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May 2021

In this issue:

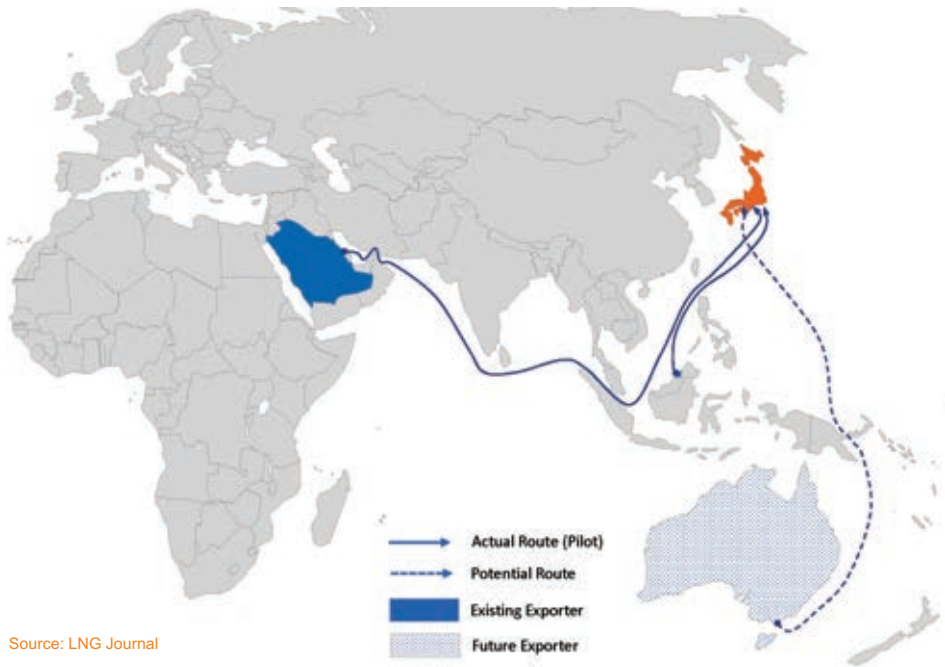
Test hydrogen shipments come out of Australia and Brunei

Investors flock to South Australia which is turning into a prime producer of green hydrogen (NH3) and ammonia – rival fuels to LNG for ships, trucks and power stations. However, the only NH3 exporters to date are Saudi Arabia and Brunei, from where test shipments to Japan took place throughout 2020. Regular trade is due to start in August this year, once the first dedicated hydrogen carrier – the Suiso Frontier – entered into service; our Markets Editor Anja Karl writes.

In Brunei Darussalam, a small sultanate on the northwest coast of Borneo Island, green hydrogen can be produced for cheap, largely based on solar energy. Here, the Japanese engineering firm Chiyoda, together with Mitsubishi and Mitsui and the shipping company NYK Line, completed world's first global hydrogen supply chain.

The first NH3 shipment from Sungai Liang Industrial Park (SPARK) set sail to Japan in late December 2019, shipped from Muara Port, Brunei, to the Japanese city of Kawasaki. The cargo arrived in early January 2020, ushering in a period of at least two regular NH3 shipments each month. The green fuel was shipped in a cylinder tank inside frame matching common ISO containers. For ship tracking purposes, that means even if the container ships were known, the number of cylinder tanks onboard would still be unclear without the bill of lading.

Actual & Potential Routes of Hydrogen Shipments to Japan in 2020-21



Source: LNG Journal

Hydrogen from Brunei shipped in ISO containers

NH3 export from Brunei's SPARK hydrogen plant were initially contracted to run for one year, supplying some 200 metric tons of hydrogen to Japan. Under the deal, five ISO tank containers made the 5,000 km journey from Muara Port to Kawasaki every two weeks, with each container carrying 20 kilolitres of methylcyclohexane (MCH), a liquid state of hydrogen.

Hydrogen, in the form of MCH, can be stored and transported in a chemically stable and safe liquid state. Prior to shipment, the hydrogen is combined with toluene at the hydrogen supply site in Brunei. The carriers are then shipped to a dehydrogenation plant in Kawasaki, where the MCH is being re-converted into green hydrogen for use as fuel co-fire gas turbines at various hybrid gas-fired power stations in Japan, some owned by Toa Oil Company.

Eager to turn Japan into a 'hydrogen economy', the government in Tokyo instated policies that could boost the country's annual hydrogen demand from currently 2 million tons to 3 million tons by 2030, and potentially to 20 million tons by 2050. Reacting to this, Kawasaki announced it will build two dedicated commercial-scale hydrogen carries with a view to importing 225,000 tonnes by 2030.

Suiso Frontier – the first dedicated hydrogen carrier

The first hydrogen vessel, the *Suiso Frontier*, has however not yet completed construction and sea trials. Ship tracking data shows, the vessel has not moved away from its position at Kawasaki's Kobe yard since January this year.

Today, all ships capable to carry hydrogen are conventional chemical carriers that might equally be shipping ammonia or ethylene. But going forward, Kawasaki vowed to expand its fleet to 80 hydrogen carriers by 2050, stating it wants to increase hydrogen-related sales by 120 billion yen ($1.16 billion) over the decade.

Liquefying hydrogen more costly than LNG

However, to liquefy hydrogen, it needs freezing to minus 253 Celsius – significantly lower than LNG's minus 162 Celsius – which adds to the cost of commercialising hydrogen. To develop a

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hydrogen supply chain, Kawasaki urgently needs to bring down costs. The aim is to reduce hydrogen supply cost from currently 100 Japanese yen ($0.96) per cubic meter to ¥29.7 by 2030, and down to just ¥18 yen per cubic meter by 2050.

"We need demand from the power sector to bring down cost by scaling up," Motohiko Nishimura, Kawasaki's vice executive officer, adding the company is in talks with multiple companies and cities to find buyers. Ultimately, Nishimura wants the Japanese government to incentivise the use of a cleaner fuel and create a system to clarify who would bear the extra cost.

Australian oil majors turn to hydrogen

Savvy players Australian majors like Santos, Woodside and Origin Energy have invested in large-scale renewable hydrogen projects in South Australia, targeting export markets like Japan, China, South Korea and Germany. Santos, operator of the Gladstone LNG export plant (7.8 mtp) on Curtis Island in Queensland and Darwin LNG (10 mtpa) in the Northern Territory, sees growing demand for green fuels in North Asia – a market were the Australian major already has a strong standing.

"Our existing LNG customer base in Asia will be the hydrogen customers of the future, and as technology evolves and they transition to new clean fuels, we will transition with them," said Santos CEO Kevin Gallagher.

As a first step, Santos wants to decarbonise the natural gas at its operations in the Cooper Basin by turning it into so-called 'blue hydrogen' through the process of steam methane reforming. Natural gas is hereby mixed with very hot steam, in presence of a catalyst – mostly nickel or platinum metals. This process creates hydrogen and carbon monoxide, which is subsequently captured. "Carbon capture and storage (CCS) is the fastest and most efficient route to a hydrogen economy," Gallagher said, with a reference to the economic advantages of blue hydrogen.

The Japanese manufacturer Kawasaki is also working to replicate its Australian LNG supply chain with hydrogen. Under an A$500 million pilot project, it aims to ship the first cargo of liquid hydrogen this spring. By summer 2021, over 75 tonnes of hydrogen are meant to be shipped to Japan, extracted from brown coal in the Australian state of Victoria.

In the desert of Saudi Arabia, state-dominated oil giant Saudi Amaco is also venturing into green hydrogen production. It built and commissioned a green hydrogen plant with a design capacity of 650 tonnes per day, powered by 4 gigawatts (GW) of renewable electricity. The first Saudi cargo of 30,711 cubic meters was shipped to Japan on September 20, 2020, onboard the chemical tanker 'Florentine' followed by a second, similar-sized shipment in October.

Santos strives to produce 'blue' hydrogen at scale

Producing hydrogen from natural gas along with carbon capture, utilisation and storage (CCUS) can cost around 22 percent less when using a process just launched by Shell Catalysts & Technologies. With CO2 costing $25–35 per tonne, 'blue hydrogen' becomes competitive with 'grey,' unabated hydrogen, even with the higher capital costs for capturing carbon.

A concept study is underway, building on the 1.7 million ton Copper Basin CCS project for which Santos was targeting a final investment decision (FID) in late 2020. "The Cooper Basin hydrogen concept study builds on our progress towards the 1.7 million tonne Cooper Basin CCS project," Gallagher said, underlining the company's aim to produce blue hydrogen at scale.

"With the Cooper Basin's reinjection capacity assessed at up to 20 million tonnes of carbon dioxide per year for 50 years, it has the potential to de-carbonise

Hydrogen Shipments in 2020-21

Vessel	Month	Capacity (m3)	Trade
General cargo via ISO container	Dec-20	25	Brunei - Japan
General cargo via ISO container	Dec-20	25	Brunei - Japan
General cargo via ISO container	Nov-20	25	Brunei - Japan
General cargo via ISO container	Nov-20	25	Brunei - Japan
Unidentified chemical tanker	Nov-20	≈30,000	Saudi Arabia - Japan
General cargo via ISO container	Oct-20	25	Brunei - Japan
General cargo via ISO container	Oct-20	25	Brunei - Japan
Unidentified chemical tanker	Oct-20	≈30,000	Saudi Arabia - Japan
Florentine	Sep-20	30,711	Saudi Arabia - Japan
General cargo via ISO container	Sep-20	25	Brunei - Japan
General cargo via ISO container	Sep-20	25	Brunei - Japan
General cargo via ISO container	Aug-20	25	Brunei - Japan
General cargo via ISO container	Aug-20	25	Brunei - Japan
General cargo via ISO container	Jul-20	25	Brunei - Japan
General cargo via ISO container	Jul-20	25	Brunei - Japan
General cargo via ISO container	Jun-20	25	Brunei - Japan
General cargo via ISO container	Jun-20	25	Brunei - Japan
General cargo via ISO container	May-20	25	Brunei - Japan
General cargo via ISO container	May-20	25	Brunei - Japan
General cargo via ISO container	Apr-20	25	Brunei - Japan
General cargo via ISO container	Apr-20	25	Brunei - Japan
General cargo via ISO container	Mar-20	25	Brunei - Japan
General cargo via ISO container	Mar-20	25	Brunei - Japan
General cargo via ISO container	Feb-20	25	Brunei - Japan
General cargo via ISO container	Feb-20	25	Brunei - Japan
General cargo via ISO container	Jan-20	25	Brunei - Japan
General cargo via ISO container	Jan-20	25	Brunei - Japan

Note - ISO container assumptions:

1. Total shipped volume in 2020 according to Mitsubishi: 210 tonnes
2. ISO container capacity (liquid) ≈ 25m3
3. 1m3 (liquid) ≈ 0.353 tonnes
4. 210 tonnes ≈ 595m3 ≈ 24 containers in 2020 or c. 2 containers per month if total number spread evenly across the year
5. No apparent shipments via ISO container or chemical tanker since expiration of announced trial period in 2020

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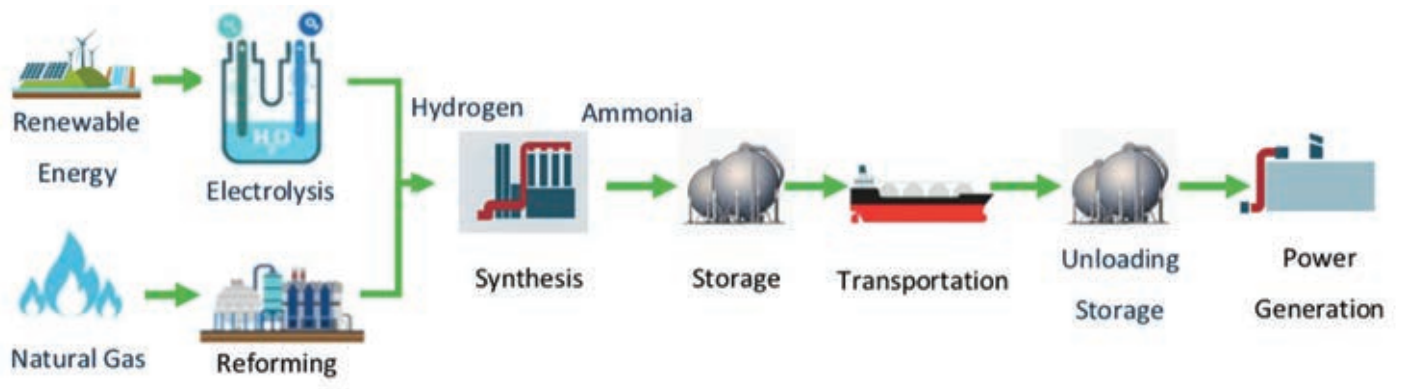
energy at its source," he explained. However, the project's original timeline has lapsed during the Covid crisis and FID was pushed back to mid-2021.

Mitsubishi Heavy Industries (MHI), another large Japanese engineering conglomerate, is also invested in hydrogen Down Under through a participation in the Australian H2U Group. The deal sees MHI carry out the front-end engineering and design (FEED) study for H2U's Eyre Peninsula Gateway project in South Australia.

The proposed 75 MW green electrolyser plant in Whyalla, set to be Australia's largest unit of this kind built to date, will supply hydrogen to produce an estimated 40,000 tonnes of ammonia annually – most of which destined for export. The project is backed by $250 million in government finance.

"Our intention of net-100 percent renewable energy generation by 2030 will produce some of the most cost-effective green hydrogen in the world," the South Australian energy minister Dan van Holst Pellekaan said, pointing auf the region's rich endowment of wind and solar resources.



Hydrogen could soon outcompete LNG in Asia

Costs of producing green hydrogen in Australia are expected to decline from currently A$7.4 per kilo down to just under A$2.29 in 2025. Cheaper solar PV and wind power technologies, as well as falling costs of electrolysers, means that the goal of producing hydrogen below A$2 per kilo could come into reach, "possibly rapidly", reckon researchers from the Crawford School of Energy Policy at the Australian National University.

Renewable hydrogen from Down Under hence has the potential to become cost competitive with LNG. According to Bloomberg New Energy Finance's Hydrogen Economy Outlook, solar-based hydrogen in Australia can be stored and transported to a power plant at a cost between $8-14/MMBtu by 2050. At the lower end of this range, hydrogen would become competitive with LNG prices in Asia, where CME quotes Platt's Japan/Korea futures for June 2021 delivery at $8.55 per MMBtu and for July delivery at $8.515 per MMBtu.

Provided the right policies are put in place to help scale up the technology, green hydrogen could help mitigate 34 percent of global greenhouse gas emissions from fossil fuels and industry – at a manageable cost. According to BNEF findings, renewable hydrogen could be produced for $0.8 to $1.6 per kilo in most parts of the world before 2050. This is equivalent to gas priced at $6-12 per MMBtu, making it competitive with current natural gas prices in Brazil, China, India, Germany and Scandinavia on an energy-equivalent basis.

By factoring in cost of storage and pipeline infrastructure, the delivered cost of renewable hydrogen in China, India and Western Europe could fall to around $2 per kilo ($15 per MMBtu) in 2030 and $1 per kilo ($7.4 per MMBtu) in 2050.

Ammonia favoured due to 'shorter 'time-to-market'

Ammonia is yet another exiting new green fuel. Some see it as the frontrunner for green hydrogen produced in Australia, given that it can be used more easily as a fuel for ships and power plant fuel, while the global hydrogen market is still evolving. .

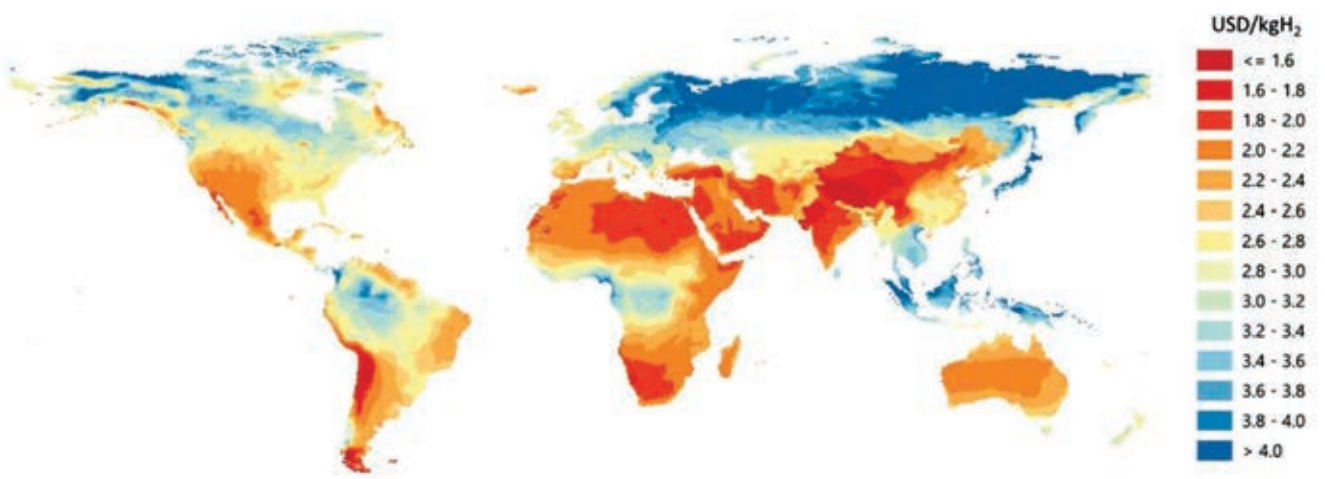
Origin Energy, the utility shareholder in Australia-Pacific LNG in Queensland, is striving to build export-scale green ammonia plants in Tasmania's Bell Bay. A $3.2 million feasibility study is underway into building a 500 MW plant that would produce more than 420,000 tonnes of zero emissions ammonia per year.

Fortescue Metals' separate ammonia venture is also meant to be built at Bell Bay, about 40 kilometres northwest of Launceston.

After breakthroughs in curbing energy related emissions, industrial decarbonisation is the next frontier. At electricity prices below $35 per MWh hydrogen use for greenfield ammonia and steel production sites is more cost-competitive than applying CCS to the emissions from fuel consumption, McKinsey finds.

The most polluting industrial processes are the manufacturing of cement (3 Gton CO2), and steel (2.9 Gton CO2), and in these sectors emissions cannot simply be reduced a change in fuels (e.g. coal-to-gas switch), but only by changes to processes. Analysts suggest a combination of demand-side measures, using hydrogen and ammonia as industrial feedstock or power generation fuel, and carbon capture and storage (CCS).

Hydrogen costs from hybrid solar PV and onshore wind systems in the long term



Ammonia co-fired turbines tested at JERA power plants

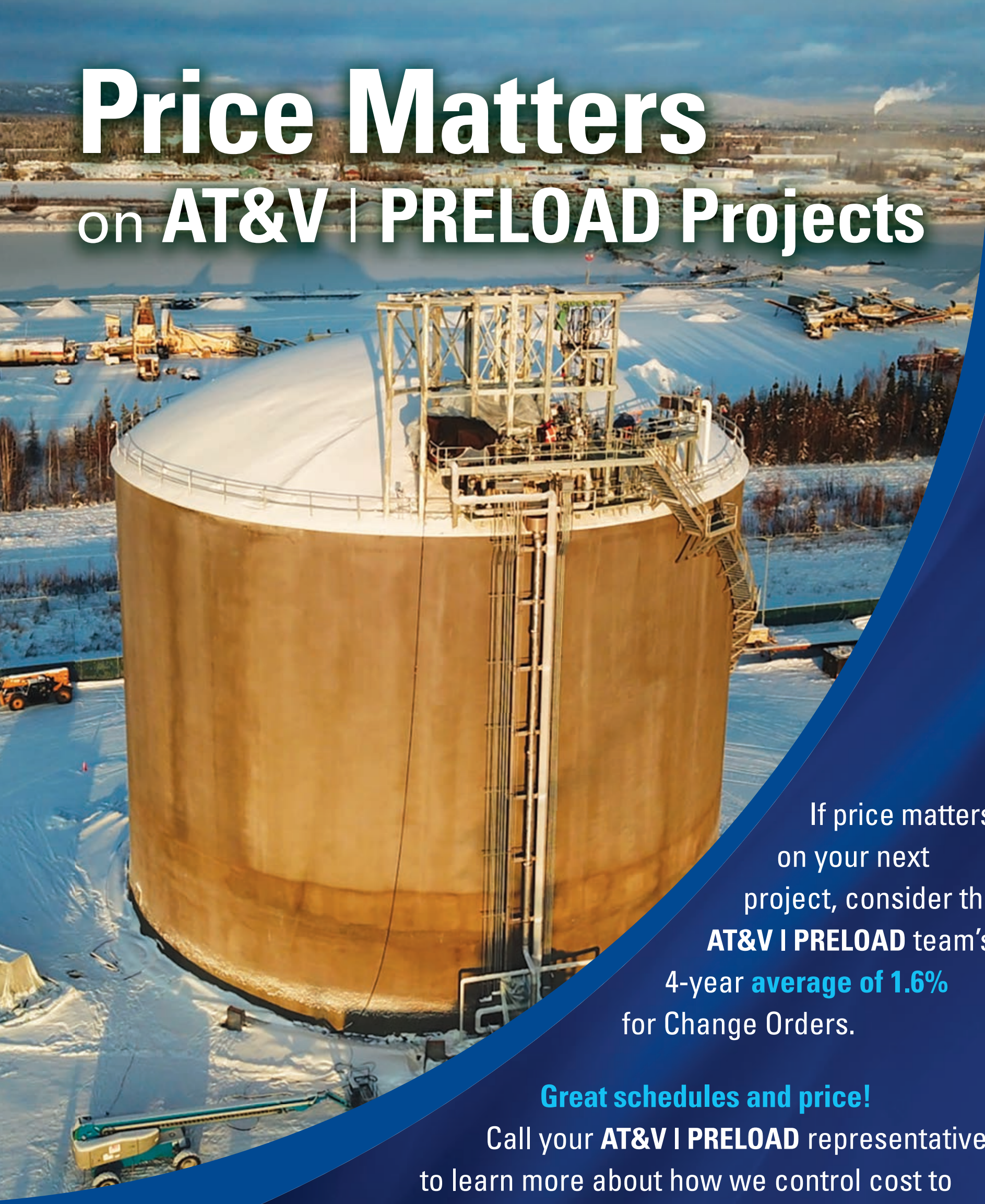
The Japanese turbine manufacturer Marubeni has started trial runs on ammonia co-firing, making use of stored hydrogen at low cost. The Marubeni-led technical study – running through to the end for February 2021 – entails a series of trials for direct usage of ammonia as a fuel in JERA's thermal power plants.

In the context of the feasibility study and during technical trials, researchers from Marubeni and IHI Corp will be also scrutinizing the economics of equipment cost, operational expenses as well as the cost for producing and transporting ammonia to the power stations.

Marubeni and IHI Corp's efforts on ammonia co-firing are in line with Japanese government's aspirations to implement hydrogen-based energy projects. Dubbed NEDO, the research project seeks to develop multi-burner ammonia co-firing technology for pulverized coal boilers, which can later be amended for use in gas-fired power units.

JERA is looking to find out the necessary capital investment to retrofit its existing plants with the novel ammonia co-firing technology, once it is ready for commercialization. To this end, it is allowing researchers to carry out tests and trial runs at some of its thermal power plants. Woodside Energy is also participating in the study, striving to identify challenges related to realizing large-scale ammonia production lines.

Most turbine manufacturers – notably GE, Siemens, Ansaldo and MHI – are looking to modify burners and combustion systems to achieve hydrogen or ammonia co-firing. Working with Siemens, Energias de Portugal (EDP) will demonstrate the concept of hydrogen co-firing at its 1.2 GW Ribatjo power plant near Lisbon. The three combined-cycle units (3 x 392 MW), powered by Siemens V94.3A gas turbines in single shaft configuration, have a combined capacity of 1.176 MW. Installation and commissioning of the developed technologies at Ribatejo plant will start in September 2021. ■



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Mozambican LNG prospects

Over the past decade, Mozambique has chipped away at the development of its fledgling LNG sector. Now, with success and a GDP boost on the horizon, a growing insurgency is putting all at risk. Markets Editor Alexander Wilk elaborates.

Mozambique's substantial and well-documented gas reserves underpin some of the few remaining greenfield LNG developments with real prospects of completion. Crucially, they are located at the edge of the Pacific Basin, with direct access to the LNG growth markets of India, the Middle East, China and Japan. Unsurprisingly, these prospects have previously continued to whet the appetite of investors, even as the Mozambican government initially struggled to strike a balance between national development and investor reward and armed conflict has flared up several times since late-2017. However, as the prospects of LNG developments have taken concrete shape through final investment decisions (FIDs) and actual construction under way, the country is at risk of being swallowed up by intensifying armed insurgencies and counterinsurgencies. This has put past progress in the country's fledging LNG sector at risk, including a desperately needed boost to national GDP. Whilst ExxonMobil had already chosen to delay FID for its Rovuma LNG development following a COVID-19 induced oil price crash, Total declared force majeure on its Mozambique LNG project on 26 April. This left only Eni's Coral Sul FLNG venture standing at the time of writing, being more insulated from violence far offshore.

Mozambique LNG

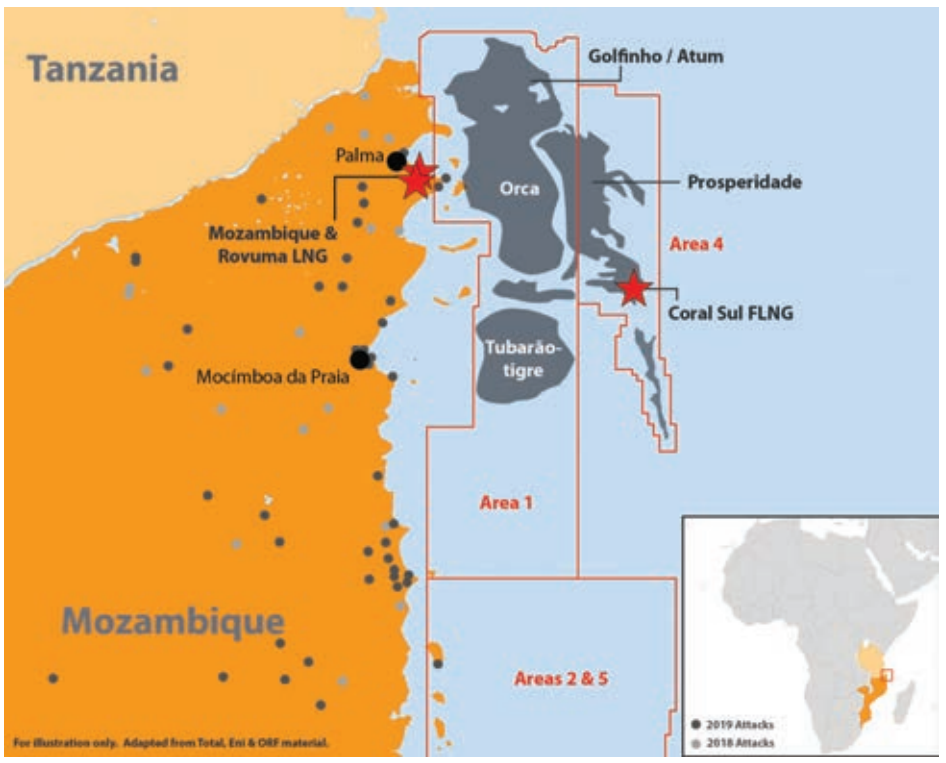
It is hard to overstate the importance of LNG to Mozambique's need for significant revenues to jumpstart its economy. In 2016, the country was embroiled in a debt scandal that prompted the International Monetary Fund and foreign donors to cut off support, triggering a currency collapse and a default on the country's sovereign debt. In 2019, Mozambique was forced to ask for a second debt restructuring of US$727 million in three years. Alongside Total's Mozambique LNG development, Italian multinational Eni's Coral Sul FLNG project is scheduled for first gas in 2023/24 whilst the ExxonMobil-led Rovuma LNG was originally looking to start shipments in 2024. According to a Fitch report, 'the combined capacity of the three projects is roughly equivalent to twice the size of Mozambique's 2020 GDP'.

It is therefore understandable that the African Energy Chamber deplored Total's decision to declare *force majeure* on the project and delay it indefinitely. It highlighted that Total continued to operate in countries that outranked Mozambique on the 2020 Global Terrorism Index risk scale, such as Nigeria, Iraq and Libya. Total, however, likely assessed the imminent security risk to its staff on site as more severe and asserted the situation was 'out of […] control'. In a statement, Total called upon the Mozambican authorities to restore order and stability whilst Carlos Zacarias, chairman of Mozambique's National Petroleum Institute, highlighted Total had not abandoned the project.

Notably, it is not just the Mozambican government that will feel the impact of Total's decision. Italian contractor Saipem – leading partner in the CCS joint-venture tasked with the project's engineering, procurement and construction – also has a sizeable stake in the project. Saipem teamed with McDermott and Chiyoda Corporation to win the US$8 billion contract in 2019, with Saipem's share constituting an estimated US$6 billion.

The Mozambique LNG project has been in the pipeline since 2010 and was set to become the country's first onshore development. At the time, US exploration and production (E&P) specialist Anadarko booked sizeable reserves in Offshore Area 1, with the Golfinho/Atum gas fields underpinning Mozambique LNG's two-train development with LNG capacity of around 13 million tonnes per annum (mtpa).

Being an E&P specialist that had just been acquired by rival Occidental, Anadarko sold its 26.5 percent operated interest to Total for US$3.9 billion, allowing the French supermajor to assume the role as the project's main operator in September 2019. Total has been keen to expand its position in the global LNG market, and reaffirmed its commitment to the project. At the time it had been nine years during which important progress had been made – including an environmental assessment, concessions negotiations and governmental project approval – but the project was nonetheless lagging the original envisioned start-up of 2018.



Mozambique's Gas Master Plan set very high LNG development targets at the time, arguing that more than 26 billion boe of potential gas resources in addition to existing recoverable reserves, there would be ample feedstock for at least 10 LNG trains (i.e. roughly 50 mtpa), all operational by 2026. However, Anadarko's and ENI's timetables did not reflect such an optimistic outlook.

Gaining momentum

It all started promisingly. The development of Mozambique LNG gained significant momentum after Anadarko officially sanctioned the project in June 2019. With planned CAPEX of US$20 billion, the project was thus one of the most significant examples of a hydrocarbon final investment decision (FID) that year, second only to Novatek's Arctic LNG-2 in Russia. This also places Mozambique LNG among the largest foreign direct investments in Africa to date. The project had been rescheduled for first LNG in 2024 and was expected to generate annual revenues of roughly US$3 billion for the Mozambican state.

