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Sempra determined to take FID on Costa Azul LNG this year

Though all major liquefaction projects have been deferred to 2021 and beyond, Sempra Energy is pressing ahead with its Costa Azul project at Mexico's Pacific Coast. The US developer said it is "optimistic" to receive a government export authorisation and take FID "this year". Rival developers have delayed projects due to the pandemic and implemented radical cost-cutting measures of nearly \$55 billion combined. – Markets Editor Anja Karl investigates.

Sempra Energy CEO Jeffrey Martin told investors he is having "an active dialogue with the Mexican government to obtain the long-term export permit." The novelty of the permit may cause the delay, he said, as Sempra is seeking the first permit that would authorise hydrocarbon exports from Mexico from a private entity.

Costa Azul, developed by Sempra LNG and its Mexican subsidiary IEnova, has firm 20-year offtake contracts in place with Mitsui and Total for the purchase of 2.5 million tons per annum (mtpa) from Phase-1. It also has a \$1.5 billion EPC contract with Technip that insulates the venture from cost overruns during the construction phase. The brownfield project entails the conversion of an existing regasification terminal in Baja California into a liquefaction terminal, set to re-export US-produced gas delivered to the site by pipeline.

Though Sempra pushed back its Port Arthur LNG project in Texas to 2021, CEO J. Martin is determined to advance the Mexican project in the hope of gaining a competitive edge over its biggest US rival. Cheniere Energy pushed back the in-service date of Sabine Pass Train 6 to 2022, having already reached FID in June. Train 6 will take Sabine Pass' current capacity of 22.5 mtpa to an overall 27 mtpa, but not all may come to market before mid-2023.

Mexico mulls rival LNG project

Critics caution the holdup on Costa Azul LNG is actually being caused by Mexican plans to obtain a sizeable stake in future LNG exports. The hydrocarbon industry in Mexico has hitherto been mainly state-run, so the President Andrés Manuel Obrador might want a state entity to handle LNG exports, rather than a US private company.



Source: Sempra Energy International

Sempra's permit request was apparently brought to the President's attention in July, but he could be delaying the approval to allow Mexican companies establish rival LNG export ventures such as the planned 12 mtpa Puerto Libertad project in the north-western state of Sonora. Mexico Pacific Ltd awarded a FEED contract to Technip for the project that would liquefy imported gas from Arizona for re-export to global markets.

Once Sempra gets that Mexican export permit, however, development of Costa Azul LNG and first exports should ensue swiftly since much of essential infrastructure already exists. The US-Mexico gas interconnector is in place, as is a permit for gas flows, and the jetty and tanks.

No room for new US projects until 2025

Apart from Costa Azul, no other substantial LNG export project nears financial close this year.

In the United States, there seems to be no room for new projects until 2025 after a record amount of over 21 mtpa of new capacity was sanctioned and built in 2019. More than 16 mtpa was meant to be added this year but the coronavirus crisis pushed down global energy demand and

left many existing US LNG export plants underutilized.

Well-advanced US liquefaction projects that were close to being sanctioned this summer, have now been deferred:

- Tellurian has quietly pushed back financial close on the **Driftwood LNG** project in Louisiana to next year, with the 27.6 mtpa plant now slated to start up in 2024 and not in 2023 as initially planned. Full operation of the liquefaction plant is unlikely to be reached before 2026.
- Cheniere's **Corpus Christi Stage** will most likely be delayed due to a lack of stable offtake and record low LNG prices in Asia Pacific which render netback prices unattractive. The proposed 9.5 mtpa Stage 3 expansion will unlikely go ahead. So far, only two small offtake deals are tied to the expansion project which is insufficient to meet Cheniere's investment criteria.
- Sempra has postponed FID to 2021 on its **Port Arthur LNG expansion** with additional Trains 3 and 4, each with a capacity of 6.73 mtpa. Though a fixed-price EPC contract is in place with Bechtel, developers in May decided to defer the project citing demand uncertainty.

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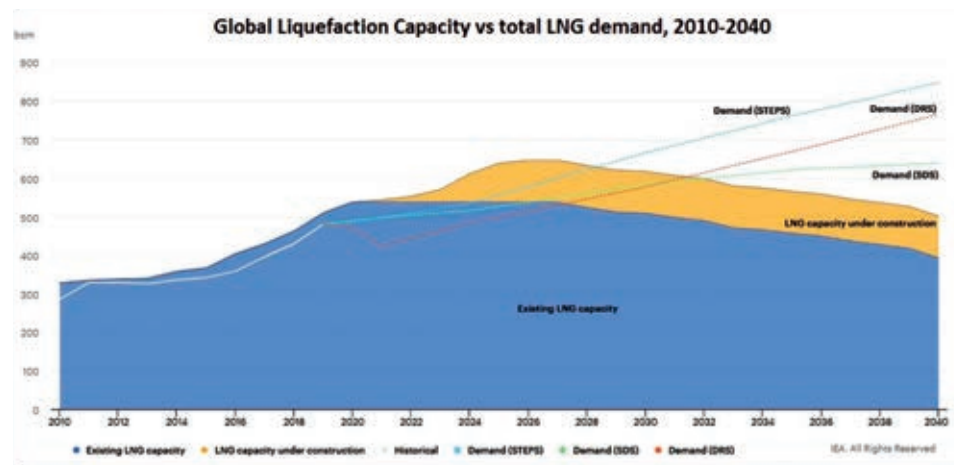
- Financial close for the 13 mtpa **Delfin LNG** project is currently envisaged for 2021, according to Delfin Midstream CEO Dudley Poston. Working with Samsung Heavy Industries and Black & Veatch, he claims the project can be built at a capital cost of around \$550 per tonne per annum, but Delfin is still short of securing 2.5 mtpa of LNG firm offtake contracts.
- NextDecade Corp., the owner of the **Rio Grande LNG** export project in Texas, hopes to solve challenges in their commercial efforts to underpin the 27 mtpa project. Financing is in place based on price expectations of where offtake contracts will be firmed up, VP James McTaggart said, so it comes down to striking such long-term deals to reach FID in 2021.
- Plaquemines' **Parish LNG** is in limbo, and Venture Global refrains to comment on whether it still aims to take FID on the 20 mtpa project this year. The odds seem to be against the venture, at least for now.
- Annova's approach on the 6.95 mtpa **Brownsville LNG** project in Texas is more transparent, as the company stated on its website it intends to start construction in 2021.

Morgan Stanley's commodity strategist Devin McDermott sees "no major FIDs on LNG export projects in the near future," as developers struggle with lower oil and gas prices and demand destruction. Global LNG demand is forecast to rise from

"If you are a big major you are concerned about the commodity price, not its volume. You have to not invest money in 2020 to protect your balance sheet"

- Oswald Clint, senior analyst at Bernstein

363 million tonnes in 2019 to 365 million tonnes in 2020 and 369 million tonnes in 2021, according to Poten & Partners' *LNG Market Outlook*. But the shipbrokers reckon "it is not until 2022



that some strength may emerge in global gas markets."

Oil majors wait for higher prices

Major oil players with large LNG portfolios are in no rush to invest in a depressed market. They have the comfort to wait out the crisis – be it for another 12 to 18 months. "If you are a big major you are concerned about the commodity price, not its volume. You have to not invest money in 2020 to protect your balance sheet," Bernstein analyst Oswald Clint commented. Scaling back supply is hoped to push up prices by 2025.

Shell reacted swiftly in late March by exiting the **Lake Charles LNG** project in Louisiana, citing the plunge in oil prices. The decision was made to "preserve cash and reinforce the resilience of our business," said Maarten Wetselaar, director for Integrated Gas and New Energies at Shell. Energy Transfer is now solely trying to advance the 16.45 mtpa project and is in search for new partners.

Production of **Prelude FLNG**, the world's largest floating liquefaction terminal has been shuttered since April and Shell said it will keep the plant offline "indefinitely" as long as demand uncertainties persist. Development of the Crux gas field project, designate to backfill gas to Prelude FLNG has also been shelved.

ExxonMobil indicated it will cut Capex and not move ahead with the \$30 billion **Rovuma LNG** project. The oil major has withdrawn an application for \$2 billion of funding from EXIM Bank for the 15.2 mtpa Rovuma LNG, blaming concerns of the US export agency about CNPC's participation in the project. Analysts expect the \$30 billion project to reach FID before July 2021, provided fresh financing can be secured.

Australian developers have pushed back all major ventures: Woodside's **Scarborough LNG** and Santos' **Barossa LNG**, worth a combined \$22 billion, were initially meant to reach FID this year. But Australia's biggest LNG exporter is postponing FID on its North West Shelf project – Scarborough, the linked Pluto Train 2 and Browse development projects. Woodside said it seeks to slash Capex by A\$3.5 billion.

In contrast, Qatar's massive 49 mtpa **North Field Expansion** is moving ahead. Qatargas keeps working to boost its existing 77 mtpa of liquefaction capacity to 110 mtpa by 2025 by adding four trains at Ras Laffan LNG. The emirate also reaffirmed the potential to expand capacity beyond its 126 mtpa target.

Regional lockdown to hit demand, again

Energy demand looks likely to be hit again as governments impose regional lockdowns to reign in a second wave of coronavirus infections. The likelihood of widespread lockdowns this winter rises by the day, in which case the loss of 6.7 million tons of LNG demand for 2020 may not be enough, Poten & Partner warns.

"Rather, we could be looking at a loss of as much as 13.8 mt in 2020, compared to last year, with a slower recovery in 2021 and 2021," analysts said. If that comes to pass, the outlook for LNG market participants from producers is bleak and the prospect for new projects taking FID remains dire. ■

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Turkey: Potentially leveraging flexible LNG

Increasing flexible LNG supply may be Turkey's key to unlock more favourable long-term pipeline gas supply terms, our Markets Editor Alexander Wilk writes.

A protracted energy market reform backlog has put Turkey under pressure as its existing long-term gas supply contracts prevent meaningful renegotiations of existing terms before their expiration. Turkey has hitherto been reluctant to advance proposed energy market reforms as the government was keen to preserve the status quo of its energy champion BOTAS. Whilst there may have been good reasons for locking in gas supply for decades ahead when prices were high, with an economy impacted by COVID-19, absent energy demand growth and a global supply glut that rationale no longer holds water. Accordingly, Turkey has announced a strict negotiating stance, eschewing 'old-style' supply contracts. In our view, existing headroom in LNG import capacity as well as lower energy demand and prices mean Turkish demands for more favourable terms from both pipeline gas and LNG suppliers are viable. We have already observed this position gaining traction within the market, with flexible US and Qatari supply set to continue on their robust growth paths.

Turkish energy demand hit

Turkey has been engrossed with market preparations for the impending renegotiations of long-term gas supply contracts. The preparations' main thrust go towards a long-awaited market liberalisation by freeing the market from long-term contracts, oil-linked prices, Take or Pay (ToP) obligations and destination clauses that have so far prevented re-exports.

Unfortunately, Turkey's energy sector has been severely impacted by COVID-19 as the country's economy slowed. Demand for power decreased by 4.5% in the first five months of the year whilst gas consumption for industrial purposes fell by 16% over the same period. In the residential sector, gas consumption decreased by 2%, according to Turkey's Energy Market Regulation Authority (EMRA). The most drastic demand declines took place in April and May, when Turkey's natural gas demand in the power sector fell by 46 percent whilst in the residential sector consumption slumped by 22.5 percent on average.

Although Turkey's overall gas demand

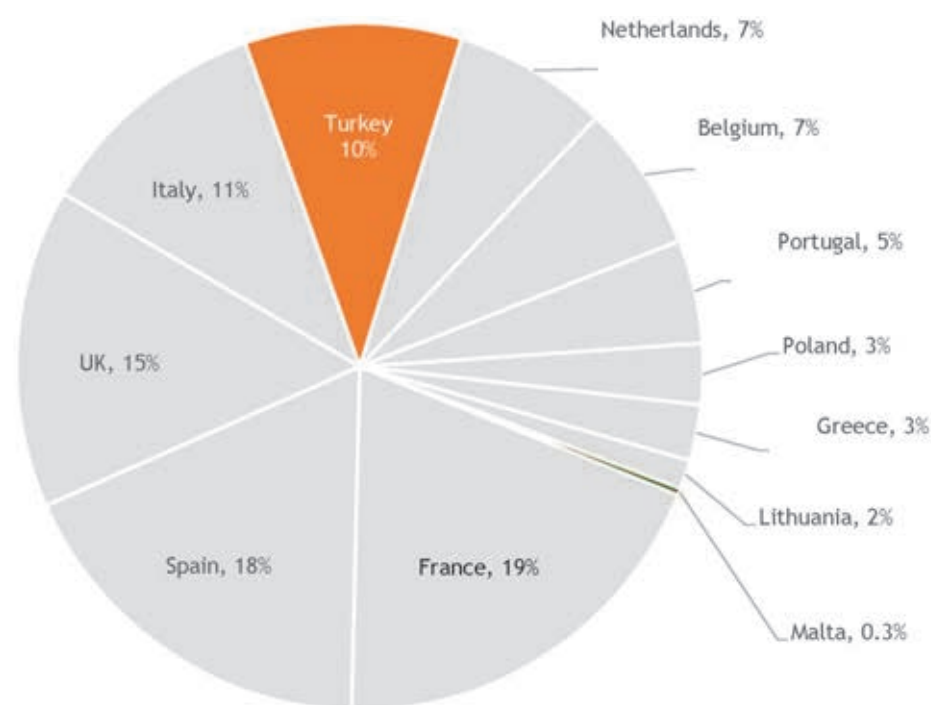
recovered in June and July, private consumption continues to lag. Notably, the virus-induced economic downturn led to the annual inflation rate accelerating from 11.4 percent to 12.6 percent in May, according to the World Bank. The institution also highlights how the pandemic has had negative impacts on Turkey's trade and financial flows. The annualised surplus of 1.1 percent of gross domestic product (GDP) – a monetary assessment of a country's market value in a specific time period and thereby a measure of its wealth – recorded in 4Q 2019 had declined to just 0.2 percent by 1Q 2020. The Bank further projected Turkey's current account to have declined to an estimated deficit of 1.6 percent in 2Q 2020.

COVID-19 as transformational accelerator

However, we think that prevailing market conditions created by the COVID-19 pandemic may well act as an accelerator to Turkey's domestic gas market transformation and potentially impact Turkish LNG demand. Notably, EMRA has been keen to implement fundamental changes to Turkey's gas economy to increase energy supply security and open it up to more competition, when it proposed its Natural Gas Market Law (NGML) in 2001. Unfortunately, progress has been rather slow since. For example, a planned split of state-controlled Turkish energy champion BOTAS into a pipeline, storage and LNG business alongside independent regulation and supervision by 2015 – an important part of NGML's quest for market liberalisation – remains to be implemented.

Arguably, Turkey's government preferred to maintain BOTAS' structural integrity to preserve existing contractual obligations that provide long-term gas supplies. The government's security of supply policy also encompassed the adoption of price-related risk by subsidising domestic gas consumption, thus relieving BOTAS of significant pressure. This may have made sense at the time when energy prices were considerably higher than today, but in the prevailing context of gas prices below US\$4.50/mmBtu in major European liquid hubs and a surplus of both LNG

European LNG Importers, 2019



Source: LNG Journal

and pipeline gas elsewhere in the world, long-term offtake obligations with restrictive clauses are beginning to become detrimental in the new normal of low prices and oversupply.

LNG as important pipeline alternative

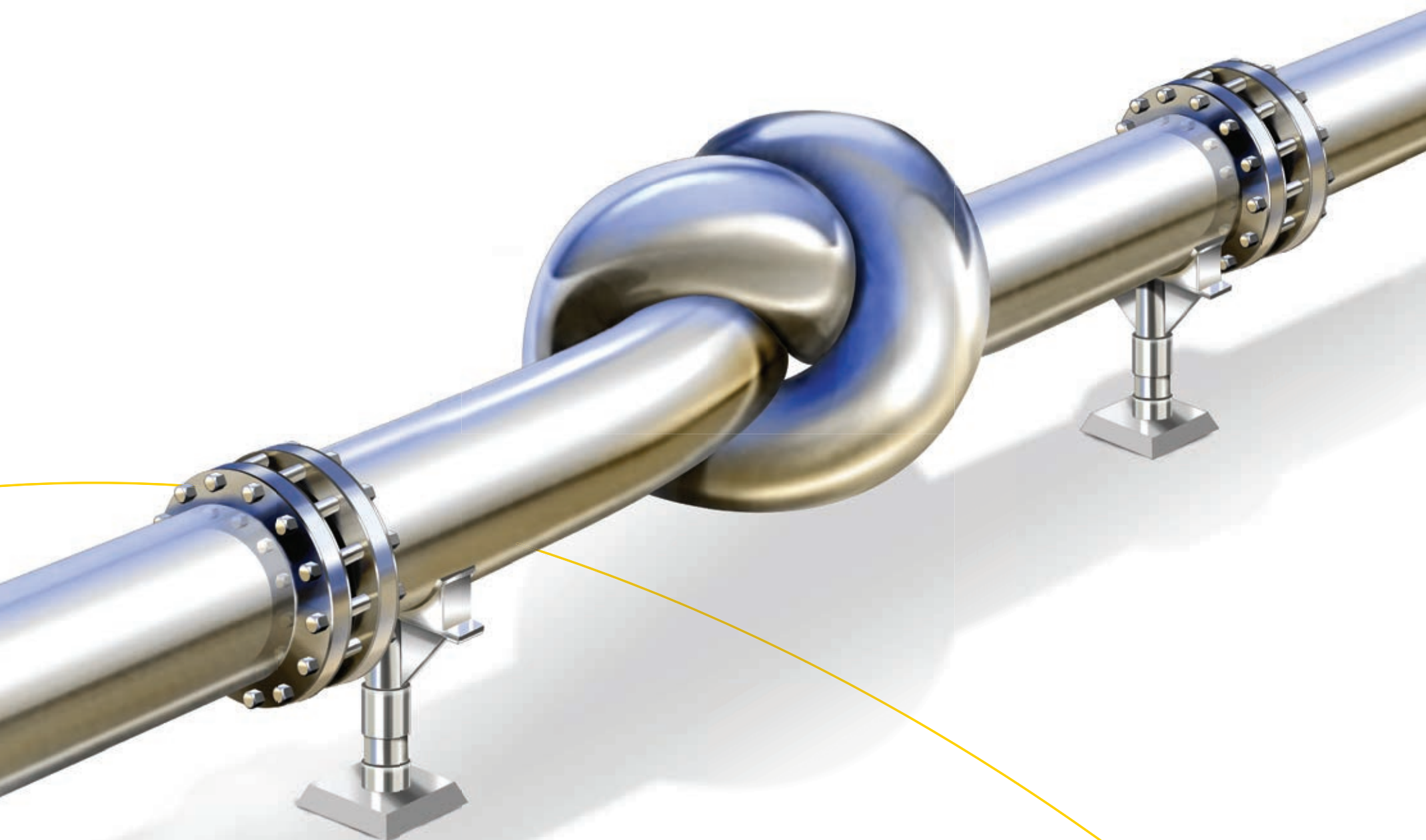
Historic low LNG prices have enabled Turkey to benefit from substituting a significant share of pipeline gas in 2019 and 1H 2020. The country has steadily increased its LNG offtake (even after accounting for vessel load levels and in-transit gas boil off), seeing landed LNG volumes rise by 10.6 percent from 7.86mmt in 2018 to 8.80mmt in 2019, our data shows. In 2020 to date, we have recorded landed LNG volumes of 9.02mmt, an increase of 24.8 percent year-on-year even when October 2019 as a whole is included (October 2020 had not yet passed at the time of writing). The resulting utilisation established Turkey as one of Europe's top five LNG importers in 2019.

Notably, this volumetric growth was achieved even as average terminal utilisation from Turkey's four operational terminals – Marmara Ereğlisi and Izmir's Aliaga LNG facility, the Pardus Energy-owned Turquoise FSRU at the port of Çakmaklı (ETKI LNG) and the MOL FSRU Challenger offshore Dörtyol in southern Turkey's Iskenderun Bay – showed combined capacity utilisation of c.

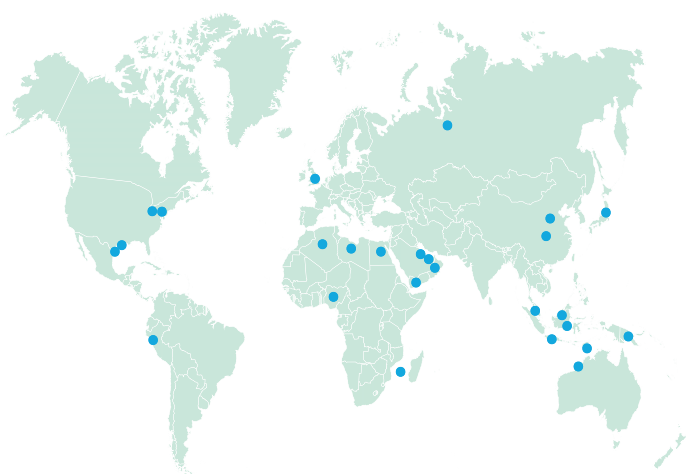
51 percent on average for the year. Importantly, Aliaga underwent two regas capacity expansion in December 2016 and again in September 2017. There is a third expansion programme scheduled to complete in 2021. However, we also highlight that the Neptune FSRU – originally earmarked to bolster Aliaga's capacity – has never taken on that role but has been employed in the Pacific Basin since August. Nevertheless, we think there remains considerable potential headroom for additional LNG imports of c. 7.0mmt (roughly 9.52bcm) if all four terminals average capacity utilisation at a sustainable 90 percent over the year. This figure would rise to roughly 8.78mmt (11.94bcm) if overall utilisation were to average 100 percent.

Looming renegotiations

Notably, 2021 will see the expiration of a number of long-term contracts with Turkey's existing suppliers amounting to roughly 15.94bcm/year. Most of these contracts were concluded in the 1980s and 1990s and subsequently locked in 'peak oil'-induced higher prices. As is typical with legacy supply contracts, we expect these agreements to also entail restrictions to cargo diversions and the review of contractual terms, which are likely to include penalties for failing to offtake supply (i.e. ToP clauses). The lion's share of contracts due to expire in 2021 comprises supply by various

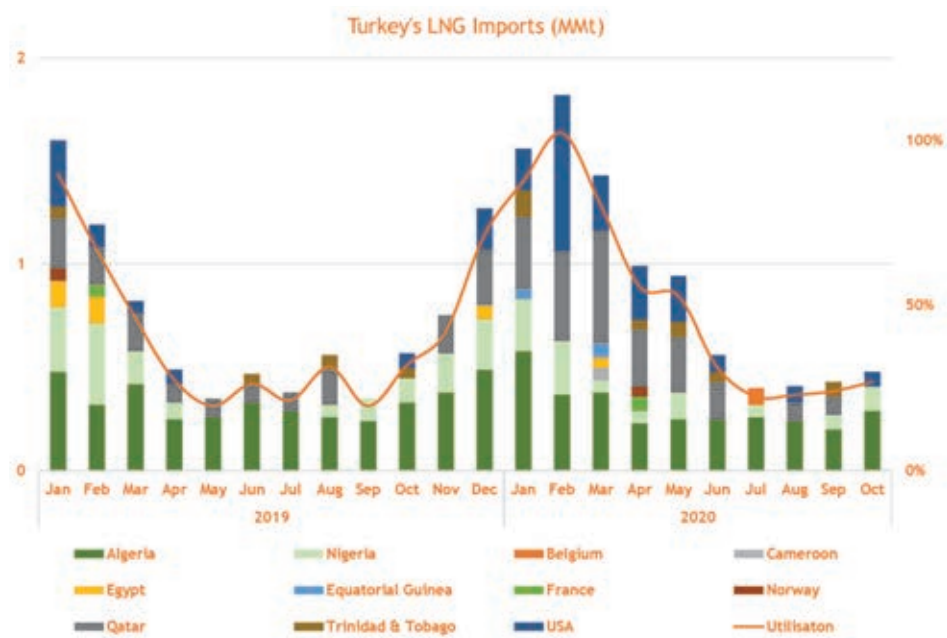


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Source: LNG Journal

Gazprom entities, amounting to c. 8.0 bcm/year, according to EMRA. In addition, a 6.60bcm contract with Azerbaijan Gas Supply Company (AGSC) – the gas marketing arm of the Shah Deniz pipeline consortium – signed in 2001 is set expire in 2021. Moreover, a long-term LNG contract with Nigeria LNG (roughly 1.34bcm/year) is also due to expire that year, our database shows.

LNG capacity headroom as leverage

We think that Turkey will be keen to use its LNG capacity headroom in the upcoming renegotiations of both long-term pipeline contracts with Russia’s Gazprom as well as long-standing LNG supplier Nigeria LNG (NLNG). As our analysis above has indicated, even if

Turkey’s terminals remain below full utilisation, the country could relatively quickly cover roughly 60 percent of the supply implicated by imminent contract expirations with flexible LNG supply. Although not realistic as a constant for the whole year, this figure would rise to 75 percent assuming 100 percent capacity utilisation.

Moreover, in a peculiar twist of circumstances, the aforementioned decrease in Turkish industrial output due to the protracted COVID-19 pandemic may well aid Turkey in its quest of squeezing better terms out of its long-term pipeline gas and LNG suppliers. With overall gas demand in retreat and no viable vaccine on the horizon, the notion that existing LNG capacity headroom could viably compensate for

considerable losses in long-term supply were Gazprom, AGSC and NLNG to refuse more flexible terms bestows Turkey with leverage. The prevailing low-price environment only adds to that leverage.

Accordingly, Turkey’s Deputy Energy Minister and former EMRA commissioner Alparslan Bayraktar sees 2021 as an important year for the restructuring of the country’s domestic natural gas market by introducing some market liberalisations and long-needed “flexibility and competitiveness”. In a webinar hosted by the Atlantic Council in May this year, Bayraktar indicated that Turkey would be unwilling to accept similar long-term contracts it has signed in the past and that all new contracts will be rather short in duration.

Negotiating stance gains traction

In this regard, we see considerable potential for flexible supply from the United States, whereby portfolio players including Shell, Cheniere, Tellurian, BP and Naturgy have steadily expanded the market share of US spot LNG in Turkey. Whereas US LNG shipped to Turkey amounted to 0.39mmt in 2018, this volume had increased by 67 percent to 0.65mmt in 2019 and more than doubled to 1.98mmt in 2020.

Qatar has also been supplying a string of spot cargoes since September 2017, amounting to 5.94mmt at the time writing. Importantly, BOTAS and Qatargas signed a 1.5mmt medium-term supply contract

for three years in September with a seemingly flexible destination clause whereby deliveries are made either at Aliaga, the adjacent ETKI facility or at Marmara Ereğlisi. The gas will be delivered from Qatargas II capacity.

But market liberalisation remains important

As a result, we expect suppliers of imminently expiring long-term contracts to be forced to show greater flexibility to retain market share. However, we caution that the aforementioned lacklustre progress on the 2001 NGML may still impede Turkey’s negotiators in making full use of their new potential for negotiating power. At this time, the quasi monopoly still held by BOTAS and propped up by long-term agreements and government subsidies makes it difficult to reflect supply–demand fundamentals, but which is vital in achieving an open market price. The lack of open price discovery has previously been advanced as an argument by Gazprom in particular when it came to similar price renegotiations elsewhere.

Consequently, we see considerable potential for Turkey to continue to grow its LNG offtakes – it certainly has the capacity to do so and the prevailing low-price environment would help. Since full market liberalisation as envisioned by NGML is unlikely to conclude before much of current long-term supply is due for renegotiation, we also see increased flexible LNG supply as an important stepping stone towards that goal.

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Brace for LNG buying spree as 33% of supply

Hard-nosed buyers are bargaining for cheap term LNG supplies as about one-third of active contracts are due to expire between 2020 and 2025. Contracting activity collapsed this year with only 35 bcm signed to date, which gives buyers plenty of bargaining power to negotiate flexible pricing and delivery terms, our Markets Editor Anja Karl finds.

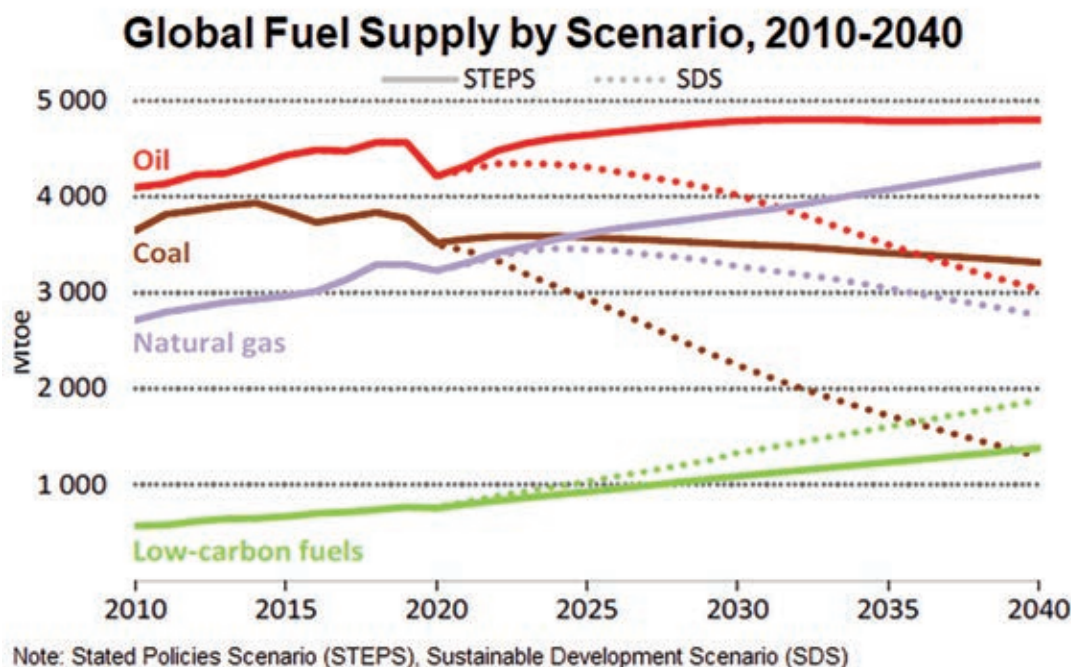
The pandemic has made global energy demand fall off a cliff. Gas demand is expected to fall by 3 percent or 120 bcm – its largest drop on record. LNG plays a central role in balancing markets, though monthly global exports decreased by 17 percent between January and July, according to latest figures by the International Energy Agency (IEA).

