	GTT	4	Various
Woodside Cheney	174,000	Maran	Hyundai Samho	Mar-16	Greece	DFDE	GTT	4	Various
Woodside Donaldson	165,500	Teekay LNG	Samsung	Dec-09	Singapore	DFDE	GTT	4	Various
Woodside Goode	159,800	Maran	Daewoo	Jul-14	Greece	DFDE	GTT	4	Various
Woodside Reeswithers	173,400	Maran	Daewoo	Nov-16	Greece	DFDE	GTT	4	Various
Woodside Rogers	155,900	Maran Gas	DSME	Jul-13	Greece	DFDE	GTT	4	Various
Yamal Spirit	174,000	Teekay	Hyundai Samho	Jan-19	Bahama	MEGI-DF	GTT	4	Various
Yari LNG	159,983	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Yenisei River	155,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	GTT	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	GTT	5	Qatar-Atlantic
Zekreet	135,420	J4 Consortium	Mitsui Chiba	Dec-98	Japan	S	Moss	5	Qatargas

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LNG Import Terminals

Explanatory Notes

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

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

Country	Location (Project)	Owners	Start up	Tanks	Storage Capacity
Belgium	Zeebrugge	Fluxys	1987	4	380,000
Canada	Canaport Saint John	Irving Oil, Repsol	2009	3	480,000
Chile	Quintero	ENAP, Metrogas, Enagas	2009	3	334,000
	Mejillones	Engie, Ameris Capital AGF	2010	1	175,000
China	Beihai LNG, Guangxi	Sinopec	2015	4	640,000
	Dalian	PetroChina	2011	3	480,000
	Dapeng ND Guangdong	CNOOC	2018	4	640,000
	Dongguan, Guangdong	Jovo Group	2013	2	160 000
	Fujian LNG (Xiuyu)	CNOOC, Fujian I&D Corp.	2008	2	640,000
	Guangdong	CNOOC,BP	2006	3	480,000
	Haikou, Hainan LNG	CNOOC	2014	3	480,000
	Ningbo, Zhejiang	CNOOC, Zhejiang Energy	2012	3	480,000
	Qidong, Jiangsu	Guanghui Energy	2018	1	60,000
	Qingdao, Shandong	Sinopec	2014	3	480,000
	Rudong	PetroChina	2011	3	530,000
	Shanghai	CNOOC, Shenergy Group	2009	3	495,000
	Shanghai, Mengtougou	Shanghai Gas	2008	3	120 000
	Shenzen, Diefu	CNOOC	2016	2	320,000
	Tangshan, Hebei	PetroChina	2013	3	480,000
	Tianjin North	Sinopec	2017	2	320,000
	Yuedong, Guangdong	CNOOC	2016	2	320,000
	Zhoushan Zhejiang	Enn Group	2018	2	320,000
	Zhuhai, Gaolan	CNOOC	2013	3	480,000
Dominican Republic	Punta Caucedo	AES Andres	2003	1	160 000
Finland	Pori	Gasum Skangas	2016	1	30,000
	Tornio	Gasum Skangas	2018	1	30,000
France	Fos Tonkin	Elengy	1972	3	150,000
	Montoir-de-Bretagne	Elengy	1980	3	360,000
	Fos Cavaou	Engie, Total	2010	3	330,000
	Dunkirk LNG	EDF, Fluxys, Total	2016	3	570,000
Gibraltar	Gasnor	Shell	2018	1	5,000
Greece	Revithoussa	DEPA	2000	3	225,000
India	Dabhol	GAIL, NTPC (Ratnagiri Gas & Power)	2009	3	480,000
	Dahej	Petronet LNG	2004	4	592,000
	Hazira	Shell India, Total	2005	2	320,000
	Kochi, Kerala	Petronet LNG	2013	2	320,000
	Mundra	Gujarat State Petroleum, Adani Group	2018	2	320,000
	Kamarajar (Ennore), Tamil Nadu	Indian Oil, DFC, ICICI Bank	2019	2	360,000
Indonesia	Arun	Pertamina	2015	5	507,000
Italy	Panigaglia	Snam	1969	2	100,000
	Porto Levante (offshore GBS)	ExxonMobil, Qatar Petroleum, Edison Gas	2009	2	250,000
Japan	Negishi	Tokyo Gas	1969	14	1,180,000
	Sodegaura	Tokyo Gas	1973	35	2,660,000
	Ohgishima	Tokyo Gas	1998	4	850,000
	Higashi-Ohgishima	Tokyo Electric	1984	9	540,000
	Futtsu	Tokyo Electric	1985	10	1,110,000
	Yokkaichi LNG	Chubu Electric	1988	4	320,000
	Kawagoe	Chubu Electric	1997	6	840,000
	Yokkaichi Works	Toho Gas	1991	2	160,000
	Chita LNG Joint	Toho Gas, Chubu Electric	1978	4	300,000
	Chita LNG	Toho Gas, Chubu Electric	1983	7	640,000
	Chita - Midorihama	Toho Gas	2001	3	600,000
	Senboku I	Osaka Gas	1972	4	180,000
	Senboku II	Osaka Gas	1977	18	1,585,000
	Himeji	Osaka Gas	1984	8	740,000
	Himeji LNG	Kansai Electric	1979	7	520,000
	Yanai	Chugoku Electric	1990	6	480,000
	Niigata	Nihonkai LNG, Tohoku Electric	1984	8	720,000
	Oita	Oita Gas, Kyushu Electric	1990	5	460,000
	Tobata	Kitakyushu LNG	1977	8	480,000
	Fukuoka	Saibu Gas	1993	2	70,000
	Sodeshi	Shizuoka Gas	1996	3	337,200
	Hatsukaichi	Hiroshima Gas	1996	2	170,000
	Kagoshima	Nippon Gas	1996	2	136,000
	Shin-Minato	Sendai City Gas	1997	1	80,000
	Nagasaki	Saibu Gas	2003	1	36,000
	Sakai	Kansai Electric, Cosmo Oil	2006	3	420,000