Following Total's entry as main operator, the project had also managed to attract the majority of its total planned CAPEX in July last year, when its shareholders concluded a US$14.9 billion senior debt financing agreement.

The US$14.9 billion financing agreement comprises direct and covered loans from 19 commercial banks, eight export credit agencies (ECAs) and the African Development Bank (AfDB). Among the leading state-controlled financiers, Japan Bank for International Cooperation (JBIC) signed a loan agreement for US$536 million with Japanese LNG player Mitsui. The Japanese funds are further supplemented by private financial institutions.

Future supply contracts

Mitsui, in turn, has teamed up with the Japan Oil, Gas and Metals National Corporation (JOGMEC) to jointly with Total, Mozambique's Empresa Nacional de Hidrocarbonetos E.P. and others develop the Golfinho/Atum gas field in the northernmost part of Offshore Area 1. Crucially, besides the construction of required production infrastructure, Mitsui is also earmarked to market around 30 percent – equivalent to roughly 4.3mtpa – of the project's LNG capacity. JOGMEC announced Mozambican LNG is intended to 'accelerate the diversification of Japan's LNG imports and secure long-term LNG supply to Japan once production commences'. Accordingly, JBIC will continue to actively support Japanese and Mozambican interests to facilitate steady energy supply to Japan.

Leading the roster of future offtakers,

therefore, would be Japan. Before divesting its interest to Total, Anadarko signed a 1.6mtpa LNG supply agreement with Japan's JERA and Taiwan's CPC for a 17-year period from the point of commissioning. Moreover, supply contracts encompassing an additional 9.58mtpa have been concluded with, inter alia, Tokyo Gas & Centrica, Shell, CNOOC, Pertamina and Bharat Petroleum, each lasting between 13 and 20 years. Most, if not all of these contracts, are likely to be on an ex-ship basis, visibility gained from our vessel data suggests. Overall, roughly 87 percent of Mozambique's initial capacity has been committed.

China is set to be the second most prominent destination for Mozambican gas, with CNOOC signing supply deal of 1.5mtpa for 13 years, accounting for roughly 12 percent of Mozambique LNG's annual capacity. India's Bharat Petroleum, meanwhile, is looking to import 1mtpa for its LNG truck loading business at Dahej and growing city gas network in India.

Old trouble rearing its head

Mozambique has been struggling with an Islamist insurgency in the Cabo Delgado province – home to Mozambique LNG – since October 2017. However, attacks have grown increasingly sophisticated and focussed as Mozambique's LNG developments began to take shape, edging closer to the coastal site of Mozambique LNG. Insurgents had also launched armed attacks up and down the coast without venturing beyond the delimitations set by existing on- and offshore hydrocarbon exploration and production areas in Cabo Delgado.

Although the US International Development Finance Corporation (DFC) agreed to provide up to US$1.5 billion in political risk insurance in September 2020, Total chose to postpone the restart of works at the end of that year. In late March this year, the government of Mozambique and Total announced that construction works on the Mozambique LNG project would soon resume after a 25km military cordon was put in place around the construction site at Afungi. With Total's *force majeure* notice, however, this did not come to pass.

The heightened security around the plant also resulted in several thousand Mozambicans fleeing the violence engulfing Palma and seeking refuge within the project's concession area, according to a statement from the United Nations Office for the Coordination of Humanitarian Affairs. The site was viewed as safe as military forces were tasked by the government to protect it.

Rovuma complications

The insurgency has also had an impact beyond the Total-led Mozambique LNG project - and is likely to continue to do so. ExxonMobil had been working on plans to construct the US$30 billion Rovuma LNG plant with capacity of 15mtpa, equivalent to the Corpus Christi LNG plant in the United States. The Rovuma LNG project's FID was originally expected to take place in 1H 2020, but in March that year ExxonMobil, alongside many of its peers, opted for CAPEX cuts in view of COVID-19 difficulties and an ongoing oil price collapse from around $68.27/bbl in early January to just $19.33/bbl on 21 April.

For those reasons, Rovuma LNG's FID had initially been postponed to sometime in 2021. This, in turn, may well have a knock-on effect on Rovuma LNG's financing costs, with yields on Mozambican sovereign debt responding swiftly to higher insurgency risk.

Yields on Mozambique's Eurobonds had reportedly increased by 25 basis points to 10.45 percent on 29 March, shortly after the insurgency began to spread to Palma, and rose beyond that in the beginning of April, the highest level up to that time this year, a graph provided by Cbonds suggests. Only neighbouring Zambia, which defaulted in November last year, attracted higher yields in Africa. A bond's yield signifies the level of risk associated with it, translating into high yields for high-risk bonds to generate a higher return for the lender.

Coral Sul unscathed

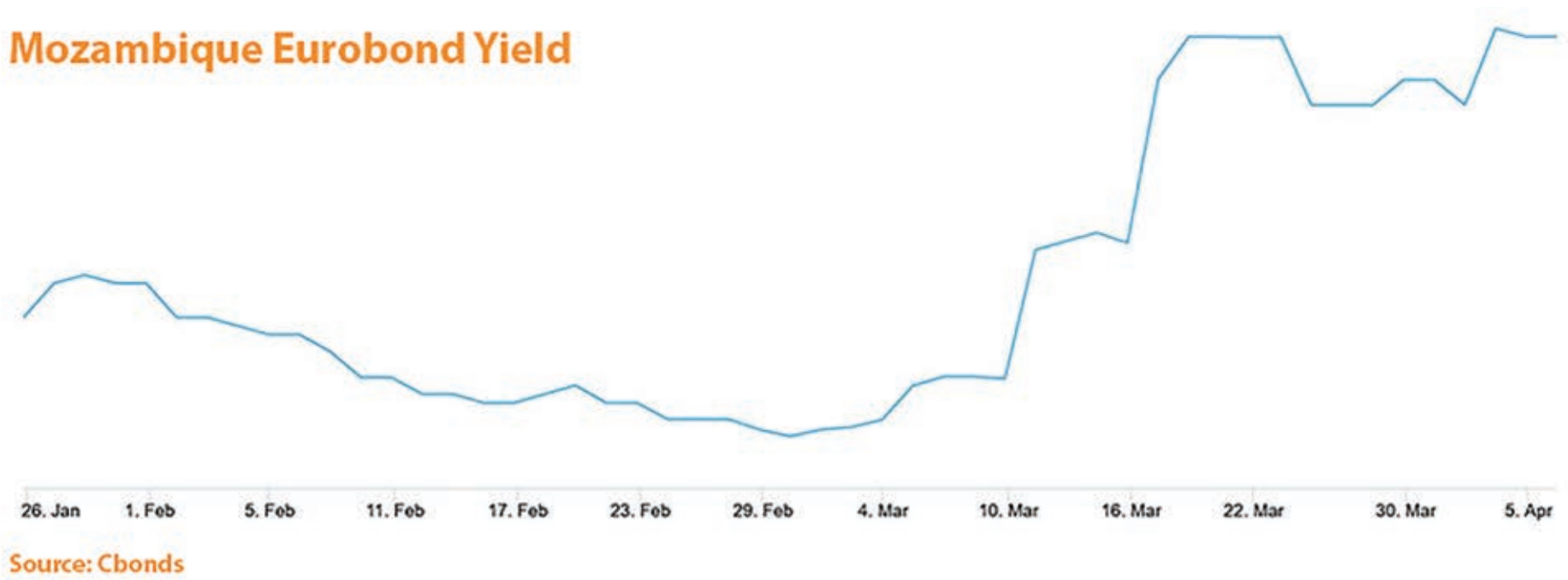
At the time of writing, the Coral Sul FLNG development was relatively safe from the ongoing troubles on land, with no security incidences reported. The 3.4mtpa Coral Sul FLNG facility was Mozambique's first approved LNG project and is scheduled to produce and ship LNG from the southern part of the Coral field. In 2016, the Coral Sul concessionaires signed a 20-year offtake agreement for all its Coral Sul production with BP.

In November 2020, Eni announced the lifting and installation of the last of the FLNG plant's 13 topside modules. Eni said this lifting marked the end of onshore-modules fabrication, meaning the entire gas treatment and liquefaction plant has been configured and is in line with the expected sail-away in 2021. Once permanently installed, the plant will be the first FLNG facility built for deep waters and the first built specifically for Africa. Coral Sul's production start-up was still earmarked for 2022 at the time of writing.

Nevertheless, even an offshore project relies on onshore logistics ranging from equipment storage and maintenance to personnel management, which means there is potential risk from violence, too.

Concluding thoughts

Mozambique's LNG plans have been in the works for more than a decade. Developers have been more cautious than the Mozambican government (which initially envisioned a considerably higher capacity in a very short amount of time) in view of the plethora of greenfield challenges ahead of them, including deepwater drilling and onshore construction. The actual speed of progress had always been too slow to meet the initial target of first LNG in 2018 but Mozambique LNG and Coral Sul have nonetheless been on the path for first exports after 2022, even working under COVID-19 precautions. A surge in violence is threatening to undo much of what has been achieved. Attacks were scaled up as soon as construction work began in earnest and broadly trace the scope of Mozambique's hydrocarbon developments along the coast. Whilst the Total-led Mozambique LNG and Eni-led Coral Sul FLNG projects have had their FIDs, signed long-term buyers and have been engrossed in actual construction, Exxon's Rovuma LNG project has yet to receive its FID. Only Eni's Coral Sul FLNG project seems insulated from onshore violence, with construction and drilling in advanced stages. But, of course, it is also the smallest of the three projects in capacity terms. Following Total's force majeure, it remains to be seen how Exxon will proceed with its Rovuma project. This leaves the timeline of Mozambique's LNG development under intense pressure. ■



LNG trade still lagging March equivalent by third week of April

LNG trade was still behind its March equivalent at the time writing due to lagging demand in Europe and the Far East, our Markets Editor Alexander Wilk reports.

After global LNG trade grew encouragingly in March, LNG flows by the third week of April had amounted to 0.65mmt (-3 percent) less than at the same time in March. Although Australia and Russia are likely to end April with significantly higher month-on-month exports, the United States have so far struggled to repeat their strong showing in March whilst Qatar's exports continue to slow following a busy winter period. Meanwhile, a strong net demand curtailment in Europe overshadowed robust growth in the Caribbean and South America alongside a chequered picture in Asia.

Exports

Our preliminary data indicated at the time of writing that LNG exports up to 23rd April were lagging their March equivalents. At 23.72mmt, they were down 0.65mmt (-3 percent) from the 24.37mmt recorded on 23rd March.

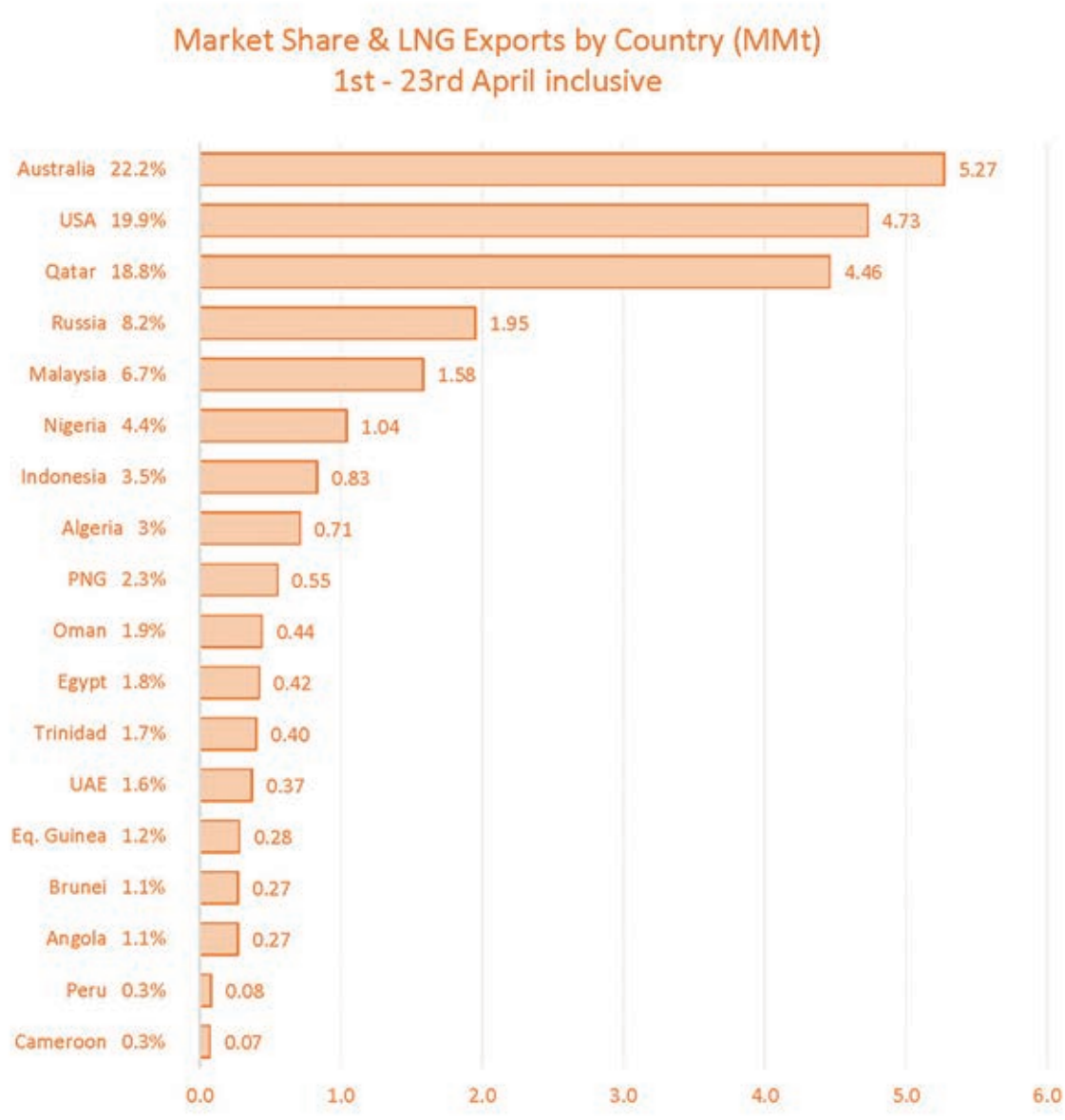
Whilst exports in the Pacific up to 23rd April had kept pace with their time-equivalents in March – up by 0.08mmt (1 percent) to 9.32mmt from 9.24mmt – shipments in the Atlantic still had some catching up to do. Exports within the Atlantic Basin stood at 8.71mmt, down 0.14mmt (-2 percent) from 8.85mmt. Concurrently, Middle Eastern shipments were down by 0.59mmt (-9 percent) on shipments totalling 5.69mmt compared to 6.28mmt on 23rd March.

Consequently, the Pacific Basin's capacity utilisation had increased marginally by 1pp to 90 percent whilst in the Atlantic Basin and the Middle East utilisation was down by 1pp and 9pp to 76 percent and 95 percent, respectively.

Pacific Basin

The export growth in the Pacific to date was primarily carried by slightly higher Australian exports – up by 0.05mmt (0.9 percent) to 5.27mmt – as well as a significant boost to Russian shipments from Sakhalin-2 LNG. The plant had returned to the market following scheduled maintenance with both trains back in action. Accordingly, the plant had seen exports jump by 0.27mmt (57 percent) to 0.74mmt on 23rd April from 0.47mmt on 23rd March.

However, Pacific shipments from Southeast Asia as well as South America – Brunei, Malaysia, Indonesia and Peru – were down by 0.24mmt (-7 percent), weighed down particularly by Peru's single export of 0.08mmt compared to 0.26mmt this time in March. Southeast Asian shipments were down by only 0.06mmt without indication that they would not catch up by the end of the month. Given that our data indicated key Asian buyers such as China and Taiwan were seeing strong demand growth, we therefore expected Pacific exports to show month-on-month growth by the end of April.



Source: LNG Journal

Atlantic Basin

The overall amount of LNG shipped from Europe and Africa (not including re-exports) had seen a marginal net increase of 0.03mmt (0.8 percent) on 23rd April, which was carried by an additional shipment from Equatorial Guinea's EG LNG facility. In contrast, Algerian exports fell behind their March equivalents by 0.12mmt (-14 percent) to 0.71mmt whilst exports from other African exporters remained broadly flat. Norway, of course, was not due any exports because of ongoing repairs whilst Russia's Yamal LNG saw broadly steady shipments of 1.21mmt month-on-month on 23rd April. As such we are also optimistic at this point that the eastern half of the Atlantic will have continued the month-on-month growth seen in March by the end of April.

In contrast, LNG export growth in the Atlantic was held back by an overall lacklustre performance in US LNG shipments. Sabine Pass in particular was trailing its exports of 1.80mmt last month with just 1.59mmt on 23rd April, a difference of 0.21mmt (-12 percent). Additionally, a total reduction of 0.12mmt at Cove Point LNG, Elba Island LNG and Freeport LNG overshadowed even a notable increase of 0.10mmt (11 percent) to 1.02mmt at Corpus Christi LNG, which put its third train into service in April. Cameron LNG had merely kept shipments steady. Although we expect Sabine Pass to increase shipments in the coming week, the lacklustre performance to date is indicative of potentially slower month-on-month growth by the end of April.

As such, even continued robust export growth by Atlantic LNG in Trinidad & Tobago by 0.05mmt (14 percent) from 0.35mmt to 0.40mmt could not lift the Atlantic's overall export level at the time of writing.

Middle East

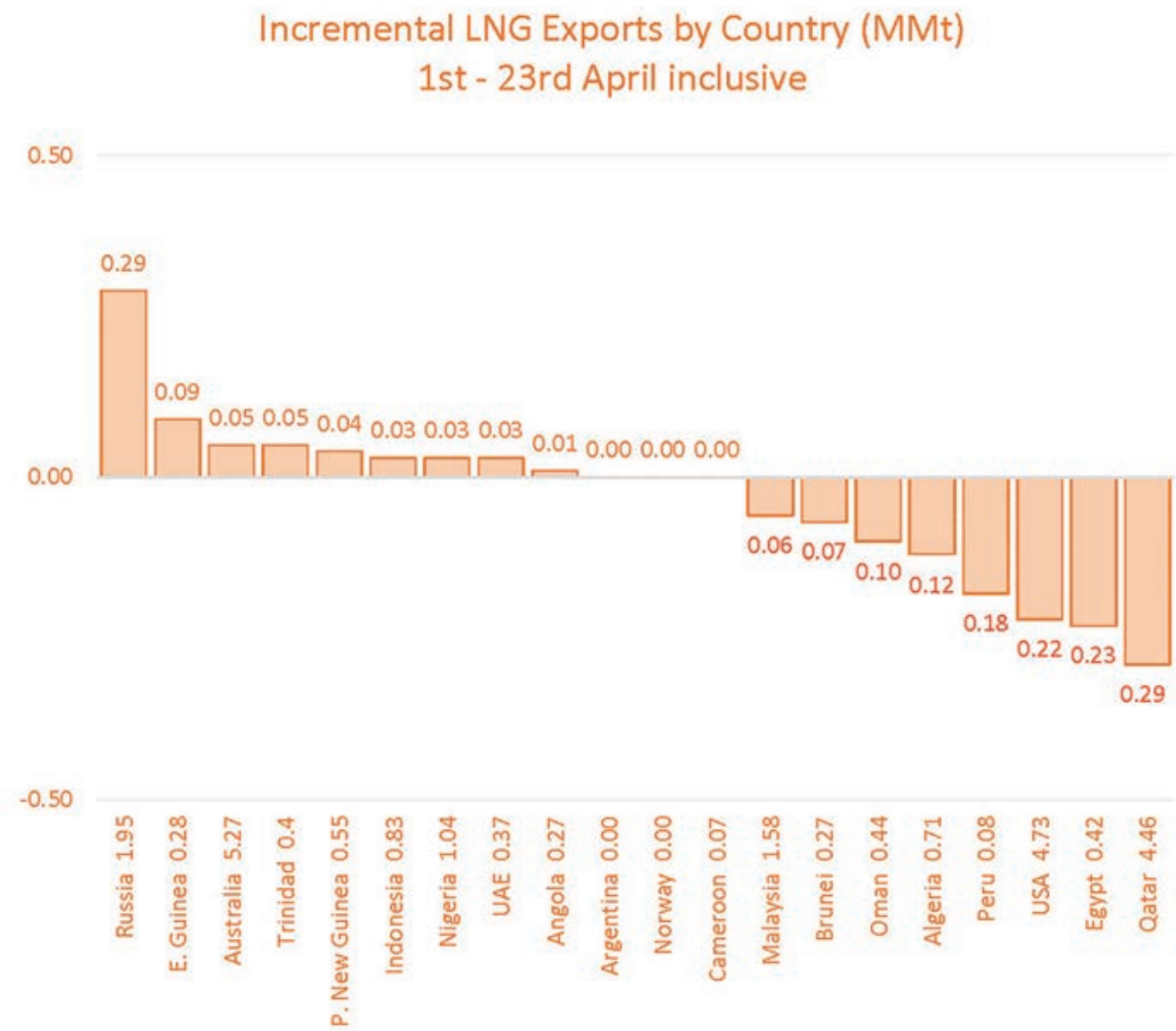
April shipments from Middle Eastern plants at the time of writing had continued to trend downward, coming in 0.59mmt (-9 percent) below their past-month equivalent of 6.28mmt at 5.69mmt on 23rd April. Exports had continued to slow in Qatar – down 0.29mmt (-6 percent) – whilst they slumped by 0.23mmt (-35 percent) in Egypt. Oman also struggled to maintain output, which was down 0.10mmt (-19 percent) and stood in contrast to growth of 0.03mmt (9 percent) in the UAE. Our preliminary data therefore suggests to us Middle Eastern LNG shipments are likely going to be down for the whole month in April.

Imports & Domestic Trade

At 22.73mmt, global LNG offtakes were down significantly on 23rd April, having decreased by 0.23mmt (-6 percent) from their month-on-month equivalent of 24.21mmt in March.

This reduction was primarily due to less demand in the Pacific Basin, where demand was down 1.19mmt (-7 percent). In contrast, Middle Eastern offtakes had already increased robustly by 0.21mmt (27 percent) to 0.98mmt whilst Atlantic imports of 6.72mmt had been weighed down by lower European demand.

Accordingly, capacity utilisation in the Pacific and Atlantic Basins had suffered, down by 4pp and 2pp to 52 percent and 38 percent, respectively. In contrast, Middle Eastern capacity utilisation improved drastically by 10pp to 43 percent.



Source: LNG Journal

Pacific Basin

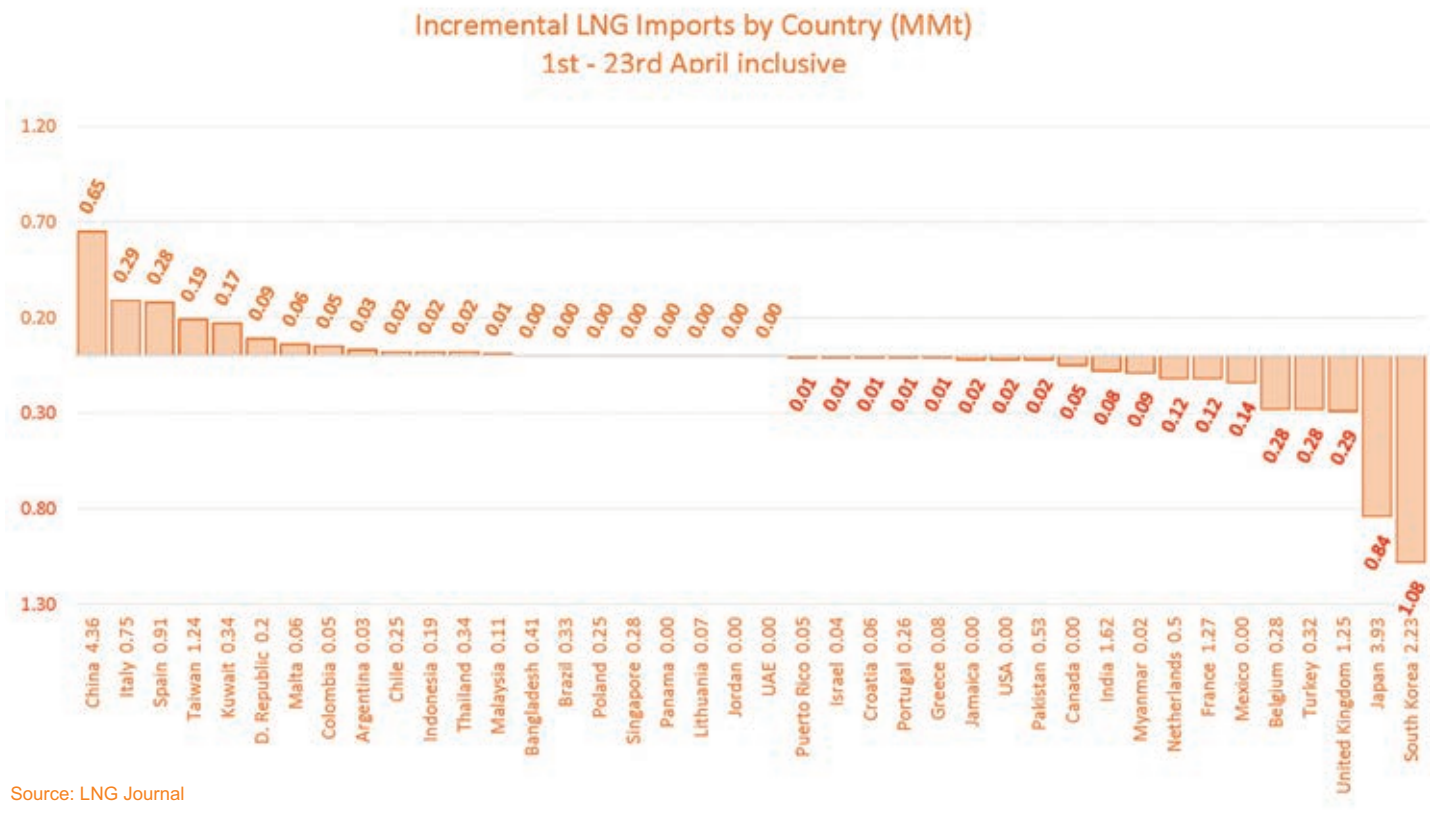
Pacific Basin imports up to 23rd April had continued on a downward trajectory since February, led by lower Japanese and South Korean imports, which were down by 0.84mmt (-18 percent) and 1.08mmt (-33 percent), respectively. India had also shown early warning signs of lower demand and we expect at least the country's month-on-month growth to slow drastically if the new COVID-19 outbreak is leading to a new lockdown.

A silver lining was, however, provided by robust demand growth of 0.65mmt (17 percent) in China and 0.19mmt (18 percent) in Taiwan as well as an increase in Indonesian and Malaysian demand totalling 0.03mmt. Notably, Indonesia inaugurated its fourth FSRU on 19th April. Current market visibility indicated China was still expecting at least 1.32mmt to arrive by the end of April.

Elsewhere in the Pacific, the roster of typically price-conscious Pacific buyers – including Bangladesh, Thailand, Chile, Mexico, Singapore and Myanmar – had slashed their overall imports by 0.19mmt. This was not entirely surprising given the strong month-on-month growth in March. The reduction was primarily due to Mexico's market absence for the month of April to date.

Atlantic Basin

In line with their Pacific equivalents, LNG imports in the Atlantic Basin represented a significant demand decrease of 0.42mmt (-6 percent). Net demand growth of 0.14mmt in South America and the Caribbean – led by the Dominican Republic and Colombia – could not move past a net reduction of 0.49mmt in Europe. Here, prominent importers in volume terms led by the United Kingdom, Turkey and Belgium had slashed offtakes by 1.12mmt, which was only partially compensated by growth totalling 0.63mmt in Italy, Spain and Malta. At the time of writing, we were expecting a further 1.39mmt to arrive in Europe. Notably, Argentina had returned to the market and we expect the country to support Atlantic demand in the coming months.



Source: LNG Journal

Middle East

In contrast, the Middle East had already cemented month-on-month demand growth for the whole month of April as demand had jumped by 0.21mmt (27 percent) from 0.77mmt to 0.98mmt on 23rd April. We therefore expect regional April demand to exceed that of March both in growth and absolute terms. Notably, the bulk of that growth was carried by Kuwait's Mina al Ahmadi LNG, which had already doubled imports to 0.34mmt at the time of writing. ■

For the Record

ABS, the US classification society, has held its annual meeting of members in Houston and recalled a past year of success in enacting ship safety and technical development, including in the LNG and gas carriers sphere. "Through 2020, we adjusted with the ebbs and flows of the global economic forces and strengthened our industry fundamentals ahead of regulatory obligations that allowed ABS to grow our classed fleet to 273 million gross tons and maintain our leadership role across the entire Global Offshore market," said Christopher J. Wiernicki, the ABS Chairman, President and Chief Executive in his report. "We lead the Global Marine market in gas carriers and containerships with a solid share of tankers, continue to command the industry in safety and remain the top performing Recognized Organization (RO) in the three most active port State regions globally," stated Wiernicki.

ABS recalled in its 65-page annual report that it was the first class society to class an LNG carriers and for over 60 years has led the industry in supporting the evolution of LNG technologies. "ABS has long supported the use of natural gas and other gases as marine fuel, and in 2020 made some significant strides in aiding their advancement," said the report. It said that in keeping with this history, ABS was the natural fit to provide classification services for the first LNG bunkering vessel designed for the Pacific Northwest Coast of North America. The 4,000 cubic metres capacity articulated tug-barge (ATB) will be built for Cryopeak LNG Solutions, a gas provider in the Canadian province of British Columbia and is expected to enter into service in 2023. Designed in a joint effort between Cryopeak and Island Tug and Barge, a bulk transporter of petroleum products also based in British Columbia, the vessel will provide LNG maritime fuel along the West Coast of Canada.