Lockdowns, the disruption of industrial supply chains and a plunge in energy demand, has made LNG contracting activity collapse from its high of 95 bcm in 2018 to about 35 bcm in the first nine months of this year, the global energy watchdog said in its flagship World Energy Outlook 2020.

The United States has borne the brunt in downward supply adjustments which underscores the outsized role of US LNG in market balancing at a time of a historic oversupply. Without the flexibility in US supply, the 2020 demand would have been “less orderly,” the IEA noted and

“could potentially have had a damaging effect on the commercial and contractual structures underpinning global gas trade.”

Investors slashed infrastructure spending by 18 percent in reaction to a 5 percent drop in global energy demand. The setbacks of the pandemic might trigger a more sustainable energy system, with the crisis acting as a “catalyst for change.” The estimated falls of 8 percent in oil demand and 7% in coal use stand in sharp contrast to a slight rise in the contribution of renewables, IEA analysts pointed out. Natural gas demand fell around 3 percent, while global electricity demand looks set to be down by



Source: International Energy Agency; World Energy Outlook 2020

a relatively modest 2 percent for the year.

Prior to the pandemic, energy demand was projected to grow by 12 percent between 2019 and 2030.

Now, the IEA anticipates a more modest 9% growth, if the economy returns to pre-crisis level in 2021 – or a rather sluggish 4 percent growth, if global markets return to pre-crisis size only in 2023.

Reshape in supply structure

Looking beyond the Covid-19 induced demand shock, IEA analysts say the structure of LNG supply is set to be reshaped. One-third of active contracts are due to expire between 2020 and 2025, accounting for 190 bcm of legacy supply, while export capacity is set to expand by 20% from projects currently under development.

Flexible-destination clauses and adaptable pricing is what buyers want, notably utility buyers who are looking to use LNG as a fuel for power generation in competition with thermal coal.

Fuel markets have been knocked down, as the lockdowns caused significant excess supply capacity. The risk of a second lockdown this winter may exacerbate the supply overhang. Investors have already slashed infrastructure spending by 18 percent in reaction to a 5 percent drop in global energy demand. Oil and coal use fell sharply, natural gas more modestly.

In oil markets, a recovery as in the

Stated Policies Scenario (STEPS) would require a price rise to \$75/barrel by 2030. However, the US tight oil sector is no longer the engine of supply growth, fuelled by easy credit that has now dried up. Conventional producers are burdened by the collapse in prices and revenues.

Projections for natural gas in the STEPS see a 2 percent downward revision in 2030 demand, compared with the 2019 projections, similar to oil but much smaller than the 9 percent demand drop for thermal coal. Shale gas production in the United States is expected to bounce back relatively quickly, but Qatar and Russia could also drive growth, given their vast reserves of low cost supplies.

Rebound and beyond

In 2021, gas demand is expected to rise 3 percent or 130 bcm year-on-year, though the resurgence of Covid-19 cases and the prospect of a prolonged pandemic make a swift demand recovery increasingly unlikely. Asia, Africa and the Middle East are set to drive demand growth, while more mature markets may not reach their 2019 level before 2022 or beyond.

The impact of pandemic will, however, have repercussions on the medium-term growth potential, resulting in 75 bcm of lost growth in the years through to 2025. After a 4 percent demand drop this year, growth is likely to return to 1.5 percent per year from 2021.



September LNG trade continues to improve on Asian and some European demand

September LNG trade continued on the marginal improvement trajectory of August on the back of higher Middle Eastern and Atlantic exports to cover additional demand in Asia and in some European countries, our Markets Editor Alexander Wilk reports.

Global LNG trade continued to inch upwards in September, expanding marginally by 0.21mmt (1 percent). Although this represents significantly faster growth than the 0.05mmt (0.2 percent) seen in July, it was also considerably slower than the 0.52mmt (2 percent) growth in August. This growth was predominantly due to South Korea increasing offtakes robustly, surpassing major reductions in China and India. In Europe, Italy and France also saw significant demand growth. In contrast to August, Middle Eastern exports were instrumental in facilitating global LNG trade growth as Qatar made a turnabout and boosted exports to the Far East in particular. As such, overall trade performance in September 2020 still represented a decrease of 0.72mmt (-2 percent) compared to September 2019. However, the negative gap on year-on-year trade has continued to shrink since the difference was 9.5 percent last month.

Exports

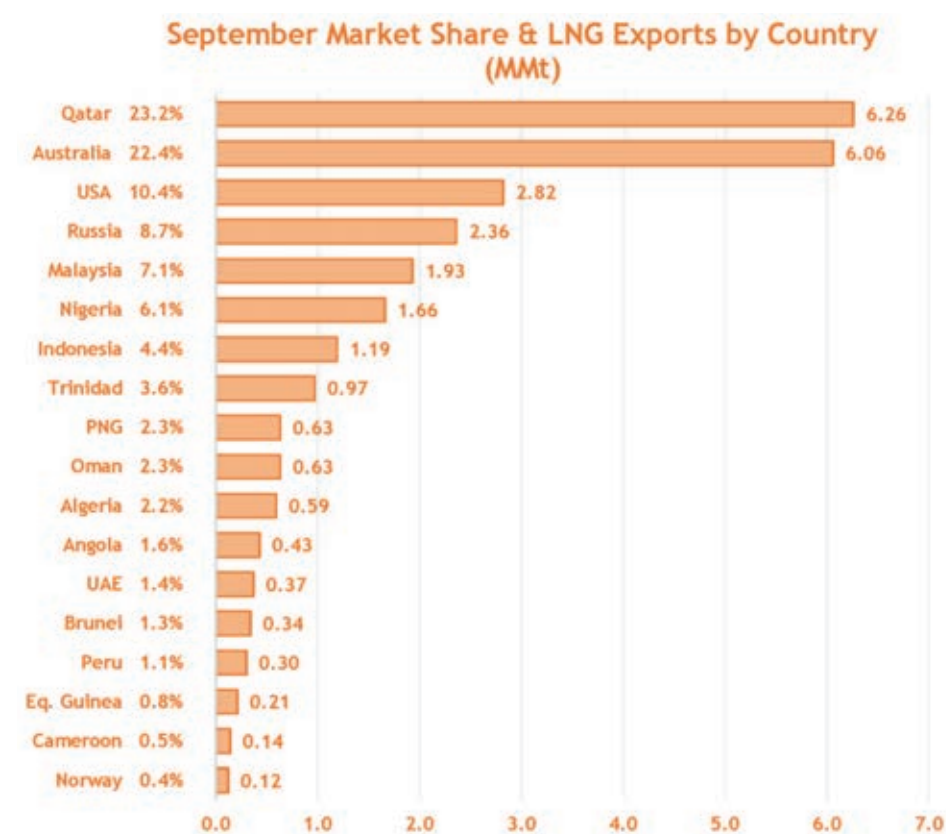
September's slight month-on-month export performance increase of 0.21mmt (1 percent) was primarily supported by the Middle East, where shipments were up by 0.16mmt (2 percent) over August to

reach 7.26mmt. The Atlantic Basin's performance came in as close second, improving by 0.15mmt (2 percent) month-on-month. The Pacific Basin, however, saw exports decrease marginally by 0.08mmt (-0.7 percent) in September.

Pacific Basin

The Pacific Basin ended the month of September 0.08mmt (-0.7percent) down in exports compared to August, which decreased capacity utilisation by 0.74pp to 84.6 percent.

The Basin's biggest exporter – Australia – shipped 0.16mmt (-2.6 percent) less month-on-month, and thereby reimbarbed on a trajectory of month-on-month export decreases as seen earlier in June and July. At the time, shipments had dropped due to maintenance and lower South Korean demand whereas in September a significant reduction in Chinese demand had an impact. Feedgas issues at NWS LNG also seem to have been the case. Accordingly, Australia's performance was driven by significantly lower production levels at NWS LNG, which dropped by almost 22 percent to 1.21mmt (-0.34mmt). Gorgon LNG also decreased its monthly exports by 0.07mmt (-7.3 percent) to



Source: LNG Journal

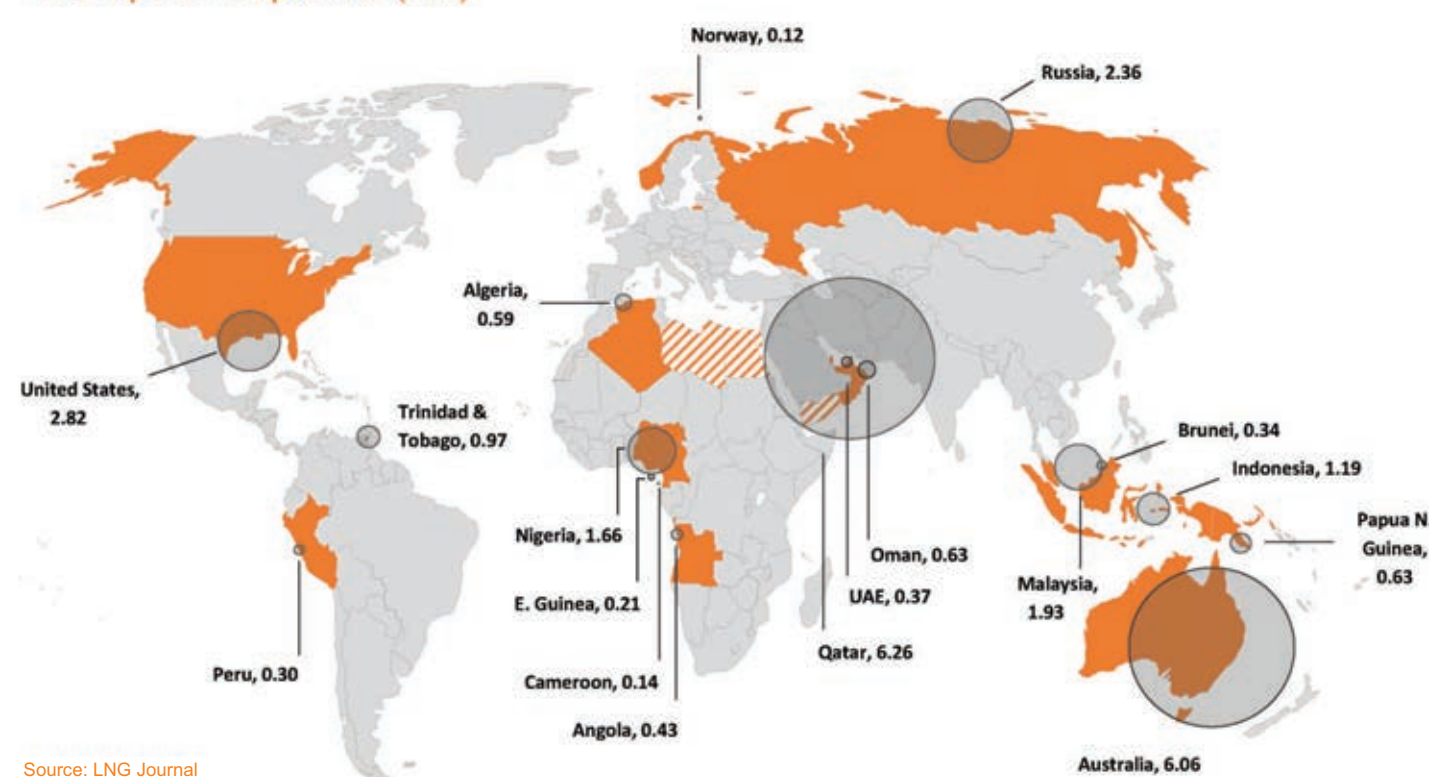
0.89mmt whilst Wheatstone LNG cut exports by 0.08mmt (-10 percent). As a result, even robust export growth from other Australian plants, in part helped by Japanese demand growth, could not tip the balance. Pluto LNG made up for some of its losses in August by increasing shipments by 0.06mmt (16.7 percent).

Ichthys LNG increased shipments by 0.15mmt (23 percent) whilst neighbouring Darwin LNG slashed exports by 0.12mmt (-35.3 percent). In eastern Australia, Gladstone LNG raised exports by 0.15mmt (36.6 percent) whilst Queensland Curtis LNG and Australia Pacific LNG raised shipments by 0.04mmt (7 percent) and 0.05mmt (8.6 percent), respectively.

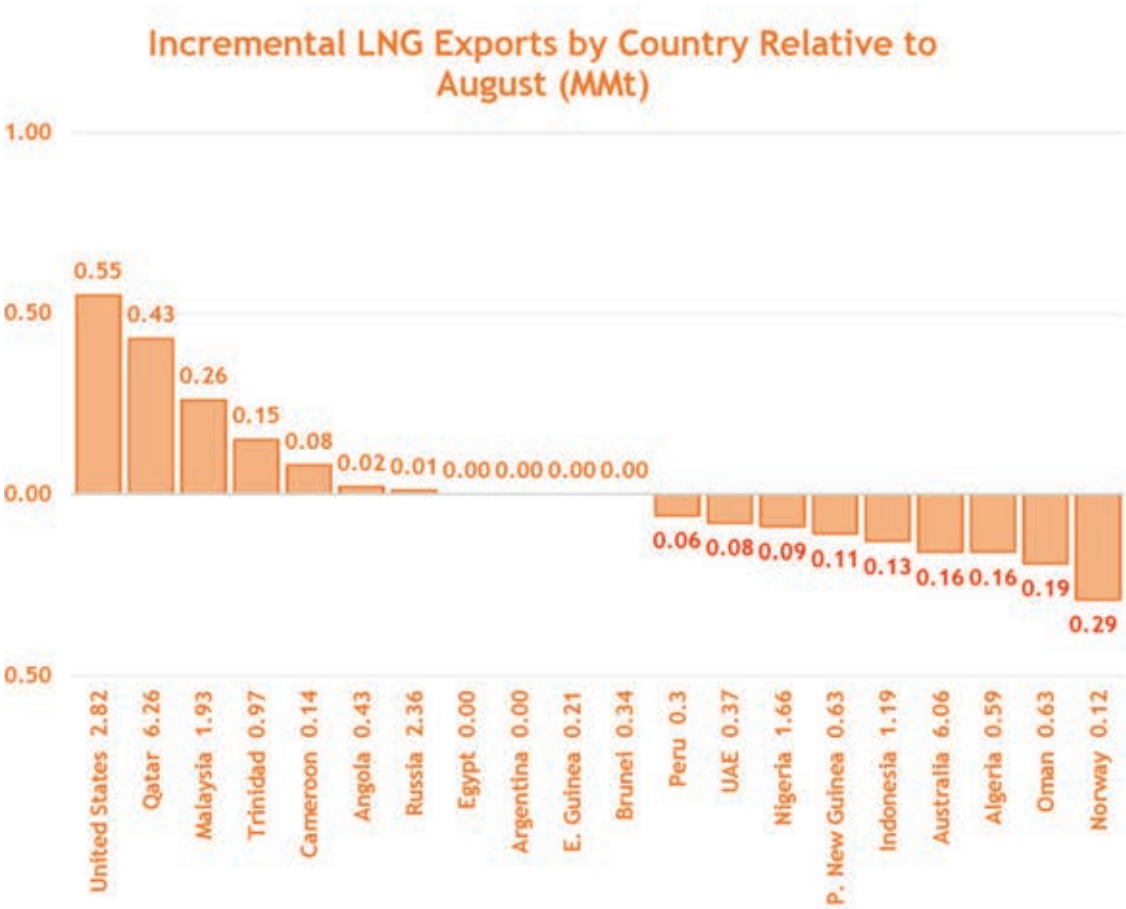
North of Australia, Papua New Guinea's PNG LNG saw shipments decrease by 0.11mmt (-14.9 percent) to 0.63mmt on one less cargo shipped as well as lower load levels, according to our data and calculations. In our view, the plant was affected by China's demand reduction in September and managed to only partially compensate with shipments to Japan. PNG LNG typically supplies China, Japan and Taiwan.

A similar effect in terms of shipments could be observed in neighbouring Indonesia, where the number of cargoes shipped to China decreased by 36 percent whilst they doubled to Japan. Still, at 1.19mmt Indonesia shipped 0.13mmt (-22.8 percent) less in September than in August. Although the country's domestic shipments also grew by 26 percent to 0.19mmt, they could only cushion the month-on-month export reduction from

LNG Exports in September (MMt)



Source: LNG Journal



Source: LNG Journal

Indonesia's three plants.

However, Malaysia saw a substantial month-on-month export increase of 0.26mmt (15.6 percent) in September as it managed to capitalise on a demand increase in South Korea. Malaysian shipments to the peninsula grew by 0.25mmt (45 percent) in September whilst shipments to China and Japan remained broadly flat. In similar vein, Brunei LNG kept September shipments steady at 0.34mmt as it held on to market share in Japan and Malaysia.

Elsewhere in the Pacific, Russia's Sakhalin-2 LNG continued to grow exports, increasing shipments by 0.12mmt (14.8 percent) to 0.93mmt in September compared to 0.81mmt in August. That growth mainly derived from an increase in exports to Japan by 0.18mmt, which, however, was tempered by lower demand for Russian LNG in South Korea and Taiwan. Concurrently, Peru's Pampa Melchorita plant decreased exports by 0.06mmt (-16.7 percent) to 0.30mmt due to lower Chinese demand.

Atlantic Basin

The Atlantic Basin's overall shipped LNG increased slightly by 0.15mmt (2 percent) month-on-month in September, leading to growth in export capacity utilisation of 1pp to 65 percent.

The amount of LNG exported within the eastern part of the Atlantic Basin – comprising Europe, Russia and Africa – saw a considerable overall net decrease of

0.55mmt (-10.7 percent) month-on-month in September, driven by maintenance at Snøhvit LNG that caused the plant to ship 0.29mmt (-71 percent) less month-on-month. Negative growth for the sub-region was also facilitated by a 0.16mmt (-21 percent) export reduction from Algeria as well as decreases of 0.09mmt (-5 percent) and 0.11mmt (-7 percent) from Nigeria and Russia, respectively. As was the case elsewhere, Yamal LNG also suffered from lower Chinese demand as well as fewer exports to Taiwan. Notably, the seasonal window for taking advantage of the Northeast Passage in the Arctic is closing fast. Instead, Yamal increased the number of transshipments from two to three in September. A total of 0.22mmt of Yamal LNG also went into Belgium's Zeebrugge terminal, some of which we suspect was bunkered, ready to be re-exported at a later date. However, we continued to detect relatively little scope for arbitrage as re-exports remained elusive in September.

Net African LNG exports were down by 0.05mmt (-4.7 percent) month-on-month in September, led by continued subdued supply from Algeria's Arzew plant, which curtailed shipments by 0.14mmt (-27 percent). Although the FLNG vessel Hilli Episeyo stationed offshore Kribi in Cameroon increased monthly output by 0.08mmt (133 percent) to 0.14mmt, Angola LNG increased exports only slightly by 0.02mmt

LNG, meanwhile, underwent scheduled maintenance, which reduced the plant's exports by 0.18mmt (-42 percent) to 0.25mmt in September. However, the remaining US LNG plants – led by Sabine Pass LNG – saw shipments increase. As such, Sabine Pass' loadings were up 0.48mmt (76 percent), although this barely compensated for the absence of Cameron LNG in comparison to August. Corpus Christi LNG increased shipments by 0.41mmt (98 percent). Third in line was Freeport LNG with a month-on-month increment of 0.32mmt (139 percent). In addition, Elba Island LNG maintained its exports in broad terms by shipping one cargo of 0.08mmt, up 0.01mmt (14 percent) from the 0.07mmt seen in August. Market visibility at the time of writing indicated these volumetric increases were supported by US LNG gaining traction in South Korea alongside demand growth for US LNG in some European countries (e.g. Spain) and the Middle East (mainly Pakistan). However, we highlight that roughly 0.42mmt were still en route to the Pacific without confirmed destinations but with estimated arrivals towards the end of October so that the eventual composition of demand for US LNG – but not overall volumes shipped – had yet to transpire at the time of writing.

In South America, after maintaining broadly steady exports of 0.82mmt in August, Atlantic LNG in Trinidad & Tobago also returned to export growth

(5 percent) to 0.43mmt. As Equatorial Guinea's EG LNG only maintained exports at 0.21mmt, the 0.09mmt (-5 percent) reduction at Nigeria's Bonny Island facility thereby exacerbated the export decrease in Algeria.

In the western half of the Basin, exports continued to grow as LNG volumes shipped increased by 0.70mmt (22.6 percent) from 3.09mmt in August to 3.79mmt in September. As expected last month, US LNG exports were hampered by severe weather in September, with Cameron LNG exporting no LNG in the month. Cove Point

with 0.15mmt (18 percent) more in shipments as Caribbean and European demand continued to increase. Argentina's Tango FLNG barge, however, did not load a cargo.

Middle East

In contrast to August, when Middle Eastern LNG exports decreased substantially by 0.58mmt (-8 percent) to 7.10mmt, September shipments returned to growth by increasing slightly by 0.16mmt (2 percent). The performance was underpinned by a robust increase in Qatari shipments and which was only tempered by some reductions in Oman and the UAE. As such, the Basin's utilisation of operational export capacity (i.e. excluding Yemen and Egypt) increased by 2pp to 94 percent in September.

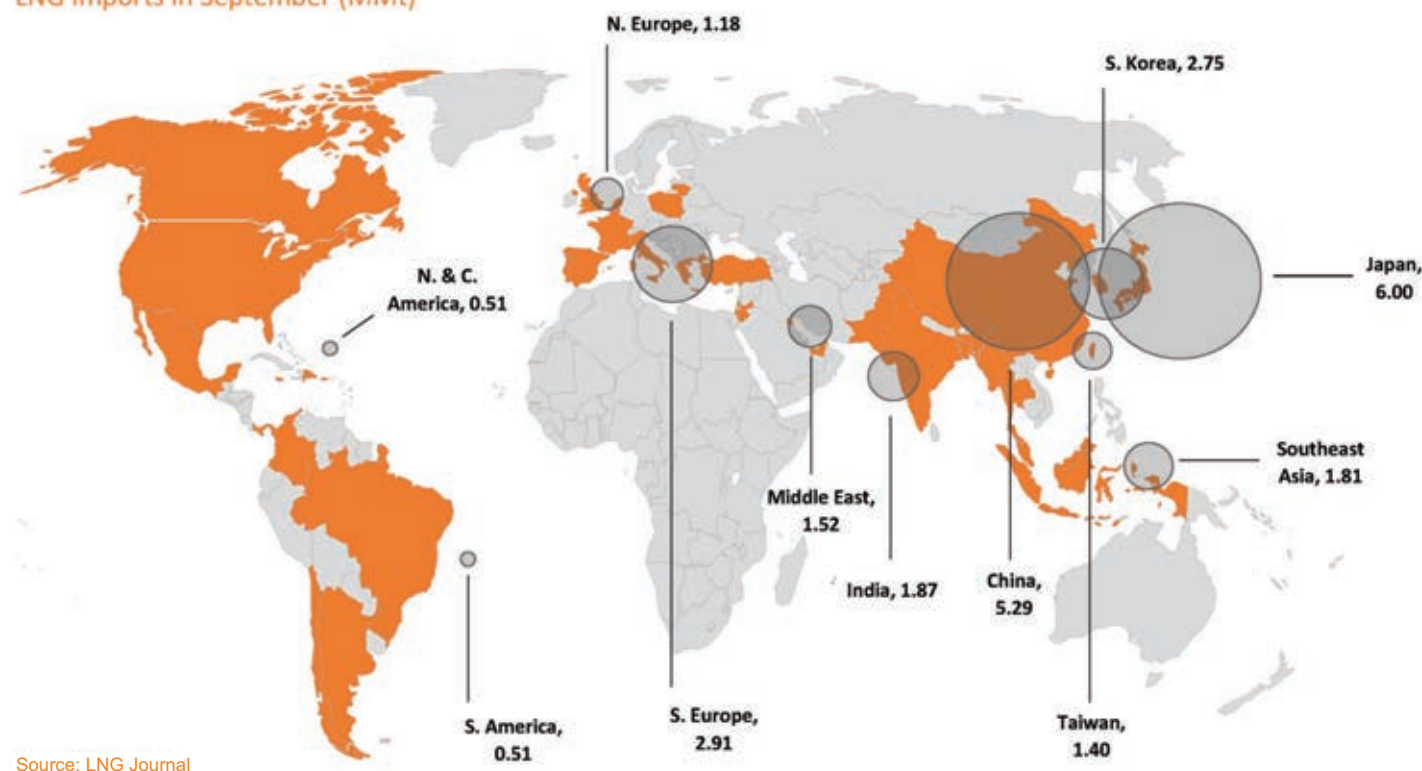
Owed to the massive size of the Ras Laffan LNG complex, Middle Eastern LNG supply was determined by changes to Qatar's exports. Not considering Idku LNG's continued market absence following a one-off shipment in July, Qatar accounted for all of the Basin's monthly export growth in September. The Persian Gulf state's shipments increased by 0.43mmt (7 percent) month-on-month. Whilst European demand for Qatari gas decreased by 0.23mmt (-12.5 percent), demand in the Middle East, on the Indian subcontinent and the Far East increased by c. 0.63mmt (16 percent). Although Qatar's market share in Taiwan, Thailand and India decreased, shipments to Bangladesh, China, South Korea and Japan in particular increased noticeably by a total of 0.72mmt (43 percent).

The other active producers on the Arabian Peninsula – Oman and the UAE – saw an overall export decrease of 0.27mmt (-21.3 percent) led by Oman. Although the country retained its 0.30mmt market share in South Korea, it lost significant traction in Japan, South Korea and India, which weighed on Omani LNG exports by 0.19mmt (-42 percent) in September. The UAE, meanwhile, struggled to compensate for a decrease of 0.13mmt in exports to the Middle East and a 0.10mmt (-31 percent) reduction in shipments to India. Abu Dhabi's Das Island plant shipped only 0.17mmt to the Far East – namely Japan and Taiwan – in addition to 0.20mmt to India.

Imports & Domestic Trade

LNG import levels in September were determined by the Pacific Basin, where

LNG Imports in September (MMt)



Source: LNG Journal

demand was up by 0.43mmt (2 percent) over August to reach 19.50mmt in September. This was contrasted by relatively minor demand growth in the Atlantic Basin and a reduction in the Middle East, where offtakes increased by 0.13mmt (2 percent) and decreased by 0.20mmt (-12 percent), respectively.

Pacific Basin

Pacific Basin imports grew in September, increasing by 0.43mmt (2 percent) to 19.50mmt from the 19.07mmt seen in August. The commensurate import capacity utilisation thereby also increased by 1pp to 52 percent. Overall Pacific demand continued to be underpinned by steady Japanese demand of 6.0mmt whilst South Korea was leading demand growth within the Basin,

boosting LNG offtakes by 0.82mmt (42.7 percent). Meanwhile, China decreased offtakes by 0.39mmt (-6.9 percent) to 5.29mmt.

As a prominent emerging LNG demand centre in the Pacific Basin, India's demand once more stood out by showing a significant month-on-month decrease of 0.33mmt (-15 percent). This negative demand profile in September was in stark contrast to the robust growth seen in May and June, although July and August already showed a distinct slowdown in offtakes. In May, demand rebounded quickly after a brief interim in April when the country was put under one of the strictest lockdowns seen at the time.

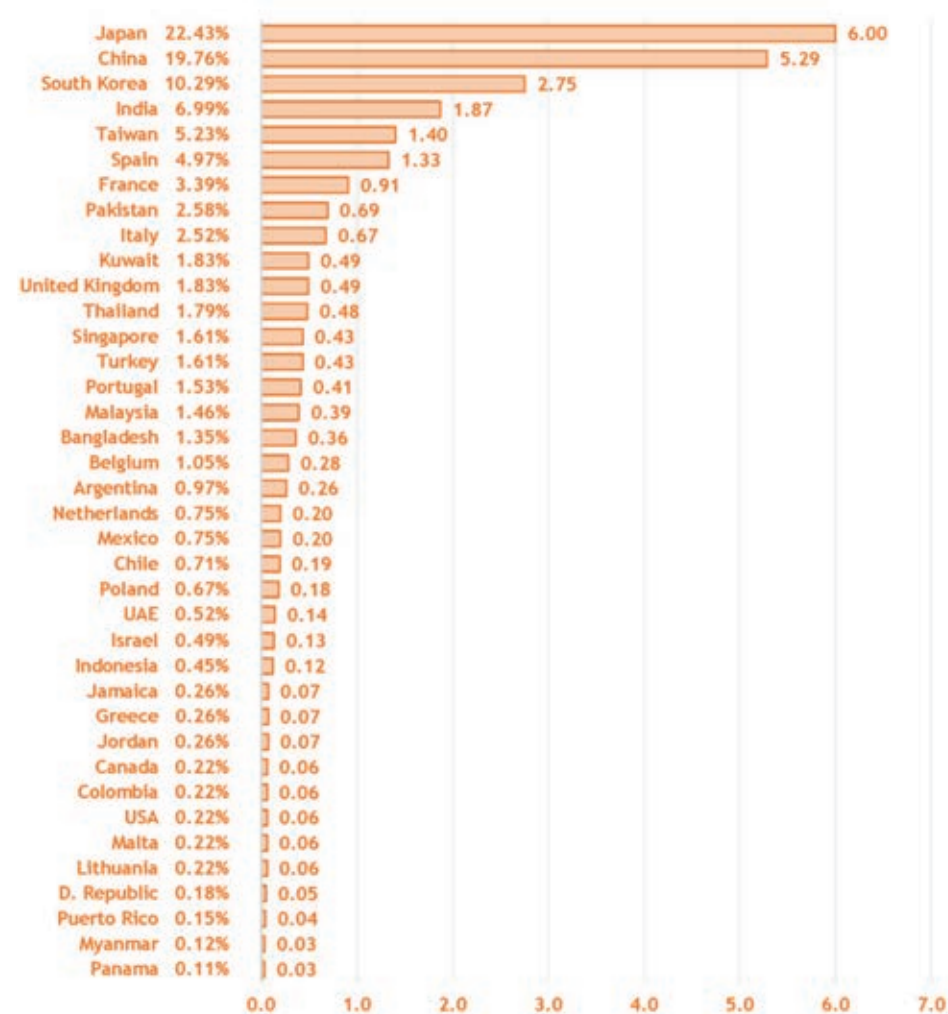
In Southeast Asia, as expected, Indonesian demand growth remained

elusive as offtakes continued to slide. However, they continued to decrease at a steady slow pace, coming in 0.01mmt (-7.5 percent) below the 0.13mmt in August. Indonesian legislators had previously extended their Large-Scale Social Restrictions measures until end-July as infection rates threatened to accelerate and the country's LNG demand

consequently more than halved that month. We highlight that Indonesia re-imposed a citywide lockdown on Jakarta – the country's major LNG demand centre – on 14 September to contain a new outbreak and which is scheduled to last until 31 October. We therefore expect relatively weak Indonesian demand in October, too. In contrast, neighbouring Malaysia saw domestic demand increase robustly by 0.14mmt (56 percent) to 0.39mmt. Malaysian LNG demand was covered by three Australian shipments via Gladstone LNG and Queensland Curtis LNG and one Malaysia LNG cargo delivered to Pengerang's petrochemical plants as well as two Brunei LNG shipments totalling 0.14mmt to the Sungai Udang FSRU.

