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A way forward for FLNG

The first implementations of FLNG technology were balance sheet financed with concepts capturing all stages of gas production on one vessel. However, this resulted in very costly projects, with cheaper innovations seeking to edge them out as leading concepts. Markets Editor Alexander Wilk reports.

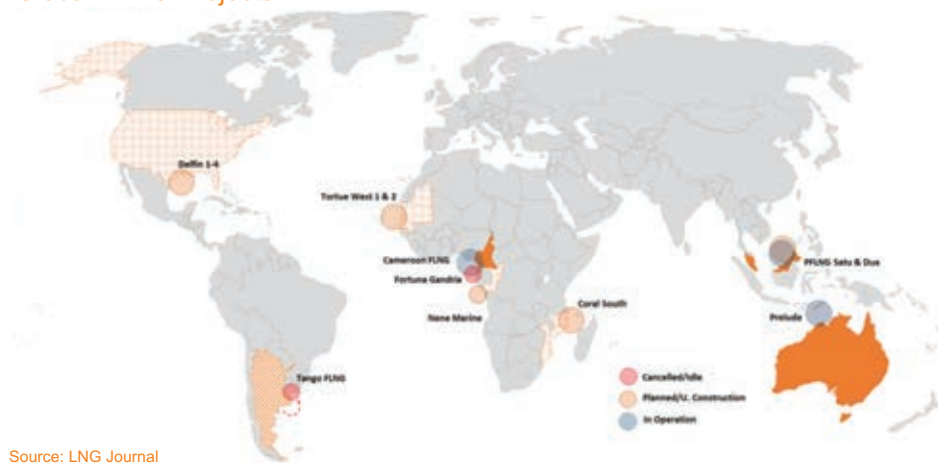
The Floating LNG (FLNG) sphere is entering interesting times. At first buoyed by high oil prices, interest waned after they collapsed in 2014. On the one hand, established projects such as Shell's Prelude and YPF's Tango FLNG barges experienced harsh setbacks in 2020 whilst on the other Cameroon's FLNG project has settled into stable production, our data shows. Concurrently, Malaysia's FLNG expansion is continuing although progress has at times stumbled. There also remains a roster of new projects waiting in the wings. Crucially, it is important whether an FLNG project is of the 'wellstream' or 'liquefier' type. There is a difference in approaches, which in our view is an important factor for the likelihood of long-term success for these projects due to project complexity and overall costs.

Floating LNG technology has evolved dramatically since the late 1990s, when the first ambitious projects for large-scale offshore LNG production were tabled. Although the origins of FLNG can be traced back to early-stage concepts by Moss Maritime in 1979, major problems – including the hyper-mobility of barges causing significant undulation within their tanks, or the impact force of waves – highlighted that neither the technology nor the expertise existed at the time.

This changed with the first major FLNG research project in the 1990s. The so-called 'Doughnut' was an FLNG production concept developed by Mobil. The design comprised a floating plant with capacity of six million tonnes per annum (mtpa) on a symmetrical hull built around a moonpool. Alas, due to safety concerns related to the proposed concrete construction the idea also did not come to fruition.

Among Mobil's successors in the fledging FLNG sphere was Shell, which through work on the Azure study (co-sponsored by the European Union) arrived at a basic design package for FLNG vessels that culminated in the

Global FLNG Projects



Source: LNG Journal

Prelude barge. Azure demonstrated the possibility of an integrated FLNG design chain, comprising a Floating Production Storage and Offloading (FPSO) unit at the beginning, a floating regasification unit (FSRU) at the recipient point, and shuttles that would move LNG between the two.

Wellstream vs Liquefier

Importantly, a 'wellstream' element was baked into the Azure model, whereby the FLNG unit would be positioned above an offshore gas field to both produce gas from subsea wells and liquefy it onboard. Probably the most prominent example of this type of FLNG facility is Shell's Prelude FLNG barge due to its sheer size whilst PFLNG Satu – owned and operated by Malaysian government-controlled energy giant Petronas – was the world's first commercially producing FLNG facility. Among other upcoming wellhead FLNG projects are Petronas' second FLNG facility – PFLNG Dua – as well as the Eni-led Coral South project offshore Mozambique.

The wellstream concept hitherto carried merit by allowing a more flexible (at least when compared to onshore plants) floating facility to commercialise smaller offshore gas assets that would otherwise have been left stranded. Australia's onshore Ichthys LNG project with its 800km subsea pipeline network, for example, is an impressive reminder of what it takes to produce LNG onshore from a roster of difficult-to-reach offshore

fields at a time when most of the known 'low-hanging fruit' of hydrocarbon deposits have already been tapped. Concurrently, Petronas was able to move its PFLNG Satu unit from the Kanowit field offshore Sarawak to the Kebabangan field offshore Sabah. PFLNG Satu produced several cargoes from Kanowit prior to moving, according to our data, and we thus assume production ceased to be commercially viable at the wellhead. In contrast, production from Kebabangan has been underway since May 2019.

However, this pioneering prowess came at a cost. The world's first two 'wellstream' FLNG developments – PFLNG Satu and Prelude – are likely to be located towards the upper end of the scale (Shell has never confirmed CAPEX estimates). In addition to liquefying gas onboard, a wellstream FLNG vessel is an integral part to the so-called 'Christmas tree' on the ocean floor underneath, i.e. the network of wells, pipelines and subsea stations that carry the untreated gas to the vessel. This means that although touted as modular, each wellstream vessel is still likely to be custom-built for a specific set of circumstances based on the gas asset(s) it is producing from. Untreated gas at the wellhead can vary widely in composition from field to field. This in turn is likely to limit the scope of deployment.

In contrast, so-called 'liquefier' FLNG vessels do not have to work within the

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Maritime Content Ltd

2 Prospect Road
St Albans AL1 2AX
United Kingdom
www.LNGjournal.com
+44 (0)20 7253 2700

Publisher

Stuart Fryer

Markets & Commissioning Editor

Anja Karl
anja@lngjournal.com

Markets Editor

Alexander Wilk
alexander@lngjournal.com

Technical Editor

Ian Cochran
iancochran74@gmail.com

Fuelling Editor

Malcolm Ramsay
malcolmrays@gmail.com

Advertising

David Jeffries, Only Media Ltd
Tel: +44 (0) 208 150 5293
djeffries@lngjournal.com

Subscriptions Sales Manager

Stephan Venter
venter@lngjournal.com

Subscriptions Renewals Manager & Customer Care

Gabi Weck
gabi@lngjournal.com

Production

Vivian Chee
chee@btconnect.com

Subscription

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www.lngjournal.com
hotline +44 (0)20 7253 2700

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same specialised settings since they are designed to liquefy pre-treated gas delivered via pipeline either from onshore or offshore facilities. In our view, this is where true modularity can be achieved, allowing not only for the moving of vessels when required, but also the use of converted LNG tankers to slash CapEx since there is less of a requirement for specialist pre-treatment facilities onboard. At the time of writing, the only example of this concept in operation was the Golar-managed Hilli Episeyo FLNG vessel that forms part of Cameroon's FLNG project.

However, the re-use of converted LNGCs also means there is an inherent limit to the capacity per vessel compared to that of a custom-built unit. Accordingly, Shell's Prelude facility has 50 percent more capacity than the Hilli Episeyo. Moreover, despite being less complex and cheaper to install, being of the 'liquefier' variety is not a synonym for automatic success – as evidenced by the failed Fortuna Gandria development – whilst the increased dynamism due to higher deployment flexibility arguably can result in abrupt contract disruptions as seen recently in Argentina.

Wellstream - trailblazing complexity

The case for offshore gas fields otherwise too small for conventional development received a significant boost through the early production ramp-up at Shell's Prelude project in Australia, comprising the world's largest FLNG barge to date.

Initial evidence indicated the energy major's seemingly considered approach was paying off. Given that Prelude's annual LNG capacity lies between 45 and 55 cargoes (depending on carrier capacity), it was already approaching 80% annualised capacity utilisation in August 2019, having settled into a stable rhythm of c. one cargo every 10 days. At the time, the FLNG barge was thus on track to prove the wellstream FLNG concept at a scale equivalent to an onshore LNG train, which promised to be excellent news for isolated small offshore gas fields the world over.

However, what may have appeared a considered approach was likely more due to enforced caution. Nobody had ever built something like Prelude. Perhaps unsurprisingly, therefore, the project was plagued by delays and probably high costs owed to the complexity of the undertaking.

High costs

Prelude received its go-ahead in May 2011, with CapEx of US\$10.8 – 12.6

billion, on our estimate. Whilst Shell has not released official CapEx figures, assuming the cost per mtpa of LNG capacity for the part-turnkey project to be broadly similar to approved onshore LNG projects at the time (for lack of a similarly sized FLNG benchmark), we expect CapEx to be around US\$3-3.5 billion per mtpa.

This would put Prelude in a lower CapEx bracket than neighbouring greenfield LNG projects such as the bold but technically demanding Ichthys LNG, which ended up costing US\$45 billion, up 32% on the initial budget of US\$32 billion set in 2012. This is not to say that Prelude may not have had its own share of cost increases – when first touted, the project's CapEx was pegged at roughly US\$5 billion.

We highlight, however, that projects such as Ichthys were not only built out of profit motivations. Ichthys was also given the go-ahead to enhance energy security for Japan through the proxy of the project's leading shareholder INPEX. Prelude's only purpose, on the other hand, is to make smaller offshore gas fields commercially viable and overall costs, therefore, are of prime importance.

Unscheduled delays

Shell cut first steel for the facility's substructure in October 2012, with the completed vessel originally planned to be towed to site in Australia by end-2015 for first production as early as 2016. However, quality control checks in 2015 uncovered issues with the coating of the giant ballast water tanks, which delayed the departure of the barge from South Korea by what at the time was thought would be up to seven months and ended up being more than a year.

Prelude only received its cooldown cargo from Peru's Pampa Melchorita plant via the *Methane Mickie Harper* on 5th October 2018, according to our data. Still, it took more than nine additional

months to put the barge's first commercial LNG cargo onboard the *Valencia Knutsen* on 10th June 2019, our data shows. Consequently, the facility suffered a total delay of roughly three years from yard to production.

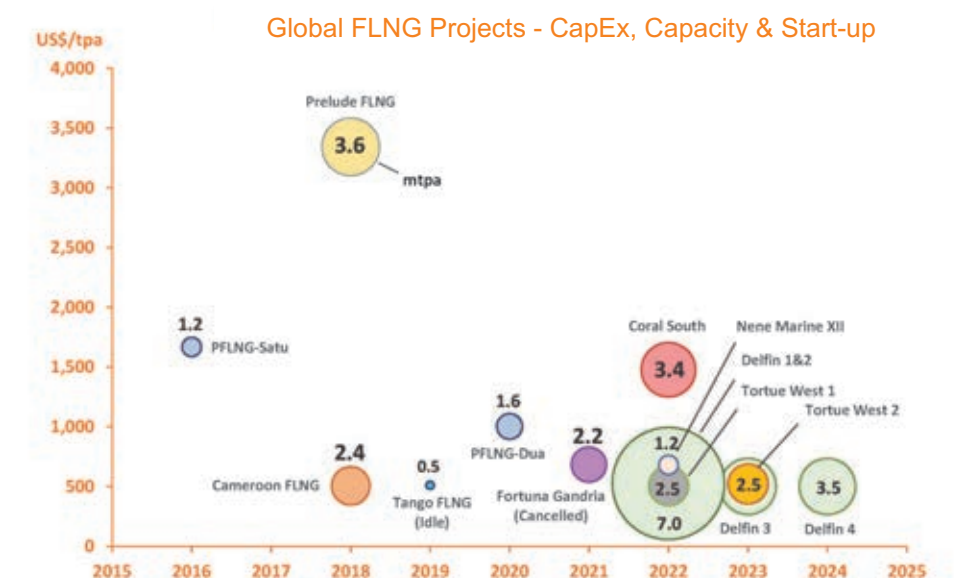
Initial success did not last

Unfortunately, Prelude only enjoyed regular shipments for roughly seven months. Shell was forced to suspend its FLNG shipments following an electrical fault in early February 2020. A notification from Australia's National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) had mandated the move in January that year. The technical issue reportedly limited several of the vessel's amenities and was compounded by a power failure, which warranted onboard staff reduction.

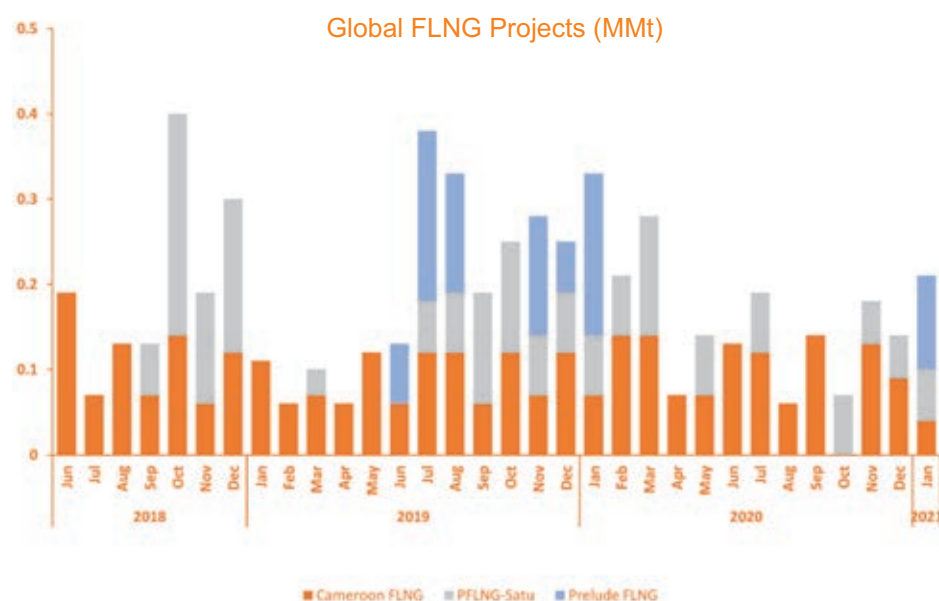
In our view, these fundamental system failures and the time of almost a year it took to fix them highlight Prelude's sheer complexity. We also think it is very likely the ensuing low-price environment – in line with last year's COVID-induced oil price crash – led Shell to extend Prelude's suspension. Notably, Shell announced at the end of June 2020 it would be impairing its Australian gas assets, principally QCLNG and Prelude, by up to US\$9 billion due to international gas prices being significantly below those on which the projects were costed.

Time to market: PFLNG Satu & Dua

Although much smaller in scale compared to Prelude – PFLNG Satu and Dua both have a nameplate capacity of only roughly 30 percent of Prelude – their implementation went much smoother. Nevertheless, both projects showed and – in the case of PFLNG Dua – still show a similarly lengthy time from arrival above their respective gas field to first commercial exports.



Source: LNG Journal



Source: LNG Journal

Wellstream connections take time

Whilst the time to market argument could have also been made about Prelude, there it seemed to have been due to unscheduled delays. When considering the PFLNG units, it is interesting to note that they still require a similarly long time from installation to first LNG export as Prelude despite their smaller size.

Nevertheless, PFLNG Satu proved a key argument in favour of FLNG – deployment flexibility. According to our data, the Malaysian vessel saw a continuous downward trend in production between October 2018 and May 2019, necessitating a relocation from its original site at the Kanowit gas field offshore Bintulu to the Kebabangan cluster of minor gas fields, 90km offshore Sabah. This transfer took place without an apparent hitch and PFLNG Satu has been back in production since.

The PFLNG Dua – PFLNG Satu's slightly larger sister vessel – meanwhile arrived at the Rotan field off Borneo from South Korea in February 2020. It has yet to ship a cargo, according to our data.

Potential lessons – Coral South

With Prelude and the PFLNG duo presenting a mixed bag of promising potential alongside protracted setbacks, it is likely going to be left to Eni's Coral South FLNG development offshore Mozambique to cement the effectiveness of the large-scale 'wellstream' concept. The Italian oil and gas major's other FLNG project – originally planned for the Congo's offshore Nene Marine field – has yet to receive its final investment decision (FID). Importantly, IHS Markit highlighted a risk of Eni divesting its Congolese assets to support its balance sheet. Meanwhile, Eni took Coral South's FID in June 2017 and the vessel is still being constructed by Samsung in Korea.

Eni has scheduled first Coral South production for some time in 2022.

Liquefier - promises of efficiency

Perhaps less able to catch the imagination than mega-projects such as Prelude, FLNG projects of the 'liquefier' variety have been quietly reaching for market share. Crucially, these are less of 'first of a kind' projects – which have been challenging for Shell and Petronas – but instead comprise innovation using existing assets. Since they are designed to receive pre-treated gas from onshore pipelines, offshore platforms or FPSOs, their execution has been simplified. So far, reliance on converted LNGCs has meant project capacity was capped at around 2.4mtpa. However, this is likely to change.

Project execution – Cameroon FLNG

At the time of writing, the only example of the liquefier concept in operation was the Golar-managed Hilli Episeyo FLNG vessel that forms part of Cameroon's FLNG project. The development has hitherto been the poster child of a successfully executed FLNG project, starting production on-time in June 2018 at US\$70 million under budget. The conversion of the Hilli Episeyo from LNG carrier to FLNG vessel took just 36 months to complete followed by another six months for deployment, installation and commissioning – a total of 42 months or roughly half the time it took for Prelude to ship its first cargo. Except for a brief maintenance period in October last year, the facility has also been in continued production, our data shows. Golar provides the Hilli Episeyo under a production tolling agreement with oil firm Perenco and Cameroon's state-run Societe Nationale Des Hydrocarbures (SNH). Perenco has committed the plant's output

to Gazprom Marketing & Trading until 2026. Processed gas is delivered from via the Sanaga-2 platform.

Taking the baton – Tortue FLNG

The apparent success of Cameroon FLNG has also helped to float BP's Tortue FLNG project offshore Mauritania and Senegal. The FID for Phase I was taken in December 2018 and Golar was again contracted to supply the FLNG vessel – the former carrier *Gimi*, currently converted at Keppel in Singapore – on a lease basis. Golar's Cameroon experience will serve as a broad project template, whereby the vessel will host the liquefaction units whilst gas is pre-treated aboard a nearby FPSO. The converted *Gimi* is expected to arrive at the project in the first half of 2022.

Unlocking scale – Delfin

Meanwhile, US/Norwegian company Delfin Midstream through its subsidiary Delfin LNG is planning to introduce scale to Golar's liquefier approach whilst maintaining the two West African projects' proven Black & Veatch PRICO liquefaction process. Delfin hopes to be able to take advantage of abundant US gas by essentially daisy-chaining up to six FLNG units, with Phase I envisioning four installed production units of 3.5mtpa each. Taken together, Phase I would thus more than quadruple Prelude's nominal liquefaction capacity.

Importantly, Delfin is looking to innovate on Golar's approach by liquefying pre-treated gas but from new vessels custom-built for the project to avoid the previous size constraints inherent to the repurposing of former LNGCs. Moreover, the custom designs will be compatible with both conventional LNGCs and much smaller LNG bunkering and coastal carriers, according to Delfin.

The company purchased the UTOS pipeline, the largest natural gas pipeline in the Gulf of Mexico, in 2014 and submitted its Deepwater Port license application in 2015. Having obtained permits from the Maritime Administration (a simpler and quicker process than its equivalent for onshore projects with FERC) and the US Department of Energy, the company concluded the front-end engineering and design (FEED) phase for its first FLNG vessel.

Project risks remain – Delfin, Fortuna Gandria & Tango FLNG

Whilst it may seem that the liquefier path

is the golden ticket to FLNG's future, we highlight that although Delfin was careful to develop a term sheet for a lump-sum turnkey contract with Black & Veatch and FLNG specialist Samsung Heavy Industries, such a turnkey agreement did not save Shell from pre-launch delays when implementing Prelude. Moreover, by opting for custom-built units, Delfin is foregoing the considerable liquefier-concept expertise already accumulated by companies such as Golar and Keppel O&M.

Less commitment?

Finally, YPF's force majeure notice and subsequent release of the Tango FLNG asset leaseholders cancelling their contracts when forced to do so. Whereas increased deployment flexibility is normally an advantage, it also makes it easier to cancel the asset lease and send the vessel on its way. This would be much more difficult with a wellstream FLNG development due to its integration with the subsea well system, even if the asset holders were operating on a similar lease model to the existing liquefier projects. Arguably, this concern feeds directly into financing risk of liquefier projects, which so far have tended to be less balance sheet financed. A resulting complex combination of construction financing and sale and leaseback structures without support from firm offtake agreements can still impose unsurmountable hurdles as happened to the Fortue Gandria development in Equatorial Guinea. The project was cancelled after Ophir was unable to secure financing in 2018. First gas from the project was originally planned for 2022.

Potential future

As it stands, the liquefier model seems poised to edge out its wellstream counterpart. As indicated above, it will remain to be seen how well Eni's Coral South development is executed. Although current plans for scaling the liquefier model to above Prelude-levels are reserved to Delfin's brownfield development by taking advantage of pre-installed subsea pipelines and custom-built liquefaction units, we see potential for this method to be adapted using repurposed LNGCs in combination with FPSOs in greenfield areas. To that end, there are currently 34 LNGCs above or approaching the age of 25 years, when its owners typically begin mulling such vessel's commercial future. ■

US-China trade remains fractious under new Biden administration

On Joe Biden's first days in the Oval Office he signed a flurry of executive orders like re-joining the Paris Agreement and the WHO, but relations with China remain tense and factious as the new US President inherits a trade war that now involves over \$700 billion in bilateral trade. Though China's Phase 1 trade commitment to buy an additional \$52.4 billion of energy from the United States by end-2021 will remain in place, analysts say it looks "difficult to achieve." – Markets Editor Anja Karl reports.

