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China – the “only bright spot” for beleaguered LNG markets in Asia Pacific

The widening Henry Hub/JKM spread will soon make US LNG deliveries to China profitable again, brokers and analysts told LNG Journal's Markets & Commissioning Editor Anja Karl

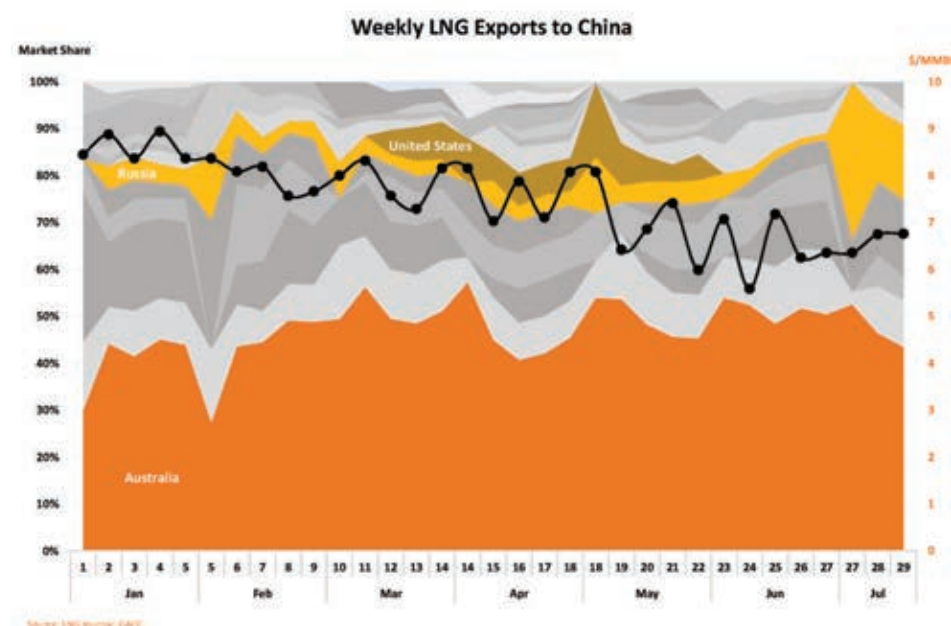
China's early post-COVID demand recovery gives it headroom to absorb spot LNG cargoes on top of contractual supply from Australia and Qatar. With Asia spot LNG priced as low as \$2.30 per MMBtu, US LNG deliveries are currently uncompetitive. But the arbitrage window between Henry Hub and the Japan-Korea Market (JKM) is about to reopen. “We expect higher Northeast Asian prices will end the recent practice of cancelling offtake cargoes from US projects from October US loadings,” James Whistler, Global Head of Energy Derivatives at SSY told *LNG Journal* in an interview.

The JKM swaps forward curve is seen reach just over \$2.50 per MMBtu by September and valued at \$4.00 per MMBtu for November. The forward curve for JKM swaps is currently in a “considerable contango,” caused by both a standard seasonal profile as we move into winter and limited expectations for a swift COVID-19 demand recovery.

“The profitability of sending US cargoes to Northeast Asian for loading months prior to October look marginal at best on current forward prices,” Whistler said. “But it's worth noting that the US is seeing a worsening COVID-19 picture and this may well drive down Henry Hub prices – all things being equal and Asian spot LNG prices remain as forecast, this would improve US cargo economics earlier than October.”

Australian and Qatari cargoes, generally contracted under oil-index pricing, are currently providing low-priced LNG to Asia in the \$3-\$4 per MMBtu range. Spot cargoes are even more competitive, priced currently around \$2.30 per MMBtu, Whistler explained, stressing “the US cannot compete with this.”

Henry Hub spot prices, last seen at \$1.63 per MMBtu on the New York Mercantile Exchange (NYMEX), make



feed gas uneconomic once liquefaction and freight is taken into consideration. “We are seeing this manifest itself in the swathe of US cargo cancellations recently,” Whistler said.

China hunger for LNG returns

China does not enjoy a discount on LNG deliveries, but the country's quick revival from the COVID crisis has turned it into what natural gas analysts call “the only bright spot” in Asia Pacific. China's LNG procurement bounced back to well above 2019-levels year-to-date as spot prices for

the super-chilled fuel have plummeted. According to SSY, China's ability to absorb spot cargoes has benefited over the past 5 months and China's early post-COVID demand recovery has helped it take advantage of this. “The low prices have also helped LNG compete against piped gas imports,” Whistler said, and “this has seen LNG displace its piped cousin quite considerably over the past few months.”

Back in April, JKM spot prices have fallen to below a historic low of less than \$2 per MMBtu and are now hovering just above that price mark – “well beneath most

LNG *journal*



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Subscription

Print & online **£655/€810/US\$1050**

Online only **£595/€725/US\$950**

See website for more details
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hotline +44 (0)20 7253 2700

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Printed by The Manson Group Ltd
Reynolds House, 8 Porters' Wood
Valley Road Industrial Estate
St Albans, Herts AL3 6PZ, U.K.

producer's break even points," Tim Daiss Oil & LNG market analyst Asia-Pacific at Critical Resource told *LNG Journal*.

"In a normal market, US LNG cargoes, priced against HH, would easily compete against JKM indexed cargoes. But these are not normal markets," Daiss said, pointing at a continued supply overhang, buyers' high inventory levels, and mostly demand destruction for the fuel amid the Covid 19 pandemic, especially in LNG legacy buyers such as Japan, South Korea, and Taiwan.

Looking ahead, he forecasts JKM prices to rise faster than Henry Hub prices. According to Critical Resource estimates, JKM futures are set to top \$2.52 per MMBtu by September, and potentially \$3 per MMBtu in October, while prices at the U.S. Henry Hub will also trend upwards from currently around \$1.75 per MMBtu, but remain "well beneath" the \$2.681 per MMBtu mark, reached at the middle of September last year. Still, US LNG cargoes will "remain at a cost disadvantage" compared to Australian cargoes, Daiss said.

The upward trend for JKM swaps will over time make of make US LNG more competitive over time, market participants agree. A widening arbitrage window between Henry Hub (HH) and JKM prices would allow Chinese buyers to ramp up US import volumes, making good on some of its lagging contractual offtake of American energy imports. Under Phase-1 of the China-US trade deal, agreed after month of tit-for-tat sanctions, Beijing had committed to an additional \$18.5 billion of purchases of US energy products in 2020 above 2017 levels. This implies an annual target of \$25.3 billion, according to the Peterson Institute for International Economics or PIIE.

'Dismal times' for LNG producers

Economic lockdowns, subdued demand and depressed gas prices at all major gas trading hubs have caused an array of cargo cancellations and shut-ins of some liquefaction trains at key US LNG export facilities. Further shut-ins are on the cards, most analysts agree, as "these are dismal times for LNG producers, particularly in North America." Shipments of US LNG to China have fallen sharply in recent months as the Covid-19 pandemic slashed energy demand across Asia, Europe and Latin America.

Landed LNG cargoes in China from the United States have fallen to 9 in May and June, compared to 72 cargoes from



LNG cargo, loaded at Cheniere Energy's Sabine Pass LNG terminal

Australia and some 8 or 9 both from Qatar and Russia, according to our LNG Unlimited Data. Australia is the clear winner in terms of LNG deliveries into China, still the world's fastest growing gas market ahead of India.

US LNG delivered to Europe is "bleeding cash"

At the height of the coronavirus crisis, prices at the U.S. Henry Hub fell towards \$1.60 per MMBtu – below Platt's JKM price marker for deliveries into Japan and South Korea. Prices were effectively being set by a netback from TTF, occasionally with discounts for landing on-the-water US LNG cargoes in northwest Europe. At the time, delivered gas prices into China fell below \$2.40 per MMBtu, while prices at an increasingly saturated European gas market in April had sunk to around \$2.30 per MMBtu at the Dutch Title Transfer Facility (TTF) gas trading hub. "Any US LNG delivered into Europe this summer in this cost band is bleeding cash," said Wood Mackenzie's Asia Pacific vice chair, Gavin Thompson.

"This situation cannot go on for much longer," he stressed. Even the most efficient liquefaction plant in the US cannot support a negative spread between feedgas costs – highly correlated to Henry Hub – and FOB LNG prices, so "any cargoes sold at this price level are effectively distressed."

Capacity shut-ins needed to balance the market

At current low oil and gas prices, it makes little sense to ship LNG from the U.S. Gulf Coast to Asia so surplus cargoes are heading to Europe instead, where storage levels are filling up fast.

Poten & Partners, a global ship and commodity brokerage, says it is "very clear that there is going to be some kind of supply response to balance the market." LNG exports facilities in the United

States are "likely to shoulder most of the downside," ship brokers said, referring to a partial closure of some liquefaction capacity, deferred construction of new Trains and delayed project FIDs.

Shut-ins of uneconomic US liquefaction capacity are widely seen as the "last mechanism to rebalance the market." Still, US LNG imports into Northwest Europe in Q1-2020 were close to 50% higher than the same period in 2019. According to Timera Energy Consultants calculations, shut-in of U.S. gas production take place at a price range of \$4.0–4.8 per MMBtu, considering LNG vessel spot charter rates have fallen to around \$40,000 per day, down nearly 80% from Q4-2019 highs at over \$200,000 per day.

To date, US developers struggle to maintain contractual offtake at most liquefaction plants, with roughly 40 US cargoes cancelled for the month of July alone. Preliminary numbers for August indicate there will be up to 45 cancellations, according to Poten & Partners estimates. Considering that the US export potential is 80-85 cargoes per month, the current cancellations account for half of the total US liquefaction and export capacity.

Buyers are hesitant to sign firm offtake agreements, so developers struggle to agree debt financing and delay financial investment decisions (FIDs) on expansion projects, or new LNG Trains. At the start of 2020, twelve US LNG developers including Cheniere, Sempra and NextDecade announced to take FID on new projects or expansions over the coming twelve month. But since the COVID crisis unfolded in April, that number has fallen to four and analysts said it might ultimately be just one of these projects that go forward this year.

Trying to buy time until demand in Asia recovers, US operators of liquefaction terminals have been scaling down trains or scheduled extended



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maintenance periods over the summer. Cheniere Energy, for example, is understood to shut down one 4.5 mtpa Train at its Sabine Pass liquefaction plant (22.5 mtpa total capacity) for planned maintenance in September. The largest US LNG exporter has signalled it will not take a financial investment decision (FID) on the Corpus Christi Stage 3 expansion this year, not least due to mounting cargo cancellations.

Cheniere sales contract, as filed to the SEC, states that buyers must decide whether to lift an M+2 cargo by the 20th day of the month. Late cancellations make buyers liable to paying the difference between the cargo's original value and the amount for which it can be resold.

At the start of 2020, in the months before the demand destruction due to the Covid-19 pandemic, Cheniere used to fill 40–45 tankers per month at a roughly three-to-one ratio between Sabine Pass and Corpus Christi. While contract deadlines for Freeport and Cameron are unknown to the market, Energy Aspects says initial market soundings suggest as many as 45 cargoes were cancelled in August, slightly higher than in June.

Australia's LNG stays attractive

Australian gas exporters have jumped at the opportunity to ship more LNG to China which turned into the biggest buyer of Australian cargoes, overtaking Japan. In contrast to US suppliers, it's unlikely there will be shut-ins of wells, or a major cut in output from Australian upstream projects due to lower oil and LNG prices.

"There is certainly no sign so far of reduced Australian LNG shipments to China," Graeme Bethune, head of Australian energy consultancy

EnergyQuest said, adding that Australia delivered 40 cargoes to China in April, up from 36 in April 2019. "Most Australian LNG is sold under long-term oil-linked contracts and oil prices would need to remain very low for a considerable period for there to be shut-ins," he said, explaining market indicators show that "west coast LNG projects stay 'cash flow positive' at oil prices above about \$15 per barrel and east coast projects above \$25/bbl."

Strikingly, the Arrow Energy deployment – a Shell/PetroChina joint venture – has recently taken financial close for the first phase of the \$10 billion project. This unexpected move will add up to 90 billion cubic feet per year of coal seam gas supply by 2023.

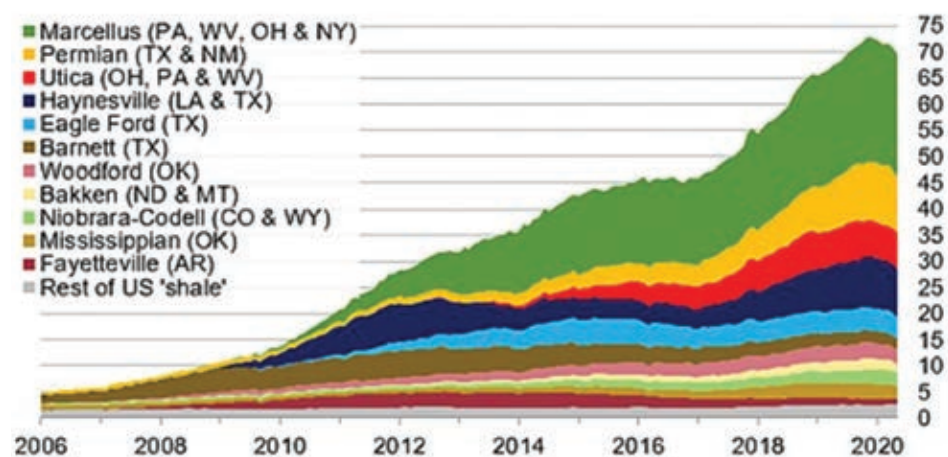
Woodside Petroleum, the largest Australian exporter and operator of North West Shelf LNG and the nearby Pluto LNG, stressed it had no plans to cut LNG production given that shipments are typically based on 12-month schedules.

Most big Asian buyers are seen to honour their offtake commitments for long-term LNG supply, though much fewer spot cargoes are sold at current low prices. There were no spot cargoes in April from the North West Shelf or the Chevron-operated Gorgon LNG plant in Western Australia. "Spot deals from other projects were at very low prices," EnergyQuest said. "One cargo from Wheatstone was sold at \$1.80-1.90 per MMBtu and two cargoes from Inpex-operated Ichthys LNG and one cargo from ConocoPhillips' Darwin LNG with the latter all believed to have been priced at around \$1.70-1.75 per MMBtu."

US gas storages fill up fast

The situation is dire in North America. Amid low demand for US LNG and pipeline gas exports, domestic gas

Monthly dry shale gas production
billion cubic feet per day



storages are filling up fast which depresses prices and accelerates the coal-to-gas switching in the power sector. According to Energy Aspects data, US feedgas is now more than 5.0 Bcf/d below its late-March highs and is a major contributor in the shoulder season's stubbornly high injection rate despite weaker production year-on-year.

"As more gas that was bound for US liquefaction is pushed back into storage, prices will have little room for upside outside of extended summer heat, especially as we have also noted that an initial return of associated gas volumes is taking hold," analysts commented. This dynamic has already led to correction mechanisms: US dry gas production started to fall both in the Appalachian and Permian Shale where low oil prices have led to shut-ins of mostly oil-directed wells which affects associated gas output. Dry gas production is seen average 84.9 Bcf/d in 2021, according to figures by the U.S. Energy Information Administration (EIA) which could push up Henry Hub prices to \$2.89 per MMBtu early next year.

In 2021, forecast dry natural gas production averages 84.9 Bcf/d, rising in the second half of 2021 in response to higher spot gas prices. EIA analysts say

prices will recover to an average \$23/bbl during the second quarter of 2020, before increasing to \$32/bbl during the second half of the year.

Signs of 'modest' demand recovery

But there is some silver lining on the horizon as gas demand is recovering in Asia and also northwest Europe. Staying optimistic, developers started up Train-3 at Cameron LNG in Hackberry, Louisiana, not least because China is returning to import more LNG. Market observers cautioned, however, the "outlook though the summer and autumn months look bleak." Utilization rates for US LNG terminals are "likely to fall further," which could lead to a meagre 0.5 Bcf/day rise of US exports to 5.5 Bcf/d on average in 2020.

Starting from 2021, analysts anticipate another modest rise of just over 0.5 Bcf/day to slightly above 6 Bcf/d between November 2020 and November 2021. Though demand is gradually picking up, the coronavirus crisis is expected to cause further project delays which have the potential to tighten the global LNG supply balance significantly in the years between 2023 and 2035. ■

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June LNG trade suffers but Asian demand looking up in July

LNG trade in June marks the preliminary low point in a declining trend set in motion by widespread public health measures in response to COVID-19 since March. It also marks a notable decrease year-on-year, which only underscores the prevailing tough market conditions for exporters big and small. However, the market continues to evolve with China and India in the ascent as new long-term demand centres. Markets Editor Alexander Wilk reports

Global LNG trade has been on a distinct declining trend since March, when public health measures at stalling the spread of COVID-19 began to take hold. Exports decreased by 2.16mmt (-7%) in April, followed by a 1.11mmt (-16%) reduction in May. In June, this trend saw its preliminary peak, whereby global conventional LNG trade saw a 2.83mmt reduction, decreasing to 26.30mmt (-9.7%) from the 29.13mmt seen in May. Trade performance in June 2020 also marks a decrease of 1.79mmt over 2019, equating to 6.4% of negative growth year-on-year.

June's month-on-month performance drop in terms of volume was primarily due to the Atlantic Basin, where trade was down 1.816mmt (-18.5%) to 7.95mmt on the 9.76mmt seen in May. Coming in second by volume drop was the Pacific Basin, where trade decreased by 1.15mmt (-9.8%) to 10.56mmt from 11.71mmt in May. Meanwhile, Middle Eastern trade continued on its growth path since May by 0.13mmt (1.7%) month-on-month to 7.79mmt from May's 7.66mmt. However, even that growth slowed considerably in June. We highlight that trade in all three Basins found year-on-year growth to be elusive, with Atlantic trade down by 0.82mmt (-9.4%) year-on-year, followed by the Pacific with 0.77mmt (-6.58%) and the Middle East with 0.20mmt (-2.5%).

Trade Flows

LNG trade was primarily determined by a slowdown in intra-regional trade in June. Although in May the amount of LNG shipped within each respective Basin had already decreased by 1.57mmt (-8%) to 17.3mmt from 18.87mmt in April, in June that month-on-month reduction accelerated to 2.56mmt (-15%). This meant total intra-basin trade stood at 14.74mmt at the end of June.

Intra-basin

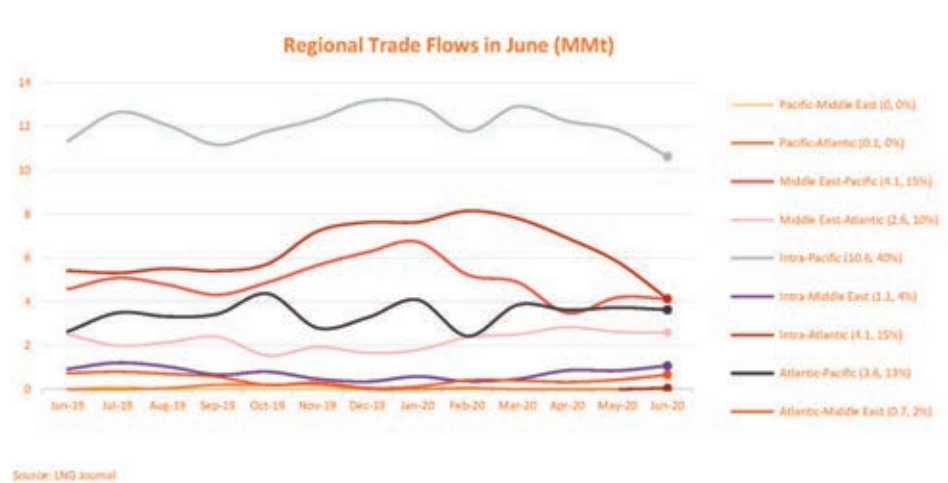
The intra-basin trade reduction in June was led by the Atlantic Basin, where volumes decreased by 1.49mmt (-28%), followed by the Pacific with 1.25mmt (-11%). Our data highlights a net demand

reduction in Europe, which subsequently had a severe impact on US LNG exports within the Basin. In the Pacific, demand reductions in South Korea and China coincided with scheduled maintenance in Australia and Russia. This by far outweighed increased domestic demand in Indonesia, the commissioning of new LNG import capacity in Myanmar and even renewed demand growth in Japan. In similar vein, intra-Middle Eastern trade, whilst enjoying relatively robust growth of 0.18mmt (21%) in June on higher exports to Pakistan and Kuwait from Qatar, could not tip the balance for intra-basin LNG flows overall.

Inter-basin

LNG flows from suppliers in the Pacific are typically bound to the Basin. Rarely does a cargo leave the region, one exception being a string of Peruvian cargoes arriving in Europe between September and November last year. In terms of inter-basin trade in June, LNG that originated in the Pacific found its way into the Atlantic Basin only for the second time this year as a Peruvian cargo of 0.05mmt aboard the Magdala was en route to Europe at the time of writing.

Inter-basin trade between the Middle East and the Pacific Basin saw negative month-on-month growth by way of a 0.06mmt (-1.4%) decrease in June. The relatively minor reduction nonetheless stood in stark contrast to the 0.61mmt growth seen in May. Notably, Oman shipped 0.16mmt less to the Pacific region in June than in May, instead doubling intra-basin exports to the Persian Gulf. Specifically, Omani shipments to China disappeared in June, only partially replaced with a cargo to Thailand, whilst the country's exports to India and Japan reduced by more than a third. As such, the slight increment in inter-basin trade between the Middle East and the Pacific was mainly carried by Qatar, which increased shipments to India, China and Japan, whilst the UAE's Das Island plant kept shipments to the Pacific broadly steady month-on-month.



Middle Eastern exports to the Atlantic Basin, meanwhile, continued to decrease in June after they began to decline in May. In particular Qatari shipments to the United Kingdom decreased by 0.51mmt (54%) in June, accompanied by less drastic export reductions to France, Poland, Greece and Turkey. As such, the volume of Middle Eastern cargoes shipped to Europe was down 0.49mmt (-20%) month-on-month. The monthly decline could have been worse but for a considerable boost in cargoes shipped from Qatar to Argentina, with LNG trade between the two countries expanding by 0.46mmt (354%) in June.

Concurrently, Atlantic Basin trade was no longer led by intra-basin shipments, with Europe no longer occupying the role of sink for excess LNG, alongside a tumble in US LNG exports. Instead, inter-basin trade from the Atlantic to the Middle East grew robustly by 0.23mmt (53%) in June. Nigeria stood out as an active seeker of Middle Eastern destinations for LNG that might previously have gone to Spain and France, finding climate-driven spot demand in the UAE and Jordan. Other Atlantic supply also flowed into the Middle East from Russia via reloads at Zeebrugge, from Angola's merchant plant at Soyo as well as two cargoes from the United States and Trinidad, respectively.

Pacific Basin

The decrease in Pacific trade in June was underpinned by continued subdued Far Eastern LNG demand, where government measures targeting the COVID-19 outbreak weighed on energy

consumption. Decreasing North Asian demand at this time of year is particularly significant since it forms part of the countries' second high demand season when electricity demand rises due to higher electricity demand from air conditioning.