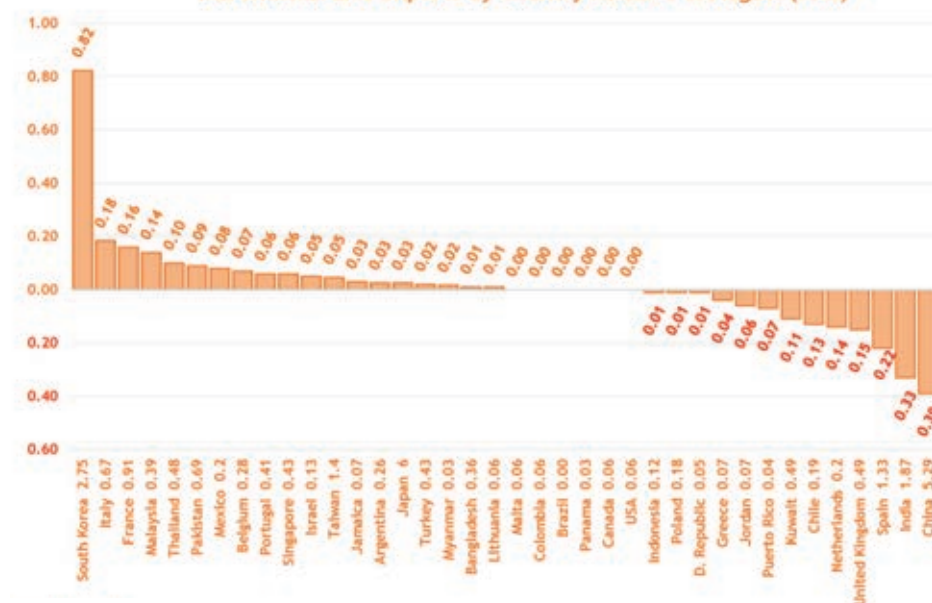
The roster of typically price-conscious Asian buyers – including Bangladesh, Thailand, Chile, Mexico, Singapore and Myanmar – collectively increased imports by 0.14mmt. This was primarily due to Thailand increasing its monthly LNG intake by 0.10mmt (26.3 percent) from 0.38mmt to 0.48mmt. Mexico, Singapore and Bangladesh also increased imports by 0.08mmt (66.7 percent), 0.06mmt (16.2 percent) and 0.01mmt (2.9 percent), respectively. The Pacific's latest demand-side addition, Myanmar, saw September imports grow by 0.02mmt (110.4 percent).

Market Share & LNG Imports by Country (MMt)



Source: LNG Journal

Incremental LNG Imports by Country Relative to August (MMt)



Source: LNG Journal

Our shipping data highlights that the Golar Kelvin took on its second cargo earmarked for Thanlyin LNG from Malaysia LNG in mid-September. Nevertheless, continuously decreasing demand in Chile tempered the roster's overall growth as the South American country cut offtakes by 0.13mmt (-40.6 percent) in Chile.

The roster's demand growth also had a marginally positive impact on FSRU utilisation in the Pacific by importing 0.01mmt more month-on-month through

these floating terminals. In combination with the aforementioned demand in Indonesia and Malaysia, Bangladesh's demand supported FSRU utilisation within the Basin, boosting it by almost 9pp to 48.6 percent. As highlighted in the Atlantic and Middle East sections below, overall FSRU utilisation across all three basins thus also increased.

Atlantic Basin

As their their Pacific equivalents, LNG imports in the Atlantic Basin reimported

on monthly growth that had seen a brief interlude in August as they increased by 0.13mmt (2 percent) to 5.72mmt in September. The increase was driven by a number of additional cargoes in the western half of the Basin, where Canada, Colombia, the United States as well as Panama imported additional 0.21mmt in September whilst having imported no LNG in August.

As to the remaining importers in the Caribbean and South America – including Argentina, Brazil, Jamaica, Puerto Rico

and the Dominican Republic – saw month-on-month LNG demand decrease slightly by 0.02mmt overall in September and thus continued the month-on-month decrease for the region that had set in the previous month, albeit at a much slower pace than the 0.30mmt reduction seen in August. Robust growth in the Jamaica and Argentina of 0.06mmt overall could not compensate for the decline seen in the Dominican Republic and Puerto Rico.

In North America, Canada imported a rare cargo and thereby added to the demand seen in the United States. US LNG imports remained steady at 0.06mmt in September following a single cargo import via the Everett Marine Terminal.

European demand, meanwhile, saw net negative demand growth in September even as Italy and France in particular increased offtakes robustly by 0.18mmt (37.5 percent) and 0.16mmt (21.4 percent), respectively. Belgium, Portugal, Turkey, Malta and Lithuania also imported 0.16mmt more overall compared to August. Accordingly, the use of FSRU capacity by volume throughout the basin increased by almost 5pp to 19 percent. However, significant demand decreases totalling 0.56mmt – led by 0.22mmt (-14.2 percent) in Spain and 0.15mmt (-23.4 percent) in the United Kingdom – outweighed the aforementioned instances of European growth.

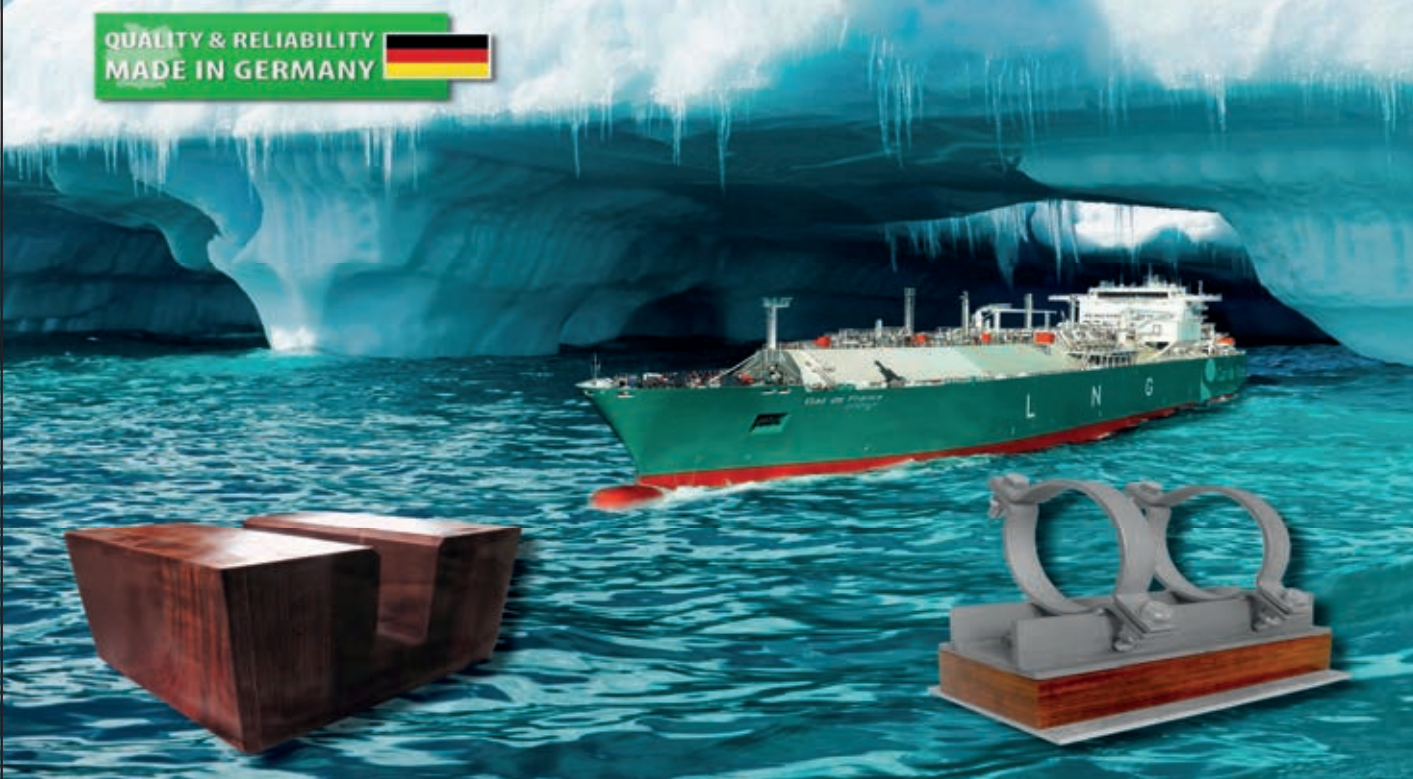
Middle East

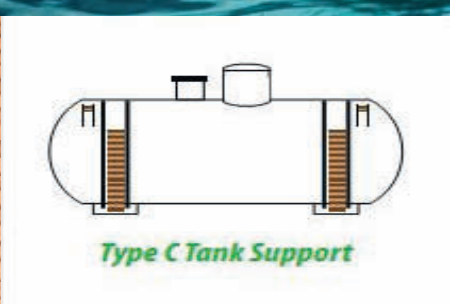
Among the three basins, the Middle East stood alone in not achieving a monthly demand growth margin in September, instead showing a net decrease of 0.20mmt (-12 percent) over August. In particular, Dubai's DUSUP slashed offtakes by 0.17mmt in September and thereby decreased offtakes to 0.14mmt. Meanwhile, Kuwait's Mina al Ahmadi terminal decreased offtakes by 0.11mmt (-18 percent) to 0.49mmt alongside a curtailment of 0.06mmt (-46 percent) to 0.07mmt seen at Jordan's Aqaba LNG. In contrast, Pakistan's Port Qasim facility raised monthly imports by 0.09mmt (15 percent) to the 0.69mmt mark in September. Similarly, Israel imported 0.05mmt (63 percent) more to reach 0.13mmt in September compared to 0.08mmt in August. This increments notwithstanding, Middle Eastern import capacity utilisation still saw a reduction of 7pp to 51 percent in September. This shift also translated into a commensurate decrease in FSRU capacity utilisation by 7pp to 51 percent. ■



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For the Record

AGL ENERGY of Australia has pledged at the annual meeting to pursue the Crib Point LNG project on Westernport Bay, south of Melbourne in the state of Victoria as one of the vital tools in the cleaner energy transition. AGL is expected to make a final investment decision on the Crib Point project around the end of 2020. “We hope to progress the Crib Point LNG import jetty in Victoria to support flexibility in the gas market and satisfy our customer demand,” Brett Redman, AGL Chief Executive, told the Virtual AGM. AGL is based in Sydney and is one of the nation’s main utilities, with 4.2 million customers receiving electricity and gas services in New South Wales, Victoria, Queensland and South Australia. It is also investing in renewables, peak-shaving and storage and has other major projects across Australia in addition to the LNG terminal venture. “Along with our ongoing role as a major contractor of gas supply, we see the Crib Point project as an opportunity for us to play our part,” added Redman. “The project is progressing well and is currently undergoing the appropriate environmental approvals,” he stated. “AGL has engaged extensively with both the community and local and state governments to ensure we understand concerns regarding the project’s impact on local marine life, as well as the broader environment,” the CEO told shareholders.

A second LNG project aimed at bringing in more natural gas to another area of the nation threatened with gas supply shortages in the southeast is being developed by Australian Industrial Energy in the state of NSW at Port Kembla, south of Sydney. That project is backed by the world’s largest LNG purchaser, JERA Co. Inc. of Japan, the Japanese trading house Marubeni Corp. and Australian mining billionaire Andrew Forrest’s Squadron Energy. The Crib Point project in Victoria has a price tag of A\$300 million (US\$208M) and involves a floating terminal moored at a newly constructed jetty for LNG carriers making deliveries. The venture also includes a 55-kilometres natural gas pipeline to the Melbourne satellite town of Pakenham to connect to the Victorian gas grid.

Redman told shareholders that backed

by its large customer base and trading expertise, AGL had a big role to play as an enabler of the energy transition. “There are many opportunities as we look to a future of meeting customer demand through flexible, low carbon energy supply,” said the CEO. “This includes the gas-fired power station at Newcastle on which we expect to reach a final investment decision in the second half of this financial year,” he explained. “I have talked before about the dawn of the battery age. Last month, we announced plans for a multi-site integrated battery system across a number of AGL sites,” he added. The Australian energy system needs batteries, gas and other dispatchable forms of energy supply to support renewables when the wind is not blowing or sun shining,” he told the AGM.

AVENIR LNG Ltd, a company owned by Norwegian shipping and infrastructure companies, has taken delivery of its first dual-purpose liquefied natural gas bunkering and supply vessel (LBV), the “Avenir Advantage”. The ship was constructed by Keppel Offshore and Marine at the Nantong Shipyard in China’s eastern Jiangsu province. “Following her maiden voyage, ‘Avenir Advantage’ will commence a three-year charter to Petronas LNG in Malaysia, becoming the first dedicated LBV in South East Asia,” said Avenir. “She will supply LNG to fuel ships operating in the region and deliver LNG directly to Petronas small-scale customers,” added the company.

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 “Avenir Advantage” is the first of two ships ordered from the Keppel Nantong shipyard. Each vessel has a cargo capacity of 7,500 cubic metres capacity with two Type-C storage tanks. 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 Sardinia project company Higas, while the local partners on the Italians

island are Gas & Heat and CPL Concordia, each holding 10 percent of the Sardinia venture. “With the delivery of the ‘Avenir Advantage’, we move one step closer to delivering our shareholders’ vision of creating a small-scale LNG supply and marketing portfolio,” said Milorad Doljanin, Chief Executive of Avenir LNG. “The flexible design of our vessels allows us to support the development of the LNG bunker fuel market whilst adding to the global small-scale supply fleet and thereby supporting our strategic objective of supplying natural gas to otherwise inaccessible areas,” explained Doljanin. Avenir LNG is currently building a fleet of six LBVs of 7,500 cubic metres capacity and 20,000 cubic metres capacity and the small Higas LNG import facility in Sardinia will have 10,800 cubic metres of capacity.

For the Sardinia LNG import project, Higas started building the facility in Oristano back in 2018 and previously expected the terminal to be completed before the start of 2020. The project operator now expects the facility to be on line by the end of 2020 or early 2021. The Sardinia terminal will be able to receive LNG from small and medium-sized carriers, to discharge the fuel into the storage tanks mainly for use in liquid form as fuel for vehicles and local industry as well as marine activities. The facility on the Italian island features six horizontal low-pressure cryogenic tanks and will have a capacity for several thousand LNG truck-loadings per annum.

AXPO, the Swiss renewable energy producer and global energy trading firm, is opening an office in Singapore to become the latest firm to join Asia’s growing liquefied natural gas trading market in the city-state where 50 LNG trading and shipping firms have offices. The Singapore government confirmed recently that it was already the most significant global hub for LNG because of the influx of more and more trading firms. Axpo said that it had hired energy industry executive Sophie Ducoloner to head the new Axpo Singapore subsidiary as its Managing Director, effective from the 1st of December 2020. This latest expansion of the company’s international energy trading business comes as demand in the world’s biggest market for LNG imports is forecast to increase strongly over the next decade. “We’re expanding our trading activities in Asia because of the significant potential in its booming LNG market,” said Domenico De Luca, Head of Trading and Sales at

Axpo. “This move will strengthen Axpo’s presence in the region and further accelerate the growth of our global LNG portfolio,” he added. De Luca said he was delighted to have Sophie Ducoloner joining the firm to lead operations in Singapore.

Ducoloner has about 20 years of experience in the Asian and international LNG markets, including stints at Japan’s JERA Global Markets, France’s EDF Trading and Russia’s Gazprom Marketing and Trading. “She brings considerable industry experience and local knowledge that will prove invaluable in developing our business in the region,” said De Luca. “Her first tasks will be to hire a team of experienced industry professionals, establish Axpo’s new branch office and develop activities that support Axpo’s wider regional strategy and ambitions,” he explained. “Axpo Singapore will focus on trading and delivering a full range of energy solutions, including procuring energy, portfolio optimisation and energy risk management,” added De Luca. With the opening of its new Singapore office, Axpo said it would have a presence in 30 countries and be active in 40 markets across Europe, the US and Asia.

BAKER HUGHES, the US liquefied natural gas equipment supplier, has secured an order from Qatar Petroleum to supply multiple main refrigerant compressors and turbines for the LNG producer’s North Field East LNG expansion. The total award is part of four LNG mega-Trains representing 33 million tonnes per annum of additional capacity, which will increase Qatar’s total LNG output from 77 MTPA to 110 MTPA. “This order is among the largest LNG deals secured by Baker Hughes in the past five years, for both MTPA and equipment awarded,” said the Houston, Texas-based company, without disclosing the actual value of the contract. “The order reinforces more than two decades of trust and successful turbomachinery collaboration between Baker Hughes, Qatar Petroleum and Qatargas,” said Baker Hughes.

Qatargas already operates six existing LNG mega-Trains driven by Frame 9E gas turbine refrigerant compressors provided by Baker Hughes. “This deal illustrates the continued strength of Baker Hughes’ partnership with Qatar Petroleum, which began 25 years ago upon our delivery of the first LNG Train in Qatar,” explained Lorenzo Simonelli, Chairman and Chief Executive of Baker Hughes. “As we look ahead to the next two decades, in almost any scenario natural gas will be a key

transition fuel, and likely a destination fuel for a lower carbon future,” said the CEO. “Building on our track record of delivering proven, reliable and highly efficient LNG technology, we remain committed to taking energy forward in Qatar for more years to come,” added Simonelli.

The company said each MRC train would consist of three Frame 9E DLN Ultra Low NOx gas turbines and six centrifugal compressors across four LNG mega-Trains for a total scope of supply of 12 gas turbines to drive 24 centrifugal compressors. Packaging, manufacturing and testing of the gas turbine-compressor trains will take place at Baker Hughes’ facilities in Florence and Massa in Italy. The North Field in the Persian Gulf is the world’s single largest non-associated natural gas field. The NFE project of Qatar Petroleum will have Qatargas as the operator and will keep the Qataris at the forefront of LNG production along with Australia and the US. First gas from the Qatari expansion project is expected to be produced by the end of 2025. A second phase planned for the North Field, called the North Field South project, will further increase Qatar’s LNG production capacity from 110 MTPA to 126 MTPA.

CARNIVAL CRUISE Corp. of the US said the LNG-powered liner “Mardi Gras” took part in sea trials from the Finnish Meyer Turku shipyard ahead of moving to its base in Florida to begin operations in February 2021 as the cruise industry continues to boost future demand for LNG maritime fuel. As well as the “Mardi Gras” being the largest Carnival ship it will also be the first based in North America to be powered by LNG. The 180,000-tons vessel is more than six times the size of its namesake, the “Mardi Gras” which sailed for the line from 1972 to 1993.

The giant cruise ship was floated out at the Meyer Turku shipyard in January 2020 and was originally scheduled for delivery to Florida in August 2020. However, the delivery of the ship with cabins and facilities for 5,200 passengers was delayed on several occasions, due to the Covid-19 pandemic, and is now scheduled to enter service from Port Canaveral in Florida on the 6th of February 2021. Carnival oversaw the launch of its first LNG-powered vessel, the “AIDAnova”, in 2018 as the cruise industry anticipated the marketing advantages presented by the new International Maritime Organization regulations for clean fuel use in ports and at sea. Most recently in 2019,

Carnival launched the second LNG-powered cruise ship for its global fleet, the “Costa Smeralda”.

Carnival is leading the cruise industry’s use of LNG to power its vessels and has nine additional next-generation LNG-powered vessels due for delivery between 2020 and 2025 for its Costa Cruises, AIDA Cruises, P&O Cruises UK, Carnival Cruise Line and Princess Cruises brands. The LNG-powered “Mardi Gras” will be fueled under a supply agreement signed with Royal Dutch Shell. Shell will use an ocean-going bunker barge to support the growing cruise line demand for LNG as a marine fuel. The Shell barge will serve cruise liners at ports along the southeast US coast, including the Florida base of the “Mardi Gras”, Port Canaveral.

CEDIGAZ said the future expansion of natural gas is underpinned by the development of new resources in gas-rich producing countries, which will expand LNG export capabilities. Natural gas stands as the fastest-growing fossil fuel and will expand its market share in the world energy mix from 23 percent in 2019 to 25 percent in 2040, while that of coal and oil declines strongly. The report from Cedigaz, an international association created in 1961 by a group of international gas companies and the French Institute of Petroleum, said Asia and the Middle East will contribute respectively 58 percent and 24 percent of global gas demand growth over the outlook period. “China alone accounts for one-third of the incremental demand. The future expansion of natural gas in the energy mix is conditioned on new developments of abundant and low-cost resources in gas-rich countries (North America, Russia and the Middle East), which will expand LNG export capacities to meet the growing gas demand, especially in emerging Asian markets,” stated Cedigaz. “The future growth of natural gas also partly depends on investments in low-carbon gas,” it added.

Inter-regional gas trade is expected to grow at a faster rate than demand, by 2.7 percent per annum over the outlook period. Pipeline gas inter-regional trade is expected to increase by 1.3 percent annum up to 2040, mainly driven by exports from Russia and Central Asia to China. “In Europe, Russian pipeline gas is expected to regain market share in the medium term and long term as global LNG supply tightens and heads towards Asia,” the report explained. “LNG trade is forecast to expand much faster than pipeline trade, rising by almost 4 percent a year up to

2040. The share of LNG in inter-regional flows will progress from 47 percent in 2019 to 60 percent in 2040,” stated Cedigaz. There will also be short term and longer term impacts caused by Covid-19 on natural gas demand, despite an expected post-pandemic recovery. “In Cedigaz Scenario (multi-wave pandemic), global gas and energy demand recover slightly in 2021 before accelerating afterwards as the pandemic recedes,” added Cedigaz.

Any losses are seen affecting natural gas transported by pipelines, whereas LNG demand in the medium term and long term is not expected to be affected because of a rebound in LNG demand post-2021 in Asia amid abundant and competitive cargo supplies. Cedigaz said that long-term growth in gas demand will be conditioned by new investments in LNG infrastructure. Despite project delays in the current context of the crisis, post-final investment decision projects should be sufficient to cover global LNG demand until 2025-2026. The French body forecast that the LNG market was expected to remain oversupplied in the next three years, before gradually rebalancing as LNG demand in Asia returns to prior levels. “LNG will thus play a growing role in both Europe and Asia in the first half of this decade,” said Cedigaz. “In the longer term, the centre of gravity of natural gas trade shifts further from Europe to Asia, where emerging markets absorb the bulk of the incremental LNG and pipeline gas supply,” it predicted. An additional LNG liquefaction capacity of 86 million tonnes is required to cover the global demand by 2030 and this gap rises to 167 million tonnes per annum by 2040. “Therefore, the future expansion of gas in the next two decades is conditioned on the timely materialization of investments, especially in the upstream and LNG business, and this represents a key challenge in a context of low oil and gas prices,” Cedigaz concluded.

CHART Industries said it received orders for its ISO containers for LNG applications with a second leasing order from Latin American and Caribbean project New Fortress Energy. At the same time, Atlanta, Georgia-based Chart is expanding its liquid hydrogen and LNG businesses with strategic agreements. Chart said the value of the latest New Fortress contract totaled \$7.7 million. “The first order of a similar size was booked in July 2020, and we look forward to our continued relationship with New Fortress as they execute their vision,” said chart.

“As a reminder, we see double digit near-term growth in our repair, service and leasing business, and continue to expect growing demand for LNG equipment for infrastructure,” stated the company.

Chart also completed the divestiture of its cryobiological products business, MVE Biological Products, to Cryoport Inc., headquartered in Brentwood, Tennessee, for \$320M in cash. In other activities, Chart and Plug Power Inc., based in Latham, New York state, executed a master supply agreement for Chart to deliver liquid hydrogen storage and transport equipment to Plug and its subsidiaries. “We are excited about this agreement between two strong and experienced companies in the hydrogen value chain,” said Chart. “In conjunction with the agreement, Chart received \$7.8M of equipment orders from Plug that are booked in the third quarter of 2020,” it added.

Plug Power is a leader within the US hydrogen economy, using 40 tons of liquid hydrogen per day. “Plug Power is well-positioned in the industry with capabilities in generation, liquefaction and distribution of hydrogen fuel, complementing its industry-leading position in the design, construction, and operation of more than 100 customer-facing hydrogen fueling stations,” explained Chart. Chart stated that it was close to executing a formal joint development agreement and entity with one of its key hydrogen customers which will focus on developing first-of-a-kind liquid hydrogen fueling applications. “This agreement builds upon Chart’s 50-plus years of experience designing and manufacturing hydrogen equipment for storage, transport and power applications as well as our customer’s multi-station infrastructure in the United States for the expansion of fuel cell vehicles,” it explained. “Timing this agreement with the California Energy Commission’s September 2020 grant funding for multi-year, multiple hydrogen fuel stations, the future of a scalable fueling infrastructure is accelerating,” added Chart.

CHART completed the acquisition in October of the Alabama-based cryogenic trailer and hydrogen trailer transport assets of Worthington Industries. “This acquisition includes ownership of the Theodore, Alabama manufacturing site, all trailer-related intellectual property, manufacturing capabilities, equipment and repair backlog,” said Chart. The new Atlanta, Georgia-based owner said the facility has around 300,000 square feet of

under-roof space adjacent to the Port of Mobile, and the associated employees will now join the Chart team. “This acquisition will produce strong synergies by combining Chart’s deep knowledge of cryogenics and liquid hydrogen storage and handling with the Theodore operations expertise and experience in the packaging and assembly of liquid hydrogen trailers,” stated Chart. “The addition of the trailer business to Chart’s hydrogen equipment and solution offering expands our mobile equipment to larger sized transports and brings another location already certified by significant hydrogen customers,” it stated.

Chart added that it expected the Chart hydrogen-related revenue from this facility in 2021 to be between \$15 million to \$20M with upside potential to \$30M in 2021. “Owning this strategically located site near the Port of Mobile will grow our manufacturing capacity for Chart’s LNG products including tender cars for locomotive fueling and onboard storage tanks for marine fueling applications and expand our repair, service and leasing footprint,” said Jill Evanko, Chart’s Chief Executive and President. “In particular, we will be able to provide expanded options for our North, Latin and Central American customers, including shorter lead-times of our ISO containers for LNG built in our Changzhou, China facility and stored onsite in Alabama,” added Evanko.

In another development, Chart said it had given a firm undertaking to subscribe to the share capital increase initiated by French-listed company McPhy for an amount of €30 million (\$35.2M), which will result in approximately 4.3 percent of the capital of McPhy, post completion of an anticipated €150M capital offering. McPhy specializes in zero-carbon hydrogen production and distribution equipment. In conjunction with the strategic investment, Chart and McPhy also executed a commercial memorandum of understanding. “The MoU between McPhy and Chart is intended to set the pace of commercial collaboration to stimulate new hydrogen demand for the parties’ respective equipment and solutions globally, by identifying new customers and projects,” Chart explained. Chart and McPhy said that they would also work on studying options to scale up projects for production, storage, transport and fueling in all addressable markets. “We are thrilled to welcome Chart Industries as a strategic investor and partner, bringing deep expertise in their hydrogen-related applications,” stated Laurent Carme,

McPhy Chief Executive. “We anticipate new commercial opportunities in hydrogen across Europe and globally through this partnership,” added Carme. Chart’s 23 global locations for manufacturing equipment, including 10 in Europe, also offer capabilities to manufacture hydrogen equipment in China and India.

CHINA GAS Holdings, one of the leading non-state controlled companies in the Chinese sector involved in city-gas and LNG, has been included in the Hang Seng Shanghai-Shenzhen-Hong Kong 300 Index for growing corporations as it pledged to replace more coal with gas in Northern China. The 300 Index measures the overall performance of the companies in terms of capitalization of their operations in Hong Kong, mainland China and Macao. China Gas, based in Hong Kong, said it had additionally been included in Hang Seng Corporate Sustainability Benchmark Index. The company is developing into one of the nation’s main gas services providers with a free-market strategy offering full backing for continued Chinese reforms and a green agenda.

The company is involved in more than 600 projects in cities and towns with city-gas pipeline concessions, 17 natural gas pipeline transmission projects and 556 LNG and compressed natural gas filling stations for vehicles. “China Gas, which was founded in 2002, has seen rapid and healthy development for more than a decade, and was included in Hang Seng China Enterprise Index on 5 March 2018,” explained Liu Ming Hui, Executive Chairman, Managing Director and President of China Gas. “We are much encouraged that China Gas is included in Hang Seng Shanghai-Shenzhen-Hong Kong 300 Index and Hang Seng Corporate Sustainability Benchmark,” he added. “It not only represents recognition of the capital market for the value of China Gas, its position in the corresponding industry segment, and transparent corporate management and business performance, but is also an endorsement of the exertions of its 60,000 staff,” stated the Chairman.

“China Gas will continue to heed the nation’s call for smog control and green development, and actively seize related opportunities such as the arrival of Russian gas and natural gas market reform,” explained Chairman Liu. “We will keep developing our core city-gas businesses, and at the same time accelerate the roll-out of potentially-rich projects, such as ‘coal-to-gas replacement’ in industrial and commercial applications,

‘replacement of coal with gas’ in towns and villages in Northern China, asset-light value-added business and natural gas integrated energy,” he stated. China Gas said it would continue to be at the forefront of the development of the Chinese gas industry, providing “smart” energy and “green” protection for the public.