Lower oil prices, reduced US crude production and limited recovery in crude processing capacity in China are all factors that lower the likelihood of China living up to its trade commitments. Crude oil imports from the US ramped up to about 350,000 barrels per day (b/d) on average in 2020, but this is still way below the required amount of more than 1.5 million b/d to meet the deal.

According to Sushant Gupta, head of Wood Mackenzie's Asia group, the Chinese government's move to temporary lift LNG import tariffs has helped increase volumes – “but by nowhere near enough to fill the gap left by reduced crude imports.”

US officials reckon China needs to issue waivers or further adjustments to tariffs to meet its buying commitments, notably of American liquefied natural gas. In April 2020, the Chinese government had begun granting tax waivers to LNG importers and removed 25 percent taxes from imported US LNG, which changed trade flows at the time but did not create additional demand. According to Chinese customs data, crude oil imports fell from 45.36 million tonnes in November to 38.47 million tonnes in December 2020, while LNG imports increased from 6.61

million tonnes to 7.59 million tonnes over the same period.

LNG price volatility rises post-pandemic

Oil and natural gas prices have become more volatile as leading economies return to growth post-pandemic and energy demand recovers. For the US economy, the impact from inflation and foreign exchange on commodity prices will hinge on how Biden funds his proposed \$1.9 trillion stimulus, analysts said, suggesting: “If it comes from drawing down past inflows to Asia, price volatility could increase.”

The recent LNG price rally in Asia propelled up prices for spot cargoes to prohibitive highs and caused some demand destruction, particularly in China, where state-dominated regional gas distributors cannot fully hand on higher costs of imported LNG to end-customers. At the height of the cold spell, spot LNG prices surged by nearly 200 percent and the Japan-Korea Marker (JKM) for February reached a record high of \$32.494 per MMBtu on January 12 – higher than the JKM March-21 contract which was last seen trading at \$8.365 per MMBtu.



Asian spot LNG price spikes were caused by supply outages and a hard winter. In December and January, blistering cold temperatures gripped wider Beijing, Tokyo, Shanghai and Seoul, pushing up gas demand for heating and power generation. Chinese city gas operators had to cater to a sudden surge in gas demand, pushing up sales and profits to some extent, though Fitch Rating noted that rising spot LNG prices put pressure on dollar

margins. The sky-high seasonal demand in Asia widened prices spreads between the US Gulf Coast and the Northwest Europe free-on-board (FOB) cargoes against the JKM North Asia spot price, and the bulk of available spot cargoes had been diverted to Asian markets. “All available tonnage was fixed in a frenzy by charterers,” shipbrokers SSY noted, “and portfolio players were eager to cover Atlantic liftings in January and February,

US LNG cargoes headed to China in Dec-20 and Jan-21

Cargo ID	Export Facility	Vessel Name	IMO Number	Sailed Date	Import Country	Import Facility	Arrival Date	Original Cargo MMt	Delivered MMt	Delivered bcf	Discharge ID	Route
LAHM744200	Sabine Pass LNG	Ribera del Duero Knutsen	9477593	04-Jan-21	China	Dalian LNG	08-Feb-21	0.07	0.07	3.36	LAHM746118	Via Suez Canal
3EPT944197	Sabine Pass LNG	LNG Schneeweisschen	9771913	01-Jan-21	China	Tianjin LNG	03-Feb-21	0.07	0.07	3.36	3EPT946115	Via Suez Canal
LARL744194	Sabine Pass LNG	WilForce	9627954	29-Dec-20	China	Beihai LNG	29-Jan-21	0.07	0.07	3.36	LARL746112	Via Suez Canal
ZCEH444187	Sabine Pass LNG	GasLog Shanghai	9600528	22-Dec-20	China	Zhoushan LNG	26-Jan-21	0.07	0.07	3.36	ZCEH446105	Via Suez Canal
MAOR444182	Freeport LNG	British Sponsor	9766580	17-Dec-20	China	Shenzhen Diefu LNG	19-Jan-21	0.08	0.07	3.36	MAOR446100	Via Suez Canal
ZCEK744180	Corpus Christi LNG	GasLog Chelsea	9390185	15-Dec-20	China	Qidong LNG	24-Jan-21	0.06	0.06	2.88	ZCEK746098	Via Cape of Good Hope
9MIB944179	Cameron LNG	Seri Balhaf	9331660	14-Dec-20	China	Qidong LNG	14-Jan-21	0.07	0.06	2.88	9MIB946097	Via Panama Canal
V7AF444177	Freeport LNG	Golar Bear	9626039	12-Dec-20	China	Zhoushan LNG	17-Jan-21	0.06	0.06	2.88	V7AF446095	Via Suez Canal
9V540644173	Freeport LNG	BW Tulip	9758064	08-Dec-20	China	Qingdao LNG	03-Jan-21	0.07	0.07	3.36	9V540646091	Via Panama Canal
EARD44172	Corpus Christi LNG	La Mancha Knutsen	9721724	07-Dec-20	China	Zhuhai LNG	08-Jan-21	0.08	0.08	3.84	EARD46090	Via Panama Canal
MAOR644171	Freeport LNG	British Listener	9766566	06-Dec-20	China	Zhoushan LNG	12-Jan-21	0.07	0.07	3.36	MAOR646089	Via Suez Canal
SVC1744171	Sabine Pass LNG	Maran Gas Hector	9682605	06-Dec-20	China	Hainan LNG	13-Jan-21	0.08	0.07	3.36	SVC1746089	Via Panama Canal
MAOS244170	Freeport LNG	British Partner	9766530	05-Dec-20	China	Tianjin LNG	10-Jan-21	0.07	0.06	2.88	MAOS246088	Via Suez Canal
C6EQ244170	Cameron LNG	Diamond Gas Metropolis	9862487	05-Dec-20	China	Zhejiang LNG	31-Dec-20	0.08	0.08	3.84	C6EQ246088	Via Panama Canal
3EKM644169	Sabine Pass LNG	SK Audace	9693161	04-Dec-20	China	Qingdao LNG	31-Dec-20	0.07	0.07	3.36	3EKM646087	Via Panama Canal



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leaving all three major basins practically drained of prompt freight.”

Chinese LNG tenders left unawarded

Some hard-nosed Asian buyers soon started to shun expensive US spot LNG and turned to pipeline gas instead. Traders indicated that JKM’s record high of nearly \$32.50 per MMBtu in early January has caused some demand destruction, notably in China where importers cannot fully pass on their costs to the downstream market. LNG Journal’s market tracker shows that only two US LNG cargoes left the Sabine Pass LNG export facility in January en route to China, compared with 13 cargoes in December.

At the peak of January’s cold snap, utilities were forced to ramp up gas-fired power plants to full capacity to make up for a temporary dip in coal-fired power output. Zhejiang Energy reportedly supplied a total 400 million cubic meters of gas from January 1-9, up 33.6 percent year on year, whereby gas-burn for power generation surged 73.7 percent.

Alerted by the LNG price rally, and eager to shield state oil and gas companies, the Chinese government cracked down on domestic gas price increases from mid-January. The National Development and Reform Commission (NDRC)

CNOOC, PetroChina, Guangzhou Gas and Guangdong Energy consequently left some LNG purchase tenders – issued in mid-December for January-February deliveries – unawarded. State-dominated Chinese buyers are reluctant to pay anything above \$15 per MMBtu given that they can also revert to pipeline gas, imported from Russia and Turkmenistan, or domestic supplies. National oil companies, as well as most rated Chinese gas distributors have long-term gas supply contracts in place, which are typically oil-indexed and far less volatile than spot prices. Volumes imported under such long-term contracts can be increased within limits, insulating offtakers with multiple supply sources against sudden spot LNG price spikes.

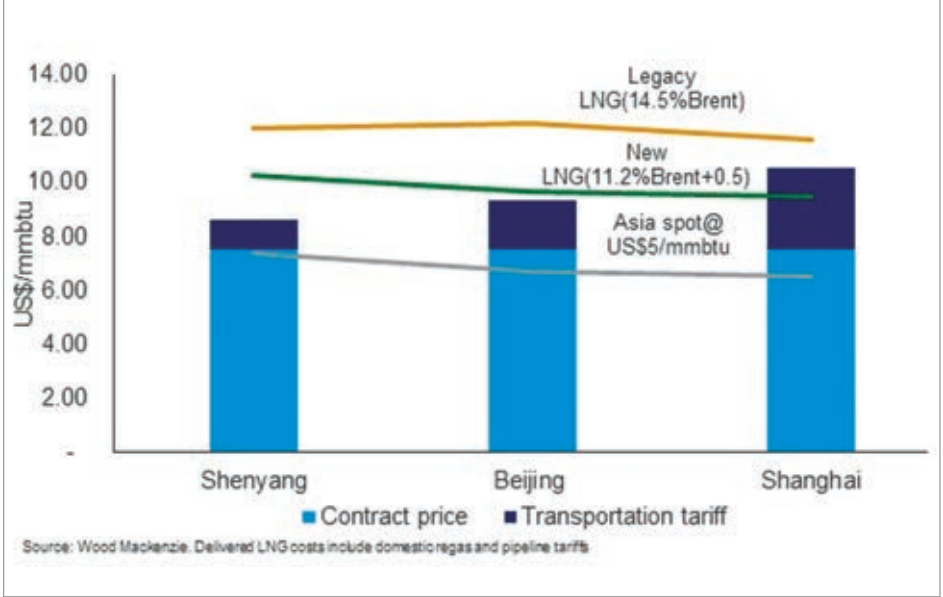
Prices ease as supply returns

In recent weeks, easing supply constraints added a bearish element. The return of additional LNG supply volumes – notably the return of Shell’s Prelude floating liquefaction unit – reduces supply constraints and brings down prices. “US LNG cargoes that are produced today can reach Asia in 38 days, even if they travel via the Cape of Good Hope, so prices should definitely ease by mid-February,” said IHS Markit director of Southeast Asia and LNG, Chong Zhi Xin.

Starting from March, the start-up of the 4.5 mtpa

Corpus Christi Train 3 is expected to add between 5 to 10 vessels per month,

though it is unclear how much of that will be going to the Pacific Basin. Energy Aspects expect 19 vessels to be delivered to Northeast Asia over the first quarter of 2021, which is up from just four vessels over the first quarter in 2020.



With JKM Mar-21 contracts last seen trading at \$8.365 per MMBtu, and JKM Apr-21 priced as low as \$6.325 per MMBtu, there will be no demand for European reloads and cargoes being diverted from the Atlantic Basin this spring. The intra-basin arbitrage window is set to close completely by April, reducing the number of US shipments to Northeast Asia and easing the Panama Canal congestion.

Ongoing delays for LNG tankers transiting the Panama Canal were lately worsened by fog on top of the pandemic precautions, according to shipbrokers at Simpson Spence Young (SSY). “The rapid increase in tonnage attempting to transit and Covid-19 restrictions for pilots and essential staff at the locks increased the waiting time for transiting without a slot by as much as 12-14 days,” SSY said in its latest market report. “These delays disturbed the schedule of several players who in turn had to buy spot cargoes to backfill shorts created by Panama delays.”

Portfolio players consequently redesigned their shipping routes and

scheduling for US LNG cargoes, resulting in rising demand for Suez and Cape of Good Hope passages. Shift in shipping will be sustained as long as Panama Canal congestions persist. At the time of writing, LNG Journal ship-tracking data showed only seven January-loaded LNG cargoes were looking to transit the Panama Canal – a far cry from the 19 tankers having set sail to Asia via the Suez Canal.

The extra shipping cost linked to a 97-day round trip for a US cargo to Northeast Asia via the Cape of Good Hope (COGH) relative to delivering to Europe is \$2.40 per MMBtu at prevailing freight rates and boil-off costs, according to Energy Aspects. The Panama route only costs \$1.16 per MMBtu extra at current rates.

Gazprom strives to step up supplies

In the face of high spot LNG prices in Asia, Russia’s Gazprom has been keen to position itself as a reliable alternative gas supplier. Since November, it has delivered 25 percent more natural gas than

“US LNG cargoes produced today can reach Asia in 38 days, even if they travel via the Cape of Good Hope, so prices should ease by mid-February”

- Chong Zhi Xin, director at IHS Markit.

mandated that trucked LNG prices are not permitted to exceed 20% of the city gas price guideline, while several LNG import and regas terminals were notified that ex-factory trucked gas prices should not be higher than Yuan 5,500-6,000 per million ton.

contracted to China through the 'Power of Siberia' pipeline. Further increases are planned in 2021, and construction works for the second pipeline leg are being fast-tracked.

On January 22, Gazpromod Soyuz Vostok was registered in Mongolia as a special purpose vehicle to conduct a feasibility study for a gas trunkline to China. "With the Soyuz Vostok pipeline, Russia's Power of Siberia 2 pipeline will extend through Mongolia, and its export capacity might become more than 1.3 times higher than that of Power of Siberia. This will allow us to export large amounts of gas from Western Siberia not only westward but also eastward," commented Gazprom chairman Alexey Miller.

Starting from early November, Gazprom has been busy laying the second 800-km section of the Power of Siberia

pipeline, running between the Kovyktinskoye field Irkutsk to the Chayandinskoye field and onwards to the Chinese border across Mongolia. Gazprom's overall 'Power of Siberia' gas delivery contract with China's CNPC is for 38 Bcm per annum and analysts noted the 5 Bcm delivered in the first year was equivalent to 3.7 million tonnes of LNG, less than from a standard Train at a large-scale plant.

The government of Mongolia agreed in principle to the Russian gas interconnector as it will earn transit fees and volumes keep rising as China takes steps to import more gas to facilitate a fuel shift away from thermal coal for heating and power generation. More than 7.1 million households have been connected to the Chinese national gas network over the course of 2020,

particularly in northern China, increasing local gas demand.

For LNG portfolio players, however, the increase in comparatively cheap Russian pipeline gas is a serious competition. By factoring in the huge expenses of transporting Russian pipeline gas over thousands of miles towards Beijing and Shanghai, pipeline gas loses much of its competitive advantage.

Costs hinge on point of sale

Analysts expect that Gazprom will eventually export over 8 Bcm per year of natural gas from Siberia to CNPC but the competitiveness of Russian gas imports in China is entirely dependent on where it is sold. Bringing Russian pipeline gas as all the way to the Yangtze River Delta is not lucrative." Particularly because the

Yangtze River Delta is a region that already has six LNG regas terminals, with a further three greenfield projects under construction and two more proposed.

Things look different further north. In the Northeast, tariffs from the Russian border are only around \$1 per MMBtu to reach a city such as Shenyang, making Power of Siberia gas attractive. But to take these gas volumes further south to Shanghai will increase tariffs to around \$3 per MMBtu.

Though legacy LNG contracts are the marginal source of supply into China, recent LNG contracting trends are seeing term deals signed around 11 percent of oil, Wood Mackenzie understands. At this level of oil indexation, new LNG projects would not really have to fear Russian pipeline gas into China. ■

First US LNG project in jeopardy

The new US Administration has moved quickly on oil and gas banning orders with the upholding of Oregon's decision against the Jordan Cove LNG project over water issues. The Federal Energy Regulatory Commission (FERC) had previously approved the construction and operation of the Jordan Cove venture in March 2020. However, a last-minute move by the state denied a clean water permit for the project and the FERC has just upheld that decision on January 19 after months of delay.

Pembina's Jordan Cove project had petitioned the FERC to override Oregon's decision as a construction permit had already been approved, saying the local body had exceeded its authority under the Federal Clean Water Act. However, the FERC on the eve of the US presidential inauguration decided unanimously that this one Oregon department had not exceeded its authority.

Analysts commented that given the anti-hydrocarbon policies being led by the incoming Democratic Party presidency, including the banning of hydraulic fracturing to develop shale gas and shale oil, and the established left-wing extremism in the state of Oregon in cities like Portland, the decision was unlikely to be reversed.

Jordan Cove and other facilities were planned for a 200-acre site with five small-scale Trains, each with 1.5 million tonnes per annum of output, for a total of 7.8 mtpa. It would have given a route

to the Asian natural gas market to more than 25 billion cubic feet per day of gas supplies from Western Canada and the US Rockies. Project developer Pembina had signed preliminary LNG supply accords with JERA and Itochu of Japan.

Industry opposes fracking ban

US upstream players, power producers and energy-intensive industries adamantly oppose plans of the Biden administration to end sales of new leases on public lands and waters. If permanent, this is feared to lower US offshore oil and gas production by about 30 percent by 2035.

Such policies, if enacted, will make electricity and gas prices surge which would seriously harm the industry and could put millions of jobs at risk. The US Department of Energy's Office, under the former President Trump, filed a report on impacts of the so-called "ill-conceived ban on hydraulic fracturing." According to these findings, annual average gasoline prices would increase over 100 percent to over \$4.20 per gallon in 2022 and 2023, and annual average diesel prices would increase 95 percent to \$4.56 per gallon in 2022.

Fracking for shale oil and gas over has boosted US trade revenues over the past years and provided ample feed-gas supplies to export LNG to 39 countries. Assistant Secretary for Fossil Energy Steven Winberg underlined that hydraulic fracturing had tapped the "great reservoir" of America's natural



Render of the Jordan Cove LNG export project in Oregon

resources. "That technology made the US the world's largest oil and natural gas producer, while also creating high-paying jobs and delivering great consumer savings," he said, warning of "devastating" impacts of a ban.

"Banning this technology would derail our recovery from recent Covid-related economic disruptions and increase the risk of another recession," Winberg said, noting that US LNG exports helped to reduce the trade deficit in 2019 and created \$9.5 billion in revenue.

Appalachian wildcatters in the red

Upstream companies are already feeling the pinch. Slashing Capex and delaying projects has barely kept some Appalachian fracking companies afloat as they struggle to survive weak demand and low prices. According to the Institute for Energy Economics and Financial Analysis (IEEFA), several US

wildcatters have resorted to some form of financial hedging in an effort to achieve a positive cash flow.

Range Resources cut its capital costs to \$72 million in the third quarter of 2020, some 60% less and the \$178 million spent in the same quarter a year earlier. Only National Fuel managed to increase Capex during the quarter, primarily because it bought Shell's dry gas assets in July. Besides Shell's "fire sale" of its Appalachian assets, ExxonMobil appears likely to include some of its North American gas assets in a planned impairment that could reach \$20 billion, analysts said.

Wildcatters in the Appalachian also curbed shale gas output, but the reduction in supplied had little effect in propelling up prices as demand remains sluggish. The U.S. Energy Information Administration (EIA) expects that gas consumption will be down by 2 percent this year and another 5 percent in 2021. ■

January trade growth likely weaker than in December

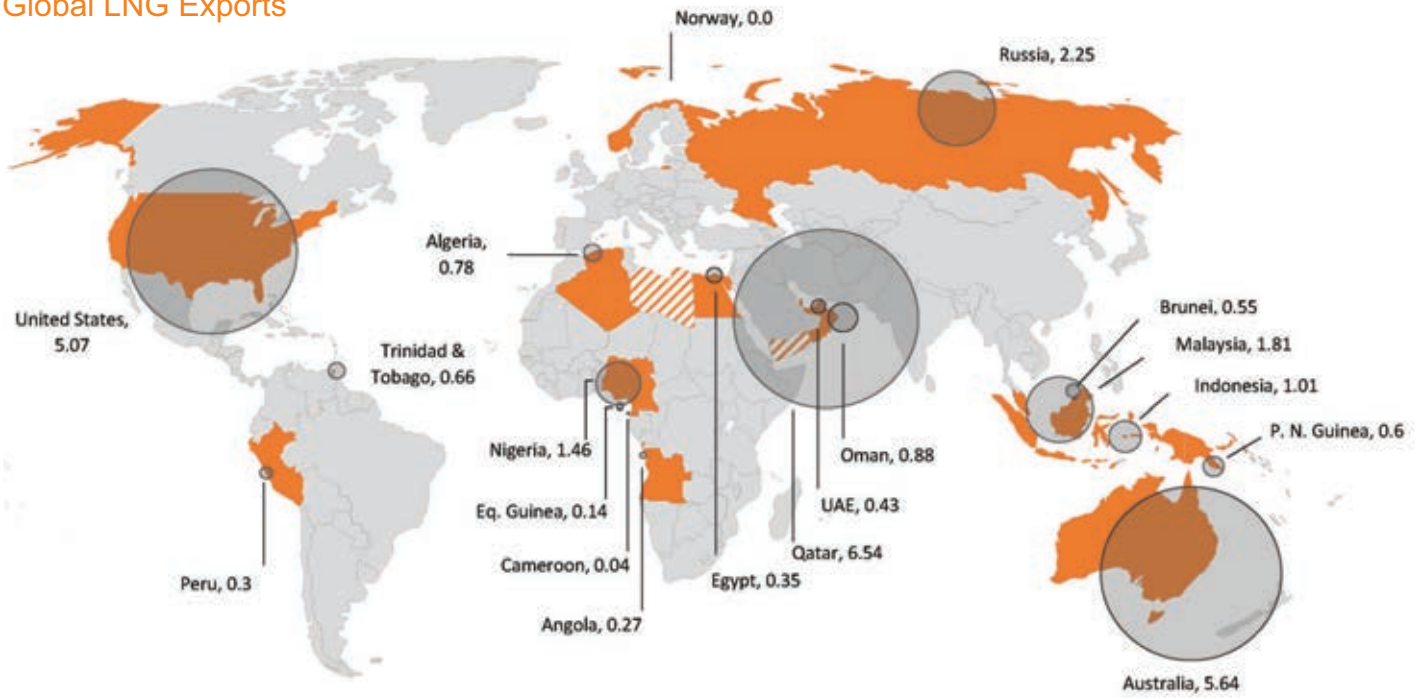
January trade growth is likely to come in below its December counterpart, our preliminary data indicate. Although there was still time for an improvement before month-end, significant trade growth is likely going to be elusive in January, our Markets Editor Alexander Wilk reports.

