



GUNVOR DROPS EXMAR FSRU AFTER ARBITRATION DECISION

The Belgian shipowner will begin marketing the S188 for redeployment following charter cancellation. After taking a loss in arbitration, commodity trader Gunvor has cancelled the charter for an Exmar floating storage and regasification unit (FSRU). Antwerp-based, Brussels-traded shipowner Exmar disclosed the end of the deal on Friday and said it would begin marketing the 25,000-cbm S188 (built 2017) for redeployment. "Exmar received a termination fee equal to two years hire as a result of the early termination," the company said. Exmar did not disclose the sum. The S188 had been employed by Gunvor in Bangladesh since 2018 for what was supposed to be 10 years. Arbitration proceedings began the next year after Exmar tried to refinance the vessel in a sale and leaseback agreement with China's CSSC. Exmar said the deal was not executed pending security documentation requiring Gunvor's signature, with the Swiss company raising "some legal arguments that could lead to arbitration". The dispute forced Exmar to work with lenders to obtain extensions on its loans, set to come due at the end of September 2019. Bangladesh also moved toward larger gas projects, putting the charter in doubt. On Monday, Exmar said it

had prevailed on two preliminary issues with the arbitration tribunal issuing a partial final award while rejecting Gunvor's application for declaratory relief. The company said there would be no negative impact on its Ebitda generated from the charter. In the first quarter of 2021, Exmar generated \$3.4m in Ebitda, down from \$16.1m for the first quarter in 2020. Gunvor declined to comment. The S188 is still listed as laid up by shipbroking giant Clarksons. [source : www.tradewindsnews.com](http://www.tradewindsnews.com)

FSRU FIXED FOR GHANA LNG IMPORT PROJECT

A floating storage and regasification unit earmarked for Swan LNG's new terminal in India has been chartered on a short-term basis by the developers of Ghana's first import project. A spokesman for Ghana's Tema LNG confirmed the 180,000-cbm Vasant 1 (built 2020) had been "engaged" and is en route to Ghana. The vessel will operate as an interim FSRU in advance of the installation of a long-term replacement expected on site next year, he said. "This is an important moment for the project that will ensure that Ghana can swiftly benefit from the introduction of the reliable and efficient supply of cost-effective LNG through the Tema terminal," he said. One broker report listed the FSRU as fixed to the Helios Investment Partners-led project in the Tema port, near Accra in the Gulf of Guinea, for a year at \$20,000 per day. The Torman 1 — a purpose-built 28,000-cbm barge-based floating regasification unit — has already arrived in Tema. Under the original plan, LNG cargoes would have been imported to a floating storage unit (FSU) and regasified on the barge before being sent ashore. But the Vasant 1 will now take on the role of the FSU. The vessel was delivered last year. It was built to serve Swan's 5 million tonnes per annum terminal at Jafrabad in Gujarat state but construction there has been set back by two damaging cyclones and the FSRU was left trading on the spot market. The fixture of the Vasant 1 leaves a question mark hanging over the NYK Line-controlled, 127,705-cbm LNG Flora (built 1993), which had been earmarked to work as a FSU for the Ghana project. TradeWinds reported the selection of the Moss-type vessel in late 2018. Databases show its name has changed to Torman II. But Tema LNG and NYK Line indicated the vessel is not on contract to the project. [source : www.tradewindsnews.com](http://www.tradewindsnews.com)

KOREA LINE LNG INKS LNGBV AT HYUNDAI

Shipowner Korea Line LNG (KL LNG) has ordered a \$60m large-size LNG bunker vessel (LNGBV) at Hyundai Mipo Dockyard (HMD) against a long-term charter worth about \$92m with an energy major. A spin-off from Korea Line Corp (KLC), KL LNG said it has contracted a single 18,000-cbm on the back of charter employment with an LNG bunkering company in Asia. It did not disclose the name of the charterer. "This long-term time-charter contract is for five years and has an option to extend [by] up to 10 years," a KL LNG executive said. "The ship will be trading worldwide. The contract is worth about \$92m for 10 years." The official added that the vessel is slated for delivery in the first quarter of 2023. Shipping sources indicated that energy major Shell is the charterer behind the LNGBV newbuilding. "Shell has chartered two vessels — one from Pan Ocean and one from KLC LNG," one shipping source said. "It is putting one ship in Singapore and the other in the Gulf of Mexico." Pan Ocean was recently reported to have ordered a similar-size LNGBV newbuilding with HMD for delivery in May 2023. TradeWinds reported that Pan Ocean had also fixed its newbuilding to Shell for six years with an option to extend the hire by another two. Pan Ocean was reported to be paying about \$55m for the bunker newbuilding but shipbuilding sources said the

price is closer to \$60m — a level similar to what KLC LNG is paying for its ship. KL LNG’s newbuilding is the second LNCBV it has signed up with HMD. Two years ago, the company ordered a similar-size ship for charter to Shell at the Ulsan-based yard. The newbuilding — Hull No 8298 — is scheduled to be delivered in January 2022. Details of the charter were not disclosed. KL LNG also has one LNCBV, the 7,500-cbm SM Jeju LNG 2 (built 2020). KLC spun off its LNG division last year to form KL LNG. The purpose of setting up a separate outfit was to allow the new company to be an LNG specialist with a focus on LNG transport and LNG bunkering. source : www.tradewindsnews.com

PETRONAS CONFIRMS LNG NEWBUILDING TRIO FOR LNG CANADA SHIPMENTS

Malaysian giant inks time charters with Hyundai LNG Shipping on South Korean orders. Malaysia’s Petronas has signed time charters with South Korean shipowner Hyundai LNG Shipping on three LNG newbuildings that are set to lift the energy company’s cargoes from the under-construction LNG Canada project. Petronas confirmed the deal on Thursday, detailing that the 174,000-cbm vessels will be built at Hyundai Heavy Industries in South Korea. The time charters were signed virtually, watched by Petronas executive vice president and chief executive of gas and new energy Adnan Zainal Abidin, Hyundai LNG Shipping president and chief executive Kyubong Lee and HHI senior executive vice president and chief operating officer SY Park. Petronas said the ships are slated to be delivered from the second quarter of 2024 on a staggered basis and will “primarily be used to lift cargoes from LNG Canada”.TradeWinds reported on 14 April that Petronas had homed in on Hyundai LNG Shipping for the vessels after a tender for the ships was launched last year. Previously, it worked closely with its shipping subsidiary MISC on LNG newbuilding tonnage.The order is believed to have three optional vessels attached. Petronas — which controls a 25% stake in the \$30bn Shell-led LNG Canada project in Kitimat, British Columbia — claimed the newbuildings will be “amongst the most energy efficient LNG carriers ever built”. It detailed the ships would have shaft generators powered by LNG, air lubrication systems, optimised hull design and enhanced performance monitoring. “Collectively, these features will give the identical vessels the lowest carbon emission footprint in their class,” Petronas said. Petronas said the trio expands its global LNG fleet to 27 vessels, including small, medium and large ships. The company said the multi-sized fleet has enabled it to deliver more than 11,500 cargoes to over 25 countries from its global portfolio of supply in Malaysia, Australia, Egypt and, from 2024, Canada. The 14-million-tonne-per-annum LNG Canada is due onstream by the middle of this decade. source : www.tradewindsnews.com

SANTOS COMPLETES BAYU-UNDAN, DARWIN LNG SELL DOWN

Australia’s Santos on April 30 said it had completed the sell-down of 25% interest in Bayu-Undan field in the Timor Sea and Darwin LNG project to South Korea’s SK E&S, which is also a partner in Barossa. The sell-down resulted in net funds to Santos of US\$186mn at completion, being the sale price of US\$390mn less the cashflows from the 25% interests from the effective date of October 1, 2019, to completion, the company said. Santos and SK E&S have also signed a memorandum of understanding to jointly investigate opportunities for carbon-neutral LNG from Barossa, including collaboration relating to Santos’