ABS noted that in December 2020 it completed a joint development project in LNG bunkering and the use of LNG as a marine fuel - a two-year project with Singapore's Sembcorp Marine and the Star Institute of High Performance Computing that set out in 2018 to advance the use of LNG as a marine fuel and to make it more accessible, reliable and safer for the industry. "The project brought together engineers with diverse backgrounds and expertise to study a range of key issues including leakage during bunkering, boil-off rate management for Type C tanks, and the heat transfer between LNG containment and surrounding structures," explained ABS. The class society declared that was also continuing to advance both the use of ethane as fuel and the development of very large ethane carriers (VLECs), some which will have LNG Ready notation. "The first of an order of 12 VLECs now being built to ABS class has been delivered to Zhejiang Satellite Petrochemical (STL) by Samsung Heavy Industries (SHI) of South Korea," said ABS. The "Seri Everest", the largest VLEC ever built with more than 98,000 cubic metres of capacity, is the first of a phase-one order by STL, which was subsequently sold to Malaysia's MISC Group. A second phase of the order also includes six vessels, four of which have been purchased by Eastern Pacific Shipping, bringing the total to 12. They are scheduled to trade from the US to China to support STL's Ethane Cracker facility in Jiangsu province. This is the first VLEC to be delivered with the LNG Cargo Ready notation that was released by ABS in 2019. "The notation provides assurance to owners and charterers that the VLEC can be upgraded to trade LNG cargoes in the future," added ABS.

AIR PRODUCTS, the US provider of LNG equipment with new liquefaction contracts for Qatar, Mozambique and Mexico, has opened a new hydrogen fuelling station at its industrial gases facility in Ulsan City in South Korea. The filling station was built with the Air Products hydrogen fuelling technology and is operated by the company. "It is part of the company's ongoing commitment to Ulsan City, which houses the country's hydrogen industry hub and is one of the three pilot cities in the national hydrogen economy roadmap," explained Air Products. The LeHigh Valley, Pennsylvania-based company is a world-leading industrial gases provider and has served the South Korean market for close to 50 years. Air Products has established a leading position in the country and has been supporting hydrogen demonstration projects for over a decade.

Ulsan is South Korea's largest hydrogen production and distribution city and has been designated as a Free Trade Zone for hydrogen mobility development. It was the first city to operate hydrogen buses and taxis and has established itself as the center of hydrogen fuel-cell vehicles. At the same time, South Korea remains the world's third-largest LNG importer after Japan and China. "Hydrogen and fuel cell technologies are part of the solution to the energy and environmental challenges of today and tomorrow," said Kim Kyo-Yung, President of Air Products Korea. "As the world's largest hydrogen producer and a global leader in hydrogen technology, Air Products is committed to supporting South Korea to realize a hydrogen-powered society through our expertise across every aspect of the 'Hydrogen for Mobility' value chain," added Kim.

South Korea's hydrogen ambitions include the goal of producing 6.2 million fuel-cell vehicles and rolling out at least 1,200 hydrogen fueling stations by 2040. LNG still remains a large part of the business of Air Products and in its most recent LNG contracts, it was chosen to provide its proprietary LNG technology, equipment and related process license and advisory services to Sempra Energy's Costa Azul LNG export project on the Pacific Coast in northern Mexico. Earlier in 2020, Air Products was selected to supply the LNG process technology and equipment for Mozambique's first onshore LNG production plant in the nation's northeast Cabo Delgado province. It was also chosen by Qatargas for the massive LNG production expansion project at Ras Laffan.

ALGERIA has held talks with French major Total in Algiers. The country's Minister of Energy and Mines Mohamed Arkab held face-to-face discussions with Total Chairman and Chief Executive Patrick Pouyanné on future liquefied natural gas projects and other issues. "The two parties discussed future projects to be carried out in liquefied natural gas, renewable energies, energy storage and petrochemicals, in particular the petrochemicals project which is making steady progress," said a statement. To this end, the two parties reaffirmed their willingness to work to strengthen the partnership between Algerian state energy company Sonatrach and Total, though gave no specific details on LNG projects. Total and Sonatrach signed an agreement in June 2020 to renew their partnership in the LNG export and import sector.

This agreement notably allowed the extension of existing supply contracts for three additional years to provide 2 million tonnes per annum of Algerian LNG to the French market, primarily through the LNG terminal at Fos Cavaou, west of Marseilles. That agreement also includes the sub-charter of a Total-owned LNG carrier to Sonatrach. Algerian LNG exports have been recovering from a low ebb and now amount to around 12.40 million tonnes per annum combined from the Arzew and Skikda liquefaction plants on the Mediterranean Coast. Algeria is also a main pipeline natural gas supplier to Europe and in 2020 exported 14.8 Bcm of gas to Italy, an increase of 12 percent compared with 2019.

The country additionally supplied 9.6 Bcm of pipeline gas to Spain, part of which flowed through to Portugal. Total's main current energy projects are located in the Tin Fouye-Tabankort (TFT) gas fields, among the largest in Algeria and located in the prolific Illizi-Ghadames Basin, as well as the Timimoun gas fields and oil projects in the Berkine Basin. Total and Sonatrach are also advancing with their petrochemical project development for Western Algeria.

CHEVRON CORP and a group of other energy producers won a landmark case before the United States Court of Appeals for the Second Circuit, which unanimously ruled that the City of New York's climate-change lawsuit against the US major and others was without merit and must be dismissed. The court upheld the federal district court's decision that New York's claims are barred, holding that municipalities cannot "utilize state tort law to hold multinational oil companies liable for the damages" caused by global greenhouse-gas emissions.

"However, global warming was one of the greatest challenges facing humanity," said the court, while ruling that it was a "uniquely international problem of national concern" and therefore was not well-suited to the application of state law. Chevron is one of the world's leading LNG operators from plants in Western Australia such as Gorgon LNG and Wheatstone LNG, as well as in Angola in southwest Africa. Analysts said that other global oil and gas companies such as ExxonMobil, Royal Dutch Shell, BP and Total would be positively impacted by the Supreme Court victory in the US.

LNG is one of the main transition fuels and energy majors have also been at the forefront for many years of other climate-change mitigation methods such as carbon-capture and storage. The US

Court of Appeals rejected New York City's attempt to regulate and recover damages from the targeted defendants who carried out "legal commercial conduct in producing and selling fossil fuels" around the world. "Every single person who uses gas and electricity contributes to global warming," stated the US Court of Appeals in its ruling.

In the process, the court rejected the City's attempt to "sidestep" the "numerous federal statutory regimes and international treaties" that "provide interlocking frameworks for regulating greenhouse-gas emissions", as well as enforcement mechanisms. Chevron General Counsel R. Hewitt Pate pointed out the landmark nature of the ruling as it was a "unanimous opinion by a distinguished panel of judges appointed by Presidents from both parties" and explained in clear detail why the US climate tort lawsuits are meritless. "As the court noted, for over a century, a mostly unbroken string of cases has applied federal law to disputes involving interstate air or water pollution," said Pate.

"And it was fitting, the court concluded, that Congress had, under the Clean Air Act, tasked expert federal agencies with addressing climate change in this technically complex area of environmental law, rather than judges, who lack the scientific, economic and technological resources to cope with issues of this order," stated Pate.

Pate added that Chevron, based in San Ramon, California, was accelerating its work on today's energy transition, while continuing to supply oil and natural gas that remains essential for people around the world. "We believe that working with the new US Administration, other governments, and other honest stakeholders on constructive global solutions is a better path than meritless, cynical and wasteful litigation," concluded the Chevron General Counsel.

EDF TRADING, a wholly-owned subsidiary of French utility EDF SA, has made several executive changes. EDFT has named Valentino Scavardone as its new Head of Origination for Europe and appointment of Sylvie Billion as its new Chief Financial Officer. Scavardone in his now role in Origination for Europe will report to Philipp Büssenschütt, EDF Trading's Chief Commercial Officer. "The energy market landscape continues to evolve with new opportunities developing especially in the renewables markets and the European Gas markets through increasing LNG imports," explained Büssenschütt. "Valentino and our Origination team will be working alongside our trading teams to develop new products, identify areas for expansion and continue to grow our customer flow business," stated Büssenschütt.

Scavardone said he was looking forward to growing the Origination business and supporting the EDF Group and its customers. Valentino joined the previous EDF Trading (EDFT) entity in 2010 as a Senior Originator and was appointed Head of Southern Europe Origination in 2013. Prior to joining EDFT, he was at the French-Belgian firm Electrabel-GDF Suez and E.ON of Germany. EDF Trading named a new CFO in Sylvie Billion, who will report to Béatrice Bigois, Chief Executive, and will be a member of the company's Executive Committee. "I'm delighted to welcome Sylvie to EDF Trading. She has extensive international experience of leading and working in financial risk and asset liability management," stated CEO Béatrice Bigois.

Billion joins EDF Trading from EDF where she was also CFO and an Executive Committee Member for the International Division. Previously Billion held roles at French bank BNP Paribas, multi-national firm Accenture and Dutch bank ABN Amro Group before joining EDF in 2001 as Group Financial Risk Controller. She later became Group Treasurer in charge of Treasury, Group Financing, Capital Markets and Asset Management and in 2010, she moved to EDF distribution subsidiary ERDF as CFO and a member of the Executive Committee. Billion left EDF temporarily in 2013 to join the Executive Committee of the Global

Fund, a multilateral financing institution as CFO and Head of the Finance, IT, Sourcing and Administration Division.

ENAGAS, the Spanish national gas grid operator with Europe's largest LNG import terminal network, posted lower first-quarter net profits, though praised the contribution to earnings of its Trans-Adriatic Pipeline (TAP) investment. "The Trans-Adriatic Pipeline has started to contribute significantly to the results of the company, after its commissioning at the end of 2020," explained Enagás.

The company's first-quarter net profits came to €92.9 million ($111.5M) compared with €119.1M in the first three months of 2020. Enagás, which has capacity at five LNG regasification terminals in Spain handling over 200 cargoes a year, said the first-quarter 2021 deliveries by the Trans-Adriatic Pipeline amounted 1.16 billion cubic metres of natural gas to its target markets.

The operational availability for the first quarter was 100 percent on the pipeline, an 878-kilometres transportation system bringing Caspian natural gas from Azerbaijan to Greece, Albania, via the Adriatic Sea and Italy and whose main shareholders are among Europe's main LNG terminal and grid operators. The pipeline, known as TAP and which took over four years to build, is the European leg of the Southern Gas Corridor, a gateway project that in time will transport 10 Bcm per annum of gas supplies from Azerbaijan to multiple markets in Europe and as an alternative to Russian gas from Gazprom. TAP's shareholders in addition to Enagás include the gas grid operators of Italy and Belgium, Snam and Fluxys, as well as UK oil and gas major BP, Swiss trading firm Axpo and the Azerbaijani energy company Socar.

Enagás operates most of Spain's LNG terminals, Snam has two terminals in Italy and Fluxys operates the Zeebrugge LNG facility and has a major stake in Dunkirk LNG in France. These three LNG-focused shareholders in TAP have 55 percent of the equity. Enagás has four import terminals in Spain at Barcelona in the northeast, Cartagena in the southeast, Huelva in the southwest and Gijon in the northwest. It also owns a 50 percent stake in the facility serving the northwest city of Bilbao. Enagás said it expected its overall earnings to increase further in 2021 and reach around €380M by the end of 2021, helped by cost savings and increasing demand. The company's investments outside Spain such as TAP, account for just over 38 percent of the company's income. Enagás said that so far this year, through April 18, the demand for natural gas in Spain had been 100.5 terawatt hours, a 4.7 percent increase from the same period of 2020.The company's other overseas operations include natural gas assets in Mexico, Chile and Peru as well as the US pipeline company, Tallgrass Energy, in which Enagás has a 30 percent stake.

ENI, the Italian energy company, has strengthened its presence in future LNG importer Vietnam through the acquisition of Block 115, located in the Song Hong basin and the nearby Ken Bau natural gas and condensate discovery. Eni acquired a 100 percent interest in the Block from Krisenergy, an independent upstream company focused on the production and development of oil and gas in the basins of Southeast Asia. "The acquired Block is adjacent to Block 114 where the operator Eni Vietnam and its partner Essar Exploration and Production Limited have recently announced the Ken Bau gas and condensate discovery currently under appraisal," explained Eni.

Milan-based Eni said the new acreage also borders Block 116, operated by Eni Vietnam with a 100 percent participating interest. The Block covers an area of 7,382 square kilometres with a water depth ranging from 90 metres to 1,000 metres. "Eni's presence in the country is further strengthened with this acquisition, consolidating its position in the recently discovered Ken Bau play, in line with the strategy of expanding its gas portfolio in the Far East," said Eni. Eni has been present in Vietnam since 2013, and currently operates five blocks all located in the under-explored Song Hong and Phu Khanh basins. Vietnam is currently developing about half-a-dozen LNG and power projects with overseas partners to try and keep pace with future energy needs to enable its economic expansion.

The leading LNG import projects include the Quang Ninh LNG-for-power venture owned by a partnership comprising PetroVietnam, Tokyo Gas and Marubeni Corp. Vietnam is also developing another terminal involving US major ExxonMobil Corp. at the port city of Haiphong. Another Vietnamese LNG-for-power venture is being developed by Singapore-based company Delta Offshore Energy and partners in Bac Lieu province in the Mekong Delta of south Vietnam. Other ventures are planned for Ninh Thuan province, south of Cam Ranh Bay, and at Long An, also on the Mekong Delta.

EXCELERATE Energy, the US pioneer of floating liquefied natural gas import terminals, has completed its 2,000th commercial ship-to-ship transfer of LNG worldwide after completing its latest operation in the Bay of Bengal off Bangladesh. Excelerate's floating storage and regasification unit (FSRU), the "Excellence", received the cargo from a conventional carrier near Moheshkhali Island. The "Excellence" FSRU, now one of two Excelerate vessels operating in the Bay of Bengal, has enabled Bangladesh to import 3.75 million tonnes per annum of LNG since it was deployed in 2018 to bring LNG to generate electric power for one of Asia's poorest nations. The first Moheshkhali Island venture was co-developed by PetroBangla, the International Finance Corp., part of World Bank Group, and Excelerate.

In the landmark STS operation on April 3 a total of 144,191 cubic metres of LNG was transferred using the double-banked LNG transfer system. To date, Excelerate has successfully transferred over 236.4 million cubic metres of LNG using its STS protocol. "Having achieved this milestone safely is a testament to the hard work and dedication of our team and vessel crews worldwide," stated Chief Operating Officer Cal Bancroft. "Operating in challenging locations like the Bay of Bengal is why customers can count on our teams to deliver much-needed energy," added Bancroft. Excelerate said it was continuing to provided clean, reliable energy to Bangladesh through its two FSRUs operating in the Bay of Bengal.

Bangladesh's second LNG import terminal is also located offshore Moheshkhali Island. It began operations in April 2019 in the form of Excelerate's FSRU "Summit LNG", formerly the FSRU "Excelerate" previously moored in Abu Dhabi, and has a capacity of 3.8 MTPA. "Both projects have represented a 20 percent uplift in gas supply to the country, allowing for a more resilient gas and power grid for the Chattogram region, which is home to residents, fertilizer factories, and several industries that were previously underserved," explained Excelerate. Excelerate conducted the industry's first commercial STS transfer of LNG in 2007. Since then, STS transfers have been commercially accepted and proven in a wide range of environments, including open ocean and protected bodies of water at various locations between the LNG load ports and market delivery points. The Excelerate company has started FSRU-led import ventures in the US, South America, Asia and the Middle East and has its headquarters in The Woodlands in Houston in Texas. It is part of a privately held US energy group founded by American businessman George Kaiser, who is also the majority shareholder of the publicly-traded Bank of Oklahoma.

EXXONMOBIL Corp. has proposed a huge public-private carbon storage project at the centre of the Gulf Coast LNG industry that would collect carbon-dioxide emissions from petrochemical plants and refineries in the area and bury them under the Gulf of Mexico. Joe Blommaert, President of ExxonMobil's Low Carbon Solutions business, outlined the proposal from the largest US oil producer and major global LNG player. The ExxonMobil project would target about 50 industrial plants, mostly refineries and petrochemical facilities along the Gulf Coast, where four LNG exports plants operate and others are under construction, including ExxonMobil's joint venture with Qatar Petroleum, the Golden Pass project. ExxonMobil said its plan would require around $100 billion or more from companies and government agencies to store 50 million metric tons of CO2 by 2030, with capacity potentially doubling by 2040.

The project would be centred on the area of Houston which has a large concentration of oil and gas industry facilities from refineries to petrochemical plants. "We could create an economy of scale where we can reduce the cost of the carbon-dioxide mitigation, create jobs and reduce the emissions," explained the ExxonMobil executive. ExxonMobil's carbon storage project is proposed for the Houston Ship Channel, a 50-mile (80-km) long waterway that is part of the Port of Houston and has dozens of refineries and chemical plants along its banks. ExxonMobil acknowledges that the proposal would require support from other companies and from federal, state and local government agencies.

ExxonMobil has long been a leader in carbon-capture and storage and has pledged to increase spending on low-carbon projects to lower emissions at a realistic pace and not by shutting down plants and throwing people out of work. ExxonMobil, based in Irving, Texas, is contacting potential partners for the project among its refining and chemical plant rivals along the Gulf Coast. The company has described investors, banks

and government officials as being receptive to the CCS plan for the GoM. ExxonMobil CCS project aims to capture CO2 from the 50 largest industrial emitters along the Houston Ship Channel and then send the CO2 by pipeline to offshore reservoirs up to 6,000 feet (1.83 km) below the sea floor. ExxonMobil estimates that CCS projects could be a market valued at around $2 trillion by 2040. "This could be the catalyzing project that puts carbon capture on the fast track," said ExxonMobil.

FIRST GEN Corp. of the Philippines has chosen BW LNG of Singapore to provide a floating storage regasification unit (FSRU) for its LNG import terminal project at Batangas in Luzon. The Filipino company chose BW Gas over Höegh LNG after a tender for the five-year charter agreement. "The project will allow First Gen to accelerate its ability to introduce LNG to the Philippines as early as the third quarter of 2022," said the company. "It will serve the natural gas requirements of existing and future gas-fired power plants of third parties and First Gen affiliates in the region," it added. The vessel expected to be chartered is the "BW Paris" with 162,500 cubic metres capacity of storage, according to company filings in Manila. The FSRU also has a nominal and peak gas send-out capacity of 500 million standard cubic feet per day and 700 MMscf per day respectively.

First Gen, the largest provider of gas-fired power in the Philippines, had earlier chosen Australia-based McConnell Dowell as its engineering contractor for the FSRU onshore requirements. The First Gen FSRU will provide fast-track energy security for the Batangas region as the major domestic gas field depletes. The work given to McConnell Dowell is for the first phase of the interim LNG terminal (IOT) project and a major part of it will be the modification of an existing jetty to support the BW Gas FSRU. The value of the engineering contract is around US$300 million.

The Asian nation's domestic Malampaya natural gas resources are running down just as the gas-fired power plant network begins to expand. The only other completed regasification facility in the Philippines is at Pagbilao in Quezon province. Australia-listed Energy World Corp. has a facility linked to its 100-percent owned 650MW gas-fired power project. LNG imports will only begin there when the power plant is completed.

FLUXYS BELGIUM, the operator of the national gas grid and the LNG terminal at Zeebrugge, reported increases in annual revenues and net profits as LNG shipping and truck-loading activities rose to record levels even amid the challenges of the Covid-19 pandemic. Fluxys posted a 5.5 percent increase in operating revenues of €560.59 million ($658M) compared with €530.99M in the previous year, while the extra LNG terminal income was partially offset by lower gas transmission levels. The company's net profits rose 5.2 percent to €73.23M versus €69.49M in 2019. The start of the long-term trans-shipment contract for Yamal LNG in Russia in December 2019 pushed traffic at the Zeebrugge terminal to new heights in 2020.

A total of 172 vessels docked at the terminal, smashing the previous record of 130 in 2019. Fluxys said that March 2020 was the busiest ever month for ship traffic at the terminal, with a total of 30 vessels docking, more than double the previous record in May 2019. The number of trans-shipment operations almost tripled while the number of unloading operations decreased. LNG truck traffic increased by over 20 percent to nearly 3,200 loading operations. Fluxys said it would propose a gross dividend of €1.37 per share at the May 11 annual meeting compared with €1.30 per share in 2019. "Despite the widespread impact of the coronavirus outbreak, all of Fluxys Belgium's essential services remained operational and the company focused fully on playing its vital role in society and for its customers, ensuring safety and continuity of gas supply," stated the company.

The LNG and gas grid businesses are conducted within tariff limits set by the Belgian market regulator. In June 2018 the regulator set out a new tariff methodology for the transmission and storage of natural gas and LNG terminal activities for the period 2020-2023. "The new methodology is based on existing principles that have been honed and supplemented," Fluxys noted. Investments in property, plant and equipment were more than halved in 2020 to €42.3M compared with €91.3M in 2019. "In 2020, €31.9M was spent on transmission projects, €700,000 on storage infrastructure and €9.7M on LNG infrastructure projects," said Fluxys.

Transmission volumes for natural-gas-fired power plants rose by about 5 percent, while gas transmission volumes were down overall compared with 2019. Border-to-border volumes declined by 14 percent to 204.9 terawatt hours and volumes for consumption on the Belgian market fell slightly by 1 percent to around 190.6 TWh. "Transmission to distribution system operators was down by 4 percent, reflecting milder weather. Offtake by directly connected industrial companies fell slightly by nearly 1 percent," said Fluxys. Looking forward, Fluxys Belgium has set itself the objective of halving its own greenhouse-gas emissions by 2025 compared with 2017 levels. To this end, it is rolling out various programmes designed to further reduce GHG from the operation of its infrastructure. "One new thing is that three additional open-rack vaporizers will be built at the LNG terminal in Zeebrugge and using the heat from seawater to regasify LNG will significantly reduce the terminal's energy consumption and emissions," stated the company.

FNB GAS, the German Association of Gas Transmission System Operators grouping a dozen companies overseeing 40,000 kilometres of natural gas pipeline flows and other infrastructure, has published its development and implementation plan through 2030, including up to 200 gas projects and provisions for just two LNG import terminals. The Berlin-based FNB Gas said a total of 28 ventures have reached the status of "project conclusion-completion or commissioning" compared with the previous draft Gas Network Development Plan As a result of current planning, 15 projects have been changed, one discontinued and there have been delays in 13 others. In the case of five ventures, this has an impact on the planned date of capacity supply.

Another 172 projects or measures are unchanged and are being continued in accordance with the draft Development Plan. FNB Gas was founded in 2012 by the German TSOs, the network companies operating the major supra-regional and cross-border gas transportation pipelines. German natural gas supplies mostly come from Russia's Gazprom and offshore fields in Norway, though three LNG import projects were at the planning or development stages, an onshore terminal at Brunsbüttel on the Elbe River near the port of Hamburg, and another west of Hamburg and also on the Elbe at the town of Stade. A third project was proposed for the port of Wilhelmshaven in the form of a floating storage and regasification unit, though the developers of that venture have ended their capacity requests.

The FNB Gas report shows that for the following LNG ventures, the planned commissioning has changed in comparison to the draft Gas Network Plan. As regards the Brunsbüttel-Hetlingen pipeline and the Hetlingen GPCM station, these are required to connect the planned onshore LNG terminal at Brunsbüttel. "According to the change to the commissioning of the LNG terminal announced by the operator, this is now scheduled for July 2024," said the FNB Gas report. For the Stade LNG terminal, the Stade-South Elbe pipeline and South Elbe GPCM station are envisaged and the start-up date has been pushed back to November 2025. FNB Gas noted that in relation to the Wilhelmshaven floating LNG project using an FRSU, the GPCM station and connecting pipeline, as well as the Friedeburg-Etzel GPCM station and pipeline, have seen capacity reservations withdrawn for the planned regasification terminal on the North Sea coast. The members of FNA Gas include: Bayernets GmbH, Ferngas Netzgesellschaft mbH, Fluxys TENP GmbH, GASCADE Gastransport GmbH, Gastransport Nord GmbH, Gasunie Deutschland Transport Services GmbH, GRTgaz Deutschland GmbH, Nowega GmbH, ONTRAS Gastransport GmbH, Open Grid Europe GmbH, terranets bw GmbH and Thyssengas GmbH.

GASTRADE of Greece, the lead developer of a joint venture floating LNG terminal offshore Greece's northeast port of Alexandroupolis to serve the Balkans, has signed accords with two utilities in North Macedonia, a part of the former Yugoslavia until 1991 when it became an independent state. Gastrade said the cooperation agreements are with National Energy Resources (NER AD) Skopje and AD Power Plants of Northern Macedonia (AD ESM). The deals to be future customers of the Alexandroupolis LNG Terminal, a floating storage and regasification unit (FSRU) with links to the shore, were signed in the North Macedonian capital Skopje. The signatories were Gastrade Vice President Kostis Sifnaios, the Executive Director of NER AD Bajram Rexhepi as well as the General Manager of AD ESM Vasko Kovacevski. The signings of the agreements were witnessed by the Prime Minister of the Republic of North Macedonia, Zoran Zaev.

The Alexandroupolis FSRU terminal will have storage capacity of 170,000 cubic metres and regasification capacity

of at least 5.5 billion cubic metre of natural gas per annum. The FSRU will be moored in an offshore area about 17.6 kilometres southwest of the port of Alexandroupolis. The floating unit will be connected to the Greek National Natural Gas Transmission grid through a pipeline system of a total length of 28km. The FLNG terminal is expected to commence operations and deliver gas into the regional systems in 2023.

North Macedonia firm NER AD aims to acquire an equity share in Gastrade while AD ESM is interested in reserving capacity at the Terminal on a long-term basis. "The parties will work together in formulating the details of both agreements to be presented to their respective governance bodies for their approval," explained Gastrade. The project is strategically located at the crossroads of the Southern and Vertical Gas Corridor and offers access for LNG to the markets of Greece, Bulgaria, Serbia, Romania, Northern Macedonia and nations further away like Moldova and Ukraine. The European Union-backed project also supports other gas infrastructure projects in the region such as the Greece-Bulgaria interconnector (IGB), the Greece-North Macedonia interconnector, the Trans-Adriatic Pipeline, the Bulgaria-Serbia interconnector (IBS) and the onshore Greek Revithoussa LNG Terminal.

Together with Revithoussa, they provide the only natural gas supply infrastructures in the region which are independent of gas transmissions through Turkey. The natural gas transmission network of Bulgaria in January 2021 completed a share participation transaction in the Alexandroupolis FLNG project. The deal gives the grid company, Bulgartransgaz, a 20 percent stake in the Greek company and its LNG project.

GAZPROM said the Svobodny thermal power plant has started up to serve the Amur Gas Processing Plant, one of the world's largest and part of the "Power of Siberia" project comprising pipeline gas for China and LNG for trucks transporting liquid helium as a new Russian Far East export. The power plant will supply process steam and electricity to the Amur Gas Processing Plant, currently under construction. The commissioning ceremony for the Svobodny TPP was held on April 20 in the town of Svobodny in the Amur Region. In the course of the event, supplies of process steam to the Amur Gas Processing Plant started for the purposes of commissioning. The Amur GPP will become one of the world's largest facilities in terms of gas processing with 42 billion cubic metres per annum of capacity with a staggered start-up of processing trains from 2021 through 2023.

The Amur GPP will process multi-component natural gas received via the "Power of Siberia" gas pipeline from the Yakutia and Irkutsk gas production centres. "Valuable components extracted in the course of processing will be used as feedstock for the petrochemical and other industries," explained Gazprom. The GPP will include the world's largest helium production facilities with an annual capacity of up to 60 million cubic metres. The plant will have six production trains. While the first two lines will start in 2021, the other four would be consecutively put in operation before the end of 2024. In addition to natural gas and helium, the Amur GPP's commercial products will include ethane, propane, butane, and pentane-hexane fraction. The pipeline gas supplies for China started in December 2019 via Gazprom's "Power of Siberia" trunkline from the Chayandinskoye gas field.

During 2020 the "Power of Siberia" supplies to China came to just 3.84 Bcm via the trunkline, which was less than the expected 5 Bcm in the first year. Gazprom and China National Petroleum Corp. have signed a 30-year supply agreement for Russian gas to be supplied via the eastern route amounting to 38 Bcm per annum once incremental increases had been met over a period of five years. Gazprom said a central link in the export system for commercial helium, one of the components extracted at Amur, will be a Logistics Centre for servicing thermally-insulated containers. The Centre is being set up near the city of Vladivostok and will be the world's largest hub for delivering liquid helium to the global market. The trucks delivering the helium containers to the export terminal will be powered by LNG from a small-scale fuel plant.

The trucks are Russian-built with two cryogenic fuel tanks for 530 litres of LNG each, which is a sufficient amount of fuel for the vehicle to cover a distance of up to 1,400 kilometres without refuelling. About 20 LNG trucks are being delivered by mid-June 2021. They were manufactured in line with the requirements of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Each truck is equipped with modern safety systems (ABS, VDCS), satellite navigation system, and the ITIS system designed for monitoring, recording and control of motor vehicles and drivers. The main purpose of the Svobodny power plant is to provide the Amur GPP with thermal energy (steam) and electricity. "Steam performs an important function across the GPP's entire production chain. It is used as a heat carrier in heat exchangers and is required for both preheating feed gas and conducting the gas separation process," explained Gazprom. "The overall installed capacity of the TPP is 160 megawatts for power and 249 Gcal/h for heat," it added.

Two dry cooling towers, which are required for cooling the water used in the process cycle, were winterized so as to protect their assemblies and equipment during extreme cold temperatures in the area of Svobodny of minus-40 degrees Celsius. "The power plant was constructed in just two years, a short period when the climatic conditions are concerned, the specifics of the construction site's geological structure and its remoteness from equipment manufacturers, as well as the restrictions imposed due to the Covid-19 pandemic," added Gazprom.

GOLAR LNG Ltd shares plunged almost 8 percent after Chief Executive Iain Ross resigned after nearly four years with the Norwegian-founded LNG shipping and projects company as it was completing the sell-off of assets to US LNG-for-power projects company New Fortress Energy. "The New Fortress Energy transactions will simplify the Golar group structure, crystalize underlying value and strengthen the balance sheet," said the Golar LNG Ltd statement announcing the departure of CEO Ross. "The majority of the closing conditions have been completed, including prepayment notices. Closing of the transactions is expected shortly," Golar added. Golar LNG Ltd also said it would immediately start the search for a new CEO, adding that Ross's contractual termination period of six months can be prolonged or reduced upon mutual agreement.

Ross, who took over the helm of Golar LNG Ltd in September 2017, had been an executive with Australian-based global energy and LNG engineering company WorleyParsons before joining Golar. Golar LNG Ltd shares were last down 7.66 percent on April 13 at $9.76 per share on the Nasdaq global stock exchange, a low for 2021. Golar is in the final stages of closing the sale of its 50 percent stake in Hygo Energy Transition, formerly known as Golar Power, and its 32 percent interest in its US affiliate Golar LNG Partners, both to New York-based New Fortress. Hygo itself was a joint venture set up between Golar and US private equity firm Stonepeak Infrastructure Partners. Golar LNG Ltd's shares last fell by a large amount, more than 30 percent, on 26th of September 2020 when it was caught up briefly in a Brazilian corruption investigation.