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage	
				Tanks	Capacity
Japan (continued)	Mizushima	Nippon Oil, Chugoku Electric	2006	2	320,000
	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
	Ishikari LNG	Hokkaido Gas, Hokkaido Electric	2012	2	380,000
	Okinawa	Okinawa Electric Power	2012	2	280,000
	Naoetsu	Inpex	2013	2	360,000
	Joetsu	Chubu	2011	3	540,000
	Hachinohe LNG	Nippon Oil	2015	2	280,000
	Hitachi LNG	Tokyo Gas	2015	1	230,000
	Soma Fukushima	Japan Petroleum Exploration	2017	1	225,000
Korea	Boryeong	GS Energy, SK E&S	2017	3	200,000
	Incheon	Kogas	1996	20	2,880,000
	Kwangyang	POSCO	2005	4	530,000
	Pyeong-Taek	Kogas	1986	23	3,360,000
	Samcheok	Kogas	2014	3	600,000
	Tong-Yeong	Kogas	2002	17	2,620,000
Malaysia	Pengerang Johor	Petronas Gas	2017	2	400,000
Mexico	Altamira	Vopak, Enagas	2006	2	300,000
	Energia Costa Azul	Sempra LNG	2008	2	320,000
	Manzanillo	Samsung, Kogas, Mitsui	2012	2	300,000
Netherlands	Gate LNG	Gasunie, Royal Vopak	2011	3	540,000
Panama	Costa Norte	AES	2018	1	130,000
Phillipines	Pagbilao LNG	Energy World Corp.	2017	1	130,000
Poland	Swinoujscie	Baltic Gaz System	2015	2	320,000
Portugal	Sines	REN Atlantico	2004	3	390,000
Puerto Rico	Penuelas	EcoElectrica	2000	1	160,000
Singapore	Singapore	Singapore Energy Authority	2013	3	540,000
Spain	Barcelona	Enagas	1969	8	840,000
	Huelva	Enagas	1988	5	610,000
	Cartagena	Enagas	1989	5	587,000
	Bilbao	Enagas, EVE	2003	3	450,000
	Sagunto	GNF, Osaka Gas, Oman Oil	2006	4	600,000
	Mugardos, El Ferrol	Reganosa, Sonatrach, Sojitz Corp.	2006	2	300,000
	El Musel, Gijón,	Enagas	2013	2	300,000
Taiwan	Yung-An	CPC	1990	6	690,000
	Tai-Chung	CPC	2009	5	800,000
Thailand	Map Ta Phut	PTT LNG	2011	2	320,000
Turkey	Marmara Ereglisi	Botas	1994	3	255,000
	Izmir	EgeGaz	2006	2	280,000
USA	Everett	Suez LNG NA	1971	2	155,000
	Lake Charles	Shell, ETE	1982	4	425,000
	Freeport	Freeport LNG Development	2008	2	320,000
	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	Capacity
China	Shenzhen	CNPC Yudean Power	2021	2	120,000
	Yangjiang	CNPC Yudean Power	2023	2	120,000
	Zhangzhou Fujian	CNOOC	2022	2	160,000
India	Dhamra Odisha	Indian Oil, Adani, GAIL	2020	2	320,000
	Jaigarh	Hiranandani Group	2019	2	320,000
	Kodinar	Hindustan Petroleum Corp.	2022	1	160,000