CMA CGM, has seen the first of nine LNG-powered vessels join its fleet and undertake its maiden on the “French Asia” route calling at 12 ports in 84 days. The French-flagged container ship, “Jacques Saadé”, is a 23,000 twenty-foot equivalent units (TEU) vessel and was constructed at the Hudong-Zhonghua Shipyard near Shanghai in China as the first Ultra Large Container Vessel to use LNG as fuel. CMA CGM Group Chairman and Chief Executive Rodolphe Saadé explained that the nine ships were ordered in November of 2017 to keep the Marseilles-based shipping line at the forefront of the clean-fuel revolution in the shipping industry. The “Jacques Saadé”, named after the Chairman’s late French-Lebanese father who died in 2018, is on the French International Register as will be the other eight ships. “They will bear the names of landmark Parisian monuments and other renowned venues and institutions from throughout the French capital (Champs Elysées, Palais Royal, Louvre, Rivoli, Montmartre, Concorde, Trocadéro, and Sorbonne),” the company disclosed.

CMA CGM noted that it had chosen French energy major Total in a “major industrial partnership” as its LNG supplier. The “Jacques Saadé” on its 84-day maiden voyage was scheduled to call on the Asian leg at the ports of Pusan in South Korea; Tianjin, Ningbo, Shanghai and Yantian, China; Singapore; Port Kelang in Malaysia; and on the European leg at Southampton in the UK, Dunkirk in France, Hamburg in Germany, Rotterdam in the Netherlands and Algeciras in Spain. CMA CGM stated that it has a weekly service on the “France Asia” route calling at the 12 ports, not counting its home port of Marseilles. “The CMA CGM ‘Jacques Saadé’ embodies our commitment to the planet,” said the company Rodolphe Saadé, Chairman and Chief Executive Officer. “This vessel has been enhanced with the latest technologies and is the result of 7 years of research and development,” he added. “While guaranteeing the safety of our crew, it preserves air quality and will be part of our fight against global warming,” added Saadé. “It significantly

improves the environmental footprint of carried goods. We have taken a big step forward. We need to go further to build transport that is even more respectful of the environment,” he declared.

The shipping line listed the innovations to LNG motorization on the first vessel and the other eight on order. The cockpit has the latest embedded digital technologies to assist the commander and crew, in particular for port manoeuvres. The vessels also feature a redesigned straight bow with an integrated bulb, a redesigned rudder, and a redesigned propeller all of which substantially improve the vessels hydrodynamics, thereby reducing energy consumption. The nine vessels bear a specific “LNG Powered” label that will be recognizable on all seas across the globe.

CONOCOPHILLIPS has advanced its Optimized Cascade Process (OCP) for natural gas liquefaction, currently licensed in 27 processing trains worldwide. New operational and control tools were added to enhance overall efficiency, flexibility and reduce process costs. The traditional OCP turbomachinery configuration (OCP Pro) has two 50% refrigeration compressor trains in parallel serving one refrigeration process train. This two-trains-in-one arrangement remains preferable for developers of larger 3-to-8 mtpa baseload trains. In contrast, customers contracting smaller parcels with more-flexible terms will prefer the new OCP Compass configuration which cuts cost by reducing the LNG train’s equipment count and footprint through modularization. Together with Baker Hughes, a turbomachinery configuration was developed that couples three refrigerant services on a single shaft, driven by an aeroderivative gas turbine or electric motor. OCP Compass is designed for midscale LNG applications in the 1-to-3 mtpa capacity range, in either single-string or two-trains-in-one configurations. Multiple OCP Compass trains can be combined to address capacity requirements of larger baseload facilities (>3 mtpa), while capturing lower costs through replication of smaller liquefaction trains. In addition, ConocoPhillips will license its heavy removal unit (HRU) technology, OCP CryoSep, which recovers heavy hydrocarbons and removes components that would otherwise freeze in the liquefaction unit or lead to excessive BTU content.

CONOCOPHILLIPS, one of the pioneers of LNG in Alaska, has agreed to acquire onshore oil and gas company Concho Resources in an all-stock deal for \$9.7 billion plus debts to create a complementary acreage positions in key Northern American basins. The ConocoPhillips deal also includes Concho's net debt of \$3.9Bln, valuing the transaction at \$13.6Bln. The combination will be the largest independent oil and gas company, with production of over 1.5 million barrels of oil equivalent per day. ConocoPhillips said the transaction brings together contiguous and complementary acreage positions across the Delaware and Midland basins and includes positions in the Eagle Ford Shale and Bakken Basin in the Lower 48 States and in the Montney Shale in Canada.

The largest of Concho's core areas is in the Delaware Basin where its position spans 520,000 gross acres. The Delaware Basin is a large geographic area spanning the southwest corner of New Mexico and parts of West Texas. Analysts noted that the US major had always been a pioneer with American resources and its predecessor company started LNG exports to Japanese utilities more than 50 years ago from the small-scale Kenai Peninsula plant in Alaska that has now closed. ConocoPhillips also still holds key LNG resources, including the operatorship of the Australia-Pacific LNG export plant in Queensland with partners such as China Petroleum & Chemical Corp., known as Sinopec. Its other LNG assets include a stake in the Qatargas III project, a mega-Train in Qatar with partners Qatar Petroleum and Mitsui & Co. of Japan.

ConocoPhillips said that the Concho deal is expected to capture \$500 million of annual cost and capital savings by 2022 from lower general and administrative costs and a reduction in ConocoPhillips' future global new ventures exploration program. The combined company would target an average reinvestment level of less than 70 percent of cash from operations to ensure sufficient free cash flow generation to fund returns of capital to shareholders. The transaction is expected to close in the first quarter of 2021 after approval by the shareholders of both companies and the regulators. Concho's Chairman and Chief Executive Tim Leach will join the ConocoPhillips board and executive leadership team as Executive Vice-President and President of Lower 48 (States) assets. Under the terms of the deal, each share of Concho common stock will be exchanged for a fixed ratio of

1.46 shares of ConocoPhillips common stock. "We believe Concho is a tremendous fit with ConocoPhillips," said Chairman and Chief Executive Ryan Lance. The ConocoPhillips CEO said that the vital exploration and production sector was at a crossroads. "All our stakeholders seek a more stable outlook for a business that has become more volatile in recent years," he said. "In 2016, our company launched a successful strategy built around discipline and returns. Since then, we have led the sector in executing that strategy and establishing ConocoPhillips as a competitively advantaged company," added Lance. "We're taking our successful business model to the next level with the acquisition of Concho Resources," he stated.

The company will hold about 23 billion barrels of oil equivalent resources with an average cost of supply of less than a West Texas Intermediate crude price of \$30 per barrel. "We are both widely recognized as having high-quality, low cost of supply unconventional assets," said Lance. "The combined company will have contiguous and complementary 'core-of-the-core' acreage positions across the Delaware and Midland basins, as well as the Eagle Ford and Bakken," he explained. "Our unmatched unconventional positions, when combined with our other world-class global assets, will give ConocoPhillips unmatched scale, quality and portfolio diversification among independents," he said. "Because of the scale of our combined Permian (Basin) operations, Tim (Leach) will have offices in both Midland (Texas) and Houston," said Lance.

DELFIN Midstream, the US LNG export project shareholder offshore Louisiana, has completed the engineering and design phase of the venture for the first of its floating production vessels with South Korean shipyard Samsung Heavy Industries and US liquefaction technology company Black & Veatch. The Delfin FLNG project is based on the deployment of floating liquefaction facilities with other moored production and storage vessels. The Delfin developers have already been awarded a deepwater port licence by the US Maritime Administration and the venture has been approved by the US Coast Guard. Delfin purchased the UTOS pipeline, the largest natural gas pipeline in the Gulf of Mexico, and submitted its deepwater port license application in 2015.

The UTOS pipeline is the only 42-inch pipeline in the GoM and was formerly owned and operated by Enbridge Inc.

Delfin proposed to activate the formerly abandoned offshore system pipeline for the FLNG project and construct new connecting pipelines, a compressor station and associated facilities. The Federal Energy Regulatory Commission approved the onshore facilities in September 2017 but required the company to make the facilities available for service within three years. Delfin then asked the FERC for a three-year and six-month extension until 28th March, 2023 to build facilities to connect up to the FLNG units 30 miles off the coast of Louisiana. In its latest statement, Delfin said the front-end engineering work on the first vessel was complete and output would be 3.5 million tonnes per annum. With ultimately four FLNG vessels in operation, the project would have four units for around 14 MTPA, which would provide an unmatched operational flexibility to service the bunkering and small-scale market as well.

The company says that the Delfin FLNGs are "liquefiers" providing all-in costs of \$500 to \$550 per tonne. "The tripartite cooperation has been successful in developing a robust, low-cost and efficient FLNG Vessel design for the project," said Delfin. Delfin added that each FLNG vessel could be developed independently, with its own commercial and financial structure, allowing Delfin to be at the lower end of the global LNG cost curve and offering final investment decision thresholds of between 2.0 MTPA and 2.5 MTPA of firm offtake. The Delfin newbuild FLNG design uses the Kansas-based Black & Veatch's patented PRICO® liquefaction technology, direct air cooling and waste-heat recovery to achieve maximum fuel efficiency and minimal green-house gas emissions. "Each vessel will be equipped with two offloading facilities to service both large, ocean-going carriers as well as the regional demand for LNG bunkering and small-scale carriers," explained Delfin.

In parallel to the FEED completion, the parties said they had developed a Term Sheet for a Lump-Sum, Turnkey Engineering, Procurement, Construction, Integration and Commissioning contract as the basis for the development of a fully-termed agreement. "The successful completion of our FEED confirms our ability to offer industry leading pricing of 115 percent of Henry Hub plus \$2.00 for 20 year transactions," said Delfin Chief Executive Dudley Poston. "The flexibility of a low cost, floating asset also allows Delfin to offer shorter term 10 year deals for 115 percent of Henry Hub plus \$2.40

or flexible tolling structures," he added. Delfin stated that it continued to advance commercial discussions with multiple buyers and end-users and the completion of its FEED was a landmark for the future FID for the first project vessel. "Recent hurricane activities in the Gulf of Mexico have highlighted the importance of sound design and operational measures to minimize potential downtime of LNG export facilities," said Wouter Pastoor, Chief Operating Officer of Delfin. The Delfin project vessels will be self-propelled and use a disconnectable, mooring solution to allow the FLNG unit to sail away if a severe hurricane passes over the site. "The same technology and operational procedures have been used for decades on oil FPSOs in tropical storm locations," stated Wooter. Delfin has said that it also sees room for expansion using its "liquefiers" with areas identified as South Texas, the Pacific Coast of Mexico and Western Canada.

DNV GL, the European maritime classification society, has released its marine fuel forecasts through 2050 with liquefied natural gas being one of the preferred options even over the new hyped fuel of hydrogen because of the estimated price of hydrogen and the high investment costs for the engine and fuel systems. The Maritime division of DNV GL, which is based in the German port of Hamburg, outlined its latest projections in the fourth edition of its "Maritime Forecast to 2050". "The purpose of 'Maritime Forecast to 2050' is to enhance the ability of shipping stakeholders, especially shipowners, to navigate the technological, regulatory and market uncertainties in the industry, and set shipping on a pathway to decarbonization," explained the Norwegian-German class society. It is based on a library of 30 outcomes which project 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. "The grand challenge of our time is finding a pathway towards decarbonization," said Knut Orbeck-Nilssen, Chief Executive of the DNV GL Maritime division. "Reducing GHG emissions is rapidly becoming the defining decision-making factor for the future of the shipping industry. The pressure to act decisively is mounting," explained Orbeck-Nilssen. "Perfect is the enemy of good, and so we mustn't wait for an ideal solution to arrive and risk making no progress at all," said Orbeck-Nilssen. "Using a wide range of scenarios involving

different fuel types and technologies, and varying degrees of regulatory pressure, our new report helps to map a way forward, offering shipowners clear insights on how to meet the challenges and opportunities ahead,” he added.

The Maritime Forecast identifies the choice of fuel as the essential factor in decarbonizing shipping. “The industry is at the beginning of a transition phase, with many potential options emerging alongside conventional fuels. This increasingly diverse fuel environment means that engine and fuel choice now represent potential risks that could lead to a stranded asset,” stated DNV GL. The 30 scenarios result in widely different outcomes for the fuel mix in the fleet. In the outcomes with no decarbonization ambitions, very low sulphur fuel oil, marine gas oil and LNG dominate. “Fossil LNG gains a significant share until regulations tighten in 2030 or 2040,” said the report. “Bio-Marine Gas Oil, e-MGO, bio-LNG and e-LNG emerge as drop-in fuels for existing ships,” it added. “By 2050, E-ammonia, blue ammonia and bio-methanol frequently end up with a strong share of the market and are the most promising carbon-neutral fuels in the long run,” the report explained. “A surprising result from the model is the relative limited uptake of hydrogen as a ship fuel, as a result of both the estimated price of the fuel and the investment costs for the engine and fuel systems,” it said.

The report noted that hydrogen still plays “an integral role” as a building block in the production of several carbon-neutral fuels such as e-ammonia, blue ammonia and e-methanol, all of which gain significant uptake under the decarbonization pathways. It concluded that hydrogen as a ship fuel may also find niche applications in some vessel types, such as ferries and cruise ships, as well as in specific regions where investments have been made into local production and distribution.

DOOSAN Heavy Industries and Construction, South Korea's leading power plant builder, is on the point of reviving its gas turbines business to capture market share in the domestic market and eventually in Asia in the growing LNG-for-power sector. Doosan Heavy and five Korean power companies are cooperating on coming up with a model gas-fired power plant to use regasified LNG and Doosan's gas turbines. The five Korean utilities involved are Korea South-East Power, Korea Midland

Power, Korea Western Power, Korea Southern Power and Korea East-West Power. They are all subsidiaries of the state-controlled company Korea Electric Power Corp. (KEPCO).

The cooperation pact was announced following a visit to Doosan Heavy's gas turbine plant in Changwon, located 390 kilometres southeast of the capital Seoul, by South Korean President Moon Jae-in. Doosan Heavy has been making efforts to build a gas turbines business since 2013 and aimed at the combined-cycle power plant using LNG. The company succeeded independently to develop a turbine for plants using LNG in 2019, making it only the fifth company in the world with the proven turbine technology. “Given that a huge market growth is expected, we aim to further promote our company's growth by leveraging our industry-academia-research alliances to effectively develop a top-notch Korean standard gas-fired combined cycle power plant model,” stated Hongook Park, Chief Executive of Doosan Heavy's Power Service Business Group.

At the same time Doosan Heavy is being affected by the economic slump and said it planned to issue new shares worth 1.3 trillion South Korean won (\$1.12 billion) to raise finance to meet the challenges ahead. A government task force is aiming to advance the project of a Korean-designed standard LNG-for-Power plant while also promoting a home-grown Korean gas turbine industry. Doosan announced in June 2020 that it had signed contracts with Korea Western Power for the power block installation and plant construction work required at the Gimpo Combined Heat and Power (CHP) plant. Plants like this consist essentially of an electricity generator combined with equipment for recovering and using the heat produced by that generator. The 500-megawatt Gimpo CHP Plant, located in Gyeonggi Province, is scheduled to be completed by the first half of 2023 and will use the first Doosan-designed gas turbines. Doosan's first locally manufactured turbines had been under development for six years as part of a government-backed project before the final assembly was completed in September 2019 of the first turbine.

EDF TRADING, a leader in the international wholesale energy markets and a partner of Japanese LNG trader JERA Global Markets, has entered the Japanese power market. EDF Trading, a wholly-owned subsidiary of French utility and energy company EDF SA, said it had already started transactions in Japan. In

addition to trading LNG, EDF Trading is also active in the electricity, pipeline natural gas, liquefied petroleum gas, oil and environmental products markets. In its LNG trading, EDF is a partner of JERA Global Markets (JERAGM), a joint venture between JERA Co. Inc. (67 percent) through JERA Trading International and EDF Trading (33 percent).

JERAGM operates one of the largest seaborne energy portfolios in the world and buys LNG and other resources for the largest utilities in Japan. JERA Co. Inc. is the largest LNG importer with 35 million tonnes per annum of volumes and is also Japan's biggest fossil-fuel generator being owned jointly by Tokyo Electric Power Co. and Chubu Electric. “We are very pleased to announce that we started transacting Japanese power on the EEX platform last week,” said EDF Trading Chief Commercial Officer, Philipp Büssenschütt. “We will be trading Japanese Power out of London for the time being,” he added. “As liquidity in the Japanese power market increases, we will apply the lessons learned from our experience of European power market liberalization to expand our activities,” added Büssenschütt.

EDF Trading's LNG partnership with Japan also extends to the coal and freight markets. The EDF Trading group manages a portfolio of assets with the ability to source, supply, transport, store, blend and convert physical commodities around the world. These capabilities enable it to deliver asset optimisation services, risk management and wholesale market access to the EDF Group and its third-party customers. EDF Trading is one of the largest wholesale market traders in Europe for power and gas. It is also present in North America, where EDF is one of the leading marketers of gas and power and one of the main providers of generation services for power generation companies, as well as being a retailer for large commercial and industrial customers. EDF Trading is a 100 percent-owned subsidiary of EDF and has around 800 employees with key offices in London, Paris, Singapore and Houston.

EGYPT and the Italian company Eni are trying to find an agreement to allow the restart of the idled Damietta LNG export facility, located east of Alexandria, and one of two Egyptian liquefaction facilities on the East Mediterranean coast. The plant has a nameplate capacity of 5.5 million tonnes per annum of LNG has been shut since November 2012 when Egypt suffered domestic natural gas

shortages. LNG exports from the Idku liquefaction plant with 7.2 MTPA of capacity, also near Alexandria, resumed in 2017 under the auspices of Royal Dutch Shell which acquired the facility after its BG Group takeover.

However, Egypt has curtailed Idku exports in because of weak global prices. Egyptian exports were halted again earlier in 2020 because of record low prices with the oil price plunge and Covid-19, as well as global over-supply, contributing to the Japan-Korea Marker North Asia spot price dropping under \$2.00 per million British thermal units. In August, Egypt then resumed shipments and completed its first LNG cargo delivery since March 2020, with a shipment from Idku arriving in Taiwan on August 16, according to shipping data. The situation with Damietta LNG has been complicated by a legal dispute over compensation due to the operators after the plant was idled in 2012 as the government diverted gas to domestic users. The owner of the Damietta liquefaction plant, a joint venture called Segas, is 40 percent held by Eni through Union Fenosa Gas (50 percent Eni and 50 percent Spanish utility Naturgy).

UFG was awarded \$2 billion by the World Bank's International Centre for Settlement of Investment Disputes because of the lost income from the Egyptian feed-gas diversions. Eni is a prominent participant in Egypt's exploration and production sector. Among its several discoveries in recent years was the Zohr field in Egypt's East Med waters, enabling the nation to become an exporter again after importing LNG for several years. The February 2020 agreements negotiated by Eni and others provided for the resolution of all outstanding disputes and the re-opening of Damietta by June 2020. The Eni-led deal was signed by Egyptian General Petroleum Corp. (EGPC), the Egyptian Natural Gas Holding Company (EGAS) and Naturgy, formerly Gas Natural Fenosa. Naturgy then said in April 2020 that it would continue to pursue its claim for its 50 percent share of the compensation from the Egyptian government following the collapse of the previous agreement. The Spanish utility apparently prefers to exit the Damietta project and receive \$600 million in cash and most of UFG's assets outside of Egypt. Analysts said that executives believe the main conditions to advance the February agreement was for the plant to start operating, but work to return to normal operation could take up to three months.

EMGF, the East Mediterranean Gas Forum, grouping Israel, its Arab neighbours as well as the Palestinian Authority, Italy, Greece and Cyprus has been formalized to develop natural gas and economic development in the region. Egypt and Jordan are the Arab nations involved in the establishment of the EMGF as an intergovernmental organisation and it was launched at a virtual ceremony hosted by Cairo. The forum initially is seeking to cooperate on the establishment of a natural gas pipeline connecting Israel, Greece and Cyprus to Italy and on to the rest of the European Union. The eventual aim is to supply the continent with 10 percent of its natural gas supplies in competition to LNG and Russian pipeline gas supplier Gazprom. The forum was initiated three years ago by Israeli Energy Minister Yuval Steinitz and his Egyptian counterpart Tarek El Mula.

The Egyptians hosted the online event officially setting up the EMGF which followed the signing of a Memorandum of Understanding in January 2020. “The directors general of each member country’s Energy Ministry will now form a working group to take things forward, while an advisory committee will be set up to include private sector international energy companies,” said a statement. France has applied to join the body and the EU and the United States are involved as observers. “The EMGF will contribute to advancing regional stability and prosperity, creating an environment of trust, prosperity, stability and neighbourly relations through regional energy cooperation,” said the joint declaration. “We are open for any East Mediterranean country to apply for membership and for any other country, regional, or international organization to apply to join as an observer, given that they share the same values and objectives of the EMGF and the willingness to cooperate for the welfare of the whole region,” it added. Israel said it supported the Palestinian Authority being part of the forum.

Analysts note that the EMGF offers the Palestinian Authority the prospects of benefitting from its own offshore gas field. One of the medium-term aims of the EMGF members is to help develop the Gaza Marine gas field, which has estimated reserves of at least 1 trillion cubic feet. Royal Dutch Shell in 2018 sold its 90 percent stake and operating role in the Gaza Marine gas field to the Palestine Investment Fund, which eventually plans to bring in a new partner to develop the long-delayed project first considered by

BG Group of the UK before it was taken over by Shell. “The forum brings regional cooperation with Arab and European countries, the first of its kind in history, with contracts to export (Israeli) gas to Jordan and Egypt worth \$30 billion, and that is just the beginning,” added Israeli Minister Steinitz. Egypt began importing Israeli natural gas from the Tamar and Leviathan fields in offshore Israeli waters at the start of 2020. The 2015 discovery of the giant offshore Zohr gas field by Italian energy company Eni helped to re-established Egypt as self-sufficient in gas and enabled it to begin exporting LNG again from its two liquefaction plants located east of Alexandria. Egypt had temporarily become an LNG importer amid surging domestic natural gas demand, which is also being experienced by the other nations in the region. Egypt boosted its gas production by more than 12.4 percent to a record 7.2 billion standard cubic feet per day in the last 2019-2020 fiscal year and is undertaking new exploration activities backed by companies such as Eni and BP of the UK in the Nile Delta and the East Med basin.

ENAGAS, the Spanish natural gas network operator and LNG terminal owner, said its terminals unloaded 190 LNG cargoes in the first nine months of 2020, 4 percent more than in 2019, including 64 shipments in the third quarter as the gas market recovered to pre-Covid-19 levels. The company posted a profit after tax of €348.9 million (\$411.5M) for the nine-month period, in line with expectations and 4.7 percent more than in the same period of last year. The company said conventional demand for natural gas in Spain was back to pre-Covid-19 levels. The owner of four LNG regasification terminals in Spain and with stakes in two others in South America also operates 12,000 kilometres of Spanish high-pressure gas pipelines and 19 compressor stations.

However, because of the challenges of the pandemic and the energy market slump, Enagás had intensified its cost-control and savings plan for financial and operating expenses. Spanish demand for natural gas in September was back to similar level to that recorded before the declaration of the Covid-19 state of emergency. Enagás forecast that Spain would end 2020 with a total demand for natural gas of around 353 terawatt hours, higher than that registered in 2018. The company also reported that the Trans-Adriatic Pipeline (TAP) project, in which

Enagás has a 16 percent stake, is substantially completed and its start-up is scheduled for the final quarter of 2020. The TAP project links Turkey with gas grid connections to Italy through Greece and Albania.

Enagás said it was also promoting various green hydrogen projects in line with its commitment on decarbonization, including the “Green Hysland” venture on the island of Majorca. The Enagás green hydrogen initiative is the first in a Mediterranean country and has been selected for funding from the European Commission. Enagás has four domestic import terminals around Spain at Barcelona in the northeast, Cartagena in the southeast, Huelva in the southwest and Gijon in the northwest. It also owns a 50 percent stake in the facility serving the northwest city of Bilbao. Enagás said its earnings underpinned its dividend commitment for 2020 of €1.68 euros (\$1.98) per share, an increase of 5 percent, and kept its shareholder remuneration policy on track for the 2020-2026 period. Enagás stated that its financial structure was solid, with more than 80 percent of debts at a fixed rate and without significant maturities until 2022. In the United States, where Enagás owns a 30.2 percent stake in pipeline company Tallgrass Energy, it said the medium-term forecasts were positive. “There has been a sustained recovery in prices and demand. Along these lines, the North American market is expected to stabilize production in 2021 and in 2022 and this is expected to be sustained in the medium and long term,” said Enagás.

EQUINOR, the operator of the LNG export plant on Melkoya Island in Northern Norway, said that the facility would not be re-starting until later in 2021 after a fire described as a very serious incident that had disturbed local residents in the nearby town of Hammerfest. Equinor said it had informed the market about the plant being closed for the rest of the year after the September 28 fire, though the company did not want to speculate on the economic consequences for Equinor itself, partly owned by the Norwegian state. The fire at the Melkoya island plant had the fire service battling to bring the blaze under control. It was the third incident at the Hammerfest plant during the month of September. “Equinor is also looking into findings pointed out by the Petroleum Safety Authority (PSA) in a recent inspection,” said the company.

Equinor stated it was very grateful

for the efforts of local emergency services and for the work Equinor's own emergency response organization did to put out the fire “in a very demanding situation” and the company was relieved that no one was injured in the fire or in fighting it. “The fire was dramatic, especially for employees, suppliers and neighbors in Hammerfest,” said Irene Rummelhoff, Executive Vice President of Marketing, Midstream and Processing at Equinor. “We are following up everyone who works at Hammerfest LNG with information about the incident and how we handle it further. This work includes town halls and meetings at unit level. In addition, those who feel the need for it can talk to health professionals,” she added. “There is also a need for information about the incident and the plant’s safety measures among the local community,” Rummelhof added in her full post-fire statement.

The plant had suffered an outage on September 11 and was only restarted in the early hours of September 28. An attempt to restart the plant had been postponed on September 13 due to a gas leak. Feed-gas for the single-Train Hammerfest liquefaction facility comes from the Snohvit gas field in the Barents Sea. Hammerfest exported 4.72 million tonnes of LNG in 2019 compared with 5.17MT in the previous year. Most of the volumes are delivered to European destinations like France, Spain, the Netherlands and Lithuania. The Norwegian facility also exported small quantities last year to Asian nations such as China and India. Most feed-gas for Hammerfest comes from a total of 20 wells in the Snohvit and Albatross fields. This output is transported to land through a 143-kilometre pipeline. A previous scheduled maintenance saw Hammerfest reopen on June 18 after several weeks of shutdown. Equinor has 37 percent of the Snohvit field and the LNG plant and the other large partners include French major Total and Germany’s Wintershall Dea.

FIRST GEN Corp., the largest provider of gas-fired power in the Philippines, has received the go-ahead from the Filipino Department of Energy to develop its proposed interim floating LNG facility in the port area of Batangas City as it awaits construction of a permanent onshore terminal. First Gen said its wholly-owned subsidiary FGEN LNG was given final clearance by the regulators for an application filed in March 2020. The Filipino utility said it would now start work in the fourth

quarter of 2020 on modifying an existing jetty and building onshore gas receiving capability at its complex in Batangas City. In parallel with the construction phase, FGEN LNG is preparing to issue a binding invitation to tender for a floating storage and regasification unit (FSRU) upon completion of its ongoing non-binding process.

Three FSRU providers, Singapore-based BW Gas, Greek-owned shipping company GasLog LNG and Norway's Hoegh LNG have expressed interest in concluding a charter agreement for the FSRU that will provide storage and regasification services to the interim project. FGEN LNG said the deployment of an FSRU would allow the introduction of LNG to the Philippines as early as the third quarter of 2022 to serve the natural gas requirements of existing and future gas-fired power plants of FGEN LNG affiliates as well as third parties. The company said it believed the project would play a critical role in ensuring the energy security of the northern Philippines and the capital Manila on Luzon island, particularly as the nation's domestic Malampaya natural gas resources run down just as the gas-fired power plant network begins to expand. It also has a joint venture with Tokyo Gas in jointly developing the LNG hub in Batangas province to meet the nation's growing gas-fired power needs. First Gen and Tokyo Gas held a ground-breaking ceremony 18 months ago for the onshore terminal that has been designated an "Energy Project of National Significance," in recognition of its importance to national grid security.

The only other completed regasification facility in the Philippines is at Pagbilao in Quezon province where Australia-listed Energy World Corp. has a facility linked to its 100-percent owned 650MW gas-fired power project. LNG imports will only begin when the power plant is built. "We are thankful to Energy Secretary Alfonso G. Cusi, and to the Downstream Natural Gas Review and Evaluation Committee of the DoE, for the support and guidance that they have provided during the evaluation process," said First Gen Executive Vice-President and Chief Commercial Officer Jonathan C. Russell. FGEN LNG believes the project will play a critical role in ensuring the energy security of the Luzon Grid and the Philippines, particularly as the Malampaya gas field is expected to be less reliable in the future.

The company already operates four gas-fired power plants with an aggregate capacity of about 2,000 megawatts. These

are the 1,000-MW Santa Rita plant, the 500-MW San Lorenzo facility and the 414-MW San Gabriel and 97-MW Avion plants. First Gen said the arrival of LNG in the Philippines would encourage new power plant developments and more industrial and transport users seeking a cleaner replacement for polluting fuels. The company concluded that it expected the continuing reduction in supply from the Malampaya gas field up to the expiration of contracts in 2024.

FLUXYS Belgium said first-half net profits increased in a market little affected by the impacts of the Covid-19 pandemic as the Zeebrugge LNG import terminal experienced record traffic and there was keen interest for additional send-out capacity. Fluxys said its regulated turnover increased 8.5 percent to €275.8 million (\$322M) compared with €253.9M in the first half of 2019. The company's net profit was up more than 15 percent to €36.6M versus €31.4M in the first six months of 2019. "The increase in regulated turnover and net profit is mainly due to the commissioning of the fifth storage tank for trans-shipment services in Zeebrugge in late 2019 and is in accordance with the tariff methodology and the associated authorised manageable costs and incentives," said Fluxys. The Zeebrugge terminal and a unit of the Yamal LNG plant in Arctic Russia, operated by Russian company Novatek, have a 20-year agreement for up to 107 trans-shipments per year through the Belgian facility.