Moomba CCS project, bilateral arrangements for carbon credits and potential future development of zero-emission hydrogen. Completion of the sell-down to SK E&S sees Santos' interest in Bayu-Undan and Darwin LNG change to 43.4%. Santos remains the operator of both assets. The remaining interests are held by SK E&S (25%), Inpex (11.4%), Eni (11%), Jera (6.1%) and Tokyo Gas (3.1%). Santos is also the operator of the Barossa project and announced the final investment decision to proceed with the project last month. First gas from Barossa to backfill Darwin LNG is expected in the first half of 2025. source : www.naturalgasworld.com

VENTURE GLOBAL CLOSER TO FID AT PLAQUEMINES LNG PROJECT

US LNG developer Venture Global said April 29 it formed a new partnership with engineering firm Zachry Group to facilitate development of the planned Plaquemines LNG export project in Louisiana. Venture in November awarded the engineering, procurement and construction (EPC) contract for Phase 1 of the LNG project to engineering and construction firm KBR. Through a new joint venture with KBR and Zachry Group, dubbed KZJV, the partners will work together to execute the EPC contract. "KZJV will integrate highly modularized, owner-furnished equipment for the 10mn mt/yr nameplate facility, identical to the systems being successfully delivered and installed at Venture Global LNG's Calcasieu Pass project," Venture said. "Construction of this project will result in thousands of jobs." The Calcasieu Pass is Venture's first LNG facility in Louisiana. Plans there call for an 18-train, 10mn mt/yr terminal. Venture in February secured a \$500mn term loan with a banking syndicate led by JPMorgan Chase that it will use, in part, to fund pre-FID construction activities at Plaquemines. Plaquemines LNG has received all regulatory approvals and has binding offtake agreements with Poland's PGNiG and French utility EDF for a total of 3.5mn mt/yr from Phase 1. A final investment decision (FID) on the liquefaction terminal and its companion Gator Express pipeline project is not expected until financial close, which according to a timeline on the project's website is anticipated by mid-2021. source : www.naturalgasworld.com

PETRONET LNG PLANS BUNKERING SERVICES TO OCEAN GOING SHIPS FROM ITS KOCHI TERMINAL

The ₹4,700 crore terminal in Kochi had already provided LNG bunkering to two Norwegian ships in 2015. Petronet LNG Ltd (PLL) intends to start bunkering services to ocean going vessels from its Kochi terminal as part of shoring up its business volumes. Globally ships are slowly converting to LNG or other green fuels. Given the circumstances, providing bunkering services would definitely mop up our revenues as well, Yogananda Reddy, Chief General Manager and Vice President, PLL, Kochi terminal said. "We are working on the project, but yet to finalise the market requirements like the number of ships plying with LNG as fuel on the international shipping route off Kochi," he told.

The ₹4,700 crore terminal in Kochi had already provided LNG bunkering to two Norwegian ships in 2015. But a similar model cannot be worked out now in view of the bigger size of many ocean-going ships. These ships cannot be berthed at the terminal for fueling and there is a need to deploy bunker barges for alongside bunkering on the route of ships, he added.

Asked on the investment part of the project, Reddy said, "It is too early to say anything on the cost aspect as it all depends on the customer base, their requirements etc. A final figure can be arrived at once we get the exact number of customers." Meanwhile, the 5-million tonne Kochi terminal has attained 30 per cent of its capacity after the natural gas started flowing to Mangaluru with the completion of GAIL pipelines in March. Mangaluru is a good consumption point for natural gas and the prominent customers include MRPL, Mangalore Chemicals and Fertilisers, OMPL etc which started taking a sizeable quantity. The gas connectivity has also ensured the arrival of two LNG laden ships per month to the terminal with 1,50,000 cubic metre of liquified natural gas against one in the earlier period, he said. To a question on the project to convert fishing boats with LNG, Reddy said the Central Institute of Fisheries Technology is carrying out a 100 running hour trial. The initial trials are satisfactory, and it is expected that the agency would soon come up with their findings. Besides, a 20-25 per cent cost reduction in fuel for fishing boats, LNG is less polluting compared to diesel. Reddy was all praise for the Kerala Government in reducing KVAT for LNG to five per cent from 14.5 per cent. "This is a major decision which would boost the business and make natural gas competitive in the market. We are also in discussions with KSRTC to convert 500 buses plying in the State with LNG," he added. Source : <https://www.thehindubusinessline.com/>

AVENIR LNG CLOSES IN ON FIXTURES FOR ITS TWO 20,000-CBM NEWBUILDS

Supply-focused small-scale owner to examine its next ship requirements as it looks to new markets. Shipowner Avenir LNG expects to wrap up employment for its two 20,000-cbm newbuildings by the end of this quarter. And the LNG carrier owner is starting to consider what it needs to build to open up new markets. Company chief executive Peter Mackey said Avenir has had a great deal of interest on the two largest of its six LNG carriers but is being "quite cautious" about how it fixes them. But he told TradeWinds that both the Avenir Allegiance and Avenir Achievement will "go firm" by the end of the second quarter. He said both 20,000-cbm vessels are set to be used for projects in which Avenir is providing LNG supply and using its own assets.

Ship	Size (cbm)	Delivery	Yard	Charterer
Avenir Advantage	7,500	2020	Keppel Nantong	Petronas*
Avenir Accolade	7,500	2021	Keppel Nantong	New Fortress
Avenir Aspiration	7,500	2021	CIMC Sinopacific	Avenir LNG
Avenir Allegiance	20,000	2021	CIMC Sinopacific	Open
Avenir Ascension	7,500	2021	CIMC Sinopacific	Open
Avenir Achievement	20,000	2021	CIMC Sinopacific	Open

*Ship is time chartered from Future Horizons, a 50:50 MISC-Avenir LNG joint venture

SNAM talk

Mackey said broker reports that detailed the newbuilding Avenir Allegiance, which has been launched but not yet delivered, had been fixed to Italy's SNAM for seven years are incorrect. He said that while the company has been in discussions with SNAM on its requirement, Avenir has three to four competing projects for that ship. "Our goal is about supplying LNG to new markets and our ships are the enabler," Mackey said. "If we see an opportunity for a charter we will look at

that." Avenir has already taken delivery of the first two of four 7,500-cbm LNG newbuildings. The first of these is fixed to Petronas with the second to New Fortress Energy.

Sisters cosy up

On Monday, the company pulled off something of a first in the small-scale LNG industry by using the Petronas-chartered Avenir Advantage (built 2020) to bunker its sistership newbuilding Avenir Accolade off Malaysia. The Avenir Accolade is now heading to Europe to load a cargo of LNG that will deliver to the company's Higas LNG import terminal on the Mediterranean island of Sardinia in late May to commission the facility. Mackey said Avenir, which is awaiting its operating permit from the government for the new terminal, will start cool-down operations with trucked nitrogen on Monday and bring in LNG on trucks from France to continue the commissioning later in the week. The next 7,500-cbm delivery, the newbuilding Avenir Aspiration, has been earmarked to serve this project.

New wave

The final 7,500-cbm newbuilding, the Avenir Ascension, remains open at present in that discussions on it are not as advanced as on other vessels, Mackey said. He said the conversation now is not about whether Avenir should build more ships but what assets will enable the next wave of growth of the business. He said this may involve the company buying more trucks, building onshore terminals, regasification barges and ships. "It is the full range of assets," he said. Mackey said 2020 had been "a very bizarre year". But he said the LNG industry has "come back with a bang in 2021" and is "really roaring into life again".