Global LNG trade this month saw a net decline of 1.41mmt (-4.6 percent) up until 29 January. Although the month had yet to close, our preliminary data indicate January growth is unlikely to outperform that of December. Notably, Australia continued to struggle to capture Far Eastern demand growth whilst Qatar continued to strengthen its position in the Pacific. Accordingly, supply growth was led by Qatar, where exports grew by 0.45mmt (7 percent) to 6.54mmt compared to the 6.09mmt for the period up to 29 December. Global LNG demand was carried by a boost in offtakes in Japan, China and South Korea, which together outweighed seasonal major reductions in India and the Middle East. In Europe, major importers such as Turkey and Spain continued to see noticeable demand growth although this was overshadowed by drastic reductions in British and French imports. Similarly, in South America, less demand in Brazil and some Caribbean offtakers such as the Dominican Republic outweighed offtake growth in the Jamaica as Colombia and Argentina were not seen in the market.

Exports

Our preliminary data for January

Global LNG Exports



Source: LNG Journal

indicates month-on-month export performance is set to come in below that of December, with shipments decreasing by 1.41mmt (-4.6 percent) compared to the 2.08mmt (6.89 percent) in December. Exports were led by the Middle East, where shipments were up by 0.14mmt (2 percent) over December to reach 8.20mmt. Exports from the Atlantic

Basin, however, had decreased by 0.69mmt (-7 percent) on 29 January month-on-month. The Pacific Basin had also seen exports decrease by 1.17mmt (-9.8 percent) by 29 January as Australia continued to struggle to maintain exports on the same level as in November.

Pacific Basin

The Pacific Basin ended the month to 29 January with 10.72mmt in exports, down significantly by 1.17mmt (-9.8 percent) compared to the 11.89mmt recorded for the equivalent period in December. Consequently, capacity utilisation stood at 81 percent.

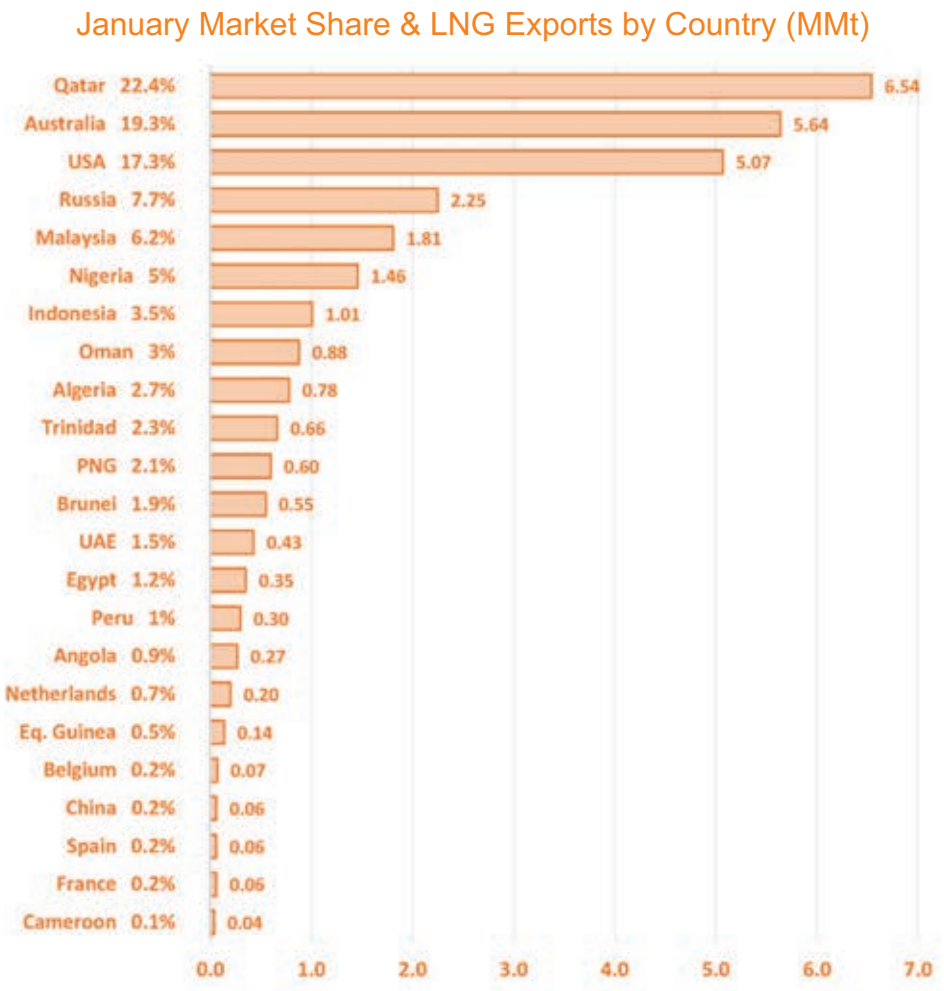
The Basin's biggest exporter – Australia – shipped 0.31mmt (-5.2 percent) less month-on-month. The country thereby continued to decrease month-on-month exports as was the case in December. Exports from NWS LNG in particular decreased by 0.23mmt (-18.4 percent) from 1.25mmt to 1.02mmt. This was followed by Australia Pacific LNG, which saw exports decrease by 0.20mmt (-22 percent) to 0.71mmt. The relatively modest increases elsewhere in Australia's eastern half, namely at Darwin LNG and Gladstone, totalling 0.04mmt could not compensate for the reductions at Ichthys LNG, where shipments decreased by 0.08mmt (-12.9 percent) to 0.54mmt.

In western Australia, LNG shipments decreased across all but two producers.

Wheatstone LNG increased exports by 0.05mmt (9.1 percent) to 0.72mmt alongside Pluto LNG, which increased its shipments by 0.10 to 0.43mmt. However, NWS LNG and Gorgon LNG saw exports fall by 0.23mmt and 0.11mmt, respectively. As to unconventional LNG production, Shell's Prelude FLNG barge was seen again in the market with exports totalling 0.11mmt in line with our expectations in December. The floating plant received a cooldown cargo via the Shell-controlled LNGC *Methane Heather Sally* in November, our data shows.

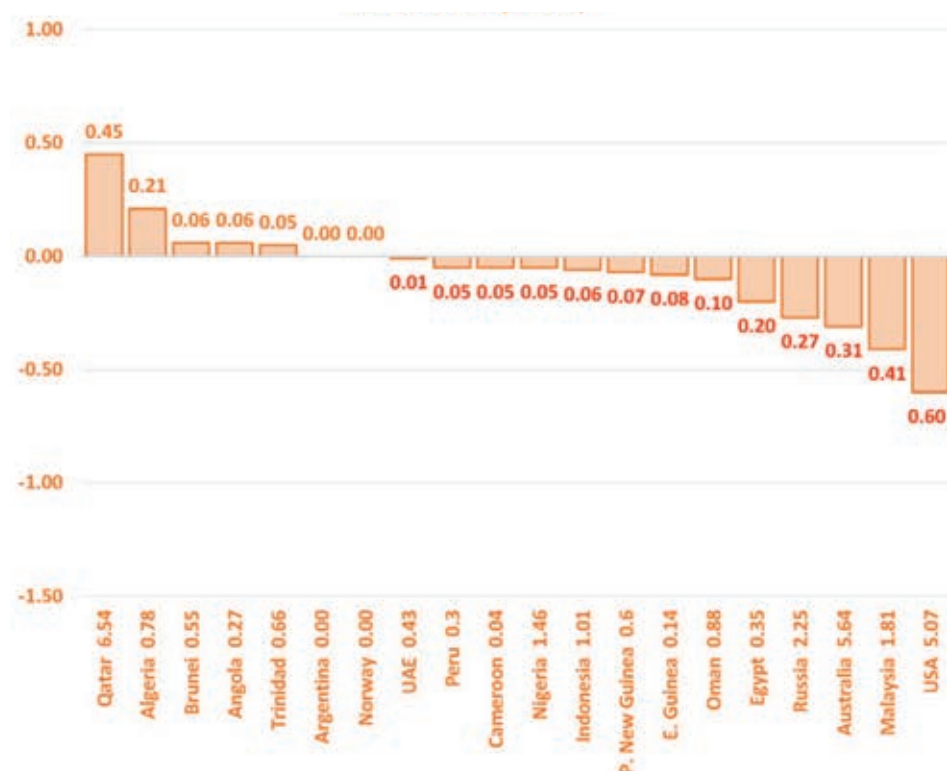
North of Australia, Papua New Guinea's PNG LNG saw shipments decrease by 0.07mmt (-10.4 percent) to 0.60mmt on one less cargo shipped over the report period compared to its equivalent in December. In neighbouring Indonesia, the amount of LNG shipped also decreased by roughly one cargo, decreasing by 0.06mmt (-6 percent) to 1.01mmt. Meanwhile, Malaysia saw monthly exports slump by 0.41mmt (-26 percent) in January at the time of writing. In contrast, neighbouring Brunei LNG increased January shipments by 0.06mmt (12.2 percent) to 0.55mmt.

Elsewhere in the Pacific, Russia's Sakhalin-2 LNG also saw exports decrease slightly from December. The plant reduced shipments by 0.04mmt (-4.2 percent) to 0.92mmt in January from 0.96mmt in the equivalent period in December. Concurrently, Peru's Pampa



Source: LNG Journal

Incremental LNG Exports by Country Relative to December (MMt)



Source: LNG Journal

Melchorita plant also reduced exports by 0.05mmt (-14 percent) to 0.35mmt in January from 0.35mmt in December.

Atlantic Basin

The Atlantic Basin's overall shipped LNG had decreased significantly by 0.69mmt (-7 percent) month-on-month on 29 January. This led to a fall in export capacity utilisation by 8pp to 69 percent.

The overall amount of LNG exported within the eastern part of the Atlantic Basin – comprising Europe, Russia and Africa (and not including re-exports) – had seen a marginal net increase of 0.04mmt (0.9 percent) month-on-month on 29 January. However, the ongoing outage at Snøhvit LNG that was caused by a fire in late October 2020 still weighed on the eastern Atlantic's overall growth rate.

Importantly, the Atlantic's robust LNG export growth in December did not continue in January as previous strong export growth in the United States did not continue in January. Overall US shipments decreased by 0.49mmt (-9 percent) to 5.67mmt in January. This stood in stark contrast to the robust month-on-month growth seen in November and December. Market visibility at the time of writing indicated US LNG export growth was hampered by lower demand within the Pacific Basin.

In South America, Atlantic LNG in Trinidad & Tobago continued to increase monthly exports, reaching 0.66mmt on 29 January, up 0.05mmt (8 percent) from 0.61mmt in December. Atlantic LNG shipments benefitted from higher demand in the Caribbean and North

America, which compensated for a loss in market share in Europe and Asia.

Middle East

In contrast to Pacific and Atlantic Basin producers, January shipments from Middle Eastern plants increased by 0.14mmt (2 percent) from 8.06mmt in December to 8.20mmt in January. The increase was underpinned by continued high output growth by Qatar. Meanwhile, the country's fellow regional producers in Oman, the UAE and Egypt did not keep month-on-month growth apace. Nevertheless, the Basin's utilisation of operational export capacity (i.e., excluding Yemen) still stood at 106 percent on 29 January.

Once more the massive size of the Ras Laffan LNG complex was a determining

factor in the degree of overall monthly change to Middle Eastern LNG supply. Preliminary figures for Qatar's January exports continued to rise up by 0.45mmt (7 percent) following a sharp increase already in December. According to our data, the Ras Laffan LNG complex operated at full capacity in December on 6.54mmt in LNG exports at the time of writing. Higher demand for Qatari gas in South Asia and the Far East in particular continued to support the country's LNG shipments.

The other active producers on the Arabian Peninsula – Oman and the UAE – saw an overall export decrease of 0.11mmt (-8 percent) led by Oman. The country saw shipments fall by 0.10mmt to 0.88mmt whilst neighbouring UAE had reduced exports by a more moderate 0.01mmt (-2 percent) by 29 January.

Egypt, meanwhile, also did not continue to build on its comeback in November, when Idku LNG shipped 0.46mmt via seven cargoes to China, India, Pakistan, the United Kingdom and the Far East. In January, Egyptian export volumes contracted by 0.20mmt to 0.35mmt (-36 percent) on what market our visibility suggested was lower Pacific spot demand, both in the Far East and in India.

Imports & Domestic Trade

Global LNG demand was determined by the Pacific Basin, where month-on-month imports had remained broadly steady at 23.71mmt by 29 January. This was contrasted by a significant demand reduction in the Atlantic Basin (with some notable exceptions) and the continued seasonal demand retreat in the Middle East, where offtakes decreased by

1.09mmt (-17 percent) and by 0.04mmt (-5 percent), respectively.

Pacific Basin

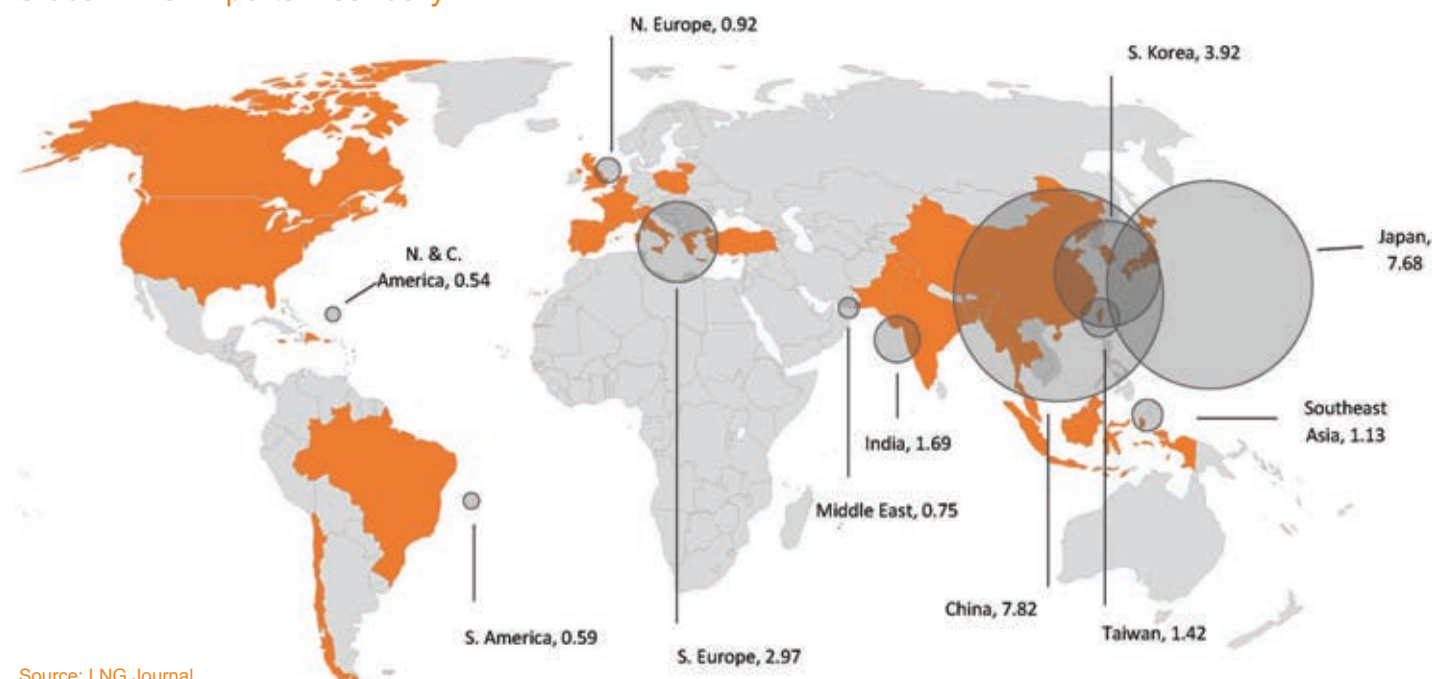
Month-on-month Pacific Basin imports had remained broadly steady by 29 January compared to robust growth in December. As such, demand in the Pacific could not compensate for the seasonal reduction in Middle Eastern offtakes or a retreat in Atlantic Basin demand. Overall Pacific offtakes were underpinned by China, which was leading demand growth within the Basin, as well as Japan and South Korea. Together, these three importers increased LNG offtakes by 0.54mmt on combined imports of 19.42mmt by 29 January.

However, India once again stood out by decreasing offtakes by 0.23mmt (-12 percent) to 1.69mmt. As a prominent emerging LNG demand centre in South Asia, India's LNG offtake therefore stood in stark contrast to the significant month-on-month growth of 0.39mmt (21.1 percent) in October. Nevertheless, considering historic data, we think India's demand reduction since October is seasonal rather than structural.

In Southeast Asia, Indonesia saw demand increase by 0.09mmt (69 percent) to 0.22mmt whilst neighbouring Malaysia saw domestic offtakes reduce by 0.03mmt (-21 percent) to 0.11mmt.

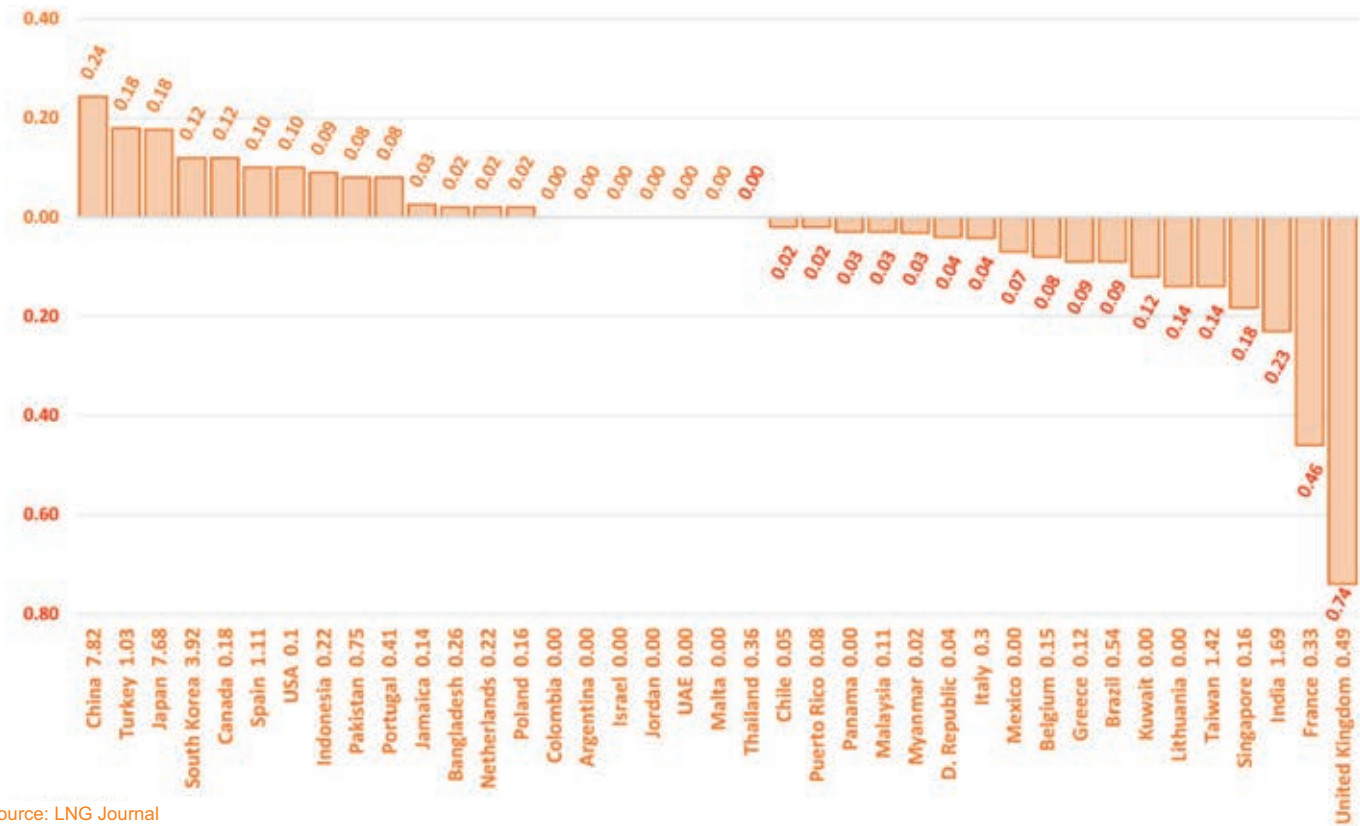
The roster of typically price-conscious Pacific buyers – including Bangladesh, Thailand, Chile, Mexico, Singapore and Myanmar – collectively slashed imports by 0.29mmt. This was primarily due to Singapore having imported 0.18mmt less by 29 January whilst Mexico was not seen in the market. Myanmar and Chile also had reduced their imports by 0.03 and

Global LNG Imports – January



Source: LNG Journal

Incremental LNG Imports by country relative to December (MMt)



Source: LNG Journal

0.02mmt, respectively whilst Thailand merely saw steady demand in January. Nevertheless, the roster’s overall demand reduction was tempered by Bangladesh, which increased its monthly LNG intake by 0.02mmt (8.3 percent).

Atlantic Basin

In contrast to their Pacific equivalents,

LNG imports in the Atlantic Basin decreased significantly by 1.09mmt (-17 percent), thus continuing their decrease from 6.96mmt in Noveber to 6.88mmt in December.