The agreement started in 2019 after the commissioning of the fifth LNG storage tank. "Despite the widespread impact of the Covid-19 outbreak, all of Fluxys Belgium's essential services remained operational and the company focused fully on its vital role towards society and its customers," the company added. The number of ships docking at the Zeebrugge LNG terminal doubled compared with the first half of 2019 with 39 vessels being unloaded, 75 others arriving for trans-shipments and two to load LNG. "March 2020 was the busiest ever month for ship traffic at the terminal, with a total of 30 vessels docking, more than double the previous record in May 2019," said Fluxys. In the first half of the year, the terminal sent out around 11 percent more natural gas into the transmission system than in the same period of 2019. "LNG-trailer traffic for truck-loading was also up by around 11 percent, with almost 1,550 LNG trucks being loaded," said the company.

Fluxys added that there was a lot of

market interest for additional send-out capacity. "Responding to market signals, the Zeebrugge LNG terminal conducted a non-binding consultation over the summer to gauge demand for additional send-out capacity," said the company. "This revealed a positive interest in additional capacity from 2024 onwards, and a binding market consultation will therefore be held later in 2020," stated Fluxys. The LNG success was offset by declines in natural gas transmission volumes. Belgium is the most connected gas transmission grid in Europe with links between the Zeebrugge terminal and Dunkirk on the French Coast and other infrastructure such as bi-directional transmission between the UK and continental Europe.

The country is also a crossroads for substantial Norwegian and Russian natural gas production flowing to France, Spain, Switzerland and Italy. Fluxys additionally offers a wide range of arbitrage and trading on the Zeebrugge Trading Point natural gas market. "The volumes transported in the network were lower than in the first half of 2019," said Fluxys. "Border-to-border volumes fell by 2.5 percent to 224 terawatt hours (TWh) and volumes for consumption on the Belgian market softened by around 3 percent to approximately 98 TWh," said Fluxys. "Transmission to distribution system operators was down by 6.5 percent, reflecting the milder temperatures," it added. Fluxys said that transmission for natural gas-fired power plants saw a slight increase of 0.3 percent.

GLENFARNE Group, the owner of the Magnolia LNG export project in Louisiana, has been granted five more years by the Federal Energy Regulatory Commission to complete the Louisiana plant and associated facilities. The regulators had previously approved construction of Magnolia LNG and related pipeline expansions in April 2016 under its previous owner, the Australian-listed company LNG Ltd that ceased trading amid financial difficulties. That approval had required LNG Ltd to complete the project within five years, by April 2021. The Magnolia plant is proposed for a 115-acre site near the Calcasieu Ship Channel. It is designed to produce 8.8 million tonnes per annum of LNG from four Trains. Glenfarne, a New York-based fund specialising in energy infrastructure investment, had told the FERC in its September 2020 filing that "unforeseeable developments in the global LNG market had affected Magnolia

LNG's ability to enter into long-term LNG offtake contracts" and meant it had not been ready to proceed on schedule.

The Magnolia project permit extension was also accorded to US pipeline company Kinder Morgan for the Magnolia feed-gas link and is now set at April 15, 2026, for the in-service date. A final investment decision had not been taken on Magnolia under its previous owner as it sought to finalize a purchase agreement with a Vietnamese power and import venture in the Mekong Delta. That accord has now lapsed. Glenfarne also acquired LNG Ltd.'s patented optimized single mixed refrigerant (OSMR) liquefaction technology from the Australian bankruptcy administrators who sold the assets. Its purchase of Magnolia boosts the amount of US LNG export capacity Glenfarne has under development to 12 MTPA as it also owns Texas LNG Brownsville.

The Texas project received authorization from the FERC in November 2019 for the facility to be sited along the Brownsville Ship Channel. Texas LNG seeks to supply Permian feed-gas as LNG to global customers along with two other rival projects being developed alongside. These are the Rio Grande LNG project with five liquefaction Trains and over 26 MTPA of output and the smaller scale Annova LNG venture. Rio Grande is owned by NextDecade Corp and one of the main shareholders in Annova is Exelon Corp, the utility headquartered in Chicago. All three Brownsville projects have pushed back their investment decisions and original construction and engineering timetables.

KARPOWERSHIP has brought the world's first LNG-to-Power floating project into operation offshore Amurang in North Sulawesi in Indonesia as the vessel, the 125-megawatt "Powership Zeynep Sultan", started generating electricity. The "Powership Zeynep Sultan" was built to 1984 and originally operated on Marine Fuel Oil (MFO) but has recently been converted to have its engines and generators converted to dual-fuel with LNG capability. "Our first LNG-to-power project is a success, the engines on 'Powership Zeynep Sultan' are beginning to run on LNG thanks to our supply from a partner's floating storage and regasification unit," said Karpowership. "We aim to have 80 percent of our fleet running on LNG by 2025, providing more economic and environmental value to our partners," said the Turkish company.

Karpowership is a subsidiary of the Turkish industrial group, Karadeniz Holding, whose Chief Executive is Orhan Remzi Karadeniz. The Karpowership unit operates 25 floating power plants in about a dozen countries around the world and the Indonesian venture is the first in operating using LNG. The LNG offshore Amurang is being converted via a small-scale floating storage and regasification unit (FSRU), the 14,000 cubic metres capacity vessel “Hua Xiang 8”, according to shipping data. The small-scale FSRU was constructed in China in 2017 at the Qidong Fengshun yard for Zhejiang Huaxiang, a Chinese liquefied petroleum gas (LPG) market player with plans to build up a fleet of coastal LNG carriers of various sizes.

The FSRU is now working for PT Sulawesi Regas Satu, a joint venture comprising the government-owned utility company Perusahaan Listrik Negara (PLN) and Indonesian shipping company PT Humpuss, which said earlier in 2020 it was acquiring the Chinese FSRU. The LNG-to-Power project has a gas supply agreement signed with Indonesian power company PLN and with volumes provided via Pertamina, the Indonesian state-owned oil and natural gas company. “Through our Powership’s dual-fuel engine capability, combined with the innovation of FSRU technology, we are able to offer a seamless transition to LNG-to-Power for our partners in Amurang,” Karpowership’s Chief Commercial Officer Zeynep Harezi.

KAWASAKI Heavy Industries has held a naming ceremony at the Sakaide shipyard for Japan’s first liquefied natural gas bunkering vessel, the “Kaguya”, as Japanese companies respond to the International Maritime Organization’s campaign for cleaner fuel in the shipping industry. The bunkering ship has capacity of 3,500 cubic metres and is owned by a group of Japanese firms, including the shipping companies NYK Line and Kawasaki Kisen Co. (K-Line), as well as the largest LNG importer, JERA Co. Inc., and Toyota Tsusho Co., the logistics arm of the Toyota trading house. “As a powerful response to the stricter IMO emission regulations for ships from 2020, the introduction of ships that use LNG as fuel instead of heavy oil is progressing worldwide,” said the companies. “This ship is Japan’s first LNG bunkering vessel equipped with facilities for supplying fuel to LNG-propelled vessels at sea,” it added.

The event at the Sakaide yard was attended by most of the leading company executives involved in the project, including, Hitoshi Nagasawa, President of NYK Line and Koichi Akin, President of K-Line. Also in attendance was Nao Nakamura, Managing Executive Officer of JERA and Toshiro Hidaka, CEO of Machinery, Energy and Plants at Toyota Tsusho. “The vessel will be handed over after undergoing tests using actual LNG,” said a statement. “The ‘Kaguya’ will be based at the JERA’s Kawagoe power plant and import terminal northwest of Tokyo and will supply LNG fuel to vessels in the Chubu coastal region,” it added. The leading Japanese LNG bunkering company is currently Mitsui Osk Lines, which has embarked on a global project with Total of France for jointly-owned vessels to be based in key fuel markets in Europe and elsewhere.

The MOL-Total venture already has one ship in operation in northwest Europe and a second will be delivered from China in 2021 and deployed in the Mediterranean. This bunker vessel is being built by Hudong-Zhonghua Shipbuilding in Shanghai, China. It will have capacity of 18,600 cubic metres for a length of about 135 metres and will be fitted with the Mark III membrane containment system provided by French company GTT. The first Total-MOL LNG bunkering vessel was launched in Shanghai in November 2019 and was delivered to operate from Rotterdam in the Netherlands and other Northern European ports.

KEPPEL Offshore and Marine, the Singapore shipbuilding and conversions company, has signed a contract for the first LNG floating regasification and storage unit that will be deployed in the Latin American country of El Salvador and will also build the largest US hopper-dredger for the Gulf of Mexico. Keppel said the El Salvador LNG FSRU contract is the fifth such conversion it will be undertaking and the two latest contracts, for the FSRU and the dredger, were worth around S\$200 million (US\$147M). The company said the LNG FSRU would be delivered to the Port of Acajutla in El Salvador. “The contract was inked with FSRU Development Pte Ltd, a joint venture company between BW Gas Limited and Invenenergy Investment Company LLC,” said Keppel. “The FSRU will be El Salvador’s first integrated LNG-to-power project,” it added. “FSRUs are a cleaner, quicker, and safer storage and regasification solution which is

particularly suitable for deployment in remote areas with smaller energy requirement,” explained the Singaporean company.

Keppel noted that its yard converted the world’s first FSRU in 2008 and has been strengthening its comprehensive suite of offerings along the gas value chain. “We are pleased to receive orders from new and repeat customers even in a challenging market,” said Chris Ong, Chief Executive of Keppel O&M. “It is testament to our track record and the value-add we provide in developing innovative and fit-for-purpose solutions that meet market demands,” added the CEO. “Keppel’s partnership with the BW Group has grown from strength to strength, having worked together on more than 10 projects, including FPSO and FSRU conversions,” stated Ong. BW Group’s shipping unit is based in Singapore and is an LNG sector operator with FSRUs and conventional carriers.

In the US, Keppel O&M’s subsidiary Keppel AmFELS will be constructing a high-specification Trailing Suction Hopper Dredger (TSHD) for Manson Construction Co. The TSHD will be the first dredger built at Keppel AmFELS’ yard in Brownsville, Texas. The project represents Keppel’s ninth newbuild dredger. The payments for the LNG FSRU conversion and the dredger will be on progressive payment terms. To date, Keppel O&M has delivered four dredgers and is currently building another four, with hopper capacities ranging from 6,000 cubic metres to 10,500 cubic metres. “This is an exciting first newbuild project for Keppel O&M with Manson Construction and we will be building the largest US hopper-dredger. We look forward to supporting Manson Construction as they grow their fleet of vessels,” stated Keppel CEO Ong. “Amidst the challenges of dealing with Covid-19, we have put in place measures across all our operations, whether in Singapore or the US, to ensure that work is conducted in both a responsible and efficient manner so that we can deliver the vessels safely, on time, and within budget,” the CEO concluded.

NEXTDECADE Corp., the owner of the Rio Grande LNG export project near the port of Brownsville in Texas, said it had developed proprietary processes using proven technology to reduce carbon-dioxide emissions at the facility. The company, listed on the Nasdaq global exchange, said the plans would see a drop of 90 percent in carbon-dioxide equivalent

(CO2e) emissions at Rio Grande and it was exploring options to address the remaining emissions to possibly achieve carbon-neutrality. Rio Grande previously proposed that the plant would have five liquefaction Trains instead of six while maintaining annual output of 27 million tonnes per annum. NextDecade had also said its activities before taking a final investment decision were focusing on engineering and reducing the facility’s environmental footprint.

Analysts noted that this was especially relevant as the Rio Grande plant will be close to two other facilities on the Brownsville Ship Channel area. These are Texas LNG, owned by New York-based Glenfarne Group, and Annova LNG whose backers include Exelon Corp., the utility headquartered in Chicago. “Throughout the course of NextDecade’s pre-FID development activities, and intensively in recent months, the company has evaluated multiple technical solutions to ascertain the commercial viability of dramatically reducing CO2e emissions,” the company explained. Based on these evaluations, NextDecade stated that carbon capture and storage (CCS) is the most feasible technical solution for Rio Grande LNG.

The company said it believed that the addition of proven CCS technology in conjunction with its proprietary processes could reduce the CO2e emissions of Rio Grande LNG by approximately 90 percent. While NextDecade advances its work in this area, it added that it was also exploring options to address the remaining 10 percent of CO2e emissions. “Natural gas has a critical role to play in the global energy transition to a low-carbon economy, ensuring the security of energy supplies and preserving high quality jobs in the United States and around the world,” said Matt Schatzman, NextDecade’s Chairman and Chief Executive. “Our work to date confirms that reliable, competitively priced LNG and responsible environmental stewardship are not mutually exclusive,” added Schatzman. “A solution that promises both is indeed eminently feasible with the thoughtful use of existing technologies and the application of our proprietary processes,” declared the CEO. NextDecade added that it was continuing to work on remaining commercial agreements needed to achieve an FID in 2021, enabled by what it described as “flexible commercial offerings and leadership in environmental and social performance”, including targeting carbon-neutrality at the Rio Grande plant.

NORWAY, the only European LNG exporter from its own plant, has signalled that exploration and production investment on the Norwegian Continental Shelf is alive and well with 33 energy companies applying for blocks in the latest licensing round. The Norwegian Ministry of Petroleum and Energy has received its large number of applications in the licensing round for Awards in Predefined Areas (APA) 2020. “In a challenging year for the petroleum industry, I am very pleased with the interest shown by companies for new licenses on the Norwegian Continental Shelf (NCS),” said Norwegian Minister of Petroleum and Energy Tina Bru. “We have received a large number of applications, and this is important in order to make discoveries that will contribute to long-term value creation, employment and state revenues,” added the Norwegian Minister.

While Norway is a large-scale pipeline gas supplier to Western Europe in competition to Gazprom, it is also the only European exporter of LNG from a baseload liquefaction plant at Hammerfest. The plant on Melkoya island uses feed-gas from the Barents Sea and the facility was originally intended to be a supplier to the US East Coast before shale-gas turned the US into an exporter. The offshore licence awards in the Nordic nation’s Predefined Areas (APA) is an annual round for the best-known areas on the Norwegian Continental Shelf and most of the applicants are European based, though also include US, Japanese and Middle East companies. The Ministry said that the total of 33 applications received by the deadline included a broad variety of companies, ranging from large international players to mid-sized companies and smaller exploration outfits.

The total number of applications is regarded as high and at around the level of the last few years. “Predictable and stable framework conditions and an active licensing policy are two of the main pillars in the Government’s petroleum policy,” explained Minister Bru. “The high interest expressed by the companies in new exploration acreage shows that our long-term petroleum policy has the desired effect, also during challenging times,” she continued. She noted that the APA-area is expanding as knowledge about the geology in areas of the NCS increases. The predefined area was expanded in the Norwegian Sea during the preparation for this year’s licensing round. The Ministry said it had received interest both in the newly included areas and in the previously

announced APA-areas. Its objective is to award new production licenses in the announced areas at the beginning of 2021.

The first licensing round on the NCS took place in 1965. The activity started in the North Sea, and exploration in the Norwegian Sea and the Barents Sea started around 15 years later. The petroleum sector is important for Norwegian employment, and a considerable number of people are employed directly or indirectly in the industry. The competence and the competitiveness of the oil and gas sector also provides considerable positive ripple-effects to other parts of the economy. Since the first oil discovery was made, the sector has contributed with over 15,400 billion Norwegian crowns (\$1,608Bln) in value creation, and has given the Norwegian state a net cash-flow of over 6,500Bln crowns (\$678Bln) since 2000. The Ministry said that the state net cash-flow in 2019 from the petroleum sector was 257Bln crowns (\$26.8Bln). The use of petroleum revenue in the National Budget to benefit citizens last year equalled more than 180,000 crowns (\$18,800) per family of four.

OIL SEARCH, the Australian-listed company based in Papua New Guinea, said that discussions were continuing between PNG LNG plant operator ExxonMobil and the Oceania nation’s government on the LNG expansion project as cargo deliveries increased in the third quarter. “The objective is securing fair and balanced fiscal terms on the P’nyang Gas Agreement,” said Oil Search in its third-quarter earnings report. A total of 31 cargoes were delivered to customers during the third quarter compared with 27 in the second quarter, comprising 23 cargoes sold under contract (including six under mid-term sale and purchase agreements) and eight on the spot market. “Two DES cargoes were on the water at the end of the period, compared to four DES cargoes on the water at the end of the second quarter,” said Oil Search.

The company added that its internal analysis during the quarter, utilising independent data and discussions with potential customers, assessed the impact of Covid-19 on future LNG demand. This resulted in a view that the supply gap anticipated for the mid-2020s has been deferred by a few years. The PNG LNG plant, located northwest of the capital Port Moresby, produced at an annualised rate of 8.9 million tonnes per annum in the third quarter, Oil Search noted. Oil Search

reported that its average oil and condensate price realised during the third quarter was US\$36.52 per barrel, up 58 percent on the prior quarter. The average realised LNG and gas price fell 42 percent to US\$4.23 per million British thermal units, due to the two-to-three month oil price lag. “There was sustained outperformance of PNG LNG, which operated at an annualised rate of 8.9 MTPA during the quarter and delivered the highest first nine months of production since the project commenced in 2014,” explained Oil Search.

Overall sales in the quarter to the end of September, including LNG, oil and other production rose to 7.54 million barrels of oil equivalent compared with 6.78M boe in the prior three months and 6.47M boe in the third quarter of 2019. However, total operating revenues fell to US\$189M in the third quarter from US\$266.2M in the previous three months and US\$361.2M in the corresponding quarter of 2019. Oil Search lowered its 2020 capital investment guidance to US\$390M-US\$460M following further reductions in exploration activities and rephasing of front-end engineering and design activities in Alaska, where it has oil assets. “Oil Search continued to operate under strict Covid-19 safe protocols while preparing the business for the ongoing impacts of the pandemic,” said Managing Director Keiran Wulff. “Our field-based workforce remains within strict quarantine zones to minimise the risk of transmission across business-critical field teams,” explained Wulff. “The health and safety of our staff, contractors and the communities where the company operates remains a key priority for Oil Search,” he stated. “Importantly, no Covid-19 cases have been reported within our PNG operations, which highlights the successful efforts of the team and the PNG LNG operator in maintaining safe and reliable operations,” added Wulff. “The ongoing discussions between all parties on progressing LNG expansion opportunities in PNG have coincided with a strengthening in demand and a potential improvement in the LNG price outlook, despite the Covid-19 impact on global energy and LNG demand pushing back the demand window to around 2027,” he said.

PAVILION ENERGY of Singapore has signed a cooperation agreement with Gasum of Finland to develop a global LNG bunkering supply network for customers in Singapore and Northern Europe, including Amsterdam, Rotterdam and Antwerp. Under a memorandum of

understanding, the Asian and Nordic partners said they had agreed to leverage each other’s LNG bunkering infrastructure and supply capabilities to provide global supply points for customers. “Pavilion Energy is thrilled to partner with Gasum and provide customers with a wide LNG bunker network for ocean-going vessels sailing between the Far East and Northern Europe,” said Mr Frédéric H. Barnaud, Group Chief Executive of Pavilion Energy, after the virtual signing in both Finland and Singapore.

As a licensed LNG importer and bunker supplier for Singapore, Pavilion has taken several firm steps to invest in and support Singapore’s LNG bunker readiness. The company is a subsidiary of the city-state’s wealth fund Temasek. Gasum is owned by the government of Finland and has five LNG bunkering vessels in operation and several LNG terminals and plants in Nordic region. “We will complement this alliance with additional LNG bunkering partnerships in the Mediterranean, North Asia and the Americas,” added Barnaud. “Our network will combine global commercial offerings with regional operational expertise and bring further momentum to the emergence of a thriving LNG bunkering industry,” he stated. Johanna Lamminen, the CEO of Gasum, said the partnership underlined their aims for the eventual creation of a global bunkering network. “For our customers this means that we will support them with LNG wherever they are,” added Lamminen. “We are very happy to have Pavilion Energy as a partner in the Far East supporting our shipping customers,” said the Gasum CEO.

Gasum owns a network of LNG import terminals, a liquefaction plant and an expanding chain of LNG fuel stations for vehicles in the Nordic region. Its terminals include Sweden’s Nynashamn small-scale facility with 20,000 cubic metres capacity of storage and purchased in April 2020 by Gasum from Germany’s Linde AG. The Finnish company also has a small-scale liquefaction plant in Risavika, near Stavanger in Norway, in addition to owning and operating other small regasification and import terminals in Ora and Alesund in Norway and Lysekil in Sweden. It also partly owns the Pori LNG import terminal in Finland and has a stake in the Finnish Tornio Magna regasification facility. The Tornio terminal in Northern Finland is the largest in the Nordic region. It is located on the Swedish border which allows it to serve Gasum’s customers in Finland, Sweden and Norway.

PIERIDAE ENERGY, the Canadian LNG plant developer with plans to export cargoes to Germany, has engaged leading energy engineer Bechtel to replace another US firm KBR and to review its export project in Nova Scotia and come up with a construction price. “Respected global engineering firm Bechtel is now on board to initiate a detailed review of scope and design and to develop a comprehensive engineering, procurement, construction and commissioning plan by March 31, 2021 for the Goldboro LNG facility, along with delivering a final lump sum, turnkey EPCC contract price proposal by May 31 of next year,” said Pieridae in a statement. KBR carried out initial work but earlier in 2020 decided that it was pulling back from energy industry activities as part of a strategy change to concentrate on government contracts in defence and other areas.

Pieridae Chief Executive Alfred Sorensen said that appointing Bechtel for the engineering work was a very positive step forward for Goldboro LNG. “Bechtel has significant experience building and delivering global LNG projects, helping their customers deliver about 30 percent of the world’s LNG capacity over the past two decades,” added Sorensen. “They have a proven track record of delivering projects throughout the world on time and on budget,” he stated. Pieridae has a supply agreement with German energy company Uniper Global Commodities. The Toronto-listed company has also managed negotiate extensions of deadlines under its 20-year accord with

Uniper. The key extension is June 30, 2021 for the deadline to make a positive final investment decision for the LNG plant to be built. The Calgary Alberta-based company's deal with Uniper is for all of the LNG produced from Goldboro’s Train 1, amounting to 4.8 million tonnes per annum. Among its regulatory approvals, Canada has granted Pieridae 20-year licenses to import natural gas from the United States and export it as LNG from the Goldboro plant. In addition, the US Department of Energy has granted Pieridae a similar licence to export natural gas from the US to Canada to supply Goldboro with feed-gas and to export the LNG from Canada.

POSCO, the South Korean steelmaker, LNG importer and trading company, said it formed a venture with research subsidiaries of US oil and gas major ExxonMobil to apply high-manganese steel to storage tanks for use in LNG and energy applications. POSCO signed the accord with ExxonMobil's Research Engineering Company (RE) and ExxonMobil Upstream Research Company (URC) during an online ceremony. The Korean group and the two ExxonMobil research units have agreed to make joint efforts to expand high-manganese steel's applications to global LNG projects and other energy-related sectors. ExxonMobil RE is in charge of basic research for materials for the US company and ExxonMobil URC is responsible for new material applications in existing facilities.

Manganese steel refers to steel alloy containing 10 percent to 27 percent manganese to improve durability, strength and cryogenic toughness. Due to its strength, the material is designed to be applied to cryogenic LNG and fuel tanks. POSCO developed its high-manganese steel in 2013, containing 22.5 percent to 25.5 percent of manganese and it is capable of withstanding temperatures as low as minus 196 degrees Celsius. The Korean group believes it is the world's first company to develop high-manganese steel for commercial use. POSCO won government approval for using high-manganese steel for land-based LNG tanks and applied the material to LNG storage Tank No. 5 at POSCO Energy's LNG import terminal at Kwangyang in Korea’s southern Jeolla province. The Kwangyang LNG terminal was Korea's first import facility not controlled by state-run Korea Gas Corp. when it opened in 2005 and currently has 530,000 cubic metres of storage.

The International Maritime Organization's Maritime Safety Committee has approved interim guidelines on applying POSCO's high-manganese steel in cryogenic LNG storage and fuel tanks. “This cooperation and commitment to long-term, strategic technology development combines ExxonMobil's expertise in metallurgy application with POSCO's expertise in world-class, high-quality steel manufacturing,” said ExxonMobil URC President Tristan Aspray. The head of POSCO's Technical Research Laboratories, Lee Duk-lak, said he was delighted with the cooperation venture. “Along with steel alloy and its related technologies, we hope POSCO and ExxonMobil advance their work on reducing carbon-dioxide emissions and on other eco-friendly technologies,” said Lee.

POSCO said that this was not the first time that the Korea steel company and trader had teamed up with ExxonMobil on developing new materials. In 2017, the two sides jointly developed high-manganese steel for pipelines carrying oil sand slurry. “The energy dual challenge, supplying energy for modern life while minimizing the impact on the environment, is one of the most important issues facing society,” said ExxonMobil RE Vice President Vijay Swarup. “Technology innovation and collaboration are critical today, and we believe that the partnership with POSCO will provide novel technology solutions to address the dual challenge,” added Swarup.

QATAR Petroleum, the leading global LNG exporter, has arranged storage and redelivery capacity for 25 years at Europe’s largest import terminal, the UK Isle of Grain facility, located southeast of London. The deal was signed between the UK company and gas network operator, National Grid Plc, and Qatar Petroleum’s Qatar Terminal Limited (QTL) unit after the conclusion of an open season process launched by the UK operator away back in November 2019. Qatar said its affiliate will subscribe to the equivalent of up to 7.2 million tonnes per annum of LNG as part of the terminal's future throughput capacity. The Qataris said that by entering into the agreement the Gulf nation was “reaffirming” its commitment to the UK gas market. Qatargas is a majority shareholder at the UK’s second-largest import terminal, the South Hook facility at the Welsh port of Milford Haven.

The Isle of Grain terminal, located on the Isle of Grain on the Thames-Medway

estuary about 45 miles southeast of London in the country of Kent, is currently able to store and deliver enough gas to meet at least 25 percent of UK gas demand. The UK-Qatar agreement was signed by Saad Sherida Al-Kaabi, Qatar’s Minister of State for Energy Affairs as well as being President and Chief Executive Qatar Petroleum, and Jon Butterworth, the Managing Director of National Grid Ventures, during a virtual ceremony. The ceremony was attended by the Kwasi Kwarteng, the Minister of State for Business, Energy and Clean Growth in the UK, and senior executives from both sides. “We believe this agreement will facilitate a greater role for LNG as a reliable, economic, and environmentally friendly source of energy in the UK,” said Al-Kaabi.

The Qatari CEO also highlighted the strong cooperation between Qatar and the UK in the field of energy, as well as the importance of this agreement. “Our agreement with Grain LNG will strengthen our position in support of advancing greater access to secure, flexible, and reliable gas supplies for all customers in the UK,” explained Al-Kaabi. “I would like to commend National Grid for a very transparent and successful Open Season process, and look forward to further cooperation to strengthen our relationship,” he stated. National Grid’s Butterworth said it was an important day for UK gas security, for Grain LNG and for the community around the Isle of Grain. “LNG imports play a critical role in making sure the UK has the gas it needs, when it needs it,” added Butterworth. “This agreement ensures that Grain LNG will continue to offer the UK a flexible and reliable supply of gas to complement the growth of intermittent renewable generation,” he stated.

“It also secures the future of a facility that is a significant contributor to the economy on the Isle of Grain. I look forward to working with Qatar Petroleum in the coming years and to continuing to operate a world-class asset that market participants and UK consumers can rely on,” he declared. The Isle of Grain terminal began operations in 2005 and is regulated by the Office of Gas and Electricity Markets, known as Ofgem. The regasification facility has 1 million cubic metres of LNG storage capacity spread across eight storage tanks and an annual throughput capacity of 20 billion cubic metres of natural gas. The terminal will be expanding its facilities with an additional tank and associated vaporizer

Diary of events

February 2021

American LNG Forum)

February 9-10, 2021

Hotel Marriott Marquis
1777 Walker St, Houston,
Texas, USA

<https://americanlngforum.com>

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>

capacity, bringing its future annual throughput to 25 Bcm of natural gas, or 18.5 million tonnes per annum of LNG.

SEA CARGO CHARTER is a new body founded by a group of the world's largest energy and commodities companies, including major LNG cargo market participants Royal Dutch Shell and Total as well as the trading firms Gunvor and Trafigura, to disclose the climate-change alignments of their own shipping activities. The 17 founding members of the group pointed out in their statement that the international shipping industry carries around 80 percent of world trade flows and is responsible for 2-3 percent of global greenhouse-gas emissions annually. The shipping of crude oil, coal and LNG as well as iron ore, grain and other bulk commodities make up over 80 percent of global seaborne trade. "The Sea Cargo Charter is a global framework that allows for the integration of climate considerations into chartering decisions to favor climate-aligned maritime transport," said the statement signed by the 17 founding companies. "The Sea Cargo Charter establishes a common baseline to quantitatively assess and disclose whether shipping activities are aligned with adopted climate goals," it added.

Charter signatories aim to ensure that their activities align with the policies and ambitions adopted by member states of the International Maritime Organization, the specialized London-based United Nations agency responsible for regulating shipping. "This includes its ambition for greenhouse-gas emissions from international shipping to peak as soon as possible and to reduce shipping's total annual greenhouse gas emissions by at least 50 percent of 2008 levels by 2050, with a strong emphasis on zero emissions," the Sea Cargo Charter signatories stated. One of the founding members, French energy major Total, said it shared the ambition of many to get to net-zero emissions by 2050. "As a broad-based energy company, we are actively working on improving the environmental footprint of the maritime industry," said Luc Gillet, Senior Vice President for Shipping at Total Trading & Shipping. "By becoming a founding member of the Sea Cargo Charter, we reaffirm our support for this key sector," added Gillett. "This pioneering initiative will provide a transparent standard emissions reporting approach and will pave the way for a sustainable shipping industry," stated Gillet.