Source : www.tradewindsnews.com

SMALL-SCALE INVESTMENTS BACK ITALY'S COMMITMENT TO LNG

Already an import link in Italy's natural gas supply chain, the OLT Offshore LNG Toscana receiving terminal will expand its versatility by converting its floating storage and regasification unit (FSRU) to load small-scale (ssLNG) carriers. Permanently moored 22 km off of Italy's coast between Pisa and Livorno, *FSRU Toscana* is used as a receiving terminal for large LNG carriers, storing and regasifying LNG into the country's national gas grid via a subsea pipeline. Following authorisation by Italy's Ministry of the Economic Development in October 2020, OLT can now provide a new LNG reloading service for ssLNG carriers which will underpin wider distribution of LNG for bunkering, power generation and heavy truck refuelling. Following the introduction of the ssLNG service within the OLT Regasification Code, OLT Offshore LNG Toscana gathered feedback from stakeholders through an expression of interest. In their responses, stakeholders outlined their proposals regarding their interest in annual capacity, expressed in the number of ssLNG carriers they expect to book, their small-scale service tariff expectations, and detailed the ssLNG carriers they expected to use. OLT plans to start offering the ssLNG service 1 January 2022 – Before that can happen, however, the terminal will need to undergo modifications. These will cover the mooring system to allow the safe approach of smaller LNG carriers on the port side and changes to the existing LNG transfer systems. Based on a feasibility study, the ssLNG carriers must have a length between 90 and 120 m. Maximum loading capacity will be about 900 m³/hr. These modifications are expected to be conducted without interrupting LNG loading operations at the terminal. OLT will be the first regasification terminal in Italy to provide the discharge of LNG into ssLNG carriers.

Growing ssLNG sector

The ssLNG market has developed due to the European Community's efforts to promote the availability of lower carbon-intensive fuels in the transport sector to support the clean-energy transition. The European Green Deal has further strengthened this path, setting the rules for an energy transition in all sectors – industrial, civil and transport – which will have to achieve total greenhouse gas (GHG) emissions neutrality by 2050. LNG is seen as an essential fuel in that clean energy transition. LNG will allow the transition to carbon-neutral fuels, such as hydrogen by 2050, says OLT Offshore LNG Toscana. In Europe, LNG propulsion has been rapidly growing in ferries, passenger ferries, tugs, dredgers and cruise ships – with 12 new orders and two vessels already operating in the North Sea and the Mediterranean. The energy transition process". The fleet of LNG bunkering vessels is growing, too, with 31 in operation and 20 under construction, according to DNV. Moreover, LNG is playing a central role in heavy road transport. In Italy, for example, the number of LNG distributors for vehicle use had grown from six in 2016 to 94 by the end of 2020. The OLT Offshore LNG Toscana regasification terminal is seen as a key component in underpinning the ssLNG market, serving as an LNG hub in the Mediterranean. This is particularly relevant if a Sulphur Emissions Control Area (SECA), similar to those in the North Sea and Baltic Sea, is established in the Mediterranean. The growing number of LNG-fuelled vessels in the region, such as Costa Smeralda, will be supported by expanding ssLNG bunkering infrastructure

Sardinia terminal

Further south on the island of Sardinia, a new ssLNG import, storage and distribution terminal is being developed by Avenir LNG and local Italian partners Gas & Heat and CPL Concordia. Being built at the port of Oristano, the Higas terminal will have a jetty capable of receiving LNG vessels up to 20,000 m³, an unloading arm, six horizontal cryogenic holding tanks (1,500 m³ each), two LNG truck loading bays, and a natural gas captive power generation system. When it opens in H1 2021, the terminal will be able to load in excess of 8,000 LNG trucks each year (some 180,000 tonnes), for subsequent distribution to smaller satellite stations across the island. Sardinia currently lacks a system of access to natural gas and only a small number of industrial customers receive LNG by truck, which is brought to the island by ferry. Developer Avenir LNG is backed by some LNG industry heavyweights – Stolt Nieslen, with a 45% stake, Höegh LNG and Golar LNG, each with 22.5% interest and NOTC, 10%. In turn, Avenir LNG holds 80% of the equity in the terminal, with the remaining 20% stake split equally between Gas & Heat and CPL Concordia.

Green light for Venice terminal

In January, Italian regulators gave the green light to start the construction and operation of an LNG import terminal in Porto Marghera in Venice. Venice LNG, a subsidiary of the Decal Spa Group, reported it received authorisation from the Italian Ministry of Economic Development in agreement with the Ministry of Infrastructures and Transport. With a storage capacity of 32,000 m³, the Venice LNG import terminal will be a brownfield development in the South Industrial Canal of Porto

Marghera.

Venice LNG called the regulatory green light a “step forward in the fuel infrastructure for road and marine transport.” Financing for the project comes from a private investment of over €100M (US\$121M) by Decal Spa Group, with an additional €18.5M (US\$22.3M) through the North Adriatic Sea Port Authority and co-financed by the European Commission under the Connecting Europe Facility (CEF) initiative through the “Gainn4SEA” and “Venice LNG Facility” projects. LNG will be transported to the Venice LNG import terminal via small- and medium-sized LNG carriers, with a maximum capacity of 30,000 m³, and will be distributed on tank trucks, ISO-tanks and LNG bunker barges. Venice LNG anticipates no more than 50 LNG carriers – about one per week – calling at the facility. Venice LNG president and chief executive Gian Luigi Triboldi noted the project went through a long technical-administrative path, involving many national and local authorities and stakeholders. “Now, we are ready to make our contribution to promote the use of LNG, which plays a key role in the energy transition process,” said Mr Triboldi. Venice LNG expects to handle 150,000 m³ of LNG per year in its first phase, with a maximum output of 900,000 m³. Construction is expected to take two years. About 150 km south of Venice, a new small-scale LNG facility is being constructed by Depositi Italiani GNL, 51% owned by Pir and 49% by Edison SpA, at the port of Ravenna; it will support the distribution of LNG for heavy vehicle and vessel refuelling. With expected commissioning in Q4 2021, the facility will have two 10,000-m³ storage tanks and the ability to load LNG onto LNG bunkering barges and tanker trucks. Initial estimates are that 520,000 m³ of LNG would be distributed, 496,000 m³ of which would be by tanker truck and 24,000 m³ by barge. Source :

www.rivieramm.com

NEW GENERATION OF ICE-BREAKING LNG CARRIERS TAKES SHAPE IN RUSSIA

Vast Russian natural gas resources located above the frigid Arctic circle have spawned a new generation of robust, ice-breaking LNG carriers designed with reinforced hulls, enhanced podded propulsion and vibration-resistant cargo containment technology. A steel cutting ceremony was held in April at Russia’s Zvezda Shipbuilding Complex for one of the latest of these LNG carriers that will operate in temperatures of as low as -52°C by mid-decade. Like all 15 LNG carriers being built by Zvezda in the series, the ARC7 ice class LNG carrier is being built for a long-term, time-charter for Novatek’s Arctic LNG 2 project. Designed by Zvezda with technology partner Samsung Heavy Industries, each vessel will have an overall length of 300 m, beam of 48.8 m, depth of 26 m, with a capacity of 172,600 m³ using GTT’s Mark III membrane containment technology. This is the second of 14 to be built for Smart LNG, a joint venture between Sovcomflot and Novatek. The lead vessel of the series is owned by Sovcomflot. This is an historic project for Russia, since these next generation dual-fuel vessels are the first LNG carriers built in the country. Featuring impressive ice-breaking capabilities, the LNG carriers’ reinforced hulls will allow transiting stern first in ice up to 2.1 m thick and 1.5 m thick moving forward. Additionally, these new LNG carriers will underpin local Russian maritime technology knowledge and development. All will have enhanced manoeuvrability supplied by three 15-MW General Electric Sapfir azimuth podded thrusters, produced locally in Bolshoy Kamen at the Sapphire Steerable

Thrusters Plant, a joint venture of Rosneft and GE. Set for delivery between March 2023 and December 2025, this series of Arctic LNG carriers is being financed by VEB.RF.