Following a moderate demand increase of 0.13mmt (1%) in May, the Pacific Basin's imports slipped into negative growth of 0.44mmt (-2%) in June. The commensurate import capacity utilisation thereby also decreased by 1pp to 49%. Leading demand curtailment in the Pacific was South Korea, which cut back on LNG imports by 0.46mmt (16%). Even Chinese LNG demand growth went into reverse in June as offtakes decreased by 0.41mmt (-7%) compared to the 0.35mmt (7%) growth seen in May. Neighbouring Taiwan followed suit, reducing its LNG imports by 0.25mmt (-17%).

The Basin's supply response ended the month of June 2.82mmt (-9.7%) down in exports compared to May, which in turn decreased regional capacity utilisation by 8pp to 79%. The Pacific's biggest exporter – Australia – shipped 0.55mmt (-8.9%) less month-on-month, partly due to maintenance but also because South Korea continued to curtail offtakes. Accordingly, Australian plants heavily exposed to South Korean demand suffered, which led to Gladstone LNG reducing exports by 0.18mmt (-30%) in June, our data shows. Similarly, Russia's Sakhalin-2 LNG scheduled annual maintenance in June to avoid the regional demand slump, which led to the plant's exports decrease by 0.32mmt to 0.62mmt (-34%).

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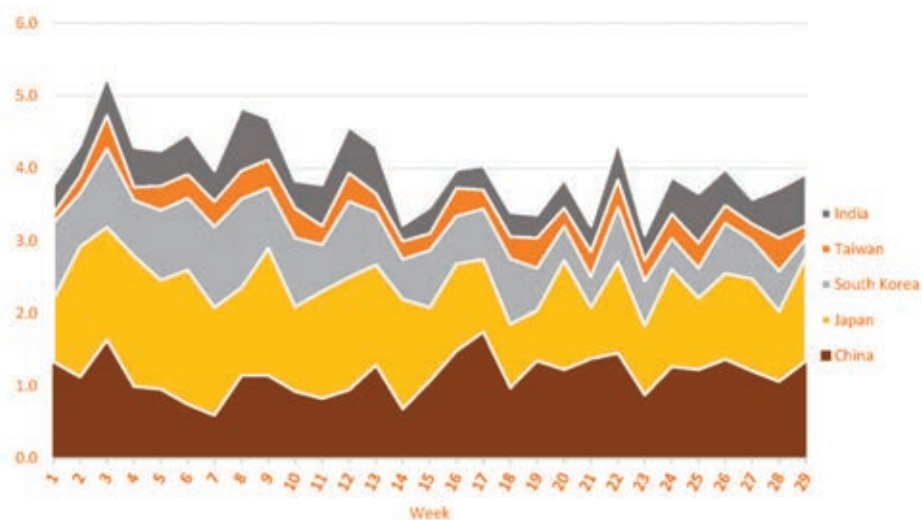
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Major Pacific LNG Imports in 2020 (MMt)



Source: LNG Journal

Although China's June demand stumble had no discernible knock-on effect on Australian exports since these are mainly rooted in long-term contracts, its effect could be observed in Papua New Guinea, for example, where PNG LNG saw shipments decrease by 0.09mmt (-12%) to 0.66mmt. Neighbouring Indonesia also saw a net cargo loading decline of 0.12mmt, led by a 0.10mmt (-45%) reduction at Donggi-Senoro LNG caused by lower Chinese and Far Eastern demand in general.

Nevertheless, our current data indicates monthly Chinese demand is already on track for renewed demand growth in July, underlined by an uptick in landed prices in the first half of the month. In our view, this cements China's status as one of the few sustained bright spots for LNG demand in Northeast Asia, as highlighted by our Markets Editor Anja Karl's analysis in her article above.

Unlike Indonesia, Malaysia saw significant monthly export growth in June. Notably, Petronas announced at the beginning of that month it would be 'optimising production volume' on low LNG prices, thereby hinting at imminent export reductions. However, its giant

Malaysia LNG complex still increased exports by 0.23mmt (14%) month-on-month. Like Australia, Malaysia did not suffer from China's temporary demand reduction, quite the opposite. Although shipments to Japan decreased by 0.16mmt, a significant volume increase of 0.13mmt (26%) to China almost compensated on its own. With monthly exports to Thailand broadly stable at 0.13mmt, Malaysia also benefitted from one additional cargo going to South Korea to push those exports up to 0.30mmt, whilst also exporting a cargo to Taiwan (Malaysia did not ship LNG to Taiwan in May). Finally, Myanmar's entry into the LNG market consolidated Malaysia's month-on-month LNG export growth by adding 0.13mmt in shipments.

With absent Chinese demand growth in June, it was left to India and Japan to temper the Pacific's decrease in demand. India's LNG consumption continued to grow robustly by 0.29mmt (17%) to 2.01mmt. As highlighted above, the country's LNG offtake has embarked on a sustained growth trajectory, even accelerating in recent weeks. As a result, African exporters – led by Nigeria – but also European re-exporters found a

much-needed LNG sink in India in June. We currently see India continue in this role in July, too, with imported LNG during the first two weeks of July already exceeding its June equivalent by 0.21mmt at the time of writing.

Japan's LNG demand also returned to growth in June, increasing offtakes by 0.23mmt (5%) to 4.87mmt. Although the country ended its official COVID-19 state of emergency in late May, we also highlight that last year some power operators warned they would be unable to comply with new nuclear safety measures approved in June 2019 before the deadline in May 2020. Meanwhile, several units are facing construction delays due to safety investigations, which points to another underlying reasons for the LNG demand increase, we think. Our current data outlook already shows considerable acceleration in Japanese demand growth for July, with imports during the first two weeks exceeding those of the equivalent June period by 0.60mmt.

Atlantic Basin

The amount of LNG exported within the eastern part of the Atlantic Basin – comprising Africa, Europe and Russia – saw a considerable net reduction of 0.39mmt (-8%) month-on-month in June. This decrease was led by Russia's Yamal LNG, which cut exports by 0.31mmt (-20%) from 1.54mmt to 1.23mmt in June. Although the plant was successful in doubling shipments both to the Middle East and the Pacific Basin via re-loads and use of the Northeast Passage in the Arctic, exports to European buyers were slashed by 0.53mmt (-40%) as they themselves sought to offload 0.47mmt via re-exports, most of which went to the Middle East and the Pacific. Atlantic LNG demand retreated by 3.38mmt (-35%) in June as key European buyers such as France, the Netherlands, the United Kingdom and Belgium cut their monthly

offtakes by 3.18mmt overall.

Injections into EU gas storage capacity have been on a declining trend since mid-May with an increasing amount being diverted to non-EU capacity as a short-term measure. In June and early July, however, this diversion of gas has slowed considerably, too, as European gas storage in general is filling up. Crucially, storage held by major European LNG importers was saturated to levels between 76 and 99% on 17 July, according to GSE data, whilst storage capacity utilisation across Europe had grown by 23pp to 76% since mid-April.

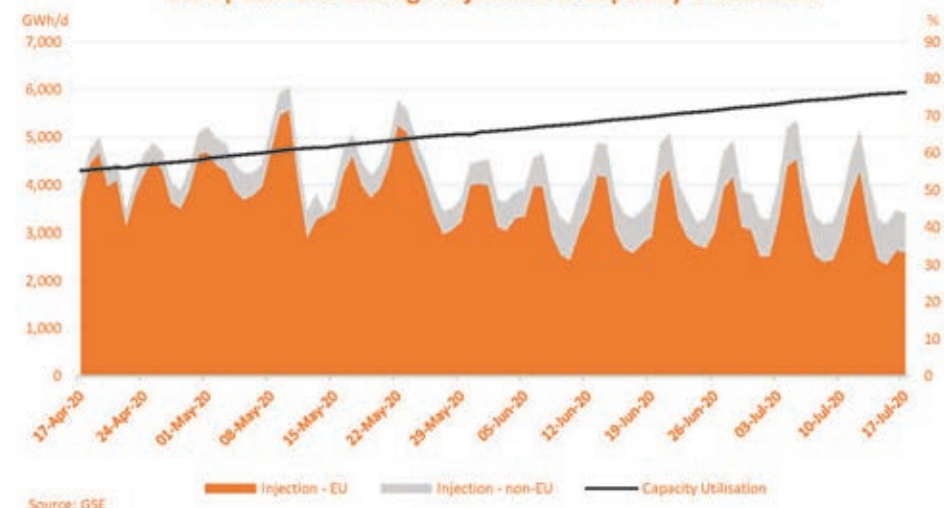
This development in European demand was instrumental to the tumbling of supply from the western half of the Basin, where exports retreated by a total of 1.44mmt (-27%) from 5.34mmt in May to 3.14mmt in June, almost twice as fast as the month-on-month reduction of 0.76mmt (-14%) in May. US LNG exports suffered a heavy net export decline of 1.41mmt (-34%) as capacity holders were forced to cancel a considerable number of shipments, as our Markets Editor Anja Karl highlights in her article above. The common thread was the simultaneous disappearance of demand growth in Northeast Asia as well as Europe stepping out of its role as convenient sink for excess US LNG. Meanwhile, demand growth elsewhere, such as in India, was supplied by competitive volumes out of Africa where merchant plants such as Angola LNG or large-scale operations such as Nigeria's Bonny Island facility are not bound by the rigid cost structure underpinning the tolling model of US LNG, in our view. Even South America only proved a limited haven for US LNG as Brazil did not show demand and shipments to Argentina saw stiff competition from spot supply originating in Qatar.

The sharp increase in Argentinian demand was not just significant for

Re-exports (black) and re-loads (yellow) in June

Source: LNG Journal
Not to scale. For illustration only.

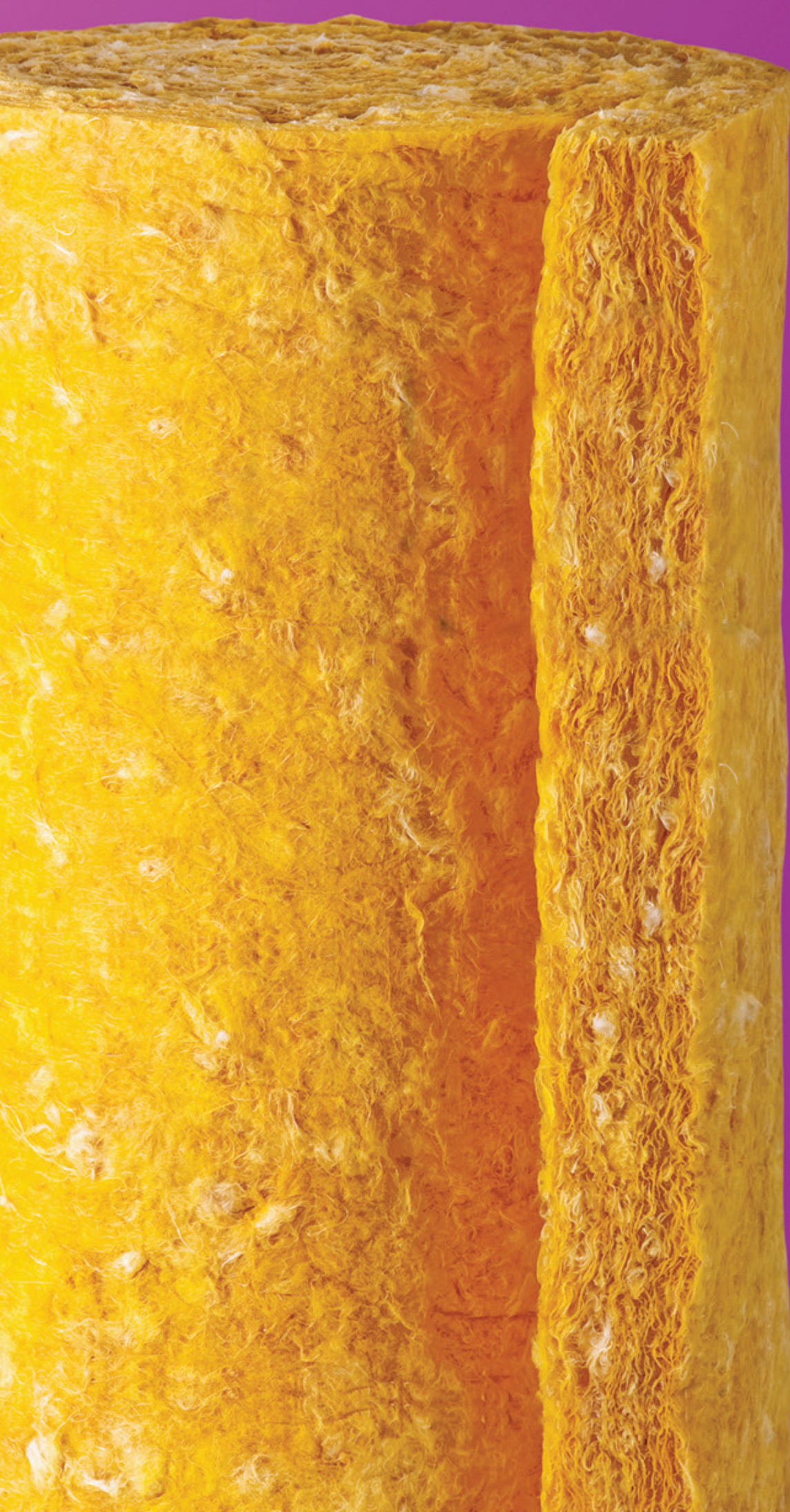
European Gas Storage Injection & Capacity Utilisation



Source: GSE

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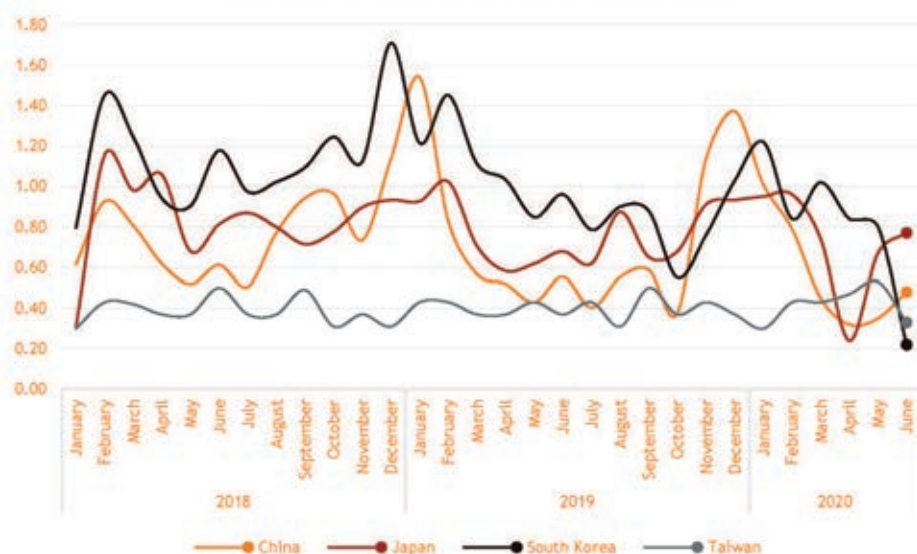
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Source: LNG Journal

Atlantic Basin demand overall, it also fuelled continued growth in FSRU capacity utilisation with imports up by 0.47mmt (17%) month-on-month. Imports were also considerably ahead of their year-on-year equivalent, showing robust growth 0.56mmt (20%). Argentina's sole LNG inlet is via the FSRU Expedient moored at Escobar, where imports grew by 0.50mmt month-on-month to 0.56mmt

in June, pushing utilisation to above nameplate.

Middle East

Middle Eastern supply was underpinned by Qatari export growth, which nonetheless only kept the region's shipments broadly steady in June. Overall, exported Middle Eastern LNG grew only moderately by 0.13mmt (2%) to

7.79mmt. Whilst this modest growth should not detract from the Basin's continuous high utilisation of operational export capacity (i.e. excluding Yemen), which rose to just above nameplate (101%) in June, our data reveals that even Middle Eastern LNG suppliers as a group – among the most established in the world – struggled to maintain their output in current market conditions.

Whilst Qatar increased its shipments by 0.27mmt (4%) month-on-month, that growth did not extend to exports to the Atlantic Basin, to which Qatari shipments remained broadly flat. Notably, month-on-month shipments to the United Kingdom decreased faster than in May, falling by 0.51mmt (55%) in June. Although increased exports to other European destinations – namely Italy, Belgium and Spain – could partially compensate, it was the rapid growth in exports to Argentina instead that allowed Qatar's exports to the Atlantic to hold the line in June. Meanwhile, the Gulf State's exports to the Pacific grew by only one cargo overall as even robust growth of exports to India could not compensate for a dramatic decrease of shipments to South Korea by 0.58mmt (-72%). Fortunately, exports to China and Japan increased by 0.23mmt combined to underpin month-on-month growth, modest it may be, of Qatari LNG flows to that Basin. As such, it was left to Qatar's shipments within the Middle East to deliver the bulk of the country's month-on-month increase in exports.

with Oman's down by 12pp to 80% and the UAE's down by 15pp to 87%. Egypt's Idku LNG, meanwhile, did not export a cargo in June as the protracted low-price environment is still making these shipments unattractive.

FLNG

Although representing only marginal capacity by global standards, exports from FLNG plants have suffered disproportionately from the prevailing low-price environment. Shipments decreased to 0.13mmt in June from 0.20mmt seen in May, representing a significant month-on-month decrease in FLNG exports by 0.07mmt (-35%). Consequently, global FLNG capacity utilisation also decreased from 30% in May to 19% in June. Notably, only the Hilli Episeyo stationed offshore Kribi in Cameroon exported LNG in June. Although the African offshore plant doubled shipments, Argentina's Tango FLNG barge at Bahia Blanca and Malaysia's PFLNG facility did not export cargoes whilst Shell's Australian Prelude barge also continued its market absence.

Force Majeure

Indeed, YPF declared force majeure on Belgian gas shipping firm Exmar, from which the Argentine energy champion is chartering the Tango FLNG barge. YPF asserts the effects of COVID-19 on the

The sharp increase in Argentinian demand was not just significant for Atlantic Basin demand overall, it also fuelled continued growth in FSRU capacity utilisation

Shipments to Pakistan grew by 0.13mmt (40%) whilst exports to Kuwait increased by 0.10mmt (33%) in June.

In contrast, the two other active producers in the Persian Gulf – Oman and the UAE – saw exports decline by 0.08mmt and 0.06mmt, respectively. Consequently, both saw export capacity utilisation decrease month-on-month,

Argentine gas market have removed its ability to fulfill its standing FLNG agreements, including liquefying gas and the capacity to pay invoices due for Exmar services performed since mid-March 2020.



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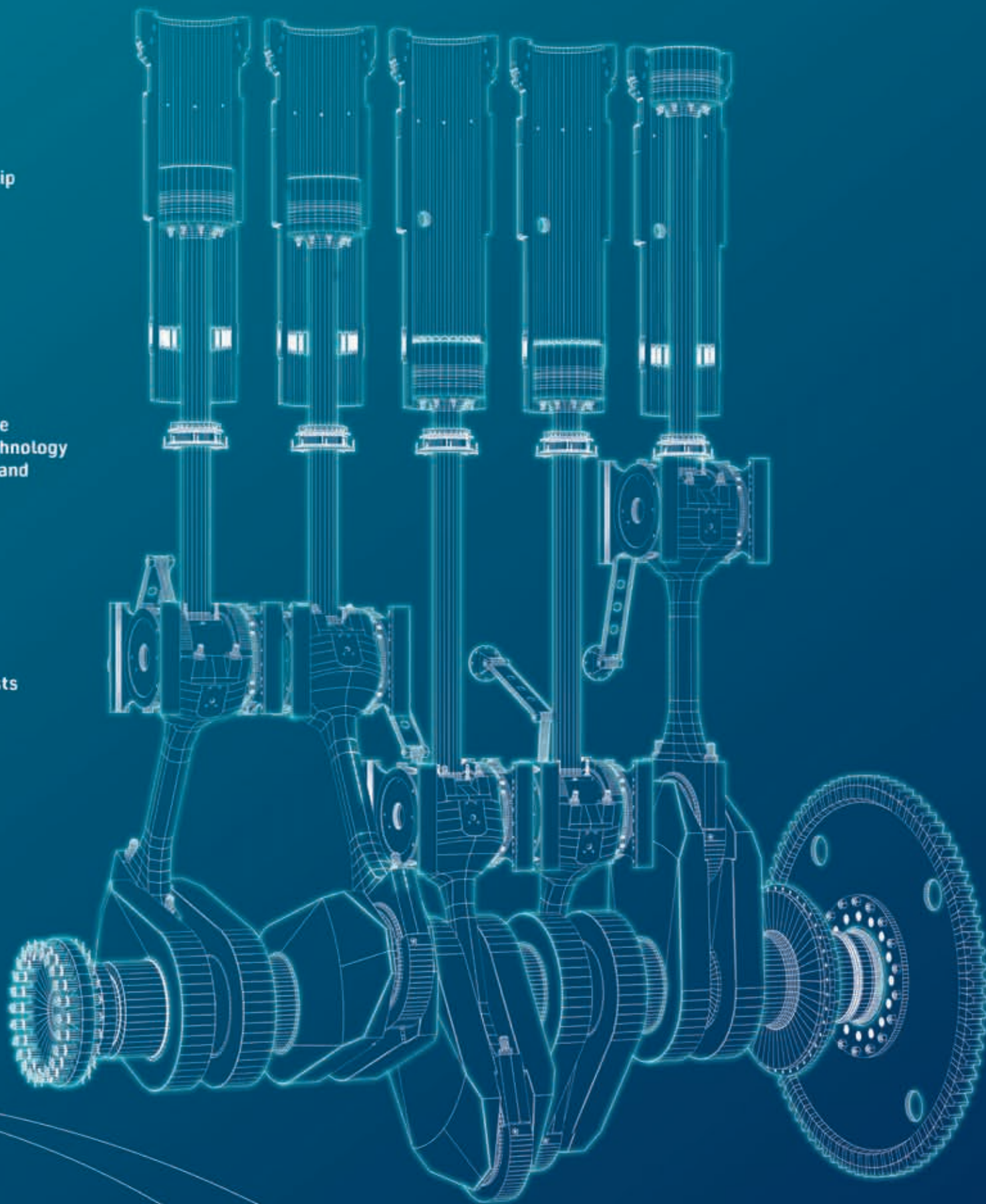
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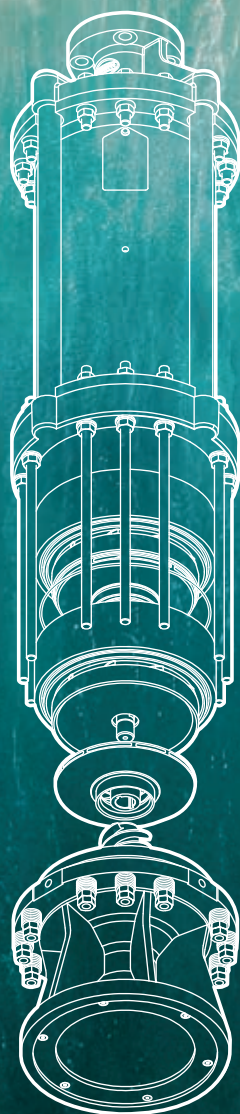


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Australian LNG heads to South Korea and Indonesia, outcompetes thermal coal

The economics of Australian term LNG deliveries as well as spot LNG cargoes are becoming more attractive than imported thermal coal in markets like South Korea, Japan and Indonesia from September. Anja Karl investigates.