Jan Dieleman, Chairman of the Sea Cargo Charter drafting group, said one of the aims was to make GHG emissions regulations simpler to understand in the whole shipping industry. "A standard greenhouse gas emissions reporting process will simplify some of the complexities often associated with reporting," explained Dieleman. "It will encourage a more transparent and consistent approach to tracking emissions, which will be a critical part of making shipping more sustainable," he added. The 17 founding signatories of the Sea Cargo Charter are: Anglo American, ADM, Bunge, Cargill Ocean Transportation, COFCO International, Dow, Equinor, Gunvor Group, Klaveness Combination Carriers, Louis Dreyfus Company, Norden, Occidental, Shell, Torvald Klaveness, Total, Trafigura, and Ørsted. "All other responsible shippers are invited to join the initiative," they stated. "The Sea Cargo Charter enables leaders from diverse industry sectors to use their influence to drive change and promote shipping's green transition by choosing maritime transport that is aligned with agreed climate targets over that which is not," said Johannah Christensen, Managing Director, Head of Projects & Programmes for the non-profit Global Maritime Forum.

The Sea Cargo Charter is intended to evolve over time as the IMO adjusts its policies and regulations and when further adverse environmental and social impacts are identified for inclusion. The actual development of the Sea Cargo Charter has been led by global shippers, Anglo American, Cargill Ocean Transportation, Dow, Norden, Total, Trafigura and leading industry players, Euronav, Gorrissen Federspiel, Stena Bulk. They received expert support provided by the Global Maritime Forum, Smart Freight Centre, University College London Energy Institute-UMAS, and Stephenson Harwood.

SHELL said its Prelude floating liquefied natural gas export plant off the coast of northwest Australia would not resume full production this year after being shut down in February 2020 because of safety issues. Shell closed the Prelude FLNG hull following technical problems on the vessel that required additionally safety measures by the Australian regulatory authorities. "Full production is not expected to resume before year end," said Shell. "We continue to work through the process for

hydrocarbon restart of Shell's Prelude FLNG facility, with safety and stability foremost in mind," it explained. "Prelude is a multi-decade project, and our focus is on delivering sustained performance over the long term," added the Anglo-Dutch company. Shell had been given more time by the Australian regulatory authorities to meet additional safety requirements brought to its attention by inspectors visiting the Prelude FLNG hull.

Shell was previously told that due to "mitigating circumstances" of Covid-19 it had been given until May 31 to satisfy a list of requirements that followed a previous inspection visit. The Australian regulator that had given new directives to Shell is the National Offshore Petroleum Safety and Environmental Management Authority (Nopsema). The Prelude FLNG hull, located 475 kilometres north-northeast of the town of Broome in Western Australia, started commercial operations in June 2019 and has capacity to produce 3.6 million tonnes per annum of LNG. It is anchored in the Browse Basin and is the world's fourth FLNG venture to start operations.

At the end of January 2020, Shell was asked by Nopsema to act on two particular issues on the Prelude hull. It was firstly told to conduct a detailed review of those aspects of the safety management system that related to the safe isolation of plant and equipment and to identify the gaps with industry good practice. Another directive told Shell "not to conduct intrusive activities into plant and equipment where the loss of containment as a result of that intrusive activity could result in risk to the health and safety of persons." Nopsema had conducted an inspection that included the topic "Safe Isolation of Plant and Equipment". However, it said at the time that Shell's written aspects of the SMS were broadly consistent with good industry practice. The report made 10 recommendations to improve minor gaps including action on possible electrical trips.

TC ENERGY Corp., the leading North American pipeline company supplying natural gas to the US and Mexico and feed-gas for projects such as LNG Canada, has announced the retirement of President and Chief Executive Russ Girling. The CEO will step down from his posts and the board of the Calgary, Alberta-based company at the end of December. His replacement has been named as François Poirier, currently

Chief Operating Officer and President of TC Energy's Power & Storage and Mexican divisions. Girling will assist Poirier with the transition through February 28, 2021. One of TC Energy's main current projects is building the Coastal GasLink Pipeline from Dawson Creek to the Royal Dutch Shell-led LNG Canada project at Kitimat in British Columbia. Among its many other ventures in North America, the Canadian company is a shareholder in the South Texas-Tuxpan pipeline with Sempra Energy's IEnova. The pipeline crosses part of the Gulf of Mexico from Texas and was built at a cost of \$2.5 billion for US exports to Mexico. "On behalf of all Board members, I would like to thank Russ for his invaluable contributions to the company," said Siim Vanaselja, TC Energy's Board Chairman. "Over the last decade, he has led TC Energy through a period of unprecedented growth and transformation, including the development of its Liquids pipelines footprint, expansion of its Mexican natural gas pipelines business, the successful US\$13 billion acquisition of Columbia Pipeline Group and advancement of North American LNG," stated the Board Chairman.

Vanaselja praised Girling for creating "a culture of excellence" focused first on the safety of employees and those in the communities where the company operates. "It has been a privilege and honour to lead TC Energy over the past 10 years and to be part of the extraordinary TC team," said Girling. "With the wisdom and guidance of the Board and the skills and tenacity of our dedicated employees, we have accomplished many things, delivered the energy critical to millions of people safely and reliably every day, and created significant shareholder value," stated Girling. "I am grateful for the opportunity and confident in how the Company is positioned to prosper as global demand for energy continues to grow and transition in the years ahead," Girling concluded. Vanaselja said he was confident in the choice of François Poirier as Girling's successor having seen his leadership over six years at TC Energy. "He has had exposure to all aspects of our business and consistently shown unwavering commitment to the company's long-term success. His integrity, strategic thinking, commercial acumen and bottom-line focus will serve the Company well in the years ahead," stated the Chairman. ■

Facing up to the methane slip

Technical Editor, Ian Cochran, looks at the problems of reducing methane slip

Due to possible IMO regulations aimed at tightening methane slip from ships' gas fuelled propulsion systems coming sooner rather than later, the two major 2-stroke diesel engine designers have made moves to further reduce this slippage.

A recent IMO report, the Fourth Greenhouse Gas (GHG) study, prepared by a consortium of organisations led by CE Delft, found that GHG emissions from shipping increased by 9.6% from 2012 to 2018 from 977 mill tonnes to 1.1 bill tonnes.

Experts predicted a 50% rise in emissions by 2050.

Of the pollutants, methane had increased by 150% during the period, while black carbon has risen by 12%. Methane traps 86 times more heat in the atmosphere than the same amount of CO₂ over a 20-year time period, the report claimed.

This huge rise in methane emissions was largely down to the operation of ships powered by LNG, including the dual-fuel 2-stroke fitted vessels.

The report also highlighted the need to include methane in future phases of the IMO's Energy Efficiency Design Index (EEDI) regulations. Currently, only CO₂ emissions are limited under the EEDI.

Dr Bryan Comer, Senior Researcher, ICCT Marine Program, who led the review and revision of the study's bottom-up methodology, said that a lack of an IMO methane regulation was a problem.

"Methane is not yet regulated by the IMO, but it should be because it has a much stronger global warming potential than CO₂. We urge IMO to include all greenhouse gases, including methane, in the next phase of the EEDI to limit emissions from new LNG-fuelled ships," he said.

Recently, both MAN Energy Solutions (MAN) and WinGD claimed a considerable reduction in methane slip in their latest dual fuel engine ranges. In addition, large orders were announced for gas friendly dual fuel engines to be fitted on newbuildings.

For example, MAN has received an order for five 6G70ME-GI Mk 10.5 dual-fuel engines, which will be fitted on board five 210,000-dwt Newcastlemax bulkcarriers ordered by Singapore-based shipping company, Eastern Pacific (EPS).

EPS has chartered the vessels to Australian mining giant BHP for five years, upon their delivery in 2022. They will ship iron ore from Western Australia to China.

Thomas Hansen, MAN's Head of Promotion and Customer Support, said: "This order is notable in that these Newcastlemax bulkers are the first dual-

fuel vessels of their size and show the capability of our engine technology. It also shows that the bulk segment – as well as the tramp trade – is keenly aware of the need to deal with greenhouse gases, and the inherent potential of alternative fuels. Our recent Hafnia order is another example of this trend."

Hafnia placed an order at Guangzhou Shipyard International (GSI) last month for two 6G60ME-GI Mk 10.5 dual-fuel engines to power two LR2s under a timecharter to Total. An option for a further two vessels was included in the contract.

Hansen concluded: "It's encouraging that major market players are giving such consideration to the environment. In this respect, the ME-GI engine's negligible methane slip is a significant advantage. The ME-GI is mature technology that continues to accumulate references in multiple segments."

MAN claimed that its low-speed, dual-fuel references now exceeded 333 units, with ME-GI engines recording over 1.5 mill operating hours on LNG alone.

The company has developed an ME-LGI (liquid gas injection) dual-fuel engine, enabling the use of more sustainable fuels, such as methanol and liquefied petroleum gas (LPG) in the future.

MAN also said that it believed it is time for what it terms a 'Maritime Energy Transition' to find clean, de-carbonised solutions for seaborne trade and transportation. The engine developer strongly promoted a global 'turn to gas', driven by the IMO, and a common approach by the shipping industry and politics to invest in infrastructure development and retrofits.

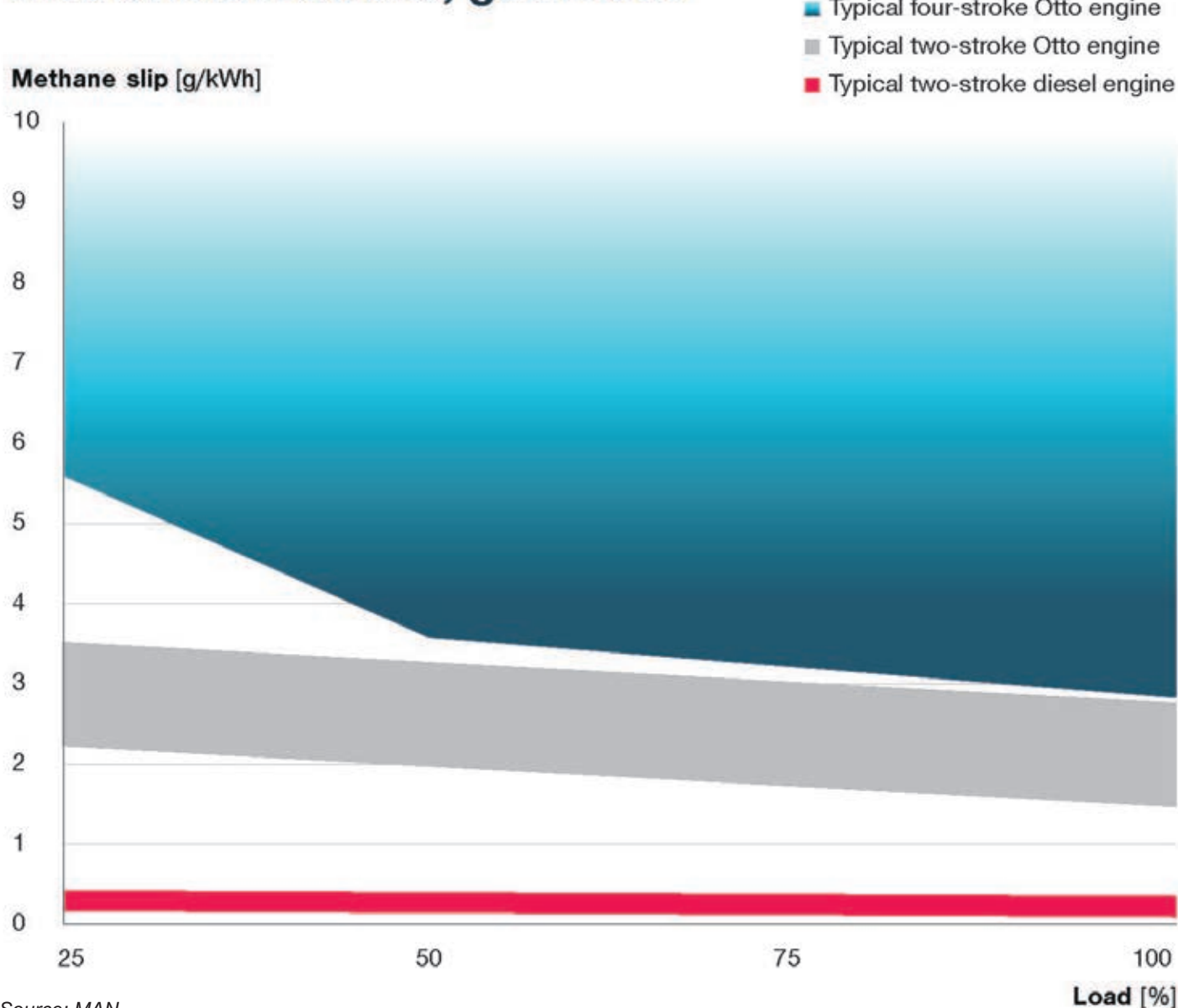
Methane slip study

In a paper recently published by the engine designer, it was pointed out that the methane slip issue had received a lot of attention recently and raised questions on the climate benefits of LNG as a fuel.

In some contemporary reciprocating engines, LNG used as a fuel can lead to emissions of small but significant quantities of unburned CH₄ into the atmosphere.

Three separate methods are being examined to achieve lower methane slip

Methane emissions, gas mode



Source: MAN

Methane emissions in gas mode – comparison of different engine types



David Jung Alfa Laval Business Development Manager

levels - First, ongoing improvements to internal engine design and electronic controls will further increase fuel efficiency and minimise emission: Second, newly developed after treatment solutions, namely oxidation catalysts, have the potential to reduce methane slip by high double-digit percentages: Third, MAN is also evaluating options to bring the negligible methane slip of its ME-GI 2-stroke dual-fuel engines to its medium speed dual-fuel engines by transferring the ME-GI Diesel combustion principle to its 4-stroke dual-fuel engines.

Moreover, as well as orders for new engines, MAN PrimeServ, the company's after-sales organisation, is seeing growing demand for conversions of existing oil-fuelled engines to LNG fuelling on both land and sea. Accordingly, PrimeServ has developed methodology to retrofit MAN's major diesel engine series for gaseous fuels, with packages designed to ensure that the existing MAN 2- and 4-stroke engines remain viable assets.

Without countermeasures, there are several routes by which methane can escape unburned into the atmosphere from both 2- and 4-stroke gas burning engines, MAN said. This methane evades combustion and is emitted via the engine exhaust, as well as the crankcase ventilation - the methane slip.

As well as a source of GHG leakage into the atmosphere, methane slip is also wasted fuel, thus not converted into energy.

In its 2-stroke engine programme, MAN is offering what it claims to be a very effective solution to minimise methane slip. ME-GI 2-stroke dual-fuel engines are achieving low levels of

unburned methane emission, due to operating with the high pressure Diesel combustion principle.

With regard to the possible use of exhaust after treatment to minimise the methane slip from 2-stroke DF engines, oxidation catalysts were not feasible given that the exhaust gas temperatures typical of these engines are too low to trigger a reaction with the unburned methane, MAN explained.

Modular design

MAN's engines modular design supports retrofitting to various engine configurations and the electronically controlled ME-C engines can be readily converted to dual-fuel operation. The resulting dual-fuel engines can, in turn, be retrofitted for operation on other fuels: for example, methanol engines (ME-LGIM) can be retrofitted to operation on LPG (ME-LGIP), etc. Furthermore, MAN is working towards offering engines and retrofit solutions for use with ammonia (NH₃) as a fuel. The aim is to have an ammonia-burning engine ready by 2024.

For the 4-stroke models, MAN has been addressing methane slip since it introduced DF engines in the mid-2000s. For example, since the launch of the 4-stroke MAN 51/60 DF engine, countermeasures have more than halved its methane slip, giving this engine type a 5% to 15% advantage over liquid fuel engines in terms of GHG emissions, even when the methane slip is considered in the calculation.

As the technology matures, measures are being applied in both new 4-stroke DF engines ie the 51/60 and 35/45 DF, and diesel engines being retrofitted by the MAN PrimeServ after-sales department to run on LNG, such as 48/60 diesel to 51/60 DF conversions.

MAN said that it had already reduced methane slip from its 4-stroke gas-burning engines by more than half in the last 10 years, leading to a GHG benefit of around 5% to 15%, compared to conventional diesel engines.

Large containership

As for rival WinGD, which claims the lion's share of the LNG carrier propulsion system market, one of the company's dual-fuel engine designs is powering the recently delivered 23,000 TEU containership 'CMA CGM Jacques Saade'.

The first of nine, she is the world's largest containership to be fitted with an LNG fuelled engine - WinGD's 12X92DF.

In a move to combat methane slip,

WinGD has co-operated with partner Alfa Laval to produce a solution.

Alfa Laval's PureCool system is the main component in WinGD's Intelligent Control by Exhaust gas Recycling (iCER) technology, an option that can be used on the new WinGD X-DF engines to reduce methane slip and significantly boost fuel and energy efficiency, the company claimed.

"With IMO aiming to cut greenhouse gas emissions by at least 50% compared to 2008 levels, LNG has a major role as a bridge fuel in moving towards a carbon-neutral future," explained David Jung, Alfa Laval's Business Development Manager.

"However, the awareness of methane slip and its influence on global warming is increasing. New regulations are not unthinkable, and any improvement from today's environmental benchmark is important. With or without regulations, WinGD's iCER technology with the Alfa Laval PureCool system will help the shipping industry align more fully with climate goals by minimising methane slip."

PureCool is the cascade exhaust gas cooling system at the heart of WinGD's iCER concept and is the first development to be unveiled in X-DF2.0, WinGD's second-generation dual-fuel engine technology.

"The iCER option is a standalone installation adjacent to the engine," said Jung. "During operation in gas mode, it improves combustion by cooling and recirculating about 50% of the exhaust gas through a low-pressure path with full turbocharger capacity. This minimises methane slip, and the PureCool system provides the vital cooling function that makes it possible."

Trials at WinGD's dedicated engine test facility, which were the final step in a two-year testing programme, showed a methane slip reduction of up to 50%.

"This is not fine-tuning or a marginal improvement of LNG technology," Jung added. "This is a major environmental gain that truly strengthens LNG's profile. With the PureCool system at its heart, iCER will cut methane slip by as much as half."

Beyond the methane slip reduction, an iCER solution fitted with PureCool offers engine buyers significant operational benefits – thus creating value even prior to potential compliance regulations. When combustion is improved with iCER, fuel consumption in gas mode is reduced by 3%.

"The PureCool system improves a vessel's efficiency along with its emissions," Jung said. "The fuel savings inherent to iCER can have a positive impact on a vessel's Energy Efficiency Design Index (EEDI)."

The need for regulatory action becomes apparent when figures produced by DNV GL suggest that the number of ships fitted with engines capable of burning LNG consumption as a fuel will grow by a factor of four or five times from 2018 to 2023 and will double over the next couple of years.

Although tankers held the lion's share of dual fuelled or LNG ready engines this year, large containerships are fuelling the growth going forward. There are also around 30 cruise ships, either on order or in service using LNG, according to DNV GL figures.

Today, about 5% of the world's shipping orderbook comprises vessels fitted with engines capable or ready to be converted to LNG. These figures exclude LNGCs.

Another champion of LNG as an interim fuel is Shell. Krishna Achuthanandam, Marine LNG Business Development Team Leader speaking at a webinar, agreed that LNG is the best available low emission fuel available today.

He claimed that LNG has a five to 10 year payback over low sulfur fuel oil and said the company had been working on the logistics of supplying the fuel.

Addressing methane slip, he said over the last 25 years or so, methane slip measured on dual fuel Otto cycle engines had been slashed by around 75%.

Work is ongoing to further drastically reduce methane slip during the next few years and Shell is involved with the engine manufacturers to help solve the problem.

He claimed that Shell was taking the lead in advocacy regarding methane slip and had introduced a methane slip measurement tool on its managed vessels.

Understandably, methane slip is now firmly on the IMO's radar and in 2019, it declared that the aim was to produce 'concrete proposals to reduce methane slip and volatile organic compounds emissions'. This work is still ongoing in the form of a study.

Due to the pandemic, the IMO's 75th MEPC meeting was postponed earlier this year but will now be held virtually between 16th and 23rd November this year when an update might be forthcoming. ■

LNG-powered fuel cells promise deep-sea potential

A Norwegian consortium of technology developers has announced plans for a pilot project to develop flexible fuel cells, capable of running on LNG. LNG Journal's fuelling editor Malcolm Ramsay reports

The new technology aims to reduce emissions from shipping by 40 to 100% and to offer shipping lines the ability to switch between fuel sources. Core partners in the pilot project are fuelling specialist Odfjell, cleantech developer Prototech, maritime engine manufacturer Wärtsilä and oil and gas exploration and production company Lundin Energy Norway.

“We are developing a fuel cell system that can run on different fuels depending on what is and will be available at different locations at a given time. The aim is to reduce end-users risk around selecting a single future fuel,” Bernt Skeie, CEO of Protech, said in comments to *LNG Journal*.

On-land testing 2021

An initial on-land testing phase is scheduled to take place at the Sustainable Energy catapult centre in Norway in 2021 with installation onboard a Odfjell chemical tanker set to take place thereafter.

“We are currently testing a down-scaled system on-land to verify functionality, performance, and reliability, and to prepare for the ship installation,” Skeie explains. “On-board the Odfjell vessel, the system is sized to be able to cover the auxiliary load of the vessel both during transit and in port operations.

“In this way, we will be able to test and verify the system under realistic operational conditions. This data will give valuable input to possible future installations covering both propulsive

power and auxiliaries.”

While battery technology offers some potential for transport solutions on land, and for certain vessels while in dock, the technology is limited for deep-sea transit an area where the fuel cell developers see advantage.

“Ships are to be operated for 20-30 years, and we need flexible solutions that can meet future emission requirements. We do not have time to wait, we have to think about zero emissions already now,” Erik Hjortland, VP Technology at Odfjell notes. “The fuel cell project is one of the paths we are pursuing. We focus on machinery rather than focusing on one single type of fuel. Fuel cell technology gives us flexibility that ensures environmentally efficient operation regardless of fuel changes that may occur in the years ahead.”

Flexible operation

The new technology is based on a solid oxide fuel cell (SOFC) stack that can provide emission-free operation over long distances and flexibility in operation based on the availability or pricing of fuel in different locations.

“The new energy solution has the potential to take us a big step closer to the goal of climate neutrality. Fuel flexibility will be a significant contribution to secure future solutions for new ships. And it does not stop with ships, this solution can also be used in offshore oil and gas operations,” Ingve Sørffonn, Technical Director in Wärtsilä, notes.

As well as LNG, the system can be run



Fuel cell

on green ammonia at sites where this fuel is available, offering the potential for completely emission-free operation.

“The maximum power output from the fuel cells will be 1.2 megawatts, which covers almost all port operations, as well as the power usage during transit. The down-scaled on-land test will be approximately 100 kilowatts,” Skeie adds.

Total efficiency of up to 85%

Scandinavia has been a driver in uptake of LNG fuelling for the maritime sector, due to some of the strictest Emission Control Areas in the world and the prevalence of short sea shipping routes in the Baltic region. As a result, LNG bunkering infrastructure is relatively well-established alongside alternative fuel sources.

“The development of this fuel cell is an example of how forward-looking shipping companies and our unique maritime expertise have the prerequisites to drive new solutions through a broad

collaboration within the maritime cluster,” Harald Solberg, CEO of the Norwegian Shipowners' Association, state. “In the long run, scaling up such solutions will be of great importance in achieving our climate goals, they will have business value, and they can create new jobs in Norway. Norwegian shipping has set ambitious climate goals. This type of projects is very important for us to be able to develop solutions that quickly reduce emissions.”

Although the low-emission profile of the fuel cell is a driving factor in its development, efficiency remains an important goal for the developers with pilot project aiming to demonstrate ‘significant cost savings’

“The electrical energy efficiency of our high temperature fuel cell systems is 60-65%. In a closed system in which heat is also captured another 20% can be added to the equation bringing total efficiency up to 80-85%,” Skeie adds.

CHEOP system

The partners now hope the new Clean Highly Efficient Offshore Power (CHEOP) technology will not only meet strict emissions limits while in ECA zones but will also support cleaner operation across the global deep-sea fleet.

“This [deep-sea] fleet consists of more than 50,000 ships globally and thus constitutes a big share of international shipping. It is difficult to achieve the goal of climate neutrality without finding solutions for this segment,” a spokesperson for Odfjell notes.

Funding for the project has so far been provided by the partners with support from Gassnova and the Research Council of Norway (NFR).



Illustration of the fuel cell solution mounted on board an Odfjell ship. Photo - Odfjell



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World LNG Carrier Fleet

LNG carrier	Capacity m ³	Owned or Ordered by	Builder	Delivery Date	Flag	Power Plant	Cargo System	No. of tanks	Ship built for Export plant
Aamira	266,000	QGTC	Samsung	Dec-10	Liberia	DRL	GTT	5	Qatargas IV
Abadi	135,000	Brunei Gas Carriers	Mitsubishi Nagasaki	Jun-02	Brunei	S	Moss	5	Brunei LNG
Abalamabie	174,900	Bonny Gas	Samsung	June-16	Bermuda	DFDE	GTT	4	Nigeria LNG
Adam LNG	162,000	Oman LNG	Hyundai	Dec-14	Marshall Is.	DFDE	GTT	4	Oman LNG
Adriano Knutsen	180,000	Knutsen	Hyundai	Jul-19	Spain	MEGI-DF	GTT	4	charter
Al Aamriya	210,100	J5 Consortium	Daewoo	Feb-08	Marshall Is.	DRL	GTT	4	Qatargas
Al Areesh	151,700	Teekay LNG	Daewoo	Jan-07	Qatar	S	GTT	4	Ras Gas II
Al Bahiya	210,185	QGTC	Samsung	Oct-09	Liberia	DRL	GTT	5	Qatar-Atlantic
Al Biddah	135,275	J4 Consortium	Kawasaki Sakaide	Nov-99	Japan	S	Moss	5	Qatargas
Al Daayen	151,700	Teekay LNG	Daewoo	Apr-07	Qatar	S	GTT	4	RasGas II
Al Dafna	266,000	QGTC	Samsung	Oct-09	Marshall Is.	LR DRL	GTT	4	Qatar-Atlantic
Al Deebel	145,000	Peninsular LNG	Samsung	Dec-05	Bahamas	S	GTT	4	Qatargas
Al Gattara	216,200	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	GTT	4	Qatargas II
Al Ghariya	210,100	ProNav	Daewoo	Feb-08	Bahamas	DRL	GTT	4	Qatargas
Al Gharaffa	216,200	OSG/Nakilat	Hyundai	Jan-08	Marshall Is.	DRL	GTT	4	Various
Al Ghashamiya	216,000	QGTC	Samsung	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Al Ghuwairiya	261,700	QGTC	Daewoo	Aug-08	Marshall Is.	DRL	GTT	5	Qatar-Atl'c Basin
Al Hamla	216,000	OSG	Samsung	Feb-08	Marshall Is.	DRL	GTT	4	QatarGas
Al Hamra	137,000	National Gas Shipping	Kvaerner-Masa	Jan-97	Liberia	S	Moss	4	ADGAS
Al Huwaila	217,000	Teekay	Samsung	May-08	Bahamas	DRL	GTT	4	RasGas III
Al Jasra	137,100	J4 Consortium	Mitsubishi Nagasaki	Jul-00	Japan	S	Moss	5	Qatargas
Al Jassasiya	145,700	Maran-Nakilat	Daewoo	May-07	Greece	S	GTT	4	RasGas
Al Kharaitiyat	216,200	QGTC	Hyundai	May-09	Liberia	DRL	GTT	4	Qatargas III
Al Kharaana	210,000	QGTC	Daewoo	Oct-09	Marshall Is.	DRL	GTT	4	Qatargas IV
Al Kharsaah	217,000	Teekay	Samsung	May-08	Bahamas	DRL	GTT	4	RasGas III
Al Khatiya	210,000	QGTC	DSME	Oct-09	Marshall Is.	DRL	GTT	4	Qatargas IV
Al Khaznah	135,500	National Gas Shipping	Mitsui Chiba	Jun-94	Liberia	S	Moss	5	ADGAS
Al Khor	137,350	J4 Consortium	Mitsubishi Nagasaki	Dec-96	Japan	S	Moss	5	Qatargas
Al Khuwair	217,000	Teekay LNG	Samsung	Jul-08	Korea	DRL	GTT	4	RasGas
Al Mafyar	266,000	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	GTT	4	Qatargas II
Al Marrouna	151,700	Teekay	Daewoo	Nov-07	Bahamas	S	GTT		Ras Gas I
Al Mayeda	266,000	QGTC	Samsung	Jan-09	Liberia	DRL	GTT	5	Qatar-US/Var.
Al Nuaman	210,000	QGTC	DSME	Dec-09	Marshall Is.	DRL	GTT	4	Qatargas IV
Al Oraiq	210,000	J5 Consortium	Daewoo	Apr-08	Marshall Is.	DRL	GTT	4	Various
Al Rayyan	135,360	J4 Consortium	Kawasaki Sakaide	Mar-97	Japan	S	Moss	5	Qatargas
Al Rekayyat	216,200	QGTC	Hyundai	Jun-09	Bahamas	DRL	GTT	4	Qatar-Atlantic
Al Ruwais	210,100	ProNav	Daewoo	Nov-07	Germany	DRL	GTT	4	Qatargas II
Al Sadd	210,100	QGTC	Daewoo	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Al Safliya	210,100	ProNav	Daewoo	Dec-07	Bahamas	DRL	GTT	4	Qatargas II
Al Sahla	216,200	J5	Hyundai	Jun-08	Japan	DRL	GTT	4	Ras Gas III
Al Samriya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GTT	5	Qatargas II
Al Sheehaniya	210,100	QGTC	Daewoo	Feb-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Al Shamal	217,000	Teekay LNG	Samsung	Jun-08	Qatar	DRL	GTT	4	RasGas
Al Thakhira	145,000	Peninsular LNG	Samsung	Sep-05	Bahamas	S	GTT	4	Qatargas
Al Thumama	216,000	J5 Consortium	Hyundai	Apr-08	Japan	DRL	GTT	4	Rasgas
Al Utouriya	215,000	J5	Hyundai	Sep-08	Panama	DRL	GTT	4	RasGas
Al Utourma	215,000	J5	Hyundai	Sep-08	Panama	DRL	GTT	4	Ras Gas III
Al Wajbah	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-97	Japan	S	Moss	5	Qatargas
Al Wakrah	135,360	J4 Consortium	Kawasaki Sakaide	Dec-98	Japan	S	Moss	5	Qatargas
Al Zhubarah	137,570	J4 Consortium	Mitsui Chiba	Dec-96	Japan	S	Moss	5	Qatargas
Alto Acrux	147,000	LNG Marine Transport	Mitsubishi	Mar-08	Bahamas	S	Moss	4	Various
Amali	148,000	Brunei-Shell	DSME	Jul-11	Brunei	DFDE	GTT	4	Brunei LNG
Amanl	154,800	Brunei-Shell	Hyundai	Nov-14	Brunei	DFDE	GTT	4	Brunei LNG
Aman Bintulu	18,928	Perbadanan / NYK Line	NKK Tsu	Oct-93	Malaysia	S	GTT	3	Petronas
Aman Hakata	18,800	Perbadanan / NYK Line	NKK Tsu	Nov-98	Malaysia	S	GTT	3	Petronas
Aman Sendai	18,928	Perbadanan / NYK Line	NKK Tsu	May-97	Malaysia	S	GTT	3	Petronas
Arctic Aurora	160,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	GTT	4	Various
Arctic Discoverer	140,000	K Line	Mitsui Chiba	Jan-06	Bahamas	S	Moss	4	Various
Arctic Lady	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Apr-86	Norway	S	Moss	4	Various
Arctic Princess	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Jan-06	Norway	S	Moss	4	Various
Arctic Sun	89,880	Arctic LNG Shipping	IHI Chita	Dec-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Arctic Voyager	140,000	K Line	Kawasaki	Jul-06	Bahamas	S	Moss	4	Statoil
Arkat	148,000	Brunei-Shell	DSME	Feb-11	Brunei	DFDE	GTT	4	Brunei LNG
Arwa Spirit	165,000	Teekay LNG	Samsung	Sep-08	Marshall Is.	DFDE	GTT	4	Various