100% fleet utilisation

With long-term charter agreements in place with Yamal LNG, Gazprom and Equinor, Dynagas has its own unique fleet of ice class notation 1 (or equivalent) LNG carriers that operate in sub-zero and ice-infested waters. Its LNG carrier *Ob River* was the first to carry an LNG cargo on the Northern Sea Route in 2012, proving the viability of such operations. Sister vessels *Ob River*, *Clean Energy*, and *Amur River* were all built by South Korea's Hyundai Heavy Industries between 2007 and 2008. Each vessel has an overall length of 288.2 m, beam of 44.2 m, draught of 12.4 m, with a capacity of 150,000 m³ and steam turbine propulsion. The company's other vessels, *Arctic Aurora*, *Lena River* and *Yenisei River*, were all built between 2013 and 2014 by HHI. Each vessel has a length overall of 228.1 m, beam of 44.2 m, draught of 12.5 m, with tri-fuel, diesel-electric (TFDE) propulsion and a capacity of 155,000 m³. Dynagas Holdings' limited partnership, Dynagas LNG Partners LP, formed to own and operate its fleet, reported 100% fleet utilisation with an average time charter equivalent of US\$61,134 per day during Q4 2020. It inked a new charter deal with Equinor for the 2013-built, Ice Class 1A FS, fully winterised *Arctic Aurora* that will keep the vessel employed into 2023, generating about US\$21.5M for Dynagas LNG.

Gas carrier design for multi-fuel future

With the LNG-fuelled fleet growing, new ice-class LNG bunkering vessels are also being conceived. Leaning into the multi-fuel future, Danish naval architectural and marine engineering firm Knud E Hansen has unveiled a flexible liquefied gas and bunkering vessel design that can accommodate LNG and zero-emissions fuels, such as compressed and liquefied hydrogen. Knud E Hansen senior mechanical engineer Kim Nørby Christensen explained the idea behind the X-gas Project: "It will be able to transport almost any gas (liquid or compressed) for future fuels. When we mention hydrogen, we see it as the link in the power-to-x technology, as hydrogen plants are planned in many countries, but there must be a link like the X-gas to connect production plants and consumers." This covers the carriage of CO₂ and ammonia, too. Knud E Hansen's X-gas Project is a series of medium-capacity liquefied gas supply and bunkering vessels, the largest of which would be a 'flagship' 126.5-m vessel with a total cargo capacity of 9,000 m³ for LNG, split between two IMO Type C tanks. The vessel will have a beam of 20.5 m, design draught of 5.25 m and deadweight of 4,775 tonnes. The tank system, the top side equipment and the associated ship particulars will change depending on the application, "but we target almost all the gasses that the operator wants to carry, and we will take care of the necessary ship particulars for the request," said Mr Christensen. He noted that with the variety of fuels under consideration for the future, and with the large differences in mass density and energy density, "we consider a brand like X-gas to be the right way to promote tankers under a common 'umbrella', here represented by the LNG 'flagship'." Built with the notation Ice Class 1A, the liquefied gas transport and bunkering vessel would be capable of

navigating in difficult ice conditions, with the assistance of icebreakers when necessary under DNV rules, or the equivalent Finnish-Swedish Ice Class 1A notation. Ice Class 1A vessels have thicker hull plating and ice-strengthened framing.

Knud E Hansen says the X-gas platform can be built with different tank capacities and containment systems, including membrane tanks. Notable is the vessel's low-profile and forward deck house, which will enable it to safely approach and pull alongside cruise ships with low-hanging lifeboats. Additionally, this minimises the need for ballast during cargo transfer, lowering operational costs. Lastly, the forward deck house allows for larger cargo tanks without impeding bridge visibility. For improved manoeuvring and safety, the design features two propulsion thrusters aft and two bow thrusters and an autodocking system for alongside mooring. Propulsion for the vessel will be supplied by four-stroke, dual-fuel diesel-electric engines, and an energy storage system (ESS) with a lithium-ion battery bank for engine load optimisation. This will allow the vessel to operate on batteries during low load conditions - avoiding methane slip when operating on LNG. The batteries will provide all of the power required during cargo transfer or bunkering operations, resulting in no emissions or exhaust - especially important when refuelling passenger vessels. Service speed will be 13 knots. Other energy efficiency features incorporated in the design are the use of boil-off gas in the dual-fuel engines, with the ability to store any surplus energy in the batteries. Waste heat from the engine cooling water is converted to electric and thermal power through a number of Organic Rankine Cycle waste heat units. Source : www.rivieramm.com

LNG CONTAINMENT SOLUTION EVOLVES FOR MORE EFFICIENT TWO-STROKE ENGINES

GTT's NO96 Super+ CCS has a lower boil-off rate to match the efficiency of two-stroke, slow-speed, dual-fuel engine technology. French cryogenic engineering firm GTT has released a refinement of its popular NO96 LNG cargo containment system (CCS) that promises to further reduce cargo boil-off rates, matching the consumption needs of new generation two-stroke, dual-fuel engine technology. GTT commercial vice president David Colson explains that the introduction of highly efficient, two-stroke, slow-speed dual-fuel engine technology from MAN Energy Solutions and WinGD in 2010 and 2011 provided the impetus for the development of the NO96 Super+, an evolution of its popular NO96 system. "We had to match our systems' natural boil-off rate - which we guarantee - with the consumption of the engines," Mr Colson tells *LNG Shipping & Terminals*. This meant GTT had to reduce the standard boil-off rate (BOR) of 0.15% volume per day from its systems. GTT released the Mark III Flex with a guaranteed BOR of 0.085% in 2011, but "we didn't have a solution for NO96 better than 0.1%. NO96 Super+ is now the equivalent of the Mark III Flex in terms of guaranteed BOR," he says.

Building on the success of NO96 technology, NO96 Super+ technology integrates insulating reinforced polyurethane foam panels instead of plywood boxes, used for both the primary and secondary insulation spaces, to reduce the heat ingress inside the tank. Glass wool flat joints are inserted between adjacent foam panels to optimise the behaviour of the system and ensure it has the best thermal performance. As in NO96, NO96 Super+ uses the principle of double Invar metallic membranes and

the mechanical anchors fixing the insulating panels to the inner hull. With NO96 Super+, GTT can offer a guaranteed BOR of 0.085%/d for the current standard size design of LNG carrier of 174,000 m³. For larger capacity vessels, such as 200,000 m³, depending on tank configuration, the guaranteed rate may be reduced further. NO96 Super+ received an approval in principle (AiP) from class society Bureau Veritas in April. This will allow shipyard licensees China's Hudong-Zhonghua Shipbuilding and South Korea's Daewoo Shipbuilding & Marine Engineering to propose NO96 Super+ CCS in their responses to tenders that have equivalent boil-off performance as those made by Hudong-Zhonghua, Samsung and Hyundai in their proposals using Mark III Flex technology. "Now they can be equivalent without having to add any supplementary boil-off handling equipment like reliquefaction," says Mr Colson. While classification societies have already approved the system, they will have to approve the construction process to ensure that there are no difficulties, says Mr Colson. As this is an evolution and not a radical new technology, he says the construction approach is almost identical to the previous systems, with one or two slight modifications. "But the methodology and the processes and the way the system was put together is very similar," he says. A mock-up using NO96 Super+ technology was erected in February 2021 and validated the satisfactory assembly of the CCS. He expects the first LNG newbuild proposal containing the NO96 Super+ technology by June 2021.