LNG buying activity is gaining traction, spurred by rising demand from South Korean independents, second-tier Chinese importers and Indonesian utility buyers – all keen to strike mid-term deals at current low gas prices. In fact, deliveries of oil-indexed LNG cargoes have become competitive with thermal coal prices. Hence imported Australian coal increasingly gets displaced by LNG in markets like South Korea, Japan and Indonesia.

“Any large-scale displacement of Australian coal from the Korean import mix would weigh heavily on coal prices,” Energy Aspects said, noting the drop in coal prices might help preserve the use of some coal-fired generation units. The fuel switch from coal-to-gas in the Korean power sector could cause up to 1 million tons per month of incremental LNG demand from September 2020 until January 2021.

The fuel switch window will reopen from September, which is expected to be the first month when both oil-indexed and JKM LNG prices look commercially competitive with coal in the South Korean power market.

KOGAS’ fuel switching gets policy tailwinds

The trend away from coal- to LNG-fuelled power generation benefits from policy tailwinds in South Korea, where further mandatory coal power plant closures would “allow for greater oil-indexed imports at a time when they are cheapest.”

“This would prevent KOGAS from having to sell its long-term supply on the global spot market,” Energy Aspects said. The South Korean gas company recently noted a considerable month-on-month downturn in gas sales to the domestic power sector as coal power plants closures, imposed to limit emissions in major urban centers came to an end, while oil-indexed LNG deliveries were still uncompetitive against coal and spot LNG in power.

Today’s thermal coal market in Asia Pacific faces another source of downward pressure: The Chinese government is in a trade dispute with Australia, after the

latter supported an U.S. investigation into the origins of the coronavirus. If that feud is escalating, analysts see a risk that China will halt its coal imports from Australia which would have a knock-on effect on global coal and LNG markets.

China-Australia feud could curtail coal imports

“If China displaces a share of Australian coal with its own domestic production, rather than just importing from another supplier, it could drag down seaborne coal prices in the Pacific,” analysts said.

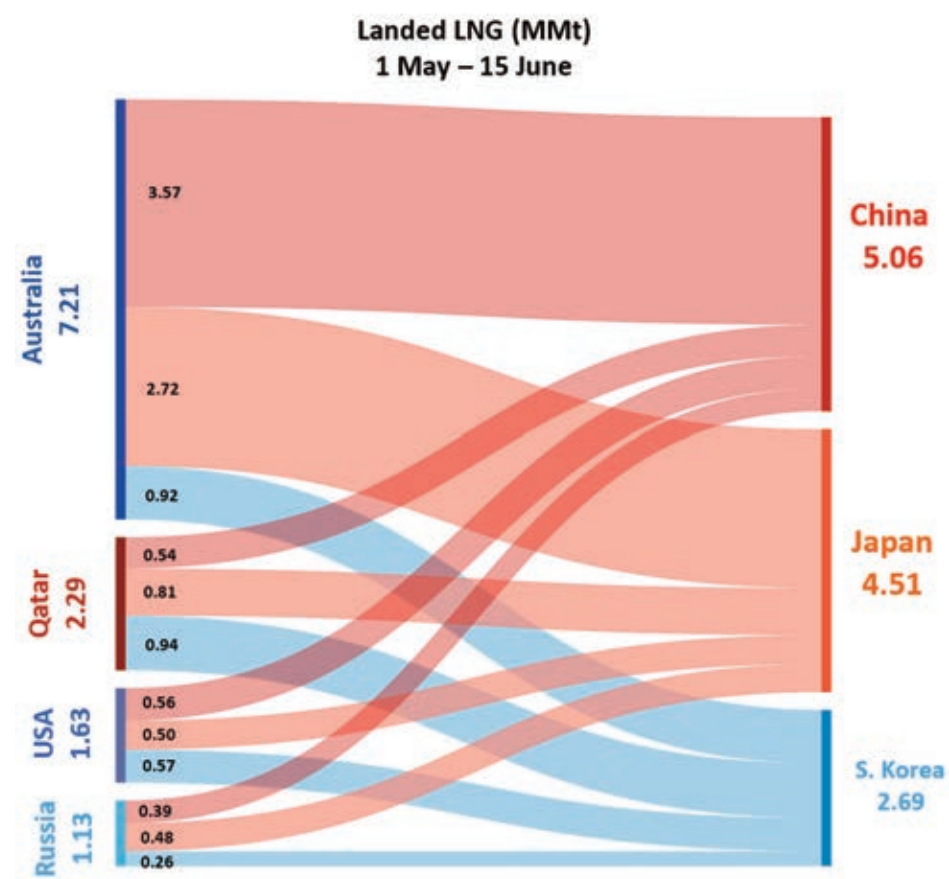
China’s National People’s Congress had repeatedly stressed the importance of domestic ‘clean coal’ in the topic of energy security, indicating support for a domestic output push. “Collapsing Pacific coal prices would be a headwind against South Korean fuel switching, as well as spot LNG being competitive against coal elsewhere in Asia’s power sector,” analyst said, concluding the affordability of LNG in Asia will continue to lead to demand growth despite residual lockdowns in some countries.

Landed LNG cargoes in China from the United States have fallen to 9 in May and June, compared to 72 cargoes from Australia and some 8 or 9 both from Qatar and Russia, according to our LNG Unlimited Data. Australia is the clear winner in terms of LNG deliveries into China, still the world’s fastest growing gas market ahead of India.

By 2025, the International Energy Agency (IEA) expects China to overtake Japan as the world’s biggest LNG buyer with imports of 128 Bcm a year, equivalent to around 174 million tonnes. IEA analysts cautioned, however, this scenario is “highly dependent on China’s future policy direction” and whether that includes an ongoing push for coal-to-gas switching for industry, residential heating and power generation.

Ample LNG buying activity has been seen from Korean independents and second-tier Chinese LNG importers, with Energy Aspects expecting upside in LNG demand especially from China.

In contrast, Citigroup’s research remains rather cautious by estimating China’s full-year gas demand will grow by



just 4%. The bank’s director Antony Yuen argues the country’s LNG imports could peak in the early 2020s, saying pipeline gas imports started to grow faster than LNG import this year.

During the first two months of 2020, when the pandemic peaked in China, state-buyers kept importing some cargoes, filling up strategic storage and making advantage of low spot prices. At the same time, the Gazprom-led Power of Siberia gas pipeline is expected to transport 5 Bcm of Russian gas to northern China this year and volumes will reach 38 Bcm per year full capacity in 2025.

Prior to the Covid-19 crisis, Chinese state-owned oil and gas companies were planning to bring online some 80 Bcm of new LNG regasification capacity by 2024. Though the timeline of this capacity build-out may be delayed, once realized, it will allow for more than 40 Bcm of additional LNG imports assuming a conservative utilization rate of 55-60%.

Japan shuns thermal coal, turns to LNG instead

Coal is no longer a favourite fuel in Japan’s new energy policy which stipulates to mothball or retire up to 100

inefficient coal-fired power plants by 2030. Analysts say this will shift Japan’s energy mix towards nuclear and gas, creating upside for LNG imports. However, rather than phasing out all of Japan’s pre-1995 coal-fired fleet, market observers say it is more likely that all lower efficiency plants could be targeted. Low-efficiency coal power plants are defined as requiring more than 8,600 Btu of fuel per kWh of electricity output.

If all these units will be closed, Japan would lose an estimated 24 GW of thermal generating capacity which represents about 51% of the country’s currently operating fleet of coal power plants. This is a significant proportion of the current mix, representing about 51% of Japan’s operational coal-fired plants.

Japan’s ‘lost’ coal generation could reach around 160 TWh by 2030, Wood Mackenzie estimates based on Japan’s current coal phase-out schedule. In this case, the contribution of nuclear power would have to be increased but gas-fired generation is likely to make up for most of the lost capacity. By 2030, up to an additional 13 million tons (Mt) of LNG could be required to help fill the gap.

“Any issue with

‘Any issue with nuclear restarts – an obvious risk – and LNG demand could be higher still’

nuclear restarts – an obvious risk – and LNG demand could be higher still,” analysts said, stressing this would “inevitably increase generation costs.”

Japanese contracted spot LNG cargo prices for June rebounded to \$3.80 per million British thermal units after falling to a record low of \$2.20 per MMBtu in the previous month of May, though still well down on June 2019 when they were

valued at \$5.50 per MMBtu.

Spot cargoes delivered to Japan in June were priced at \$3.80 per MMBtu versus \$2.60 per MMBtu in the previous month and cost almost half the price of \$7.50 per MMBtu prevailing in June 2019, according to the data from the Japanese Ministry of Economy, Trade and Industry Ministry.

Overall Japanese LNG imports plunged by almost 19% to 4.51 million tonnes from 5.56MT in May 2019 as the government implemented restrictions for the Covid-19 pandemic. Around 65 LNG cargoes were imported to Japan in May, compared with 80 cargoes the previous month. According to METI figures, the normal level of LNG deliveries at the start of 2020 was around 100 cargoes.

Costs for monthly LNG shipments fell to 236.66 billion yen (\$2.20bn), some

22.2% less than the May 2019 import bill of \$304.86 billion yen, according to the Japanese Finance Ministry.

Indonesia's LNG demand stays resilient

Notwithstanding the current global economic downturn, Indonesia's LNG demand has proven to remain resilient. Import volumes are forecast to reach 3.1 million tonnes in the second half of 2020, rising by 1.2 Mt or 63% year-on-year. Following a slow first quarter, Indonesia's LNG consumption keeps rising from 1.1 Mt in the second quarter and appears to be well-cushioned against the impact of Covid-19. Reduced pipeline gas and low spot prices have supported Indonesia's demand for spot LNG cargoes.

“Cost of generation and meeting growing electricity demand is key in Indonesia,” said Wood Mackenzie's principal analyst Lucy Cullen. “While coal will always be cheaper, it would be interesting to see in the longer term whether lower gas prices could encourage greater role of gas in the energy mix,

and eventually accelerate the country's energy transition.”

Regulations, recently introduced by the government, are aimed at lowering domestic gas price to \$6 per MMBtu for seven key industries as well as the electricity sector. These measures are meant to improve industrial competitiveness, especially for exports, and create multiplier effects.

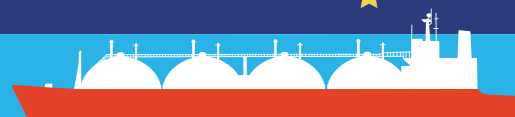
The share natural gas of Indonesia's total primary energy demand has been about 12-13% over the past few years, but LNG is targeted to fuel a growing share of Indonesia's power generation mix in the years ahead, offering opportunities for infrastructure development.

“The story of Indonesia is consistent with Asia's outlook at large. According to Wood Mackenzie projections, the region's LNG imports will reach 250 Mt this year, a 2.5% increase compared to last year, and could hit 315 Mt in 2025. By 2040, Asia is expected to account for up to 40 percent of global LNG consumption with Indonesia and its Southeast Asian neighbors seen as key engines of this growth. ■

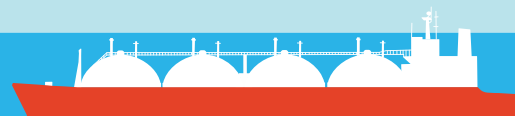
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Five trends in the current LNGC orderbook

We are observing five distinct trends within the current LNGC orderbook. There is a distinct move towards two ends of the spectrum when it comes to newbuild sizes: either new orders are for very large or very small vessels to offer maximum flexibility or meet specific small-scale requirements. Alexander Wilk investigates

As a result of this divergence, specific sectors of the current fleet are ageing much faster than others as they are not replenished with newbuilds. Meanwhile, Chinese yards have helped to reign in newbuild prices since 2010. At the same time, we are seeing an emerging division between Chinese and South Korean yards based on technology. Finally, lower emissions policies have had a clear impact on engine and containment system choice.

Our market visibility indicates the current LNGC orderbook comprises 122 vessels amounting to c. 11.06 million DWT that have a delivery horizon of late 2023. The current schedule indicates the bulk of deliveries will take place in 2021, delays notwithstanding.

1. Newbuild sizing is moving to opposite corners, leaving the middle ground unoccupied

More than 93% of vessels currently on order are massing more than 80,000 DWT whilst only nine have less than 40,000 DWT. We are not seeing any vessels in-between these two categories. In our view, this underscores two major trends in the LNG shipping market: On the one hand, demand for large capacity LNGCs is rising to ensure sufficient flexibility and cost efficiency on longer journeys. As LNG demand rises globally alongside a policy initiative to increasingly switch from coal to gas, we think fleet owners are betting on demand for large cargo batches by LNG buyers. At the same time, modern containment systems support partial loadings and discharges. On the other hand, the same broad coal-to-gas policy change has led to an ongoing expansion of smaller LNG projects – led by

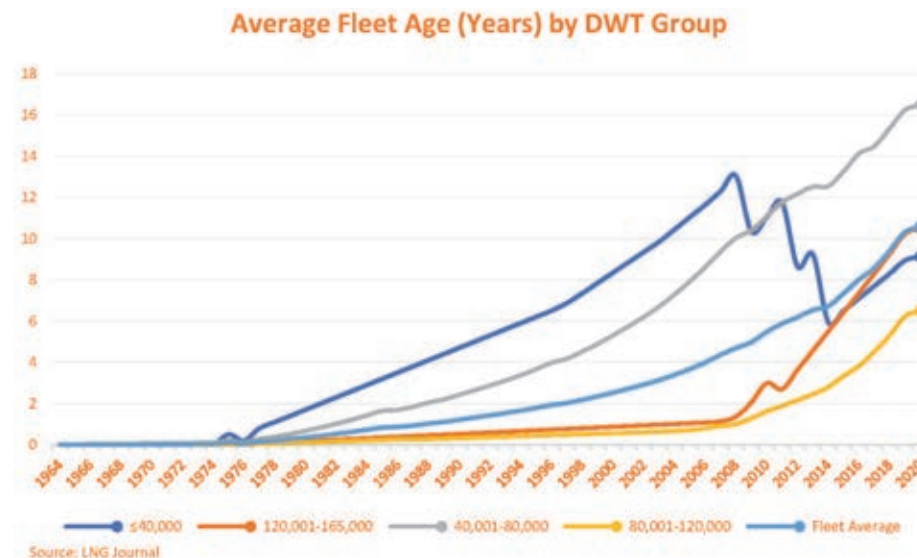
Scandinavian and Baltic small-scale LNG trade developed by Skangas, Gazprom and others – according to our terminal database.

2. Order choices mean specific fleet sectors are ageing much faster on average

These two trends also had the effect that the group of mid-range LNGCs is ageing the fastest, our data indicates. Accordingly, the 40,000-80,000 DWT group within the global LNGC fleet is currently the oldest since it is not replenished. The average age of vessels in that particular group is in excess of 16 years – up to a decade older than the average for the group of 80,000-120,000 DWT vessels. A similar trend applies to the largest vessels within the global fleet: Qatar's Q-Flex and Q-Max vessels.

3. Chinese yards are tempering newbuild prices

More than third of LNGCs on order are currently under construction at Hyundai Heavy Industries in South Korea, followed by neighbouring Samsung Heavy Industries and Daewoo Shipbuilding & Marine Engineering. Notably, Chinese yards, led by Hudong Zhonghua, are continuing to eat into the market share of established South Korean yards. What began as a trickle in 2003 with isolated orders such as the Min Rong – a conventional 82,359 DWT LNGC dedicated to supplying China from Tangguh LNG – has since grown into a sizeable stream. Alongside an increasing flow of Chinese capital into major LNG projects such as Australia Pacific LNG and Yamal LNG came a rise in orders for LNGC capacity from Chinese yards. Far from being coincidence, Chinese state policy is



pushing for domestic yard capacity to expand and capture market share to support domestic industrial capacity.

In our view, the rise of Chinese yard capacity capable of delivering conventional LNGCs has also contributed to a stabilisation of LNGC newbuild prices. The value of new orders has been on a downwards trend since 2010. Although the relatively high prices in the mid-2000s were partially due to an expansion of Qatar's LNG fleet, which includes its unique (and expensive) Q-Flex and Q-Max vessels, our research indicates Chinese newbuild prices averaged around \$170mln compared to an average of \$200mln for vessels built in South Korea.

4. Emerging division between Chinese and South Korean yards based on technology

A key aspect of the price difference is due to South Korean vessels' tendency to incorporate the latest technology available. For example, the fleet of ice-breaking Arc-7 class LNGCs employed by Yamal LNG in Russia was built by Daewoo and Hyundai Heavy Industries. Our research indicates

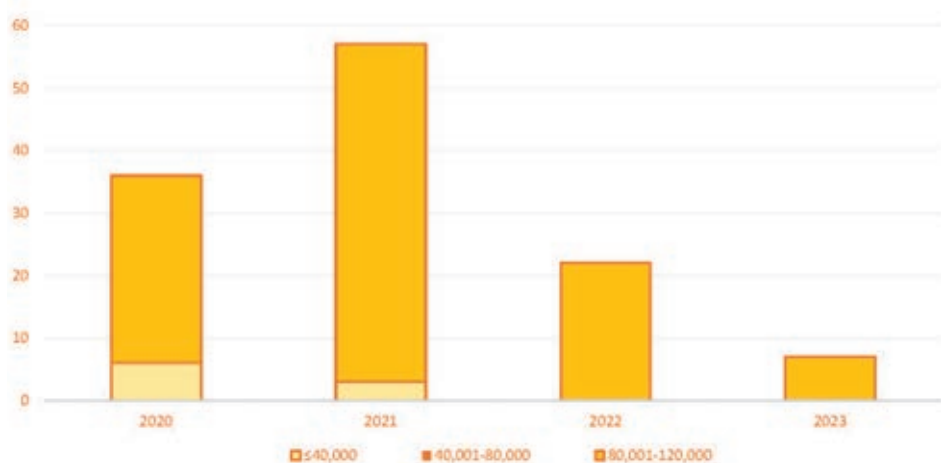
the cost of these specialist LNGCs was at c. \$312 mln each. Consequently, we are also detecting an emerging division between Chinese and South Korean yards, with the former weighing on prices for 'standard' LNG capacity whilst the latter are leveraging the technical know-how garnered over more than a decade of market dominance to provide additional value in the specialist LNGC sector.

5. Containment system choices need to take account of new environmental regulations

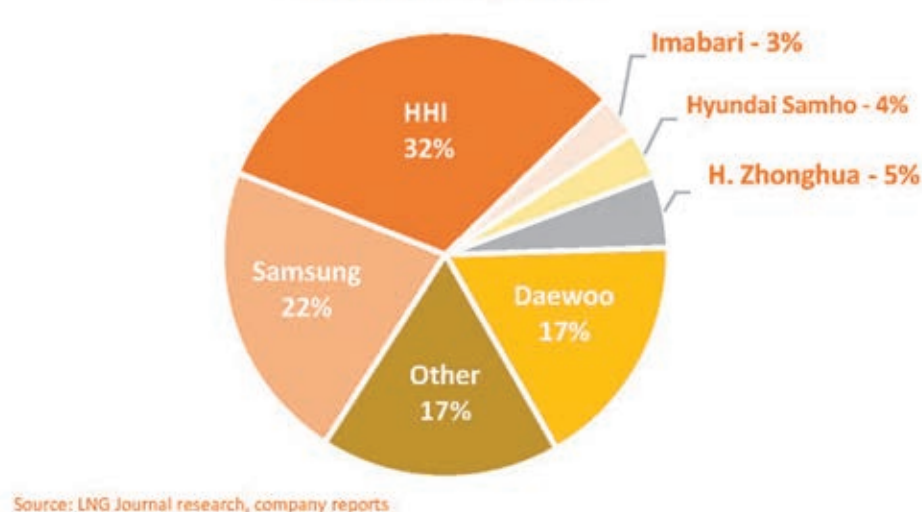
Since January 2020, the marine sector is bound by the steepest one-time cut to sulphur emissions ever imposed by the International Maritime Organisation (IMO). Whilst IMO regulations to reduce emissions from sulphur oxides have been in force since 2005, Annex VI of the MARPOL Convention, the new 2020 rules are slashing them by more than 80% to further reduce air pollution emanating from maritime trade.

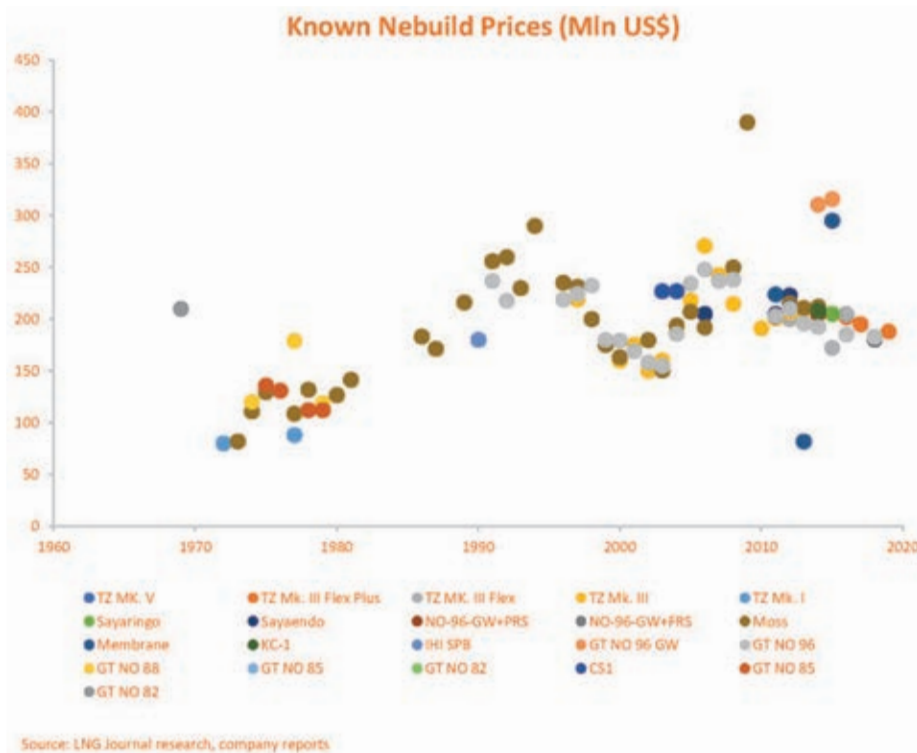
Accordingly, we have observed a distinct shift by fleet owners towards more LNG propulsion. Where such

Order Book Outlook



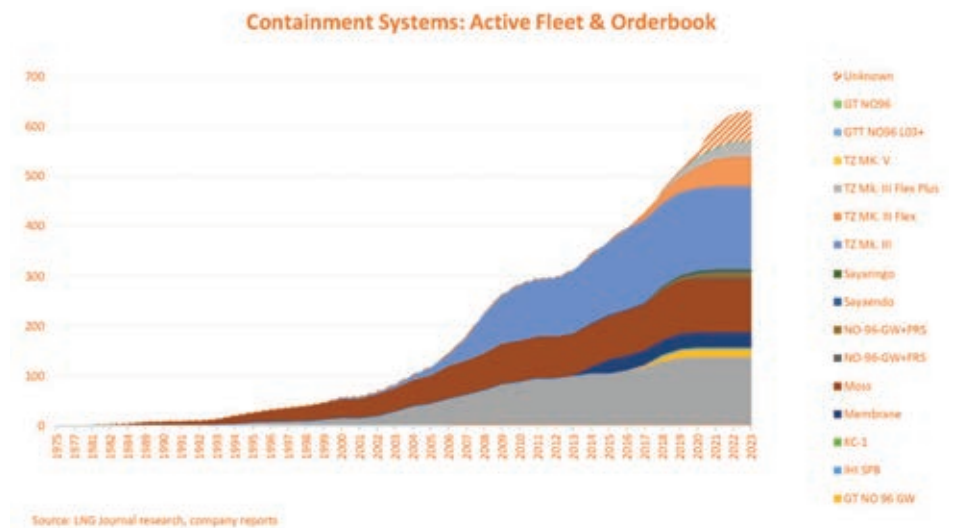
Orderbook by Yard





information is available, all newbuild orders – both conventional and small-scale – are including engine choices that allow the use of LNG, such as ME-GI and X-DF engines. These engines provide shipowners and operators with the option of using either Heavy Fuel Oil or gas to run their vessels, making use of the

vessel's boil-off gas (BOG). Running their vessels on BOG means they are virtually free of sulphur emissions during that time. Fleet owners are thus also preparing themselves for a potential extension of global CO₂ cap-and-trade schemes aimed at reducing CO₂ emissions, such as the European Union's



emissions trading system, membership to which is already mandatory for the aviation industry.