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Aseem	154,850	K Line-Petronet	Samsung	Nov-09	Malta	S	GTT	4	Qatar-India
Asia Endeavour	160,000	Chevron	Samsung	Dec-14	Bahamas	DFDE	GTT	4	Various
Asia Energy	160,000	Chevron	Samsung	Sept-14	Bahamas	DFDE	GTT	4	Various
Asia Excellence	160,000	Chevron	Samsung	Sept-13	Bahamas	DFDE	GTT	4	Various
Asia Venture	160,000	Chevron	Samsung	Sept-17	Bahamas	DFDE	GTT	4	Various
Asia Vision	160,000	Chevron	Samsung	June-14	Bahamas	DFDE	GTT	4	Various
Bahrain Spirit	173,000	Teekay	Daewoo	Sept-18	Bahamas	DFDE	GTT	4	Various
Barcelona Knutsen	173,400	Knutsen	Daewoo	May-10	N.I.S.	DFDE	GTT	4	Various
Bebatic	75,060	Brunei Shell Tankers	Atlantique	Oct-72	Brunei	S	GTT	6	Brunei LNG
Beidou Star	172,000	MOL	Hudong	Oct-15	Hong Kong	DRL	GTT	4	Various
Berge Arzew	138,088	BW Gas	Daewoo	Jul-04	Norway	S	GTT	4	Sonatrach
Bilbao Knutsen	138,000	Knutsen / Marpetrol	IZAR Sestao	Jan-04	Spain	S	GTT	4	Atlantic LNG
Bilis	77,730	Brunei Shell Tankers	La Seyne	Mar-75	Brunei	S	GTT	5	Brunei LNG
Bishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-15	Panama	S	Moss	4	Australia-Japan
Boris Davydov	172,600	Dynagas	Daewoo	Sept-18	Cyprus	DFDE	GTT	4	Yamal LNG
Boris Vilkitsky	172,600	Dynagas	Daewoo	Jan-17	Cyprus	DFDE	GTT	4	Yamal LNG
British Achiever	173,644	BP Shipping	Daewoo	June-18	Isle of Man	MEGI-DF	GTT	4	Various
British Contributor	173,644	BP Shipping	Daewoo	Oct-18	Isle of Man	MEGI-DF	GTT	4	Various
British Diamond	155,000	BP Shipping	Hyundai	Sep-08	Isle of Man	DFDE	GTT	4	Indonesia-Various
British Emerald	155,000	BP Shipping	Hyundai	Jun-07	UK	DFDE	GTT	4	Tangguh LNG
British Innovator	138,200	BP Shipping	Samsung	Jul-03	Isle of Man	S	GTT	4	Various
British Listener	173,644	BP Shipping	Daewoo	June-19	Isle of Man	MEGI-DF	GTT	4	Various
British Mentor	173,644	BP Shipping	Daewoo	July-19	Isle of Man	MEGI-DF	GTT	4	Various
British Merchant	138,000	BP Shipping	Samsung	Apr-03	Isle of Man	S	GTT	4	Various
British Partner	173,644	BP Shipping	Daewoo	Mar-18	Isle of Man	MEGI-DF	GTT	4	Various
British Ruby	155,000	BP Shipping	Hyundai	Jan-08	U.K.	DFDE	GTT	4	Various
British Sapphire	155,000	BP Shipping	Hyundai	Sep-08	Isle of Man	DFDE	GTT	4	Tangguh
British Sponsor	173,644	BP Shipping	Daewoo	Sept-19	Isle of Man	MEGI-DF	GTT	4	Various
British Trader	138,000	BP Shipping	Samsung	Dec-02	Isle of Man	S	GTT	4	Engas
Broog	135,466	J4 Consortium	Mitsui Chiba	May-98	Japan	S	Moss	5	Qatargas
Bu Samara	266,000	QGTC	Samsung	Dec-08	Qatar	DRL	GTT	5	Qatargas
BW GDF Suez Boston	138,059	BW Gas	Daewoo	Jan-03	Norway	S	GTT	4	Suez LN
BW GDF Suez Everett	138,028	BW Gas	Daewoo	Jun-03	Norway	S	GTT	4	Suez LNG
BW Integrity	170,000	BW Gas	Samsung	May-17	Singapore	DFDE	GTT	4	FSRU
BW Lilac	173,400	BW Gas	Daewoo	Mar-18	Malta	MEGI-DF	GTT	4	various
BW Magna	173,400	BW Gas-Acu Brazil	Daewoo	Mar-19	Singapore	DFDE	GTT	4	FSRU-Brazil
BW Pavilion Aranda	173,400	BW Gas	Daewoo	Oct-19	Singapore	MEGI-DF	GTT	4	Various
BW Pavilion Leeara	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	GTT	4	Various
BW Pavilion Vanda	161,880	BW Gas	Hyundai	Feb-15	Singapore	DFDE	GTT	4	Various
BW Singapore	170,000	BW Gas	Samsung	May-15	Singapore	DFDE	GTT	4	FSRU
BW Suez Brussels	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GTT	4	Yemen-Atlantic
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GTT	4	Yemen-Atlantic
BW Tulip	173,400	BW Gas	Daewoo	Jan-18	Malta	MEGI-DF	GTT	4	various
Cadiz Knutsen	138,826	Knutsen / Marpetrol	IZAR Puerto Real	Jun-04	Spain	S	GTT	4	Engas
Cape Ann	145,000	Hoegh LNG/MOL	Samsung	May-10	Liberia	DFDE	GTT	4	Various
Castillo de Santisteban	173,600	Elcano	STX	Aug-10	Malta	S	GTT		Various
Castillo de Villalba	138,000	Elcano	IZAR	Nov-03	Spain	S	GTT	4	Sonatrach
Catalunya Spirit	138,000	Teekay LNG Partners	IZAR Sestao	Mar-03	Liberia	S	GTT	4	Atlantic LNG
Celestine River	145,000	KLNG	Kawasaki	Dec-07	Bahamas	S	Moss		Various
Cesi Beihai	174,100	MOL-China LNG	Hudong	June-17	Hong Kong	S	GTT	4	Australia-China
Cesi Gladstone	174,100	MOL-China LNG	Hudong	Oct-16	Hong Kong	S	GTT	4	Australia-China
Cesi Lianyungang	174,100	MOL-China LNG	Hudong	June-18	Hong Kong	S	GTT	4	Australia-China
Cesi Qingdao	174,100	MOL-China LNG	Hudong	Nov-16	Hong Kong	S	GTT	4	Australia-China
Cesi Tianjin	174,100	MOL-China LNG	Hudong	Sept-17	Hong Kong	S	GTT	4	Australia-China
Challenger FSRU	263,000	MOL LNG	Daewoo	Oct-17	St Kitts	DFDE	GTT	4	Various
Cheikh Bouamama	75,500	Skikda LNG Transport	USC	Jul-08	Bahamas	S	GTT	4	Sonatrach
Cheikh El Mokrani	75,500	Med LNG Corp	USC	Jun-07	Bahamas	S	GTT	4	Sonatrach
Christophe de Margerie	172,600	SCF	Daewoo	Nov-16	Cyprus	DFDE	GTT	4	Various
Clean Energy	150,000	Dynagas	Hyundai	Mar-07	Marshall Is.	S	GTT	4	Various
Clean Force	150,000	Dynagas	Hyundai	Jan-08	Marshall Is.	S	GTT	4	Various
Clean Ocean	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	GTT	4	Various
Clean Planet	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	GTT	4	Various
Clean Vision	160,000	Dynagas	Hyundai	Jun-15	Marshall Is.	DFDE	GTT	4	Various
Cool Explorer	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Cool Runner	160,000	Thenamaris	Samsung	May-14	Bermuda	DFDE	GTT	4	Various
Cool Voyager	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Corcovado LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Creole Spirit	174,000	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	GTT	4	Cheniere



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Cubal	160,400	Mitsui/NYK/Teekay	Samsung	Jan-12	Bahamas	DFDE	GTT	4	Various
Cygnus Passage	145,400	Cygnus LNG	Mitsubishi	Feb-09	Panama	S	Moss	4	Various
Dapeng Moon	147,000	China Ships	Hudong	Jul-09	China	S	GTT	4	Various
Dapeng Star	147,000	China Ships	Hudong	Nov-09	China	S	GTT	4	Various
Dapeng Sun	147,000	China Ships	Hudong	Jul-07	China	S	GTT	4	Woodside Energy
Diamond Gas Orchid	165,000	MOL-Jera	MHI-Nagasaki	Aug-18	Japan	S-gas	Moss	4	US-Japan
Diamond Gas Rose	165,000	MOL-Jera	MHI-Nagasaki	Aug-18	Japan	S-gas	Moss	4	US-Japan
Disha	136,000	Petronet LNG Ltd.	Daewoo	Jan-04	Malta	S	GTT	4	Qatargas
Doha	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-99	Japan	S	Moss	5	Qatargas
Duhail	210,100	ProNav	Daewoo	Jan-08	Germany	DRL	GTT	4	Various
Dukhan	135,000	J4 Consortium	Mitsui Chiba	Oct-04	Japan	S	Moss	4	Qatargas
Dwiputra	127,385	Humpuss Consortium	Mitsubishi Nagasaki	Mar-94	Bahamas	S	Moss	4	Pertamina
Ebisu	147,547	Golar LNG	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
Eduard Toll	172,000	Teekay-CLNG	Daewoo	Dec-17	Bahamas	MEGI-DF	GTT	4	Various
Ejnan	145,000	4J	Samsung	Jan-07	Bahamas	S	GTT		RasGas
Ekaputra	136,400	Humpuss Consortium	Mitsubishi Nagasaki	Jan-90	Liberia	S	Moss	5	Pertamina
Energy Advance	145,000	Tokyo LNG Tankers	Kawasaki Sakaide	Mar-05	Japan	S	Moss	4	Darwin
Energy Atlantic	159,924	Alpha	STX Jinhae	Sep-15	Malta	DFDE	GTT	4	Various
Energy Confidence	155,000	Tokyo LNG Tankers	Kawasaki	Apr-09	Panama	S	Moss	4	Various
Energy Frontier	147,600	Tokyo LNG Tankers	Kawasaki Sakaide	Sep-03	Japan	S	Moss	4	Darwin
Energy Glory	165,000	Tokyo LNG Tankers	JMU	Sept-18	Japan	S	Moss	4	Various
Energy Horizon	177,000	Tokyo LNG Tankers	Kawasaki	Jul-11	Japan	S	Moss	4	Pluto LNG
Energy Innovator	165 000	MOL-Tokyo gas	JMU Tsu	April-19	Japan	TFDE	IHI-SPB	4	Cove Point-Japan
Energy Liberty	165 000	MOL	JMU Tsu	Oct-18	Japan	TFDE	IHI-SPB	4	Various
Energy Navigator	147,000	Tokyo LNG Tankers	Kawasaki Sakaide	May-08	Japan	S	Moss	4	Various
Energy Progress	145,000	MOL	Kawasaki	Nov-06	Japan	S	Moss	4	Bayu Undan LNG
Energy Universe	165,000	MOL-Tokyo Gas	JMU Tsu	Sept-19	Japan	TFDE	IHI-SPB	4	Cove Point-Japan
Enshu Maru	165,257	K Line	Kawasaki	June-18	Japan	S	Moss	4	Various
Esshu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-14	Panama	S	Moss	4	Australia-Japan
Excalibur	138,200	Exmar/ Excelerate	Daewoo	Oct-02	Belgium	S	GTT	4	Various
Excel	138,106	Exmar/ MOL	Daewoo	Sep-03	Belgium	S	GTT	4	Various
Excelerate	138,000	Exmar/Excelerate	Daewoo	Oct-06	Belgium	S	GTT	4	Various
Excellence	138,000	GKFF Ltd.	Daewoo	May-05	Belgium	S	GTT	4	Excelerate Energy
Excelsior	138,000	Exmar	Daewoo	Jan-05	Belgium	S	GTT	4	Various
Exemplar	150,900	Excelerate	Daewoo	Jun-10	Belgium	S	GTT	4	Various
Expedient	151,000	Excelerate	Daewoo	Nov-09	Belgium	S	GTT	4	Various
Experience RV	174,000	Exmar/Excelerate	Daewoo	Jul-14	Marshall Is.	DFDE	GTT		Various
Explorer	150,900	Exmar/Excelerate	Daewoo	Mar-08	Belgium	S	GTT	4	Excelerate
Express	151,000	Exmar/Excelerate	Daewoo	May-09	Belgium	S	GTT	4	Various
Exquisite	150,900	Excelerate	Daewoo	Sep-09	Belgium	S	GTT	4	Various
Fedor Litke	172,636	Dynagas	Daewoo	Nov-17	Cyprus	DFDE	GTT	4	Various
Flex Endeavour	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	GTT	4	Various
Flex Enterprise	173,400	Flex LNG	Daewoo	Jan-18	Marshall Is.	MEGI-DF	GTT	4	Various
Flex Rainbow	174,000	Flex LNG	Samsung	July-18	Marshall Is.	MEGI-DF	GTT	4	Various
Flex Ranger	174,000	Flex LNG	Samsung	April-18	Marshall Is.	MEGI-DF	GTT	4	Various
Fraiha	210,100	J5 Consortium	Daewoo	Sep-08	Marshall Is.	DRL	GTT	4	Qatargas
FSRU Independence	170,000	Hoegh	Hyundai	Feb-14	NIS	DFDE	GTT	4	Various
FSRU Lampung	170,000	Hoegh	Hyundai	May-14	Indonesia	DFDE	GTT	4	Various
Fuji LNG	147,895	TMSC Gas	Kawasaki	Jun-04	Malta	S	Moss	4	Various
Fuwairit	138,000	Peninsular LNG	Samsung	Jan-04	Bahamas	S	GTT	4	RasGas II
Galea	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
Galicia Spirit	140,620	Teekay LNG Partners	Daewoo	Jul-04	Liberia	S	GTT	4	Engas
Gaselys	153,500	GdF/NYK	Atlantique	Mar-07	France	DFDE	CS 1	4	Engas
Gallina	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
GasLog Chelsea	153,000	GasLog	Hanjin Korea	Dec-09	Panama	TFDE	GTT	4	Various
Gaslog Geneva	174,000	GasLog	Samsung	Sept-16	Bermuda	TFDE	GTT	4	Shell charter
Gaslog Genoa	174,000	GasLog	Samsung	Jun-18	Bermuda	TFDE	XDF	4	Various
Gaslog Gibraltar	174,000	GasLog	Samsung	Oct-16	Bermuda	TFDE	GTT	4	Shell charter
Gaslog Glasgow	174,000	GasLog	Samsung	Jun-16	Bermuda	TFDE	GTT	4	Shell charter
Gaslog Gladstone	174,000	GasLog	Samsung	May-19	Bermuda	XDF	GTT	4	Various
Gaslog Greece	174,000	GasLog	Samsung	Mar-16	Bermuda	TFDE	GTT	4	Shell charter
GasLog Hongkong	174,000	GasLog	Hyundai	Jun-18	Bermuda	XDF	GTT	4	Various
GasLog Houston	174,000	GasLog	Hyundai	Jan-18	Bermuda	XDF	GTT	4	Various
GasLog Salem	165,000	GasLog	Samsung	Apr-15	Liberia	TFDE	GTT	4	Various
GasLog Santiago	155,000	GasLog	Samsung	Mar-13	Liberia	TFDE	GTT	4	Various
GasLog Saratoga	155,000	GasLog	Samsung	Dec-14	Bermuda	TFDE	GTT	4	Various
Gaslog Savannah	155,000	GasLog	Samsung	May-10	Bermuda	DFDE	GTT	4	Various
GasLog Seattle	155,000	GasLog	Samsung	Oct-13	Bermuda	TFDE	GTT	4	Various



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GasLog Shanghai	155,000	GasLog	Samsung	Jan-13	Liberia	TFDE	GTT	4	Various
Gaslog Singapore	155,000	GasLog	Samsung	Jul-10	Bermuda	DFDE	GTT	4	Various
Gaslog Skagen	155,000	GasLog	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Gaslog Sydney	155,000	GasLog	Samsung	May-13	Bermuda	DFDE	GTT	4	Various
Gaslog Warsaw	174,000	GasLog	Samsung	May-19	Bermuda	TFDE	GTT	4	Various
GDF-Suez Global Energy	74,000	Gaz de France	Chantiers	Dec-06	France	DFDE	CS1	4	Sonatrach
GDF-Suez Point Fortin	154,200	LNG Japan	Imabari/Koyo	Feb-10	Panama	DFDE	GTT	4	Various
Gemmata	138,100	Shell Shipping	Mitsubishi Nagasaki	Mar-04	Singapore	S	Moss	5	Shell
Georgiy Brusilov	172,000	Dynagas	Daewoo	Jun-18	Cyprus	DFDE	GTT	4	Yamal LNG
Georgiy Ushakov	172,600	Teekay-China	JV Daewoo	Oct-19	Bahamas	MEGI-DF	GTT	4	Various
Ghasha	137,510	National Gas Shipping	Mitsui	Jun-95	Liberia	S	Moss	5	ADGAS
Gigira Laitebo	177,000	MOL-Itochu	Hyundai	Feb-09	Panama	DFDE	GTT	4	Various
Golar Arctic	140,645	Golar LNG	Daewoo	Dec-03	Marshall Is.	S	GTT	4	Shell Spot
Golar Bear	160,000	Golar	Samsung	Mar-14	Bermuda	TFDE	GTT	4	Various
Golar Celsius	160,000	Golar LNG	Samsung	Sep-13	Bermuda	DFDE	GTT	4	Various
Golar Crystal	160,000	Golar LNG	Samsung	Oct-13	Bermuda	TFDE	GTT	4	Various
Golar Eskimo (FSRU)	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	GTT	4	Various
Golar Freeze	125,850	Golar LNG	HDW	Feb-77	UK	S	Moss	5	Various
Golar Glacier	162,000	Golar LNG	Hyundai	Sep-14	Marshall Is.	TFDE	GTT	4	Various
Golar Grand	145,880	Golar LNG	Daewoo	2006	IoM	S	GTT	4	Various
Golar Ice	160,000	Golar LNG	Samsung	Feb-15	Bermuda	DFDE	GTT	4	Various
Golar Igloo (FSRU)	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	GTT	4	Various
Golar Kelvin	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	GTT	4	Various
Golar Maria	145,950	Golar LNG	Daewoo	2006	Marshall Is.	S	GTT	4	Various
Golar Mazo	135,225	Golar LNG/PPP	Mitsubishi	Jan-00	Liberia	S	Moss	5	Pertamina
Golar Penguin	160,000	Golar LNG	Samsung	Mar-14	Marshall Is.	TFDE	GTT	4	Various
Golar Seal	160,000	Golar LNG	Samsung	Aug-13	Bermuda	TFDE	GTT	4	Various
Golar Singapore (FSRU)	160,000	Golar LNG	Samsung	June-15	Bermuda	TFDE	GTT	4	Various
Golar Snow	160,000	Golar LNG	Samsung	Jan-15	Bermuda	TFDE	GTT	4	Various
Golar Tundra (FSRU)	160,000	Golar LNG	Samsung	Dec-15	Bermuda	TFDE	GTT	4	Various
Golar Viking	140,000	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	Moss	4	Various
Golar Winter	138,250	Golar LNG	Daewoo	Apr-04	Marshall Is.	S	GTT	4	Petrobras
Grace Acacia	150,000	Algaet Shipping	Hyundai	Jan-07	Japan	S	GTT	4	Various
Grace Barleria	150,000	Swallowtail Ship	Hyundai	Oct-07	Japan	S	GTT	4	Various
Grace Cosmos	150,000	AGH Shipping	Hyundai	Mar-08	Japan	S	GTT	4	Various
Grace Dahlia	177,000	Tokyo Gas	Kawasaki	Oct-13	Japan	S	Moss	4	Various
Gracilis	138,830	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	GTT	4	Shell BG
Granatina	140,645	Shell Shipping	Daewoo	Dec-03	Singapore	S	GTT	4	Shell
Grand Aniva	147,200	Sovcomflot/NYK	Mitsubishi	Jan-08	Japan	S	Moss	4	Various
Grand Elena	147,200	Sovcomflot/NYK	Mitsubishi	Oct-07	Japan	S	Moss	4	Various
Grand Mereya	147,200	Primorsk/MOL/K Line	Chiba	May-08	Japan	S	Moss	4	Sakhalin II
Hanjin Muscat	138,200	Hanjin Shipping	Hanjin	Jul-99	Panama	S	GTT	4	Oman Gas
Hanjin Pyeong Taek	130,600	Hanjin Shipping	Hanjin	Sep-95	Panama	S	GTT	4	Pertamina
Hanjin Ras Laffan	138,214	Hanjin Shipping	Hanjin	Jul-00	Panama	S	GTT	4	QatarGas
Hanjin Sur	138,333	Hanjin Shipping	Hanjin	Jan-00	Panama	S	GTT	4	Oman Gas
Hispania Spirit	140,500	Teekay LNG Partners	Daewoo	Sep-02	Spain	S	GTT	4	Atlantic LNG
Hoegh Esperanza FSRU	170,000	Hoegh	Hyundai	April-18	Norway	DFDE	GTT	4	Various
Hoegh Gallant FSRU	170,050	Hoegh LNG	Hyundai	May-14	Marshall Is.	DFDE	GTT	4	chartered
Hoegh Giant FSRU	170,050	Hoegh LNG	Hyundai	Jan-18	Marshall Is.	DFDE	GTT	4	various
Hoegh Grace FSRU	170,050	Hoegh LNG	Hyundai	May-15	Marshall Is.	DFDE	GTT	4	various
Hyundai Aquapia	135,000	Hyundai MM	Hyundai	Mar-00	Panama	S	Moss	4	Oman Gas
Hyundai	135,000	Hyundai MM	Hyundai	Jan-00	Panama	S	Moss	4	RasGas
Hyundai Ecopia	145,000	Hyundai	Hyundai	Nov-08	Panama	S	GTT	4	Various
Hyundai Greenpia	125,000	Hyundai MM	Hyundai	Nov-96	Panama	S	Moss	4	Pertamina
Hyundai Oceanpia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	Oman Gas
Hyundai Technopia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	RasGas
Hyundai Utopia	125,182	Hyundai MM	Hyundai	Jun-94	Panama	S	Moss	4	Pertamina
Iberica Knutsen	138,000	Knutsen OAS	Daewoo	Aug-06	Norway	S	GT 96	4	Gas Natural
Ibra LNG	147,100	Oman Gas	Samsung	Jun-06	Panama	S	GTT	4	Oman LNG
Ibri LNG	145,000	Oman Gas	Mitsubishi	Jul-06	Panama	S	GTT	4	Oman LNG
Ish	137,540	National Gas Shipping	Mitsubishi Nagasaki	Nov-95	Liberia	S	Moss	5	ADGAS
K Acacia	138,017	Korea Line	Daewoo	Jan-00	Panama	S	GTT	4	Oman Gas
K Freesia	135,256	Korea Line	Daewoo	Jun-00	Panama	S	GTT	4	RasGas
Kinisis	173,400	K-Line	Daewoo	Jan-18	Liberia	MEGI-DF	GTT	4	Various
K Jasmine	145,700	Korea Line	Daewoo	Mar-08	Panama	S	GTT	4	Kogas offtake
K Mugungwha	152,000	K Line	Daewoo	Nov-08	Panama	S	GTT	4	Various
Kita LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Kotawaka Maru	125,200	J3 Consortium	Kawasaki Sakaide	Jan-84	Japan	S	Moss	5	Darwin



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Kumul	172,000	MOL	Hudong	May-16	Hong Kong	DRL	GTT	4	PNG-Asia
Lalla Fatma N'Soumer	145,000	Algeria Nippon Gas	Kawasaki Sakaide	Dec-04	Bahamas	S	Moss	4	Various
Lijmilya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GTT	5	Various
LNG Abalamabie	174,900	Bonny Gas	Samsung	Nov-16	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Abuja	126,530	Bonny Gas Transport	GD Quincy	Sep-80	Bahamas	S	Moss	5	Nigeria LNG
LNG Abuja II	174,900	Bonny Gas	Samsung	Oct 16	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Adamawa	141,000	Bonny Gas Transport	Hyundai	Jun-05	Bermuda	S	Moss	4	Various
LNG Akwa Ibom	141,000	Bonny Gas Transport	Hyundai	Nov-04	Bermuda	S	Moss	4	Various
LNG Aquarius	126,300	MOL/LNG Japan	GD Quincy	Jun-77	Marshall Is.	S	Moss	5	Various
LNG Barka	153,000	NYK	Kawasaki	Jan-09	Bahamas	S	Moss	4	Various
LNG Bayelsa	137,500	Bonny Gas Transport	Hyundai	Feb-03	Bermuda	S	Moss	4	Nigeria LNG
LNG Benue	145,700	BW Gas	Daewoo	Mar-06	Bermuda	S	GTT	4	Nigeria LNG
LNG Bonny	177,000	Bonny Gas Transport	Hyundai	Oct-15	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Borno	149,600	NYK Line	Samsung	Aug-07	Japan	S	GTT	4	Nigeria LNG
LNG Capricorn	126,300	MOL/LNG Japan	GD Quincy	Jun-78	Marshall Is.	S	Moss	5	Pertamina
LNG Cross River	141,000	Bonny Gas Transport	Hyundai	Sep-05	Bermuda	S	Moss	4	Various
LNG Dream	145,000	Osaka Gas	Kawasaki	Sep-06	Japan	S	Moss	4	Woodside Energy
LNG Dubhe	174,000	MOL-Cosco	Hudong	Sept-19	China	S	GTT	4	Russia-Asia
LNG Ebisu	147,500	MOL	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
LNG Edo	126,530	Bonny Gas Transport	GD Quincy	May-80	Bahamas	S	Moss	5	Nigeria LNG
LNG Enugu	145,000	BW Gas	Daewoo	Oct-05	Bermuda	S	GTT	4	Nigeria LNG
LNG Fimina	175,000	Bonny Gas Transport	Samsung	Oct-15	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Flora	127,700	J3 Consortium	Kawasaki Sakaide	Mar-93	Japan	S	Moss	4	Pertamina
LNG Fukurokuju	165,000	MOL	Kawasaki	June-15	Japan	S	Moss	4	Various
LNG Gemini	126,300	MOL/LNG Japan	GD Quincy	Sep-78	Marshall Is.	S	Moss	5	Pertamina
LNG Imo	148,300	BW Gas	Daewoo	Jun-08	Bermuda	S	GTT	4	Nigeria LNG
LNG Jamal	135,330	Osaka Gas/J3 Consortium	Mitsubishi Nagasaki	Oct-00	Japan	S	Moss	5	Oman Gas
LNG Juno	177,300	MOL-Osaka	Mitsubishi	Oct-18	Marshall Is.	DFDE	Moss	4	Freeport LNG/Various
LNG Jupiter	145,000	NYK Line	Kawasaki	Jul-09	Bahamas	S	Moss	4	Various
LNG Jurojin	155,300	MOL	MHI Nagasaki	Nov-15	Japan	S	KM	4	Various
LNG Kano	148,471	BW Gas	Daewoo	Jan-07	Bermuda	S	GTT	4	NLNG
LNG Lagos	177,000	Bonny Gas	Hyundai	Oct-15	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Leo	126,400	MOL/LNG Japan	GD Quincy	Dec-78	Marshall Is.	S	Moss	5	Pertamina
LNG Lerici	65,000	Exmar	Italcantieri Sestri	Mar-98	Italy	S	GTT	4	Sonatrach
LNG Libra	126,400	Hoegh LNG	GD Quincy	Apr-79	Marshall Is.	S	Moss	5	Various
LNG Lokoja	148,300	BW Gas	Daewoo	Dec-06	Bermuda	S	GTT	4	Nigeria LNG
LNG Mars	155,000	MOL/Osaka Gas	Mitsubishi	Oct-16	Marshall Is.	S	Moss	5	Various
LNG Merak	174,000	MOL-Cosco	Hudong	Nov-19	China	S	GTT	4	Russia-Asia
LNG Ogun	148,300	NYK Line	Samsung	Aug-07	Japan	S	GTT	4	Nigeria LNG
LNG Ondo	148,300	BW Gas	Daewoo	Sep-07	Bermuda	S	GTT	4	Nigeria LNG
LNG Oyo	140,500	BW Gas	Daewoo	Dec-05	Bermuda	S	GTT	4	Nigeria LNG
LNG Pioneer	138,000	MOL	Daewoo	Jul-05	Bahamas	S	GTT	4	Idku
LNG Port Harcourt	175,000	Bonny Gas	Samsung	Oct-15	Bermuda	DFDE	GTT	4	Nigeria LNG
LNG Portovenere	65,000	Exmar	Italcantieri Sestri	Jun-96	Italy	S	GTT	4	Sonatrach
LNG River Niger	141,000	Bonny Gas Transport	Hyundai	May-06	Bermuda	S	Moss	4	Various
LNG River Orashi	145,910	BW Gas	Daewoo	Nov-04	Bermuda	S	GTT	4	Nigeria LNG
LNG Rivers	137,231	Bonny Gas Transport	Hyundai	Jun-02	Bermuda	S	Moss	4	Nigeria LNG
LNG Sakura	177,000	NYK-Kepco	Kawasaki	Mar-18	Bahamas	DFDE	GTT	4	Various
LNG Saturn	153,000	MOL	MHI	Nov-15	Japan	S	Moss	4	Various
LNG Schneeweisschen	180,000	MOL-Itochu	Daewoo	Aug-18	Panama	XDF	GTT	4	Various
LNG Sokoto	137,231	Bonny Gas Transport	Hyundai	Aug-02	Bermuda	S	Moss	4	Nigeria LNG
LNG Taurus	126,300	MOL/LNG Japan	GD Quincy	Aug-79	Marshall Is.	S	Moss	5	Various
LNG Venus	155,000	Osaka/MOL	MHI	Oct-14	Japan	S	Moss	4	Various
LNG Vesta	127,547	Tokyo Gas Consortium	Mitsubishi Nagasaki	Jun-94	Japan	S	Moss	4	Pertamina
LNG Virgo	126,400	MOL/LNG Japan	GD Quincy	Dec-79	Marshall Is.	S	Moss	5	Pertamina
Lobito	160,400	Mitsui/NYK/Teekay	Samsung	Oct-11	Bahamas	DFDE	GTT	4	Various
Lusail	138,000	Peninsular LNG	Samsung	May-05	Bahamas	S	GTT	4	Qatar
Macoma	173,400	Teekay	Daewoo	Oct-17	Bahamas	DFDE	GTT	4	Various
Madrid Spirit	138,000	Teekay LNG Partners	IZAR Puerto Real	Jan-05	Spain	S	GTT	4	Engas
Magdala	173,400	Teekay	Daewoo	Feb-18	Bahamas	DFDE	GTT	4	Various
Magellan Spirit	165,500	Teekay LNG Partners	Samsung	Sep-08	Denmark	DFDE	GTT	4	Various
Malanje	160,400	Mitsui/NYK/Teekay	Samsung	Jul-11	Bahamas	DFDE	GTT	4	Various
Maran Gas Achilles	174,000	Maran	Hyundai Samho	Feb-16	Greece	DFDE	GTT	4	Various
Maran Gas Agamemnon	174,000	Maran	Hyundai Samho	May-16	Greece	DFDE	GTT	4	Various
Maran Gas Alexandria	161,870	Maran	Hyundai Samho	Sep-15	Greece	DFDE	GTT	4	Various
Maran Gas Amphipolis	173,400	Maran	Daewoo	Aug-16	Greece	DFDE	GTT	4	Various
Maran Gas Apollonia	161,870	Maran	Daewoo	Jan-14	Greece	DFDE	GTT	4	Various
Maran Gas Asclepius	145,000	Kristen Navigation	Daewoo	Jul-05	Bermuda	S	GTT	4	Qatar