In looking at GTT's development roadmap, Mr Colson points out that candidate future fuels - ammonia and hydrogen - pose their own unique shipboard cargo containment challenges. As it incorporates an Invar metallic barrier - containing 36% nickel - NO96 Super+ is not compatible for use with ammonia. "Nickel doesn't like ammonia," says Mr Colson. "Our Mark III system, with a stainless steel barrier and low nickel content, however, is compatible with ammonia." In February, GTT received an AiP from BV regarding the use of Mark III technology, which was an 'NH3 Ready' notation, meaning Mark III could be used for ammonia fuel-tank containment. Shipped at -34°C, ammonia has a higher density and about half the energy content as LNG, which must be maintained at minus 162°C. "Ammonia could be a solution going forward because there's no carbon molecule," says Mr Colson, but it depends on how ammonia is produced. "It's not green today and it's also a very inefficient fuel and highly toxic", he points out. He said that GTT is not a believer in ethanol or methanol as shipping fuel solutions. "The next step as far as we're concerned is hydrogen." He describes hydrogen as "a different beast." It is the smallest molecule in the periodic table - which means it can migrate through materials - and needs to be kept at -253°C, "so you have a significant challenge for the installation itself. You need to be able to control the liquid and keep it liquid. Our current systems haven't got the performance to do that, so we're looking at other solutions," he says. Still, Mr Colson says, hydrogen as a global energy solution is some years off. He also notes that a recent report by the World Bank, which touted hydrogen and was unflattering to LNG as a marine fuel, fell far short of providing the full story, failing to properly discuss advances made in reducing methane emissions, methane slip and use of bioLNG. "I think LNG has a definite future. It's important that people understand LNG is definitely part of the mix," he says.

JIP explores LNG carrier designs with Type A CCS

Elsewhere, Qatar Petroleum (QP) joined with a subsidiary of China State Shipbuilding, ABS and LNT Marine in a joint industry project in March to develop new medium- and large-sized LNG carrier designs based on LNT A-Box cargo containment systems. Other signatories to the agreement were Qatargas and affiliates of ConocoPhillips, ExxonMobil, Shell and Total. The LNT A-Box system is based on an independent IMO Type A tank as the primary barrier and a full secondary barrier. The tank is flexible in shape and geometry, catering for excellent volume utilisation, while the internal structure mitigates sloshing and eliminates any loading limitations. The tank itself is not insulated, but is installed in an insulated cargo space. This means that the insulation is attached to the interior surface of the hold, while a liquid-tight barrier is fitted on the inner surface of the insulation, acting as the secondary barrier. In between the tank and the secondary barrier is a cold inter-barrier space, which offers direct access for visual inspections and maintenance of both barriers, as well as the tank supports. The first LNG carrier fitted with the new CCS was the 45,000-m³ *Saga Dawn*, which entered service in Q2 2020. Source : www.rivieramm.com

NEW TWO-STROKE, LEAN-BURN, DUAL-FUEL ENGINE TARGETS LNG CARRIERS

With its eye on the LNG carrier market, MAN Energy Solutions demonstrated its first two-stroke, low-pressure Otto-cycle engine, targeted for delivery in early 2022. Up until about 10 years ago, steam turbines powered by steam generated from boil-off gas (BOG) were the propulsion power of choice for LNG carriers. While steam turbines still power a large portion of the fleet, a new crop of two-stroke, slow-speed, dual-fuel engines – underpinned by reliquefaction technology – have emerged as the preferred prime movers for today's generation LNG carriers, cutting fuel consumption, improving emissions and lowering cargo transportation costs.

In 2016, Teekay's 174,000 m³ *Creole Spirit* became the first LNG carrier equipped with MAN Energy Solutions' two-stroke, slow-speed, high-pressure, Diesel-cycle, dual-fuel MAN B&W ME-GI engine, equipped with a Burckhardt compressor and partial reliquefaction system. Fuel consumption for the M-type, electronically controlled and gas-injected engine was estimated to be 100 tonnes per day – significantly less than the 125 to 130 tonnes per day for a comparable four-stroke, dual-fuel, diesel-electric propulsion system.

In 2017, SK Shipping's *SK Audace* became the first LNG carrier fitted with two-stroke, low-pressure, dual-fuel X-DF engines from Winterthur Gas & Diesel (WinGD). Based on the lean-burn, Otto-cycle combustion principle, in which fuel and air are premixed and burned at a relatively high air-to-fuel ratio, the two-stroke X-DF engines can operate on low loads of gas and are IMO Tier III-compliant out of the box, emitting low NOx emissions and virtually no sulphur oxides or particulate matter.

With Otto-cycle, lean-burn technology gaining significant traction in the LNG carrier sector – where more than 175 vessels are on order – MAN Energy Solutions set out to develop its own low-pressure, two-stroke, dual-fuel engine offering four years

ago. Initial results of its engine R&D were released in mid-March to the press during a ceremony live-streamed from MAN Energy Solutions' Copenhagen Research Centre. An Otto-cycle variant of the company's ME-GI engine, the ME-GA will be well suited for LNG carriers, since the vessels use BOG that can be fed directly into the engine via a low-pressure compressor. Similar in price to MAN Energy Solutions' two-stroke, dual-fuel Diesel-cycle ME-GI engine, the ME-GA reduces the need for certain additional surrounding equipment, lowering the capex for shipowners. This stems from the relative high cost of the fuel gas supply system (FGSS), including the high-pressure compressor, for boosting the pressure of the BOG to the 300-bar injection pressure needed for the ME-GI – an investment only used for the LNG carrier application.

As its pre-mixed combustion results in low NO_x emissions, the ME-GA engine is inherently Tier II and Tier III compliant in gas-operation mode. To fully utilise its dual-fuel potential in Tier III areas, the engine is being offered with exhaust gas recirculation (EGR). “We initiated this ME-GA project in late 2017 when we recognised a strong market desire for a lower-cost alternative to the ME-GI engine, driven primarily by the LNG carrier market,” said MAN Energy Solutions chief sales officer Wayne Jones, OBE. “Crucially, this new supplement to our dual-fuel portfolio continues our mission to decarbonise shipping and further the maritime energy transition to sustainable fuels.” MAN Energy Solutions senior vice president and head of two-stroke promotion and customer support, Bjarne Foldager, noted the intense effort made by the engine designer to develop its Otto-cycle engine entrant: “It’s taken a team of 150 colleagues, and hundreds of tests and operational hours, to get the engine to this important stage. In doing so, we have drawn on the invaluable experience gained from developing our successful ME-GI concept. Similarly, our proprietary EGR system also plays an important role in the ME-GA set-up. Not only does it deliver NO_x-compliance, it also helps maintain control of the ignition process and reduces fuel consumption by 3 and 5% in gas and fuel-oil modes, respectively.” In November 2020, MAN Energy Solutions announced that it would offer its proprietary EGR system as an emissions solution for the ME-GA. EGR is a NO_x-emissions-reduction technique that ensures IMO Tier III-compliance in diesel mode for the ME-GA. The engine designer reports that EGR will enable the ME-GA to reduce specific gas consumption by about 3%, and specific fuel-oil consumption by 5%. It will also significantly reduce methane slip by 30 to 50% and improve the stability of the Otto-cycle combustion process. EGR will enable the ME-GA to meet Tier III requirements in both fuel oil and gas modes, without additional aftertreatment.

The ME-GA EGR solution is a high-pressure system, which can be integrated into existing engineroom designs, and the EGR unit itself does not change the engine footprint. Its design-similarity to that of ME-C engines' EGR systems will lower its price point, since the supply chain and components are already matured. The volume requirements of the ME-GA EGR system are also significantly lower with, for example, less pipework required than for low-pressure EGR solutions. With Tier III compliance in gas mode, the engine meets all current and upcoming NO_x emission regulations with the addition of EGR. MAN Energy Solutions aims to start testing the first commercial ME-GA design by the end of 2021, with the first engine delivery following in early 2022.