Running dual-fuel engines requires highly efficient containment systems. On the one hand, they go hand-in-hand with on-board gas cycles aimed at diverting BOG to the engine or refrigerating at least part of it to minimise in-transit cargo loss. On the other, containment systems with lower profiles such as membrane systems allow for lower air resistance of LNGCs, thus saving considerable amounts of fuel in the long run.

Our data indicates membrane type containment systems currently have the largest market share, accounting for more than 50% of the market in 2020. We highlight that more than 60 orders still need to have their containment system confirmed, which means the real market share of membrane type systems is likely to be much higher. We suspect that the true market share of membrane systems is above 90%.

Accordingly, we expect that particular containment segment to dominate the LNGC orderbook going forward. ■



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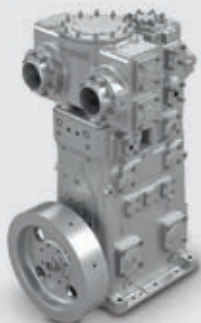
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For the Record

AIR PRODUCTS, the US industrial gases and LNG equipment provider, has signed a deal in conjunction with ACWA Power of Saudi Arabia and a new smart city planned in the Kingdom for a \$5 billion world-scale green hydrogen-based ammonia production facility powered by renewable energy. The location is Neom, a proposed cross-border city in the Tabuk Province of northwest Saudi Arabia. It is planned to incorporate smart-city technologies and also function as a tourist destination. The site is near the Red Sea and the borders of Egypt and Jordan. The joint venture project is the first partnership for Neom with leading international and national partners in the renewable energy field and Air Products said it would be a cornerstone for its strategy to become a major player in the global hydrogen market. “It is based on proven, world-class technology and will include the innovative integration of over four gigawatts of renewable power from solar, wind and storage,” said Air Products. “There will be production of 650 tons per day of hydrogen by electrolysis using Thyssenkrupp technology and the production of nitrogen by air separation using Air Products technology,” it added. The production of green ammonia will amount to 1.2 million tons per year using Haldor Topsoe technology. The project is scheduled to be onstream in 2025. “Air Products will be the exclusive off-taker of the green ammonia and intends to transport it around the world to help produce green hydrogen for the transportation market,” said the Lehigh Valley, Pennsylvania-based company.

The company conducts its industrial gases business alongside its provision of LNG equipment products such as the main cryogenic heat exchangers for plants and its proprietary propane pre-cooled mixed refrigerant liquefaction process. Most of the worldwide LNG production comes from Air Products technology and the company provides key equipment for the natural gas liquefaction process for large export plants, small and mid-sized plants and floating LNG facilities. It is also involved in Chinese industrial gases projects and

other similar ventures in Saudi Arabia.

“We are honored and proud to partner with ACWA Power and Neom and use proven technologies to make the world’s dream of 100 percent green energy a reality,” said Seifi Ghasemi, Chairman, President and Chief Executive for Air Products. “Harnessing the unique profile of Neom’s sun and wind to convert water to hydrogen, this project will yield a totally clean source of energy on a massive scale and will save the world over three million tons of carbon-dioxide emissions annually,” added Ghasemi. Mohammad A. Abunayyan, the Chairman of ACWA Power, said the project stems from Crown Prince Mohammed bin Salman’s aspirations for Neom to become the global pioneer in sustainable living. “ACWA Power is proud to take part in this ground-breaking and first-of-its-kind investment,” stated Abunayyan. “We have a proven track record of leveraging pioneering renewable technologies to deliver carbon-free power at the lowest cost,” he explained. “With our global experience, we are confident that our collaboration with an industry-leading company like Air Products will create significant opportunities in the production of green hydrogen, and further us in our goal to help countries meet their clean energy targets and unlock significant socio-economic benefits,” stated Abunayyan. The project is based in Neom’s industrial cluster and is enabled by its unique mandate. The investment is intended to integrate and localize cutting-edge technologies that will harness solar and wind power to produce sustainable and globally accessible green energy.

ALASKA Gasline Development Corp. has released an updated \$38.7 billion cost estimate for the Alaska LNG Project, which it believed would increase the project’s ability to deliver natural gas to Alaskans and LNG to export markets at competitive prices. The updated cost estimate was presented during AGDC board meeting on June 15. The updated estimate reflects a \$5.5 billion (12.4 percent) cost reduction off the previous \$44.2Bln cost estimate compiled in 2015 by the project’s previous joint venture leaders, including UK major BP, ExxonMobil, ConocoPhillips and AGDC. “The new estimate will enhance the competitive price of LNG from the Alaska LNG project versus similar projects vying to serve major Asian markets,” said the company owned by the state of Alaska.

“Long-term LNG demand is forecast to exceed available supply as consumers seek the environmental benefits of LNG over other energy sources,” it stated.

AGDC said the \$38.7Bln estimate was established during a rigorous, 14-month process incorporating significant third-party natural gas and LNG industry expertise. Along with AGDC staff, participants included representatives from BP, ExxonMobil, and engineering company Fluor Corp. “Alaska LNG’s cost reductions capitalize on technology and process improvements developed in the LNG industry over the past several years, reflecting maturation of the industry,” said the statement. “These improvements include advancements in gas liquefaction technology and modular construction techniques, lower engineering costs and a streamlined project management team,” it added. “The cost estimate validates the efficiency of the Alaska LNG project’s design and major components, including a North Slope gas treatment plant, an 800-mile pipeline, and a Nikiski, AK-based LNG plant,” stated AGDC.

AGDC President Frank Richards explained that the update improve the competitive position of Alaska LNG and its ability to deliver LNG and natural gas at favourable prices. “We are incorporating these results into our discussions with potential partners as we work to transition to a new market-led project team and maximize project benefits for the State of Alaska,” said Richards. “While the results strengthen the case for developing this project, it will ultimately be the market that determines the best path forward,” he added. AGDC obtained federal authorization to construct and operate the Alaska LNG project on the 21st of May 2020.

CHENIERE Energy, the largest US liquefied natural gas producer, has followed the strategy of major oil and gas companies by publishing its inaugural corporate responsibility report to monitor its performance on environmental, social and governance issues. Cheniere’s policies are more important than most as it is currently the bedrock of the US LNG export industry with its Gulf Coast plants at Sabine Pass in Louisiana and at Corpus Christi in Texas.

Cheniere’s corporate responsibility report includes disclosures aligned with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), the Sustainable Accounting Standards Board (SASB) and other

leading reporting standards. Cheniere has pledged to issues its corporate responsibility report on an annual basis. “We are proud to publish our inaugural corporate responsibility report, a company-wide effort that represents a significant step forward in our transparency commitments on sustainability issues,” said Jack Fusco, Cheniere’s President and Chief Executive. “From Covid-19 to climate change to diversity and inclusion, Cheniere’s ‘First and Forward’ report forms the foundation of disclosures on key ESG themes,” added the CEO. “Our commitment to address ESG issues is core to our operations and critical to our future as a leading global LNG provider,” stated Fusco.

The Cheniere report demonstrates the company’s progress through action across key themes, climate, environment, workforce, health and safety, community, and governance since it began operations in February 2016. Since that date the company as of the end of April 2020 had shipped more than 1,100 cumulative LNG cargoes totaling over 75 million tonnes of LNG produced, loaded and exported from the plants in Louisiana and Texas. Cheniere said it was planning to achieve a 35 percent reduction in greenhouse gas (GHG) intensity in operations and cutting methane intensity by 64 percent. It is also focusing on improving health and safety with a 63 percent reduction in total recordable incident rate (TRIR) and a 43 percent reduction in lost time incident rate (LTIR). The Gulf Coast company is additionally improving workforce diversity, with a 15 percent increase in ethnic minority employees and a 21 percent increase in women and 14 percent in ethnic minorities in management. Investing more than \$3.7 million into local communities, including more than \$1 million for global Covid-19 relief efforts.

This new strategy will be overseen by a new board-level body on climate and sustainability issues. “Cheniere’s ‘First and Forward’ report is a benchmark for actions that improve the company’s ESG performance,” said the company. “The report details Cheniere’s commitments to support the transition to a lower-carbon economy and reaffirms natural gas as a fundamental energy source in a lower-carbon future,” it stated. Cheniere’s total first-quarter revenues, mostly LNG sales, rose 20 percent to \$2.71 billion from \$2.26Bln in the same three months of 2019. Cheniere like other companies is trying to weather the Covid-19 crisis.

It has cancelled cargoes shipped in 2020 because of the combined effects of Covid-19, market over-supply and historically low prices. The company, which receives a fixed fee when cargoes are cancelled, is reviewing different options for adjusting its LNG operations if current market conditions persist. Fusco also said recently that Cheniere would need more long-term contracts with buyers in Europe and Asia to support new Trains beyond the ones under construction, which is difficult because of the Covid-19 lockdown. Sabine Pass currently has five processing Trains on stream with nameplate capacity of 22.5 million tonnes per annum and the second Train at Corpus Christi also started up in 2019. Cheniere's plant developments are continuing with the construction of Train 3 at Corpus Christi and Train 6 at Sabine Pass. The Houston-based company has already received regulatory permission to proceed with developing what it calls its Stage 3 project comprising seven midscale liquefaction Trains adjacent to the Corpus Christi project, each with an expected nominal production capacity of around 1.4 MTPA of LNG. The total expected output of the seven midscale Trains is around 9.5 MTPA and take Cheniere's overall production to more than 50 MTPA.

COASTAL GasLink pipeline, the project to deliver at least 2.1 billion cubic feet of natural gas per day to the LNG Canada export plant being built in Kitimat in British Columbia, laid its first section of pipes in the ground in July and a peak workforce of 2,500 is expected to be on site in the months ahead. Coastal GasLink, whose operator is North American pipeline company TC Energy, said it was ready to launch its summer construction programme in BC after a financing deal for the pipeline was concluded in May 2020. The company said construction was also beginning on compressor and metering stations that will form anchor points along the 670-kilometres (416-mile) pipeline route running from the Dawson Creek area of northeast BC to the Pacific coastal town of Kitimat.

Work on the main compressor station is scheduled to begin in July and the company said activity on the entire project will gradually ramp up in the following months. Once completed, the pipeline will connect abundant Western Canadian Sedimentary Basin natural gas supply to the Royal Dutch Shell-led

operated liquefaction plant near Kitimat. TC Energy completed project financing and the sale of a 65 percent equity interest in the pipeline project, allowing a full work programme to go ahead. The transaction released proceeds of around C\$2.1 billion (US\$1.5Bln) for the Calgary-based operator from the sale to two equity finds, KKR-Keats Pipeline Investors II (Canada) Ltd. (KKR) and a subsidiary of Alberta Investment Management Corp. (AIMCo).

Shell and its four partners in LNG Canada, Mitsubishi Corp. of Japan, Malaysian energy company Petronas, Chinese major PetroChina and Korea Gas Corp., have already started construction of the plant. The facility is being built on a brownfield site near Kitimat that had been an energy products terminal before being acquired by Shell in 2011. The Shell-led export project is working closely with the Haisla First Nation whose traditional lands are in the Kitimat coastal region as well as with other First Nations along the pipeline route. TC Energy has said it remained committed to partnering with the 20 First Nations who have executed agreements with Coastal GasLink project. The company has provided an opportunity for them to invest in the project with an option to acquire a 10 percent equity interest in Coastal GasLink. Coastal GasLink selected Toronto-based Aecon Group Inc. as the prime contractor for construction of the compressor and metering stations. The initial phase of the project includes the Wilde Lake Compressor Station and the Kitimat Meter Station.

CRYOPEAK LNG Solutions Corp. has completed the largest ever delivery of liquefied natural gas by truck in the Canadian Northwest Territories with the vehicle being driven over 3,000 kilometres to reach a power plant located in a town inside the Arctic Circle. The LNG was delivered to the town of Inuvik and to a plant owned by Northwest Territories Power Corp. where LNG supports the primary fuel for electricity services for the northern community. The delivery is in line with the continued focus of NTPC to make low-carbon electricity available across the Northern Territories. Cryopeak has been transporting LNG to Inuvik for three years. The town is located 2 degrees above the Arctic Circle on the Mackenzie River and Delta and is home to the Inuvialuit and Gwich'in peoples as well as other residents.

The delivery of LNG totaled around 18,000 gallons and was made possible by Cryopeak's proprietary "Super B-Train" transportation trailer. "Cryopeak's mission is to provide LNG to remote locations in the most reliable, sustainable and economic manner possible," said the company, which is based in Richmond, British Columbia. "The Super B-Train and Cryopeak's LNG production facility in Fort Nelson, BC, are critical pieces towards realizing this mission," it added. Cryopeak said its primarily focuses in the remote North is to provide reliable low-carbon fuel to serve mining, industrial heating and power generation. "It was an incredible journey, both manning the truck, and seeing how far Cryopeak has come in the ability to deliver clean, affordable and reliable natural gas to serve the region," said Blair Mease, who drove the B-Train the 3,729 kilometres from point of loading to delivery. The previous largest truck delivery was in February 2020 to a small-scale power plant at the Silvertip mine on the Yukon-BC border owned by Coeur Silvertip Holdings Ltd.

Cryopeak noted that the Super B-Train is designed with up to 70 percent greater load capacity than standard trailers currently operating in Canada, improving LNG's competitiveness as a fuel source for remote locations. Understanding that transportation often represents the largest cost of LNG for customers and NTPC was eager to work with Cryopeak on this supply initiative. "The Government of the Northwest Territories is committed to finding ways to reduce the cost of living for its residents, and we continue to collaborate with the NTPC to look for innovative solutions to do just that," said Katrina Nogleby, the local Minister of Infrastructure and Industry, Tourism and Investment. "This delivery - the largest for liquefied natural gas this far north in Canada - marks an important step toward making lower carbon electricity available across the NWT," added the Minister. Aleksandar Cook, senior vice president at Cryopeak said the company was proud of its latest achievement. "It is the culmination of years of planning to deliver LNG in our Super B-Train to a community located 200km north of the Arctic Circle and approximately 100km from the Arctic Ocean," added Cook. "It's a testament to the hard work and dedication of everyone in our Cryopeak team as well as the continued support and shared

vision of our financial sponsor, BP Energy Partners," he stated, referring to the Dallas, Texas-based private equity firm with no ties to the UK oil and gas major of the same name.

DOMINION Energy, operator of the Cove Point liquefied natural gas plant in Maryland, has agreed a transaction valued at \$9.7 billion to sell its gas transmission and gas storage assets to Berkshire Hathaway Energy owned by US investor Warren Buffett, including a 25 percent stake in Cove Point and its operatorship. Dominion said its reason for selling was strategic as it now aimed to become a pure-play, state-regulated, sustainability-focused utility operator. The Richmond, Virginia-based company Dominion explained that the definitive agreement was for the sale of gas transmission and storage assets to the Buffett unit, including more than 7,700 miles of natural gas storage and transmission pipelines and about 900 billion cubic feet of gas storage. Berkshire Hathaway Energy's purchase includes the assumption of about \$5.7Bln of existing debts and the buyer will also make a cash payment of around \$4Bln to Dominion.

Assets covered by the sale agreement include the company's ownership interests in Dominion Energy Transmission, Questar Pipeline, including Overthrust and White River Hub, Carolina Gas Transmission, Iroquois Gas Transmission System (50 percent interest), legacy gathering and processing operations, farmout acreage, as well as a 25 percent operating interest in Cove Point. "These assets will be reclassified as discontinued operations for GAAP reporting and excluded from operating earnings for full-year 2020," said Dominion. "The company's interest in the Atlantic Coast Pipeline is not included in the transaction," it added. The deal is expected to be concluded during the fourth quarter of 2020, subject to regulatory approvals, including from the US Department of Energy.

The Atlantic Coast Pipeline project is not included in the deal because Dominion and partner Duke Energy also announced the cancellation of the venture on June 5, 2020. The natural gas pipeline proposal was first put forward in 2014 and had been set to stretch hundreds of miles across West Virginia, Virginia and North Carolina. The companies said that despite a recent win for the project in the US Supreme Court,



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FOR THE RECORD

ongoing delays, litigation and an expected increase in costs threatened the economic viability of the project. The pipeline had faced intense criticism and legal challenges from environmental and other groups. “The announcement further reflects Dominion Energy’s focus on its premier state-regulated, sustainability-focused utilities that operate in some of the most attractive regions in the country,” said Thomas F. Farrell, Dominion Energy Chairman, President and Chief Executive. “Over the past several years the company has taken a series of steps, including mergers with Questar Corp. and SCANA Corp. and the divestiture of Blue Racer Midstream and merchant generation assets - to increase materially the state-regulated nature of our profile, enhance the customer experience, strengthen our balance sheet and improve transparency and predictability,” explained Farrell. “Our mission over that period has remained the same: providing round-the-clock affordable and sustainable energy, world-class customer service, and meaningful community engagement,” he stated.

Buffett, Chairman of the Berkshire Hathaway group, said he admired Farrell for his exceptional leadership across the energy industry. “We are very proud to be adding such a great portfolio of natural gas assets to our already strong energy business,” added Buffett. Farrell declared that Dominion aimed to become an industry-leading clean-energy profile which includes a comprehensive net zero target by 2050 for both carbon and methane emissions as well as one of the nation’s largest zero-carbon electric generation and storage investment programs. “Over the next 15 years we plan to invest up to \$55Bln in emissions reduction technologies including zero-carbon generation and energy storage, gas distribution line replacement, and renewable natural gas,” said Farrell. “In addition, between 2018 and 2025 we expect to retire more than four gigawatts of coal-fired and oil-fired electric generation,” he stated. Additionally, Berkshire Hathaway will acquire 25 percent of Cove Point LNG. However, Dominion will continue to own 50 percent of Cove Point, with Brookfield Asset Management continuing to own the remaining 25 percent. Canadian equity fund Brookfield agreed in October 2019 to purchase a 25 percent stake in Dominion’s Cove Point LNG facility. It is a single-Train Maryland plant holding

tolling agreements with Japanese trading house Sumitomo Corp. and partner Tokyo Gas and Indian state-owned gas utility Gas Authority of India. The Japanese and Indian companies hold 20-year tolling contracts for liquefaction capacity at Cove Point.

That previous deal with Brookfield was part of Dominion’s plan to establish a permanent capital structure for the LNG subsidiary, whose assets include the liquefaction plant and storage facilities on Chesapeake Bay at Lusby in Maryland. The Cove Point plant is relatively small in comparison to Cheniere Energy’s Sabine Pass plant where 22.5 MTPA of LNG is being produced from five Trains and with one more Train is being built. The Berkshire Hathaway energy unit will operate the Cove Point facility once the transaction closes. The Cove Point export terminal is one of only six LNG export facilities in the US. “This premier natural gas transmission and storage business has been operated and managed in a best-in-class manner,” said Bill Fehrman, Berkshire Hathaway Energy’s President and CEO. “Acquiring this portfolio of natural gas assets considerably expands our company’s footprint in several Eastern and Western states as well as globally, increasing the market reach and diversity of Berkshire Hathaway Energy,” added Fehrman.

ENI, the Italian energy company with widespread LNG interests, said it would write off around €3.5 billion euros (\$4Bln) from the value of its assets after revising down its long-term outlook for oil and gas prices. Eni said it was cutting its 2023 long-term price assumption for North Sea Brent crude to \$60 a barrel from a previous \$70 and gas on the Italian hub to \$5.5 per million British thermal units from \$7.8 per MMBtu. Milan-based Eni has been one of the most successful global exploration and production companies in recent years with major discoveries offshore nations such as Egypt and Mozambique.

Eni is leading a project for the Coral South floating LNG project from Area 4 resources in the Rovuma Basin offshore Mozambique and is also part of an onshore project in the southeast African nation with ExxonMobil China National Petroleum Corp. and others. “Our changed long-term assumptions, reached four months after the outbreak of the Covid-19 pandemic, reflect our current expectations about future prices and will

be incorporated in our processes of capital allocation,” explained Eni Chief Executive Claudio Descalzi.

The move follows similar write-downs by other global operators such as BP of the UK and Royal Dutch Shell. The majors have suffered a twin blow in 2020 with the mid-March oil price plunge and the negative economic effects of Covid-19. Eni said it expected post-tax impairment charges against non-current assets, including a devaluation of tax credits recorded in connection with tax-losses carry-forwards, of €3.5Bln, plus or minus 20 percent. It said it would book the write-downs, most of them on upstream assets, in its second-quarter results. It said it now forecast Brent at \$40, \$48 and \$55 per barrel in the period 2020-2022, respectively, from a previous \$45, \$55 and \$70 per barrel. Earlier in 2020 Eni pledged to reduce its greenhouse gas emissions by 80 percent in one of the most ambitious clean-up strategies in an industry urged by investors to get involved in more projects to cope with the effects of climate change.

The company said it was creating two

new business groups, Natural Resources to develop the upstream oil and gas portfolio sustainably and Energy Evolution, dedicated to supporting the company’s power generation and marketing. Eni said it believed the overhaul would help the implementation of company strategy to 2050, combining value creation, portfolio sustainability and financial strength. “The key and unique element of this strategy is the combination of growth objectives with financial value creation as well as environmental sustainability, which will lead to a significant reduction in full life-cycle carbon emissions,” said Eni. The company stated that the new structure reflected Eni’s pivot to the energy transition.

EXCELERATE Energy, the pioneer of more than a dozen LNG import projects worldwide, has taken delivery of its 10th floating storage and regasification unit, the “Excelebrate Sequoia”, from the Daewoo Shipbuilding and Marine Engineering shipyard in South Korea. The FSRU has a storage capacity of

173,400 cubic metres and is capable of operating as both an import facility and as a full LNG trading vessel. In September of 2019, Excelebrate and Greek shipping company Maran Gas Maritime signed a five-year bareboat charter agreement for the FSRU. Excelebrate will have the option to purchase the “Excelebrate Sequoia” during the five-year charter. “We are pleased to have the ‘Excelebrate Sequoia’ in our fleet to serve our portfolio of regasification customers,” stated Excelebrate’s President and Managing Director Steven Kobos. “Since the delivery of the industry’s first FSRU in 2005, our technology has allowed us to quickly and reliably open new natural gas markets around the world,” explained Kobos. “We have seen first-hand the difference our floating regasification terminals have made in communities who would have otherwise been locked out,” he added. “We will continue to deliver affordable, clean energy to markets that need it,” stated Kobos.