The Golar LNG Ltd shares then had plunged to $6.83 per share from $10.14 per share in the previous session after the news emerged of Hygo CEO Eduardo Antonello being involved in the probe into certain activities before he had joined Hygo. It came at a time when Hygo was expanding its LNG-for-power projects in northeast Brazil, now purchased by New Fortress, led by its high-profile CEO Wes Edens. Antonello later stepped down from Hygo over the controversy and was replaced by Paul Hanrahan. The Golar assets sales deals involving New Fortress taking over Golar's US unit, Golar LNG Partners. and the Hygo stake, have since been approved by shareholders of Golar LNG Partners after first being revealed in mid-January 2021. The transactions were valued at more than $5 billion in cash and the assets will turn New Fortress into the leading gas-to-power company in Brazil while providing LNG shipping assets and experience. New Fortress intends to expand its reach in South America, underpinned by Hygo's three gas-to-power projects in Brazil. New Fortress already has projects in Jamaica and Puerto Rico and in 2020 signed two new long-term LNG agreements to acquire supplies to support new ventures in Mexico and Nicaragua.

GRUPO HAM of Spain, the fuel infrastructure company with a station network, has opened a new LNG filling station in the Spanish capital Madrid, taking its number of stations to 80 in Europe and South America. Ham said the LNG fuel facility was located at the Transportes Carrasco facilities at Velilla de San Antonio at the M-208, one of the main roads in Madrid.

The HAM Carrasco station has been designed and built by the HAM Group and Transportes Carrasco for LNG for road transport, especially trucks.

The new service station has a 80 cubic metres tank of 18bar pressure, with an LNG dispenser for trucks and heavy vehicles, which can be freely accessed 24/7 and throughout the year. "With the

opening of the new HAM Carrasco gas station, our customers can refuel in an extensive network, in continuous expansion, made up of 80 LNG and compressed natural gas stations, which allow them to circulate on the main national and European routes," said HAM. The company noted that an average truck filling up with LNG is able to travel distances of up to 1,600 kilometres without the need to refuel. "At HAM Group we continue working together with our subsidiaries to develop new projects and continue to expand our network of LNG and CNG service stations in Spain and the rest of Europe," it added.

The HAM network of LNG and CNG stations comprises 33 in Spain, 16 in Italy, 12 in the Netherlands, nine in Belgium, eight in France and one each in Chile and Peru. In its most recent South American opening HAM partnered with Peruvian firm Limagas to build the first LNG and CNG station in Peru, an LNG exporting nation. The station is on one of the main avenues of the city of Cuzco, located in the Peruvian Andes. The Cuzco CGN-LNG gas station is the first of three planned natural gas stations in Peru, including a second station in Cuzco and another to be opened at Quillabamba during 2021.

GTT, the French LNG storage tank designer, has obtained approval from the France-based maritime classification society Bureau Veritas related to the use of a digital solution for sloshing activity assessments in the tanks of LNG carriers. GTT explained that the Approval in Principle from the French class society was for sloshing assessments in the Framework of the Class Survey to optimise the LNG membrane tank maintenance frequency. "This digital solution is based on GTT's 'Sloshing Virtual Sensor' technology, using the tank digital twin1, also designed by GTT, and the real-time operational data of the floating units (FSRU2, FLNG3 and LNGC4) to monitor the evolution of critical parameters with regards to the tank integrity," said GTT. "Combined with an appropriate risk analysis, the solution can support Alternative Survey Plans aiming at optimising the tank maintenance while complying with strict safety standards," added GTT.

According to GTT, this will translate into increased operational flexibility and substantial cost saving for the ship-owners. The term "sloshing" is used to describe the violent resonant motion of the free surface of a liquid cargo inside a moving tank. This could be in the form of standing waves in partially filled cargo tanks on board an LNG carrier. The moving liquid will exert forces on bodies inside the tank and on the tank walls and is regarded in severe form as a potential ship security threat. "Artificial intelligence combined with the expertise of GTT's teams has made it possible to develop a unique digital solution to optimise the frequency of tank maintenance, while guaranteeing the highest safety standard," said Philippe Berterottière, Chairman and Chief Executive of GTT. "With this new cutting-edge digital solution, GTT is putting its innovation and technological know-how at the service of ship-owners, in order to help them adapt to an increasingly demanding commercial environment," stated Berterottière.

Matthieu de Tugny, Executive Vice President of the Marine and Offshore division at Bureau Veritas, explained the advances made by GTT and the class society. "Digitalization combined with artificial intelligence is a major transformation for the shipping industry bringing new challenges and opportunities," added De Tugny. "I am proud Bureau Veritas helped GTT to pioneer this digital solution for sloshing activity assessment in the framework of class survey (using sloshing model tests, real-time operational data and machine learning) with the highest safety standards," he explained. The Bureau Veritas executive said this AiP demonstrated not only technical expertise in the fields of sloshing for gas carriers but also strong competencies in digitalization and artificial intelligence. "Our role remains more than ever to help the industry understand, and address, both risk and opportunity as we look into future technologies," declared De Tugny.

HOEGH LNG, the Norwegian-US fleet owner, has seen its floating storage and regasification unit (FSRU), the "Höegh Giant", arrive offshore India to be the Asian nation's seventh LNG import terminal. The vessel will serve as an LNG import terminal at Jaigarh port for the West Coast Indian state of Maharashtra. The "Höegh Giant" left Singapore on April 4 and arrived off Jaigarh port on April 10. The FSRU has been chartered by the Indian Hiranandani Group's H-Energy subsidiary for a period of 10 years with annual termination options for the charterer after year five.

The "Höegh Giant" underwent minor modifications at the Singaporean Keppel yard following its deployment as an LNG carrier for Spanish utility and LNG importer Naturgy Energy. The ship is first FSRU operating in India and with affiliated onshore facilities will, after commissioning, be able to deliver natural gas to the 55-kilometres long Jaigarh-Dabhol pipeline and the national grid. The facilities at Jaigarh will include LNG truck-loading and bunkering as well as re-loading of partial cargoes onto small-scale vessels. The "Höegh Giant" was built in 2017 and has a storage capacity of 170,000 cubic metres and peak regasification capability of 750 million standard cubic feet per day to handle up to 6 million tonnes per annum of LNG.

H-Energy additionally has proposed the development of an onshore terminal in the second phase able to handle 8 MTPA of cargoes. The commissioning of the "Höegh Giant" at Jaigarh will give India 48.5 million tonnes per annum of regasification capacity. India imported 25.29 million tonnes of LNG in 2020, an increase of 5.5 percent on 2019 when the total was 23.98MT, after rising 7.1 percent from the total of 22.42MT received in 2018. Analysts note that India's import capability requires further onshore infrastructure and a better geographic spread of terminals on the East Coast. LNG deliveries to India come mainly from Qatar, which provides over one-third of volumes, as well as West Africa, the US, Australia and the spot market. India easily maintained its position as the fourth-largest LNG importer in 2020 after Japan, China and South Korea, though the Indians would have to add an additional 15 MTPA to their receipts to overtake the Koreans into third spot. The arrival of the "Höegh Giant" followed the 2020 opening of the sixth Indian facility at Mundra in Gujarat state, also on the West Coast, and co-owned by Gujarat State Petroleum Corp. and the Adani Group. The other main operating terminals on India's West Coast around Mumbai are at Dahej, India's largest with 17.5 MTPA of capacity, as well as at Hazira and Dabhol.

INDIA recorded slightly higher liquefied natural gas imports for the first month in four in March 2021, along with domestic gas production, as a new LNG import facility on the West Coast was being commissioned to boost delivery capability amid the nation's slow economic recovery from the ongoing effects of Covid-19. LNG deliveries to India for the month of March came to 2.20 million tonnes, or around 32 cargoes, which was just 0.1 percent higher than the 2.19MT received in March 2020. Imports for the whole 2020-2021 fiscal year amounted 24.31MT, a decline of 3 percent compared with the 25.07MT imported in the previous fiscal year, according to the latest data from the Indian Ministry of Petroleum and Natural Gas. LNG imports for the month of February 2021 had come to 2.08MT versus 2.60MT in February 2020, a drop of 20.2 percent. India's calendar-year imports for 2020 had moved above the 25MT mark to 25.29MT.

That was 5.5 percent higher than in 2019 when the shipments amounted to 23.98MT, after rising 7.1 percent from the 22.42MT received in 2018. The previous Indian monthly year-on-year increase in LNG imports until March 2021 was in November 2020 when 2.14MT was received. LNG deliveries to India come mainly from Qatar, which provides over one-third of volumes, as well as West Africa, the US, Asian nations, Australia and the spot market. Ministry data also showed that the costs of importing cargoes of LNG amounted to around $800M for March, or around $25M per cargo, versus $700M in the same month of 2020. The LNG bill for the 12 months of the fiscal-year was $7.4 billion compared with $9.5Bln in the same period of 2019-2020.

India's domestic production of natural gas for March increased to 2.68 billion cubic metres, a rise of 11.1 percent compared with March 2020 when the output was 2.41 Bcm.

New gas production has come on stream in the Krishna-Godavari Basin in eastern India from projects involving the Indian group Reliance Industries and UK major BP. Production of domestic gas for the whole fiscal year came to 28.67 Bcm, a fall of 8.1 percent on the 31.18 Bcm recorded in the previous fiscal year. That's as India's seventh import facility is on track for commissioning at Jaigarh Port, south of Mumbai in Maharashtra state in the form of a chartered floating storage and regasification unit (FSRU). The commissioning of the "Höegh Giant" at Jaigarh will give India 48.5 MTPA of regasification capacity, well below the current annual import level of around 25 MTPA. The Ministry data for March 2021, with a one-month time lag, showed that capacity utilization at the Dahej import terminal was averaging 94.0 percent monthly. The Dahej capacity is 17.5 MTPA. At the Hazira facility, the monthly utilisation rate dropped to 79.0 percent for 5 MTPA, while the newest Mundra

terminal had 35.6 percent of usage for its 5 MTPA of capacity. Dabhol had 70.8 percent use for its 5 MTPA, while at the Kochi facility there was 17.3 percent usage for 5 MTPA and at Kamarajar (Ennore), the only East Coast terminal, usage was 12.0 percent for 5 MTPA.

KINDER MORGAN, the US natural gas pipeline operator and stakeholder in LNG exports and projects, reported first-quarter net income of $1.40 billion compared was a net loss of $306M in the prior-year quarter and said a new Louisiana pipeline expansion to serve Train 6 at Sabine Pass LNG was on track. "The (profit) increases are primarily related to the February winter storm and are therefore largely non-recurring," stated Kinder Morgan. "We realized greater margins on Kinder Morgan's Texas intrastate pipeline systems resulting from the temporary supply and demand imbalances and substantial spot market price volatility caused by the storm," explained the Houston-based company. The earnings performance for the first quarter was also better due to $971M of impairment charges taken in the first quarter of 2020. "Apart from the storm and throughout the quarter, our assets continued to provide strong cash flow as we remain guided by a sound corporate philosophy: fund our capital needs internally, maintain a healthy balance sheet and return excess cash to our shareholders " stated Kinder Morgan Executive Chairman Richard D. Kinder.

The company noted that construction continued on Kinder Morgan Louisiana Pipeline's Acadiana expansion project, which is costing $145M, and the work was on track. "The project is designed to provide 945,000 dekatherms (cubic feet) per day (Dth/d) of capacity to serve Train 6 at Cheniere's Sabine Pass Liquefaction facility in Cameron Parish, Louisiana," said the company. "The project is anticipated to be placed into commercial service as early as the first quarter of 2022," added Kinder Morgan. Kinder Morgan itself is a shareholder in the Elba Island LNG export plant in Georgia and has a stake in the currently dormant Gulf LNG export project near Pascagoula in the state of Mississippi. Kinder Morgan added that natural gas transport volumes were down 3 percent overall year-on-year, with notable volume declines on the Colorado Interstate Gas Pipeline (CIG) due to production falls in the Rockies Basin.

However, the company reported increased volumes on the Tennessee Gas Pipeline (TGP), due primarily to weather-related rises in usage across the Texas system and higher deliveries to LNG plants and to customers in Mexico. There were also higher volumes on the Permian Highway Pipeline going into service and on the Elba Express in Georgia due to increased deliveries to the Elba Island LNG export plant. KMI Chief Executive Steve Kean said the strongest quarterly performance came from its Natural Gas Pipelines division in the face of challenging circumstances presented by the February winter storm in Texas. "That performance was a result of actions we took following previous weather events," explained Kean. "Those actions included enhanced weatherization at storage and other facilities, ensuring critical facilities had backup generation so they wouldn't lose power, and deploying additional personnel and equipment at normally automated facilities to maintain operations and be positioned to make any necessary repairs if roads became impassable," he said. "Our storage assets performed exceptionally well, allowing us to deliver gas into the market throughout the storm. These storage withdrawals, along with gas we purchased before and during the event, enabled us to deliver significant volumes of gas at contractual or prevailing prices," stated the CEO.

Kean praised the "outstanding performance of the people in our Texas intrastate pipeline systems and the facilities they kept operational" throughout the storm. Kinder Morgan said that system deliverability and resiliency were also enhanced by investments in pipeline expansion projects and asset maintenance in Texas. "These investments, by Kinder Morgan and our joint venture partners, totaled more than $5 billion in the last three years alone," said the company. "We are particularly proud of the fact that the Permian Highway Pipeline, which went into commercial service six weeks prior to the storm, played a key role in keeping more lights and heat on in Austin than would otherwise have been the case," added Kinder Morgan President Kim Dang. In its 2021 Outlook, Kinder Morgan expects net income for the year to be around $2.7Bln to $2.9Bln.

KOSMOS ENERGY, the US shareholder in the floating LNG projects offshore the West African nations of Mauritania and Senegal, has announced a new leadership team in its exploration division. Kosmos is developing FLNG production under the Greater Tortue-Ahmeyim project with UK major BP as operator, said two executives had been promoted. The Dallas-based company, listed on both the New York Stock Exchange and the London Stock Exchange, said Tim Nicholson had been promoted to Senior Vice President and Head of Exploration, and John Shinol has been promoted to SVP and Chief Geoscientist. Both had joined Kosmos in 2018 and have been part of the company's infrastructure-led exploration (ILX) efforts over that period, primarily in the US Gulf of Mexico and Equatorial Guinea in West Africa.

Nicholson and Shinol were both formerly at Cobalt International Energy where they were responsible for several large discoveries in West Africa (Angola) and the US Gulf of Mexico (North Platte, Anchor, and Heidelberg). Kosmos said that Tracey Henderson, the previous SVP of Exploration, had left Kosmos to pursue other interests. "As we see momentum return to our ILX activities in 2021, I am delighted to have two highly experienced, oil finders leading our exploration efforts," said Andrew G. Inglis, the Kosmos Chairman and Chief Executive. "Tim and John have a long track record of proven-basin exploration success in our focus geographies of West Africa and the US Gulf of Mexico," explained Inglis. "We have a deep hopper of high-quality ILX opportunities, a strong bench strength of exploration talent and have already seen early success in 2021," added the Kosmos CEO. "I would like to thank Tracey for her time at Kosmos, particularly her contribution to the company's frontier basin success in the past," stated Inglis.

In the Senegal and Mauritania operations, Kosmos and partner BP are aiming for the first phase of the planned floating LNG project to be 80 percent completed by the end of 2021. Kosmos said in its most recent earnings statement that it expected nine planned infill wells in the Mauritania- Senegal business to provide near-term production growth and a ramp-up in activity on Phase 1 of the Tortue-Ahmeyim project. Kosmos added that the Tortue-Ahmeyim project had made good progress at the end of 2020 and the project remained on track for first gas in the first half of 2023.

LNG CANADA, the export project in British Columbia, has provided one of the greatest reconciliations ever between Canada and its indigenous peoples in terms of economic participation and is also helping to carry the province out of the Covid-19 slowdown. The LNG Canada project, led by Royal Dutch Shell, is the largest private sector investment in Canada's history with spending of C$40 billion (US$30.2Bln) and the venture's Chief Executive Peter Zebedee has given an update on progress at a Web conference of the International Gas Union, the global body promoting LNG and pipeline gas use worldwide. "We continue to advance work and we're reaching key and important milestones as we remain fully committed to delivering our first cargo by the middle of this decade," said Zebedee.

The CEO stated that since construction began three years ago the liquefaction and export site at Kitimat, 640 kilometres north of Vancouver, is now starting to take shape. "As our activities across all work fronts progress, not surprisingly people are really starting to take notice," stated Zebedee. 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 construction at the brownfield site near Kitimat that had been an energy products terminal before being acquired by Shell in 2011. The US$5-billion pipeline of 670 kilometres is being built by Canada's TC Energy to bring the feed-gas from the Montney natural gas basin to the Kitimat liquefaction and export facility on the Pacific Coast.

The LNG Canada CEO explained that independent analysts had cited LNG Canada as having "a positive ripple effect" throughout the rest of the construction industry across the trades and crafts in BC and into the upstream in the Montney basin. "One highly respected economist estimates that LNG Canada on its own

Diary of events

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June
7th China LNG & Gas International Exhibition
23 - 25 June, 2021
National Exhibition & Convention Centre (NECC), Shanghai, China
https://www.dmgevents.com/events/

August
Canada Gas & LNG Exhibition and Conference
23 - 25 August, 2021
JW Marriott Parq Vancouver, Canada
https://www.canadagaslng.com/

will lift the British Columbia economy in 2021, adding up to a full half percent of all of the provinces gross domestic product," said Zebedee. He also pointed out that support was soaring among the BC population for the joint venture and its aims of providing clean energy for Asia to replace polluting coal. Support among Canadians in BC for the LNG Canada venture has surged from 66 percent to 74 percent, according to independent polling. "As we build the plant there is more awareness about our project and more people now understand the importance to the local economy and to the provincial economy and now they tend to support the project," explained the CEO.

He added that the growing awareness and the favorable impression really hasn't happened by accident and Shell and its partners had worked hard to explain how the venture works with the help and full participation of indigenous communities, their businesses and with the consent of all First Nations in the region. "True reconciliation with our indigenous peoples includes economic reconciliation and that's access to jobs, to training, to education and ensuring that indigenous communities have sustainable long-term benefits from economic development projects such as ours," said the CEO. "I'm really pleased to report that the value of our project's contracts and sub-contracts for indigenous and other local businesses here in British Columbia continues to grow and has now reached over C$3 billion (US$2.2Bln) for indigenous-owned businesses and local businesses," added Zebedee. The CEO also declared that LNG Canada needed to demonstrate what the benefits of natural gas from northeast British Columbia will be for the rest of the world and for places that really need it. "This is another key part of the LNG Canada story with our low-carbon emissions and electrification of our power, as well as upstream emissions controls along the pipeline," added Zebedee. "Carbon-intensity for LNG Canada is going to be a full 35 percent better than the top-performing energy facilities anywhere else in the world and a full 60 percent better than the global weighted average," he said.

MITSUI OSK LINES, the Japanese shipping company with an operating fleet of almost 100 liquefied natural gas carriers, has changed an order with a South Korean shipyard because of the cancellation of the LNG import terminal project for the German North Sea port of Wilhelmshaven. MOL said its order for a floating storage and regasfication unit (FSRU) with South Korean shipbuilder Daewoo Shipbuilding and Marine Engineering (DSME) had been altered to a conventional LNG carrier described as "super large". The Japanese shipping line was forced to act after German utility Uniper called off the Wilhelmshaven import project. MOL ordered the FSRU from DSME in May 2020 and subsequently signed a charter on the ordered unit with the Wilhelmshaven project. The FSRU had been planned for delivery by the end of June 2023.

Wilhelmshaven is Germany's only deep-sea port in the North Sea and would have been capable of offloading the largest LNG carriers. The FSRU for the German port was to have had capacity of 263,000 cubic metres capacity with a unique design tailored to large-scale imports. MOL already has an LNG vessel of similar size, the "MOL FSRU Challenger". Uniper, based in Düsseldorf, said at the end of 2020 that it was unlikely to pursue the LNG venture because of several factors, including the reluctance of market players to make binding bookings for import capacities. Uniper has since then switched its focus to other fuels and under the name "Green Wilhelmshaven", Uniper is working on a feasibility study for the development of a German hydrogen hub. Willhelmshaven was one of two LNG import terminals being planned by Germany at the start of 2020. The second is an onshore facility at Brunsbüttel, a port on the Elbe River, south of Hamburg.

However, with the demise of the Uniper-led Wilhelmshaven LNG project another German import development has come to the fore at the port of Stade, also on the Elbe. Fluxys, the Belgian natural gas grid company and owner of the Zeebrugge LNG import terminal, has agreed to become a partner and operator for the Stade project, known as the Hanseatic Energy Hub. Fluxys will be an industrial partner in Hanseatic Energy whose other additional investor is the Partners Group, a Swiss-listed private asset management firm. Under the development plan, the German terminal will be located about 45 kilometres (28 miles) from Hamburg and be operational by 2026 with capacity of around 8.5 million tonnes per annum of LNG. The terminal replacing Wilhelmshaven will also have facilities for reloading LNG carriers, supplying river barges for bunkering as well as truck and rail-loading capability.

NATIONAL GRID Plc, the owner and operator of Europe's largest LNG import terminal at the Isle of Grain southeast of London and which came on line 16 years ago, has launched an engineering project to safely extend the life-span of the facility's assets. The terminal, located on the Medway-Thames estuary, is presently able to provide up to 25 percent of the UK's gas demand with shipments from nations such as Qatar, Russia, Algeria and Trinidad. In addition to regasification, Isle of Grain LNG offers add-on services including truck-loading bays, reloads, cool-downs and trans-shipments.

National Grid has hired Frazer-Nash, a systems, engineering and technology consultancy to complete the early engineering studies. Frazer-Nash said it was examining the original design intent of the Kent-based facility and its current state of health, to identify the areas of the terminal that would require enhanced investment, overhaul or modifications. "By assessing the plant's compliance with company specifications, industry standards, and health and safety regulations, Frazer-Nash has enabled Grain LNG to ensure it can manage its plant and equipment risk," said the consultancy firm. The company has undertaken both on-site and off-site activities, including system workshops with site engineering and maintenance teams, and site-based asset reviews. "The Grain LNG Phase 1 facility is a large, complex upper tier integrated site," said Philippa Jones of the Frazer-Nash team. "As it was approaching the end of its current operating contract, and developing a business plan for future operations it wanted to understand potential future threats to its plant integrity, and asked us to undertake a systematic and detailed 'Basis of Design' review, as part of an overall life extension review," Jones explained. "In-line with asset management best practice we proposed a technical approach that provided line of sight between Grain LNG's business objectives and detailed engineering assessments," she added. "We focused our efforts on asset criticality, an innovative, risk-based approach that delivered essential insights into the key areas of risk to the facility's long-term operation," stated Jones.

The Isle of Grain terminal began operations in 2005 and is regulated by the UK Office of Gas and Electricity Markets, known as Ofgem. The regasification facility has 1 million cubic metres of LNG storage capacity spread across eight storage tanks and an annual throughput capacity of 20 billion cubic metres of natural gas. The terminal will be expanding its facilities with an additional tank and associated vaporizer capacity, bringing its future annual throughput to 25 Bcm of natural gas, or 18.5 million tonnes per annum of LNG. Frazer-Nash has over 800 employees and works from a network of 10 UK and three Australian locations.

NEXTDECADE Corp., the developer of the US Rio Grande LNG export project, has signed an agreement with Mitsubishi Heavy Industries of Japan to install post-combustion carbon-capture technology at the facility proposed for the Port of Brownsville in Texas. Next Decade and the MHI US subsidiary have signed an engineering services agreement (ESA) for the design, license, and performance guarantee of the KM CDR Process. The Japanese group has developed the KM CDR Process over three decades and the technology is owned by Mitsubishi Heavy Industries Engineering Ltd, part of the MHI group. The CCS project at Rio Grande LNG is expected to enable the capture and permanent geologic storage of more than five million tonnes of carbon dioxide (CO_2) per year. "MHI Group has deployed 13 carbon-capture systems around the world, including the world's largest post-combustion carbon-capture facility that is comparable in size to the first phase of the carbon-capture project at Rio Grande LNG," explained Houston-based NextDecade.

The Rio Grande project will produce 27 million tonnes per annum of LNG from five liquefaction Trains when completed. NextDecade, which has yet to make a final investment decision on the project, recently extended pricing in the construction contract with LNG engineer Bechtel Inc. until the end of December 2021. Additionally, NextDecade said it had agreed with Bechtel to extend the validity of the agreement until July 31, 2022. "We are pleased to have executed an ESA with MHI Group, a widely recognized leader in commercial-scale carbon-capture technology," said Matt Schatzman, NextDecade's Chairman and Chief Executive. "MHI Group's carbon-capture solution is an ideal complement to NextDecade's proprietary processes," added Schatzman. "We look forward to working with MHI Group on the CCS project at Rio Grande LNG, which we expect to be the greenest LNG project in the world," stated the CEO.

Yoshihiro Shiraiwa, the MHI American unit's President and Chief Executive, said he was proud to work with NextDecade on this "world leading" project. "This will

be the world's first application of post-combustion capture for LNG, and we expect this initiative will contribute to realising carbon neutrality in the years ahead," stated Shiraiwa.

NOVATEK, the Russian natural gas producer and LNG project operator and developer, reported first-quarter 2021 preliminary operating results showing that hydrocarbon production totalled 158.1 million barrels of oil equivalent. This included 20.15 billion cubic metres of natural gas and 3,129,00 tons of liquids (gas condensate and crude oil), resulting in an increase in total hydrocarbons produced by 7.9 million barrels of oil equivalent, or 5.3 percent, compared with the first quarter of 2020. "Preliminary natural gas volumes sold in the Russian Federation were 19.56 Bcm, representing an increase of 7.2 percent compared with the prior-year period, whereas LNG volumes sold on international markets amounted to 1.87 Bcm," said Novatek. Novatek owns the largest share in the existing Yamal LNG export plant and is constructing the Arctic LNG II project on the nearby Gydan Peninsula.

Arctic LNG II will produce 19.8 million tonnes per annum of LNG as well as gas concentrate from the principal feed-gas resources, the Utrenneye gas fields, adding to the existing Yamal facility's annual output of 17.5 MTPA. "The total natural gas sales volumes, including volumes of LNG sold, aggregated 21.43 Bcm, representing an increase of 3.6 percent compared with the first quarter of 2020," Novatek added. "The decrease attributable to volumes sold on international markets was mainly due to the decrease of the Yamal LNG shareholders' share, including Novatek' s share of LNG volumes sold on the spot market, and a corresponding increase in Yamal LNG direct sales under long-term contracts," the company explained. Novatek has offices in Moscow, though its corporate headquarters are in Tarko-Sale in the Yamal-Nenets Autonomous District in Western Siberia.

The company said it processed 3,127,000 tons of unstable gas condensate at the Purovsky Processing Plant, representing an increase of 10.8 percent versus the corresponding volumes processed in the prior reporting period. Novatek also processed 1,772,000 tons of stable gas condensate at the Ust-Luga complex, west of St Petersburg, representing a decrease of 0.8 percent in volumes processed at that facility. Petroleum product sales volumes amounted to 1,613,000 tons, including 1,022,000 tons of naphtha, 252,000 tons of jet fuel, and 339,000 tons of fuel oil and gasoil. Novatek also sold 1,020,000 tons of crude oil and 548,000 tons of stable gas condensate. The company noted that at the end of March 2021, Novatek had 0.1 Bcm of natural gas, including LNG, and 713,000 tons of stable gas condensate and petroleum products in storage or transit and recognized as inventory. The Russian company holds 60 percent of the Arctic LNG II project currently under construction and four other 10 percent stakes are shared between various shareholders. The 10 percent holdings belong to French major Total, which is also a shareholder in the Novatek company, China National Petroleum Corp., China National Offshore Corp. and a Japanese investor group comprising Mitsui & Co. and the government institution, the Japan Oil, Gas and Metals National Corp.

QATARGAS Operating Company has awarded Italian energy and LNG engineering company Saipem additional work worth $350 million within the North Field Production offshore project in the Arab Gulf underpinning the Qatar LNG expansion. The Qatargas offshore project is located about 80 kilometres (50 miles) northeast of the mainland of Qatar. The activities to be carried out comprise the construction of two additional riser platforms, two additional connecting bridges with existing wellhead platforms. Saipem said the scope also includes two corrosion resistant carbon steel cladded intra-field pipelines with a length of 13km overall and with the decommissioning of existing pipeline included. "Works associated with the exercise of the options will be fully integrated with the project activities of two contract awards announced earlier this year," added Saipem. "These are the North Field Production Sustainability Offshore and the North Field Production Sustainability Pipeline, which are both part of the strategic development of the North Field production plateau," stated Saipem. "This commercial achievement is a further proof of trust in Saipem by its key client, Qatargas," said the Milan-based company. "Saipem is already working actively on project engineering and site preparation activities and it's looking forward to progress further, by leveraging its competences, assets and technology," it added.

Qatar Petroleum, the parent company of Qatargas, in February 2021 took the final investment decision and signed onshore project engineering contracts with Japanese company Chiyoda Corp. and European-based Technip Energies for the LNG expansion. The expansion will comprise the construction of four Trains for liquefaction to take the Arab Gulf state's output from 77 million tonnes per annum up to 110 MTPA. Each of Qatar's new Trains will have a capacity of up to 8.25 MTPA with associated facilities for gas treatment, natural gas liquids recovery, as well as helium extraction and refining within the Ras Laffan complex. Qatar is then planning to boost capacity further up to 126 MTPA, or even more. Saad Sherida Al-Kaabi, Qatar Petroleum President and Chief Executive, has said that production from the expansions will start by the fourth quarter of 2025 and reach full capacity by late 2026 or early 2027. The total cost of the project will be $28.7 billion, making it one of the industry's largest investments in the past few years and the largest LNG capacity ever built. The contract covering onshore engineering, procurement and construction and signed with the Chiyoda-Technip joint venture is known as the North Field East project.

RAS AL KHAIMAH, the northern-most emirate of seven in the United Arab Emirates, has awarded Italian energy company Eni a licence for Block 7 exploration as the UAE moves to boost its exploitable natural gas resources in addition to being an LNG exporter. The exploration and production sharing agreement was signed between the Chairman of Eni's UAE subsidiary, Fuad Krekshi, and the Chief Executive of the Ras Al Khaimah Petroleum Authority, Nishant Dighe, in the presence of Sheikh Saud bin Saqr Al Qasimi, a member of the Supreme Council of the UAE and Ruler of Ras Al Khaimah.