LPG dual-fuel retrofits

MAN Energy Solutions reports that its portfolio of two-stroke, dual-fuel engines has accumulated over 1.6M operating hours from the 155 engines (6.3 GW) currently in service running on alternative fuels, LNG, LPG, ethane and methanol. It expects the option of retrofitting to dual-fuel engines to increasingly become a necessity. BW LPG is in the midst of retrofitting 15 of its very large gas carriers (VLGCs) to operate on LPG dual-fuel technology under a US\$130M programme. The sixth, seventh and eighth vessels in the programme – *BW Volans*, *BW Var* and *BW Balder* – are currently in China's Yiu Lian Dockyard in Shenzhen, China undergoing retrofit with dual-fuel, Diesel-cycle, LPG-burning ME-C-LGIP engines. World LPG Association (WLPGA) technical director Nikos Xydas sees increased adoption of LPG as a marine fuel in Asia. Speaking as a panellist at Riviera Maritime Media's *Green fuels, green engines, the role of LPG and of hydrogen fuel cells: what's right for Asia?* webinar, My Xydas noted LPG as a marine fuel produces 99% less SOx, 15% less CO₂, 10% less NOx and 90% less particular matter (PM) than compliant fuels and does not suffer from methane slip, as is the case of LNG-fuelled vessels. Currently, there are four VLGCs using LPG as a marine fuel. In total, refenced Mr Xydas, there are 79 retrofit and newbuilding LPG-fuelled vessels on the orderbook. Held in April, the webinar was supported by the Methanol Institute and the World LPG Association, and was part of Asia Maritime & Offshore Webinar Week, supported by the Hong Kong Shipowners Association and Intermanager. Source : www.rivieramm.com

KANFER EYES FIRST CHARTER DEAL FOR LNG BUNKERING THIS SUMMER: INTERVIEW

Norway's Kanfer Shipping expects to sign the first charter agreement for its small-scale LNG bunkering vessels this summer, the company's managing director Stig Hagen tells *NGW* in an interview. Kanfer, part-owned by Singapore-based AG&P, is a developer of small-scale LNG carriers and bunkering vessels, as well as maritime LNG break-bulk and storage solutions. It signed a letter of intent (LoI) with China's Taizhou Wuzhou Shipbuilding Industry in January for the construction of two small-scale LNG bunkering vessels. The vessels, with storage capacities of 6,000 m³ each, are scheduled for delivery in the first half of 2023. Its contract with Taizhou Wuzhou Shipbuilding includes an option for more vessels in the future. Kanfer will own the ships together with its partners and charter them out under long-term contracts. "Details regarding our contracts are commercial-in-confidence. There are however increased and concrete interests from different parties. Agreements like this and LNG projects generally take time, but we are confident to sign the first charter agreement during summer," Hagen says. Far more LNG bunkering vessels will be needed in the next three to five years than are currently available, Hagen explains, as the number of LNG-fuelled ships in service continues to grow. "In the medium- to long-term, we plan to build a fleet of LNG bunkering and distribution ships, the size of which will vary depending on client's requirements," he says. "We are also involved in medium scale LNG vessels as well as our unique DSV/ATB [detachable stern vessel/articulated tug barge] solution that is tailor made for gas-to-power projects."

Infrastructure Constraints

The maritime sector is undergoing an important transition, with shipowners switching from heavy fuel oil, which has dominated the global shipping mix for many decades, to cleaner alternatives. This has largely been a response to new International Maritime Organisation (IMO) standards for shipping pollutants which came into force at the start of 2020. The sulphur content for fuels is now capped at 0.5%, versus 3.5% previously, and this has spurred the greater adoption of LNG as a fuel. The number of dual-fuelled ships that run on LNG, such as containers, bulk carriers, tankers and cruise ships, is increasing substantially, Hagen says, and many more are on the order books. Regulation is driving this trend, and the price of LNG is competitive versus other fuels, he says. Despite these promising prospects, there is a lack of LNG bunkering ships and related infrastructure to support this growth. The industry needs to address high infrastructure costs and the absence of economies of scale, Hagen notes. “Challenges remain in building a more robust bunkering network, primary of which is the high cost of infrastructure,” he says. “Varying regulations per region and lack of bunkering facilities and standards are additional challenges.” Kanfer believes that designing and building tailor-made and cost-efficient LNG bunkering ships without compromising on quality and safety will remain crucial. The company, for its part, is seeking to address the high infrastructure cost using small-scale yet scalable, modular bunkering designs that can be developed in a manageable, demand-specific timeframe and within the budgetary parameters of customers. “Kanfer is focused on helping shipowners and port operators switch to LNG as a marine fuel. Together with its partners, Kanfer is combining scalable and flexible gas logistics solutions with smart engineering designs to build highly-cost efficient bunker vessels,” Hagen says.

Singapore Hub

Singapore, one of Asia’s largest trading spots, is the main hub for LNG bunkering in Asia, driving demand for the fuel and the industry’s growth. But other countries like Malaysia, South Korea and Japan are also expanding LNG bunkering activities significantly. China is also becoming an attractive spot for bunkering, given its expansive and robust trading network. “Kanfer is intent on taking part in this growing market by chartering our ships to first-class Chinese companies,” Hagen says. LNG bunkering can also be seen in India, but the infrastructure is not as developed as elsewhere in Asia. Despite current constraints, Hagen believes LNG bunkering holds promise in the country given its broad policy support for LNG. “With broad policy support, India is driving growth in gas demand in Asia, necessitating the development of import and distribution infrastructure including new import terminals, adequate storage and regasification facilities, and distribution networks to deliver gas to the end-customers,” he said. LNG can help expand energy access in areas of southeast Asia that lacks pipeline connections. The super-cooled gas can be transported in smaller volumes to supply power stations, energy-intensive industries, pipeline hubs, and city gas centres. “You cannot have pipelines to every corner around the world as this is environmentally unfriendly and extremely costly,” Hagen says. “Creating a virtual pipeline very much makes sense. This is what we are addressing in our DSV/ATB design/solution that takes care of both transportation and floating storage. This is our approach to such LNG segment. This could also be combined with LNG bunkering one way or the other.” Source : www.naturalgasworld.com

LNG MARKET GROWS, MORE SPOT TRADE IN 2020

The amount of LNG imported grew fractionally in 2020 from 354.7mn metric tons to 356.1mn mt, despite the shut-ins of production and the falling demand for energy, according to a new report by the France-based International Group of LNG Importers (GIIGNL) published April 27. The year was largely scarred by COVID-19. As industrial and heating demand fell worldwide, some US LNG plants closed as long-term capacity holders would have lost money on liquefaction and export. The report also found that more deliveries than ever were made within three months of the transaction date, accounting for 35% of the total, compared with 2019's 27%. This might have been the result of traders scrabbling for buyers at almost any price. Asia accounted for much of the demand, with Japan taking the most, with over a fifth of the total (74.4mn mt) despite a year on year drop in demand. China saw the greatest growth in terms of imported volumes (+7.2,mn mt), which is below its 2019 growth of 14%. The main surge of LNG imports took place during the second quarter of 2020, when LNG imports were favoured over pipeline imports, as a consequence of lower spot LNG prices. China buys pipeline gas from central Asia and Myanmar and was reportedly invoking *force majeure* to escape taking central Asian gas as well as LNG. Almost all exporting countries experienced decreases in their exports, with the greatest declines in Trinidad & Tobago and Malaysia (-2.4mn metric tons each), followed by Egypt (-2.1mn mt). The Atlantic Basin is the only region which experienced growth in 2020 (+3.2mn mt), although even there not all the facilities were running at capacity as there was no profit to be made on some sales; while the Pacific Basin and the Middle East recorded declines of 0.5mn mt and 1.3mn mt respectively. Australia and Qatar led the pack, with 77.8mn mt and 77.1mn mt respectively. This is the first time that Australia has taken over Qatar as leading exporter on an annual basis, the report said. Regional arbitrage opportunities rose year-on-year, especially from Q4 2020. Re-exports increased to 2.6mn mt, from 1.6mn mt in 2019. Singapore performed the most reloading operations with 1.1mn mt. China being the main destination for these. Europe followed with 1.1mn mt, of which France accounted for 0.5mn mt, not Zeebrugge which has built a tank separate from the national gas grid that is specifically for Russian LNG reloads. *NGW* has reported that other production decreases were not market related: Norway stopped producing LNG in late September following a fire at the Hammerfest LNG plant; it is not now due back on line for another year. And the Shell-operated Prelude floating LNG project off Australia got off to an erratic start. Source : www.naturalgasworld.com