Excelebrate said the vessel completed its first gas-up and cool-down operations at POSCO Energy’s Gwangyang LNG

terminal in South Korea on June 21, 2020. The terminal is Korea’s first private LNG terminal and has carried out gas-trial and gas-up and cool-down operations for more than 150 vessels since 2005. Gas-up is one of the mandatory procedures an LNG carrier must perform to make the vessel commercially ready to receive LNG cargoes. Houston-based Excelebrate is currently developing its ETM ship management services, which officially launched in February 2020. In early June 2020, it named Calvin Bancroft as the Chief Operating Officer to help oversee the ship management business. The Excelebrate fleet will all be transitioned to ETM ship management by the end of 2020.

GAZTRANSPORT and Technigaz (GTT), the French technology designer of LNG maritime and onshore storage systems, has received an order for China’s largest ever LNG storage tanks for the Nangang import terminal proposed for Tianjin City, east of Beijing. GTT said its order came from the



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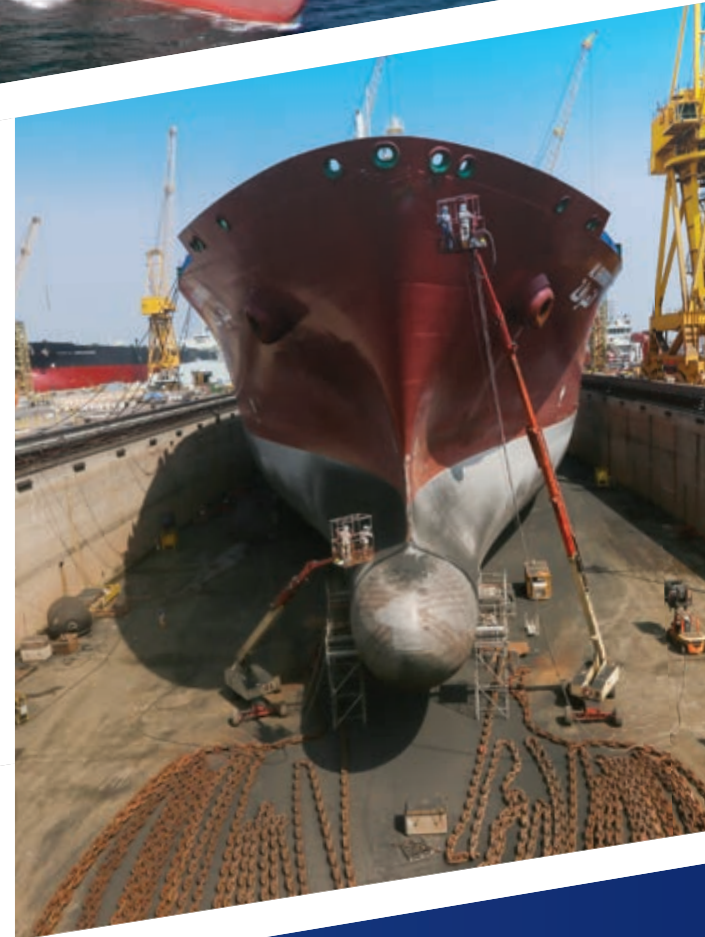
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building company China Huanqiu Contracting & Engineering Co. (HQC) for the design of two membrane full-containment LNG tanks, each with net capacity of 220,000 cubic metres. This LNG tanks order follows a preliminary agreement signed in November 2019 between GTT and the Chinese state-owned company Beijing Enterprises Group in the presence of French President Emmanuel Macron and his Chinese counterpart Xi Jinping.

The Nangang terminal is being developed by Beijing Gas and will give the Tianjin port city area three import facilities to guarantee energy supply security to the Chinese capital. The terminal will have an initial 5 million tonnes per annum of capacity and adds to the supply available from Sinopec's Tianjin North import terminal and the Floating Storage and Regasification Unit capacity deployed in recent years by China National Offshore Oil Corp. "We are honoured that the project promoted by HQC, proposing our technology, has been awarded," said Philippe Berterottière, Chairman and Chief Executive of GTT. "GTT is proud to contribute in the technological partnership between France and China," he added.

The company said that it would design these membrane tanks which will be fitted with the GST technology developed by GTT. "The onshore storage tanks will be located in the Tianjin south port Industrial Zone and are expected to be commissioned during the last quarter of 2022," explained GTT. HQC Chairwoman Wang Xinge said GTT had given full support to her company for the building of the first and largest GTT full-containment tanks in China. "We are proud to have been awarded this project and to lead the innovation in China together with Beijing Gas and GTT," she stated. With a population of around 113 million, the Beijing-Tianjin-Hebei region is one of the most important economic engines within China and has increasing natural gas demand. Beijing Gas is mainly engaged in city-gas distribution and supplies more than 10 billion cubic metres per annum to the Chinese capital and surrounding areas. The new Tianjin terminal project has already been approved by the National Development and Reform Commission. Beijing Gas said its terminal in Tianjin was expected to be completed by 2022 and would include emergency reserves comprising 10 extra storage tanks.

GECF, the Gas Exporting Countries Forum (GECF) based in Qatar and known as the OPEC of natural gas, and the International Gas Union were among the participants in a wide-ranging online discussion held by the United Nations Economic Commission for Europe (UNECE) on future LNG and pipeline gas use. The Web gathering was entitled "99 minutes of LNG - trends, developments and innovative" and examined the need for a more vibrant natural gas industry due to the long-term benefits it brings and its key role in the energy transition. The session was organised by the UNECE's Group of Experts on Gas and featured speakers from the GECF and the IGU in addition to several UN member states and for leading gas companies from 10 nations, including Germany, Indonesia, the Netherlands, Nigeria, Norway, Russia and the US.

The GECF was represented by Hussein Moghaddam, Senior Energy Forecast Analyst at the Secretariat in the Qatari capital, Doha. Moghaddam presented the latest data on Covid-19's impact on LNG markets and outlined the long-term prospects for the fuel. The GECF has 12 members: Algeria, Bolivia, Egypt, Equatorial Guinea, Iran, Libya, Nigeria, Qatar, Russia, Trinidad and Tobago, the United Arab Emirates and Venezuela. The seven observer-status countries are Angola, Azerbaijan, Iraq, Kazakhstan, Norway, Oman and Peru. The current Secretary-General of the GECF is Yury Sentyurin from Russia. During the UNECE's event Moghaddam spoke in relation to one of the key messages which was that despite the current market environment due to COVID-19 and the oil price slump, the LNG industry was better placed than ever because of its massive contribution to decarbonising the world. "While coal is still considered a critical source for energy security and affordability, particularly in Asia, coal development plans are being revised downward compared to previous years amidst low electricity demand and rising availability of alternative sources," said Moghaddam. "There is, therefore, a real opportunity for coal-to-gas switching," he added. "Further, gas and LNG can benefit from the climate policies being pushed out now due to their competitiveness and alignment with the UN's Sustainable Development Goals (SDGs)," stated Moghaddam.

The GECF is a regular contributor

to the discussions of the UNECE Group of Experts on Gas and took part in the UN body's summit in Geneva in 2019. The GECF's "Global Gas Outlook 2050" published earlier in 2020 said that gas production in GECF countries, including Qatar, would grow by almost 50 percent through 2050 to more than 2.5 trillion cubic metres, underlining the continued importance of the group. The sixth GECF summit of heads of states is scheduled to take place in Doha in 2021.

INDIAN liquefied natural gas imports edged higher in May as they recovered quickly from the previous month's slump as the nation emerged from the Covid-19 lockdown. LNG imports rose by 0.5 percent and amounted to 1.76 million tonnes, or about 25 cargoes, in May compared with 1.75MT in the same month of 2019. Shipments for the month of April came to 1.44MT, or around 20 cargoes, which was 29.4 percent lower than April 2019 when 2.04MT were delivered. Deliveries for the first two months of the fiscal year combined to total 3.20MT, a drop of 15.6 percent versus the year-ago total of 3.79MT, according to the data from the Ministry of Petroleum and Natural Gas.

The LNG deliveries to India came mainly from Qatar, Australia, the US and West Africa. The cost of the May cargoes amounted to around \$500 million compared with \$700M in April 2019. The Ministry said that gross production of natural gas for May 2020 fell by 16 percent to 2.30 billion cubic metres from 2.74Bcm in May 2019. Before the Covid-19 outbreak Indian LNG imports had been rising to more than 300 cargoes a year as more infrastructure is constructed, including pipelines to reach more industrial and city-gas customers.

The main operating terminals on India's West Coast are at Dahej, Hazira and Dabhol, near Mumbai. The newest terminal at Mundra, north of Mumbai, is now operational and awaiting more shipments. There is additionally the Kochi facility in the southwest state of Kerala and one East Coast terminal at Kamarajar, 25 kilometres north of Chennai Port in Tamil Nadu, and also known as Ennore. With the opening of the Mundra terminal, India now has 42.5 million tonnes per annum of regasification capacity. The Mundra facility is co-owned by Gujarat State Petroleum Corp. and the Adani Group and is designed with two storage tanks.

JAPANESE liquefied natural gas imports plunged by almost 19 percent last month and deliveries of thermal coal dropped by only half as much while US LNG deliveries to Japan rose, tripling from a year ago. Japan imported 4.51 million tonnes of LNG in May compared with 5.56MT in May 2019, a decline of 18.9 percent as the government implemented restrictions for the Covid-19 pandemic. The nation had received 5.13MT LNG in April compared with 5.62MT in April 2019. The May volumes amounted to around 65 cargoes compared with 80 cargoes the previous month and the normal level of deliveries at the start of 2020 of around 100 cargoes.

The latest monthly shipments cost 236.66 billion yen (\$2.20Bln), 22.2 percent less than the May 2019 import bill of \$304.86Bln yen (\$2.83Bln), according to the preliminary monthly trade figures from the Japanese Finance Ministry. One of the main competitor fuels to LNG for power generation, thermal coal, recorded a fall of 9.2 percent, just half as much as LNG, to 7.19MT compared with the May 2019 level. Nuclear power usage in Japan is still much reduced from the 50 units on line in 2011 to a handful now. The number of nuclear reactors in operation in mid-2020 is falling from nine to four or five as Japan tightens safety restrictions and several plants close for upgrades, though it cannot rely on more nuclear power for the rest of the year. Asian LNG cargo deliveries in May from nations such as Malaysia and Indonesia, Papua New Guinea and Brunei amounted to 965,000 tonnes, down 29.6 percent from the same month a year ago. Middle East deliveries from countries like Qatar, the United Arab Emirates and Oman fell by 16.8 percent to 660,000 tonnes. Shipments from Russia, mostly from the Sakhalin Island plant in the Far East, were down 39.3 percent from a year ago at 324,000 tonnes. US cargo deliveries to Japan came to 409,000 tonnes, triple the 131,000 tonnes (two cargoes) received in May 2019. Japan is expected to turn towards more low-priced US cargoes once economies got back on track after the pandemic and the oil price plunge. Last year the US shipped 3.69MT to Japanese terminals, a rise of 48.2 percent on 2018.

The balance of imports in May 2020 came from Australia, African nations and the spot market and these were also lower at 2.15MT compared with 2.73MT

in April 2020 and 2.73MT in May 2019. About 1.95MT came from Australia in the form of 29 cargoes, down from 33 shipments in May 2019 and 36 cargoes in April 2020. Japan last year also received diverse and small spot volumes from exporting countries such as Nigeria, Equatorial Guinea, Algeria and Peru. For the fiscal year, April 2019 to March 2020, the Ministry had said LNG imports for the 12 months came to 76.50MT, down 5 percent. The country's imports of LNG fell for the last calendar year to 77.32MT, which was 6.7 percent lower than the 82.85MT of shipments that arrived in 2018.

JORDAN COVE, the US LNG export project in Oregon, was issued with a final long-term order by US Secretary of Energy Dan Brouillette authorizing the export of domestically produced gas from the proposed facility at Coos Bay. The export permit, which had previously been conditional, follows the approval by the Federal Energy Regulatory Commission announced March 2020 for the siting, construction, and operation of the Jordan Cove liquefaction plant and the related Pacific Connector Pipeline. "The export authorization for Jordan Cove, the first US West Coast LNG project, will ease access to further position the US as a top supplier of LNG around the world," said Secretary Brouillette. "The issuance to Jordan Cove serves to further expand opportunities for US LNG abroad, particularly in the growing markets of Asia, and encapsulates what the Trump Administration has been working hard on for the past three years - providing reliable, affordable, and cleaner-burning natural gas to our allies around the world," stated Brouillette.

The development company, the Jordan Cove Energy Project is owned by Canada's Pembina Pipeline Corp. and it now has the authority to export up to 1.08 billion cubic feet per day of natural gas as LNG. The DoE statement said the project's natural gas will be sourced from both Canada and the United States and would be liquefied at the Jordan Cove facility for export to any nation worldwide, unless trade is prohibited by US law. Calgary, Alberta-based Pembina acquired the Jordan Cove LNG project in late 2017 in its takeover of another Canadian company, Veresen Inc. The project includes a 230-mile pipeline which would traverse four counties in Southern Oregon on the route to the liquefaction plant. The liquefaction plant and other

facilities are planned for a 200-acre site and comprise five small-scale Trains each with 1.5 million tonnes per annum of output for a total of 7.8 MTPA. "As we work to overcome the Covid-19 pandemic, LNG exports are going to be one of the building blocks toward the United States' economic recovery," said DOE's Assistant Secretary for Fossil Energy Steven Winberg. "The US has exported LNG to 38 countries, with this authorization to Jordan Cove, the United States can look to increase that number with expanded geographic coverage for LNG exports into key importing markets in Asia, providing enhanced economic opportunities both here in the US and globally," added Winberg.

Jordan Cove has multiple facilities, including two full-containment storage tanks with total capacity of 320,000 cubic metres, gas treating infrastructure, an export jetty and access to more than 25 billion cubic feet per day of gas supply from Western Canada and the US Rockies. The project's Pacific Connector pipeline will have a 36-inch diameter with capacity to transport up to 1.2 billion cubic feet of natural gas per day. Feed-gas for Jordan Cove would be sourced at the Malin Hub, creating a new outlet for natural gas from areas such as the Rockies Basin. The export plant is expected to be visited by about 120 LNG carriers per year and Pembina has signed preliminary accords with Jera Co. Inc. and Itochu Corp. of Japan for the supply of cargoes.

MOZAMBIQUE LNG is moving forward with its first phase of project financing now confirmed. The Japan Bank for International Cooperation said the \$14.4 billion financing and underwriting was finalized for the onshore Mozambique plant project led by French energy major Total and involves over 30 international banks and financial institutions. The JBIC said it signed a loan agreement to provide \$3Blbn as its portion for the financing of the offshore Area 1 resources in the southeast African nation's Rovuma Basin and the construction of the liquefaction plant onshore at Pemba in the northeast Cabo Delgado province. The project financing signing took place in Abu Dhabi in the United Arab Emirates.

The Japanese statement said that in addition to its own participation the Mozambique financing involves 21 private banks and other institutions

such as the African Development Bank, the Export-Import Bank of the United States, the UK Export Finance (UKEF) body and the Export-Import Bank of Thailand. Analysts say the level of guarantees in the financing of this project is extremely high, given Mozambique's precarious financial state and unrest in the northeast of the country involving cross-border incursions by Islamic extremists that adds to the risk factors. Much of the financing provided by private financial institutions is insured or guaranteed by state export insurance bodies such as, Japan's Nippon Export and Investment Insurance, the UKEF, Italy's SACE S.p.A., the Export Credit Insurance Corporation of South Africa as well as the Dutch Atradius State Business N.V. Japanese companies involved in the Area 1 Rovuma Basin project include Mitsui & Co. and the state-run Japan Oil, Gas and Metals National Corp. (Jogmec).

Along with Total and the Mozambique national energy company Empresa Nacional de Hidrocarbonetos (ENH), they will develop the Golfinho-Atum gas field, transport feed-gas through subsea pipeline to the onshore Pemba plant and produce an initial nameplate 13.12 million tonnes per annum of LNG. The Rovuma Area 1 contains more than 60 trillion cubic feet of gas resources of which 36 Tcf could be developed for the onshore plant. The Area 1 shareholdings have Total as operator with a 26.5 percent participating interest alongside ENH with 15 percent. Japan's Mitsui owns 20 percent, India's ONGC Videsh has 10 percent, Bharat PetroResources and Beas Rovuma Energy of India each hold 10 percent and Thailand's PTTEP has 8.5 percent.

The Total-led venture is Mozambique's first onshore LNG plant. Italian energy company Eni is leading a project for the Coral South floating LNG project from Area 4 resources in the Rovuma Basin. Eni is also planning an onshore venture with ExxonMobil and other stakeholders, including China National Petroleum Corp., but a final investment decision has yet to be taken. "Natural gas produces less greenhouse gases than other fossil fuels and mitigates environmental impacts," said the JBIC statement on the financing decisions. "Global demand for LNG is projected to grow in the future, driven by increasing demand in developing countries and rising environmental awareness," it added. "Japanese utility

companies are expected to offtake approximately 30 percent of the LNG produced by this project," stated JBIC in reference to purchase deals by companies such as Tokyo Gas and JERA Co. Inc.

NEW FORTRESS Energy, the developer of liquefied natural gas and power projects in Latin America and the Caribbean with new LNG import projects in Nicaragua and Mexico, said the company entered into a temporary supply termination agreement with the LNG subsidiary of UK utility Centrica.

Centrica agreed to terminate New Fortress's obligation to purchase any additional LNG from Centrica for the remainder of 2020 in exchange for a payment of \$105 million. The New York-based company said that as a result, New Fortress will now be able to purchase LNG in the open market at prices that are significantly lower than the price previously agreed to with Centrica.

It added that as a result of facilities commencing operations in Puerto Rico in addition to Jamaica, New Fortress had made significant progress toward achieving its earnings goals of over \$400M on an annualized basis during the third quarter of 2020. In addition, the company said it was currently advancing projects in both Mexico and Nicaragua with the goal of substantially completing them by the end of 2020. Once fully operational, New Fortress aims for these projects to contribute an additional \$150M towards operating income. Analysts said that Centrica supplies about three or four cargoes per annum to New Fortress under an agreement tied to the New Fortress supply of LNG to the Jamaica Public Services (JPS) gas-fired power plant near Montego Bay in Jamaica. "Our flexibility to opportunistically purchase LNG at market prices completes our transition from a development company to an operating company that we expect will generate significant operating margin and cash flow," said Chief Executive and Chairman Wes Edens. "We continue to advance a number of compelling new business opportunities and expect significant growth in 2020 and beyond," he stated.

In its most recent earnings, New Fortress said its quarterly losses amounted to \$38.4M compared with \$54.4M of losses in the previous quarter. New Fortress said there were increases



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in volumes sold to industrial end-users in Jamaica and sales at the Caribbean nation's Montego Bay LNG terminal. In its Mexico project, marine work at the facility in Baja California Sur has started. The import terminal proposed for the Pacific Coast of Mexico has also received all necessary permits for the onshore construction of the associated power plant. The company also executed a Public-Private Partnership with an 85 percent take-or-pay requirement in Nicaragua for 25 years and the supply of gas to a 300 megawatts power plant. New Frontier said it additionally concluded a long-term LNG supply agreement to secure significant volumes to supply certain of its committed volumes for five projects at historically low LNG prices.

PETROBRAS, the Brazilian state-run oil and gas company, has begun the binding phase in the sale process of its 10 percent remaining stake in gas pipeline firm Nova Transportadora do Sudeste (NTS) at the same time as reviving the possibility of floating LNG

production. "Potential buyers classified for this phase will receive an invitation letter with detailed instructions on the divestment process, including guidelines for carrying out due diligence and sending binding proposals," said Petrobras. Petrobras said the transaction was in line with its strategy to streamline its portfolio and reorganize capital allocation. NTS provides natural gas transportation in a network of 2,048 kilometres located in the nation's southeast and connecting Rio de Janeiro, São Paulo and Minas Gerais.

The NTS system is also connected to the Bolivia-Brazil pipeline to the west and natural gas terminals to the east and south. A group led by Canada's Brookfield Asset Management Inc., which in October 2019 bought a stake in the Cove Point LNG plant in Maryland, purchased 90 percent of NTS from Petrobras in 2016 for \$5.2 billion. Petrobras also said it was studying the possible development of several floating liquefaction plants to add an export component to the growing natural gas production from areas such as the

offshore pre-salt Santos Basin. Emissions and Climate Change Manager Viviana Coelho said during a Web conference that LNG production could be an alternative for the associated gas coming from Brazil's offshore oil fields about 250 kilometres southeast of Rio de Janeiro. Petrobras currently relies on pipelines to bring natural gas produced offshore to the coast for processing and distribution. The reservoirs, where oil and gas are trapped beneath a thick layer of salt in the Atlantic seabed, have supplied more than 65 percent of Brazil's production in just over a decade since their discovery.

A small portion of the gas is burned through flaring systems at the platforms and a significant portion is re-injected into to control reservoir pressure and increase oil production. Petrobras first considered floating LNG production back in 2011 with the UK's BG Group, later taken over by Royal Dutch Shell. The Brazilian company had been scheduled to hold a front-end engineering and design contest involving most of the world's main LNG engineering companies in 2012 but

the process did not move forward. BG and Petrobras had envisaged developing at least one liquefaction project producing around 3 million tonnes per annum of LNG.

PETRONAS, the Malaysian state energy company and stakeholder in major LNG projects from Australia to Canada, has formally installed its new President and Group Chief Executive Muhammad Taufik Tengku Aziz in succession to Wan Zulkiflee Wan Ariffin. The government of Prime Minister Muhyiddin Yassin made a series of management changes at state-owned companies and government agencies after coming to power in March 2020 following the unexpected resignation of former Prime Minister Mahathir Mohamad. The succession at Petronas was first announced on June 6 when former Chief Financial Officer Taufik Tengku Aziz was named as the new CEO. "He has accumulated 20 years of experience in financial reporting, feasibility reviews, project analysis, capital projects restructuring and risk management with primary focus on the

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oil and gas industry,” said a statement about the new CEO from the Petronas board.

Wan Zulkiflee, who led Petronas for five years and worked at the company for 35 years, has switched to another state company, becoming Chairman of the national carrier Malaysia Airlines. The outgoing Petronas CEO said he was comforted by the fact that he was leaving behind a company that is more resilient and hoped the future generation of company leaders would continue to bring progress. Malaysia through Petronas produced just over 26 million tonnes of LNG last year, making it the fourth-largest LNG exporter after Australia, Qatar and the US and just ahead of Russia. The former CEO’s major achievement was overseeing Petronas taking the global lead in floating LNG production. The first Petronas LNG production hull, “PFLNG Satu”, became the world’s first FLNG vessel to start commercial operations in April 2017 over the Kanowit stranded gas field offshore the Malaysian state of Sarawak.