Block 7 covers an area of 430 square kilometres onshore Ras Al Khaimah. Eni will act as operator of the Block with a 90 percent participating interest and Ras Al Khaimah's National Oil Company subsidiary RAK Gas would have a stake of 10 percent. "Block 7 represents an under-explored acreage in a complex thrust belt geological setting, similar to that of the recent discovery of Mahani in the adjacent Sharjah Emirate," explained Eni. "The newly acquired 3D seismic will allow the joint venture to assess the geological setting of the area and eventually unlock its hydrocarbon potential," said the Milan-based company. "The presence of the existing gas processing facilities in the Emirate would also allow a rapid development of any discoveries," stated Eni.

Eni is already present in the Emirate of Ras Al Khaimah operating Offshore Block A where, after an initial geological and geophysical study period, preparations for drilling operations have started. The acquisition of Block 7 represents another step in Eni's positioning in the Middle East and in the UAE. Abu Dhabi, the largest emirate along with Dubai, is the longest-standing LNG exporter in the Middle East from its Das Island liquefaction plant in the Gulf. Eni holds the largest exploration acreage among the energy majors present in the UAE with more than 26,000 square km gross, comprising eight exploration blocks onshore and in shallow waters offshore across the Emirates of Abu Dhabi, Ras Al Khaimah and Sharjah.

SANTOS has taken a positive final investment decision to proceed with the offshore Barossa natural gas field joint venture to provide new feed gas for the Darwin LNG plant supplying Japan. The project represents the biggest investment in Australia's oil and gas sector since 2012. The Barossa FID, which means US$3.6 billion of spending on the gas and condensate project, kick-starts the US$600 million investment in the Darwin LNG life extension and pipeline tie-in projects, extending Darwin LNG operations for another 20 years. The Santos-operated Darwin liquefaction plant has the capacity to produce around 3.7 million tonnes of LNG per annum. Santos Managing Director and Chief Executive Kevin Gallagher said the FID on Barossa was consistent with Santos strategy for utilising existing infrastructure around the company's core assets. "As we enter this next growth phase, we will remain disciplined in managing our major project costs, consistent with our low-cost operating model," added Gallagher. "As the economy re-emerges from the Covid-19 lockdowns, these job-creating and sustaining projects are critical for Australia, also unlocking new business opportunities and export income for the nation," stated the CEO. "The Barossa and Darwin life extension projects are good for the economy and good for local jobs and business opportunities in the Northern Territory," declared Gallagher. "Barossa and Darwin LNG life extension will create 600 jobs throughout the construction phase and secure 350 jobs for the next 20 years of production at the Darwin LNG facility," he said. ■

Ship-to-shore connections vital in LNG space

UK-based Trelleborg Marine & Infrastructure has delivered ship-to-shore infrastructure for more than 20 years, finding considerable success in the FSRU and LNGC sectors. Technical Editor Ian Cochran investigated.

Richard Hepworth, President of Trelleborg's marine and infrastructure operation, explained: "LNG demand is forecast to grow from 360 mill tonnes in 2020, to 700 mill tonnes by 2040, according to Shell's latest LNG report. In order for the LNG industry to successfully grow to this size, it requires supply chain partners who are able to grow with it and support the ever-increasing application base.

"Over the last 20 years, Trelleborg's marine and infrastructure operation has proven itself as the ideal partner to support such growth. To date, we have supplied nearly 700 ships and terminals with ship/shore links for the large-scale LNG market and 170 systems to the ever-growing LNG fuelling market, with our commitment to the growth of the LNG industry not just on innovation, but also investment into scaling-up the business to meet this growth. One example, is the opening of our new UK facility in 2020, dedicated to the provision of all types of ship-to-shore link (SSL) systems.

"We are also continuing the development of our already substantial service and support capability. While we have always believed it imperative and ensured that our customers have access to a dedicated team of expert engineers who can support such mission-critical operations either on site or via email or telephone our products are now being developed to also allow remote access for first line support operations. Our service team is located across the world, not only for the purposes of providing 24/7 support across different time zones, but also to reduce both mobilisation costs and carbon footprint when serving our client base. In short, our commitment to innovation, scaling up our operations and supply chains and service offerings, means that we are ideally placed to support LNG growth across the industry, to 2040 and beyond," he concluded.

David Pendleton, Managing Director and Andrew Stafford, Technical Director added that having been involved in ship-to-shore emergency shut down (ESD) connections for the past two decades, Trelleborg has seen this market develop rapidly, evolving into a global spot market, where every LNGC built today has the capability of trading to almost all LNG ports globally.

Trelleborg has developed its SSL systems into a fully integrated package. As a result, today vessels don't need to make specific allowances for terminals, as these systems contain all the interfacing hardware and logic for any gas carrier to trade with any terminal.

Trelleborg has also been at the forefront of FSRU projects in addition to standard LNG operations.

"We have seen the expanded requirements of these more complex vessel processes and developed new digital link technology that can be integrated into the existing ship-to-shore link systems, while retaining the legacy of LNGC type trading systems," they said.

This technology is able to be configured via the intuitive operator interface into a link system, providing all of the enhanced ESD and communication requirements of the FSRU operating modes, including offering the FSRU data paths to send and receive process and ethernet data with the shore facility and beyond.

"Trelleborg strives to be both thought leaders and market leaders across its product areas, and ship-to-shore links are no exception. The specialist Trelleborg team located in Hawarden, Wales, has a drive for innovation in technology and service, whether this be a simple cable adaptor to link two dissimilar systems, full development of links to meet project owner specifications, or a service engineer remotely accessing a particular product to provide assistance," they explained.

For LNGC newbuildings, customers are typically shipyards, so standalone links as per the yard's specification are offered. However, for a large LNG terminal project there may be multiple bidding paths for a job, which is dependent on customer requirements.

Significant benefits

Significant benefits can be offered with a complete package. This can include marine fenders, docking and mooring equipment, as well as high accuracy navigation and piloting systems and the ship-to-shore links.

For smaller link projects, such as LPG or LNG fuelled applications, Trelleborg will work closely with the system integrators who may be responsible for providing complete gas handling packages.

Trelleborg Industrial Solutions' suite of products - SSL Link, QRH, hose breakaway and Gutteling hoses in use in a single LNGC application

Links can be supplied and either directly commissioned, or Trelleborg's global support network can provide installation and commissioning support.

More recently, retrofits have increased involving either older equipment or systems provided by third parties, which have reached their limits of operability.

These projects require close co-operation with the vessel operators to allow these changes to take place as efficiently as possible within a limited time frame, to ensure no time is lost, be it at a drydocking or even during a vessel's transit.

In addition, separate company Trelleborg Industrial Solutions is very active in the LNG sector, with products within the company's marine and infrastructure and fluid handling operations, further complimented by a number of recent acquisitions.

For example, the acquisition of the Gutteling Group, one of the world's leading manufacturers of composite hoses, has seen Trelleborg further strengthen its position in LNG transfer and enhances the product range offered by the company's existing composite hose businesses.

The development of a new gas transfer team also helps to ensure that Trelleborg can provide local customer support.

LNG Journal was told that there were a number of synergies that allow both companies to work closely on the same projects. For example, most recently, an SSL system provided for a bunkering barge operating off the US coast, included a new product enhancement of magnetic breakaway umbilical cables.

"Solutions like this would have been possible as separate entities but being able to work together as a single Trelleborg offering brings seamless customer benefits," Pendleton and Stafford said.

To further enhance the growing number of projects and required solutions in this sector, last year Trelleborg set up a specialist office in Houston, Texas to help meet the growing demand and to supply

comprehensive LNG transfer solutions.

The company provided *LNG Journal* with a couple of case studies illustrating the extent of the work undertaken.

Last year, an LNGC reached her mandatory drydock and refit period. This gave the operator the opportunity to extend her useful life, including the critical safety systems. For example, the vessel's original conventional SSL system required an upgrade.

The replacement SSL was part of Trelleborg's SmartPort portfolio. This connects port operations, allowing operators to analyse performance and use data to improve decision making. This system integrates assets, such as fenders, mooring equipment, ship performance monitoring, and navigation systems, all underpinned by cloud technologies.

One of the most significant aspects of the upgrade was to the SSL's cabinet, which is typically installed in the ship's control room.

Cabinet replacement

A new SSL cabinet was fitted, which replaced all of the electronic components and associated hardware, providing new operator interfaces and the latest software. It mimicked the original installation to ensure the critical ESD path, telecommunications and mooring load monitoring functions were maintained.

New electronic components were fitted that can support future replacements, repairs, or spare parts, ensuring that the system is future proofed for continued support. These new components were smaller, thus creating space and enabling easier access for maintenance. They were also easier to integrate.

Other upgrade tasks included replacing components that had suffered heavy use and exposure to the harsh marine environment on the ship's deck, including ship-side connection boxes. They house the connectors to join the ship's SSL to the shore SSL system, when loading and unloading an LNG cargo.

By making use of existing footprints and cabling, commissioning engineers, working closely with the ship and yard's staff, were able to complete the on board installation within a matter of days.

Another job highlighted concerned one of the first LNG bunkering operations to come online.

A company commissioned six LNG-powered offshore support vessels (OSVs) and built a bunkering infrastructure at a base on the US Gulf coast.

By using the ISO 20519 compliant Trelleborg Universal Safety Link (USL), not only did company integrate the emergency shutdown systems at the facility and on the OSVs, but also had a full overview of the process parameters on both sides of the link.

Road tankers

Prior to the completion of the onshore storage facilities, vessels were bunkered directly from road tankers. In this arrangement, the pneumatic shutdown link, forming part of the USL, linked the truck's ESD valve to the on board bunkering shutdown system. However, this method relied on constant radio communication between the truck operator, facility and vessel crew, in order to ensure that the transfer was carried out to safely defined operational requirements.

Multiple trucks were essential to provide the required volumes, further complicating the bunkering.

Although the pneumatic shutdown link is well defined in the original SIGTTO publication, '*ESD Arrangements and Linked Ship/Shore Systems for Liquefied Gas Carriers*', and the subsequent SGMF equivalent publication, the pneumatic pressure levels required by the truck to keep the ESD valve open were in the higher range of the vessel systems' capabilities and required optimising.

As the facility began commissioning its storage capacity, there were two separate stages of LNG transfers. The facility's storage tanks were loaded by several road trucks, enabling bunkering vessels to receive required volumes directly from the facility's tanks. The trucks used the pneumatic shutdown during the tank loadings.

However, with the option to use the terminal's enhanced capabilities of the USL fibre optic system and the 155 Mbps digital synchronous optical networking (SONET) data link, the connection between the terminal facility and the vessels is now one of the most comprehensive in use at any LNG transfer facility. ■

LNGCs and EEXI

Finding a way to include LNGCs in the IMO's Energy Efficiency Existing Ship Index (EEXI) parameters has been challenging.

The IMO has found it difficult to define a suitable carbon emission reference line for this ship type because of the different propulsion systems used, including steam and gas turbines with high specific fuel consumption (SFOC).

Several correction factors are being developed to allow LNGCs to achieve compliance. Jan Wienke, DNV's Principal Engineer - Safety and Systems Engineering, explained, writing in the class society's *Maritime Impact* magazine.

He said that reference lines have been defined for all major ship types, but they all use the 2008 world fleet status as a reference.

LNGCs were originally grouped together with the gas carrier ship type and assigned a correction factor, a so-called 'cubic correction', to account for LNG's low density.

For Energy Efficiency Design Index (EEDI) Phase 1, which applies to ships with a contract date after 1st January, 2015, a separate ship type was defined for LNGCs to give proper consideration to the different propulsion systems found in these vessels and the additional power requirement of reliquefaction equipment on some ships.

Today. this ship type definition now applies to the LNGC fleet in service under the forthcoming EEXI mandate.

Special Treatment

The reasoning behind the special treatment of non-conventional propulsions systems, in particular gas and steam turbines, within the LNGC EEXI requirements was that only about one third of the existing LNGC fleet have direct diesel engine propulsion; another third are powered by steam turbines, and the rest have diesel-electric systems.

The original approach addressed gas carriers with conventional propulsion systems only and would therefore have applied to only one third of the total fleet. Steam turbines make generous use of boil-off gas (BOG), which would leave them at a severe disadvantage if treated like other propulsion systems.

Steam turbine powered LNGCs were the most challenging group because of their very high SFOC, while at the same time, the standard improvement measure, engine power limitation (EPL), is not feasible for steam turbines, as low power operation would actually further increase their SFOC.

In addition, they are no longer installed in new ships. The existing vessels equipped with this propulsion type were designed to run on the cargo BOG, while minimising cargo loss due to boil-off, he explained.

To counteract this, somehow the BOG has to be physically dealt with on board, either by using it as fuel or by reliquefying it, which costs extra energy. Whichever approach was chosen when a particular vessel was built, there needs to be a way to account for it in the equation to treat that ship type fairly.

Each of the three different propulsion types needs to be considered separately:

1) Diesel engines can be converted to or replaced by dual-fuel engines, or an EPL device can be installed.

Jan Wienke, Principal Engineer, DNV

2) Diesel-electric systems usually have dual-fuel engines, which can use the BOG and should not require any additional measures. EPL can be applied to these where appropriate.
3) Steam turbine ships have no feasible alternative to the use of BOG for propulsion because this is how they are designed. The BOG has to be accounted for in the EEXI calculation. ■

LNG bunkering scale-up drives new innovation

Maintaining efficient delivery and safety will be two of the major challenges for LNG bunkering operations as infrastructure scales-up rapidly in the near-term, according to fuelling specialist GTT (Gaztransport & Technigaz). Fuelling editor Malcolm Ramsay has more

The dramatic shift towards low-emission fuel sources over the last year is set to drive profound changes in the marine sector with GTT predicting further growth in LNG bunkering throughout the rest of 2021, and the following years.

"In the past year, there has been an increase in large LNG bunkering operations. The number of large LNG fuelled container vessels is increasing rapidly, as well the number of very large LNG fuelled tankers and bulkers, resulting in increased demand for LNG infrastructure. The major challenge will be to keep a safe and efficient delivery with such a rapid ramp-up," Alexandre Tocatlian, Head of Product Lines forLNG as Fuel, Commercial Division at GTT, told *LNG Journal*.

"Future-proof" solutions

To meet this challenge, new technologies are expected to play a key role as systems move from the early-growth phase into mature solutions that are likely to be in place for decades to come.

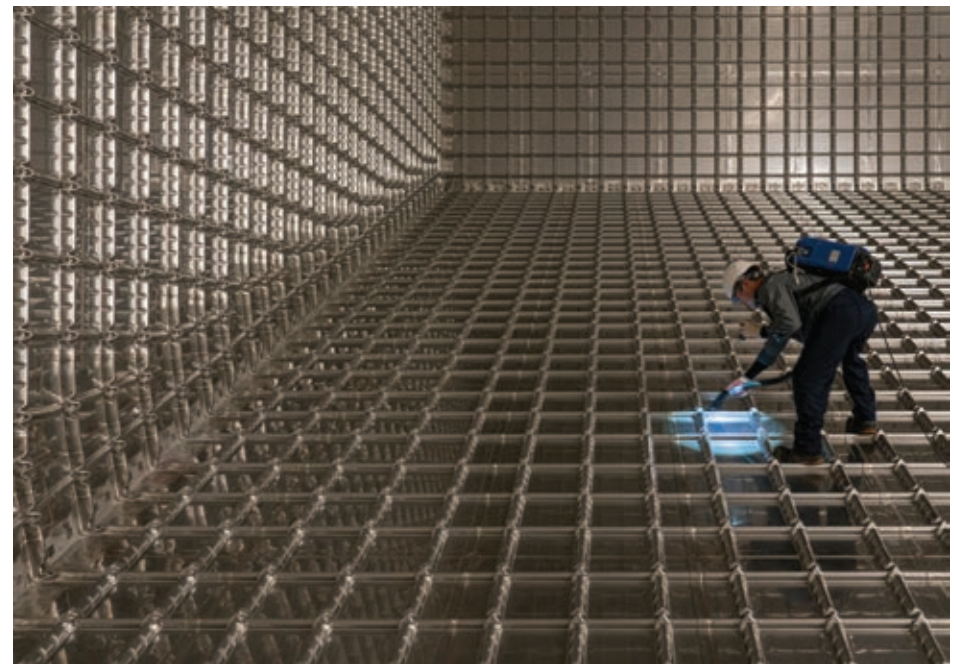
"We see a great interest from the market for "future-proof" solutions. This often translates in being able to bunker various types of fuel without major conversion to the vessel. GTT is currently developing and offering the only tank solution that is able to carry LNG as well as Ammonia. Besides, we see digital technology gaining momentum as a solution to improve efficiency and we are now in a position to address this expanding market with our subsidiaries Ascenz & Marorka," Tocatlian adds.

Headquartered in Saint-Rémy-lès-Chevreuse in France, GTT is one of the world's leading experts in containment systems for the storage and transportation of LNG.

Digitalization + AI

Central to the next-generation of technologies will be a digital-first approach that embraces advances such as machine learning to automatically augment performance. At the start of April, GTT announced the launch of a digital solution for sloshing activity assessment to optimise LNG membrane tank maintenance frequency. Based on GTT's "Sloshing Virtual Sensor" technology, the solution obtained Approval in Principle (AiP) from standards agency Bureau Veritas within the Framework of Class Survey.

"Digitalization combined with artificial intelligence is a major transformation for the shipping industry bringing new challenges and opportunities. I am proud Bureau Veritas helped GTT to pioneer this digital solution for sloshing activity assessment in the framework of class survey (using sloshing model tests, real-time operational data and machine learning) with the highest safety standards. This demonstrates not only our technical expertise in the fields of sloshing for gas carriers but also our strong competencies in digitalization and artificial intelligence. Our role remains more than ever to help the industry understand - and address - both risk and opportunity as we look into future technologies," Matthieu de Tugny, Executive Vice President Marine & Offshore at Bureau Veritas, said.



Inspection of GTT Mark III membrane system (credit GTT- Peder Otto Dybvik)

Utilising a digital twin of the LNG tank, the system processes real-time operational data of the FSRU, FLNG and LNGC floating units to monitor the evolution of critical parameters with regards to the tank integrity.

"Artificial intelligence combined with the expertise of GTT's teams has made it possible to develop a unique digital solution to optimise the frequency of tank maintenance, while guaranteeing the highest safety standard. With this new cutting-edge digital solution, GTT is putting its innovation and technological know-how at the service of ship-owners, in order to help them adapt to an increasingly demanding commercial environment" Philippe Berterottière, Chairman and CEO of GTT, said.

Asian growth engine

Alongside a shift in technology, the next wave of growth is also expected to be underpinned by the development of new geographies as demand for LNG in Asia rises rapidly this decade.

"We see a new dynamic for LNG bunkering infrastructure in Asia, with a great interest in bunkering large amount of LNG in Singapore and China. Meanwhile the infrastructure keeps expanding in Europe and US East Cost. For all areas, GTT offers a standardised solution, already in place in Rotterdam and soon to be deployed in Singapore and Mediterranean. Although European ship-owners and charterers are a bit ahead, we see the request for LNG fuelled ships spreading world-wide," Tocatlian adds.

GTT predicts that the Container Vessels segment will help to drive a resurgence in LNG projects in 2021 and the following years, following disruptions caused by the pandemic last year.

"We see main yards filling their slots with many container orders until 2023, with a reasonable part of LNG fuelled vessels. Regarding LNG fuelled vessels, GTT is currently working on the upcoming deliveries of two key projects. In May 2021, we should see the delivery from Jiangnan shipyard (China) of the first vessel of a series of 5 x 15K TEU vessels for CMA CGM, equipped with GTT membrane system. In summer 2021will be another exciting milestone for GTT, with the delivery from Vard shipyard (Norway) of the luxury expedition vessel for PONANT, the first cruise vessel equipped with GTT membrane system," Tocatlian concludes. ■

Bunkering of the CMA CGM Jacques Saadé by the Gas Agility (Credit- CMA CGM)

World LNG Carrier Fleet

LNG Carrier	Capacity m^3	Registered Owner	Builder	Delivery	Flag	Power Plant	Cargo System	No. of Tanks	Original Project
Aamira	268,000	Nakilat SHI 1753 Inc.	Samsung	Apr-10	Marshall Is.	Diesel	TZ Mk. III	10	Qatargas IV
Abadi	135,000	BGC One Nbd Sdn Bhd.	Mitsubishi	May-02	Brunei	Steam	Moss	5	Lumut
Adam LNG	162,000	Adam Maritime Transportation	HHI	Jul-14	Marshall Is.	Diesel	Membrane	4	Oman LNG
Adriano Knutsen	180,000	Hai Feng 1717 Ltd.	HHI	Jul-19	Spain	ME-GI	TZ Mk. III Flex Plus	4	Corpus Christi
Al Aamriya	210,168	J5 Nakilat No. 1 Ltd.	Daewoo	May-08	Marshall Is.	Diesel	GT NO 96	5	RasGas III
Al Areesh	148,786	Al Areesh LLC	Daewoo	Jan-07	Bahamas	Steam	GT NO 96	4	RasGas II
Al Bahiya	210,100	Nakilat DSME 2286 Inc.	Daewoo	Dec-09	Marshall Is.	Diesel	TZ Mk. III	5	Qatargas IV
Al Biddah	137,339	Mitsui/Nippon/Kawasaki/Iino	Kawasaki	Nov-99	Japan	Steam	Moss	5	Qatargas I
Al Daayen	148,853	Al Daayen LLC	Daewoo	Mar-07	Bahamas	Steam	GT NO 96	4	RasGas II
Al Dafna	268,000	Nakilat SHI 1726 Inc.	Samsung	Oct-09	Marshall Is.	Diesel	GT NO 96	10	RasGas
Al Deebel	145,000	Peninsula LNG Transport No. 3	Samsung	Nov-05	Bahamas	Steam	TZ Mk. III	4	RasGas II
Al Gattara	216,200	Overseas LNG H1 Corp.	HHI	Nov-07	Marshall Is.	Diesel	TZ Mk. III	4	Qatargas II
Al Ghariya	210,150	Julia Neptora	Daewoo	Dec-07	Bahamas	Diesel	GT NO 96	4	Qatargas II
Al Gharrafa	216,200	Overseas LNG H2 Corp.	HHI	Jan-08	Marshall Is.	Diesel	TZ Mk. III	5	Qatargas II
Al Ghashamiya	217,591	Nakilat SHI 1696 Inc.	Samsung	Apr-09	Marshall Is.	Diesel	TZ Mk. III	10	Qatargas III
Al Ghuwairiya	263,300	Nakilat Al Ghuwairiya Inc.	Daewoo	Dec-08	Marshall Is.	Diesel	GT NO 96	5	Qatargas II
Al Hamla	216,200	Overseas LNG S2 Corp.	Samsung	Feb-08	Marshall Is.	Diesel	TZ Mk. III	4	Qatargas II
Al Hamra	137,000	Al Hamra Ltd.	STX	Nov-96	Liberia	Steam	Moss	4	Das Island
Al Huwaila	217,000	Al Huwaila Inc.	Samsung	May-08	Bahamas	Diesel	TZ Mk. III	10	RasGas III
Al Jasra	137,227	Mitsui/Nippon/Kawasaki/Iino	Mitsubishi	Jun-00	Japan	Steam	Moss	5	Qatargas I
Al Jassasiya	145,700	Venice Maritime	Daewoo	May-07	Greece	Steam	GT NO 96	4	RasGas II
Al Karaana	210,100	Nakilat DSME 2284 Inc.	Daewoo	Oct-09	Marshall Is.	Diesel	GT NO 96	4	Qatargas III
Al Kharaitiyat	216,300	Nakilat HHI 1909 Inc.	HHI	Jun-09	Marshall Is.	Diesel	TZ Mk. III	4	Qatargas III
Al Kharsaah	217,000	Al Kharsaah Inc.	Samsung	Jun-08	Bahamas	Diesel	TZ Mk. III	10	RasGas III
Al Khattiya	210,150	Nakilat DSME 2283 Inc.	Daewoo	Jul-09	Marshall Is.	Diesel	GT NO 96	4	Qatargas IV
Al Khaznah	135,496	Al Khaznah Inc.	Mitsui E&S	Jul-94	Liberia	Steam	Moss	5	Das Island
Al Khor	137,354	Mitsui/Nippon/Kawasaki/Iino	Mitsubishi	Nov-96	Japan	Steam	Moss	5	Qatargas I
Al Khuwair	217,000	Al Khuwair Inc.	Samsung	Jun-08	Bahamas	Diesel	TZ Mk. III	10	RasGas III
Al Mafyar	266,000	Nakilat SHI 1697 Inc.	Samsung	Apr-09	Marshall Is.	Diesel	TZ Mk. III	5	Qatargas III
Al Marrouna	149,539	Al Marrouna LLC	Daewoo	Sep-06	Bahamas	Steam	GT NO 96	4	RasGas II
Al Mayeda	266,000	Nakilat SHI 1694 Inc.	Samsung	Jan-09	Marshall Is.	Diesel	TZ Mk. III	5	Qatargas III
Al Nuaman	210,100	Nakilat DSME 2285 Inc.	Daewoo	Dec-09	Marshall Is.	Diesel	GT NO 96	4	Qatargas III
Al Oraiq	210,200	J5 Nakilat No. 3 Ltd.	Daewoo	Jun-08	Marshall Is.	Diesel	GT NO 96	18	RasGas III
Al Rayyan	137,420	Mitsui/Nippon/Kawasaki/Iino	Kawasaki	Mar-97	Japan	Steam	Moss	5	Qatargas I
Al Rekayyat	216,293	Nakilat HHI 1910 Inc.	HHI	Jun-09	Marshall Is.	Diesel	TZ Mk. III	4	Qatargas III
Al Ruwais	210,150	Alexandra Neptana	Daewoo	Aug-07	Bahamas	Diesel	GT NO 96	4	Qatargas II
Al Sadd	210,200	Nakilat DSME 2265 Inc.	Daewoo	Mar-09	Marshall Is.	Diesel	GT NO 96	12	Qatargas III
Al Safliya	210,150	Britta Nausola	Daewoo	Sep-07	Bahamas	Diesel	GT NO 96	5	Qatargas II
Al Sahla	216,200	J5 Nakilat No. 5 Ltd.	HHI	Jun-08	Marshall Is.	Diesel	TZ Mk. III	4	RasGas III
Al Samriya	263,300	Nakilat Al Samriya Inc.	Daewoo	Feb-09	Marshall Is.	Diesel	GT NO 96	5	Qatargas II
Al Shamal	217,000	Al Shamal Inc.	Samsung	Apr-08	Bahamas	Diesel	TZ Mk. III	10	RasGas III
Al Sheehaniya	210,100	Nakilat DSME 2264 Inc.	Daewoo	Feb-09	Marshall Is.	Diesel	GT NO 96	12	Qatargas III
Al Thakhira	145,000	Peninsula LNG Transport No. 2	Samsung	Aug-05	Bahamas	Steam	TZ Mk. III	4	RasGas II
Al Thumama	216,200	J5 Nakliat No. 2 Ltd.	HHI	Feb-08	Marshall Is.	Diesel	TZ Mk. III	4	RasGas III
Al Utouriya	215,000	J5 Nakilat No. 8 Ltd.	HHI	Sep-08	Marshall Is.	Diesel	TZ Mk. III	4	RasGas III
Al Wajbah	137,308	Mitsui/Nippon/Kawasaki/Iino	Mitsubishi	Jun-97	Japan	Steam	Moss	5	Qatargas I
Al Wakrah	137,371	Mitsui/Nippon/Kawasaki/Iino	Kawasaki	Nov-98	Japan	Steam	Moss	5	Qatargas I
Al Zubarah	137,573	Mitsui/Nippon/Kawasaki/Iino	Mitsui E&S	Nov-96	Japan	Steam	Moss	5	Qatargas I
Alto Acrux	147,798	Bahamas LNG Transport Ltd.	Mitsubishi	Mar-08	Bahamas	Steam	Moss	4	Darwin LNG
Amadi	154,800	BGC Four Nbd Sdn Bhd.	HHI	Jul-15	Brunei	DFDE	Membrane	4	Lumut
Amali	148,000	BGC Spv Nbd Sdn Bhd.	Daewoo	Aug-11	Brunei	DFDE	GT NO 96	4	Lumut
Amani	154,800	BGC Three Nbd Sdn Bhd.	HHI	Oct-14	Brunei	DFDE	Membrane	4	Lumut
Amberjack LNG	174,000	Xiang Ch17 HK International	HHI	Apr-20	Malta	X-DF	TZ MK. III Flex	4	Portfolio
Amur River	149,700	Seacrown Maritime Ltd.	HHI	Nov-07	Marshall Is.	Steam	TZ Mk. III	4	Sakhalin II
Arctic Aurora	155,000	Fareastern Shipping Ltd.	HHI	Jul-14	Malta	Diesel/Gas-Electric	TZ Mk. III	4	Snøhvit LNG
Arctic Discoverer	142,612	Northern LNG Trans Co. I Ltd.	Mitsui E&S	Feb-06	Bahamas	Steam	Moss	4	Hammerfest
Arctic Lady	147,200	Barents Leasing Ltd.	Mitsubishi	Apr-06	Norway	Steam	Moss	4	Hammerfest
Arctic Princess	147,200	Rb-Quadrangle Leasing Ltd.	Mitsubishi	Jan-06	Norway	Steam	Moss	4	Hammerfest
Arctic Spirit	89,800	Arctic Spirit LLC	Ishikawajima	Dec-93	Bahamas	Steam	IHI SPB	4	Atlantic LNG
Arctic Voyager	142,759	Northern LNG Trans Co. II Ltd.	Kawasaki	Jul-06	Bahamas	Steam	Moss	4	Hammerfest
Aristidis I	174,000	Atrotos Gas Carrier Corp.	HHI	Jan-21	Malta	X-DF	TZ Mk. III Flex	4	Portfolio
Aristos I	174,000	Xiang Ch25 HK International	HHI	Nov-20	Malta	X-DF	TZ Mk. III Flex	4	Portfolio
Arkat	148,000	BGC Spv Nbd Sdn Bhd.	Daewoo	Feb-11	Brunei	DFDE	GT NO 96	4	Lumut
Arwa Spirit	165,500	Membrane Shipping Ltd.	Samsung	Aug-08	Marshall Is.	Diesel/Gas-Electric	TZ Mk. III	4	Balhaf
Aseem	155,003	India LNG Transport Co. No. 3	Samsung	Nov-09	Malta	Diesel	TZ Mk. III	4	RasGas