LNG FSRU Import Facilities

Country	Location (Project)	Owners	Start up
Argentina	Bahia Blanca GasPort	Excelerate/YPF Repsol	2008
	Escobar GasPort	Excelerate/Enarsa	2011
Bangladesh	Moheshkhali	Excelerate, PetroBangla	2018
	Cox's Bazar	Summit Power International, Excelerate Energy	2019
Brazil	Pecem, FSRU	Petrobras	2009
	Guanabara Bay FSRU	Petrobras	2009
	Salvador, Bahia FSRU	Petrobras	2013
China	Tianjin FSRU	CNOOC, Hoegh, various	2013
Colombia	Cartagena FSRU	Promigas, Sociedad Portuaria El Cayao	2016
Egypt	Ain Sokhna, Suez	EGAS, Hoegh	2015
	Ain Sokhna, Suez	EGAS, BW Gas	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertamina	2012
Italy	Livorno	OLT Offshore LNG Toscana	2013
Jordan	Aqaba, Jordan	Golar LNG	2015
Kuwait	Mina Al-Ahmadi	KPC	2009
Lithuania	Klaipeda	Klaipedos Nafta Hoegh LNG	2014
Malaysia	Malacca FSRU	Petronas	2012
Malta	FSU Armada Mediterranea	ElectroGas	2016
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
	Port Qasim	BW-Mitsui, PGP Consortium	2017
Turkey	Aliaga FSRU, Turquoise FLNG	Etki LNG	2016
	Dortyol FSRU Challenger	Botas	2018
UAE	Ruwais, Abu Dhabi	Gasco (UAE)	2016
	Jebel Ali Port, Dubai	DSA (UAE)	2010
UK	Teesside GasPort	Excelerate	2007