It was then moved in 2019 to a new location 90 kilometres offshore Sabah, the Malaysian state on the northern part of the island of Borneo for production over the Kebabangan gas cluster field. The next Petronas FLNG venture will be overseen by the new CEO. It involves a second production hull, the “PFLNG Dua”, which will be deployed at the deepwater Rotan gas field, also offshore Sabah. The “PFLNG Dua” has been built and is being fitted out at the South Korean shipbuilder Samsung Heavy Industries. The joint venture partner of Petronas in the Rotan gas field FLNG project is the Thai state energy company, PTT Exploration and Production.

RENERGEN, a South African helium and clean fuel developer with a planned small-scale plant for liquefied natural gas, has signed an agreement for the joint marketing and distribution of domestic LNG through the filling stations of French major Total. Renergen is in the construction phase of South Africa’s first commercial LNG fuel plant with affiliated helium production and the start-up is scheduled for the third quarter of 2021. The customer base for the LNG will predominantly be logistics companies operating trucks along the main highway routes of South Africa. The first route targeted under the LNG fuel agreement will be the N3 between Johannesburg, the nation’s largest city in Gauteng province,

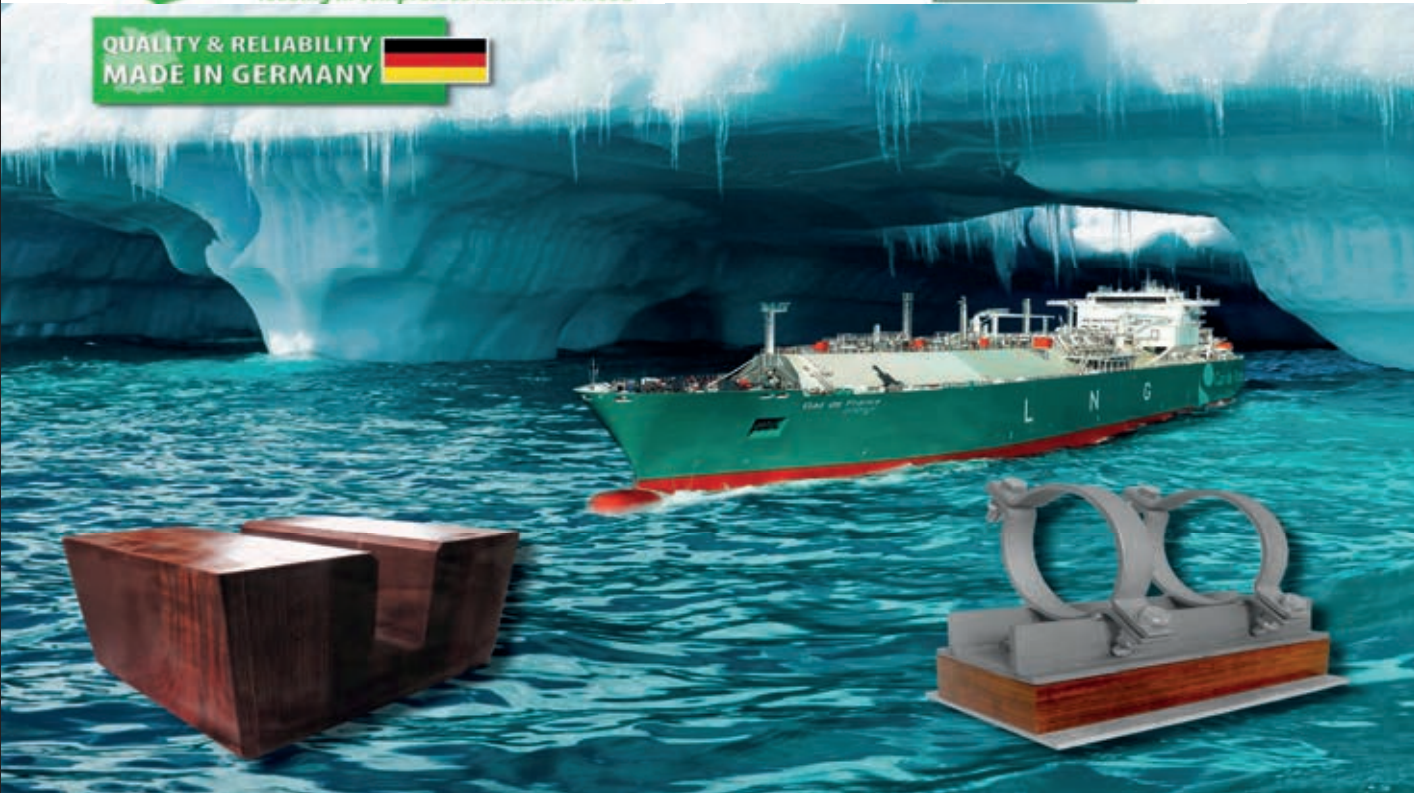
and the Indian Ocean coastal city of Durban. This will be followed by corridors leading to the other major cities once Renergen’s project is fully operational. Renergen already has two compressed natural gas (CNG) dispensing stations, one supplying the transportation company Megabus. A second CNG filling station supplies a truck fleet of the company Black Knight Logistics. The LNG and helium venture called the Virginia Gas Project is located in the Free State province of South Africa.

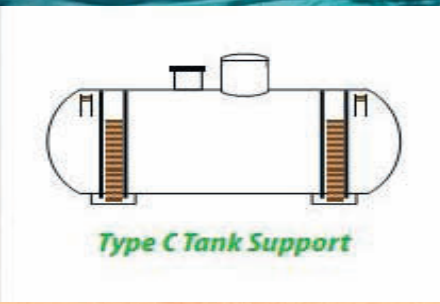
Renergen explained that when it is completed CNG will be replaced in favour of LNG, which will increase the distance the trucks and buses can travel between refills. The Virginia Gas facilities will tap exploration and production rights in 187,000 hectares of onshore gas fields across the municipalities of Welkom, Virginia and Theunissen in the Free State. “The source of the Virginia Gas Project’s natural gas is primarily microbial. It originates from deep within the

Witwatersrand Supergroup, via groundwater circulating through large faults,” said Renergen. The natural gas was first discovered in the Virginia gold mine in 1947 and the mine has been emitting combustible gas ever since.

This gas, with affiliated helium, comes to the surface via drillholes, faults and cracks in all the mines of the goldfield. “The natural gas contains one of the richest helium concentrations recorded globally,” said Renergen. Renergen’s LNG fuel distribution deal is with the




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Total subsidiary, Total South Africa Proprietary Ltd. “We are proud to have partnered with a global forward-thinking energy company,” said Renergen Chief Executive Stefano Marani. “Total has a big focus on sustainability and a proven track record in the LNG space,” he added. “This agreement is intended to provide ideal filling locations for our customers along strategic routes across the country, and the union will create a powerful first mover advantage in South Africa,” stated the CEO. Mariam Kane-Garcia, Managing Director of Total South Africa, said she was proud to be involved in another first for her company. “Total is committed to better energy and with this partnership we are taking another step towards providing affordable, reliable and clean energy,” added Kane-Garcia, MD of Total South Africa.

SHANGHAI Oil and Gas Exchange (SHPGX) said that the Chinese major, China National Offshore Oil Corp., had agreed to buy two cargoes of liquefied natural gas from Royal Dutch Shell with offset carbon emissions, marking China’s first such gas purchase. CNOOC and Shell will use carbon credits won in projects in China’s northwest Xinjiang and Qinghai region to offset the carbon emissions involved in producing and consuming the two gas cargoes. “These cargoes are ‘carbon neutral’ which means that all emissions from exploring for and producing the natural gas, to the use by the final consumers are offset by credits from a variety of nature-based projects including Shell supported afforestation projects from Qinghai and Xinjiang provinces in China,” said a statement.

CNOOC also plans to auction these two “carbon-neutral” LNG cargoes through the SHPGX, offering many downstream gas buyers a choice to decarbonise their energy use. Steve Hill, executive vice president of Shell Energy, said the Anglo-Dutch company has excited working alongside its partner CNOOC in bringing the first carbon-neutral LNG to the Chinese Mainland. “We are particularly pleased to be able to also use credits from projects in China for China,” added Hill. “Using nature-based credits in conjunction with LNG is a unique solution to support the needs of Chinese gas customers looking to decarbonise their energy use,” stated the Shell executive.

The exchange will supervise transaction organization, performance

guarantee and settlement arrangements, so that domestic users can participate in the purchase of “net zero carbon” natural gas. “As the largest LNG importer in China, CNOOC aims to provide reliable, sustainable, safe, green and low-carbon energy product,” said Wu Wenlai, Chairman of CNOOC Gas & Power. “We are very delighted to work with our trusted partner Shell for delivering the first carbon neutral LNG in the Chinese Mainland through this innovative solution,” added Wu. Taiwan previously purchased the third carbon-neutral LNG cargo traded by Shell in March 2020 and it was delivered to the Yung-An terminal in the southern port city of Kaohsiung. Shell does not disclose how much these new “green” LNG cargoes cost in comparison with a normal shipment.

THAILAND is ramping up its future LNG requirements. The nation’s oldest industrial conglomerate, the B. Grimm Group, is applying for a second LNG import licence to increase volumes received for its power projects at a time of competitive LNG supplies and prices. B.Grimm Power Public Company Ltd. became the third independent Thai company to receive an LNG import licence in May 2020 as the sector is liberalized and is now seeking to increase its volumes. B.Grimm Power’s licence awarded by the Thai Energy Regulatory Commission is for 650,000 tonnes of LNG imports per annum to feed its existing five gas-fired power plants. “If we have new gas-fired power plants, we have a right to ask for a new shipping licence for additional natural gas volumes,” said Preeyanart Soontornwata, President of B.Grimm Power.

She was speaking as a land lease agreement was signed for a sixth power plant, an electricity generation and chilled water venture linked to the new U-Tapao International Airport and Eastern Airport City Development Project. The U-Tapao project is for the company to operate a hybrid power plant using natural gas and solar with total aggregate installed capacity of 95 megawatts. B.Grimm Power is also planning to establish a new, wholly owned LNG unit for procuring and delivering the fuel. The five B.Grimm-owned power plants under construction have a combined capacity of 700MW. The company expects to start importing LNG as early as 2022. All of the company’s plants are located in the Eastern

Economic Corridor (EEC) in three provinces, in Chon Buri, Rayong and Chachoengsao.

The government wants to develop the EEC into a hub of high-tech industries with the added development of logistics and aviation services. B. Grimm Power is a leader in gas-fired small power producer (SPP) plants. SPP plants in Thailand sell electricity to the state grid and capacity to commercial buyers through private power purchase accords. National oil and gas company PTT previously had a monopoly on imports until the state-run Electricity Generating Authority of Thailand (EGAT) was given an LNG import licence in 2019. The three other licence holders now are B.Grimm Power, the Ratch Group and Gulf Energy Development. B. Grimm Power’s cargoes will be delivered to the Map Ta Phut LNG import terminal in Rayong. The two other companies had previously been awarded licences to import a combined 1.7 million tonnes per annum. A second Thai LNG terminal adjacent to the existing Map Ta Phut facility with capacity of 7.5 MTPA is under construction and is expected to start operations by 2022. A third Map Ta Phut expansion is additionally in the design phase and undergoing a feasibility study.

TOTAL has signed an agreement to renew its partnership in the field of liquefied natural gas with the North African state of Algeria as Italian energy company Eni also advances with projects. The accord between Total and Algerian oil and gas company Sonatrach allows the extension of the existing supply contracts for three additional years. This will provide 2 million tonnes per annum of Algerian LNG to the French market, primarily through the LNG import terminal at Fos Cavaou, located east of the Mediterranean port of Marseilles. Total said that the agreement also included the sub-charter of one of its LNG carriers to Sonatrach. “This agreement is part of the long history of cooperation between Total and Sonatrach,” said Laurent Vivier, President for gas at Total. “Thanks to the quality of our relationship we were able to conclude it in an extremely volatile market environment,” added Vivier. “This new contract further enhances the flexibility of Total’s LNG portfolio and strengthens our position as a major partner of Sonatrach,” he stated.

Total noted it was a historic player in

the energy sector in Algeria for almost 70 years. The group is active in oil and gas exploration and production, participating interests in the TFT II and Timimoun gas fields and in the oil fields of the Berkine Basin in southeast Algeria. In addition, Total and Sonatrach have launched engineering studies for a petrochemical project in Western Algeria. Algerian LNG exports have been falling and in the most recent official annual figures dropped by over 18 percent to about 10 million tonnes compared with 12.34MT the previous year from its two liquefaction plants at Skikda and Arzew on the Mediterranean Coast. Italian energy company Eni and Sonatrach have completed the construction of the natural gas pipeline connecting the Bir Rebaa Nord and Menzel Ladjmet Est fields in the Berkine Basin.

That completion comes as Algeria is making three-pronged marketing efforts to direct new gas finds into domestic industry, for export as pipeline gas to Europe and as LNG to mostly European markets amid low prices and high global volumes. The new Berkine Basin pipeline is 185 kilometres in length and 16 inches in diameter and will transport capacity of 7 million standard cubic metres of gas per day to markets. That project will allow for the export of the associated gas produced in Block 403 and the development of the gas fields of the blocks of North Berkine, where the drilling of the first four wells have already been completed and linked. Sonatrach has been increasing the capacity of its export infrastructure like the Medgaz gas pipeline to Spain, and building a new LNG jetty at the Skikda liquefaction plant.

US LNG cargo cancellations from Gulf Coast export plants amid over-supply and a price collapse is set to be offset by an increase in pipeline exports to Mexico, the largest component of US natural gas trade and a key take-away portion of still high production levels. These pipeline exports will rise with the completion of the southern-most segment of the Wahalajara system, the Villa de Reyes-Aguascalientes-Guadalajara (VAG) pipeline, according to a report from the US Energy Information Administration. The VAG pipeline began operations in June 2020, connecting new demand markets in Mexico to US natural gas pipeline exports. “Exports of natural gas to Mexico by pipeline are the largest component of US natural gas trade,

accounting for 40 percent of all US gross natural gas exports in 2019,” the EIA report noted.

Mexico also remains the second-largest recipient after South Korea of US LNG shipments. Since the Cheniere Energy Sabine Pass plant came on stream in February 2016, the Mexicans have received over 150 US LNG shipments. However, in recent months LNG deliveries to Mexico have fallen after exports to China resumed and more cargoes in the over-supplied market were pointed at Japan and India, as well as European nations, even at historically low prices. The Wahalajara system is a group of new pipelines that connects the Waha hub in western Texas, a major supply hub for Permian Basin natural gas producers, to Guadalajara and other population centres in west-central Mexico. The Wahalajara system provides US natural gas to meet growing demand from Mexico’s electric power and industrial sectors. “With the 0.89 billion cubic feet per day (Bcf/d) VAG pipeline entering service, EIA expects utilization of the Wahalajara system to quickly ramp up, resulting in increased US natural gas exports to Mexico out of western Texas and additional takeaway capacity out of the Permian Basin,” explained the EIA.

Mexico has been expanding its natural gas pipeline system since 2016 and supporting continual growth in US natural gas exports. Most of this growth has been in natural gas exports from southern Texas after the existing US pipeline infrastructure was expanded and the Los Ramones Phase II pipeline in central Mexico was completed. After the Sur de Texas-Tuxpan pipeline was completed in September 2019, natural gas exports to Mexico reached a record 5.5 billion cubic feet per day in October 2019. Exports on this line from the border at Brownsville in Texas to the

southeastern state of Veracruz in Mexico averaged 0.6 Bcf/d during the last quarter of 2019, or about 20 percent of the pipeline’s capacity. Overall natural gas exports from this region have only increased by 0.2 Bcf/d from 2016 to 2019 because of delays in pipeline construction in Mexico. In particular, two regional pipelines were completed in 2017 but have not been used near their capacity. They are the 1.1 Bcf/d Comanche Trail pipeline, which delivers natural gas to Mexico from San Elizaro in Texas and the 1.4 Bcf/d Trans-Pecos pipeline, which crosses the border at Presidio in Texas.

The Comanche Trail pipeline has been delivering an average of 0.1 Bcf/d of natural gas to Mexico since the San Isidro-Samalayuca pipeline entered service in June 2017. Pipeline operators do not expect flows to rise until the 0.47 Bcf/d Samalayuca-Sásabe pipeline is completed in either late 2020 or early 2021 in Mexico. The Trans-Pecos pipeline, the US segment of the Wahalajara system, did not transport significant volumes of natural gas until October 2018. The EIA noted that it is currently only operating at 10 percent to 15 percent of its total capacity. Most of the demand centres are in southern Mexico and they are waiting to be connected to the VAG pipeline.

YAMAL LNG, the operating company of the liquefaction and export plant in northern Siberia, has been awarded renewed safety certificates after an audit by the British Standards Institution (BSI) while the facility also completed scheduled maintenance of two Trains. The certificates were renewed for compliance of the Integrated Management System on Occupational Health, Safety, Environmental and Social Protection (IMS) with requirements of the international standards ISO 45001:2018

“occupational health and safety” and ISO 14001:2015 “environmental management”. “Based on the objective evidence collected during the audit between June 10 and June 17, 2020, the British Standards Institution), an international certification authority, confirmed Yamal LNG’s IMS compliance with these international standards,” said a statement. The certificates are now valid until 24 December 2020.

JSC Yamal LNG has been officially certified for international standards since June 2014. In July 2018 the scope of certification was expanded and in June 2020 a certification audit was completed for the new version of ISO 45001:20. Yamal recently completed the scheduled maintenance of the second and third liquefaction Trains with consecutive shutdowns during May to mid-June 2020. In addition to regular maintenance works, the plant upgraded its the absorbers at the mercury removal units as well as some other equipment. Yamal also said that due to the successful implementation of a Risk Based Inspection (RBI) maintenance system, the scheduled maintenance of the first liquefaction Train is able to be postponed for one year from August 2020 to 2021.

The RBI methodology allows reliable operations of the plant while reducing the total number of service hours. When the supplementary Train starts up in several months overall output at Yamal will be 17.4 million tonnes per annum. The small-scale fourth Train will produce 900,000 tonnes of LNG compared with the three larger Trains, which each have capacity of 5.5 MTPA. A total of 29 nations have received Yamal LNG since the plant came on stream at the end of 2017. The Yamal LNG shareholders are Russian natural gas company Novatek (50.1 percent), French major Total (20 percent), China National Petroleum Corp. (20 percent) and China’s Silk Road equity fund (9.9 percent).

WOODSIDE Energy, the Western Australian liquefied natural gas plant operator, has highlighted the record-breaking production achieved in 2020 at its Pluto LNG plant amid the worst cyclone to hit the Burrup Peninsula in half a century and the impact of the Covid-19 pandemic. The single-Train Pluto plant, located near Karratha, has delivered around 2.6 percent more LNG than in the previous year. The facility processes feed gas from the two offshore

Pluto and Xena gas fields and will be the centre of LNG expansion by Woodside when a second processing Train is built. It came on stream in 2012 with a nameplate capacity of 4.8 million tonnes per annum. Its main customers include the Japanese utilities Tokyo Gas and Kansei Electric with long-term contracts. Pluto asset manager Yvette Manolas attributes the excellent result to the improvements made at the start of the year. “Shared resources and knowledge across all of Woodside’s operational sites contributed to this outcome and highlighted the value of working together as one Burrup Hub to achieve excellence,” explained Manolas. “It was a result of a lot of hard work and collaboration between operations and various functions within the business, as well as support from the Karratha Gas Plant,” she added.

Record production was achieved through implementation of several long-term projects aimed at energy efficiency and minimising environmental impacts, while also maximising LNG production. One project was the execution of the dual boil-off gas (BOG) compressor operation. While Woodside aims to minimise flaring, it is essential for the safe operation of a gas plant. During ship-loading operations, a portion of the LNG vaporises when it encounters the relatively warm LNG carrier. A newly commissioned operating mode has significantly increased the ability to capture this vapour and direct it to the fuel gas system, or to recover the excess vapour to be processed into LNG. “Through the work of a multi-disciplinary team including Operations, Engineering, Maintenance and Marketing, along with the support of specialist vendors, this operating mode is expected to result in an average reduction in Pluto’s annual flaring of about 20 percent, as well as increasing production capacity,” said Woodside.

A similar activity also delivered in the first quarter was the first ever systematic cleaning of Pluto’s production-critical fin fans. These fans are responsible for rejecting most of the heat from the natural gas as it is cooled. Cleaning away dirt and debris caused by the dry and dusty Pilbara conditions has been proven by similar activity at the Karratha Gas plant to improve the efficiency of fans and, by extension, the liquefaction process. “Based on these results, new and innovative cleaning methods are already being planned as

Diary of events

September 2020
Gastech Virtual Conference
7 -11 September 2020
<https://www.gastechevent.com/>

November 2020
Abu Dhabi International Petroleum Exhibition & Conference 2020 (ADIPEC)
Nov 9-12 2020
Abu Dhabi National Exhibition Centre (ADNEC), Abu Dhabi, UAE
<https://www.adipec.com>

December 2020
23rd World Petroleum Congress
6 - 10 December 2020
George R. Brown Convention Center
1001 Avenida De Las Americas,
Houston, Texas, USA
<https://www.wpc2020.com/>

February 2021
2nd American LNG Forum
09-10 February 2021
Hotel Marriott Marquis Houston
1777 Walker St, Houston, Texas,
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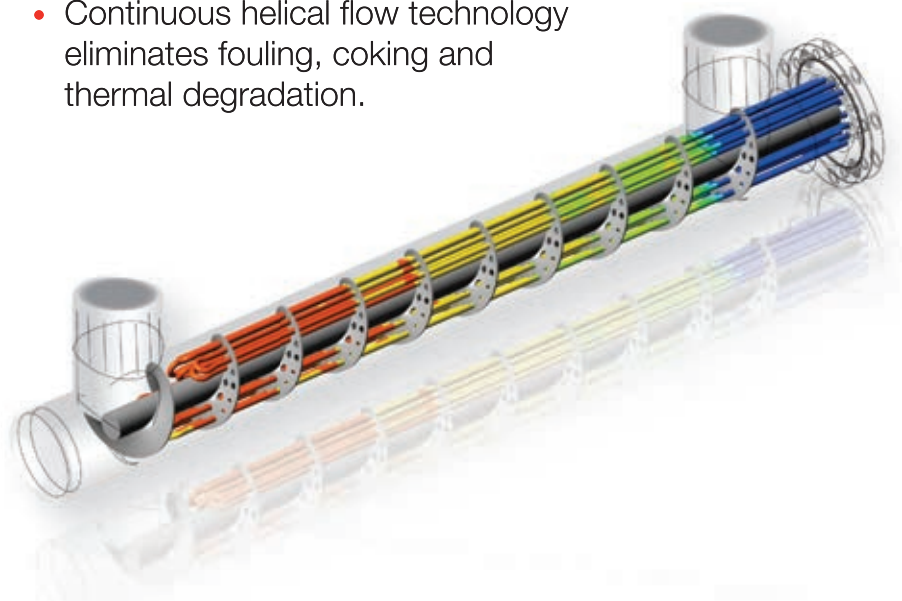
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this important activity is embedded as part of our routine maintenance strategies,” said the company.

WOODSIDE said its half-year earnings would include non-cash, post-tax impairment losses of US\$4.37 billion, including for its sales contract with Cheniere Energy’s Corpus Christi LNG plant in Texas. The main write-downs comprise US\$2.76Bln for oil and gas properties such as its three Australian LNG stakes and US\$1.16Bln for exploration and evaluation assets, including Kitimat LNG in Canada. The earnings will also reflect a non-cash, post-tax “onerous” contract provision for the Corpus Christi LNG sale and purchase agreement (SPA) of US\$447 million. “This provision reflects more closely connected global gas markets and Woodside’s view of likely reduced margins available between North American and other gas markets,” said Woodside.