Asia Endeavour	160,000	Chevron Transport Corp. Ltd.	Samsung	Jun-15	Bahamas	Diesel/Gas-Electric	TZ MK. III	4	Gorgon
Asia Energy	154,800	Chevron Transport Corp. Ltd.	Samsung	Oct-14	Bahamas	DFDE	TZ MK. III	4	Gorgon
Asia Excellence	160,000	Chevron Transport Corp. Ltd.	Samsung	Feb-15	Bahamas	DFDE	TZ MK. III	4	Gorgon
Asia Integrity	160,000	Chevron Transport Corp. Ltd.	Samsung	Feb-17	Bahamas	DFDE	TZ Mk. III	4	Wheatstone
Asia Venture	160,000	Chevron Transport Corp. Ltd.	Samsung	Jul-17	Bahamas	Diesel/Gas-Electric	TZ Mk. III Flex	4	Wheatstone
Asia Vision	154,800	Chevron Transport Corp. Ltd.	Samsung	Jul-14	Bahamas	Diesel/Gas-Electric	TZ MK. III	4	Gorgon
Barcelona Knutsen	173,400	Norspan LNG V AS	Daewoo	Jan-10	Spain	Diesel/Gas-Electric	GT NO 96	4	Portfolio
Beidou Star	172,000	Capricorn LNG Shipping Ltd.	Hudong Zhonghua	Sep-15	Hong Kong	Diesel	TZ MK. III	4	PNG LNG
Berge Arzew	138,088	Berge Arzew/Sonatrach Berge	Daewoo	Jul-04	Bahamas	Steam	GT NO 96	4	Arzew
Bilbao Knutsen	138,000	Norspan LNG AS	Izar	Jan-04	Spain	Steam	GT NO 96	4	Portfolio
Bishu Maru	164,700	Trans Pacific Shipping 3 SA	Kawasaki	Dec-17	Panama	TFDE	Moss	4	Wheatstone
Bonito LNG	174,000	Xiang Ch18 HK International	HHI	May-20	Malta	X-DF	TZ MK. III Flex	4	Portfolio
Boris Davydov	172,410	Hai Kuo Shipping 1605 Ltd.	Daewoo	Dec-18	Cyprus	TFDE - Azipod	GT NO 96 GW	4	Yamal
Boris Vilkitsky	172,410	Hai Kuo Shipping 1601 Ltd.	Daewoo	Jun-17	Cyprus	TFDE - Azipod	GT NO 96 GW	4	Yamal
British Achiever	173,644	Ngoti No. 20 Spc B SA	Daewoo	Nov-18	Isle of Man	ME-GI	GT NO 96	4	Freeport
British Contributor	173,644	Hai Kuo Shipping 1533 Ltd.	Daewoo	Dec-18	Isle of Man	ME-GI	GT NO 96	4	Freeport
British Listener	173,644	Hai Kuo Shipping 1535 Ltd.	Daewoo	Jan-19	Isle of Man	ME-GI	GT NO 96	4	Freeport
British Mentor	173,644	Ngoti No. 20 Spc C SA	Daewoo	Mar-19	Isle of Man	ME-GI	GT NO 96	4	Freeport
British Partner	173,400	Ngoti No. 20 Spc A SA	Daewoo	Jun-18	Isle of Man	ME-GI	GT NO 96	4	Freeport
British Sapphire	155,000	Sg Leasing Gems Ltd.	HHI	Jun-08	Isle of Man	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
British Sponsor	173,644	Ngoti No. 20 Spc D SA	Daewoo	May-19	Isle of Man	ME-GI	GT NO 96	4	Freeport
Broog	137,529	Mitsui/Nippon/Kawasaki/Iino	Mitsui E&S	Apr-98	Japan	Steam	Moss	5	Qatargas I
Bu Samra	266,000	Nakilat Bu Samra Inc.	Samsung	Dec-08	Marshall Is.	DRL	TZ Mk. III	5	Qatargas II
Bushu Maru	180,000	Trans Pacific Shipping 6 Ltd.	Mitsubishi	Jul-19	Bahamas	Reheat Steam Turbine	TZ MK. III Flex	4	Sabine Pass
BW Boston	138,059	BW Gas Global LNG DA	Daewoo	Jan-03	Norway	Steam	GT NO 96	4	Atlantic LNG
BW Brussels	162,400	BW LNG IV Pte Ltd.	Daewoo	Aug-09	Singapore	Diesel/Gas-Electric	GT NO 96	4	Balhaf
BW Everett	138,028	Everett LNG Pte Ltd.	Daewoo	Jun-03	Singapore	Steam	GT NO 96	4	Atlantic LNG
BW Lesmes	174,000	BW Gas AS	Daewoo	Mar-21	Bermuda	ME-GI	Membrane	4	Portfolio
BW Lilac	173,400	Helianthus Navigation Corp.	Daewoo	Mar-18	Malta	ME-GI	GT NO 96	4	Portfolio
BW Magna	173,000	BW FSRU III Pte Ltd.	Daewoo	Mar-19	Sinapore	DFDE	TZ MK. III Flex	4	Portfolio
BW Magnolia	173,400	Helen Navigation Pte Ltd.	Daewoo	Feb-20	Singapore	ME-GI	GT NO 96	4	Portfolio
BW Paris	162,400	BW FSRU IV Pte Ltd.	Daewoo	Jul-09	Sinapore	Diesel/Gas-Electric	GT NO 96	4	Balhaf
BW Pavilion Aranda	173,400	BW Diamond LNG Pte Ltd.	Daewoo	Sep-19	Singapore	ME-GI	TZ MK. III Flex	4	Portfolio
BW Pavilion Aranthera	173,400	BW Diamond LNG Pte Ltd.	Daewoo	Jul-20	Singapore	ME-GI	GT NO 96	4	Portfolio
BW Pavilion Leeara	158,629	BW Pavilion Leeara Pte Ltd.	HHI	Jun-15	Singapore	Diesel/Gas-Electric	Membrane	4	Portfolio
BW Pavilion Vanda	155,000	BW Pavilion Vanda Pte Ltd.	HHI	Feb-15	Singapore	DFDE	Membrane	4	Portfolio
BW Tatiana	135,269	FSRU Development Pte Ltd.	Mitsubishi	Dec-02	Marshall Is.	Steam	Moss	5	Atlantic LNG
BW Tulip	173,400	BW LNG I Pte Ltd.	Daewoo	Dec-17	Singapore	ME-GI	GT NO 96	4	Portfolio
Cadiz Knutsen	138,826	Norspan LNG II As	Navantia	Apr-04	Spain	Steam	GT NO 96	4	Portfolio
Cape Ann	145,130	SRV Joint Gas Two Ltd.	Samsung	Apr-10	Norway	Diesel/Gas-Electric	TZ Mk. III	4	Jaigarh LNG
Castillo De Caldelas	176,300	La Arena Nav SA	Imabari Shipbuilding	Jun-18	Malta	ME-GI	TZ Mk. III Flex	4	Portfolio
Castillo de Merida	176,300	San Isidro LNG I BV	Imabari Shipbuilding	Mar-18	Malta	ME-GI	TZ MK. III Flex	4	Portfolio
Castillo de Santisteban	170,000	Trans Gas Naviera Aie	STX	Jun-10	Malta	Diesel Electric	GT NO 96	4	Portfolio
Castillo de Villalba	138,000	Trans Gas Naviera Aie	Navantia Cadiz	Sep-03	Spain	Steam	GT NO 96	4	Portfolio
Catalunya Spirit	138,000	Teekay Gas III SL	Izar	Jun-03	Spain	Steam	GT NO 96	4	Atlantic LNG
Celsius Canberra	180,000	Xiang CH27 HK Int.	Samsung	Jan-21	Marshall Is.	X-DF	Membrane	4	Portfolio
Celsius Copenhagen	180,000	Greenheart Gas Shipco I LLC	Samsung	Nov-20	Marshall Is.	X-DF	TZ Mk. III Flex Plus	4	Portfolio
CESI Beihai	174,000	China Energy Aspiration LNG	Hudong Zhonghua	Jun-17	Hong Kong	TFDE	GT NO 96	4	APLNG
CESI Gladstone	174,000	China Energy Aspiration LNG	Hudong Zhonghua	Oct-16	Hong Kong	TFDE	GT NO 96	4	APLNG
CESI LianYungAng	174,000	China Energy Glory LNG	Hudong Zhonghua	Jun-18	Hong Kong	TFDE	GT NO 97	4	APLNG
CESI Qingdao	174,000	China Energy Hope LNG	Hudong Zhonghua	Feb-17	Hong Kong	TFDE	GT NO 96	4	APLNG
CESI Tianjin	174,000	China Energy Pioneer LNG	Hudong Zhonghua	Jul-17	Hong Kong	TFDE	GT NO 96	4	APLNG
CESI Wenzhou	174,000	China Energy Peace LNG	Hudong Zhonghua	Feb-18	Hong Kong	Diesel-Electric	GT NO 96	4	APLNG
Cheikh Bouamama	75,558	Skikda LNG Trans Corp.	Universal SB	Jul-08	Bahamas	Steam	TZ Mk. III	4	Arzew/Skikda
Cheikh El Mokrani	75,759	Mediterranean LNG Transport	Japan Marine United	Jun-07	Bahamas	Steam	TZ Mk. III	4	Skikda
Christophe de Margerie	170,000	Zelitiko Shipping Co. Ltd.	Daewoo	Nov-16	Cyprus	Diesel/Gas-Electric	GT NO 96 GW	4	Yamal
Clean Energy	149,700	Pegasus Shipholding SA	HHI	Mar-07	Marshall Is.	Steam	TZ Mk. III	4	Portfolio
Clean Horizon	162,000	Sea 43 Leasing Co Ltd.	HHI	Apr-15	Malta	Diesel/Gas-Electric	Membrane	4	Portfolio
Clean Ocean	162,000	Cdbl Ocean Ltd.	HHI	May-14	Marshall Is.	Diesel/Gas-Electric	Membrane	4	Sabine Pass
Clean Planet	162,000	Cdbl Planet Ltd.	HHI	Aug-14	Marshall Is.	Diesel Electric	Membrane	4	Yamal
Clean Vision	162,000	Sea 44 Leasing Co. Ltd.	HHI	Aug-15	Malta	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
CNTIC VPower Global	28,260	CNTIC VPower LNG Logistics	COSCO (Dalian) Shipyard Co.	Apr-20	Hong Kong	Diesel/Gas-Electric	GT NO 96	4	Portfolio
Cobia LNG	174,000	Cardiff LNG ETA Owning LLC	HHI	Feb-21	Malta	X-DF	NO-96-GW+PRS	4	Portfolio
Cool Discoverer	174,000	Serendipity Maritime Ltd.	HHI	Sep-20	Malta	X-DF	TZ MK. III Flex	4	Portfolio
Cool Explorer	160,000	Safe Port Marine Ltd.	Samsung	Jan-15	Malta	DFDE	TZ Mk. III	4	Spot
Cool Racer	174,000	Eloquent Shipping	Samsung	Feb-21	Malta	X-DF	NO-96-GW+PRS	4	Portfolio
Cool Runner	160,000	Priority Maritime Corp.	Samsung	Mar-14	Malta	Diesel Electric	TZ Mk. III	4	Wheatstone
Cool Voyager	160,000	Energy Shipping & Trading SA	Samsung	Oct-13	Malta	TFDE	TZ Mk. III	4	Wheatstone
Coral Encanto	30,000	Maxluck Plus Ltd.	Ningbo Xinle	Jul-20	Marshall Is.	DFDE	Cylinders	2	Portfolio

Corcovado LNG	160,162	Oceanus LNG Alpha LLC	Daewoo	Apr-14	Malta	Diesel Electric	GT NO 96	4	Spot
Creole Spirit	173,400	Hai Jiao 1601 Ltd.	Daewoo	Feb-16	Bahamas	ME-GI	GT NO 96	4	Sabine Pass
Cubal	160,276	Mint LNG IV Ltd.	Samsung	Jan-12	Bahamas	DFDE	TZ Mk. III	4	Soyo
Cygnus Passage	145,400	Cygnus LNG Shipping Ltd.	Mitsubishi	Jan-09	Bahamas	Steam	Moss	4	Sakhalin II
Dapeng Moon	147,200	Yue Gang LNG Shipping Co. Ltd.	Hudong Zhonghua	Jul-08	Hong Kong	Steam	TZ MK. III	4	Pluto
Dapeng Star	147,210	Yue Yang LNG Shipping Co. Ltd.	Hudong Zhonghua	Nov-09	Hong Kong	Steam	TZ MK. III	4	Pluto
Dapeng Sun	147,200	Yue Peng LNG Shipping Co. Ltd.	Hudong Zhonghua	Apr-08	Hong Kong	Steam	GT NO 96	4	North West Shelf
Diamond Gas Metropolis	174,000	Diamond LNG Shipping 4 Ltd.	HHI	Nov-20	Bahamas	X-DF	TZ Mk. III Flex	4	Portfolio
Diamond Gas Orchid	165,000	Diamond LNG Shipping 1 Pte Ltd.	Mitsubishi	Jun-18	Bahamas	STaGE	Sayaringo	4	Cameron
Diamond Gas Rose	165,000	Diamond LNG Shipping 2 Pte Ltd.	Mitsubishi	Aug-18	Bahamas	STaGE	Sayaringo	4	Cameron
Diamond Gas Sakura	165,000	Diamond LNG Shipping 3 Pte Ltd.	Japan Marine United	May-19	Bahamas	STaGE	Sayaringo	4	Cameron
Disha	136,025	India LNG Transport Co. No. 1	Daewoo	Dec-03	Malta	Gas Turbine	GT NO 96	4	RasGas
Doha	137,262	Mitsui/Nippon/Kawasaki/Iino	Mitsubishi	Jun-99	Japan	Steam	Moss	5	Qatargas I
Dorado LNG	174,000	Cardiff LNG Epsilon Owning LLC	Samsung	Dec-20	Malta	X-DF	TZ Mk. III Flex	4	Portfolio
Duhail	210,150	Gabriela Nauranto	Daewoo	Dec-07	Bahamas	Diesel	GT NO 96	4	Qatargas II
Dukhan	137,661	LNG Water Lily Shipping Corp.	Mitsui E&S	Sep-04	Liberia	Steam	Moss	5	Qatargas II
East Energy	122,255	Sinokor Maritime Co. Ltd.	STX	Aug-82	South Korea	Steam	Membrane	4	NLNG
Eduard Toll	172,410	TC LNG Explorer I LLC	Daewoo	Sep-17	Bahamas	TFDE - Azipod	GT NO 96 GW	4	Yamal
Ejnan	145,000	Peninsula LNG Transport No. 4	Samsung	Jan-07	Bahamas	Steam	TZ Mk. III	4	RasGas II
Ekaputra	136,400	Hikmah Sarana Bahari Pt.	Mitsubishi	Jan-89	Indonesia	Steam	Moss	5	Bontang
Elisa Larus	174,000	Caroline 77 Sasu	Hyundai Samho	May-20	France	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Energy Advance	147,624	Tokyo LNG Tanker/Toho LNG	Kawasaki	Mar-05	Japan	Steam	Moss	4	Portfolio
Energy Atlantic	156,000	Spectacle Shipping & Trading	STX	Sep-15	Malta	TFDE	Moss	4	Sabine Pass
Energy Confidence	153,000	Tokyo LNG Tanker/Nippon Yusen	Kawasaki	Apr-09	Japan	Steam	Moss	4	Darwin LNG
Energy Endeavour	173,400	Rossini Navigation SA	Daewoo	Jan-21	Marshall Is.	ME-GI	TZ Mk. III Flex	4	TBC
Energy Frontier	147,599	Tokyo LNG Tanker Co. Ltd.	Kawasaki	Sep-03	Japan	Steam	Moss	4	Sakhalin II
Energy Glory	165,000	Tokyo LNG Tanker/Nippon Yusen	Japan Marine United	Mar-19	Japan	TFDE	TZ Mk. III Flex Plus	4	Cove Point
Energy Horizon	177,000	Tokyo LNG Tanker/Nippon Yusen	Kawasaki	Aug-11	Japan	Steam	Moss	4	Pluto
Energy Innovator	165,000	Tokyo LNG Tanker/Mitsui OSK	Japan Marine United	Jun-19	Japan	TFDE	TZ Mk. III Flex Plus	4	Cove Point
Energy Liberty	165,000	Tokyo LNG Tanker/Mitsui OSK	Japan Marine United	Oct-18	Japan	TFDE	TZ Mk. III Flex Plus	4	Cove Point
Energy Navigator	145,000	Tokyo LNG Tanker/Mitsui OSK	Kawasaki	May-08	Japan	Steam	Moss	4	Sakhalin II
Energy Pacific	173,400	Ravel Navigation SA	Daewoo	Aug-20	Marshall Is.	ME-GI	TZ Mk. III Flex	4	Portfolio
Energy Progress	147,558	Jovial Shipping Navigation SA	Kawasaki	Nov-06	Bahamas	Steam	Moss	4	Darwin LNG
Energy Universe	166,571	Lusby Shipping SA	Japan Marine United	Aug-19	Panama	TFDE	TZ Mk. III Flex	4	Cove Point
Enshu Maru	164,700	Trans Pacific Shipping 4 SA	Kawasaki	Aug-18	Panama	Reheat Steam Turbine	Moss	4	Wheatstone
Esshu Maru	153,000	Trans Pacific Shipping 2 Ltd.	Mitsubishi	Dec-14	Bahamas	Steam	Sayaendo	4	Portfolio
Etyfa Prometheas	135,269	Enlink Trading FZE	Mitsubishi	Oct-02	Cyprus	Steam	Moss	5	Portfolio
Excalibur	138,034	Solaia Shipping LLC	Daewoo	May-02	Belgium	Steam	GT NO 96	4	Portfolio
Fedor Litke	172,410	Hai Kuo Shipping 1602 Ltd.	Daewoo	May-17	Cyprus	TFDE - Azipod	GT NO 96 GW	4	Yamal
Flex Amber	174,000	Bund 10 Holding Ltd.	HHI	Oct-20	Marshall Is.	X-DF	TZ Mk. III Flex	4	Portfolio
Flex Artemis	174,000	Flex LNG Reliance Ltd.	Daewoo	Aug-20	Marshall Is.	ME-GI	NO-96-GW+FRS	4	Portfolio
Flex Aurora	174,000	Flex LNG Aurora Ltd.	HHI	Jun-20	Marshall Is.	X-DF	TZ Mk. III Flex	4	Portfolio
Flex Constellation	173,400	Flex LNG Constellation Ltd.	Daewoo	Jun-19	Marshall Is.	ME-GI	NO-96-GW+PRS	4	Portfolio
Flex Courageous	173,400	Flex LNG Courageous Ltd.	Daewoo	Aug-19	Marshall Is.	ME-GI	NO-96-GW+PRS	4	Portfolio
Flex Endeavour	172,400	Triple H No. 3 Ltd.	Daewoo	Jan-18	Malta	ME-GI	NO-96-GW+PRS	4	Portfolio
Flex Enterprise	172,400	Triple H No. 4 Ltd.	Daewoo	Jan-18	Malta	ME-GI	NO-96-GW+PRS	4	Portfolio
Flex Freedom	173,400	Flex Freedom Ltd.	HHI	Jan-21	Marshall Is.	ME-GI	NO-96-GW+FRS	4	Portfolio
Flex Rainbow	174,000	Xiang Ch13 HK International	Samsung	Jun-18	Marshall Is.	ME-GI	TZ Mk. III Flex	4	Spot
Flex Ranger	174,101	Flex LNG Ranger Ltd.	Samsung	Jun-18	Marshall Is.	ME-GI	TZ Mk. III Flex	4	Portfolio
Flex Resolute	173,400	Flex LNG Resolute Ltd.	HHI	Sep-20	Marshall Is.	ME-GI	NO-96-GW+FRS	4	Portfolio
Flex Volunteer	170,520	Flex Volunteer Ltd.	HHI	Feb-21	Marshall Is.	X-DF	TZ Mk. III Flex	4	Portfolio
Fraiha	210,100	J5 Nakilat No. 6 Ltd.	Daewoo	Aug-08	Marshall Is.	Diesel	GT NO 96	18	RasGas III
Fuji LNG	149,172	Aletheia Owning Co Ltd.	Kawasaki	Mar-04	Malta	Steam	Moss	4	Sabine Pass
Fuwairit	138,200	Camartina Shipping Co.	Samsung	Jan-04	Bahamas	Steam	TZ Mk. III	4	RasGas II
Gail Bhuwan	180,000	Primavera Montana SA	Daewoo	Feb-21	Marshall Islnds.		X-DF	Membrane	4	Portfolio
Galicia Spirit	140,624	Teekay Gas II SL	Daewoo	Jul-04	Spain	Steam	GT NO 96	4	Portfolio
Gaslog Chelsea	153,000	Gas-Fifteen Ltd.	Hanjin (Busan)	Jun-10	Bermuda	Diesel/Gas-Electric	Sayaendo	4	Portfolio
Gaslog Geneva	174,000	Gas-Thirteen Ltd.	Samsung	Oct-16	Bermuda	TFDE	TZ Mk. III	4	Portfolio
Gaslog Genoa	174,000	Gas-Twenty Two Ltd.	Samsung	Mar-18	Bermuda	X-DF	TZ Mk. III Flex Plus	4	Portfolio
GasLog Georgetown	174,000	Ceres Shipping Ltd.	Samsung	Nov-20	Bermuda	X-DF	Membrane	4	Portfolio
Gaslog Gibraltar	174,000	Gas-Fourteen Ltd.	Samsung	Nov-16	Bermuda	TFDE	TZ Mk. III	4	Portfolio
Gaslog Gladstone	174,000	Gas-Twenty Three Ltd.	Samsung	Mar-19	Bermuda	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Gaslog Glasgow	174,000	Gas-Twelve Ltd.	Samsung	Jul-16	Bermuda	TFDE	TZ Mk. III	4	Portfolio
Gaslog Greece	174,000	Gas-Eleven Ltd.	Samsung	Mar-16	Bermuda	TFDE	TZ Mk. III	4	Portfolio
Gaslog Hong Kong	174,000	Gas-Twenty Five Ltd.	HHI	Mar-18	Bermuda	X-DF	TZ Mk. III Flex	4	Portfolio
Gaslog Houston	174,000	Gas-Twenty Four Ltd.	HHI	Dec-18	Bermuda	X-DF	TZ Mk. III Flex	4	GoM
Gaslog Salem	155,000	Gas-Ten Ltd.	Samsung	May-15	Bermuda	Diesel/Gas-Electric	Membrane	4	Portfolio
Gaslog Santiago	155,000	Gas-Four Ltd.	Samsung	Mar-13	Bermuda	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Gaslog Saratoga	155,000	Gas-Nine Ltd.	Samsung	Dec-14	Bermuda	Diesel/Gas-Electric	Membrane	4	Spot

Gaslog Savannah	155,000	Gas-One Ltd.	Samsung	May-10	Bermuda	Diesel	TZ Mk. III	4	Portfolio
Gaslog Seattle	155,000	Gas-Seven Ltd.	Samsung	Oct-13	Bermuda	TFDE	TZ Mk. III	4	Portfolio
Gaslog Shanghai	155,000	Gas-Three Ltd.	Samsung	Feb-13	Bermuda	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Gaslog Singapore	155,000	Gas-Two Ltd.	Samsung	Aug-10	Bermuda	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
GasLog Skagen	155,000	Gas-Six Ltd.	Samsung	Aug-13	Bermuda	TFDE	TZ Mk. III	4	Portfolio
Gaslog Sydney	155,000	Gas-Five Ltd.	Samsung	Jun-13	Bermuda	DFDE	TZ Mk. III	4	Portfolio
Gaslog Wales	180,000	Gas-Thirty One Ltd.	Samsung	May-20	Bermuda	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Gaslog Warsaw	180,000	GasLog Hellas-1 ENE	Samsung	Jul-19	Greece	X-DF	TZ Mk. III Flex Plus	4	Spot
Gaslog Westminster	180,000	Gas-Thirty Ltd.	Samsung	Jul-20	Bermuda	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Gaslog Windsor	180,000	Gas-Twenty Eight Ltd.	Samsung	Apr-20	Bermuda	X-DF	TZ MK. V	4	Portfolio
Gemmata	135,269	National Australia Finance	Mitsubishi	Feb-04	Singapore	Steam	Moss	5	Peru LNG
Georgiy Brusilov	172,410	Hai Kuo Shipping 1801 Pte Ltd.	Daewoo	Nov-18	Cyprus	TFDE - Azipod	GT NO 96 GW	4	Yamal
Georgiy Ushakov	172,652	DY Tankers Ltd.	Daewoo	Sep-19	Bahamas	ME-GI	GT NO 96 GW	4	Yamal
Ghasha	137,000	Ghasha Inc.	Mitsui E&S	Jun-95	Liberia	Steam	Moss	5	Das Island
Gigira Laitebo	177,419	Cleopatra LNG Shipping Co. Ltd.	HHI	Feb-10	Bahamas	DFDE	TZ Mk. III	4	RasGas
Global Energy	74,100	Global Energy Armateur SNC	STX	Jan-04	France	Diesel/Gas-Electric	CS1	4	Portfolio
Global Energy	74,100	Global Energy International	STX	Jan-04	Marshall Is.	Diesel/Gas-Electric	CS1	4	Portfolio
Global Star	173,400	Global Star Inc.	Daewoo	Jan-21	Marshall Is.	ME-GI	TZ Mk. III Flex	4	Portfolio
Golar Arctic	140,648	Golar LNG 2216 Corp.	Daewoo	Oct-03	Marshall Is.	Steam	GT NO 96	4	Jamaica LNG
Golar Bear	160,000	Cool Bear Shipping Ltd.	Samsung	Sep-14	Marshall Is.	Diesel/Gas-Electric	TZ Mk. III	4	Spot
Golar Celsius	160,000	Noble Celsius Shipping Ltd.	Samsung	Oct-13	Marshall Is.	Diesel/Gas-Electric	TZ Mk. III	4	Spot
Golar Crystal	159,800	Oriental Fleet LNG 01 Ltd.	Samsung	Sep-14	Marshall Is.	TFDE	Membrane	4	Spot
Golar Frost	160,000	Golar LNG NB12 Corp.	Samsung	Oct-14	Marshall Is.	Diesel/Gas-Electric	Membrane	4	Portfolio
Golar Glacier	162,000	Hai Jiao 1401 Ltd.	Hyundai Samho	Nov-14	Marshall Is.	TFDE	Membrane	4	Spot
Golar Grand	145,700	Golar Grand Corp.	Daewoo	Jan-06	Marshall Is.	Steam	GT NO 96	4	Gorgon
Golar Ice	160,000	Hai Jiao 1406 Ltd.	Samsung	Jan-15	Marshall Is.	Diesel Electric	Membrane	4	Spot
Golar Kelvin	162,000	Hai Jiao 1405 Ltd.	Hyundai Samho	Jan-15	Marshall Is.	DFDE	Membrane	4	Spot
Golar Maria	145,700	Golar LNG 2234 LLC	Daewoo	Jun-06	Marshall Is.	Steam	GT NO 96	4	Spot
Golar Mazo	135,255	Faraway Maritime Shipping	Mitsubishi	Dec-99	Liberia	Steam	Moss	5	Bontang
Golar Penguin	160,000	Oriental Fleet LNG 02 Ltd.	Samsung	Sep-14	Marshall Is.	TFDE	Membrane	4	Spot
Golar Seal	160,000	Compass Shipping 1 Corp. Ltd.	Samsung	Sep-13	Marshall Is.	Diesel/Gas-Electric	TZ Mk. III	4	Spot
Golar Snow	160,000	Hai Jiao 1402 Ltd.	Samsung	Jan-15	Marshall Is.	Diesel/Gas-Electric	Membrane	4	Spot
Grace Acacia	149,700	Algawin Shipping Inc.	HHI	Feb-07	Bahamas	Steam	TZ Mk. III	4	Spot
Grace Barleria	149,700	NYK Line	HHI	Apr-07	Japan	Steam	TZ Mk. III	4	Portfolio
Grace Cosmos	150,000	Algahunt Shipping Inc.	HHI	Feb-08	Bahamas	Steam	TZ Mk. III	4	Portfolio
Grace Dahlia	177,000	NYK Line	Kawasaki	Sep-13	Japan	Steam	Moss	4	Spot
Grand Aniva	145,000	NYK-SCF LNG Shpg No. 2 Ltd.	Mitsubishi	Jan-08	Cyprus	Steam	Moss	4	Sakhalin II
Grand Elena	145,580	NYK-SCF LNG Shpg No. 1 Ltd.	Mitsubishi	Oct-07	Cyprus	Steam	Moss	4	Sakhalin II
Grand Mereya	147,000	Ice Gas LNG Shipping Co. Ltd.	Mitsui E&S	Mar-08	Cyprus	Steam	Moss	4	Sakhalin II
Hanjin Muscat	138,366	H-Line Shipping Co. Ltd.	Hanjin (Busan)	Jul-99	South Korea	Steam	GT NO 96	4	Oman LNG
Hanjin Pyeongtaek	130,636	H-Line Shipping Co. Ltd.	Hanjin (Busan)	Sep-95	South Korea	Steam	GT NO 96	4	Bontang
Hanjin Ras Laffan	138,214	H-Line Shipping Co. Ltd.	Hanjin (Busan)	Jul-00	South Korea	Steam	GT NO 96	4	RasGas I
Hanjin Sur	138,333	H-Line Shipping Co. Ltd.	Hanjin (Busan)	Feb-00	South Korea	Steam	GT NO 96	4	Oman LNG
Hispania Spirit	145,500	Teekay Gas Naviera SL	Daewoo	Aug-02	Spain	Steam	GT NO 96	4	Peru LNG
Hoegh Giant	165,000	Hoegh LNG Giant Ltd.	HHI	Jan-17	Marshall Is.	Diesel/Gas-Electric	TZ MK. III Flex	4	Portfolio
Hongkong Energy	138,000	Ocean Trinity Sh No. 27 SA	Daewoo	Feb-04	Marshall Is.	Steam	GT NO 96	4	North West Shelf
Hyundai Aquapia	137,415	Hyundai LNG Shipping Co. Ltd.	HHI	May-00	South Korea	Steam	Moss	4	Oman LNG
Hyundai Cosmopia	137,415	Hyundai LNG Shipping Co. Ltd.	HHI	Feb-00	South Korea	Steam	Moss	4	RasGas I
Hyundai Ecopia	149,745	KLT 1 International SA	HHI	Nov-08	Panama	Steam	TZ Mk. III	4	Balhaf
Hyundai Greenpia	125,000	Hyundai LNG Shipping Co. Ltd.	HHI	May-96	South Korea	Steam	Moss	4	MLNG
Hyundai Oceanpia	135,000	Hyundai LNG Shipping Co. Ltd.	HHI	Jun-00	South Korea	Steam	Moss	4	Oman LNG
Hyundai Peacepia	174,000	HIb SA	Daewoo	Jun-17	Panama	ME-GI	TZ Mk. III Flex	4	Sabine Pass
Hyundai Princepia	174,000	HIa SA	Daewoo	May-17	Panama	ME-GI	TZ Mk. III Flex	4	Sabine Pass
Hyundai Technopia	137,415	Hyundai LNG Shipping Co. Ltd.	HHI	Jul-99	South Korea	Steam	Moss	4	RasGas I
Hyundai Utopia	125,182	Hyundai LNG Shipping Co. Ltd.	HHI	Jun-94	South Korea	Steam	Moss	4	Donggi Senoro
Iberica Knutsen	138,000	Norspan LNG III AS	Daewoo	Aug-06	Norway	Ultra Steam Turbine	GT NO 96	4	Portfolio
Ibra LNG	147,000	Areej LNG Carrier SA	Samsung	Jul-06	Panama	Steam	TZ Mk. III	4	Oman LNG
Ibri LNG	147,569	Dune LNG Carrier SA	Mitsubishi	Jul-06	Panama	Steam	Moss	4	Oman LNG
Ish	137,000	Ish Inc.	Mitsubishi	Nov-95	Liberia	Steam	Moss	5	Das Island
K. Acacia	138,017	Korea Line LNG Co. Ltd.	Daewoo	Dec-99	South Korea	Steam	GT NO 96	4	Oman LNG
K. Freesia	138,015	Korea Line LNG Co. Ltd.	Daewoo	Aug-00	South Korea	Steam	GT NO 96	4	RasGas I
K. Jasmine	145,878	Kolt JV No. 1 SA	Daewoo	May-08	Panama	Steam	TZ MK. III	4	Sakhalin II
K. Mugungwha	151,812	Kolt JV No. 2 SA	Daewoo	Nov-08	Panama	Steam	TZ MK. III	4	Oman LNG
Kinisis	173,400	Danae Gas Shipping Inc.	Daewoo	Oct-18	Liberia	ME-GI	TZ Mk. III Flex	4	Portfolio
Kita LNG	147,895	Oceanus LNG Beta LLC	Daewoo	May-14	Malta	Diesel Electric	GT NO 96	4	Spot
Kmarin Diamond	155,000	Sg Leasing Gems Ltd.	Hyundai Samho	Jul-08	Isle of Man	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Kmarin Emerald	155,000	Sg Leasing Gems Ltd.	HHI	May-07	Isle of Man	DFDE	TZ Mk. III	4	Portfolio
Kumul	170,000	Gemini LNG Shipping Ltd.	Hudong Zhonghua	Dec-15	Hong Kong	Diesel	TZ MK. III	4	PNG LNG
La Mancha Knutsen	176,300	Norspan LNG IX AS	HHI	Sep-16	Spain	ME-GI	Membrane	4	Portfolio