The Atlantic Basin’s offtake reduction was driven by a net European demand reduction of 1.15mmt month-on-month in January. European demand contracted as

the United Kingdom, France and Lithuania in particular reduced imports by 1.34mmt combined. Greece, Belgium and Italy also imported 0.21mmt less overall compared to December. Accordingly, these reductions negated robust growth elsewhere in Europe in net terms. This growth was led by Turkey as well as Spain, which together saw increased demand by 0.28mmt. Concurrently, Portugal, the Netherlands and Poland also added 0.12mmt to the

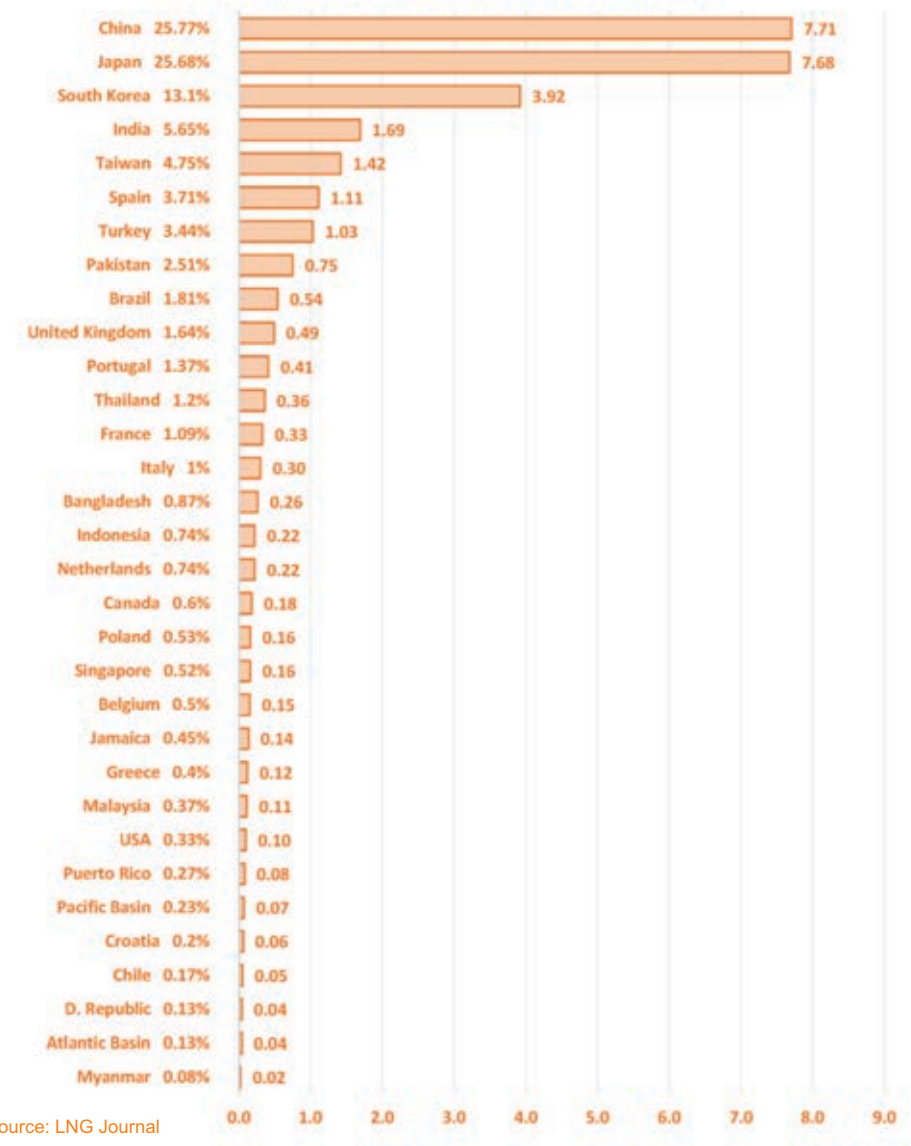
region’s demand, albeit not enough to overcome the aforementioned reductions.

As to demand in the western Atlantic, importers in the Caribbean and South America – including Brazil, Panama, Jamaica, Puerto Rico and the Dominican Republic – saw monthly net LNG demand decrease by 0.15mmt overall in January and thus did not continue with month-on-month growth from December. In North America, meanwhile, a 0.12mmt demand increase by Canada added to a 0.10mmt demand increase seen in the United States.

Middle East

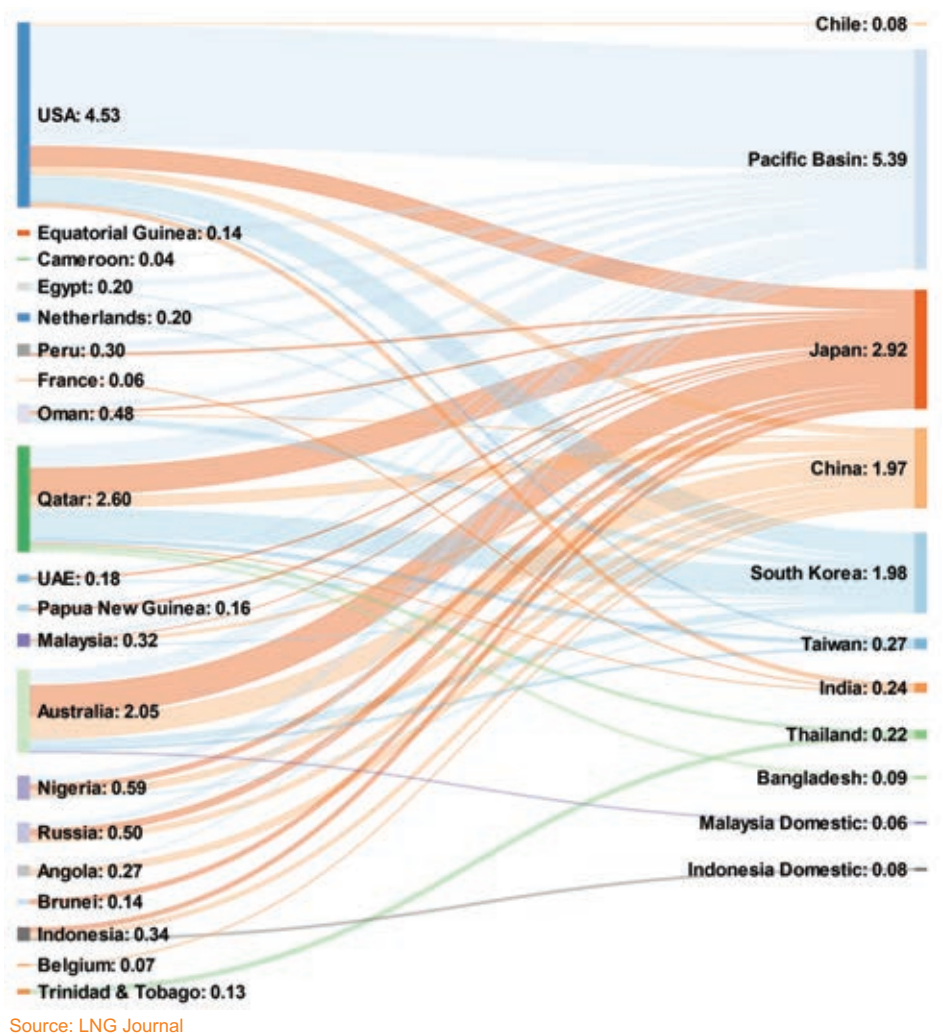
Middle Eastern offtakes continued to decrease due to the region’s seasonal demand reduction. Imports were down by 0.04mmt (-5 percent) in January. In line with the change in season and resulting cooler weather, the region has seen monthly demand shrink since September. Accordingly, Dubai’s DUSUP, which had been important for regional LNG offtake growth during the summer, did not import LNG in January and thus did not add to the month’s balance. Similarly, Jordan’s Aqaba LNG terminal, Israel’s Hadera Gateway terminal and Kuwait’s Mina al Ahmadi facility were also not seen in the market in January. With Egypt re-establishing itself as an export-only LNG player, Middle Eastern demand was left to the FSRUs stationed at

Market Share & LNG Imports by Country (MMt)



Source: LNG Journal

In-transit Cargoes En Route to Pacific Destinations



Source: LNG Journal

Pakistan's Port Qasim. The country increased offtakes by 0.08mmt (12 percent) to 0.75mmt in January, but which nonetheless was insufficient to compensate for Kuwait's market absence. The Persian Gulf importer had taken in 0.12mmt in December.

Outlook

Total LNG volumes in transit amounted to 15.58mmt on 29 January 2021, suggesting the robust demand growth seen in December is likely to pick up its thread in February. Our market visibility at the time of writing pegged the delivery horizon on 28 February. We highlight that these volumes will not be the only cargoes to be delivered in that time frame but what was presented by our market visibility at the time of writing. Factors such as different vessel speeds, weather and diversions can greatly affect the arrival of exports.

Pacific Basin

Our data indicates there were 13.30mmt destined for the Pacific Basin, with the United States the main source on 4.53mmt. This put the country ahead of Qatar and Australia, which only had 2.6mmt and 2.05mmt, respectively, en route to Pacific Basin destinations. Nevertheless, Australia was still in the lead in terms of visible exports to China with 0.55mmt compared to 0.21mmt stemming from US export plants.

Notably, China was no longer leading the Pacific's roster of importers as that position had been taken by Japan on 2.92mmt expected to arrive by 28 February. Almost 20 percent of these volumes (0.60mmt) were earmarked for Futtsu LNG followed by Himeji LNG with 0.26mmt by 8 February.

China came in second, with 1.97mmt due by 13 February, whilst South Korea was expecting 1.98mmt by 13 February. There were also 5.39mmt in transit – more than half of which were shipped from the United States – that still had to confirm their destination within the Basin as an increasing number of US exports are taking routes through the Suez Canal or via the Cape of Good Hope.

India was expecting 0.24mmt by 9 February, according to our market visibility, slightly behind Taiwan with its 0.27mmt expected by 9 February.

Atlantic Basin

The Atlantic Basin, meanwhile, can expect to receive 2.15mmt by 13 February. Cargoes en route to known Atlantic

terminals were led by 0.46mmt worth of orders destined for Turkey with a delivery horizon of 11 February, at the time of writing.

As with the Pacific Basin, there are still roughly 1.19mmt of in-transit LNG that have yet to confirm their destination within the Atlantic. However, 0.84mmt of LNG was broadly destined for Europe by 13 February, much of it likely to arrive in Turkey.

Among Atlantic exporters with LNG deliveries currently pending, the United

States is in the lead with 4.41mmt, followed by Nigeria with 0.89mmt and Russia with 0.50mmt. These cargoes were onboard, inter alia, the *BW Lilac* (0.08mmt), the *LNG Bonny II* (0.08mmt) and the *Georgiy Ushakov* (0.08mmt).

Middle East

Meanwhile, as of 29 January our data indicated there were only two cargoes aboard the *Al Marrouna* and the *Al Ghashamiya* headed to Pakistan. In terms of Middle Eastern cargoes under way to

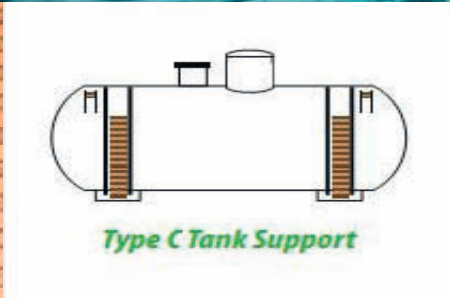
destinations outside the Basin, 3.81mmt had a delivery horizon of 18 February, including 2.95mmt that originated in Qatar, with a further 0.48mmt coming from Oman's Qalhat terminal and 0.18mmt from the UAE's Das Island facility via, inter alia, the *Milaha Ras Laffan* (0.06mmt), the *Asia Endeavour* (0.07mmt) and the *Shahamah* (0.06mmt). Notably, at the time of writing, Egypt's Idku LNG plant had four cargoes (0.20mmt) at sea, all destined for the Pacific and the Far East. ■



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LNG’s future will be a ‘greener’ one

John Roper, CEO Middle East, Uniper Global Commodities SE, explains

A large box must be ticked before LNG can be considered a cornerstone of the 21st century energy basket – and that is its decarbonisation. LNG has fairly been heralded as a coveted jigsaw piece in the global energy transition; an energy market to bridge the traditional fossil fuel industry of the past with the renewables portfolio of the future. But it can do more.

The environmental microscope on LNG will only intensify. Momentum driven by agreements like the National Visions of Arab Gulf governments, the EU’s Green Deal, Singapore’s Carbon Act, and more, have been joined by net zero targets by some of the world’s biggest economies and companies. We, for one, plan to neutralise the carbon footprint of our entire European operations by 2035.

Sense of urgency

Decarbonising LNG has always been a point on the business agenda, but this backdrop means it is now a pertinent issue that needs immediate attention. Inaction risks dulling the environmental competitiveness of the LNG market as other and cleaner energy sources – solar, wind, biomass, and hydrogen, for example – gain traction in the 2020s. And even if renewables are not as competitive as firms and governments would like – the returns are not as fruitful as fossil fuels when oil prices are

higher, for example – we nonetheless have a social responsibility to protect the planet.

LNG is considered the ‘greenest fossil fuel’ with 117 pounds of CO2 produced per million British thermal units (MMBtu) equivalent of natural gas, detailed the US Energy Information Administration (EIA). This is versus 200 pounds and 160 pounds for coal and distillate fuel oil, respectively. But LNG is still a fossil fuel market, which has polluting supply chains clashing with the global push for a net zero future. Our collective goal should be reducing the emissions (both methane and CO2) along the value chain with ‘carbon neutral’ LNG, which would make this already highly attractive market even more relevant for the 21st century climate agenda.

Balancing the books

So, what is the ‘carbon neutral’ LNG of the future that industry must achieve? Carbon neutral LNG does not mean that a cargo does not cause emissions, but that GHG emissions can be offset through the purchase of credits from carbon removal projects. Examples of such projects – many already tried and tested via clean development mechanisms (CDM) – include renewable and reforestation projects. For true carbon neutrality, methane emissions must also be

mitigated – another journey that LNG stakeholders must embark on.

But there is a catch; offsetting is not cheap. The price tag could particularly sting in today’s economic environment of depressed oil prices and a 6.5% retraction in the global growth outlook for 2021, flagged the International Monetary Fund (IMF). For example, when investing in reforestation projects to offset the carbon footprint of a cargo, the cost can easily rise to \$10 per ton of CO2 emissions or more. At this cost, if one assumes the total GHG emissions of a conventional LNG cargo at around 250,000 per tCO2e, offsetting GHG emissions for one LNG cargo amounts to \$2.5 million per cargo, according to the International Group of Liquefied Natural Gas Importers (GIIGNL).

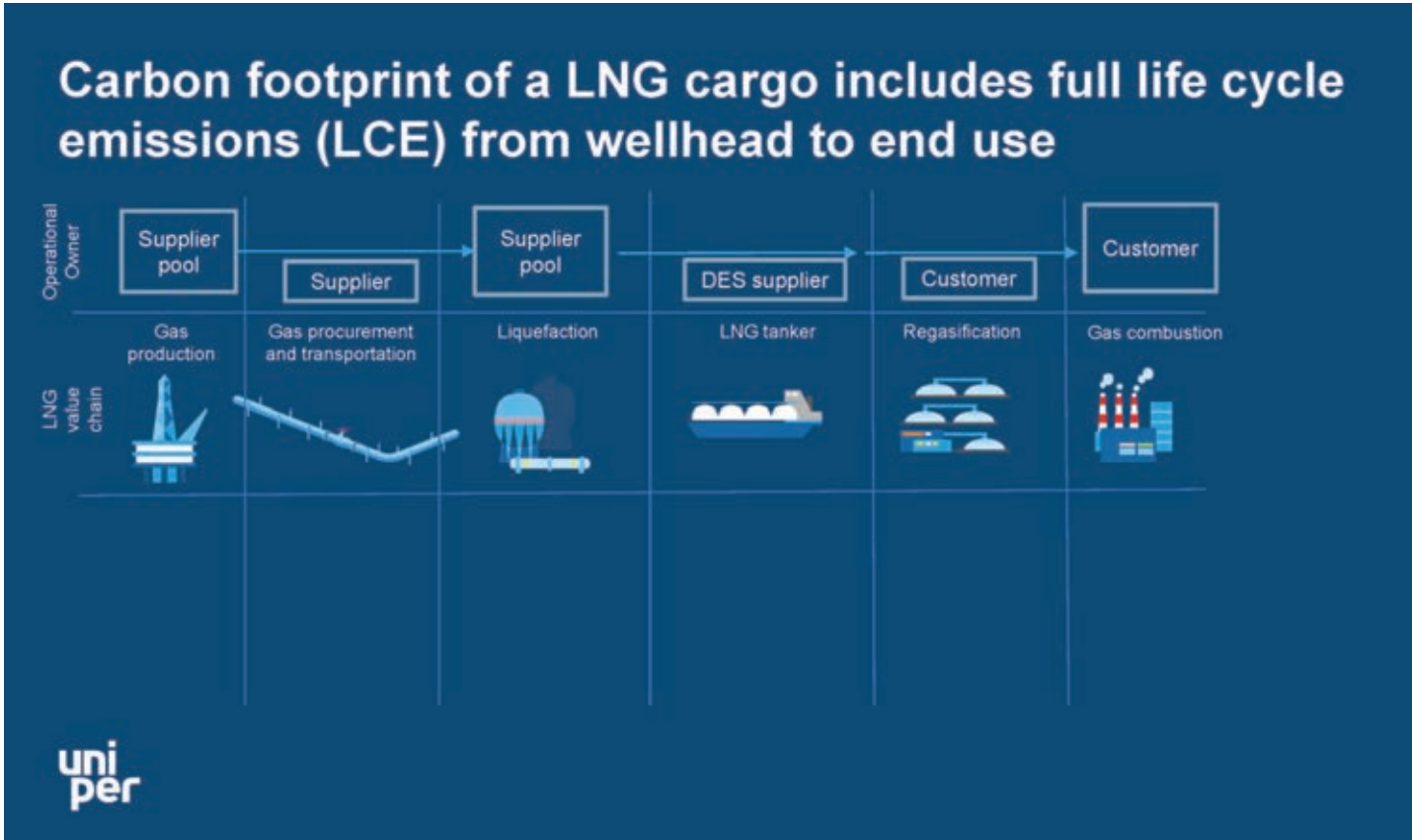
Seeing this from a cost perspective only, risks being narrow-minded. Firstly, companies will increasingly want – and need – to be able to show they have premium LNG that boasts carbon awareness and neutrality, especially as climate-related finance gets more support. Plus, pro-activity now will keep propelling the attractiveness of LNG – already considered a greener fuel by many – as its fossil fuel cousins grapple for relevance with financiers. Illustrating the shift in sentiment, more than 1,200 institutions worldwide managing \$14.5 trillion in assets have committed to divest

from fossil fuels, up from 181 managing \$50 billion five years ago, said international movement Fossil Free. LNG wants to be on the right side of this conversation – and it can easily be if it accelerates decarbonisation.

Next three steps?

The first step is to improve measuring, monitoring, verifying, and reporting, including an accounting methodology for the life-cycle assessment (LCA) emissions of LNG and the carbon footprint per LNG cargo. The second move focuses on reduction, which includes assessing and ranking abatement options, implementing emissions reduction actions efficiently, and reporting emission reductions. The third step is to increase offsetting. This encompasses originating green certificates, designing offsets per customers’ requirements (quantity, quality, origin, and so on), and creating a premium LNG product.

All three steps are needed, each tying into one another; one cannot offset CO2 emissions if monitoring has not been done effectively, and one cannot monitor efficiently if there is no accounting methodology, and so on. Clearly, there is no silver bullet to carbon neutral LNG, but as the proverb goes: ‘What comes easy won’t last and what lasts won’t come easy.’





John Roper, CEO Middle East, Uniper Global Commodities SE

John Roper has 33 years’ experience in the energy industry and has held a number of senior positions in the international upstream, LNG and trading businesses. He is currently Uniper Global Commodities SE Middle East’s CEO, and previously served as Chairman of the Remuneration Committee and Member of the Audit and Risk Committees of a private oil and gas company in the UK.

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ABS, the American Bureau of Shipping, and Singapore-based Keppel Offshore and Marine said they were currently completing key features of the world's first smart LNG bunkering vessel. ABS and Keppel said the vessel, the "FueLNG Bellina", would be equipped with Keppel's proprietary AssetCare Digital Solution. The 7,500-cubic-meter LNG bunkering vessel is owned and operated by FueLNG Pte Ltd, a joint venture between Keppel and Shell Eastern Petroleum, an Asian subsidiary of Royal Dutch Shell. The "FueLNG Bellina" was named at a ceremony in the Asian city state in October 2020 and is scheduled to be operational by the end of 2021.

The vessel will enable the FueLNG company to be the first to provide regular ship-to-ship LNG bunkering services within the Singapore port. ABS was selected by FueLNG Ltd to class the ship, which will feature notations for Smart Infrastructure (Smart INF) and Crew Assistance and Augmentation (Smart CAA). "Obtaining these notations form an integral part of the digital tools tailored by AssetCare to support FueLNG in enabling remote monitoring and real-time support of vessel operations, as well as predictive maintenance, which increases the vessel performance and efficiency," explained ABS.

ABS added that digital innovation was extended to the construction and commissioning process for this vessel.

One example is the use of Smart glasses for remote inspection, which increase yard efficiency while improving workforce safety throughout the inspection process especially during the Covid-19 pandemic.

"Already a landmark project due to its importance to Singapore's future as a global LNG bunkering hub, the addition of smart technology to the vessel makes it a milestone in the technological development of the industry as well," said Patrick Ryan, ABS Senior Vice President of Global Engineering and Technology. "The smart functionality builds on the work we have previously done In this area with Keppel in the development of the industry's first two newbuild drilling rigs with smart notations," added Ryan. ABS and Keppel both believe they are

setting the pace in digital innovation in the marine and offshore industries. "We are proud to deliver the industry's first LNG bunkering vessel with Smart Notations to FueLNG. Keppel O&M has been developing digital solutions for offshore and marine assets in recent years and our AssetCare solution reflects our commitment to leverage smart functions and technologies to continue creating value for our customers," Tan Leong Peng, Managing Director of Keppel Newbuilds. "We are glad to collaborate with ABS in spearheading this digital innovation in the offshore and marine space," added Tan.