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Maran Gas Chios	173,548	Maran	Daewoo	March-19	Greece	DFDE	GTT	4	Various
Maran Gas Coronis	145,700	Maran	Daewoo	Sep-07	Greece	S	GTT	4	Rasgas II
Maran Gas Delphi	159,800	Maran	Daewoo	Feb-14	Greece	DFDE	GTT	4	Various
Maran Gas Efessos	159,800	Maran	Daewoo	Jun-14	Greece	DFDE	GTT	4	Various
Maran Gas Hector	174,000	Maran	Hyundai Samho	Nov-16	Greece	DFDE	GTT	4	Various
Maran Gas Hydra	173,617	Maran	Daewoo	Feb-19	Greece	DFDE	GTT	4	Various
Maran Gas Lindos	159,800	Maran	Daewoo	Jun-15	Greece	DFDE	GTT	4	Various
Maran Gas Mystras	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GTT	4	Various
Maran Gas Olympias	174,500	Maran	DSME	Feb-17	Greece	DFDE	GTT	4	Various
Maran Gas Pericles	174,000	Maran	Hyundai Samho	June-16	Greece	DFDE	GTT	4	Various
Maran Gas Posidonia	161,870	Maran	Daewoo	May-14	Greece	DFDE	GTT	4	Various
Maran Gas Roxana	173,400	Maran	Daewoo	Jan-17	Greece	DFDE	GTT	4	Various
Maran Gas Sparta	161,870	Maran	Hyundai Samho	April-15	Greece	DFDE	GTT	4	Various
Maran Gas Spetses	174,000	Maran	Daewoo	Feb-18	Greece	DFDE	GTT	4	Various
Maran Gas Troy	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GTT	4	various
Maran Gas Ulysses	174,000	Maran	Hyundai Samho	Jan-17	Greece	DFDE	GTT	4	Various
Maran Gas Vergina	173,605	Maran	Daewoo	Dec-2016	Greece	DFDE	GTT	4	Various
Maria Energy	174,000	Tsakos	Hyundai	Mar-15	Marshall Is.	TFDE	GTT	4	Various
Marib Spirit	165,000	Teekay LNG	Samsung	May-08	Marshall Is.	DFDE	GTT	4	Various
Marshal Vasilevskiy	174,000	Gazprom	Hyundai	Russia	Jan-2019	DFDE	GTT	4	Russia-FSRU
Marvel Crane	177,000	NYK-Mitsui	Mitsubishi	Mar-19	Singapore	S	Moss	4	US/Various
Marvel Eagle	155,000	MOL-Osaka	Kawasaki	Sept-18	Marshall Is.	S	Moss	4	Cameron LNG/Various
Marvel Falcon	174,000	NYK-Mitsui	Samsung	Dec-18	Singapore	XDF	GTT	4	Cameron LNG/Various
Marvel Hawk	174,000	NYK-Mitsui	Samsung	Dec-18	Singapore	XDF	GTT	4	Cameron LNG/Various
Marvel Kite	174,000	NYK-Mitsui	Samsung	Dec-18	Singapore	XDF	GTT	4	Various
Marvel Pelican	155,000	MOL-Mitsui	Kawasaki	Dec-19	Marshall Is.	DFD	Moss	4	Cameron LNG-Various
Matthew	126,540	Suez LNG Shipping	Newport News	Jun-79	Bahamas	S	GTT	6	Atlantic LNG
Megara	173,000	Teekay	Daewoo	Oct-18	Bahama	MEGI-DF	GTT	4	Various
Mekaines	266,000	Naklilat	Samsung	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Meridian Spirit	165,500	Teekay LNG	Samsung	Jan-10	Denmark	DFDE	GTT	4	Various
Mesaimeer	210,100	Naklilat	Hyundai	Mar-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Methane Alison Victoria	145,000	GasLog	Samsung	Aug-07	Bermuda	S	GTT	4	Eq.Guinea LNG
Methane Becki Anne	170,000	GasLog	Samsung	Sep-10	Bermuda	TFDE	GTT	4	Various
Methane Heather Sally	145,000	GasLog	Samsung	Jul-07	Bermuda	S	GTT	4	Eq.Guinea LNG
Methane Jane Elizabeth	145,000	GasLog	Samsung	Jun-06	Bermuda	TFDE	GTT	4	Engas
Methane Julia Louise	170,000	GasLog	Samsung	Dec-09	Bermuda	TFDE	GTT	4	Various
Methane Kari Elin	138,200	Shell	Samsung	Jun-04	Bermuda	S	GTT	4	Various
Methane Lake Charles	145,000	Shell	Samsung	Feb-07	Bermuda	S	GTT	4	Marathon Oil
Methane Lydon Volney	145,000	Shell	Samsung	Aug-06	Bermuda	S	GTT	4	Engas
Methane Mickie Harper	170,000	Shell-GasLog	Samsung	Nov-10	Bermuda	TFDE	GTT	4	Various
Methane Nile Eagle	145,000	Shell-GasLog	Samsung	Dec-07	Bermuda	S	GTT	4	Engas
Methane Patricia Camila	170,000	Shell-GasLog	Samsung	Oct-10	Bermuda	TFDE	GTT	4	Various
Methane Princess	138,159	Golar LNG	Daewoo	2003	UK	S	GTT	4	Spot BG
Methane Rita Andre	145,000	GasLog	Samsung	Mar-06	Bermuda	S	GTT	4	Engas
Methane Shirley Elizabeth	145,000	GasLog	Samsung	Apr-07	Bermuda	S	GTT	4	Marathon Oil
Methane Sprit	165,000	Teekay LNG	Samsung	Mar-08	Singapore	DFDE	GTT	4	Various
Milaha Qatar	145,000	Milaha	Samsung	Apr-06	Denmark	S	GTT	4	Qatar
Milaha Ras Laffan	138,270	Milaha	Samsung	Mar-04	Denmark	S	GTT	4	RasGas II
Min Lu	147,000	China Ships	Hudong	Aug-09	China	S	GTT	4	Various
Min Rong	147,000	China LNG Ships	Hudong	Feb-09	Hong Kong	S	GTT	4	Australia-China
Mourad Didouche	126,130	Hyproc Shipping	Atlantique	Jul-80	Algeria	S	GTT	5	Sonatrach
Mozah	266,000	QGTC	Samsung	Aug-08	Qatar	DRL	GTT	5	Qatargas II
Mraweh	137,000	National Gas Shipping	Kvaerner-Masa	Jun-96	Liberia	S	Moss	4	ADGAS
Mubaraz	137,000	National Gas Shipping	Kvaerner-Masa	Jan-96	Liberia	S	Moss	4	Various
Muraq	210,100	J5-K Line	Daewoo	May-08	Marshall Is.	DRL	GTT	4	Qatar-Atlantic Basin
Murex	173,400	Teekay	Daewoo	Oct-17	Bahamas	DFDE	GTT	4	Various
Murwab	210,100	J5 Consortium	Daewoo	May-08	Marshall Is.	DRL	GTT	4	Qatargas
Muscat LNG	149,170	Oman Gas/MOL	Kawasaki Sakaide	Mar-04	Japan	S	Moss	4	Oman Gas
Myrina	173,000	Teekay	Daewoo	Sept-18	Bahamas	MEGI-DF	GTT	4	Various
Neo Energy	149,700	Tsakos	Hyundai	Feb-07	Liberia	S	GTT	4	Various
Neptune	145,000	Hoegh LNG/MOL	Samsung	Dec-09	Liberia	DFDE	GTT	4	Various
Nikolay Urvantsev	172,000	MOL-China Ships	Daewoo	Nov-19	Hong Kong	DFDE	GTT	4	Yamal
Nikolay Yevgenov	172,600	Teekay	Daewoo	Oct-18	Bahamas	MEGI-DF	GTT	4	Various
Nikolay Zubkov	172,600	Dynagas	Daewoo	Nov-18	Cyprus	DFDE	GTT	4	Yamal LNG
Nizwah LNG	145,000	Oryx LNG Carriers	Kawasaki Sakaide	Dec-05	Japan	S	Moss	4	Oman Gas
Northwest Sanderling	127,525	Australia LNG	Mitsubishi Nagasaki	Jun-89	Australia	S	Moss	4	NWS
Northwest Sandpiper	127,500	Australia LNG	Mitsui Chiba	Feb-93	Australia	S	Moss	4	NWS
Northwest Seaeagle	127,450	Australia LNG	Mitsubishi Nagasaki	Nov-92	Bermuda	S	Moss	4	NWS



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Northwest Shearwater	127,500	Australia LNG	Kawasaki Sakaide	Sep-91	Bermuda	S	Moss	4	NWS
Northwest Snipe	127,747	Australia LNG	Mitsui Chiba	Sep-90	Australia	S	Moss	4	NWS
Northwest Stormpetrel	127,600	Australia LNG	Mitsubishi Nagasaki	Dec-94	Australia	S	Moss	4	NWS
Northwest Swallow	127,708	J3 Consortium	Mitsui Chiba	Nov-89	Japan	S	Moss	4	NWS
Northwest Swan	138,000	Australia LNG	Daewoo	Mar-04	Australia	S	GTT	4	NWS
Northwest Swift	127,590	J3 Consortium	Mitsubishi Nagasaki	Sep-89	Japan	S	Moss	4	NWS
Noshu Maru	180,000	MOL-Jera	MHI-Nagasaki	Feb-19	Japan	S-gas	Moss	4	US-Japan
Oak Spirit	173,400	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	GTT	4	Cheniere
Ob River	150,000	Lance Shipping	Hyundai	Oct-07	Marshall Is.	S	GTT	4	Various
Oceanic Breeze	155,300	K-Line	Mitsubishi-Nagasaki	June-18	Japan	S	Moss	4	Darwin-Japan
Onaiza	210,100	Nakilat	Daewoo	Apr-09	Liberia	DRL	GTT	4	Qatar-Atlantic Basin
Ougarta	171,866	Hyproc Shipping	Hyundai	Mar-17	Algeria	DFDE	GTT	4	Sonatrach
Pacific Arcadia	147,200	NYK Line	MHI	Oct-14	Bahamas	S	KM	4	Various
Pacific Breeze	182,000	K Line	Kawasaki	Mar-18	Marshall Is.	DFDE	Moss	4	Ichthys LNG
Pacific Enlighten	145,000	LNG MT	Mitsubishi	Mar-09	Japan	S	Moss	4	Various
Pacific Eurus	137,000	LNG Marine Transport	Mitsubishi Nagasaki	Mar-06	Bahamas	S	Moss	4	Darwin
Pacific Mimosa	155,300	NYK Line	MHI	Nov-17	Bahamas	S	Moss	4	Australia-Japan
Pacific Notus	137,006	Pacific LNG Shipping	Mitsubishi Nagasaki	Sep-03	Bahamas	S	Moss	5	Darwin
Palu LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Pan Americas	174,000	Teekay	Hudong	Mar-18	Hong Kong	TFDE	GTT	4	US-Asia
Pan Asia	174,000	Teekay	Hudong-Zhonghua	July-17	Bahamas	TFDE	GTT	4	Cheniere
Pan Europe	174,000	Teekay	Hudong	Sept-18	Hong Kong	TFDE	GTT	4	US-global
Papua	171,800	MOL-China	Hudong	Jan-15	Hong Kong	DFDE	SSD	4	PNG LNG
Patris	173,400	K-Line	Daewoo	Feb-18	Liberia	MEGI-DF	GTT	4	Various
Polar Eagle	89,880	Polar LNG	IHI Chita	Jun-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Prachi	173,000	NYK-SCI	Hyundai	Nov-16	Singapore	TFDE	GTT	4	Petronet
Prism Agility	180,024	SK Shipping	Hyundai	April-19	Panama	DFDE	GTT	5	Various
Prism Brilliance	180,016	SK Shipping	Hyundai	March-19	Panama	DFDE	GTT	5	Various
Provalys	153,500	Gaz de France	Chantiers	Nov-06	France	DFDE	CS1	4	ELNG
Pskov	170,200	SovComFlot	STX	Mar-14	Liberia	DFDE	GTT	4	Various
Puteri Delima	130,400	MISC	Atlantique	Jan-95	Malaysia	S	GTT	4	Petronas
Puteri Delima Satu	137,100	MISC	Mitsui Chiba	Apr-02	Malaysia	S	GTT	4	Petronas
Puteri Firuz	130,400	MISC	Atlantique	May-97	Malaysia	S	GTT	4	Petronas
Puteri Firuz Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-04	Malaysia	S	GTT	4	Petronas
Puteri Intan	130,400	MISC	Atlantique	Aug-94	Malaysia	S	GTT	4	Petronas
Puteri Intan Satu	137,100	MISC	Mitsubishi Nagasaki	Dec-01	Malaysia	S	GTT	4	Petronas
Puteri Mutiera Satu	137,100	MISC	Mitsui Chiba	Apr-05	Malaysia	S	GTT	4	Petronas
Puteri Nilam	130,400	MISC	Atlantique	Jun-95	Malaysia	S	GTT	4	Petronas
Puteri Nilam Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-03	Malaysia	S	GTT	4	Petronas
Puteri Zamrud	130,400	MISC	Atlantique	May-96	Malaysia	S	GTT	4	Petronas
Puteri Zamrud Satu	137,100	MISC	Mitsui Chiba	Apr-87	Malaysia	S	GTT	4	Atlantic LNG
Raahi	136,000	Petronet LNG Ltd	Daewoo	Dec-04	Malta	S	GTT	4	Qatargas
Ramdane Abane	126,130	Hyproc Shipping	Atlantique	Jul-81	Algeria	S	GTT	5	Sonatrach
Rasheeda	266,000	QGTC	Samsung	Jun-10	Liberia	DRL	GTT		Various
Rias Baixas Knutsen	180,000	Knutsen	Hyundai	Aug-19	Spain	MEGI-DF	GTT	4	Various
Ribera del Duero Knutsen	173,400	Knutsen	Daewoo	Nov-10	Nor-NIS	DFDE	GTT	4	Various
Rioja Knutsen	176,300	Knutsen	Daewoo	Dec-16	Nor-NIS	DFDE	GTT	4	Various
Rudolf Samoylovich	172,652	Teekay-CLNG	Daewoo	Oct-18	Bahamas	MEGI-DF	GTT	4	Various
Salalah LNG	147,000	Oman Gas/MOL	Samsung	Dec-05	Japan	S	GTT	4	Oman
SCF Polar	71,500	Sovcomflot	Kockums	Aug-69	Liberia	S	GTT	6	Sonatrach
Sean Spirit	174,000	Teekay	Hyundai Samho	Feb-19	Bahama	MEGI-DF	GTT	4	Various
Seishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Jan-15	Panama	S	Moss	4	Australia-Japan
Seri Alam	138,000	MISC	Samsung	Oct-05	Malaysia	S	GTT	4	Yemen LNG
Seri Amanah	145,000	MISC	Samsung	Mar-06	Malaysia	S	GTT	4	Yemen LNG
Seri Anggun	145,000	MISC	Samsung	Nov-06	Malaysia	S	GTT	4	Yemen LNG
Seri Angkasa	145,000	MISC	Samsung	Feb-07	Malaysia	S	GTT	4	Petronas
Seri Ayu	145,000	MISC	Samsung	Oct-07	Malaysia	S	GTT	4	Various
Seri Bakti	152,300	MISC	Mitsubishi	Mar-07	Malaysia	S	GTT	4	Petronas
Seri Balhaf	152,000	MISC	Mitsubishi	Sep-08	Malaysia	S	GTT	4	Various
Seri Balquis	152,000	MISC	Mitsubishi	Dec-08	Malaysia	S	GTT	4	Various
Seri Begawan	152,300	MISC	Mitsubishi	Dec-07	Malaysia	S	GTT	4	Various
Seri Bijaksana	152,300	MISC	Mitsubishi	Feb-08	Malaysia	S	GTT	4	Petronas
Seri Camar	150,200	MISC	Hyundai	Feb-18	Malaysia	S	Moss	4	Petronas
Seri Camellia	150,000	MISC	Hyundai	Nov-16	Malaysia	S	Moss	4	Petronas
Seri Cemara	150,200	MISC	Hyundai	Apr-18	Malaysia	S	Moss	4	Petronas
Seri Cempak	150,200	MISC	Hyundai	Feb-18	Malaysia	S	Moss	4	Petronas
Seri Cenderawasih	150,000	MISC	Hyundai	Jan-17	Malaysia	S	Moss	4	Petronas
Sestao Knutsen	138,000	Knutsen	IZAR Sestao	Jan-07	Spain	S	GTT	4	Atlantic LNG



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Sevilla Knutsen	173,400	Knutsen	Daewoo	Jun-10	N.I.S.	DFDE	GTT	4	Various
Shahamah	135,500	National Gas Shipping	Kawasaki Sakaide	Oct-94	Liberia	S	Moss	5	ADGAS
Shangra	266,000	QGTC	Samsung	Nov-09	Liberia	DRL	GTT	5	Qatargas IV
Shen Hai	147,100	China LNG	Hudong Zhonghua	Sep-12	China	AB/CC Steam	GTT	4	Various
Simaisma	147,700	Maran Gas Maritime	Daewoo	Jul-06	Greece	S	GTT	4	Qatar
SK Audace	180,000	SK-Marubeni	Samsung	Jul-17	Panama	XDF	GTT	4	Various
SK Resolute	180,000	SK-Marubeni	Samsung	Jun-18	Panama	XDF	GTT	4	Various
SK Splendor	138,375	SK Shipping	Samsung	Mar-00	Panama	S	GTT	4	Oman Gas
SK Stellar	138,375	SK Shipping	Samsung	Dec-00	Panama	S	GTT	4	RasGas
SK Summit	138,000	SK Shipping	Daewoo	Aug-99	Panama	S	GTT	4	RasGas
SK Sunrise	138,306	I. S. Carriers	Samsung	Sep-03	Panama	S	GTT	4	RasGas
SK Supreme	138,200	SK Shipping	Samsung	Jan-00	Panama	S	GTT	4	RasGas
Sohar LNG	137,250	Oman Gas/ MOL	Mitsubishi Nagasaki	Oct-01	Malta	S	Moss	5	Oman Gas
Sohshu Maru	180,000	MOL	Kawasaki HI	Nov-19	Japan	S-gas	Moss	4	Various-Japan
Solaris	155,000	GasLog	Samsung	Jul-14	Bermuda	TFDE	GTT	4	Various
Sonangol Benguela	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GTT	4	Angola LNG
Sonangol Etosha	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GTT	4	Angola LNG
Sonangol Sambizanga	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GTT	4	Angola LNG
Southern Cross	172,000	MOL	Hudong	May-15	Hong Kong	DRL	GTT	4	Various
Soyo	160,400	Mitsui/NYK/Teekay	Samsung	May-11	Bahamas	DFDE	GTT	4	Various
Spirit of Hela	177,000	MOL	Hyundai	Oct-09	Panama	DFDE	GTT	4	Various
Stena Blue Sky	145,700	Stena	Daewoo	Jan-06	Panama	S	GTT	4	Various
Stena Clear Sky	171,800	Stena	Daewoo	Sep-10	Panama	DFDE	GTT	4	Various
Stena Crystal Sky	171,800	Stena	Daewoo	Jul-10	Panama	DFDE	GTT	4	Various
STX Kolt	145,700	STX Panocean	Korea Hanjin	Nov-08	Panama	DFDE	GTT	4	Various
Suez Point Fortin	154,200	Trinity LNG	Koyo Japan	Nov-09	Panama	S	GTT	4	Yemen LNG
Symphonic Breeze	147,608	K-Line	Mitsubishi Nagasaki	Oct-07	Bahamas	DFDE	Moss	4	Australia-Japan
Taitar No. 1	145,000	NYK Line	Mitsubishi	Oct-09	Liberia	S	Moss	4	Various
Taitar No. 3	145,000	NYK Line	Mitsubishi	Jan-10	Liberia	S	Moss	4	Various
Taitar No. 4	145,000	NYK	Mitsubishi	Jan-10	Liberia	S	Moss	4	Various
Tangguh Batur	145,700	Sovcomflot/NYK	Daewoo	Dec-08	Cyprus	S	GTT		Tangguh
Tangguh Foja	155,000	K Line	Samsung	Jul-08	Panama	DFDE	GTT	4	Tangguh LNG
Tangguh Hiri	155,000	Teekay LNG	Hyundai	Nov-08	Isle of Man	DFDE	GTT	4	Tangguh
Tangguh Jaya	145,700	K Line	Samsung	Nov-08	Panama	DFDE	GTT	4	Tangguh
Tangguh Palung	155,000	K Line	Samsung	Mar-09	Panama	DFDE	GTT	4	Tangguh
Tangguh Sago	155,000	Teekay LNG	Hyundai	Mar-09	Isle of Man	DFDE	GTT	4	Tangguh LNG
Tangguh Towuti	145,700	Sovcomflot/NYK	Daewoo	Oct-08	Cyprus	S	GTT	4	Tangguh
Tembek	216,200	OSG/Nakilat	Samsung	Sep-07	Marshall Is.	DRL	GTT	4	Qatargas II
Tenaga Satu	130,000	MISC	Dunkerque	Sep-82	Malaysia	S	GTT	5	Petronas
Tessala	171,866	Hyproc Shipping	Hyundai	Dec-16	Algeria	DFDE	GTT	4	Sonatrach
Torben Spirit	173,000	Teekay	Daewoo	Feb-17	Bahama	MEGI-DF	GTT	4	Various
Trinity Arrow	154,900	K Line	Imabari Shipbuilding	Mar-08	Panama	S	GTT	4	Various
Umm Al Amad	210,100	J5	Daewoo	Aug-08	Marshall Is.	DRL	GTT	4	Ras Gas III
Umm Al Ashtan	137,000	National Gas Shipping	Kvaerner- Masa	May-97	Liberia	S	Moss	4	ADGAS
Umm Bab	145,000	Kristen Navigation	Daewoo	Nov-05	Bermuda	S	GTT	4	Qatargas
Umm Slaal	266,000	QGTC	Samsung	Nov-08	Qatar	DRL	GTT	5	Qatargas
Valencia Knutsen	173,400	Knutsen	Daewoo	Sep-10	Nor-NIS	DFDE	GTT	4	Various
Velikiy Novgorod	170,200	SovComFlot	STX	Feb-14	Liberia	DFDE	GTT	4	Various
Vladimir Rusanov	172,000	MOL-China Shipping	Daewoo	Mar-18	Hong Kong	DFDE	GTT	4	Yamal
Vladimir Viz	172,000	MOL-China Shipping	Daewoo	Sept-18	Hong Kong	DFDE	GTT	4	Yamal
Vladimir Voronin	172,600	Teekay	Daewoo	Jun-19	Bahamas	MEGI-DF	GTT	4	Various
Wakaba Maru	125,000	J3 Consortium	Mitsui Chiba	Apr-85	Japan	S	Moss	5	Pertamina
WilForce	156,000	Teekay LNG	Daewoo	Aug-13	NIS	DFDE	GTT	4	Various
WilPride	156,000	Teekay	Daewoo	June-13	NIS	DFDE	GTT	4	Various
Woodside Cheney	174,000	Maran	Hyundai Samho	Mar-16	Greece	DFDE	GTT	4	Various
Woodside Donaldson	165,500	Teekay LNG	Samsung	Dec-09	Singapore	DFDE	GTT	4	Various
Woodside Goode	159,800	Maran	Daewoo	Jul-14	Greece	DFDE	GTT	4	Various
Woodside Reeswithers	173,400	Maran	Daewoo	Nov-16	Greece	DFDE	GTT	4	Various
Woodside Rogers	155,900	Maran Gas	DSME	Jul-13	Greece	DFDE	GTT	4	Various
Yakov Gakkal	172,600	Teekay-China JV	Daewoo	Nov-19	Bahamas	MEGI-DF	GTT	4	Various
Yamal Spirit	174,000	Teekay	Hyundai Samho	Jan-19	Bahama	MEGI-DF	GTT	4	Various
Yari LNG	159,983	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GTT	4	Various
Yenisei River	155,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	GTT	4	Various
YK Sovereign	127,125	SK Shipping	Hyundai	Dec-94	Panama	S	Moss	4	Pertamina
Zarga	266,000	QGTC	Samsung	Dec-09	Liberia	DRL	GTT	5	Qatar-Atlantic
Zekreet	135,420	J4 Consortium	Mitsui Chiba	Dec-98	Japan	S	Moss	5	Qatargas

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

LNG Import Terminals

Explanatory Notes

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

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

Country	Location (Project)	Owners	Start up	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	2019	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	Bahia Blanca GasPort	Excelerate/YPF Repsol	2008
	Escobar GasPort	Excelerate/Enarsa	2011
Bangladesh	Moheshkhali	Excelerate, PetroBangla	2018
	Cox's Bazar	Summit Power International, Excelerate Energy	2019
Brazil	Pecem, FSRU	Petrobras	2009
	Guanabara Bay FSRU	Petrobras	2009
	Salvador, Bahia FSRU	Petrobras	2013
China	Tianjin FSRU	CNOOC, Hoegh, various	2013
Colombia	Cartagena FSRU	Promigas, Sociedad Portuaria El Cayao	2016
Egypt	Ain Sokhna, Suez	EGAS, Hoegh	2015
	Ain Sokhna, Suez	EGAS, BW Gas	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertamina	2012
Italy	Livorno	OLT Offshore LNG Toscana	2013
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
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
	Port Qasim	BW-Mitsui, PGP Consortium	2017
Turkey	Aliaga FSRU, Turquoise FLNG	Etiki 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	-1
	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
ARGENTINA	FLNG Tango	Bahia Blanca	2019	1	0.5	1	16,100
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mitsubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
		Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
		Gladstone LNG Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
		Gorgon LNG Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
		Pluto LNG Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
		QCLNG Shell, CNOOC	2014	2	8.0	2	280,000
		Wheatstone LNG Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
		Ichthys LNG Inpex Corp., Total	2018	2	8.9	2	330,000
		Prelude FLNG Shell, Inpex, Kogas CPC	2019	1	3.5		
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
CAMEROON	Hilli Episeyo FLNG	Kribi Perenco	2018	1	1.2	1	125,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Total, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya	Equinor, Total, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG	2000	2	7.1	2	240,000
		Mitsubishi, Mitsui, Partex and Itochu					
PAPUA NEW GUINEA	PNG LNG	Oman Govt., Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
		ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-T1	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5	4	640,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	5	22.5	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
	Cheniere Corpus Christi	Texas Cheniere	2018	2	9.0	3	480,000
	Cameron Hackberry	Sempra, Total, Mitsui, Mitsubishi	2019	2	9.8	3	480,000
	Elba Island Georgia	Kinder Morgan, EIG Energy	2019	10	2.5	5	535,000
	Freeport LNG, Texas	Freeport LNG	2019	2	10.2	3	483,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000



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