US-BASED SEMPRA EYES TAKEOVER OF MEXICAN COUNTERPART

Sempra Energy, a US-based energy infrastructure company, announced April 26 it has launched an effort to acquire all of IEnova, its Mexican counterpart, that it doesn't already own. "Sempra Energy is offering to exchange each outstanding IEnova ordinary share that it does not directly or indirectly own for 0.0323 shares of Sempra's common stock," the company said. In a prospectus associated with the announcement, Sempra said the main purpose of the exchange offer is to take control of all of the outstanding stock in IEnova owned by public investors. If sanctioned, Sempra, which also controls a handful of utility companies in California, would request that relevant authorities delist IEnova from the Mexican Stock Exchange, ending its existence as a publicly-traded company. "As part of the Sempra Energy family of companies, IEnova has delivered critical energy infrastructure to the country of Mexico for over two decades, supporting economic growth and the health and prosperity

of millions,” Sempra Energy CEO Jeffrey Martin said. “We look forward to building on that track record of success and collaboration.” Sempra in the prospectus said that it believed the exchange offer is a fair and attractive one for IEnova shareholders. In November, the Sempra LNG announced it would work with IEnova on a proposed LNG export facility, Energia Costa Azul, in northwestern Mexico. Sempra at the time touted the facility as the first such project to have the potential for approval under the US–Mexico–Canada trade agreement, a retooled version of the North American Free Trade Agreement. If built, it would also be the first LNG export terminal that would connect to natural gas reserves in western US states such as Texas and New Mexico, which host parts of the Permian shale basin. The offer for IEnova, which is set to expire May 24, is part of an effort that began in December for Sempra to streamline its non-utility components under one self-funding platform dubbed Sempra Infrastructure Partners. That effort is meant to combine Sempra’s LNG segment with IEnova’s. Sempra in early April sold a 20% stake in Sempra Infrastructure Partners to investment firm KKR for \$3.37bn in cash as part of that effort. Sempra LNG also owns a majority stake in the Cameron LNG export facility in Louisiana. source : www.naturalgasworld.com

STRANDLINE, WOODSIDE INK LNG PACT

Australian minerals company Strandline Resources has signed a 10-year LNG supply agreement with a joint venture comprising Woodside and EDL LNG Fuel to Power (WEJV), it said on April 27. Under the WEJV contract, LNG will be supplied via road from Woodside’s Pluto LNG truck loading facility near Karratha in Western Australia to Coburn’s power generation facilities. Strandline said Coburn’s mine site power infrastructure is based on a low-cost, low-emission solution integrating LNG-fuelled generation with solar and battery storage technology. The LNG supply contract is based on a 10-year term and means the overall cost of power at Coburn will be lower than forecast in June 2020, it added. Strandline managing director Luke Graham said the signing of another long-term operation contract with two industry leaders in the energy sector, in Woodside and EDL, provides cost reductions and delivery certainty for the Coburn project. “With key development approvals in place, 95% production pre-sold to highly reputable global customers via long term offtake contracts, major contractors appointed and development funding secured, Strandline is well on track to become Australia’s next world-scale mineral sands producer,” he said. The WEJV contract is subject to conditions precedent regarding the development of the project, the company said. Source : www.naturalgasworld.com

NORWAY GETS NEW LNG BUNKERING VESSEL

Norwegian marine technology company Hoglund reported April 26 its role in converting a bunkering vessel to provide LNG. Hoglund supplied the LNG gas-handling system, including a tank that has a capacity of 850 m³ and can bunker at a rate of 500 m³/hr, for the bunkering vessel *Oslo Tank*, which was renamed *Bergen LNG* after the retrofit. The vessel is now in service for the Norwegian maritime sector after completing sea trials. While LNG helps the shipping industry meet its emission obligations under the IMO 2020 regime, the super-cooled gas is not without controversy. The World Bank has concluded that ammonia and hydrogen were the most promising zero-carbon fuels on the market, while LNG would play only a limited role in decarbonisation. The bank said the greenhouse mitigation benefits of LNG were uncertain, and that countries and businesses that invest in LNG to meet International Maritime Organisation (IMO) emissions standards were taking on considerable risk,

"including unnecessary capital expenditure, stranded assets, and technology lock-in." The report sparked a strong rebuke from bunkering association SEA-LNG, which said avoiding LNG while fuels like hydrogen and ammonia are not yet commercially available "is a mistake." Source : www.naturalgasworld.com

US LNG EXPORTS HOLD STEADY IN APRIL 14-21

Total US exports of LNG were unchanged in the week ending April 21 from the previous seven-day period, according to the US Energy Information Administration (EIA). The EIA reported on April 22 that 20 vessels laden with 73bn ft³ of LNG left US export terminals between April 15 and April 21. Eight vessels left the export terminal at Sabine Pass, operated by Cheniere Energy, and three left the Cameron facility, both in Louisiana. In Texas, five cargoes departed from Corpus Christi and three left from Freeport while one left from Elba Island off the coast of Georgia. The volume and number of vessels leaving US export terminals were unchanged from the April 8-14, although the points of origin were different. Piped exports and re-exports of natural gas last year were about twice as high as total LNG deliveries, though LNG exports are up exponentially from five years ago. While exports were steady, a cold snap across much of the northern US led to increased demand. The US economy took in 0.4% more natural gas from Canada than it did during the previous reporting period. The price for Henry Hub natural gas, the US benchmark, has been on a steady path higher for much of April. It was at \$2.65/mn Btu on April 21. Source : www.naturalgasworld.com

PETRONAS DELIVERS LNG TO CHINA IN ISO TANKS

Malaysian state-run Petronas has started the export of LNG to China in ISO tanks from its filling facility in Pengerang, Johor, it said on April 26. Petronas did not provide volume or price details. The maiden shipment of LNG ISO tanks was delivered to Shanghai from Pasir Gudang Port of Johor on April 23, following a spot contract signed between Petronas and Tiger Gas. The two companies signed a long-term sale and purchase agreement last year for the supply of LNG to Tiger Gas' LNG ISO tank filling facility in Bintulu, Sarawak. As part of this agreement, Petronas' LNG will be distributed to China using Tiger's ISO tanks, with the first shipment delivered from Bintulu Port to the Port of Long Kou on March 25. "This inaugural LNG ISO tank export from Peninsular Malaysia is an innovative solution that enables LNG to reach off-grid customers, not only domestically, but also internationally, extending the reach of our virtual pipeline system offering that we have started since late last year," said Petronas vice president of LNG marketing and trading, Shamsairi Ibrahim. Source : www.naturalgasworld.com

RUSSIA'S GRAND LNG DESIGNS

Russia's government approved a long-term roadmap in March for building up its LNG export industry, setting its sights on a 20% share of the global market for the super-cooled gas by 2035. But how many of these projects are realised will depend greatly on how much support Moscow is willing and able to afford them. The pandemic and accelerating decarbonisation efforts have led forecasters to dramatically alter their assumptions for long-term global oil demand. But the consensus is that the outlook for gas consumption remains robust, with growth driven by soaring use in Asia and in other areas. In its latest Stated Policies Scenario, the International Energy Agency (IEA) projects that global gas demand will rise from just over 4 trillion m³ in

2019 to 4.6 trillion m³ in 2030 and 5.2 trillion m³ in 2040, primarily thanks to soaring usage in Asia, but also gains in the Middle East and Africa. Meanwhile Shell sees LNG demand almost doubling to 700mn mt by 2040, as Asian economies swap coal and other fuels for gas in the power sector. Russia is anxious to develop export projects in time to meet this growth, wary of competition and a post-2040 slowdown in gas demand due to the rise of renewables. In its roadmap, the government points to the country's low costs and abundant gas reserves, estimated by BP at 38 trillion m³ proven, viewing Qatar, Australia and the US as its main competitors. It estimates it can supply LNG to the global market at a cost of \$3.7-7.0/mn Btu. "This is higher than Qatar's costs but looks attractive against most other players," Richard Gorry, managing director of JBC Energy Asia in Singapore, tells *NGW*. "For example, US LNG's general pricing basis is Henry Hub plus a 15% tolling fee. Henry Hub of around \$2.6/mn Btu, already very low, would imply a breakeven price around the \$6 mark and that would be before shipping."