La Seine	174,000	Xiang Ch16 HK International	HHI	Feb-20	Malta	X-DF	TZ MK. III Flex	4	Portfolio
Lalla Fatma N'Soumer	145,000	Algeria Nippon Gas	Kawasaki	Oct-04	Bahamas	Steam	Moss	4	Arzew
Lena River	155,000	Solana Holding Ltd.	HHI	Sep-13	Marshall Is.	DFDE	TZ Mk. III	4	Portfolio
Lijmiliya	263,300	Nakilat Lijmiliya Inc.	Daewoo	Dec-08	Marshall Is.	Diesel	GT NO 96	5	Qatargas II
LNG Abalamabie	162,000	Bonny Gas Transport Ltd.	Samsung	Jul-16	Bermuda	DFDE	TZ Mk. III	4	NLNG
LNG Abuja II	162,000	Bonny Gas Transport Ltd.	Samsung	Mar-16	Bermuda	DFDE	TZ Mk. III	4	NLNG
LNG Adamawa	141,000	Bonny Gas Transport Ltd.	HHI	Apr-05	Bermuda	Steam	Moss	4	NLNG
LNG Adventure	170,520	NYK	Samsung	Apr-21	France	X-DF	Membrane	4	Portfolio
LNG Akwa Ibom	141,000	Bonny Gas Transport Ltd.	HHI	Oct-04	Bermuda	Steam	Moss	4	NLNG
LNG Alliance	154,472	NYK Armateur	STX	Mar-07	France	Diesel/Gas-Electric	CS1	4	Portfolio
LNG Aquarius	126,300	Hanochem Shipping Pt.	General Dynamics	Jan-77	Indonesia	Steam	Moss	5	Bontang
LNG Barka	155,982	Lloyds TSB General Leasing 3	Kawasaki	Dec-08	Bahamas	Steam	Moss	4	Oman LNG
LNG Bayelsa	137,500	Bonny Gas Transport Ltd.	HHI	Mar-03	Bermuda	Steam	Moss	4	NLNG
LNG Benue	145,952	BW Gas LNG Carriers Pte Ltd.	Daewoo	Apr-06	Bermuda	Steam	GT NO 96	4	NLNG
LNG Bonny Ii	174,000	Bonny Gas Transport Ltd.	HHI	Dec-15	Bermuda	Diesel/Gas-Electric	TZ Mk. III	4	NLNG
LNG Borno	149,600	Okra Shipping No. 1	Samsung	Aug-07	Bermuda	Steam	TZ Mk. III	4	NLNG
LNG Cross River	141,000	Bonny Gas Transport Ltd.	HHI	Aug-05	Bermuda	Steam	Moss	4	NLNG
LNG Dream	145,000	OJV Cayman 1 Ltd.	Kawasaki	Sep-06	Bahamas	Steam	Moss	4	North West Shelf
LNG Dubhe	174,000	Arctic Red LNG Shipping Ltd.	Hudong Zhonghua	Nov-19	Hong Kong	ME-GI	GTT NO96 L03+	4	Yamal
LNG Ebisu	147,546	LNG Ebisu Shipping Corp.	Kawasaki	Jul-08	Bahamas	Steam	Moss	4	Pluto
LNG Enugu	145,926	BW Gas LNG Carriers Pte Ltd.	Daewoo	Oct-05	Bermuda	Steam	GT NO 96	4	NLNG
LNG Finima II	162,000	Bonny Gas Transport Ltd.	Samsung	Dec-15	Bermuda	DFDE	TZ Mk. III	4	NLNG
LNG Fukurokuju	164,700	LNG Fukurokuju Shipping Corp. .	Kawasaki	Jul-16	Bahamas	Steam	Moss	4	APLNG
LNG Imo	148,452	Bergesen LNG XI Pte Ltd.	Daewoo	Jun-08	Bermuda	Steam	GT NO 96	4	NLNG
LNG Jamal	135,333	Jamal Shipholding SA	Mitsubishi	Oct-00	Japan	Steam	Moss	5	Oman LNG
LNG Juno	180,000	Mog-X LNG Shipholding SA	Mitsubishi	Oct-18	Bahamas	STaGE	Moss	4	Freeport
LNG Jupiter	153,000	Lloyds TSB Equipment No. 7 Ltd.	Kawasaki	Jul-09	Bahamas	Steam	Moss	4	PNG LNG
LNG Jurojin	160,000	LNG Jurojin Shipping Corp. .	Mitsubishi	Nov-15	Bahamas	Steam	Moss	4	Portfolio
LNG Kano	148,565	Bergesen LNG IX Pte Ltd.	Daewoo	Jan-07	Bermuda	Steam	TZ MK. III	4	NLNG
LNG Kolt	153,595	KLT 5 International SA	Hanjin (Busan)	Dec-08	Panama	Steam	TZ Mk. III	4	Portfolio
LNG Lagos II	174,000	Bonny Gas Transport Ltd.	HHI	Jan-16	Bermuda	DFDE	TZ Mk. III	4	NLNG
LNG Lerici	65,000	Portovenere & Lerici Pte Ltd.	Sestri Ponente	Apr-98	Singapore	Steam	GT NO 96	4	Malaysia LNG
LNG Lokoja	148,471	Bergesen LNG VIII Pte Ltd.	Daewoo	Nov-06	Bermuda	Steam	GT NO 96	4	NLNG
LNG Maleo	127,544	Nippon/Mitsui/Kawasaki	Mitsui E&S	Jan-89	Japan	Steam	Moss	4	North West Shelf
LNG Mars	155,693	Osaka Gas Int. & Mitsui OSK	Mitsubishi	Oct-16	Japan	Steam	Moss	4	PNG LNG
LNG Megrez	174,000	Arctic Indigo LNG Shipping Ltd.	Hudong Zhonghua	Nov-20	Hong Kong	ME-GI	GTT NO96 L03+	4	Yamal
LNG Merak	174,000	Arctic Yellow LNG Shipping Ltd.	Hudong Zhonghua	Jan-20	Hong Kong	ME-GI	GTT NO96 L03+	4	Yamal
LNG Ogun	149,000	Okra Shipping No. 2	Samsung	Jul-07	Bermuda	Steam	TZ Mk. III	4	NLNG
LNG Ondo	148,478	Bergesen LNG X Pte Ltd.	Daewoo	Sep-07	Bermuda	Steam	TZ MK. III	4	NLNG
LNG Oyo	145,842	BW Gas LNG Carriers Pte Ltd.	Daewoo	Jan-06	Bermuda	Steam	GT NO 96	4	NLNG
LNG Phecda	174,000	Arctic Orange LNG Shipping Ltd.	Hudong Zhonghua	Sep-20	Hong Kong	ME-GI	GTT NO96 L03+	4	Yamal
LNG Pioneer	138,121	M&S Shipping 3 SA	Daewoo	Jul-05	Bahamas	Steam	GT NO 96	4	Das Island
LNG Port-Harcourt II	162,000	Bonny Gas Transport Ltd.	Samsung	Dec-15	Bermuda	DFDE	TZ Mk. III	4	NLNG
LNG Portovenere	65,000	Portovenere & Lerici Pte Ltd.	Sestri Ponente	Apr-97	Singapore	Steam	GT NO 96	4	Portfolio
LNG River Niger	141,000	Bonny Gas Transport Ltd.	HHI	Jul-06	Bermuda	Steam	Moss	4	NLNG
LNG River Orashi	145,914	BW Gas LNG Carriers Pte Ltd.	Daewoo	Nov-04	Bermuda	Steam	GT NO 96	4	NLNG
LNG Rivers	137,200	Bonny Gas Transport Ltd.	HHI	Jun-02	Bermuda	Steam	Moss	4	NLNG
LNG Rosenrot	176,523	Fair Wind Navigation SA	Daewoo	Jan-21	Marshall Is.	X-DF	Membrane	4	Portfolio
LNG Sakura	177,000	LNG Sakura Shipping Corp.	Kawasaki	Feb-18	Bahamas	TFDE	Moss	4	Freeport
LNG Saturn	155,300	Mog-IX LNG Shipholding SA	Mitsubishi	Feb-16	Bahamas	Ultra Steam Turbine	Moss	4	Gorgon
LNG Schneeweisschen	180,000	LNG Rose Shipping Corp.	Daewoo	Sep-18	Panama	TFDE	TZ Mk. III Flex	4	Freeport
LNG Sokoto	137,425	Bonny Gas Transport Ltd.	HHI	Sep-02	Bermuda	Steam	Moss	4	NLNG
LNG Unity	154,472	Global LNG Armateur SAS	STX	Nov-06	France	Diesel/Gas-Electric	CS1	4	Portfolio
LNG Venus	153,000	Osaka Gas Int. & Mitsui OSK	Mitsubishi	Nov-14	Japan	Steam	Sayaendo	4	North West Shelf
LNG Vesta	127,386	Europe LNGT Co. Ltd.	Mitsubishi	Jun-94	Liberia	Steam	Moss	4	Portfolio
LNGShips Athena	170,618	TMS Cardiff Gas Ltd.	HHI	Mar-21	Malta	X-DF	Membrane	4	Portfolio
LNGShips Empress	170,520	TMS Cardiff Gas Athene	Samsung	Mar-21	Malta	X-DF	Membrane	4	Portfolio
Lobito	160,276	Mint LNG III Ltd.	Samsung	Nov-11	Bahamas	DFDE	TZ Mk. III	4	Soyo
Lusail	145,000	Peninsula LNG Transport No. 1	Samsung	May-05	Bahamas	Steam	TZ Mk. III	4	RasGas II
Macoma	145,400	Compass Shipping 9 Corp. Ltd.	Daewoo	Sep-17	Bahamas	ME-GI	GT NO 96	4	Portfolio
Madrid Spirit	138,000	Teekay Gas IV SL	Navantia	Dec-04	Spain	Steam	GT NO 96	4	Atlantic LNG
Magdala	173,400	Hai Jiao 1606 Ltd.	Daewoo	Feb-18	Bahamas	ME-GI	GT NO 96	4	Portfolio
Magellan Spirit	165,500	Magellan Spirit Aps	Samsung	Apr-09	Denmark	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Malanje	160,276	Mint LNG II Ltd.	Samsung	Oct-11	Bahamas	DFDE	TZ Mk. III	4	Soyo
Maran Gas Achilles	174,000	Adonis Investment Corp.	Hyundai Samho	Jan-16	Greece	DFDE	TZ Mk. III	4	Portfolio
Maran Gas Agamemnon	174,000	Doris Navigation Inc.	Hyundai Samho	May-16	Greece	DFDE	TZ Mk. III	4	Portfolio
Maran Gas Alexandria	161,870	Greenmare Navigation Corp.	Hyundai Samho	Oct-15	Greece	DFDE	Membrane	4	QCLNG
Maran Gas Amphipolis	174,000	Nestor Navigation Corp.	Daewoo	Aug-16	Greece	DFDE	Membrane	4	Portfolio
Maran Gas Andros	173,400	Crusandel Marine Co.	Daewoo	Nov-19	Greece	ME-GI	GT NO 96	4	Freeport

Maran Gas Apollonia	161,870	Ilida Shipping Co. Ltd.	Hyundai Samho	Jan-14	Greece	Diesel Electric	TZ Mk. III	4	Punta Europa
Maran Gas Asclepius	145,000	Sea Satin Corp.	Daewoo	Jul-05	Greece	Steam	GT NO 96	4	RasGas II
Maran Gas Chios	170,000	Pleione Inc.	Daewoo	Mar-19	Greece	ME-GI	TZ Mk. III Flex	4	Portfolio
Maran Gas Coronis	145,700	Jopica Shipping Co.	Daewoo	Jul-07	Greece	Steam	TZ MK. III	4	RasGas II
Maran Gas Delphi	159,800	Ada Shipholding Inc.	Daewoo	Feb-14	Greece	Diesel Electric	TZ Mk. III	4	Portfolio
Maran Gas Efessos	159,800	Acrogiali Shipping & Trading	Daewoo	Jun-14	Greece	DFDE	Membrane	4	Portfolio
Maran Gas Hector	174,000	Dylan Corp.	Hyundai Samho	Nov-16	Greece	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Maran Gas Hydra	173,400	Hai Jiao 1802 Ltd.	Daewoo	Feb-19	Greece	ME-GI	GT NO 96	4	Sabine Pass
Maran Gas Leto	174,000	Cherise Maritime Ltd.	Hyundai Samho	Mar-16	Greece	DFDE	TZ Mk. III	4	Portfolio
Maran Gas Lindos	161,870	Olivia International Shpg Corp.	Daewoo	Jul-15	Greece	DFDE	Membrane	4	Punta Europa
Maran Gas Mystras	155,900	Blueskies Shipping Co. Ltd.	Daewoo	Aug-15	Greece	DFDE	Membrane	4	QCLNG
Maran Gas Olympias	174,000	Cygnus Enterprises Inc.	Daewoo	Feb-17	Greece	ME-GI	GT NO 96	4	Portfolio
Maran Gas Pericles	173,400	Anguilla Navigation Corp.	Hyundai Samho	Aug-16	Greece	DFDE	TZ Mk. III	4	Portfolio
Maran Gas Posidonia	161,870	Felicite Navigation Inc.	Hyundai Samho	May-14	Greece	DFDE	Membrane	4	Punta Europa
Maran Gas Psara	173,595	Highseas Shiptrade Co.	Daewoo	May-20	Greece	ME-GI	GT NO96	4	Portfolio
Maran Gas Roxana	174,000	Elisa International Ltd.	Daewoo	Jan-17	Greece	ME-GI	TZ Mk. III	4	Portfolio
Maran Gas Sparta	159,800	Lettuce Maritime Corp.	Hyundai Samho	Apr-15	Greece	DFDE	Membrane	4	QCLNG
Maran Gas Spetses	173,400	Hai Jiao 1801 Ltd.	Daewoo	Jul-18	Greece	ME-GI	TZ Mk. III Flex	4	GoM
Maran Gas Troy	155,000	Helianthus Navigation Corp.	Daewoo	Sep-15	Greece	DFDE	Membrane	4	Portfolio
Maran Gas Ulysses	173,400	Ariel Sails Navigation SA	Hyundai Samho	Jan-17	Greece	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Maran Gas Vergina	174,000	Santa Lucia Enterprises Inc.	Daewoo	Dec-16	Greece	ME-GI	GT NO 96	4	Portfolio
Maria Energy	174,000	Canyon Trading Corp.	HHI	Sep-16	Liberia	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Marib Spirit	165,500	Membrane Shipping Ltd.	Samsung	Apr-08	Marshall Is.	Diesel/Gas-Electric	TZ Mk. III	4	Balhaf
Marshal Vasilevskiy	170,000	Gazprom Flot LLC	HHI	Jan-19	Russian Fed.	Diesel/Gas-Electric	Membrane	4	Kaliningrad LNG
Marvel Crane	177,000	Rosewood Shipping Pte Ltd.	Mitsubishi	Mar-19	Singapore	STaGE	Moss	4	Cameron
Marvel Eagle	155,000	Mevius Lines SA	Kawasaki	Oct-18	Panama	Reheat Steam Turbine	Moss	4	Cameron
Marvel Falcon	174,000	Tea Tree Shipping Pte Ltd.	Samsung	Apr-18	Singapore	TFDE	TZ Mk. III Flex	4	Cameron
Marvel Hawk	177,000	Comet Arrow Gas Transport	Samsung	Dec-18	Singapore	TFDE	TZ Mk. III Flex	4	Cameron
Marvel Heron	177,000	Heron Gas Shipping SA	Mitsubishi	Sep-19	Panama	STaGE	Moss	4	Cameron
Marvel Kite	177,000	Comet Gyro Gas Transport Pte	Samsung	Jan-19	Singapore	TFDE	TZ Mk. III Flex	4	Cameron
Marvel Pelican	156,265	Pelican Gas Shipping SA	Kawasaki	Dec-19	Panama	Reheat Steam Turbine	Moss	4	Cameron
Megara	173,400	Hai Jiao 1607 Ltd.	Daewoo	Jul-18	Bahamas	ME-GI	GT NO 96	4	Portfolio
Mekaines	266,000	Nakilat SHI 1695 Inc.	Samsung	Apr-09	Marshall Is.	DRL	TZ Mk. III	5	Qatargas III
Merchant	138,000	Ocean Tiger Shipping Ltd.	Samsung	Jul-03	Marshall Is.	Steam	TZ Mk. III	4	Portfolio
Meridian Spirit	165,500	Meridian Spirit Aps	Samsung	Jan-10	Denmark	Diesel/Gas-Electric	TZ Mk. III	4	Hammerfest
Mesaimeer	216,312	Nakilat HHI 1908 Inc.	HHI	Mar-09	Marshall Is.	Diesel	TZ Mk. III	4	Qatargas III
Methane Alison Victoria	145,000	Gas-Nineteen Ltd.	Samsung	Apr-07	Bermuda	Steam	TZ Mk. III	4	Punta Europa
Methane Becki Anne	170,000	Gas-Twenty Seven Ltd.	Samsung	Sep-10	Bermuda	TFDE	TZ Mk. III	4	Singapore
Methane Heather Sally	145,000	Gas-Twenty One Ltd.	Samsung	Jan-07	Bermuda	Steam	TZ Mk. III	4	Punta Europa
Methane Jane Elizabeth	145,000	Gas-Seventeen Ltd.	Samsung	Jun-06	Bermuda	Steam	TZ Mk. III	4	Idku
Methane Julia Louise	170,000	Southern Route Maritime SA	Samsung	Apr-10	Bermuda	TFDE	TZ Mk. III	9	Singapore
Methane Kari Elin	138,267	Lombard Corporate December 1	Samsung	May-04	Bermuda	Steam	TZ Mk. III	4	Singapore
Methane Lydon Volney	145,000	Gas-Eighteen Ltd.	Samsung	Aug-06	Bermuda	Steam	TZ Mk. III	4	Idku
Methane Mickie Harper	170,000	Methane Services Ltd.	Samsung	Dec-10	Bermuda	Diesel/Gas-Electric	TZ Mk. III	4	Singapore
Methane Nile Eagle	145,000	Egypt LNG Shipping Ltd.	Samsung	Dec-07	Bermuda	Steam	TZ Mk. III	4	Idku
Methane Patricia Camila	170,000	Methane Services Ltd.	Samsung	Oct-10	Bermuda	TFDE	TZ Mk. III	4	Singapore
Methane Princess	138,000	Methane Services Ltd.	Daewoo	Aug-03	Bermuda	Steam	GT NO 96	4	Portfolio
Methane Rita Andrea	145,000	Gas-Sixteen Ltd.	Samsung	Apr-06	Bermuda	Steam	TZ Mk. III	4	Idku
Methane Shirley Elisabeth	145,000	Gas-Twenty Ltd.	Samsung	Feb-07	Bermuda	Steam	TZ Mk. III	4	Punta Europa
Methane Spirit	165,500	Methane Spirit LLC	Samsung	Feb-08	Bahamas	Diesel/Gas-Electric	TZ Mk. III	4	Atlantic LNG
Milaha Qatar	145,500	Milaha Qatar GmbH & Co. KG	Samsung	Apr-06	Malta	Steam	TZ Mk. III	4	RasGas II
Milaha Ras Laffan	138,270	Milaha Ras Laffan GmbH & Co.	Samsung	Apr-04	Malta	Steam	TZ Mk. III	4	RasGas II
Min Lu	147,100	Min Lu LNG Shipping Co. Ltd.	Hudong Zhonghua	Aug-09	Hong Kong	Steam	GT NO 96	4	Tangguh
Min Rong	145,000	Min Rong LNG Shipping Co. Ltd.	Hudong Zhonghua	Feb-09	Hong Kong	Steam	GT NO 96	4	Tangguh
Minerva Kalymnos	174,000	Koje Shipping SA	Samsung	Feb-21	Malta	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Minerva Psara	173,400	Wimbledon Shipping	Daewoo	Jan-21	Malta	ME-GI	TZ Mk. III Flex Plus	4	Portfolio
Mozah	266,000	Nakilat Haloul Inc.	Samsung	Aug-09	Marshall Is.	Diesel	TZ Mk. III	5	Qatargas II
Mraweh	137,000	Mraweh Ltd.	STX	Apr-96	Liberia	Steam	Moss	4	Das Island
Mubaraz	137,000	Mubaraz Ltd.	STX	Dec-95	Liberia	Steam	Moss	4	Das Island
Murex	173,400	Hai Jiao 1605 Ltd.	Daewoo	Jul-17	Bahamas	ME-GI	GT NO 96	4	Portfolio
Murwab	210,100	J5 Nakilat No. 4 Ltd.	Daewoo	Jun-08	Marshall Is.	Diesel	GT NO 96	18	RasGas III
Myrina	173,400	Xiang Ch1 HK International	Daewoo	May-18	Bahamas	ME-GI	GT NO 96	4	Portfolio
Neo Energy	150,000	Sea Optima SA	HHI	Jan-07	Liberia	Steam	Moss	4	Portfolio
Neptune	145,130	SRV Joint Gas Ltd.	Samsung	Nov-09	Norway	DFDE	TZ Mk. III	4	Portfolio
Nikolay Urvantsev	172,658	Dy Maritime Ltd.	Daewoo	Jul-19	Hong Kong	ME-GI	GT NO 96 GW	4	Yamal
Nikolay Yevgenov	172,410	TC LNG Explorer III LLC	Daewoo	Apr-19	Bahamas	ME-GI	GT NO 96 GW	4	Yamal
Nikolay Zubov	172,410	Hai Kuo Shipping 1606 Ltd.	Daewoo	Nov-18	Cyprus	TFDE - Azipod	GT NO 96 GW	4	Yamal
Nizwa LNG	147,684	Oryx LNG Carrier SA	Kawasaki	Dec-05	Panama	Steam	Moss	4	Oman LNG
Nohshu Maru	180,000	Trans Pacific Shipping 5 Ltd.	Mitsubishi	Feb-19	Bahamas	Reheat Steam Turbine	Moss	4	Portfolio