Woodside is the operator of the North West Shelf LNG plant and the Pluto facility in Western Australia and has a

stake in the Chevron-operated Wheatstone LNG plant. In regard to the Corpus Christi SPA, the company explained that under Australian Accounting Standards, a contract (Corpus Christi LNG) is considered “onerous” where the unavoidable cost of meeting obligations under the contract exceed the benefits expected to be received. Cheniere and Woodside’s trading unit signed the 20-year SPA in 2014 for 850,000 tonnes per annum of LNG from Train 2 at the Texas plant. Under the SPA, Woodside buys LNG on a free on board (FOB) basis for a purchase price indexed to the monthly Henry Hub price plus a fixed component. Woodside said that the combined impact of all the impairments and the “onerous” contract provision is a post-tax loss of US\$4.37Bln. “Woodside’s balance sheet strength and liquidity are not materially impacted,” it said.

The Perth-based company explained that about 80 percent of the impairment losses on oil and gas properties are due to the significant and immediate reduction in oil and natural gas prices

assumed up to 2025, impacting Woodside’s products in the prevailing economic climate. “Additional contributors are increased longer term demand uncertainty impacted by the Covid-19 pandemic and macroeconomic dynamics, and increased risk of higher carbon pricing,” said Woodside. The company emphasized that despite the challenges of the current environment, the fundamentals of Woodside’s business remain strong, particularly the outlook for its core product, natural gas export to Asia. “LNG is advantaged as an energy source in a decarbonising world,” stated Woodside.

Chief Executive Peter Coleman said the company is in a strong position to take advantage of opportunities which will inevitably arise both during and subsequent to this period of unprecedented market uncertainty. “We’ve taken some tough decisions over recent months in response to the Covid-19 pandemic and oversupply in our key markets, but Woodside’s focus remains on cash preservation, capital discipline and maintaining the strength of our

balance sheet,” said Coleman. “This will ensure we can deliver appropriate returns to shareholders and maintain our investment grade credit rating over the long term,” he added. “The unique confluence of events that has unfolded through 2020 will challenge all participants in the global energy sector and we expect to see adjustment of capital allocation priorities by other asset owners as the cycle plays out,” stated the CEO. Woodside pledged to continue the strategy to develop the Scarborough and Browse gas resources located offshore Western Australia through its proposed Burrup Hub project when the time is right. “Although these are difficult and uncertain times, the medium-term outlook for Woodside’s growth prospects and for our core product, natural gas, is positive,” he said. “In the longer term, our commitment to innovation and new technologies will ensure we can also take advantage of emerging markets for hydrogen and ammonia which will be a crucial part of the world’s transition to a lower-carbon future,” added the CEO. ■

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Global gas demand rebounds as world emerges from COVID-pandemic

China's fast economic recovery is one of the main drivers for nascent energy demand in AsiaPacific, Anja Karl learns from BP's latest World Energy Review

Singling out the world's emergence from the Covid-19 pandemic as “a pivotal moment” for global economies, BP chief executive Bernhard Looney sees signs of a rebounding global gas demand, driven a global shift to cleaner-burning fuels.

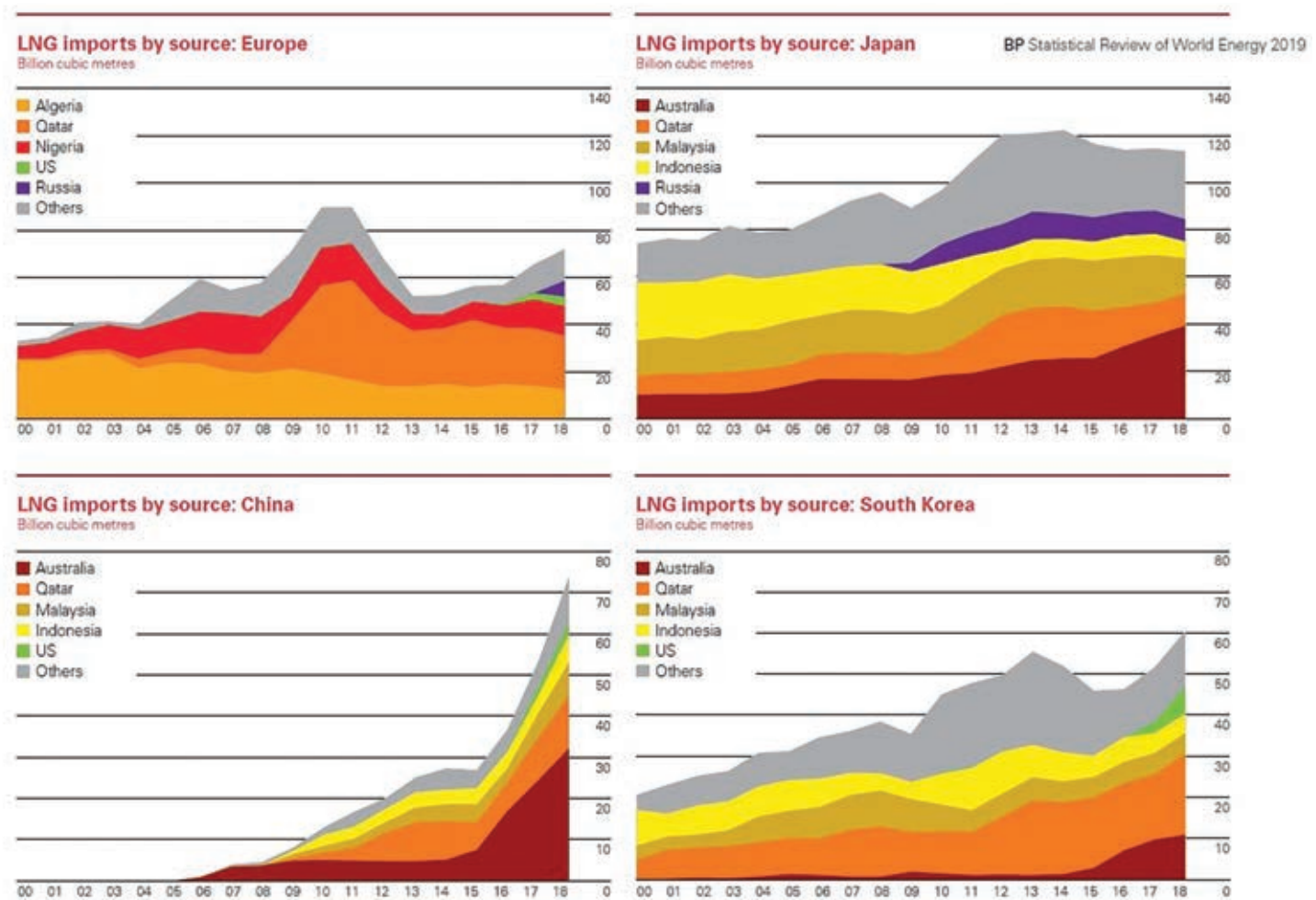
The share of gas in the world's energy mix has risen to a record 24.2 percent, while primary energy consumption increased 1.3 percent last year with renewable power making up over 40 percent of that growth.

“As BP along with the rest of the world navigate the energy transition, we will need timely, objective and comprehensive data on the global energy system,” Looney said at the launch of BP's benchmark 2019 Statistical World Energy Review.

“The pandemic has only reinforced our commitment to our ambition to become a net zero company by 2050 or sooner,” he added. Just weeks earlier, BP announced plans to cut 10,000 jobs in reaction to a global slump in oil demand. The company's gas and LNG business unit, in contrast, benefitted from a rise in trade despite markedly slower growth in consumption.

“Global natural gas consumption growth averaged 2 percent in 2019, below its 10-year average and down sharply from the exceptional growth seen in 2018 (5.3 percent),” the BP Statistical Review reads.

In the section on natural gas and LNG, BP noted an increase in output and trade, albeit slower consumption growth.



“Global natural gas consumption growth averaged 2 percent in 2019, below its 10-year average and down sharply from the exceptional growth seen in 2018 (5.3 percent),” the review reads, adding “in volume terms, demand grew by 78 Bcm, led by the United States (27 Bcm) and China (24 Bcm).”

China's growth in gas consumption, however, has slowed down significantly compared to the previous year, as the

effects of Beijing's coal-to-gas switching are fading. Weather-related effects (less unusually hot or cold days) also led to a 10 Bcm fall in Russia's domestic gas consumption – the largest decline of any country last year.

Global supply still outweighs demand

On the supply side, gas production was up 132 Bcm or 3.4 percent, outpacing the

growth in consumption. Supply from the US made up nearly two thirds of net global growth in gas supply, according to BP figures with the volumetric increase of 85 Bcm just shy of 2018's record increment (90 Bcm).

Australia added another 23 Bcm and China some 16 Bcm to the global gas supply in 2019, the Review states. Much of the surplus supply was used to feed a rising number of liquefaction terminals.

Global LNG export volumes grew by 54 Bcm, or 12.7 percent last year, the largest annual increase ever, driven by record volumes from the United States (19 Bcm) and Russia (14 Bcm) as well as continued growth from Australia (13 Bcm), BP analysts noted.

In terms of LNG imports, nearly all incremental supply in 2019 was seen headed to Europe – not Asia as was the case in years before. “European LNG imports rose by 49 Bcm, representing an unprecedented 68% increase,” BP analysts said. Growth was widespread, with 11 Bcm headed to the UK, some 10 Bcm to France and 7 Bcm to Spain. ■

LNG journal

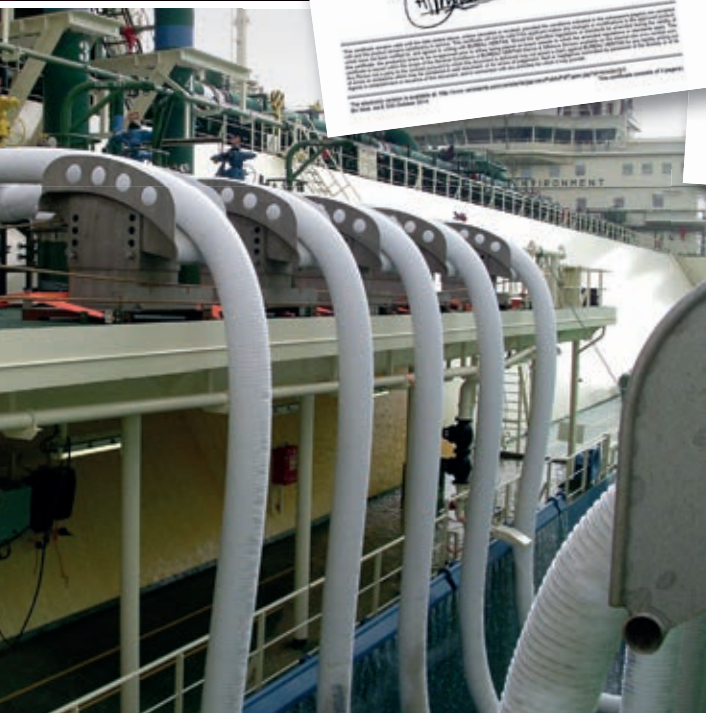
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Argentina: Tango is slipping

A protracted infrastructure backlog has made Argentina vulnerable to international energy market fluctuations, causing energy champion YPF to move away from previous LNG expansion plans and declare force majeure on Tango FLNG.

Argentina has both benefitted and suffered from a protracted low-price environment. The country's macroeconomic performance is closely linked to its energy economy as seasonal demand spikes impact the national energy trade balance. As a result, successive Argentine governments have been keen to develop the country's domestic hydrocarbon resources, chief among which is the Vaca Muerta shale oil and gas play. However, the development of the vast play is expensive and record low prices have eroded the commercial viability outlook for a large-scale liquefaction plant necessary to monetise the targeted shale gas surplus. Notably, Argentina's gas production has once again embarked on a declining trajectory – albeit from elevated year-on-year levels – with domestic demand ramping up as the regional winter season takes hold. The country's saving grace, however, is the same flush spot market and its prevailing low LNG prices that is plaguing its prospects as a growing LNG exporter.

A promising start

Argentina created quite a stir when state-controlled YPF's Tango FLNG barge moored at the port of LPG fractionator Mega – a joint venture consisting of YPF, United States chemicals major Dow and Brazil's state-controlled petrochemical champion Petrobras – exported its first commercial LNG cargo aboard the LNG carrier Excalibur in November 2019. Argentina possesses one of the largest unconventional oil and gas resource base in world through its Vaca Muerta play, which is frequently compared to the Permian Basin in the United States.

Although the barge had made its first export in June 2019, it was only a partial cargo loading of LNG that was produced during Tango's testing phase. YPF had maintained throughout that formal trading would only commence in 3Q 2019. The company's LNG shipment in mid-November thus marked the passing of a milestone in Argentina's strategy to reverse the flow of the expensive fuel.

However, we think that beyond the commercial elements of that export, there was a broader narrative to be considered,

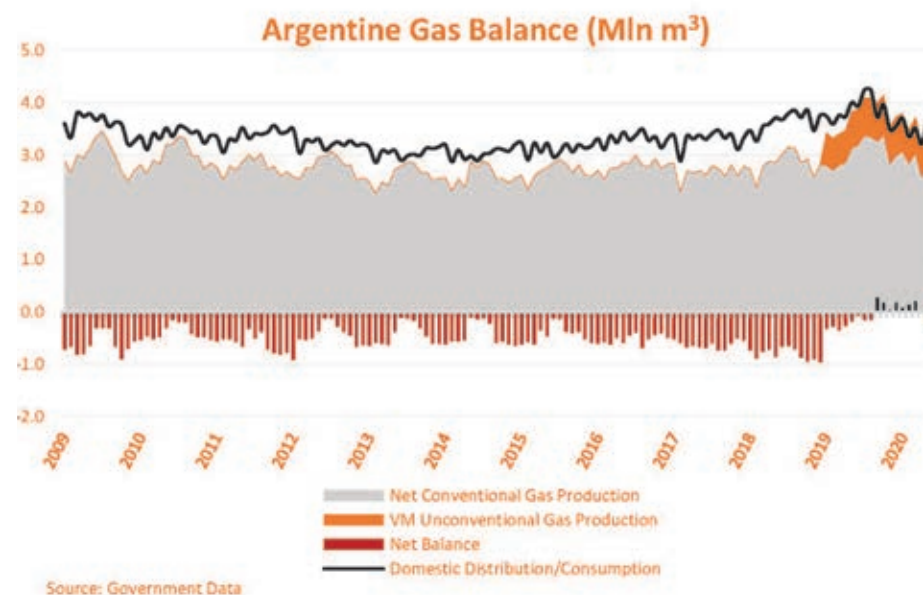
one of Argentina joining the ranks of LNG exports and thereby taking an important step on the path towards establishing a release valve for the numerous macroeconomic pressures faced by the Argentine government. The prevailing narrative at the time was also clearly aimed at establishing the country as a viable destination for energy investments. The first shipment from the Tango FLNG facility was a rather marginal operation of less than 25,000m³ via the Fuji LNG in June and the full cargo loading via the 138,000m³ Excalibur later in November thus served as 'proof' for the continuing progress of Argentina's gas market development.

Vaca Muerta gas instrumental

These exports were possible due to a steep production ramp-up at the underdeveloped Vaca Muerta oil and gas play, where YPF and other concession holders – including energy majors and independents alike – have been focussing on the need to increase output alongside production efficiency to reduce unit costs and enable the monetisation of one of Argentina's most prolific national resources.

Between 2009 – the year from which government data is available – and August 2020, domestic gas demand exceeded national gas production – both conventional and unconventional – by an average of 17% per month. As a result, Argentina had little choice but to close the gap with pipeline imports from neighbouring countries as well as spot LNG cargoes, but which significantly impacted the country's energy trade deficit.

According to the government's national gas balance, however, Argentina's gas production began to close the gap with domestic consumption as unconventional gas from Vaca Muerta added to output. In total, gas production grew by 29% year-on-year in the first five months of 2019. Although that growth has slowed this year, production between January and May remains ahead of the commensurate 2019-level, allowing for LNG demand to remain considerably below its 2018 equivalent. Unconventional gas production at the Vaca Muerta oil and gas



play has thus been instrumental in lifting Argentina's gas balance into the black – albeit only for a short time.

Path forward unclear and complicated

YPF originally envisioned the path forward for the monetisation of Vaca Muerta gas almost exclusively in the shape of LNG exports. The company insisted as late as last year that a sustained development of Vaca Muerta demands the coinciding development of large conventional LNG export capacity.

In our view, the Tango FLNG project was – and essentially remains – a pilot project to demonstrate YPF's ability to continue to take lead in the development of Argentina's gas industry. With an annual capacity of just 0.5mtpa the facility has hitherto shipped only five commercial cargoes since its commissioning in 2019; six if the pilot shipment via the Fuji LNG in June is counted, too. However, the LNG exporting business is built on scale to maintain acceptable unit costs and attract the long-term supply contracts necessary for project financing. Unsurprisingly, YPF had been calling for a conventional, onshore gas liquefaction plant for LNG production, with a much larger liquefaction plant (20-25mtpa) initially on the company's drawing board.

However, an extensive infrastructure backlog built up over the past decade will be adding to Argentina's capital demands. YPF has been pushing to expand gas exports to Chile, where Enel Generación Chile and Colbún signed new supply contracts with YPF for 365mln m³ p.a.

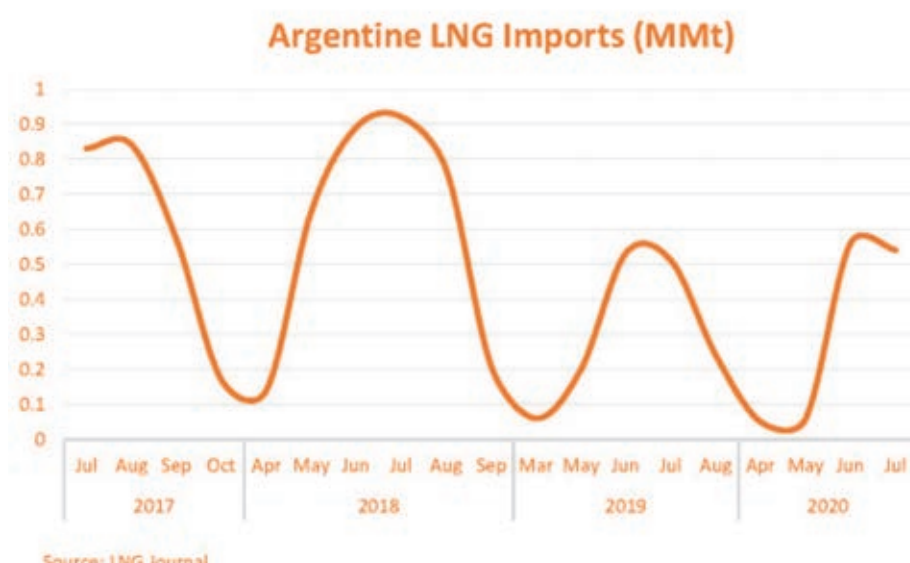
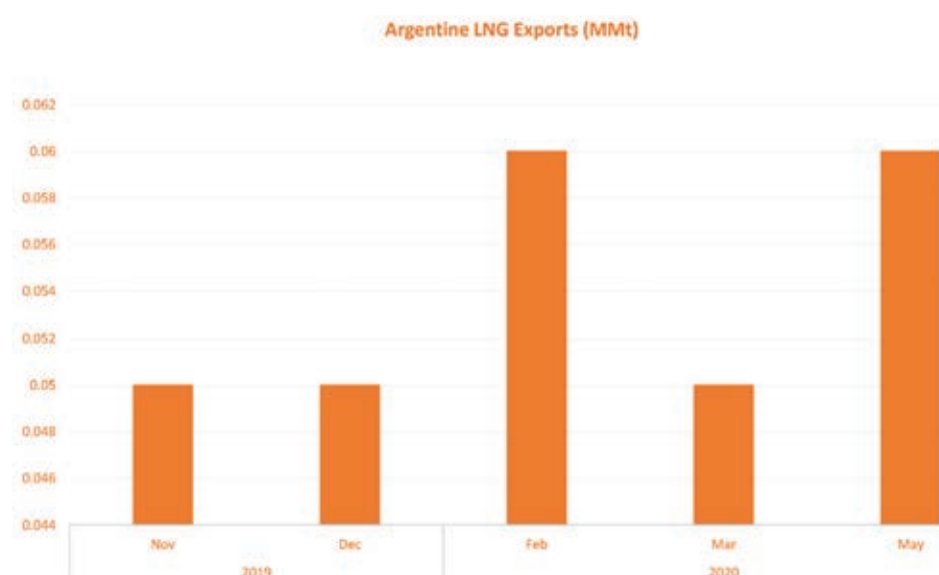
and 1.095bln m³ p.a., respectively. Deliveries, however, have been volatile as Argentina's pipeline capacity struggles to cope at times of high demand, which has been responsible for both supply interruptions and LNG imports.

Meanwhile, seasonal demand variations complicate YPF's export model and subsequently the way forward for Argentina's gas economy. These strong seasonal fluctuations in demand directly impact gas production, which surges in the southern hemisphere winter but wanes during the summer months when producers shut in wells because the domestic market is unable to absorb continuous production growth. Crucially, Argentina lacks sufficient gas storage capacity within reach of the Vaca Muerta play to bridge seasonal spikes, government data indicates.

Consequently, we also see a risk of this dynamic inducing companies active in the Vaca Muerta play to shift their focus toward crude, which is less beholden to winter-summer demand swings that would lead to excess gas supply for several months of the year. A move away from gas and towards oil would detract considerable amounts of capital from gas developments within the play.

Political and economic uncertainty

YPF is unlikely to be able to furnish these large-scale LNG infrastructure investments necessary to advance Argentina's plan for its gas economy on its own. Indeed, the development of a large-scale gas liquefaction plant from scratch would demand investment



amounting to several billion dollars as well as spreading project risk across several project partners.

However, Argentina's long history of economic crises stands in the way. It has had to call on IMF programmes 21 times since joining the Fund in 1956 and defaulted on debt held by foreigners nine times since independence in 1816. It took 15 years to resolve Argentina's debt default of 2001 and the country is currently in the midst of renewed economic woes.

A major project – the Central Gas Transport system – meant to debottleneck pipeline capacity leading from Vaca Muerta has been delayed following a crash of the peso in 2H 2019 ahead of a new administration under President Alberto Fernández taking over the government. It is yet unclear how the new government intends to continue with the development of Argentina's gas economy.

Although it announced a subsidy of \$3.5 per MMBtu for both oil and gas production in the face of the current COVID-19 crisis, we think it is unlikely to

be sufficient to sustain large-scale drilling campaigns necessary in an unconventional hydrocarbon play such as Vaca Muerta, helpful though it may be to ward of some economic stress for existing production.

We are also anticipating a significant lag between the implementation of the scheme and any new production, which means that it is unlikely to have a major impact on Argentina's gas output this year. Meanwhile, apart from the gas subsidy and a decree aimed at 'shielding' the upstream sector from macroeconomic uncertainty through mandated minimum domestic crude price of \$45/bbl until the end of 2020, the midstream and downstream sectors have been left out of the political discussion to date.