The vessel, which will be Singapore's first LNG bunkering vessel, is set to supply large ocean-going LNG-powered shipping throughout the region as Singapore becomes an LNG fuel hub. "With this industry's first smart LNG bunkering vessel, FueLNG Bellina enhances our value offering to global customers as we provide safe, cost-efficient and reliable LNG bunkering solutions," Saunak Rai, FueLNG's General Manager. "The vessel's digital tools, such as AssetCare, not only improve vessel performance and maintenance but also enable the end-to-end digitalization of the bunkering process which enhances efficiency, reliability, and convenience for customers," she added. Prior to project, ABS had recognized Keppel as the first shipyard to integrate Smart Functions and Services into rigs. The two rigs utilize data collected from a range of sensors monitoring machinery and structural health to improve their performance.

AVENIR LNG, a company owned by Norwegian shipping and infrastructure companies, said its newest 7,500 cubic metres capacity LNG bunkering vessel has been launched in China and it would be delivered later in 2021. Avenir LNG is a joint venture owned by London-based Norwegian shipping and storage company Stolt-Nielsen and its peer fleet owners and project companies, Höegh LNG and Golar LNG. The company said the latest ship delivered was dual-purpose bunkering and supply vessel, the "Avenir Aspiration". A Chinese shipyard in Nantong, CIMC Sinopacific Offshore & Engineering, constructed the bunkering ship. "We are delighted with the successful launching of our third vessel," said Peter Mackey, Chief Executive of Avenir LNG. "Our fleet is the backbone of Avenir's asset-enabled LNG supply strategy, and we look forward to taking

delivery of the 'Avenir Aspiration' later in the year," he added.

Avenir is building up a fleet of six LBVs of between 7,500 cubic metres capacity and 20,000 cubic metres capacity. Two orders went to Keppel Singmarine and two to the CIMC Sinopacific yard in Nantong. The two 20,000 cubic metres capacity bunkering vessels would be constructed at CIMC Sinopacific. Another of the LBVs, the "Avenir Advantage", was delivered in November 2020 to the Future Horizon joint venture comprising Malaysia's MISC Group and Avenir. Additionally, Malaysian energy company Petronas has chartered the "Avenir Advantage" from Future Horizon for a period of three years.

Following a maiden voyage from China, the "Avenir Advantage" completed the commissioning of the LNG re-loading equipment on the "FSU Tenaga Satu" and the first LNG bunkering of the "SIEM Aristotle" car carrier. The "Avenir Advantage" supplies the region's LNG-fuelled vessels and small-scale LNG projects. Stolt-Nielsen started up small-scale LNG sector firm Avenir in 2015 and its two newer investors, Golar and Höegh, each have 22.5 percent of Avenir to Stolt-Nielsen's 45 percent. The experienced shipping partners of Avenir are aiming to build up the market in small-scale LNG supply to off-grid industry for power generation and transportation fuel, as well as providing infrastructure to support the development of LNG as a marine fuel. Avenir additionally has an 80 percent stake in a small-scale LNG import project company Higas on the Italian island of Sardinia, while the local partners are Gas & Heat and CPL Concordia, each holding 10 percent of the Sardinia venture.

BP of the UK said it had begun directly supplying corporate customers in China with gas from imported LNG volumes. "BP has created a fully integrated gas value chain into China, directly connecting upstream resources, transportation and trading with downstream gas customers," said the London-based company. The first cargo of gas delivered under BP's new terminal usage agreement at the Guangdong Dapeng LNG (GDLNG) import terminal in Shenzhen in southern Guangdong Province, arrived on the 24th of January. Under the agreement, BP has 600,000 tonnes a year of tolling regasification capacity at GDLNG in which it also holds a 30 percent shareholding.

BP has been involved in importing LNG into China since 2006 when it brought shipments from Australia for China National Offshore Oil Corp. and unloaded them at the Dapeng Guangdong terminal, located on the Pearl River Delta. The UK company noted its position as "the first international oil and gas company with an investment in an operating Chinese LNG terminal" and pointed out that the Dapeng facility has accounted for 22 percent of China's total LNG imports. For its latest Chinese domestic natural gas supply activities BP had signed an agreement on the 9th of July 2020 with the first privately held gas company in China, the ENN Group. BP said has now started supplying ENN with 300,000 tonnes per annum of pipeline gas regasified from LNG for two years, and will supply the same amount to another company, Foran Energy. "With our world class technologies, marketing and trading capabilities, we have developed an innovative, diversified and flexible integrated business model enabling us to both provide more LNG to the region and also increase our access to downstream gas markets," explained Federica Berra, BP's Senior Vice President of Integrated Gas and Power.

Analysts note that despite criticism of China over its continued high emissions from widespread burning of coal and coke and electricity generation from coal-fired and oil-fired power stations, China recently pledged to aim for peak carbon-dioxide emissions before 2030 and to become carbon-neutral 30 years later, by 2060. "BP is proud of our long-term partnerships with stakeholders in growing markets like China," said Simon Yang, BP China President and BP Senior Vice President for Chinese Regions, Cities and Solutions. "Increasing the availability of natural gas to customers across China supports and is aligned with the country's aim to increasingly switch from coal to gas," added Yang. "We will continue to steadily grow our footprint here and more importantly support China in its aims for a better and cleaner energy future," he stated. BP remains one of the leading foreign investors in the Chinese energy sector supplying oil, gas, jet fuel, oil products to the retail market and while acting as an energy trader.

BULGARIA has completed its share participation transaction in the Alexandroupolis floating LNG import terminal proposed to supply the Balkans region with regasified volumes from offshore northeast Greece. The deal with

joint venture developer Gastrade of Greece gives the grid company, Bulgartransgaz, a 20 percent stake in the Greek company and its LNG project. The participation of Bulgartransgaz in the project was applauded by Greek Prime Minister Kyriakos Mitsotakis and his Bulgarian counterpart Boyko Borisov during a ceremony held in Athens. “The Alexandroupolis project is regarded as important for the region as it materially contributes to the diversification of energy sources and routes for the entire Southeast Europe, enhances energy security and competition in the region, and supports the creation of a regional Natural Gas Hub,” said 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 FLNG terminal is expected to commence operations and deliver gas into the regional systems in 2023. Gastrade explained that the terminal would be fully complementary to the Greece-Bulgaria interconnector (IGB) by supporting its viability while operating in harmony with existing and new strategic energy infrastructures in the region such as the Trans-Adriatic Pipeline. “The project enjoys the long-term support of the Governments of Greece and Bulgaria, as well as of the European Union since it has been included in the European Projects of Common Interest (PCI) since 2013,” added Gastrade. “The participation of Bulgartransgaz in Gastrade is a solid proof of the regional profile of the project and it constitutes a catalyst for the integration of Southeast European gas markets, securing energy liquidity and pluralism throughout the region,” stated the Greek company.

The Alexandroupolis terminal will comprise a floating storage and regasification unit (FSRU) with storage capacity of 170,000 cubic metres of LNG 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.

BURCKHARDT Compression, the Swiss manufacturer of compressor systems and a service provider for LNG

and other markets, has continued its global expansion by signing a final contract agreeing to acquire the 40 percent of Chinese company Shenyang Yuanda Compressor it didn’t already own. The contract to own all of Shenyang Yuanda Compressor, based in Shenyang in the northeast Liaoning Province of China, was signed on January 25, 2021 and closing was expected in early February. Burckhardt had announced the signing of a memorandum of understanding on buying the remaining shares back in September 2020. The company, based in Winterthur, central Switzerland, had owned 60 percent of Shenyang Yuanda Compressor since May 2016.

Burckhardt has been expanding in the sector and had previously taken over US and Japanese companies. US subsidiary Arkos Field Services was fully acquired in November 2019. Burckhardt also in April 2020 completed a deal to acquire the global compressor business of Japan Steel Works Ltd. Shenyang Yuanda employs around 650 employees in China and generated sales of about 100 million Swiss francs (\$112.6M) in 2019. “Since the initial interest in Shenyang Yuanda Compressor, the company has expanded into more segments of the market, the product portfolio has been broadened to address a wider range of market needs, and Burckhardt has gained direct access to a well-established local supply chain,” said the company. “Compressors manufactured by Shenyang Yuanda have been available in selected export markets through the international distribution and sales channels of Burckhardt since 2019,” it added.

Burckhardt offers a variety of compressor solutions for fuel gas compression that have been specifically designed for marine applications. Its M-Type Electronically Controlled-Gas Injection (ME-GI) compressor systems are designed for boil-off gas management on LNG carriers equipped with MAN Energy Solutions ME-GI two-stroke engines. Burckhardt also provides its Laby brand compressors for LNG carriers with X-DF propulsion systems and other marine compressors for vessels such as bunkering ships.

CENTRICA plc, the UK utility and energy company with a growing LNG market presence, reported a resilient financial performance in the second half of 2020 as the trading and optimisation performance continued to be strong, especially in LNG. Centrica, the owner of

the British Gas utility and whose LNG portfolio includes booked volumes from the US and Mozambique, said its activities were marked by the maintenance of a tight focus on cash generation and expenditure against the backdrop of Covid-19. “The significant restructure announced in June remains on track, and trading and optimisation performance continued to be strong, in particular in our LNG business,” said Centrica in its update to investors. “At the end of 2020 we had 6.9 million UK energy supply customers and 3.6M UK services customers, both broadly unchanged since the half year,” added Centrica.

The company stated that Covid-19 continued to impact financial performance, although as expected the gross impact was lower in the second half of 2020 than in first half. “UK business electricity demand was negatively impacted by around 15 percent in the second half compared to around 30 percent in the second quarter,” said Centrica. “Residential boiler installations recovered in the second half compared to the first half but were still around 15 percent lower than in the same period of 2019. Cash collection trends across the Group were broadly in line with previous years,” stated the company. Centrica said that it remained cautious entering 2021, with the return of tighter Covid-19 restrictions in the UK and Ireland expected to put continued pressure on business energy demand and limit the workload of services. “In addition, the related uncertain economic backdrop increases the potential for additional working capital outflow and higher bad debts,” it added.

Centrica said that it expected to report 2020 full-year adjusted earnings per share from continuing and discontinued operations ahead of current market consensus. At the end of 2020 the group’s net debt was expected to be around £2.8 billion (\$3.82Bln), a reduction of over 10 percent in the year. This is before including net proceeds of £2.7Bln from the sale of the Direct Energy subsidiary, which closed on the 5th of January 2021. Centrica, which holds import capacity at the Isle of Grain LNG terminal southeast of London, has been increasing its carrier fleet operations. It recently signed a seven-year time charter with Greek shipping line GasLog for the “GasLog Westminster”, a 180,000 cubic metres capacity carrier with X-DF propulsion and a Mark III Flex containment system. Centrica has also signed a long-term

contract for 15 years to sell 500,000 tonnes per annum of LNG to the Shenergy Group of China. The company is due to release its 2020 preliminary results on the 25th of February.

CHINA confirmed that 2020 liquefied natural gas imports hit a record as energy needs continued to grow even after the slowdown in the first half caused by the Covid-19 pandemic. Chinese imports totalled 67.13 million tonnes in 2020, an increase of 11.5 percent, according to China’s General Administration of Customs. Shipments during December to China’s network of more than 20 terminals also hit a record monthly high of 7.59MT, up 18.2 percent from the same month a year ago. The December imports surpassed the previous record of 6.61MT achieved in November 2020.

China’s main LNG suppliers are Australia, Qatar, Malaysia, Indonesia, Russia and the US. Imports by China have been increasing even at higher North Asia spot LNG cargo prices. The Japan-Korea Marker price for North Asian had fallen to its lowest ever of \$1.83 per million British thermal units on the 29th of April 2020 before jumping more than eight-fold in the closing stages of December, to a more than six-year high of \$15.10 per MMBtu.

The JKM price for February 2021 cargoes subsequently increased further to a new record of \$20.705 per MMBtu. Chinese imports had grown fast to 61.68MT in 2019, a 13.5 percent increase on 2018 when 53.81MT was received and from 2017 when 39MT was imported. China, unlike Japan, also has substantial pipeline natural gas imports. It receives pipeline gas from southeast Asian nation Myanmar, the Central Asian republics of Turkmenistan, Kazakhstan and Uzbekistan, as well as from Russia since December 2019. Analysts had forecast last year, before Covid-19 was known, that China would overtake Japan in LNG imports by 2022. LNG demand has been declining for several years in Japan, but in all outcomes it was still likely to remain above 70MT through much of the 2020s, though the Chinese are now not far behind.

CLOUGH, the Australian energy engineering company, was awarded the engineering, procurement, construction and commissioning (EPCC) contract for the FortisBC Energy truck-loading expansion at the Tilbury LNG facility at Delta in the Pacific Coast Canadian

province of British Columbia. Clough said it had been part of the project from the front-end engineering and design phase and would now take it to commissioning and start-up. “We are extremely proud to be part of this project and excited to be trusted as the EPCC partner for FortisBC,” said Peter Bennett, Clough Chief Executive and Managing Director. “This award is a continuation of a successful relationship that was established between FortisBC and Clough approximately three years ago and aligns with our principle of making a positive impact for those in the communities in which we work and live,” he explained.

The delivery of the project will generate multiple jobs and economic opportunities for Clough’s Indigenous affiliation with Musqueam Capital Corp. and local companies across BC and will be led by Clough’s office in Calgary in the province of Alberta. “Our team of engineering, project management, construction and commissioning professionals bring innovative project delivery solutions to the energy sector, backed by over 100-years of global history that reinforces our ability to deliver safe and sustainable operations while maximizing project value,” said Martin Siddle, executive vice president for Clough North America. Clough added that the project, along with other recent awards, was delivering on Clough’s growth strategy in North America.

FortisBC’s Tilbury LNG facility has been operating since 1971 and was expanded in 2018 to produce more LNG for local ferry and truck transport customers. The facility currently fills more than 1,000 LNG containers from its two loading bays for transport and overseas customers per year and is continuing to see customer growth. This C\$18.5-million (US\$14.6M) expansion project will also see more economic benefits flow to Indigenous and local businesses. FortisBC’s other project is the proposed Tilbury Phase Two LNG expansion. FortisBC has a separate joint venture to develop a full-service LNG bunkering jetty on Tilbury Island. The FortisBC’s Phase 2 project involves the supply of LNG as maritime fuel. The Tilbury Phase Two permit process started in February 2020 and was still at an early stage.

CME GROUP, the world’s leading derivatives marketplace, has launched four new Japanese electricity futures contracts and two new LNG futures contracts will be available for trading on

February 8, 2021, pending regulatory review. The four new electricity futures contracts expand CME’s already robust suite of global power futures and options and fill a gap in the Japanese electricity futures market, providing traders a robust platform for block-trade submission to CME Clearing. CME, whose headquarters are in Chicago and which emerged from mergers of the main Chicago commodities and trading platforms, competes in the market with Atlantic, Georgia-based Intercontinental Exchange.

The two new LNG contracts provide Japanese power producers with a more efficient tool to manage their price risk. “The Japanese wholesale electricity market is now fully liberalized with hundreds of retail firms and producers, creating an opportunity for a more robust derivatives market alongside it,” said Izumi Kazuhara, CME Group Head in Japan. “We are pleased to launch these new futures contracts that offer participants an efficient risk management tool,” stated Kazuhara. “At the same time, the launch of the two new yen-denominated LNG contracts will be relevant for market participants who want to trade the spread between LNG and electricity futures,” he explained.

The new electricity contracts include: Japanese power (Day-Ahead) Tokyo base-load futures, Japanese power (Day-Ahead) Tokyo peak-load futures, Japanese power (Day-Ahead) Kansai base-load futures, and Japanese power (Day-Ahead) Kansai peak-load futures. They are financially-settled in Japanese yen using the arithmetic average of the 30-minute Spot Market (Day-Ahead) prices published by the Japan Wholesale Power Exchange (JEPX) for the relevant region (Tokyo or Kansai) based on base/peak loads over the period defined by the contract. The new LNG contracts will be denominated in Japanese yen and include the Japan-Korea Market (Platts) futures and the Japan Crude Cocktail (Detailed) futures. “The former is a financially-settled contract based on the DES Japan-Korea daily LNG marker (JKM) by Platts, while the latter is a financially settled contract based on the average price of nine custom-cleared crude oils reported by the Japan Ministry of Finance and Customs,” CME explained. CME said the Japanese electricity and LNG futures contracts would be available on CME Globex, for submission for clearing through CME ClearPort, and would be listed with and subject to the rules and regulations of the New York Mercantile Exchange.

COAXIS Energy Company of South Dakota has acquired the liquefied natural gas assets and interests of Kalm Energy, an LNG and compressed natural gas sales and service provider from Nebraska, as the fuel sector expands in North America. Based out of Sioux Falls, South Dakota, Coaxis is a provider of LNG and CNG to the growing small-scale and medium-scale fuel markets. The customers of Coaxis are transportation and trucking companies, commercial utilities and industrial end-users. The LNG and CNG fuel sector is growing rapidly in the US and Canada with companies like California-based Clean Energy Fuels Corp. establishing a network of several hundred filling stations on the West Coast and a huge portfolio of fuel customers in municipal transportation, trucking and serving ports and airports.

With this transaction, Coaxis said it had increased its equipment and personnel portfolio that enables the company to serve larger markets and increase its geographic footprint. Coaxis added that it now has the fleet of equipment and personnel to supply more LNG and services from the Canadian border to Arkansas and Oklahoma. “Kalm Energy was well-established in the LNG industry and had been awarded incentives on numerous projects through the Colorado Energy Office, Nebraska Environmental Trust and Colorado Regional Air Quality Committee,” explained Coaxis. “This acquisition will help us enhance energy supply and natural gas capacity through the utilization of LNG in under-served areas with supply constraints and especially where necessary in rural areas of America,” said Coaxis President Scott Stern. “We look forward to continuing to provide great service to all current and future customers,” stated Stern.

Stern and his companies have a 43-year history of providing energy and industrial products across a five-state region in the Northern Plains. From 2016-2018, Stern also served as the Commissioner of the Governor’s Office of Economic Development for the State of South Dakota. Coaxis added that in addition to agreeing the transaction it was bringing in Mike Hoelscher, a former Kalm Energy partner, to help run the Coaxis LNG operations. The company said Hoelscher had nearly two decades of experience in the LNG and gas fuel industry.

COSCO SHIPPING Energy Transportation, the biggest Chinese owner and operator of oil and gas vessels and with a growing number of over 40 liquefied natural gas carriers in its fleet, has approved an investment in three LNG carriers for the Russian Arctic LNG II project of Novatek and its partners. Cosco Shipping said it would invest \$923 million for the construction of the vessels in a joint venture with Mitsui OSK Line of Japan. The Japanese are prominent investors in Arctic LNG II companies through Mitsui & Co. and the government institution, the Japan Oil, Gas and Metals National Corp. China National Petroleum Corp. and units of China National Offshore Oil Corp. are also shareholders in the newest Russian Arctic project to produce over 20 million tonnes per annum of LNG. A joint venture company of Cosco Shipping and MOL has signed shipbuilding contracts with the South Korean shipyard Daewoo Shipbuilding and Marine Engineering for the three newbuilds, each with 172,500 cubic metres of capacity.

Cosco Shipping currently has a total of 41 jointly-owned LNG vessels, including 38 LNG carriers in operation with aggregate capacity of 6.42 million cubic metres and three LNG vessels under construction with combined capacity of 522,000 cubic metres. The Chinese shipping line currently has stakes in ships such as the 172,600 cubic metres capacity “Boris Brusilov”, the 172,600 cubic metres capacity “Rudolph Samoylovich” and the 174,100 cubic metres capacity “Cesi Wenshou”. Others in the line are the 174,000 cubic metres capacity vessels, “LNG Dubhe”, the “Pan Europe”, the Pan Africa” and the “LNG Merak”.

The Cosco Shipping company owns 50 percent each of two other subsidiaries Cosco Shipping LNG Investment (Shanghai) Co. and China LNG Shipping (Holdings) Limited (CLNG). Cosco Shipping and the huge Chinese equity firm, the Silk Road Fund, entered into an agreement with Russian shipping line Sovcomflot and gas project developer Novatek to establish the joint venture, Maritime Arctic Transport, to manage an icebreaking fleet of Arctic ice-class vessels to serve Novatek’s Yamal LNG, Arctic LNG II and other potential projects. Cosco Shipping was set up in Shanghai in 2016 with the aim of leading China’s seaborne energy transportation. The parent company is China Cosco Shipping Corp. Ltd, a merged entity from the energy transportation arms of China Ocean Shipping Co. and China Shipping Co.

DNV GL, the European maritime classification society and risk management company with widespread operations in the LNG sector, said its name would change to DNV from March 2021. The company said that the move comes after a strategy review of the as it positions itself for a world in which many of DNV's markets are undergoing fundamental change. The present name has been in place since the 2013 merger between Norwegian class society Det Norske Veritas (DNV) Germanischer Lloyd (GL), the Hamburg-based German class society. The company explained that the name simplification was a natural consequence of a successfully completed merger and of having operated as a fully integrated company for several years now. "We merged two leading companies with complementary strengths and market positions, and combining the two names was the right solution in 2013," said Remi Eriksen, Group President and Chief Executive. "However, it was not a name that rolled off the tongue, and many customers already refer to the company as DNV," he added. "Our brand is used by many of our customers to build trust towards their stakeholders, and a simpler name will be an even stronger trust mark for our customers in the future, but still carries with it all our strengths and proud 157-year-old legacy with a purpose to safeguard life, property and the environment," stated Eriksen.