LNG Export Projects

Country	Location/Project	Project Developers	Planned Start Up	Number of Trains	Capacity In MTPA
AUSTRALIA	Pluto LNG expansion	Woodside	2021+	2	10.0
CANADA	Bear Head LNG, Nova Scotia	LNG Ltd.	2024	4	8.0
	Goldboro LNG, Nova Scotia	Pieridae Energy	2024	2	10.0
	Kitimat LNG, BC	Woodside, Chevron	2024	2	10.0
	LNG Canada, BC	Shell, Mitsubishi, Kogas, PetroChina, Petronas	2024	2	12.0
	Kwispaa FLNG, Vancouver	Steelhead LNG	2024	4	12.0
	Vancouver Tilbury	WesPac Midstream	2021	1	3.25
	Woodfibre LNG, Squamish	Pacific Oil & Gas Co	2020	2	2.1
EQ.GUINEA	Equatorial Guinea Fortuna FLNG	Ophir, Golar LNG, GEPetrol	2020+	1	2.0
INDONESIA	Sengkang LNG	Energy World Corp.	2019	4	2.0
MALAYSIA	Rotan FLNG (Sabah)	Petronas, Murphy Oil	2021	1	1.5
MOZAMBIQUE	Area 1 Onshore	Anadarko Petroleum and partners	2023+	2	10.0
	Area 4 Onshore	Eni and partners	2023+	2	10.0
	Area 4 FLNG	Eni and partners	2022	1	3.4
NIGERIA	NLNG Train 7	NNPC, Shell, Eni, Total	2022+	1	7.0
PAPUA NEW GUINEA	Elk-Antelope LNG	Total, ExxonMobil Oil Search, Petromin	Studies		
RUSSIA	Sakhalin II expansion	Gazprom, Shell, Mitsui, Mitsubishi	2021	studies	
	Vladisvostok LNG	Gazprom, Itochu, various	2023+	2	10.0
	Arctic LNG II Siberia	Novatek, Total	2023	3	19.8
USA	Alaska LNG Nikiski	Alaska Gasline Development Corp.	2023+	3	20.0
	Annova LNG, Brownsville	Exelon Corp.	2023+	6	6.0
	Commonwealth LNG, Louisiana	Commonwealth LNG LLP	2023+	8	9.0
	Corpus Christi Liquefaction, Texas	Cheniere	2019	2	9.0
	Delfin LNG, Louisiana	Delfin	2023+	3	9.0
	Driftwood LNG, Louisiana	Tellurian, Total and others	2023	6	27.6
	Freeport LNG, Texas	Freeport LNG	2019	3	15.3
	Galveston Bay LNG	NextDecade	2023+	6	27.0
	Golden Pass, Texas	Qatar Petroleum, ExxonMobil	2021	3	15.6
	Jordan Cove, Coos Bay	Pembina Corp.	2024	2	7.8
	Lake Charles, Louisiana	Shell, ETE	2024	3	15.0
	Magnolia LNG	Louisiana LNG Ltd.	2023+	4	8.0
	Port Arthur LNG	Sempra	2023+	2	10.0
	Rio Grande LNG	NextDecade	2023+	6	27.0
	Sabine Pass LNG, Louisiana	Cheniere	2016-19	1	4.5
	Texas LNG Brownsville	Chandra, Meyer, Samsung, others	2023+	2	4.0
	VG LNG (Cameron Parish)	Venture Global	2022	5	10.0
	VG LNG (Plaquemines)	Venture Global	2022	10	20.0
	VG LNG (Delta-Plaquemines)	Venture Global	2024		24.0

LNG Exporters

Country	Location/Project	Shareholders	Start up	Liquefaction		Storage	
				Trains	capacity (nominal) mtpa	No. of tanks	Total capacity m³
ABU DHABI (UAE)	Das Island (Adgas)	ADNOC, Mitsui, BP, Total	1977 1994	2 1	3.2 2.5	3	240,000
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
ARGENTINA	FLNG Tango	Bahia Blanca	2019	1	0.5	1	16,100
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 (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
		Gladstone LNG Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
		Gorgon LNG Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
		Pluto LNG Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
		QCLNG Shell, CNOOC	2014	2	8.0	2	280,000
		Wheatstone LNG Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
		Ichthys LNG Inpex Corp., Total	2018	2	8.9	2	330,000
		Prelude FLNG Shell, Inpex, Kogas CPC	2019	1	3.5		
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
CAMEROON	Hilli Episeyo FLNG	Kribi Perenco	2018	1	1.2	1	125,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Total, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya	Equinor, Total, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG	2000	2	7.1	2	240,000
		Mitsubishi, Mitsui, Partex and Itochu					
PAPUA NEW GUINEA	PNG LNG	Oman Govt., Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
		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-T1	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5	4	640,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	5	22.5	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
	Cheniere Corpus Christi	Texas Cheniere	2018	2	9.0	3	480,000
	Cameron Hackberry	Sempra, Total, Mitsui, Mitsubishi	2019	1	4.9	3	480,000
	Elba Island Georgia	Kinder Morgan, EIG Energy	2019	10	2.5	5	535,000
	Freeport LNG, Texas	Freeport LNG	2019	1	5.1	3	483,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000

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