YPF shelve further LNG expansion until further notice as COVID-19 pressure rises

Amidst that uncertainty, YPF appears to have been quietly shelving plans to expand LNG exports in market that is both oversupplied and, on the domestic side, lacks the stable gas supply crucial for a large-scale liquefaction operation.

Addressing the Institute of the Americas La Jolla (virtual) energy conference on 19 May, YPF board chairman Guillermo Nielsen said, "Certainly in LNG...we don't see room for [new investment] to fly". He also highlighted that LNG imports and pipeline exports would be YPF's preferred gas marketing model for the time being. "It's easier to get to our neighbour's markets through pipelines", he added.

This marks a clear break from the expansionist outlook offered by his predecessor Daniel Gonzalez, who maintained Argentina needed a liquefaction plant to absorb excess domestic production and bridge seasonal spikes by effectively soaking up excess supply, mimicking the effect of a gas storage facility.

COVID-19 adds pressure on supply

Meanwhile, the COVID-19 crisis continues to add pressure on Argentina's gas supply. Crucially, the country lacks gas storage capacity to bridge seasonal spikes and build up emergency stocks.

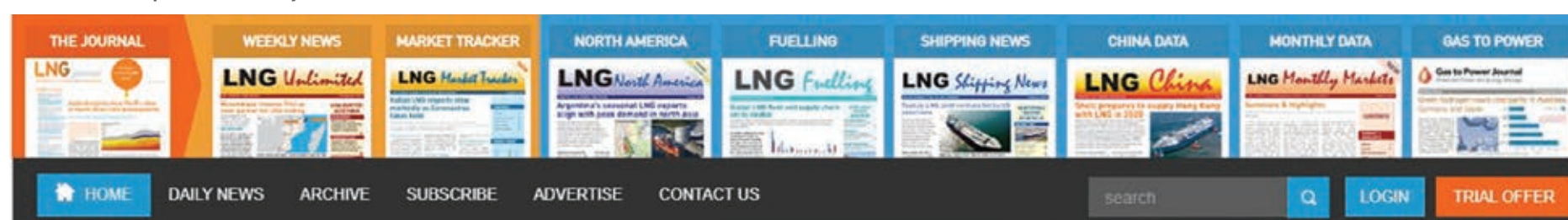
This was exemplified by YPF being forced to declare force majeure on its Tango FLNG plant in late June, halting shipments to buyers and payments to service providers, Reuters reported. Accordingly, our data is indicating Argentina's LNG imports to have edged above their year-on-year equivalent in June with preliminary July data suggesting the same.

Consequently, we highlight the risk that the pandemic is not only forcing Argentina back into a pattern of rising gas imports, but also that the resulting economic impact could potentially delay the full development of Vaca Muerta. This would leave Argentina with an ironic – and tragic – state of affairs whereby the winter demand spike we have already begun to observe in June has to be met by higher LNG imports even as the country possesses one of the largest unconventional gas resource bases in the world. Argentina's current saving grace, however, is the same flush spot market and its prevailing low LNG prices that is plaguing its prospects as an LNG exporter. ■

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WinGD to offer X-DF engine upgrades

Now claiming around 60% of the large 2-stroke prime mover market, including a significant LNG carrier orderbook, WinGD has unveiled the first enhancement to its X-DF engine series, writes LNG Journal's Technical Editor, Ian Cochran

WinGD claimed to be the only 2-stroke low speed engine designer to produce engines operating on diffusion (Diesel) and on pre-mixed (Otto) cycles in the maritime sector.

This optimal new enhancement - X-DF2.0 - is to be marketed to shipowners later this year with the dual-fuel engine series and is currently finalising tests on one of WinGD's five land-based test engines. A pilot system is due to be installed on board a ship soon, the company said, during a recent presentation.

Marcel Ott, WinGD's General Manager for China explained that X-DF2.0 is based on what the company calls its Intelligent Control by Exhaust Recycling (iCER) system.

This delivers enhanced combustion control through the use of inert gas and is claimed to be able to reduce the problematic methane slip by up to 50%, as well as give a 3% fuel consumption reduction in LNG mode, plus an up to 5% reduction in diesel mode and an increase in on board steam production, if needed.

Turbocharger capacity

iCER is designed to cool and re-circulate part of the exhaust gas through a low-pressure path during operation in gas mode. Compared to a high-pressure path, the main benefit is the ability to use the full turbocharger capacity. It is possible to re-circulate exhaust gas up to a maximum rate of 50% mass flow with an additional economiser installed.

This is handled through a system placed adjacent to the engine that circulates part of the exhaust gas after the turbine through a cascade exhaust gas cooler (CEC) to the compressor inlet. This avoids the use of a blower, which saves on the amount of power needed.

Exhaust gas and fresh air are mixed before entering the compressor wheel of the turbocharger. The CEC and a small economiser for higher steam requirements can be supplied by Alfa-Laval, one of WinGD's major partners.

The cooling process reduces the temperature of the exhaust gas to below its dew point of ~40 deg C. Below this dew point, water starts to condense out of the exhaust gas, which leads to excess water in the system. This helps to avoid an increase of acidity in the re-circulated water. The

water used for cooling the exhaust gas is re-circulated fresh water stored in a circulation tank. This re-circulated fresh water used in the CEC is cooled by sea water via a plate heat exchanger, which again can be supplied by Alfa-Laval.

iCER reduces the re-activity of gas/air mixture by replacing oxygen in the suction air with carbon dioxide. This is claimed to improve the thermodynamic behaviour of the X-DF engines in terms of BSGC, firing pressure fluctuations, emissions and allows an increase of BMEP.

It also offers an extended operating window, better lambda control, higher power density, lower fuel consumption, lower emissions and increased steam production, WinGD said.

"By adjusting the recirculation rate of inert gas and controlling parameters like fuel admission and ignition timing, we can increase compression ratios for greater efficiency," Volkmar Galke, WinGD Global Director of Sales, explained. "The result is optimised combustion through closed-loop control regardless of ambient conditions and load."

The X-DF series was first developed in 2011 and four years later, the first type approval test was achieved. Up to the middle of June, the engine has been running for around 550,000 hours, giving WinGD a comfortable experience window.

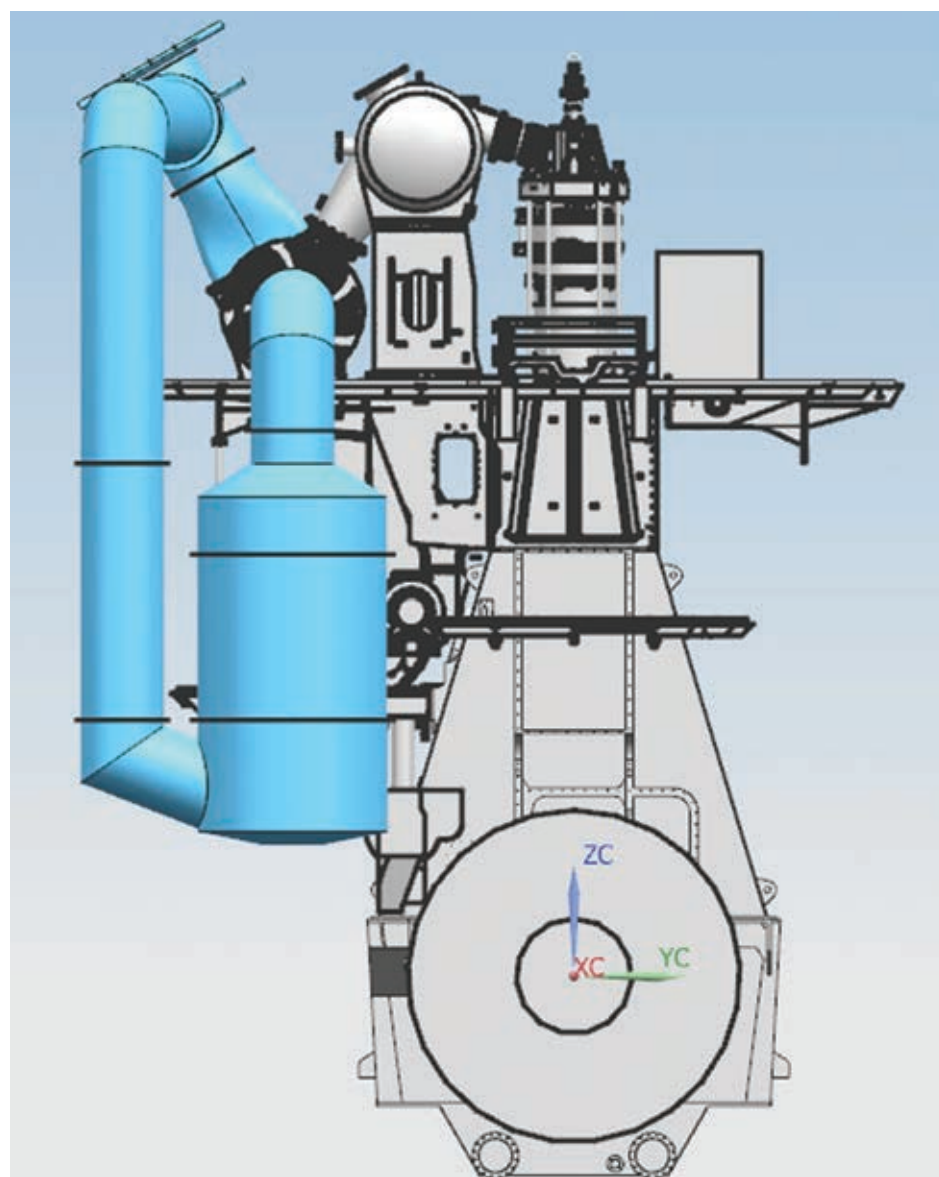
Different approach

Galke said during the presentation that the company believed that LNG would be in use in the maritime sector beyond the IMO's cut-off date of 2050, although alternative fuels were going to be needed. He thought that a different approach would have to be adopted going forward to add to the ship design, optimisation, energy mix and digitalisation.

He also stressed that the market would decide on the type of fuels to be used and not an engine designer. "We cannot tell shipowners what fuel to use but we must be ready for what is to come," Galke said, adding that efficiency improvements were ongoing and new technologies were under continuous development.

Dominik Schneider, Vice President, Research & Development, further explained that no complex and expensive after treatment equipment was needed.

He reiterated that LNG was a



In this schematic, the iCER cascade exhaust cooler can clearly be seen attached to the driving end of the engine

'bridging' fuel and that the X-DF design had no issues with blending fuels today. "We have the perfect platform to deal with new fuels and we can adapt," he said.

Schneider also explained that methane slip in an Otto cycle engine could not be avoided and the only way of dealing with it was by trying to capture the gas and recycle it. He also claimed that the X-DF series experienced a very low slip, compared with other engines on the market.

Turning to the return on investment (ROI) when opting for an X-DF2.0 engine, the company said that for a 72 series - favoured by LNGCs - there was a very short ROI, without going into details.

The iCER system was also said to be easy to retrofit on an existing X-DF engine. A shipyard could opt for an X-DF design with an iCER or leave space in the engine room to enable it to be fitted at a later date.

On the road to 2050, it was agreed that action needed to be taken today collaboratively involving engine

designers, shipyards and engine builders. "We are open to embrace the journey with as many stakeholders as possible," Schneider explained.

He also thought that the 2-stroke engine would be the prime mover of choice for some time to come and it would be ready for any fuel and low carbon options.

By the end of June, WinGD had won orders for 230 X-DF engines in its power range. Of these, 40 are in operation. Last year, the company claimed that around 90% of the LNGCs ordered were to be fitted with an X-DF engine.

WinGD told *LNG Journal* that for a 174,000 cu m standard LNGC, twin 5X72DF engines were the power units of choice.

Talking about the large planned LNGC Qatar order in Chinese and South Korean shipyards, the company said that X-DF engines would be a suitable choice. "WinGD works closely with engine builder and shipyard partners in support of any project discussions," the company said. ■

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Boil-off gas and sub cooling systems success

Air Liquide has seen considerable success with its Turbo-Brayton cryogenic units

News that Air Liquide had commissioned a Turbo-Brayton cryogenic unit on an LNGC, prompted *LNG Journal* Technical Editor, Ian Cochran to speak with Yannick Dupont, Deputy Vice President Sales Turbo-Brayton and Cryogenic solutions.

Dupont explained that this unit fitted on board the LNGC is a TBF-1225 type boil-off gas (BOG) reliquefaction and LNG sub-cooling system, which reliquefies the equivalent of 1.5 tonnes per hour of pure methane.

Commissioning was performed during gas trials in May, 2020 on TMS Cardiff Gas' newbuilding LNGC 'Qogir' built by Samsung Heavy Industries.

The system's start up and performance test was performed in just one day, which due to its engineering features, can be installed and commissioned in a very short timescale, he said.

He claimed that Air Liquide's Turbo-Brayton solution is the most compact unit available on the market, as it comes on a single skid ready to be installed and started up - hence the short installation timescale.

This patented technology offers specific technical characteristics, such as an oil-free and contactless turbo-machinery for LNG sub-cooling.

Its operation is also claimed to be very flexible and includes a high efficiency turndown mode with an unlimited number of starts and stops possible, while an immediate response is available for reliquefaction purposes.

Dupont said that daily operating costs (OPEX) are drastically reduced thanks to its five-year maintenance-free design.

With around 50 units sold on the market during the past two years, he said



Air Liquide's Turbo-Brayton unit is claimed to be easy to fit on board a gas carrier as it is mounted on a skid

that the Turbo-Brayton sub-cooler is the most efficient solution for LNG reliquefaction offshore, on LNGCs and/or on LNG bunker vessels (LNGBVs).

Of the 40 contracts won thus far, eight gas carriers have already been delivered, while the remaining 32 will be handed over in the next 18 months.

Several of the orders are for standard 174,000 cu m LNGC newbuildings, while around 10 are for fitting on LNGBVs. Dupont added that most LNGBVs being built and in operation will be equipped with this technology.

Included in the LNGC orders are two Turbo-Brayton LNG reliquefaction units type TBF-1050, which are already installed on two 174,000 cu m LNGCs constructed at Samsung Heavy Industries for GasLog under a long term charter with Shell.

An order was also received for an

LNGC to FSRU conversion project. Given that an FSRU's regasification plant could be idle for up to six months, a sub-cooler could be used to keep the gas at around -160 deg C, he explained.

He said that the unit was easy to retrofit, as little extra equipment was needed on board. For example, during the Shell chartered and Anthony Veder-managed 'Coral Methane' conversion project to an 8,750 cu m LNGBV, the time taken was less than three weeks.

First LNGBV

The first LNGBV to be fitted with a reliquefaction system using Turbo-Brayton technology was the STX built 'Cardissa', which is owned by Shell and has been in service since June, 2017 in an around northern Europe and the Baltic.

Dupont told *LNG Journal* that seven operational LNGCs are also to be retrofitted in Singapore shipyards, two of which are 170,000 cu m LNGCs owned by Norwegian interests. Several inquiries have also been received, as the system expands the vessel's life cycle and increases the quality of services offered to charterers.

He said that for a retrofit, the vessel does not need to be drydocked, however, this depends on what has to be done. The system can also be serviced during a statutory five-year drydocking at little cost, as it is extremely low maintenance being fitted with just two motors with connections and comes on a skid.

On board large LNGCs, the Turbo-

Brayton prevents boil-off – LNG vapours produced during shipments. The gas, carried at 160 deg C, warms up and partly evaporates at up to 6 tonnes per hour, which has an economic impact and also has a negative environmental impact in terms of CO2 emissions.

"Whereas other technologies allow the capture of the gas once it has escaped to reliquefy it, our system pumps the LNG from the storage tank and then re-injects it at a lower temperature, which cools everything and stops more gas escaping! This is the sub-cooling principle," Dupont explained.

Basically, the liquid is sent to the refrigeration system at -160 deg C, sub-cooled down to -170 deg C, then sent back to the LNG containment tank. When the tank receives the sub-cooled liquid, the BOG will re-condensate to liquid LNG.

Air Liquide offers capacities at around 0.5 tonnes per hour for LNGBVs, 1.35 tonnes for two of the LNGCs fitted and 1.5 tonnes per hour for another 30 of the LNGCs with the equipment subscribed.

It can be installed in an explosive environment as X-Proof, for example, in a cargo machinery room, sub-cooler room and even on deck for a coastal vessel solution.

Several patents have been taken out worldwide and the system is being marketed to many gas carrier interests, including charterers, owners, yards, storage companies and tank containment designers, such as GTT. ■

Key benefits claimed:

- **Low installation cost and time** – skid mounted system, low utilities: only water and electricity.
- **High reliability** – thanks to their magnetic bearings, Turbo-Brayton systems offer exceptional reliability.
- **Low maintenance** – a few days every five years.
- **Oil-free system** – no risk of damage due to oil contamination, no risk of losses from operational downtime.
- **Cooling power available instantaneously** – less than five mins from stand-by mode.
- **Multigas reliquefaction** – LNG, Ethylene, Propane, Ethane, Nitrogen.
- **Suitable for atmospheric and pressurised storage**
- **Safe technology** – inert process gas, no permanent refill of process gas required.
- **Fast and easy integration** – no impact on tank design, retrofit-friendly.
- **Low electrical consumption**
- **Designed for unmanned operation**

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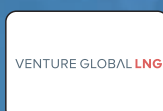
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LNG fuel for transport 'crucial' for sustainable recovery in wake of Covid-19 pandemic

Industry association, NGVA, highlights growth in LNG-fuelled vehicles. Malcolm Ramsay reports

The affordability and security of LNG as a fuel source for transport lend it strategic importance amidst the current Covid-19 pandemic, according to the Natural & Bio Gas Vehicle Association (NGVA Europe).

"The Covid-19 outbreak has unleashed an unprecedented socio-economic global crisis, affecting all citizens and sectors... gas remains a crucial solution during the current crisis," Andrea Gerini, NGVA Europe Secretary General told *LNG Journal*.

Despite the pressures caused by global lockdowns, the NGVA sees rapid growth in the LNG transport sector with over 280 European fuelling stations in operation and bunkering infrastructure in place at multiple ports.

"We are actually seeing a major uptake of LNG (and CNG) at the moment. It is one of the best, most affordable and low emission solutions, which is already available on the market," Gerini adds.

"For the EU to achieve climate neutrality by mid-century, renewable gas in transport is required. Natural gas, and renewable gases represent a quick and readily available way to complement efforts aimed at decarbonising the transport and logistics sector. Recognising their role within the sustainable recovery measures is the best way to ensure a swift restart of a safe, secure, and efficient system."

Green Deal

LNG operators in this space are currently

supported by the European Green Deal which aims to support alternative fuels but the NGVA predicts further legislation to come that will spur a refocusing of investment. A revision of legislation such as AFID will be key to further support a wider use of gas in transport across Europe, creating even most favourable conditions to maintain a competitive Total Cost of Ownership of LNG vehicles.

The NGVA is calling on policy makers to consider reframing the European Green Deal with greater support for CNG and LNG use in mobility systems, with long-term targets to create a "robust pathway made with the right set" of solutions.

"One of the major obstacles is that emissions are currently only accounted/measured at the tailpipe of a vehicle. Therefore, a new metric will be necessary to assess the effect from the use of advanced bio- and renewable fuels and the overall CO2 reduction these fuels allow," Gerini explains.

"The incoming revision of the CO2 emissions regulation will be key to create a positive ground to better support the development of cost-effective solutions like renewable gas. They are perfectly suited to immediately start off the decarbonisation of the mobility sector."

BioLNG

Besides a refocusing of investment, the current pandemic is also forecast to accelerate changes in regulatory metrics, helping to support greener gas products

such as liquefied biomethane (bioLNG).

NGVA Europe reports that biomethane already accounts for as much as 17% of CNG and LNG and almost 25% of Europe's refuelling network is supplying biomethane with a bio rate of up to 100%.

"Together with an already 20% emissions reduction measured at the tailpipe, this biomethane share results in a 35% reduction at fuel & vehicle level when compared to conventional fuels," Gerini notes.

LNG-fuelled vehicle registrations triple

Registrations for LNG-fuelled heavy-duty vehicles in Europe almost tripled in 2019, according to the latest statistics from the Natural & Bio Gas Vehicle Association (NGVA Europe).

The development signals a strong shift toward LNG as a transport fuel of choice with LNG vehicles achieving record penetration on the continents roads.

"These numbers confirm the ever-growing attraction of natural gas mobility for European consumers. This is the result of a mature gas vehicle technology with high engine efficiency and performance, widespread infrastructure and low total cost of ownership, but also great environmental benefits of gas in transport," Gerini explains.

The NGVA reports that Europeans filed registrations for 4,510 LNG trucks in 2019 alongside 69,900 new CNG passenger cars, 8,910 light commercial vehicles, 1,980 buses, 2,120 trucks. In



Secretary General Andrea Gerini

total, the association estimate there are over 1.4 million gas-fuelled light vehicles, 275,000 buses and coaches and 195,000 trucks in Europe.

European expansion

Europe has seen a rapid expansion in LNG fuelling infrastructure to support road transport in recent years with hubs in Benelux and Northern Europe helping to prove the technology.

"Looking to the Member State level, we see also very interesting, positive developments: for example Germany just extended the toll exemption for LNG fuelled heavy-duty vehicles that was in place before. This is a great role model for Europe which we greatly welcome," Gerini comments.

Demand has largely been driven by the heavy goods vehicles with logistics firms turning to LNG for its low emissions profile and low cost compared with other clean fuel solutions.

"Natural gas infrastructure and vehicles are fully compatible with renewable gas and therefore potent enabler of carbon-neutral mobility. Today, the usage of natural gas is the most cost-effective way to start a concrete path to decarbonisation across the multiple dimensions of the transport sector," NGVA Europe states.

NGVA Europe comprises 129 members from 31 countries primarily across the European Union and promotes the use of natural and renewable gas as a transport fuel. ■



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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



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



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 Shiping	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	Klaipėdos 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
		(Mistubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
		Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
		Gladstone LNG Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
		Gorgon LNG Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
		Pluto LNG Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
		QCLNG Shell, CNOOC	2014	2	8.0	2	280,000
		Wheatstone LNG Chevron, Woodside, Kuwait (KUFPEC), Jera, Kyushu	2017	2	8.9	2	300,000
		Ichthys LNG Inpex Corp., Total	2018	2	8.9	2	330,000
		Prelude FLNG Shell, Inpex, Kogas CPC	2019	1	3.5		
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
CAMEROON	Hilli Episeyo FLNG	Kribi Perenco	2018	1	1.2	1	125,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Total, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya	Equinor, Total, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG	2000	2	7.1	2	240,000
		Mitsubishi, Mitsui, Partex and Itochu					
PAPUA NEW GUINEA	PNG LNG	Oman Govt., Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
		ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-T1	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7		
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7	6	840,000
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
	Yamal LNG Siberia	Novatek, Total, CNPC, Silk Fund	2017	3	16.5	4	640,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, CIC, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	5	22.5	5	800,000
	Cove Point LNG	Dominion Energy	2017	1	5.3	7	695,000
	Cheniere Corpus Christi	Texas Cheniere	2018	2	9.0	3	480,000
	Cameron Hackberry	Sempra, Total, Mitsui, Mitsubishi	2019	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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