The CEO said the strategy positions the firm for growth in a world increasingly in need of a "trusted voice", but also positions us to shape the future of assurance. "DNV will offer the best, most efficient and digitalized ways of delivering services - be it classification, certification, verification, inspection, advisory, or digital solutions," he concluded. DNV GL, whose headquarters are in Oslo, is especially focussed on the clean-fuel options for the maritime industry. Its "Maritime Forecast to 2050" outlines the ability of shipping stakeholders, especially shipowners, to navigate the technological, regulatory and market uncertainties in the industry in an era decarbonization. It was based on a library of 30 outcomes which projected future fleet composition, energy use, fuel mix, and carbon-dioxide emissions with 16 different fuel types and 10 fuel technology systems modelled in the report. It stated that reducing greenhouse-gas emissions was rapidly becoming the defining decision-making factor for the future of the shipping industry.

ENTREPOSE Contracting, a unit of Vinci Construction Grands Projets and the UK's Taylor Woodrow, has been awarded an engineering, procurement and construction contract by the UK's National Grid to build a liquefied natural gas storage tank to serve the import terminal for London. The companies will construct a 190,000 cubic metres capacity LNG tank at the Isle of Grain import terminal southeast of London, located on the Thames-Medway river estuary. All the companies involved in the LNG tank project are all Vinci Construction subsidiaries. "This project is part of the programme to expand the capacity of the largest LNG terminal in Europe, located on the Isle of Grain, on the East Coast of England, 60km from London," said Vinci.

Vinci said that the full containment tank will have a 9 percent nickel steel inner tank with a pre-stressed concrete outer shell, poured in-situ using slip-forming. The works, for a budget of €200 million (\$243M), are set to continue until June 2025. Analysts note that LNG supplies to the Isle of Grain terminal are key to London's energy security as one shipment of LNG from a nation like Qatar can maintain the capital's power capabilities for at least five days. Vinci has already built about 20 LNG storage tanks worldwide over the past 15 years, including three which are still under construction, two in Russia with 160,000 cubic metres capacity each and one in Canada with 225,000 cubic metres capacity. "The Group is recognised for its capacity to meet the expectations of major players in the sector and confirms its leading position in the design-build of large-scale cryogenic storage tanks in any type of environment," said Vinci.

The UK regasification facility currently has 1 million cubic metres of LNG storage spread across eight tanks and an annual throughput capacity of 20 billion cubic metres of natural gas. With the terminal expanding its facilities with an additional tank and associated vaporizer capacity, its future annual throughput will increase to 25 Bcm of natural gas, or 18.5 million tonnes per annum of LNG. Qatar Petroleum announced in October 2020 that it had arranged storage and redelivery capacity for 25 years at Grain LNG. The deal was signed between the UK gas network operator National Grid and Qatar Petroleum's Qatar Terminal Limited (QTL) unit after the conclusion of an open season process.

EQUINOR, the Norwegian energy company, said it would write down the book value of its Tanzania LNG project in East Africa on the company's balance sheet by US\$982 million. Equinor said the Tanzanian LNG joint venture write-down would be reflected in the fourth-quarter earnings report scheduled to be released on the 10th of February 2021. "While progress has been made in recent years on the commercial framework for TLNG, overall project economics have not yet improved sufficiently to justify keeping it on the balance sheet," explained Equinor. "The TLNG project has an anticipated break-even price well above the portfolio average for Equinor and is, at this time, not competitive within this portfolio," said the company. "Equinor will continue to engage with the Government of Tanzania in negotiations on a commercial, fiscal and legal framework that may provide a viable business case for TLNG in the future," stated Equinor.

While Tanzania's southern neighbour Mozambique is moving ahead with several LNG projects which will change the nation's economic profile, Tanzania's reserves are not large enough to excite the major oil and gas companies. Equinor has been present in Tanzania since 2007 when the company signed a Production Sharing Agreement (PSA) with Tanzania Petroleum Development Corp. (TPDC). Equinor is the operator with a 65 percent participating interest, while US major ExxonMobil has a working interest of 35 percent in the PSA. Tanzania Petroleum has the right to participate in any project and would have a 10 percent interest.

Equinor made nine natural gas discoveries in Block 2, one of four explored blocks with proven resources offshore Tanzania. The discoveries were made in 2011 onwards. The Basin and gas resources occupy an area of some 75,000 square kilometres between the Tanzanian continental shelf edge and an area 200km east of the coast in water depths ranging from 500 metres to 3,300 metres. Royal Dutch Shell became the operator of blocks 1, 3 and 4 in Tanzania in February 2016 after its takeover of BG Group and has also been working closely with Tanzania Petroleum. Net contingent resources in the four Blocks are estimated to be at least 20 trillion cubic feet, sufficient to support a three-Train LNG development.

GASSCO, the Norwegian natural gas pipeline operator and one of the main competitors to LNG in Europe, said it

transported record gas volumes to Germany in 2020. The company said pipeline gas from the Norwegian Continental Shelf (NCS) played an important role in Europe's energy supply. Gassco said its deliveries to Europe in 2020 amounted to 107.0 billion standard cubic metres, a marginal increase from 106.9 Bcm in the previous year. However, pipeline gas deliveries to Germany rose from 47.6 Bcm in 2019 to 49.9 Bcm in 2020.

Norwegian gas arrives in Germany at two points in the state of Lower Saxony on the German northwest coast, the Emden terminal and the Dornum terminal. The Norwegian natural gas supplies to Germany in 2020 amounted to the LNG equivalent of all the current annual output of two of the largest US export plant in Louisiana, the Sabine Pass facility and Cameron LNG. "By delivering at such a high and stable rate in a very unusual year, we have clearly demonstrated the size of the demand for natural gas in a Europe which wants to reduce its consumption of coal as an energy source," explained Gassco Chief Executive Frode Leversund. Gassco noted that ensuring that the company's deliveries can be so reliable depends crucially on good collaboration with a large number of players along the value chain.

More than 60 fields on the NCS produce natural gas and it's Gassco's job to get it to customers. CEO Leversund said the gas industry was also working actively to combine profitable production with further emission reductions. "We have identified and defined various areas which we will be working with to secure further reductions in emissions. Two of our three processing plants are already fully electrified," stated Leversund. The Norwegian deliveries compare favourably in terms of energy security with pipeline volumes shipped to the European Union by Russia's Gazprom, with Germany taking Gazprom volumes of around 58 Bcm. The Russian company's pipeline gas exports to EU countries are growing with the first Nord Stream gas pipeline across the Baltic Sea and with the Nord Stream II project almost completed. Gazprom also send natural gas into the EU and the Balkans via Turkey on the TurkStream pipeline with 31.5 Bcm of capacity in two pipes.

GHANA is on track to complete an LNG import project by around March 2021 with work now focused on the onshore portion after the floating regasification unit arrived off the Ghanaian coast from a Chinese shipyard.

Jiangnan Shipbuilding, a subsidiary of China State Shipbuilding Corp., built the FRU and the vessel left the Chinese yard at the end of November 2020 for the voyage to African waters for deployment. A venture called Access LNG comprising Helios Investment Partners, a leading Africa focused private investment firm, and Gasfin Development, an LNG infrastructure company, is developing the facility. Helios established Tema LNG Terminal Co. (TLTC) to develop, construct and operate sub-Saharan Africa's first LNG import terminal.

The companies involved now say that the Tema LNG terminal venture is expected to achieve mechanical completion by around March 2021 and thereafter plans would be made for the first cargo delivery. Gasfin has led the design of the project and the fabrication of the floating infrastructure with capacity to deliver 2 million tonnes per annum of LNG. The Tema project is designed around the FRU working in conjunction with an upgraded 127,500 cubic metres capacity LNG carrier, which will act as floating storage, to deliver 250 million standard cubic feet per day of gas.

The Tema project will also have bunkering, reloading and break-bulk capabilities. The terminal will receive some LNG from Royal Dutch Shell under an agreement with Ghana National Petroleum Corp. The TLTC project company said the other current priority was the mechanical completion of the onshore works, including an 8-kilometres pipeline and a gas conditioning station. "We forecast mechanical completion for March and then we've got a commissioning period with more performance testing," said the statement. Spain's Reganosa Servicios has the contract for the operational and maintenance (O&M) side of the FRU. The Spanish firm will also oversee the pipeline. The Emerging Africa Infrastructure Fund (EAIF) committed to providing a US\$31 million loan to Access LNG in November 2020, filling in the final part of the project and guaranteeing final finance. The EAIF is backed for development financing by the governments of the Netherlands, the UK, Sweden and Switzerland as well as finance institutions, private banks and institutional investors.

It said \$31M was being lent to the Access LNG project at Tema, near where several power stations are located and are switching from light cycle oil (LCO) and heavy fuel oil (HFO) to natural gas. The

fixed infrastructure portion of the project has been in the construction phase since 2018 and was funded under a separate financing package, covering a breakwater, mooring facilities, a subsea pipeline and the onshore pipeline to take the gas from the port to Tema's industrial area.

GRTGAZ, the French natural gas grid operator and parent company of the main LNG terminals operator, has signed an agreement with the network operator of the Baltic state of Latvia for the French utility to support the modernization of the Latvian gas system and its energy transition process. GRTgaz ensures the pipeline transportation of gas throughout France and LNG deliveries through its subsidiary Elengy. GRTgaz and the Latvian operator Conexus Baltic Grid, signed a service agreement as part of the cooperation. Conexus Baltic manages 1,188 kilometres of natural gas pipelines. However, Latvia also has one of the most modern natural gas storage facilities in Europe, the Incukalna underground gas storage.

The Baltic nation has been a member of the European Union since 2004, having formerly been a part of the Soviet Union. GRTgaz said that it was evident that Conexus Baltic faced new issues in modernizing its infrastructure. GRTgaz oversees a French network comprising 32,548 kilometres of pipelines and also supplies 15 gas-fired power plants in various units. Three of France's LNG terminals, Fos Tonkin, Fos Cavaou and Montoir-de-Bretagne, are operated by Elengy within the Engie Group and as subsidiaries of GRTgaz. Latvia's neighbour and another EU member, Lithuania, has had an LNG import facility at the Baltic port of Klaipeda since 2014.

The import facility, the floating storage and regasification unit "Independence", was deployed in Klaipeda port in Lithuania to break the monopoly of Russia's Gazprom over gas supplies to the region. However, the LNG terminal has had little effect on the gas markets of neighbouring Latvia and the third Baltic state Estonia. "Conexus Baltic selected GRTgaz for its European expertise in these fields," said GRTgaz. "It is the first partnership for GRTgaz in this region of the EU," said the French company. "GRTgaz has been awarded a two-year mission covering several fields of technical expertise, project management, research and development, as well as information systems," it added.

As part of the EU's Green Action plan, Conexus has identified its need for backing

from an experienced EU state and gas network operator in implementing projects. "The gas infrastructures in Europe will have to adapt and rise to new challenges in coming years," said GRTgaz Chief Executive Thierry Trouvé. "We are keen to help Conexus benefit from our expertise in energy transition, hydrogen and pipeline maintenance and repairs," added Trouvé. "This first project in Latvia reinforces our expertise and growth ambitions. GRTgaz intends to showcase its expertise on an international project to other European gas transmission system operators," stated the GRTgaz CEO. He noted that GRTgaz has also secured other European partnerships with German gas grid operators, Ontras Gastransport GmbH and Creos Deutschland GmbH. "Our cooperation with one of the leading natural gas operators in Europe, who also runs energy research and innovation centre, is a major benefit in reaching Conexus objectives and strategic goals," said Ivars Scerbickis, Head of Technical Development and the investment department of Conexus Baltic. "The cooperation will allow us to introduce more innovative and efficient solutions in Conexus operations, thus bringing us closer to world-class practices," added Scerbickis.

GRUPO HAM of Spain, the LNG and gas fuel infrastructure company, said it partnered with Peruvian firm Limagas to build the first LNG and compressed natural gas station in the South American nation of 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 service station currently offers its customers CNG and with its two double dispensers and 80 cubic metres LNG tank will soon be filled with fuel. "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," said HAM.

With these new projects, HAM continues to help promote the use of LNG and CNG in South America, where its subsidiary HAM Chile was chosen by local Chilean company Empresas Lipigas to design, construct and commissioning the first LNG fuel in Chile. HAM's Peruvian project partner Limagas is an affiliate of Empresas Lipigas. This station will be sited at fuel facilities of Transportes San Gabriel in Linares, 300 kilometres south of the Chilean capital Santiago. While Chile is an LNG

importer, Peru has been an LNG exporter since 2010 with a plant at Pampa Melchorita comprising two liquefaction Trains and annual output of around 4 million tonnes per annum.

HAM said that the Cuzco station is on Avenida la Cultura, which extends from west to east between the districts of Cuzco, Wnachaq, San Sebastián and San Jerónimo, with significant vehicle traffic. During the station's inauguration, the authorities of the Regional Government of Cuzco said that having a natural gas filling station changed the nation's energy matrix and would help lower fuel costs. HAM now has a network of 75 LNG and CNG stations. They are located mostly in Europe with 30 in Spain, 16 in Italy, 12 in the Netherlands, nine in Belgium and eight in France, all sited at strategic points for truck transport.

ICE, the Intercontinental Exchange energy trading platform clearing house, is planning to launch its oil future contract for liquefied natural exporter Abu Dhabi on March 29, backed by leading LNG sector players. The exchange said that that trading on the ICE Murban Crude Oil Futures (IFAN) is going ahead subject to the completion of regulatory approvals. The IFAN futures debut in the markets had been delayed in 2020 by the market oil market slump and the Covid-19 pandemic. "We are making good progress on securing the regulatory approvals necessary for launch. We have received approval from the Bank of England for ICE Clear Europe to clear contracts traded on IFAD and IFAD is now a Recognized Market Operator by the Monetary Authority of Singapore," explained Jamal Oulhadj, President of ICE Futures in Abu Dhabi. "We believe that the combination of our partners, ICE's extensive global energy network and customer base, and the capital efficiencies created by clearing Murban alongside Brent, West Texas Intermediate, and Dubai, mean that Murban futures should have a deep base of support as the market uses the futures to buy, sell and hedge Murban crude," added Oulhadj.

The Murban Crude Oil Future is a physically delivered contract, basis free-onboard (FOB) cargo at the Fujairah loading terminal in the UAE. The contract will provide users with an effective hedging instrument for Arab Gulf crude oil and other grades of trading into the Asia-Pacific region. Abu Dhabi also produces LNG as well as oil for the United Arab Emirates and is aiming to increase

its natural gas resources by investing more in exploration and production in the next few years. It currently produces around 5.8 million tonnes per annum of LNG at the Das Island liquefaction plant off Abu Dhabi. In addition to the approvals from the Bank of England and Monetary Authority of Singapore, ICE Futures Abu Dhabi said it had completed the relevant regulatory processes or analysis required to permit direct access to IFAD from a range of jurisdictions including Abu Dhabi Global Market, the United States, Switzerland, the Netherlands, France, Norway, Australia, Japan and South Korea.

Contracts traded at IFAD will be cleared at ICE Clear Europe, a leading energy clearing house, and will clear alongside ICE's global energy futures platform covering oil, natural gas and the environmental complex, allowing customers to benefit from associated margin offsets. Inpex Corp., the Japanese oil and gas company with stakes in major LNG export plants and projects such as Ichthys and Prelude FLNG in Australia and Abadi LNG in Indonesia, is one of the companies that IFAD venture. The other energy companies joining the launch of IFAD include Royal Dutch Shell, BP of the UK, PetroChina, Total, PTT of Thailand, Japan's JXTG Nippon Oil & Energy and the international commodities traders Vitol.

INDIA hit a landmark annual total in liquefied natural gas imports in 2020 as the economy continued to grow along with pipeline and terminal infrastructure, even amid the challenges of the Covid-19 pandemic and with several months of shipments under the 2019 level. LNG imports to its growing network of regasification facilities for the month of December 2020 came to 2.06 million tonnes, around 30 cargoes, compared with 2.4MT in December 2019, a decline of 0.9 percent. However, this total meant India cargo receipts for the calendar year came to 25.29 million. The was about 5.5 percent higher than in 2019 when the total was 23.98MT, after rising 7.1 percent from the total of 22.42MT received in 2018.

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 maintains its position as the fourth-largest LNG importer 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. Indian LNG imports for the month of November had come to 2.14MT, or around 32 cargoes, an increase of 11.8 percent on the 1.91MT received in November 2019. Analysts said that the economic slowdown caused by Covid-19 has had some effect on LNG shipments, but overall gas demand and additional import terminal capacity have been supporting the market.

The cumulative imports for the nine months of the fiscal year to date from April to December came to 18.32MT compared 18.20MT in the same period of 2019, a rise of 0.7 percent, according to the data from the Indian Ministry of Petroleum and Natural Gas. Added to the nine-month fiscal year total are the volumes for January to March 2020, of 2.05MT, 2.55MT and 2.37MT, giving the calendar-year total of 25.29MT. The Ministry said that gross production of natural gas for the month of December 2020 was 2.425 billion cubic metres, which was lower by 7.1 percent compared with the 2.610 Bcm logged in December 2019. Domestic production from April to December 2020 amounted to 21.129 Bcm compared with 23.820 Bcm of output in the 2019 period, a drop of 11.3 percent.

Ministry data also showed that the costs of importing cargoes December 2020 were \$700M versus \$800 in the same month of 2019. The April to December costs were given as \$5.1Bln compared with \$7.1Bln in the same fiscal-year period in 2019. India's seventh import facility is also scheduled to start up in the months ahead in the Western state of Maharashtra. This follows the 2020 opening of the sixth facility at Mundra in Gujarat state, co-owned by Gujarat State Petroleum Corp. and the Adani Group. The main operating terminals on India's West Coast are at Dahej, Hazira and Dabhol, near Mumbai, and at Mundra, north of Mumbai. The newest terminal at Mundra is receiving more shipments as its regasification throughput rises.

There is additionally the Kochi facility in the southwest state of Kerala and one East Coast terminal at Kamarajar, 25 kilometres north of Chennai Port in Tamil Nadu, and also known as Ennore. Imports to the Kochi terminal are set to increase after the inauguration of the 450-kilometres Kochi-Koottanad-Mangalore natural gas pipeline to transport volumes to industrial customers further north. The Mundra import facility is co-owned by Gujarat State Petroleum Corp. and the Adani Group and is designed with two

storage tanks. With the opening of the Mundra terminal, India now has 42.5 million tonnes per annum of regasification capacity. India's seventh import facility is on track for start-up in early 2021 at Jaigarh Port, south of Mumbai in Maharashtra. Norwegian company Hoegh said recently that it had entered into a binding commitment to supply H-Energy, part of the Indian Hiranandani Group, with a floating storage and regasification unit at Jaigarh from the first quarter of 2021. Capacity utilisation at all the Indian terminals has been gradually increasing.

The Ministry data for December 2020 showed, with a one-month time lag, that capacity utilization at Dahej was averaging 95.4 percent monthly. The Dahej capacity is 17.5 MTPA. At Hazira, the monthly utilisation rate was 93.3 percent for 5 MTPA, while the new Mundra terminal had 37.1 usage for its 5 MTPA of capacity. Dabhol had 52.0 percent utilization for its 5 MTPA, while at the Kochi facility there was 16.3 percent usage for 5 MTPA and at Kamarajar (Ennore) it was 11.5 percent for 5 MTPA.

JAPANESE liquefied natural gas imports again declined on an annual basis by 3.7 percent in 2020 with only Australian, spot and US volumes increasing, though shipments to Japanese terminals still outstripped China's during the month of December. Shipments of LNG to the Japanese import network amounted to 74.46 million tonnes compared with the 77.32MT received in 2019, according to the preliminary figures from the Japanese Finance Ministry. Japan imported 7.72MT of LNG in December, its highest total of the year, surpassing the record Chinese December imports of 7.59MT. Imports in November came to 6.02MT, less than the 6.27MT received in the same month of 2019. Japan's annual shipments in 2020 shipments cost 3.31 trillion yen (\$31.10 billion), a drop of 26 percent on the 4.34 trillion yen (\$42.05Bln) spent in 2019.

LNG imports by the world's largest buyer of the fuel are continuing to decline and the 2019 total of 77.32MT was 6.7 percent lower than the 82.85MT logged in 2018. The second-largest LNG importer, China, is poised to overtake Japan in the next few years and its shipments in 2020 came to 67.13MT, just 7.33MT behind the latest Japanese total. LNG competes mainly with thermal coal for power generation in Japan amid a continued shutdown of most of the nation's nuclear

plant. The nation's thermal coal imports also dropped during 2020 by 5.2 percent to 105.17MT as the Covid-19 pandemic slowed economic activity. Nuclear power usage in Japan is still much reduced from the 50 units on line in 2011 to less than a handful now. The number of nuclear reactors in operation has fallen from nine reactors a year ago to just four reactors as Japan tightens safety restrictions and several plants close for upgrades.

Asia's annual LNG cargo deliveries to Japan from nations such as Malaysia and Indonesia, Papua New Guinea and Brunei amounted to 16.81MT, a drop of 5.9 percent from 2019. Middle East shipments from countries like Qatar, the United Arab Emirates and Oman tumbled by 11.4 percent from the previous year to 12.21MT. Shipments from Russia, mostly from the Sakhalin Island plant in the Far East, also fell by 4 percent to 6.14MT. US cargo deliveries to Japan increased in 2020 as more capacity came on stream on the Gulf Coast and shipments grew by 27.8 percent from 2019 to 4.72MT. The balance of imports in 2020 came from Australia, African nations and the spot market. That segment of the imports came mainly from Australia and amounted to 34.58MT, down slightly on the 2019 total of 35.58MT.

KINDER MORGAN, the US pipeline company, reported a small decline in fourth-quarter net income as revenues were underpinned by the growing LNG feed-gas requirements on the Gulf Coast and praised the performance of the Texas Intrastate systems, Natural Gas Pipeline of America (NGPL) and Elba Island LNG. KMI reported fourth-quarter net income of \$607 million, slightly down on the \$610M total in the same three months of 2019. "Despite the pandemic's continued drag on the economy and on energy demand, our company weathered the fourth quarter well, producing substantial earnings as expected and robust coverage of this quarter's dividend," said KMI Executive Chairman Richard D. Kinder. "Our assets continue to provide strong cash flow and our corporate philosophy remains sound: fund our capital needs internally, maintain a healthy balance sheet, and return excess cash to our shareholders," stated Kinder.