Northwest Sanderling	127,525	BHP/BP/Chevron/Japan & Others	Mitsubishi	Jan-89	Australia	Steam	Moss	4	North West Shelf
Northwest Sandpiper	125,042	BHP/BP/Chevron/Japan & Others	Mitsui E&S	Jan-93	Australia	Steam	Moss	4	North West Shelf
Northwest Snipe	127,500	BHP/BP/Chevron/Japan & Others	Mitsui E&S	Jan-90	Australia	Steam	Moss	4	North West Shelf
Northwest Stormpetrel	127,500	BHP/BP/Chevron/Japan & Others	Mitsubishi	Dec-94	Australia	Steam	Moss	4	North West Shelf
Oak Spirit	173,400	Sea 64 Leasing Co Ltd.	Daewoo	Mar-16	Bahamas	ME-GI	GT NO 96	4	Sabine Pass
Ob River	149,700	Lance Shipping SA	HHI	May-07	Marshall Is.	Steam	TZ Mk. III	4	Sakhalin II
Oceanic Breeze	155,300	Oceanic Breeze LNG Transport	Mitsubishi	Apr-18	Marshall Is.	Reheat Steam Turbine	Moss	4	Ichthys
Onaiza	210,150	Nakilat DSME 2266 Inc.	Daewoo	Apr-09	Marshall Is.	Diesel	GT NO 96	12	Qatargas III
Ougarta	170,000	Hyproc Shipping Co.	HHI	Mar-17	Algeria	DFDE	TZ Mk. III Flex	4	Arzew
Pacific Arcadia	145,400	Bahamas LNG Shipping Ltd.	Mitsubishi	Oct-14	Bahamas	Steam	Moss	4	PNG LNG
Pacific Breeze	180,000	Pacific Breeze LNG Transport	Kawasaki	Mar-18	Marshall Is.	TFDE	Moss	4	Ichthys
Pacific Enlighten	145,400	Pacific Hope Shipping Ltd.	Mitsubishi	Mar-09	Bahamas	Steam	Moss	4	North West Shelf
Pacific Eurus	137,000	Pacific Eurus Shipping	Mitsubishi	Mar-06	Bahamas	Steam	Moss	4	Das Island
Pacific Mimosa	155,300	Kaede Shipholding SA	Mitsubishi	Mar-18	Japan	Reheat Steam Turbine	Moss	4	Wheatstone
Pacific Notus	137,006	Pacific LNG Shipping	Mitsubishi	Sep-03	Bahamas	Steam	Moss	5	Darwin LNG
Palu LNG	159,800	Oceanus LNG Gamma LLC	Daewoo	Nov-14	Malta	TFDE	GT NO 96	4	Spot
Pan Africa	174,000	Pan Africa LNG Transportation	Hudong Zhonghua	Jan-19	Hong Kong	TFDE	GT NO 96	4	QCLNG
Pan Americas	174,000	Pan Americas LNG Trans	Hudong Zhonghua	Jan-18	Hong Kong	TFDE	GT NO 96	4	QCLNG
Pan Asia	174,000	Pan Asia LNG Transportation	Hudong Zhonghua	Sep-17	Hong Kong	TFDE	GT NO 96	4	QCLNG
Pan Europe	174,000	Pan Europe LNG Transportation	Hudong Zhonghua	Jul-18	Hong Kong	TFDE	GT NO 96	4	QCLNG
Papua	170,000	Aquarius LNG Shipping Ltd.	Hudong Zhonghua	Nov-14	Hong Kong	DFDE	TZ MK. III	4	PNG LNG
Patris	174,000	Artemis Gas 1 Shipping Inc.	Daewoo	Jan-18	Liberia	ME-GI	GT NO 96	4	Freeport
Pearl LNG	174,000	Cardiff LNG Delta Owning LLC	HHI	Aug-20	Malta	X-DF	NO-96-GW+PRS	4	Portfolio
Point Fortin	154,200	Los Halillos Shipping Co. SA	Koyo Dockyard	Jan-10	Panama	Steam	TZ Mk. III	4	Portfolio
Polar Spirit	89,800	Polar Spirit LLC	Ishikawajima	Jun-93	Bahamas	Steam	IHI SPB	4	Atlantic LNG
Portovyy	138,107	Global LNG Ltd.	Daewoo	Aug-03	Malta	Steam	GT NO 96	4	Portfolio
Prachi	162,000	India LNG Transport Co. No. 4	HHI	Nov-16	Singapore	Diesel/Gas-Electric	TZ Mk. III	4	Gorgon
Prism Agility	180,000	HHI ENS1 Shipholding SA	HHI	May-19	Panama	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Prism Brilliance	180,000	HHI ENS2 Shipholding SA	HHI	May-19	Panama	X-DF	TZ Mk. III Flex Plus	4	Portfolio
Pskov	170,200	Scalpay Shipping Ltd.	STX	Sep-14	Liberia	DFDE	GT NO 96	4	Portfolio
Puteri Delima	130,400	Puteri Delima Sdn Bhd.	STX	Jan-95	Malaysia	Steam	GT NO 96	4	MLNG II
Puteri Delima Satu	137,100	Puteri Delima Satu L Pte Ltd.	Mitsui E&S	Oct-02	Malaysia	Steam	GT NO 96	4	MLNG III
Puteri Firus Satu	137,100	Puteri Firus Satu	Mitsubishi	Aug-04	Malaysia	Steam	GT NO 96	4	MLNG III
Puteri Intan	137,100	Puteri Intan Sdn Bhd.	STX	Aug-94	Malaysia	Steam	GT NO 96	4	MLNG II
Puteri Intan Satu	137,100	Puteri Intan Satu L Pte Ltd.	Mitsubishi	Aug-02	Malaysia	Steam	GT NO 96	4	MLNG III
Puteri Mutiara Satu	137,100	Puteri Mutiara Satu	Mitsui E&S	Apr-05	Malaysia	Steam	GT NO 96	4	MLNG III
Puteri Nilam	130,400	Puteri Nilam Sdn Bhd.	STX	Jul-95	Malaysia	Steam	GT NO 96	4	MLNG II
Puteri Nilam Satu	137,100	Puteri Nilam Satu L Pte Ltd.	Mitsubishi	Jul-03	Malaysia	Steam	GT NO 96	4	MLNG III
Puteri Zamrud	130,400	MISC Bhd.	STX	Jun-96	Malaysia	Steam	GT NO 96	4	MLNG II
Puteri Zamrud Satu	137,100	Puteri Zamrud Satu L Pvt Ltd.	Mitsui E&S	Feb-04	Malaysia	Steam	GT NO 96	4	MLNG III
Qogir	174,000	Xiang Ch15 HK International	Samsung	Jun-20	Malta	X-DF	TZ MK. III Flex	4	Portfolio
Raahi	138,076	India LNG Transport Co. No. 2	Daewoo	Oct-04	Malta	Steam	GT NO 96	4	RasGas
Ramdane Abane	126,130	Hyproc Shipping Co.	STX	Jun-81	Algeria	Steam	GT NO 85	5	Arzew
Rasheeda	266,000	Nakilat SHI 1754 Inc.	Samsung	Aug-10	Marshall Is.	Diesel	TZ Mk. III	10	Qatargas IV
Rias Baixas Knutsen	180,000	Knutsen OAS Espana SL	HHI	Sep-19	Spain	ME-GI	TZ Mk. III Flex Plus	4	Corpus Christi
Ribera Del Duero Knutsen	173,400	Norspan LNG VIII AS	Daewoo	Dec-10	Norway	DFDE	GT NO 96	4	Portfolio
Rioja Knutsen	170,000	Norspan LNG X As	HHI	Dec-16	Spain	ME-GI	TZ Mk. III	4	Portfolio
Rudolf Samoylovich	172,410	TC LNG Explorer II LLC	Daewoo	Aug-18	Bahamas	ME-GI	GT NO 96 GW	4	Yamal
Saga Dawn	45,000	Saga LNG Shipping Pte Ltd.	China Merchants H.I.	Aug-19	Singapore	Diesel/Gas-Electric	TZ MK. III Flex	4	Portfolio
Salalah LNG	147,000	Tiwi LNG Carrier SA	Samsung	Dec-05	Panama	Steam	TZ Mk. III	4	Oman LNG
SCF Barents	174,000	Heliconia Maritime SA	HHI	Sep-20	Liberia	DFDS	TZ Mk. III Flex	4	Portfolio
SCF La Perouse	174,000	Albus Shipping Ltd.	HHI	Feb-20	Liberia	X-DF	NO-96-GW+PRS	4	Portfolio
SCF Melampus	170,200	Pabbay Shipping Ltd.	STX	Jan-15	Liberia	Diesel Electric	Membrane	4	Portfolio
SCF Mitre	170,200	Ensay Shipping Ltd.	STX	Apr-15	Liberia	Diesel Electric	Membrane	4	Portfolio
SCF Timmerman	174,000	Headliner Maritime SA	HHI	Jan-21	Liberia	X-DF	NO-96-GW+PRS	4	Portfolio
Sean Spirit	174,162	HHI Hull No. S856 LLC	Hyundai Samho	Dec-18	Bahamas	ME-GI	TZ Mk. III Flex	4	Freeport
Seishu Maru	138,000	Trans Pacific Shipping 1 Ltd.	Mitsubishi	Sep-14	Bahamas	Steam	Moss	4	PNG LNG
Senshu Maru	127,167	Nippon/Mitsui/Kawasaki	Mitsui E&S	Feb-84	Japan	Steam	Moss	5	Bontang
Seri Alam	145,572	MISC Bhd.	Samsung	Jul-05	Malaysia	Steam	Moss Seri-C	4	Bintulu
Seri Amanah	145,709	MISC Bhd.	Samsung	Mar-06	Malaysia	Steam	TZ Mk. III	4	Bintulu
Seri Anggun	145,731	MISC Bhd.	Samsung	Oct-06	Malaysia	Steam	TZ Mk. III	4	North West Shelf
Seri Angkasa	145,130	MISC Bhd.	Samsung	Dec-06	Malaysia	Steam	TZ Mk. III	4	Bintulu
Seri Ayu	145,894	MISC Bhd.	Samsung	Oct-07	Malaysia	Steam	TZ Mk. III	4	Bintulu
Seri Bakti	152,944	MISC Bhd.	Mitsubishi	Apr-07	Malaysia	Steam	TZ MK. III	4	Gladstone
Seri Balhaf	152,000	MISC Bhd.	Mitsubishi	Jan-09	Malaysia	Steam	TZ MK. III	4	Bontang
Seri Balqis	152,000	MISC Bhd.	Mitsubishi	Mar-09	Malaysia	Steam	TZ MK. III	4	NLNG
Seri Begawan	152,900	MISC Bhd.	Mitsubishi	Nov-07	Malaysia	Steam	TZ MK. III	4	Bintulu
Seri Bijaksana	152,300	MISC Bhd.	Mitsubishi	Apr-08	Malaysia	Steam	TZ MK. III	4	Bintulu
Seri Camar	150,000	Seri Camar L Pte Ltd.	HHI	Feb-18	Malaysia	Ultra Steam Turbine	Moss	4	Pacific Northwest

Seri Camellia	159,800	Seri Camellia L Pte Ltd.	HHI	Sep-16	Malaysia	Steam	Moss Seri-C	4	Pacific Northwest
Seri Cemara	150,200	Seri Cemara L Pte Ltd.	HHI	Apr-18	Malaysia	Reheat Steam Turbine	Moss	4	Portfolio
Seri Cempaka	162,000	Seri Cempaka L Pte Ltd.	HHI	Aug-17	Malaysia	Steam	Moss Seri-C	4	Pacific Northwest
Seri Cenderawasih	162,000	Seri Cenderawasih L Pvt Ltd.	HHI	Feb-17	Malaysia	Steam	Moss Seri-C	4	Pacific Northwest
Sestao Knutsen	136,947	Norspan LNG IV AS	Navantia Cadiz	Oct-07	Spain	Steam	TZ MK. III	4	Portfolio
Sevilla Knutsen	173,400	Norspan LNG VI AS	Daewoo	May-10	Spain	Diesel/Gas-Electric	GT NO 96	4	Portfolio
Shagra	268,000	Nakilat SHI 1751 Inc.	Samsung	Nov-09	Marshall Is.	Diesel	TZ Mk. III	10	Qatargas IV
Shahamah	135,496	Shahamah Inc.	Kawasaki	Oct-94	Liberia	Steam	Moss	5	Das Island
Shen Hai	147,200	Shanghai LNG Shipping Co. Ltd.	Hudong Zhonghua	Dec-12	Hong Kong	Steam	TZ MK. III	4	Bintulu
Shinshu Maru	180,000	Trans Pacific Shipping 7 Ltd.	Kawasaki	Feb-19	Bahamas	DERST	Moss	4	Freeport
Simaisma	145,889	Greenwell Corp.	Daewoo	Jul-06	Greece	Steam	GT NO 96	8	RasGas II
Singapore Energy	138,000	KSF Global No. 6 SA	Samsung	Feb-03	Marshall Is.	Steam	TZ Mk. III	4	Portfolio
SK Audace	174,000	Milestone LNG Transport SA	Samsung	Aug-17	Panama	X-DF	TZ Mk. III	4	Portfolio
SK Resolute	180,000	Great Shale LNG Transport SA	Samsung	Nov-17	Panama	X-DF	TZ Mk. III	4	Ichthys
SK Serenity	174,000	Shikc 1 Shipholding SA	Samsung	Feb-18	Panama	TFDE	KC-1	4	Sabine Pass
SK Spica	174,117	Shikc 2 Shipholding SA	Samsung	Mar-18	Panama	TFDE	KC-1	4	Sabine Pass
SK Splendor	138,370	SK Shipping Co. Ltd. -Krs	Samsung	May-00	South Korea	Steam	TZ Mk. III	4	Oman LNG
SK Stellar	138,375	Stellar Shipholding SA	Samsung	Dec-00	Panama	Steam	TZ Mk. III	4	RasGas I
SK Summit	138,003	SK Shipping Co. Ltd. -Krs	Daewoo	Aug-99	South Korea	Steam	GT NO 96	4	RasGas I
SK Sunrise	138,306	Methane Navigation SA	Samsung	Aug-03	Panama	Steam	TZ Mk. III	4	RasGas II
SK Supreme	138,225	SK Shipping Co. Ltd. -Krs	Samsung	Feb-00	South Korea	Steam	TZ Mk. III	4	RasGas I
SM Eagle	174,000	SMKLC LNG1 SA	Daewoo	May-17	Panama	ME-GI	TZ Mk. III Flex	4	Sabine Pass
SM Seahawk	174,000	SMKLC LNG2 SA	Daewoo	Jun-17	Panama	ME-GI	TZ Mk. III Flex	4	Sabine Pass
Sohar LNG	137,248	Energy Spring LNG Carrier SA	Mitsubishi	Oct-01	Panama	Steam	Moss	5	Oman LNG
Sohshu Maru	177,000	Trans Pacific Shipping 8 Ltd.	Kawasaki	Jul-19	Bahamas	DERST	Moss	4	Freeport
Solaris	155,000	Gas-Eight Ltd.	Samsung	Jul-14	Bermuda	Diesel/Gas-Electric	Membrane	4	Spot
Sonangol Benguela	160,500	Sonangol Benguela Ltd.	Daewoo	Dec-11	Bahamas	Steam	GT NO 96	4	Soyo
Sonangol Etosha	160,500	Sonangol Etosha Ltd.	Daewoo	Sep-11	Bahamas	Steam	GT NO 96	4	Soyo
Sonangol Sambizanga	160,500	Sonangol Sambizanga Ltd.	Daewoo	Aug-11	Bahamas	Steam	GT NO 96	4	Soyo
Southern Cross	172,000	Aries LNG Shipping Ltd.	Hudong Zhonghua	Jul-15	Hong Kong	DRL	TZ Mk. III	4	PNG LNG
Soyo	160,276	Mint LNG I Ltd.	Samsung	Aug-11	Bahamas	DFDE	TZ Mk. III	4	Soyo
Spirit Of Hela	177,000	Nefertiti LNG Shipping Co. Ltd.	Hyundai Samho	Nov-10	Bahamas	Diesel Electric	TZ Mk. III	4	PNG LNG
Stena Blue SKy	145,700	Blue Shipping KB	Daewoo	Aug-06	U.K.	Steam	GT NO 96	4	Spot
Stena Clear Sky	171,800	Clear Sky KB	Daewoo	May-11	U.K.	Diesel/Gas-Electric	GT NO 96	4	Portfolio
Stena Crystal SKy	171,800	Crystal Sky KB	Daewoo	May-11	U.K.	Diesel/Gas-Electric	GT NO 96	4	Portfolio
Symphonic Breeze	145,394	Reborn Maritime SA	Kawasaki	Dec-07	Bahamas	Steam	Moss	4	Portfolio
Taitar No. 1	145,000	NIMIC No. 1 SA	Mitsubishi	Oct-09	Panama	Steam	Moss	4	RasGas
Taitar No. 2	145,000	NIMIC No. 2 SA	Kawasaki	Dec-09	Panama	Steam	Moss	4	RasGas
Taitar No. 3	145,000	NIMIC No. 3 SA	Mitsubishi	Dec-09	Panama	Steam	Moss	4	RasGas
Taitar No. 4	147,000	NIMIC No. 4 SA	Kawasaki	Aug-10	Panama	Steam	Moss	4	RasGas
Tangguh Batur	145,700	LNG North-South Shipping Co.	Daewoo	Dec-08	Singapore	Steam	TZ MK. III	4	Tangguh
Tangguh Foja	155,000	Ocean1919 Shipping No. 1 SA	Samsung	Nov-08	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Hiri	155,000	Tangguh Hiri Finance Ltd.	HHI	Dec-08	Bahamas	DFDE	TZ Mk. III	4	Tangguh
Tangguh Jaya	155,000	Ocean1919 Shipping No. 2 SA	Samsung	Dec-08	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Palung	155,000	Ocean1919 Shipping No. 3 SA	Samsung	Mar-09	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Sago	155,000	Tangguh Sago Finance Ltd.	Hyundai Samho	Dec-08	Bahamas	Diesel/Gas-Electric	TZ Mk. III	4	Tangguh
Tangguh Towuti	145,700	LNG East-West Ship Singapore	Daewoo	Oct-08	Singapore	Steam	TZ MK. III	4	Tangguh
Tembek	216,200	Overseas LNG S1 Corp.	Samsung	Nov-07	Marshall Is.	Diesel	TZ Mk. III	4	Qatargas II
Tessala	170,000	Hyproc Shipping Co.	HHI	Feb-17	Algeria	Diesel/Gas-Electric	TZ Mk. III Flex	4	Arzew
Torben Spirit	173,400	Sea 168 Leasing Co. Ltd.	Daewoo	Nov-16	Bahamas	ME-GI	GT NO 96	4	Portfolio
Trader	138,000	Lloyds Industrial Leasing	Samsung	Nov-02	Isle of Man	Steam	TZ Mk. III	4	Portfolio
Traiano Knutsen	180,000	Hai Kuo Shipping 1901 G Ltd.	HHI	Jul-20	Norway	ME-GI	TZ Mk. III Flex Plus	4	Portfolio
Trinity Arrow	154,982	Cypress/Luster/Los Halillos	Koyo Dockyard	Feb-08	Panama	Steam	TZ Mk. III	4	Portfolio
Trinity Glory	154,000	Cypress/Luster/Los Halillos	Koyo Dockyard	Nov-08	Panama	Steam	TZ Mk. III	4	Bontang
Tristar Ruby	155,000	Sg Leasing Gems Ltd.	HHI	Apr-08	Liberia	Diesel/Gas-Electric	TZ Mk. III	4	Portfolio
Umm Al Amad	210,200	J5 Nakilat No. 7 Ltd.	Daewoo	Sep-08	Marshall Is.	Diesel	GT NO 96	18	RasGas III
Umm Al Ashtan	137,000	Umm Al Ashtan Ltd.	STX	May-97	Liberia	Steam	Moss	4	Das Island
Umm Bab	145,000	Sea Trade International	Daewoo	Nov-05	Greece	Steam	GT NO 96	4	RasGas II
Umm Slal	266,000	Shi Hull No. 1676 Inc.	Samsung	Nov-08	Marshall Is.	DFDE	TZ Mk. III	5	Qatargas II
Valencia Knutsen	173,400	Norspan LNG VII AS	Daewoo	Sep-10	Spain	DFDE	GT NO 96	4	Portfolio
Velikiy Novgorod	170,200	Boreray Shipping Ltd.	STX	Dec-13	Liberia	DFDE	GT NO 96	4	Portfolio
Vivit Americas LNG	180,000	Cardiff LNG Zeta Owning LLC	HHI	Oct-20	Malta	X-DF	TZ Mk. III Flex	4	Portfolio
Vladimir Rusanov	174,000	DY Maritime Ltd.	Daewoo	Jan-18	Hong Kong	ME-GI	GT NO 96 GW	4	Yamal
Vladimir Vize	172,000	Dy Maritime Ltd.	Daewoo	Sep-18	Hong Kong	ME-GI	GT NO 96 GW	4	Yamal
Vladimir Voronin	172,652	TC LNG Explorer IV LLC	Daewoo	Jul-19	Bahamas	ME-GI	GT NO 96 GW	4	Yamal
Wilforce	155,900	Compass Shipping 84 Corp. Ltd.	Daewoo	Sep-13	Norway	DFDE	GT NO 96	4	Portfolio
Wilpride	155,900	Compass Shipping 85 Corp. Ltd.	Daewoo	Nov-13	Norway	DFDE	GT NO 96	4	Portfolio
Woodside Chaney	174,000	Lamkos Seaways Ltd.	Daewoo	Jul-19	Greece	ME-GI	TZ MK. III Flex	4	Portfolio
Woodside Charles Allen	173,400	Newberry Shiptrade Ltd.	Daewoo	Oct-20	Greece	ME-GI	Membrane	4	Portfolio

Woodside Donaldson	165,500	Malt Singapore Pte Ltd.	Samsung	Oct-09	Singapore	Diesel/Gas-Electric	TZ Mk. III	4	Pluto
Woodside Goode	159,800	Armour Co. Ltd.	Daewoo	Nov-13	Greece	Diesel Electric	GT NO 96	4	RasGas
Woodside Rees Withers	173,400	Franklin Navigation Co.	Daewoo	Oct-19	Greece	ME-GI	GT NO 96	4	Portfolio
Woodside Rogers	159,800	Margie Seaway Corp.	Daewoo	Jul-13	Greece	Diesel/Gas-Electric	GT NO 96	4	Pluto
Yakov Gakkel	172,658	TC LNG Explorer VI LLC	Daewoo	Nov-19	Bahamas	ME-GI	GT NO 96 GW	4	Yamal
Yamal Spirit	174,000	Xiang Ch2 HK International	Hyundai Samho	Jan-19	Bahamas	ME-GI	TZ Mk. III Flex	4	Freeport
Yari LNG	159,800	Oceanus LNG Delta LLC	Daewoo	Nov-14	Malta	TFDE	GT NO 96	4	Spot
Yenisei River	155,000	Navajo Marine Ltd.	HHI	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Yamal
YK Sovereign	127,125	SK Shipping Co. Ltd. -Krs	HHI	Dec-94	South Korea	Steam	Moss	4	MLNG
Zarga	268,000	Nakilat SHI 1752 Inc.	Samsung	Jan-10	Marshall Is.	DRL	TZ Mk. III	5	Qatargas IV
Zekreet	137,482	Mitsui/Nippon/Kawasaki/Iino	Mitsui E&S	Dec-98	Japan	Steam	Moss	5	Qatargas I

Fleet – LNG Bunkering

Name	Built	Capacity	Registered Owner	Builder	Flag	Engine Type	Cargo System	No. of tanks	Project
Seagas	Sep-74	170	Linde Gas AB	Havyard Leirvik	Sweden	Diesel	Cylinder	1	Stockholm Viking Line
Coral Methane	Apr-09	7,551	Coral Methane Shipping BV	AVIC Dingheng	Netherlands	Gas-Diesel	Cylinder	4	Portfolio
Oizmendi	Jul-09	600	Itsas Gas Bunker Supply SL	Astilleros Zamakona	Spain	Diesel	Cylinder	2	Huelva
Green Zeebrugge	Feb-17	5,000	LNG Link Investment AS	Hanjin Heavy Industries	Belgium	Diesel/Gas-Electric	Cylinder	2	Zeebrugge
Cardissa	Jun-17	6,500	Shell Western LNG BV	STX	Netherlands	Diesel/Gas-Electric	Cylinder	1	Portfolio
Coralius	Aug-17	5,800	Sirius Veder Gas AB	Bodewes Shipyards	Sweden	DFDE	Cylinder	4	Portfolio
Kairos	Oct-18	7,500	Uranos Vermogensverwaltung	Hyundai Mipo	Cyprus	Gas-Diesel	Type C	4	Portfolio
Bunker Breeze	Oct-18	6,050	Molucas Naviera AIE	Astilleros Zamakona	Spain	Gas-Diesel	Cylinder	4	Algeciras
LNG London	Apr-19	3,000	LNG Shipping S.A.	Severnav S.A.	Belgium	LNGPac	Cylinder	6	ARA
SM Jeju LNG 1	Sep-19	7,500	Jeju LNG 1 S.A.	Samsung	Panama	Diesel/Gas-Electric	KC-1	1	Portfolio
SM Jeju LNG 2	Jan-20	7,500	Jeju LNG 2 S.A.	Samsung	Panama	Diesel/Gas-Electric	KC-1	1	Portfolio
Gas Agility	Apr-20	18,600	Emerald Green Maritime Ltd.	Hudong Zhonghua	Malta	DFDE	TZ Mk III Flex	2	Rotterdam
Kaguya	Sep-20	3,469	Central LNG Shipping Japan	Kawasaki	Japan	Gas-Diesel	Cylinder	1	JERA TPS
Avenir Advantage	Oct-20	7,500	Avenir L Pte Ltd.	Keppel Nantong	Malta	Gas-Diesel	Type C	2	Portfolio
Avenir Accolade	Nov-20	7,500	Stolt-Nielsen Gas Ltd.	Keppel Nantong	Malta	Gas-Diesel	Type C	2	Portfolio
FueLNG Bellina	Nov-20	7,500	FueLNG Pte Ltd.	Kappel Nantong	Singapore	Diesel/Gas-Electric	Cylinder	2	Portfolio
Dalian No. 1	Dec-20	8,330	Xinao Marine Shipping Co. Ltd.	Dalian Yard	China	Gas-Diesel	Cylinder	2	Portfolio
Marine Vicky	Jan-20	9,900	Sinanju Tankers Pte. Ltd.	Keppel Nantong	Singapore	Gas-Diesel	TBC	TBC	Portfolio
Imperial Gas 92	Oct-17	3,800	Imperial Logistics International BV & Co. KG	Centromost	Germany	Diesel	Cylinder	TBC	Portfolio
Imperial Gas 93	Nov-17	3,800	Imperial Logistics International BV & Co. KG	Centromost	Germany	Diesel	Cylinder	TBC	Portfolio

Fleet – Small-scale/Multipurpose

Name	Built	Capacity	Registered Owner	Builder	Flag	Engine Type	Cargo System	No. of tanks	Project
Akebono Maru	Jun-11	3,500	Chuo Kaiun K.K.	Higaki	Japan	Diesel	Cylinders	2	Japan coastal trade
Aman Sendai	May-97	18,928	Asia LNG Transport	NKK	Malaysia	Steam	TZ Mk. III	3	Malaysia LNG
Coral Acropora	Dec-12	6,573	Coral Acropora Shipping	AVIC Dingheng	Netherlands	Gas-Diesel	Cylinders	4	Portfolio
Coral Actinia	Jan-13	6,573	Coral Actinia Shipping	AVIC Dingheng	Netherlands	Gas-Diesel	Cylinders	4	Portfolio
Coral Alicia	Dec-12	6,573	Coral Alicia Shipping	AVIC Dingheng	Netherlands	Gas-Diesel	Cylinders	4	Portfolio
Coral Anthelia	May-13	6,500	Coral Anthelia Shipping	AVIC Dingheng	Netherlands	Gas-Diesel	Cylinders	4	Portfolio
Coral Energice	Feb-18	18,000	Anthony Veder Chartering	Neptun Werft	Netherlands	Gas-Diesel	TZ MK. III Flex	2	Portfolio
Coral Energy	Dec-12	15,600	Anthony Veder Rederijzaken	Meyer Werft	Netherlands	Gas-Diesel	IMO Type C	3	Portfolio
Coral Favia	Jul-10	10,000	Somargas II Pvt. Ltd.	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Baltic portfolio
Coral Fraseri	Jan-10	10,000	Innovation Shipping Co.	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Portfolio
Coral Fungia	Jan-11	10,000	Somargas II Pvt. Ltd.	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Baltic portfolio
Coral Furcata	Nov-11	10,000	Conception Shipping Company	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Portfolio
Hai Yang Shi You 301	Apr-15	30,000	COSL	Jiangnan Shipyard	China	Gas-Diesel	Membrane	4	Hainan LNG shuttle
Kakurei Maru	Nov-08	2,536	Tsurumi Sunmarine Co.	Higaki	Japan	Diesel	Cylinders	2	Japan coastal trade
Kakuyu Maru	Nov-13	2,538	Tsurumi Sunmarine Co.	Kawasaki	Japan	Diesel	Cylinders	1	Japan coastal trade
Lucia Ambition	Dec-93	18,927	Asia LNG Transport	NKK	Malaysia	Steam	TZ Mk. III	3	Malaysia-Hainan
North Pioneer	Nov-05	2,500	Japan Liquid & Gas Transport Co. & Japan Railway Agency	Shin Kurushima	Japan	Diesel	Cylinders	2	Japan coastal trade
Pioneer Knutsen	Mar-04	1,100	Knutsen Kyst LNG K/S	Bijlsma Lemmer B.V. Scheepswerf	Norway	LNG-Diesel	Cylinders	2	Norway coastal trade
Ravenna Knutsen	Feb-21	30,000	Norspan LNG 14 AS	Hyundai Mipo	Spain	X-DF	Cylinders	3	Italy coastal trade
Seoul Gas	Jul-98	4,365	Chemgas Schiffahrts GmbH & Co. mt Oste KG	Severnav Shipbuilding	Liberia	Diesel	Cylinders	2	S. Korea-China
Shinju Maru No. 1	Aug-03	2,538	JRTT & NS United Coastal Tankers	Kawasaki	Japan	Diesel	Cylinders	2	Japan coastal trade
Shinju Maru No. 2	Oct-08	2,536	Chuo Kaiun K.K.	Higaki	Japan	Diesel	Cylinders	2	Japan coastal trade
Sun Arrows	Sep-07	19,531	Maple LNG Transport Inc.	Kawasaki	Bahamas	Diesel	Moss	3	Malaysia LNG
Surya Aki	Feb-96	19,538	MCGC International Limited & Hiroshima Gas Co.	Kawasaki	Bahamas	Steam	Moss	3	Thanlyin LNG
Triputra	Dec-00	23,097	Nusantara Shipping	NKK	Indonesia	Steam	TZ Mk. III	3	Pertamina Portfolio
Unikum Spirit	Jun-11	12,000	DHJS Hull No.2007-001 LLC	AVIC Dingheng	Singapore	Diesel	Cylinders	2	Kuantan
Vision Spirit	Sep-11	12,000	I.M. Skaugen Marine Services	AVIC Dingheng	Singapore	Diesel	Cylinders	2	Portfolio

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

LNG Import Terminals

Explanatory Notes

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

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

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

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage Tanks	Storage Capacity
	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
Japan (continued)	Ishikari LNG	Hokkaido Gas, Hokkaido Electric	2012	2	380,000
	Okinawa	Okinawa Electric Power	2012	2	280,000
	Naoetsu	Inpex	2013	2	360,000
	Joetsu	JERA Co. Inc.	2011	3	540,000
	Hachinohe LNG	Nippon Oil	2015	2	280,000
	Hitachi LNG	Tokyo Gas	2015	1	230,000
	Soma Fukushima	Japan Petroleum Exploration	2017	1	225,000
Korea	Boryyeong	GS Energy, SK E&S	2017	3	200,000
	Incheon	Kogas	1996	20	2,880,000
	Kwangyang	POSCO SK E&S	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
	Jeju	Kogas	2019	2	90,000
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
Sweden	Lysekil	Gasum	2014	1	30,000
	Nynashamn	AGA Gas	2011	1	20,000
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	Storage Capacity
China	Shenzhen	CNPC Yudean Power	2021	2	120,000
	Tianjin (Nangang)	Beijing Energy	2022	10	2,000,000
	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	2021	2	320,000
	Kodinar	Hindustan Petroleum Corp.	2022	1	160,000
Japan	Himuka	Diagas Group-Osaka Gas	2022	1	65,000

LNG FSRU Import Facilities

Country	Location (Project)	Owners	Start up
Argentina	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
	Porto Sergipe FSRU	Golar LNG/Stonepeak	2020
	Porto do Acu FSRU	GNA	2020
China	Tianjin FSRU	CNOOC, Hoegh, various	2013
Croatia	Hrvatska LNG	MVM	2021
Colombia	Cartagena FSRU	Promigas, Sociedad Portuaria El Cayao	2016
Egypt	Ain Sokhna, Suez	EGAS, BW Gas	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertimana	2012
	Benoa LNG	PT Pertagas Niaga	2016
	Amurang	Karadeniz	2020
	Jawa Satu FSRU	Pertamina	2021
Israel	Hadera Gateway	Israel Electric	2013
Italy	Livorno	OLT Offshore LNG Toscana	2013
Jamaica	Old Harbour	Golar FSRU, New Fortress	2019
Jordan	Aqaba, Jordan	Golar LNG	2015
Kuwait	Mina Al-Ahmadi	KPC	2009
Lithuania	Klaipeda	Klaipedos Nafta Hoegh LNG	2014
Malaysia	Malacca FSRU	Petronas	2012
Malta	FSU Armada Mediterrana	ElectroGas	2016
Myanmar	Thanlyin	CNTIC Vpower	2020
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
	Port Qasim	BW-Mitsui, PGP Consortium	2017
Russia	Kaliningrad FSRU	Gazprom	2020
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

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
	Delfin LNG, Louisiana	Delfin	2023+	3	9.0
	Driftwood LNG, Louisiana	Tellurian, Total and others	2023	6	27.6
	Galveston Bay LNG	NextDecade	2023+	6	27.0
	Golden Pass, Texas	Qatar Petroleum, ExxonMobil	2024	3	15.6
	Jacksonville, St John's River	Eagle LNG, Ferus Natural Gas Fuels	2021+	small	TBC
	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	12.0
	VG LNG (Plaquemines)	Venture Global	2022	10	20.0
	VG LNG (Delta-Plaquemines)	Venture Global	2024	36	22.5

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	2	3.2	3	240,000
			1994	1	2.5		
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mistubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
	Darwin	Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
	Gladstone LNG	Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
	Gorgon LNG	Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
	Pluto LNG	Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
	QCLNG	Shell, CNOOC	2014	2	8.0	2	280,000
	Wheatstone LNG	Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
	Ichthys LNG	Inpex Corp., Total	2018	2	8.9	2	330,000
	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 Mitsubishi, Mitsui, Partex and Itochu	2000	2	7.1	2	240,000
		Oman Govt.,Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
PAPUA NEW GUINEA	PNG LNG	ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-TI	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5	4	640,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	5	22.5	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
	Cheniere Corpus Christi	Texas Cheniere	2018	3	15.0	3	480,000
	Cameron Hackberry	Sempra, Total, Mitsui, Mitsubishi	2019	2	9.8	3	480,000
	Elba Island Georgia	Kinder Morgan, EIG Energy	2019	10	2.5	5	535,000
	Freeport LNG,Texas	Freeport LNG	2019	2	10.2	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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