Project pipeline

Russia currently has 27mn metric tons/year of liquefaction capacity in operation, comprising primarily the Gazprom-led 9.6mn mt/yr Sakhalin LNG plant in the Far East and Novatek's 16.5mn mt/yr Yamal LNG terminal in the Arctic. Novatek also runs the 0.66mn mt/yr Kryogas-Vysotsk plant in northwest Russia. There are over a dozen more mid- and large-sized projects at various stages of planning and development. But the Russian government acknowledges that there is a lot of uncertainty about if and when some of these projects might reach first gas. In its high-end scenario, the government projects that production could rise to 65mn mt by 2024, 102.5mn mt by 2030 and 140mn mt by 2035. But in its low-end scenario, it sees supply only reaching 46mn mt by 2024, 63mn mt in 2030 and 80mn mt in 2035. Novatek is due to launch a 0.9mn mt/yr fourth train at its Yamal LNG later this year – considered a key project as it will showcase the company's proprietary Arctic Cascade liquefaction technology. So far, Russia has had to rely on foreign partners to provide such technology. The train was originally scheduled for commissioning before the end of 2019, but its launch has been postponed as a result of the pandemic, and, according to Russian press reports, operational complications. Another small-scale project on the way is Gazprom's 1.5mn mt/yr Portovaya LNG plant in northwest Russia, slated to come on stream later this year. Next up will be Novatek's 19.8mn mt/yr Arctic LNG-2 facility, located on the Gydan peninsula, whose three trains are due to launch production in 2023, 2024 and 2026. The company's 5-6mn mt/yr Obsk LNG project should start up in 2024, but unlike Arctic LNG-2, it has not reached a final investment decision (FID) yet. Novatek hopes to take this step in 2021, a year later than originally planned. The Moscow-based *Kommersant* newspaper reported in March, citing sources, that Novatek was considering dropping plans to use Arctic Cascade at Obsk LNG, because of the aforementioned difficulties at the fourth Yamal LNG train. It may opt for technology provided by Germany's Linde instead, according to the newspaper. There are several other projects that the government views as "likely" to start operations before 2030, including Gazprom's 13.3mn mt/yr Ust-Luga plant in northwest Russia, slated for launch in 2024-2025. That project too has encountered difficulties, with Gazprom and its development partner Ruzgazdobycha recently cancelling an engineering, procurement and construction (EPC) contract for its processing

facilities that had been awarded to Russia's Nipigaz. Gazprom explained it was seeking to "optimise" project costs, although the contractor claimed the developers had not arranged financing for the scheme, nor decided how much of its equipment and technology should be localised. Nipigaz added that there were "discrepancies" in the risk assessment and in how risks should be shared between contractor and client. Nevertheless, Gazprom insists that project work is on schedule. There is also Novatek's 19.8mn mt/yr Arctic LNG-1 project, expected to arrive in 2027, and the 17.7mn mt/yr Yakutsk LNG project in the Russian Far East, led by the privately-owned Yakutsk Fuel and Energy Co. (Yatek). Rosneft and ExxonMobil's 6.2mn mt/yr Far East LNG plant has a predicted launch of 2027-2028. The government considers Novatek's 19.8mn mt/yr Arctic LNG-3 and a 5.4mn mt/yr expansion at Sakhalin-2 as "possible" projects to be completed within the next decade. Gazprom also has early-stage plans for 0.5-1.5mn mt/yr and 1.5mn mt/yr projects on the Black Sea and Far Eastern shores, considered possible before 2025. Post-2030, there are potentially Gazprom's 20mn mt/yr Tambey LNG and 30mn mt/yr Shtokman LNG projects and Rosneft's 30mn mt/yr Kara LNG and 30-50mn mt/yr Taymyr LNG projects, all located in the Arctic. A 10mn mt/yr expansion at Far East LNG might also be possible after 2035.

Support from on high

The success of Russia's LNG export drive will depend greatly on how much fiscal and regulatory support the government is prepared to give to projects. Novatek's flagship Yamal LNG was completed in December 2017 on time and within its \$28bn budget. The project was founded on strong economics, but would not have been realised without the backing of the state. While most of Yamal LNG's cost was covered by its shareholders and Chinese lenders, Russia's sovereign wealth fund and state banks also contributed over \$7bn. Furthermore, the government assisted in developing necessary project infrastructure. During its 12 years of operation or until it has produced 250bn m³ of gas, Yamal LNG will be exempt from mineral extraction tax (MET) and property tax and will enjoy a reduced rate of 13.5% profit tax. It will also pay no export duties on its LNG, and receive additional regional tax breaks. "This level of support is absolutely going to be required for future projects," Ronald Smith, analyst at BCS Global Markets, tells *NGW*. "Russian producers are extremely heavily taxed. The tax code takes so much rent out of the average barrel, that to get a new field up and running the government has to extend some breaks at the front end of it." Ekaterina Rodina, an analyst at VTB Capital, notes that not all LNG projects will receive the same level of support as Yamal LNG and Arctic LNG-2. "Baltic LNG in Ust-Luga is one such example, which doesn't have such a reserve base and buys dry gas from Gazprom at a certain price, which also includes the MET paid by the gas producer," she tells *NGW*, although noting that the LNG itself enjoys zero export duties. As these tax breaks are typically won through political lobbying, helping to explain why only Russia's biggest and most influential oil and gas companies have proposed projects, with Yatek in the Far East as the exception. This is likely to remain the case. According to Smith, other companies face a "political barrier" and must also have a sufficient balance sheet to get financing moving. Novatek has made considerably greater progress in LNG than Gazprom and Rosneft for several reasons. As *NGW* has noted in the past, the company's relatively small size, strong management and laser-sharp focus on LNG work in its favour. Gazprom, in contrast, has "conservative corporate culture"

and has placed most of its attention on export pipeline development, Smith notes. While advancing its LNG plans in Ust-Luga, Gazprom is also working on the construction of a second pipeline to China via Mongolia that will carry much greater volumes of gas. Meanwhile Rosneft is looking to expand in multiple areas besides LNG, from refining and petrochemicals to upstream operations overseas. Russia has made some progress in localising more of the equipment and technology it uses in LNG development over the years, although it still has some way to go. "In large-capacity LNG projects, we believe Russia still significantly relies upon international technologies," Rodina notes. But at small and medium-scale LNG projects, Russia has developed expertise from the work at Vysotsk LNG and the fourth Yamal LNG plant, she says. Source : www.naturalgasworld.com

TOTAL DECLARES FORCE MAJEURE AT MOZAMBIQUE LNG

France's Total has declared *force majeure* on its Mozambique LNG project following further attacks in gas-rich north Mozambique by Islamist insurgents. "Considering the evolution of the security situation in the north of the Cabo Delgado province in Mozambique, Total confirms the withdrawal of all Mozambique LNG project personnel from the Afungi site," the company said on April 26. "This situation leads Total, as operator of Mozambique LNG project, to declare *force majeure*." Total expressed hope that government forces would be able to restore security and stability in the region. An armed Islamist group known as Al-Shabab launched a major attack on the town of Palma in the Cabo Delgado region on March 24, just hours after Total announced that it was resuming construction on the \$20bn Mozambique LNG project after the government beefed up security at the site. Palma was finally retaken on April 5, but the fighting left dozens of civilians dead and thousands more displaced. The Afungi site is only 12 km from the besieged town. Mozambique LNG aims to produce up to 13.1mn metric tons/yr of LNG from the Golfinho and Atum gas fields in Mozambique's Offshore Area 1 concession. It is scheduled to produce its first gas in 2024. Source : www.naturalgasworld.com

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