KMI President Kim Dang gave an overview of 2020 and outlined the prospects for 2021. "Financial contributions from all of our business segments were down compared to the fourth quarter of 2019, due to lower

energy demand as a result of the pandemic, lower commodity prices, and the December 2019 sale of Kinder Morgan Canada Limited (KML) and the US Cochin Pipeline,” said Dang. She noted, however, that one of the major highlights of the quarter was completing construction of the Permian Highway Pipeline, which went into full commercial service on January 1, overcoming multiple permitting and legal challenges. The \$2-billion Permian Highway Pipeline brings associated gas from West Texas to the Gulf Coast for use by industry and exporters. The 430-mile PHP delivers natural gas from the Waha Hub in Texas to Katy in Texas with connections along the coast and to markets in Mexico. “Our project management teams and workers in the field managed to complete several other important expansion projects during the quarter while maintaining an outstanding safety record in the face of the historic pandemic,” Dang continued.

She added that Natural Gas Pipelines segment experienced lower contributions from multiple gathering and processing assets due to sharply reduced natural gas production and from the sale of the US Cochin Pipeline in December 2019. “These reduced contributions were partially offset by greater contributions from the Texas Intrastate systems, Natural Gas Pipeline of America (NGPL), and Elba Island LNG,” stated Dang. Natural gas transport volumes were down 2 percent compared to the fourth quarter of 2019, with notable volume declines on Colorado Interstate Gas Pipeline and Wyoming Interstate Pipeline due to the production declines in the Rockies basin, and on El Paso Natural

Gas due to increases in transportation alternatives for Permian Basin production. “These declines were partially offset by increased volumes on the Texas Intrastate systems, due primarily to increased Gulf Coast contract activity largely serving LNG and industrial markets,” said Dang. “On the Tennessee Gas Pipeline there were increases in LNG and power plant deliveries sourced largely from the Appalachian region and on the Elba Express due to increased deliveries to Elba Island LNG,” she added.

KMI also reported that natural gas gathering volumes were down 20 percent from the fourth quarter of 2019 across nearly all its systems, most notably on the KinderHawk and Eagle Ford systems. “Continued low refined products demand and lower crude and condensate volumes during the fourth quarter reduced contributions from the Products Pipelines segment,” Dang said. “Crude and condensate pipeline volumes were down 26 percent and total refined products volumes were down 13 percent compared to the fourth quarter of 2019,” she added. “Gasoline volumes were below the comparable period last year by 10 percent and jet volumes were still very weak (down 47 percent) but diesel volumes were strong, 7 percent above the fourth quarter of 2019,” her report concluded.

MAN Energy Solutions has won an order from German shipping company Hapag-Lloyd for engines with LNG-powered capability and equipment for six ultra-large container vessels to be built in South Korea. Hapag-Lloyd has 234 modern container ships and is joining other global shipping lines in having LNG fuel capacity for its new vessels. The engines will operate on LNG, but have sufficient tank capacity to operate alternatively on conventional fuel. MAN Energy Solutions, based in Copenhagen, said the Hapag-Lloyd order comprises six MAN B&W 11G95ME-GI Mk10.5 main engines for the six ULCVs with 23,500 twenty-foot equivalent units. The Korean shipyard, Daewoo Shipbuilding & Marine Engineering, will construct the vessels with delivery expected from April through December 2023. “The engines will also be built in Korea and will offer the option of operating on LNG or conventional fuel, meeting Tier III emission standards through SCR (Selective Catalytic Reduction),” said Man Energy.

The first engine delivery for Hapag-Lloyd newbuild is scheduled for May 2022. “With the investment in six ultra

large container vessels we will not only be able to reduce slot costs and improve our competitiveness on the Europe-Far East trade, but also take a significant step forward in modernizing our fleet. Additionally we will further reduce our environmental impact,” said Rolf Habben Jansen, Chief Executive of Hapag-Lloyd. The newbuilds will be deployed on the Europe-Far East routes as part of The Alliance and will significantly increase Hapag-Lloyd’s competitiveness in this trade. Bjarne Foldager, Senior Vice President and Head of Two-Stroke Business at MAN Energy, said the newbuilds would be fitted with the tried and tested M-Type Electronically Controlled-Gas Injection (ME-GI) technology, which continues to accumulate positive references across multiple segments. “The engines’ fuel-efficiency and negligible methane-slip tie in perfectly with Hapag-Lloyd’s strategy of sustainability,” explained Foldager. “As we move towards a zero-carbon future, the ME-GI showcases our dual-fuel engine portfolio that is future-proofed to handle whatever alternative fuels come to prominence in the decades ahead,” he stated.

MAN Energy states that its low-speed, dual-fuel references now exceed 360 units, with the ME-GI recording over 1.5 million operating hours on LNG alone. The new business follows a series of recent ME-GI sales with five 6G70ME-GI Mk 10.5 dual-fuel engines ordered in October 2020 for five Newcastlemax bulk carriers for EPS, the Singapore-based shipping company. The previous month, Guangzhou Shipyard International Co., Ltd. (GSI) ordered two 6G60ME-GI Mk 10.5 dual-fuel engines for LR2 tankers for Hafnia, one of the world’s leading oil-product tanker owners and operators.

NEW FORTRESS Energy Inc, the New York-based company with a growing LNG projects portfolio in Latin America and the Caribbean, has entered into two deals with a combined value of \$5 billion, one to acquire Golar LNG Partners and a second to take over Hygo Energy Transition, a Brazil-focused joint venture owned by Stonepeak Infrastructure Partners and shipping company Golar LNG Ltd. Golar LNG Ltd and Stonepeak have entered into a definitive agreement and plan of merger to sell 100 percent of Hygo Energy to New Fortress, listed on the Nasdaq global exchange as is Golar LNG Partners. Under the terms of the merger agreement, New Fortress will acquire all of the outstanding shares of

Hygo for 31.4 million shares of its own Class A common stock and \$580 million in cash. “The transaction values Hygo at an enterprise value of \$3.1 billion and an equity value of \$2.18 billion,” said a statement from New Fortress outlining the deals. “The addition of Hygo will quickly expand our footprint in South America with three gas-to-power projects in Brazil’s large and fast-growing market,” said New Fortress Chairman and Chief Executive Wes Edens.

Edens is also a sports business entrepreneur. He has co-owned the English Premier League soccer team Aston Villa since July 2018. Edens is also a co-owner of the US basketball team, the Milwaukee Bucks. He noted that New Fortress would become the leading gas-to-power company in Brazil with the Hygo deal and the earlier purchase of Golar provides world-class LNG shipping experience and assets. Earlier on Jan 13, Golar LNG Partners, the owner of 10 LNG vessels and an affiliate of Golar LNG Ltd., said it planned to merge with New Fortress. Under that deal, New Fortress has agreed to acquire all of the outstanding common units and general partner units of Golar Partners for \$3.55 per unit in cash for a total purchase price of \$251M in equity value.

The Partnership’s fleet of vessels comprises four modern carriers, four floating storage and regasification units and two newbuilds. Golar Partners generated third-quarter operating income of \$32.1 million compared with \$35.90M in the prior-year quarter. In connection with the New Fortress-Golar Partners transaction, the incentive distribution rights of Golar Partners will be cancelled. The Series A preferred units of the Partnership will remain outstanding. “The sale of Golar Partners comes after an extensive search for strategic alternatives, and is an attractive solution for GMLP that creates immediate additional value for GMLP stakeholders,” said the Chairman of Golar Partners, Tor Olav Troim. New Fortress CEO Edens added that Tor Olav Troim and his teams had been pioneers in the global shipping and energy industries. “The addition of this great portfolio of assets enhances our fully integrated approach and we’re excited for them to become part of NFE,” said Edens. “This is a great step towards our goal of finishing this year with 15 to 20 terminals that bring more clean and affordable energy to growing markets around the world,” stated Edens. With the acquisition of Hygo, New Fortress will

Diary of events

May 2021

Canada Gas & LNG Exhibition & Conference 2021

May 11-13, 2021
Vancouver Convention Centre East
999 Canada Pl, Vancouver,
British Columbia
<https://www.canadagaslng.com>

June 2021

World Gas Conference 2021

June 21-25, 2021
EXCO, Daegu Exhibition &
Convention Centre
10, Exco-ro, Buk-gu, Daegu,
South Korea
<https://www.wgc2021.org>

7th China LNG & Gas International Exhibition

23 - 25 June, 2021
National Exhibition & Convention
Centre (NECC), Shanghai, China

acquire an operating floating storage and regasification unit (FSRU) terminal and a 50 percent interest in a 1500 megawatt power plant in Sergipe, northeast Brazil as well as two other FSRU terminals with 1200MW of power in advanced stages in Brazil. Hygo's fleet consists of a newbuild FSRU and two operating LNG carriers.

New Fortress will also acquire a leading owner of FSRUs and LNG carriers as well as a pioneer in floating liquefaction technologies with the Golar Partners transaction. "The addition of GMLP's fleet of six FSRUs, four LNG carriers and a 50 percent interest in Trains 1 and 2 of the 'Hilli', a floating liquefaction vessel, is expected to support both NFE's existing facilities and the international project pipeline," stated Edens. Alongside its US ventures in New Jersey and Pennsylvania, New Fortress has already completed projects in Jamaica and recently signed two long-term LNG agreements to acquire supplies to support its gas and power businesses in Puerto Rico, Mexico and Nicaragua.

NOVATEK, the main Russian liquefied natural gas developer in the Arctic region, has also been building up the customer base of its small-scale Cryogas-Vysotsk plant on the Baltic Coast while making progress on assembling a shipping fleet for the Arctic LNG II project under construction on the Gydan Peninsula of northern Siberia. Novatek owns 51 percent of the Cryogas-Vysotsk liquefaction plant, which began operations in 2019, and the other stakeholder is Gazprombank, the financial arm of pipeline gas and LNG company Gazprom. The facility operates in the Baltic port of Vysotsk, located about 160 kilometres northwest of the city of St. Petersburg, supplying Russian customers as well as small-scale users in Scandinavian and Europe.

The plant has output capacity of 660,000 tonnes per annum of LNG and other infrastructure includes 42,000 cubic metres capacity storage tank as well as a loading terminal to handle small-scale and medium-scale carriers with capacities of up to 30,000 cubic metres. Novatek said that in a period of just over a year Cryogas-Vysotsk carried out more than 200 small-scale LNG carrier loadings for deliveries to customers in Finland, Sweden, Lithuania, the Netherlands, Estonia, Poland and Spain. The plant also registered 1,200 truck-loadings during the period for deliveries to off-grid customers and fuel station

operations in the Russian domestic market around the region of Murmansk. "Cryogas-Vysotsk has a broad and diverse geography of customers as this important project serves the entire Baltic region clean-burning natural gas needs amid tightening environmental requirements for marine and automotive fuels," said Novatek Chairman Leonid Mikhelson.

As regards its large-scale LNG plants, including Yamal LNG and the under-construction project Arctic LNG II, Novatek said a steel-cutting ceremony had taken place at the Zvezda Shipyard in the Russian Far East for a new Arc7 ice-class LNG carrier to transport cargoes for Arctic LNG II. 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 Russian company holds 60 percent of the Arctic LNG II project and four other 10 percent stakes are shared between various shareholders.

SOVCOMFLOT, the Russian shipping line with an overall fleet of 145 vessels, said its LNG carrier, the "Christophe De Margerie", reached Cape Dezhnev in Russia's Far East to complete the earliest annual eastbound voyage carrying a cargo along the Northern Sea Route. The "Christophe De Margerie" with 172,600 cubic metres of capacity had lifted a cargo for Novatek's Yamal LNG plant from the Port of Sabetta in the Russian Arctic and was delivering its shipment to an Asian customer. "For the first time ever, Russian LNG has been transported across this route in January," said Sovcomflot, noting the vessel reached Cape Dezhnev on January 16.

Having reached the Bering Strait in 11 days with an average safe speed of 9.6 knots, the "Christophe de Margerie" was subsequently followed by a similar LNG tanker, the 172,600 cubic metres capacity "Nikolay Yevgenov", owned and operated by Teekay LNG, was currently completing its own independent passage along the NSR. Both LNG carriers will deliver around 140,000 tonnes of LNG produced at the Yamal LNG plant. "The total time of cargo delivery by this route is 40 percent shorter than the traditional route through the Suez Canal," added Sovcomflot, referring to the route via Western Europe and the Mediterranean. The successful NSR passage proves that during the autumn-winter navigation season, commercial cargo shipping across

the Eastern part of the Russian Arctic becomes possible for an additional one or two months. "This voyage is yet another step towards the year-round, safe navigation along the full length of the NSR," added Sovcomflot. "This will also help realise Russia's plans to grow NSR cargo traffic and further unlock the route's transit potential," stated the fleet owner.

Simultaneously, another Arc7 ice-class LNG tanker, the 172,600 cubic metres capacity carrier "Nikolay Zubov", travelling in the opposite direction to the port of Sabetta after offloading its LNG cargo, entered the westbound ice route along the NSR on January 6 and subsequently reached the Ob Bay on January 17. The "Nikolay Zubov" is owned by Greek shipping company Dynagas. All three of the Arc7 ice-class LNG tankers independently passed the ice-covered part of the NSR, without ice-breaker support, along the navigational routes recommended by the State Research Centre, the Arctic and Antarctic Research Institute, and the Marine Operations Headquarters of Russia's Atomflot.

Sovcomflot said that the "Christophe de Margerie's" with its double action hull design, sailed stern-first for about 66 percent of the steaming time, to overcome ice hummocks. "The voyage of the 'Christophe de Margerie', in January, continues the longstanding efforts of SCF and Novatek to develop large-capacity cargo shipping in the Arctic, and to further expand the window of transportation opportunities in the challenging ice and navigational conditions of the Arctic Sea Basin," said Igor Tonkovidov, President and Chief Executive of Sovcomflot. "Year-round navigation in the Eastern part of the Russian Arctic has been a centuries-old dream of Russia's pioneering seafarers, and now we are one step closer to it," stated Igor Tonkovidov. "This will result in more efficient use of the Northern Sea Route for the Russian economy, while contributing to the success of large-scale industrial projects at the Ob River estuary and across the entire Russian Arctic," added the CEO. Tonkovidov added that Sergey Gen, the Master of the "Christophe de Margerie", reported the successful completion of the passage to Vitaly Saveliev, Russia's Minister of Transport, via a video link. "The Minister congratulated SCF on this accomplishment and thanked the Master and his crew for their excellent performance throughout this important task," said Sovcomflot.

SUBSEA 7 SA, the European contractor listed on the Norwegian stock exchange, said it was proud to support African oil and gas development after being awarded a lean-gas project contract in the LNG-producing nation of Angola. Subsea 7 said its "substantial" contract was awarded by Cabinda Gulf Oil Company (CABGOC), a subsidiary of US major Chevron Corp. operator of the LNG plant. The contract is for the Sanha Lean Gas Connection (SLGC) project comprising the construction and installation of the Lean Gas Platform system in Block-0 offshore the southwest African state at a water depth of around 70 metres.

Project management and engineering would be performed from Subsea 7's offices in Paris and Lisbon. Subsea 7 contracts listed as "substantial" are usually worth between \$150 million to \$300M. Fabrication will take place at Sonamet's yard in Lobito, Angola, from 2021 to 2022, while offshore operations will occur from 2022 and 2023. "We are delighted to have been awarded this contract by CABGOC, following a public tender," said Gilles Lafaye, the Subsea 7 Senior Vice President for Africa, the Middle East and Caspian Region. "This is the result of a long-term collaboration with the client and a track record of delivering successful projects," added Lafaye. "The project reinforces Subsea 7's presence in Angola and our commitment to support Africa's energy industry," he stated.

Angola has taken up the rotating presidency of the Organisation of Petroleum Exporting Countries and will chair OPEC meetings during 2021 at a time of change and challenges in the industry. Angola is the second-largest oil producer in Sub-Saharan Africa and uses associated gas to produce LNG as a clean energy source at its liquefaction plant. The other shareholders in addition to Chevron and Angolan energy company Sonangol are BP of the UK, Eni of Italy and France's Total. The Angola LNG plant is located 350 kilometres north of the capital Luanda in Soyo, at the mouth of the Congo River and is one of the world's most modern LNG processing facilities. A pipeline network of over 500km delivers gas from offshore oil fields to the Soyo plant designed to process 1.1 billion cubic feet of natural gas per day and produce 5.2 million tonnes per annum of LNG. US reserves of natural gas decreased by 1.9 percent, the first annual decline in the country since 2015, though they remained

at their second-highest level ever and three states Ohio, Pennsylvania and Louisiana boosted their proved gas resources. The annual data published by the government showed that proved reserves dropped from 504.5 trillion cubic feet (Tcf) at year-end 2018 to 494.9 Tcf at year-end 2019. Proved reserves of natural gas from shale increased from 68 percent of the US total in 2018 to 71 percent at year-end 2019. “Net downward revisions of reserves in the Eagle Ford, Barnett, and Bossier shale plays (all in Texas) contributed the most to the annual drop,” said the report, based on estimates of hydrocarbon resources that analysis of geologic and engineering data demonstrates was reasonable.

Texas, Oklahoma, and Wyoming reported the largest net decreases in proved reserves of natural gas of all states in 2019. “Proved reserves of natural gas in Texas decreased by 8.7 percent overall as downward revisions of natural gas reserves in the Eagle Ford and Barnett Shale plays exceeded gains from the proved reserves of associated-dissolved natural gas that accompanied crude oil development in the Permian Basin,” the report explained. Oklahoma’s natural gas reserves (which includes the Woodford shale play) declined 11.6 percent. “Wyoming’s proved natural gas reserves declined 17.8 percent - unlike Texas or Oklahoma, which had extensions of 15 Tcf and 5 Tcf from the Wolfcamp and Woodford shale plays to alleviate a portion of their State’s downward revisions and production, Wyoming had only 0.4 Tcf of extensions and discoveries during 2019,” the report stated.

Ohio, Pennsylvania, and Louisiana reported the largest net increases in proved natural gas reserves in 2019. Ohio reported a 42.4 percent (10.4 Tcf) increase, as operators in the Utica basin and the Pleasant shale play reported record-level acquisitions of reserves from their competitors and applied new valuation to that volume. Pennsylvania reported a 2.3 percent (2.4 Tcf) increase in proved reserves from the Marcellus shale play. Louisiana reported a 6.9 percent (2.4 Tcf) increase in gas reserves from the Haynesville shale in northern Louisiana. Operators in Texas reported the largest extensions and discoveries of proved natural gas reserves in the US, totaling 15.7 Tcf. “The largest natural gas discoveries in Texas were from extensions to oil fields with associated-dissolved natural gas in the Permian Basin, non-associated natural gas in the

Haynesville-Bossier shale play and non-associated natural gas in the Eagle Ford shale play,” explained the report. Pennsylvania saw the next-largest volume of extensions and discoveries at 13.8 Tcf. These discoveries were in the Marcellus shale of southwestern Pennsylvania.

VENICE LNG, a company owned by Italian industrial groups Decal SpA, said it had obtained an authorization decree for the construction and operation of a small-scale LNG storage terminal in the industrial area of Porto Marghera. The permit has come from the Italian Ministry of Economic Development in agreement with the Ministry of Infrastructures and Transport. The main infrastructure will consist of a 32,000 cubic metres capacity small-scale LNG import terminal able to receive feeder ships of up to 30,000 cubic metres capacity.

Facilities will be located in an area owned by Decal, alongside the existing oil storage site along the South Industrial Canal and on restored land formerly used for a coal plant. Venice LNG’s construction phase is expected to begin in the third quarter of 2021, while operations are scheduled for start-up by around mid-2024. “This step forward in the fuel infrastructure for road and marine transport is made possible thanks to a private investment of over €100 million (\$120M) by Decal Spa Group through its subsidiary Venice LNG,” said the company. “The project is promoted and supported by the North Adriatic Sea Port Authority and co-financed by the European Commission under the Connecting Europe Facility initiative for a total of €18.5M (\$22.3M),” it added.

LNG will arrive at the Venice storage terminal by small and medium-sized carriers and will be distributed on tank trucks, ISO-tanks and barges. “Thanks to LNG, pollutants in the atmosphere and in the waters of the Venice lagoon will be drastically reduced,” stated the company. The authorization incorporates the requirements by all the authorities involved in the procedure, including the Veneto Region, and which must be fulfilled by Venice LNG before and during the construction and operation of the coastal storage facility.

Among the requirements, there will be mitigation of dust and noise emissions during the construction phase, along with an Environmental Monitoring Plan and the implementation of procedures to limit waste production. “We are pleased to have reached the authorization decree, since it

confirms the value of our project,” said Gian Luigi Triboldi, President and Chief Executive of Venice LNG. “Our project went through a long technical-administrative path, involving many authorities and the local community too. Now, we are ready to give our contribution to promote the use of LNG, which plays a key role in the energy transition process,” explained the CEO.

In addition to the storage tank, the Venice project also includes a jetty and a system to allow the loading of barges and the installation of a boil-off gas management system. About three-quarters of the volumes will be aimed at the road transport market and the balance will be sold to the ship bunkering sector. The largest LNG facility in the region is Adriatic LNG, which imports cargoes from Qatar to be fed into the Italian natural gas transmission system. The EU is promoting small-scale LNG distribution and more use of the fuel in trucking as part of its clean energy policy. With the implementation of the International Maritime Organization’s 0.5 percent global sulphur cap in 2020, LNG is being put forward as the most economic and viable alternative fuel for ship owners.

WOODSIDE Petroleum, the Western Australian operator of two LNG export plants, posted a plunge of more than 33 percent in 2020 LNG sales revenues after the roller-coaster price movements in the year of Covid-19. Woodside reported that LNG sales revenues in 2020 amounted to US\$2.53 billion, well down from the US\$3.74Bln logged in the previous year. The Perth-based company, which operates the North West Shelf LNG plant, Pluto LNG and has a stake in the Chevron-operated Wheatstone LNG plant, also saw overall annual revenues, including oil and petroleum products, drop to US\$3.61Bln from US\$4.95Bln in 2019. Fourth-quarter LNG sales revenues to December 2020 declined to US\$607 million versus US\$991M in the prior-year quarter, but were higher than the US\$462M reported in the three months to September 2020.

The company noted that its average realised LNG price in the fourth quarter was US\$4.8 per million British thermal units, compared with US\$3.9 per MMBtu in the third quarter and US\$8.1 per MMBtu in the prior-year fourth quarter. Woodside Chief Executive Peter Coleman said the annual income fall came as 2020 annual production was 12 percent higher than in 2019. On the positive side, he noted that sales revenue in the fourth

quarter rose 32 percent to US\$920M from US\$699M compared with the third quarter of 2020 on the back of higher oil and gas prices.

Coleman also gave an overview marking progress on the company’s various ventures, including the Burrup Gas Hub plan in Western Australia, backed by the Scarborough gas field. “Production licences were awarded for the processing of Scarborough gas through an expanded Pluto facility and we remain on track for a targeted final investment decision on the development in the second half of this year,” said Coleman. The design capacity of the Scarborough offshore development was increased by around 20 percent to produce 8.0 million tonnes per annum of LNG. This follows completion of technical feasibility studies in December 2020. Coleman said that the Pluto Train 2 construction plan had been reviewed and optimised to improve execution efficiency with the chosen engineering, procurement and construction contractor, the US company Bechtel. “Oil and gas prices have strengthened considerably heading into the first quarter of 2021. We agreed to our highest ever spot LNG price for delivery in the coming quarter, surpassing our previous record set in 2012,” Coleman noted without giving the prices.

In Senegal, Woodside completed the acquisition of UK-listed Cairn Energy’s interest in the Sangomar offshore oil development and a contract was awarded for the operation and maintenance of the floating production storage and offloading facility, which is targeted for delivery and first oil in 2023. Woodside’s equity interest in Sangomar increased to 68.33 percent and to 75 percent for the remaining evaluation area. The company also exercised its right to pre-empt the sale by FAR Ltd’s Sangomar stake to Indian energy company ONGC Videsh. “Late in the quarter, the North West Shelf Project participants executed fully termed agreements to process third-party gas from Pluto and Waitsia, marking the first step towards securing the long-term future of Australia’s first and largest LNG plant as a tolling facility,” stated Coleman. As regards, scheduled LNG Train shutdowns, Woodside said there would be two at the NWS plant. LNG Trains 2 and 4 would each be shut for approximately one month with Train 4 being off stream in the second quarter of 2021 concurrent with the Goodwyn platform, and Train 2 in the third quarter of 2021 aligned with North Rankin Complex temporary closures. ■

Maintaining shipboard equipment vital

Equipment maintenance agreements are today the mainstay of vessel operations, reports Technical Editor Ian Cochran.

They provide peace of mind and can save a considerable amount of money when things go wrong.

Most equipment suppliers offer service and maintenance agreements of some kind often agreed when ordering the equipment and with the building of the ship.

One of the largest equipment service providers is Wärtsilä who last month signed a five-year extension to its optimised maintenance agreement with Golar Management.

Golar Management operates and manages a fleet of LNGCs and FSRUs out of Oslo, Norway.

The latest agreement covers 16 ship installations - 14 fitted with Wärtsilä 50DF dual-fuel engines, plus another two fitted with Wärtsilä 34DF dual-fuel and Wärtsilä 20DF dual-fuel engines.

The extension contract was signed last December.

This agreement will enable Golar to pursue a predictive maintenance strategy enabled by dynamic maintenance planning and asset diagnostics, the company said.

Furthermore, Wärtsilä's operational support provides round-the-clock remote support and practical advice from dedicated Wärtsilä's expertise centres.

The combination of advanced diagnostics and Wärtsilä's considerable equipment expertise greatly enhances the

safety, reliability and efficiency of the equipment and systems installed. Flexibility in maintenance scheduling will also be provided by conducting maintenance based on actual equipment condition optimised for the vessels' operations, the company said.

"We are pleased to continue our long-term partnership with Wärtsilä with this service agreement extension. Wärtsilä's digital remote support capabilities have proved to be of great value for us, saving both time and costs by often eliminating the need to have service people sent on board in person," said Øistein Dahl, Golar Management Norway Managing Director.

"Lifecycle support is a key element of our strategy, and an important factor for us to be a trusted and reliable partner to our customers. With Wärtsilä optimised maintenance, we are able to increase availability and reduce unscheduled maintenance.

"By renewing and extending this agreement, we are also strengthening the partnership that exists between our companies, and we are proud that Golar is continuing their journey with us," added Henrik Wilhelms, Director Performance Services, Wärtsilä Marine Power.

The new five-year lifecycle solution agreement includes the 14 vessels signed up for an optimised maintenance programme earlier plus two additional Golar-managed vessels.

The original contract - a five-year technical management agreement - was signed in 2015 and included the remote monitoring of engines, maintenance planning, advisory services, and guaranteed availability of personnel and spare parts.

In addition to planning and consultation services, the technical management agreement included a condition-based maintenance (CBM) system that supported the optimisation of the performance of the installed equipment.

Also under the terms of the agreement, a dedicated contract manager offers technical advice and consultation, as well as maintenance planning, increasing the predictability of maintenance and service needs.

GasLog covered

Golar is not the only LNGC owner to place its faith in Wärtsilä, as in October 2017, the company revealed that GasLog had placed its entire LNGC fleet under an asset and lifecycle management agreement.

GasLog signed the first dynamic maintenance agreement with Wärtsilä back in 2011. This was for six LNGCs and marked the start of a long co-operation which now covers agreements for several more vessels.

Down the years, the growing volume of

installed engines in GasLog's fleet made maintenance planning a tedious and time-consuming task, tying-up a significant number of the company's resources which could otherwise be utilised for more critical tasks, the company said.

At the time, GasLog said it could benefit from Wärtsilä's extensive global network of skilled and authorised service engineers. In addition, the agreements' pricing structure allowed GasLog to budget engine maintenance accurately, which covers a substantial part of the company's overall operations & maintenance budget.

The three most important benefits of the GasLog agreements were claimed to be peace of mind with regards to maintenance planning and budgeting, the warranty of both repairs and support, and the global service network offered.

Today, dynamic maintenance planning (DMP) is a vital part of asset and lifecycle management agreements. The savings calculated are vessel specific and depend on the ships' operating profiles, the company explained.

Wärtsilä said that its optimised maintenance service improves long-term cost predictability and asset availability by data driven maintenance planning and scheduling maintenance procedures to suit business operations.

At the solution's core is continuous proactive support and recommendations from experts at the Wärtsilä expertise centres, who help to optimise maintenance intervals according to the vessel's actual needs and prevent unexpected downtime - with guaranteed service levels and predictable costs, the company claimed.

**Wärtsilä has just announced that it will supply the dual-fuel engines for six new 172,500 cu m LNGs being built to serve the Arctic LNG 2 project.

The order, which is valued at more than €100 mill, was placed at the end of last year by Daewoo Shipbuilding and Marine Engineering (DSME).

There is also an option for a further four ships included in the deal.

Each vessel will be fitted with six Wärtsilä 46DF dual-fuel engines, plus gas valve units and auxiliaries. Deliveries of the equipment will commence in August, 2021.



'Golar Nanook' is included in the latest maintenance agreement with Wärtsilä

Second Arc7 series construction starts

Zvezda Shipbuilding Complex recently announced that it had started the construction of a second Arc7 LNGC in the latest series. Technical Editor Ian Cochran takes a look at this innovative gas carrier series.

The shipyard is operated by a consortium consisting of Rosneftegaz, Rosneft, and Gazprombank.

PAO NOVATEK will operate the Arc7s to load gas at its Arctic LNG2 project.

Domestic investment firm VEB.RF has provided finance for their construction.

Earlier, Zvezda and VEB.RF had finalised the contracts for the building of 15 LNGCs to ship gas along the Northern Sea Route (NSR).

They will be operated under long-term timecharter contracts.

The first ship is being built as a pilot vessel for PAO Sovcomflot, while the second and subsequent 13 vessels are to be operated by SMART LNG, a joint venture company involving Sovcomflot and NOVATEK. The third contract was signed with LLC Arctic LNG 2, an affiliate of NOVATEK.

Zvezda said that for several years, the vessels were exclusively ordered from overseas shipyards and this is the first time that LNGCs are being constructed in Russia.

The latest series have a cargo tank capacity of 172,600 cu m, are 300 m in length, and have a moulded beam of 48.8 m. They will operate on LNG as a fuel.

With an installed power capacity of 45 MW, they were designed to independently break through ice of more than 2 m thick.

They will be fitted with three unique rudder propellers, which are being manufactured by VRK Sapphire, a joint venture between Rosneft and GE, in Bolshoy Kamen, where the Zvezda

shipyard is located.

These will provide the newer Arc7s with higher icebreaking capabilities and manoeuvrability, when operating in the challenging conditions across both the Western and the Eastern sectors of the Russian Arctic, compared with the Arc7s currently serving the Yamal LNG project.

The vessels will fly the Russian flag and the Russian Maritime Register of Shipping (RS) will provide technical supervision during their construction.

They will also be fitted with GTT's Mk III cargo containment system.

GTT had signed a technical assistance and license deal with Zvezda, which obtained its GTT license after a qualification process that started in September, 2017, including the construction of a Mk III containment system mock-up.

Zvezda shipyard is equipped with what is described as unique equipment for Russian shipyards, as well as advanced technology, enabling it to build specialist ships, the company claimed.

Another six Arc7s are under construction at Daewoo Shipbuilding & Marine Engineering (DSME).

Differing from the Zvezda Arc7s, each of the six newbuilding LNGCs will be fitted with three of the largest and most powerful ABB patented Azipod propulsion



An artist's impression of the second Arc7 series

units ever supplied for ships operating in ice.

Together, the giant 17 MW Azipod units will provide a total power of 51 MW (68,400 HP), enabling the vessels to navigate safely through ice up to 2.1 m thick without icebreaker assistance.

The contract to supply the package, which included 18 Azipods, generators, switchboards, transformers, electric drives and propulsion control systems, was valued at more than \$300 mill, ABB said.

Wärtsilä engines

Wärtsilä is to supply the dual-fuel engines for the six DSME Arc7s in an order valued at more than €100 mill. There is an option for a further four ships.

Each vessel will be fitted with six Wärtsilä 46DF dual-fuel engines, plus gas valve units and auxiliaries. Deliveries of the equipment will commence in August 2021.

Upon their deliveries starting in 2023, the latest six vessels will also serve Arctic LNG 2 and will each have the capacity to transport 170,000 cu m of LNG.

The original 15 'Christophe de Margerie' class built at DSME for several LNGC owners was estimated to have cost in excess of \$300 mill each.

Since their delivery they have carried out several different voyages often loading gas at Sabetta (Yamal) and discharging at European receiving terminals where the gas is stored and then transhipped to other destinations, including Asia/Pacific.

However, they were designed as

double-acting LNGCs with the NSR transits in mind to deliver gas from Yamal to Asia.

Last month, proving their worth, the 'Christophe de Margerie', successfully completed an independent passage along the eastern part of the Northern Sea Route (NSR) on the 16th January when she reached Cape Dezhnev in Russia's Far East.

Using her double-acting capability, she sailed stern first for about 66% of the transit, to overcome the ice hummocks.

This marked the first time that Russian LNG had been shipped across this route in January.

She reached the Bering Strait in 11 days with an average speed of 9.6 knots.

'Christophe de Margerie' was followed by another Arc7 'Nikolay Yevgenov', which also completed an independent passage along the NSR.

Both LNGCs were loaded with around 140,000 tonnes of LNG produced at Yamal and bound for Asia/Pacific destinations.

Simultaneously, a third Arc7 'Nikolay Zubov' sailed in the opposite direction bound for Sabetta after offloading her LNG cargo. She entered the westbound ice route along the NSR on the 6th January and subsequently reached Ob Bay on the 17th January.

According to NOVATEK, all three Arc7s transited the ice covered part of the NSR, without icebreaker assistance, along navigational routes recommended by the Russian State Research Centre, Arctic and Antarctic Research Institute and Atomflot's marine operations headquarters.



Zvezda is fitted with the latest shipbuilding technology

Standardisation to boost LNG fuelling in 2021

Standardisation is set to be a driving factor in wider adoption of LNG fuelling infrastructure in 2021, according to industrial cryogenics specialist Cryostar. LNG Fuelling editor Malcolm Ramsay reports

Following a volatile year across the transport sector last year, the company is optimistic that fuelling solutions focused on LNG will stage a strong recovery in 2021.

“The pandemic has most probably affected the delivery time of equipment such as trucks and refuelling stations, but the demand is still very high and the market is growing. 2020 has seen a lot of new stations pop-up and a lot of them have been postponed to 2021 due to the pandemic, the 2021 numbers will therefore look very good in terms of station opening,” Philippe Heisch, Cryostar Global Sales Manager LNG distribution systems, told *LNG Journal*.

Proven substitute

Comparing LNG fuelling in the maritime sector with land-based infrastructure, Cryostar notes that road transport suffered the least from lockdowns, making it “an attractive sector” to drive the continuing switch to alternative energies.

“Stronger environmental policies and incentive schemes, such as the German toll or Polish incentive, create the possibility to communicate more effectively on a range of topics such as greener transport, noise and pollution level restrictions in cities,” Heisch adds. “LNG is the only available and proven substitute to diesel for HDV’s, and people are starting to become aware of LNG as a fuel for transport and accept it.”

The rise of LNG fuelling stations in

Europe has outpaced most other regions around the world with the highest density of facilities in the Benelux region, Northern France, Italy, Germany and Scandinavia.

“Country-level policies in Europe are driven by a global EU policy to change the energy mix and find solutions to achieve the Cop 21 objectives. LNG and BIO LNG are contributing to this effort,” Philippe Fauvel, Head of Sales at Cryostar, notes.

Market acceleration

With the rising interest in LNG as a transport fuel, the competitive pressure on the next generation of fuelling technology is likely to be greater, with Cryostar predicting that developers will need to innovate faster as the energy transition accelerates.

“Technology providers need to be able to follow the market acceleration while providing constant quality. Repeatability of projects and designs must be integrated in order to win in efficiency and synergies. Homogeneity of the refuelling interface and procedure needs to be focused on in order to bring similar refuelling experience across the refuelling network,” Heisch explains.

The Natural & Bio Gas Vehicle Association (NGVA Europe) estimates that rapid growth in recent years has led to the establishment of more than 280 LNG fuelling stations and 3,840 Compressed Natural Gas (CNG) fuelling stations in Europe to date, with the number set to rise faster in the years to



Cryostar LNG dispenser

come. The association expects the network to grow to more than 10,000 CNG stations and 2,000 LNG stations by 2030.

Technological challenges

Heisch predicts that higher LNG consumption from future stations will be amongst the technological challenges ahead, along with the need to achieve saturation power. This will represent a step change from earlier prototype designs and the first generation of LNG stations, where issues with low consumption and Boil-Off Gas were primary concerns.

“There is a challenge about costing and capex investment. Versus a pure diesel refuelling system, an LNG system may cost several times the price across the full package. Our effort in standardisation and creating a stable norms environment is helping to validate the business models of our customers. An effort on this specific topic will also help to accelerate the adoption,” Fauvel adds.

Developers also expect to see growing interest in BioLNG and alternative gas mixes, such as hydrogen, in future creating technological challenges both for refuelling facilities and onboard vehicle technology.

Investment growth

The geographical profile of LNG fuelling infrastructure is also set to change as the new dynamics of the energy transition

spur investment across a wider range of countries.

“Scandinavia, Italy and Germany are definitely taking the lead in Europe, followed by Poland where the demand started to grow late 2019. Poland has a long small scale LNG history and a lot of know-how. South Africa has started to invest into LNG infrastructure too as well as some South American countries such as Chile, Peru, Argentina, and Brazil,” Heisch notes.

Headquartered in the Alsace region of France close to the Swiss border, Cryostar is a subsidiary of German multinational the Linde Group. The firm designs and manufactures a range of cryogenic solutions for LNG, industrial gases, clean energy and hydrocarbon applications.

The firm developed the containerised FuelNG-Deploy system which features a relocatable vehicle fuelling station, capable of serving up to 150 of vehicles per day and featuring storage capacity for up to 120 cubic metres of LNG. The firm also produces the permanent FuelNG-Sustain permanent vehicle fuelling station, with storage capacity up to 80 cubic metres.

“Developing new technologies is in our DNA. In 2021 we will commercialise a few new products as well as some product improvements. We cannot disclose too much at this time, but most will be driven by the driver fuelling experience, easy and lean installations, as well as digitalisation,” Heisch concludes. ■



LNG tank



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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/lino	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/lino	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/lino	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/lino	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 Nakilat 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/lino	Mitsubishi	Jun-97	Japan	Steam	Moss	5	Qatargas I
Al Wakrah	137,371	Mitsui/Nippon/Kawasaki/lino	Kawasaki	Nov-98	Japan	Steam	Moss	5	Qatargas I
Al Zubarah	137,573	Mitsui/Nippon/Kawasaki/lino	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	Capital Trading	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



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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 Lilac	173,400	Helianthus Navigation Corp.	Daewoo	Mar-18	Malta	ME-GI	GT NO 96	4	Data unavailable
BW Magna	173,000	BW FSRU III Pte Ltd.	Daewoo	Mar-19	Sinapore	DFDE	TZ MK. III Flex	4	Data unavailable
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	Data unavailable
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	Celsius Shipping	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
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 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



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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
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	0
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	Data unavailable
Flex Courageous	173,400	Flex LNG Courageous Ltd.	Daewoo	Aug-19	Marshall Is.	ME-GI	NO-96-GW+PRS	4	Data unavailable
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	Data unavailable
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
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
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 Galveston	170,520	GasLog LNG Services	Samsung	Jan-21	Bermuda	X-DF	Membrane	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



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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
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	Hla 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



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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 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 li	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	MOL	DSME	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
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



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Maran Gas Chios	170,000	Pleione Inc.	Daewoo	Mar-19	Greece	ME-GI	TZ Mk. III Flex	4	Data unavailable
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	Data unavailable
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	Data unavailable
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
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	Data unavailable
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



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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	Data unavailable
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	170,551	Sovcomflot	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



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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	Data unavailable
Wilpride	155,900	Compass Shipping 85 Corp. Ltd.	Daewoo	Nov-13	Norway	DFDE	GT NO 96	4	N/A
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



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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	Data unavailable
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 Fraseri	Jan-10	10,000	Innovation Shipping Co.	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Portfolio
Coral Furcata	Nov-11	10,000	Conception Shipping Company	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Portfolio
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
Seoul Gas	Jul-98	4,365	Chemgas Schiffahrts GmbH & Co. mt Oste KG	Severnav Shipbuilding	Liberia	Diesel	Cylinders	2	S. Korea-China
Coral Favia	Jul-10	10,000	Somargas II Pvt. Ltd.	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Baltic portfolio
Coral Fungia	Jan-11	10,000	Somargas II Pvt. Ltd.	Wuzhou Shipbuilding	Singapore	Diesel	Cylinders	2	Baltic portfolio
Unikum Spirit	Jun-11	12,000	DHJS Hull No.2007-001 LLC	AVIC Dingheng	Singapore	Diesel	Cylinders	2	Kuantan
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
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
Vision Spirit	Sep-11	12,000	I.M. Skaugen Marine Services	AVIC Dingheng	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

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](mailto:John.McKay@lngjournal.com)

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

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage	
				Tanks	Capacity
Japan (continued)	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
	Ishikari LNG	Hokkaido Gas, Hokkaido Electric	2012	2	380,000
	Okinawa	Okinawa Electric Power	2012	2	280,000
	Naoetsu	Inpex	2013	2	360,000
	Joetsu	JERA Co. Inc.	2011	3	540,000
	Hachinohe LNG	Nippon Oil	2015	2	280,000
	Hitachi LNG	Tokyo Gas	2015	1	230,000
Korea	Soma Fukushima	Japan Petroleum Exploration	2017	1	225,000
	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
Malaysia	Jeju	Kogas	2019	2	90,000
	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	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, Pertamina	2012
	Benoa LNG	PT Pertagas Niaga	2016
	Amurang	Karadeniz	2020
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 Mediterranea	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	Etik 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 1994	2 1	3.2 2.5	3	240,000
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mitsubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
	Darwin	Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
	Gladstone LNG	Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
	Gorgon LNG	Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
	Pluto LNG	Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
	QCLNG	Shell, CNOOC	2014	2	8.0	2	280,000
	Wheatstone LNG	Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
	Ichthys LNG	Inpex Corp., Total	2018	2	8.9	2	330,000
	Prelude FLNG	Shell, Inpex, Kogas CPC	2019	1	3.5		
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
CAMEROON	Hilli Episeyo FLNG	Kribi Perenco	2018	1	1.2	1	125,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Total, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya	Equinor, Total, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG	2000	2	7.1	2	240,000
		Mitsubishi, Mitsui, Partex and Itochu					
		Oman Govt., Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
PAPUA NEW GUINEA	PNG LNG	ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-T1	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5	4	640,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	5	22.5	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
	Cheniere Corpus Christi	Texas Cheniere	2018	2	9.0	3	480,000
	Cameron Hackberry	Sempra, Total, Mitsui, Mitsubishi	2019	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

A young boy with dark hair, wearing a blue and white plaid shirt, is shown in profile, looking down at a tablet computer. The scene is dimly lit, with the light from the tablet illuminating his face and shirt. The background is dark, creating a focused and contemplative atmosphere.

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