

LNG Shipping News

AN LNG JOURNAL TITLE ON LNG CARRIERS

13 April 2017

Global LNG trade at record level - IGU

Last year, global LNG trade reached a record 258 mill tonnes – an increase of 5% from 2015 - according to the International Gas Union's (IGU) 2017 World LNG report.

The dramatic increase is particularly noticeable when compared with the average 0.5% growth rate of the previous four years, the report said. It was primarily attributed to a significant increase in new supply, due largely to the start of exports from the US Gulf of Mexico, as well as the start of commercial operations in Australia Pacific LNG, among others.

There was also significant increases in demand as LNG increases its role as a fuel in new markets. Much of the demand increase came from Asian markets, with China's LNG consumption increasing dramatically by roughly 35% to 27 mill tonnes per annum. However, some markets - including the two largest Japan and South Korea - showed signs of slowing down, as other forms of energy came to the fore, in part showing the flexible value of LNG as a fuel source. This was particularly prevalent in Brazil, where a resurgence in hydro power reduced LNG demand by 80%.

The latter half of last year saw Asian and spot LNG prices reach \$9.95 per MMBtu by February, 2017, due to disruptions to supply and cold winter temperatures. This followed a dip in price in the first half of the year to \$4.05 MMBtu, primarily due to supply outstripping demand, generating an average 2016 Northeast Asian



LNG trade boomed in 2016 and is expected to grow further
Photo credit: Höegh LNG

spot price of \$5.52 MMBtu. The UK National Balancing Point (NBP) finished 2016 at \$5.44 MMBtu.

In 2016 global liquefaction capacity reached 339.7 mill tonnes per annum - building on the 2015 measurement of 301.5 tonnes per annum and growing at a consistent rate. This growth includes new projects such as Sabine Pass LNG, as well as Gorgon LNG and Australia Pacific LNG. Global liquefaction capacity is expected to grow significantly over the next few years, with 114.6 tonnes per annum of capacity under construction as of January, 2017.

LNG continued to play an es-

sential role in the shipping sector, the report said with 31 newbuildings delivered from shipyards last year. This constituted an increase of 7%, compared to 2015. The IGU's most recent report - 'Enabling Clean Marine Transport' - emphasised the huge impact switching to LNG fuel can have on emissions generated by shipping, with one tanker on 3% bunker fuel producing as much in emissions as 50 mill diesel-fuelled cars.

"The increased use of natural gas is hugely beneficial to the environment, and subsequently human health, across the globe. Our recent reports on urban air quality, as well as the use of LNG in marine shipping, are testament to this. This year's World LNG report is extremely promising, and LNG maintains an essential role in expanding access to gas across the globe, acting as a key pillar in the future energy mix," said David Carroll, IGU president.

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”

- David Carroll, IGU president

Frank sings Arc7 LNGC praises

At the recent Gastech 2017 expo, Sovcomflot President and CEO Sergey Frank highlighted the delivery of the world's first icebreaking LNGC 'Christophe de Margerie' on 26th March.

Three days later, she became the first vessel to berth at the gas terminal at Sabetta (YNAD). The LNGC was built to serve the Yamal LNG project, transporting natural gas year round in ice conditions encountered in the Kara Sea and Gulf of Ob.

Frank emphasised that the creation of this unique LNGC had been the result of years of work by a large team of specialists from Sovcomflot, Daewoo Shipbuilding & Marine Engineering, ABB, Wärtsilä, Aker Arctic, Yamal LNG, the Central Research Institute of Marine Fleet (CRIMF) and the Russian Registry of Shipping (RS).

The LNGCs propulsion system consists of three Azipod units, providing 45 MW total power. They provide a high icebreaking capability and manoeuvrability, as well as the ability to move stern-first (double acting tanker - DAT concept), which is needed to overcome hummocks and heavy ice fields. As well as being powered by traditional fuels, her propulsion system can also run on boil-off-gas (BOG).

In his presentation, Frank said that during ice trials, which had taken place from 19th February to 8th March in the Kara and Laptev Seas, 'Christophe de Margerie' had surpassed many design targets. She proved her capability to move stern-first in 1.5 m thick ice at a speed of 7.2 knots (the target figure was 5 knots) and ahead at a speed of 2.5 knots (the target figure was 2 knots), he claimed.

In the coastal area to the west of the Nordenskiöld Archipelago, she successfully broke through an ice ridge with a height of 2 m - 4.5 m above the ice, a keel depth of 12 m - 15 m and a cross-sectional area of 650 sq m, moving stern first.

When the LNGC arrived at Murmansk for its ice trials in the Kara Sea, GAC Russia provided the vessel with a range of services, including - obtaining her permit to operate in Russian territorial waters; boarding engineers and scientists for the trials; delivering equipment and supplies on board; co-ordinating her route with the Russian Coast Guard Service; and



Sergey Frank has sung the praises of the first Yamal LNG Arc7

providing advice on navigation in the Arctic.

Once the trials were completed, customs and border formalities were completed and the ice crew disembarked. GAC Russia also handled safe passenger operations in Murmansk, arranged bunker supplies and delivered machine parts and ship supplies.

Tatyana Shorokhova, GAC Russia's General Manager, said the expertise of GAC's team at the port was an integral part of the successful preparation and implementation of the high profile maiden call at Sabetta of the first Ice

Class LNGC.

"This was an important milestone, both for us and for the country, and one which attracted considerable media attention," she added. "We believe that this is the start of a new era for Sabetta, and we look forward with confidence to the part that we will play in that future."

"GAC Russia will be at hand when commercial shipments start to provide the world-class professional agency services and other support, thus further strengthening our position in the Arctic," she said. ■

GAIL to short term charter LNGCs

Indian state gas utility GAIL India is to short term charter LNGCs to ship gas from the US.

According to Indian news agency PTI, this move comes after GAIL was forced to scrap a \$7 billion tender to build gas tankers in India, Oil Minister Dharmendra Pradhan reportedly said.

After more than two years, last October GAIL dropped a tender for chartering newly built LNGCs to transport LNG from the US after bidders did not agree to the 'Make-in-India' terms. GAIL wanted local shipbuilders to build one out of three ships in India.

"The tender was cancelled by GAIL as the bids received contained multiple deviations and were not in line with the tender condition," he said in a written reply to a question in Lok Sabha, reported PTI.

Two Japanese bidders - a consortium of Mitsui OSK Lines (MOL)/Nippon Yusen Kabushiki Kaisha (NYK Line) and Mitsui and Co and a consortium comprising Mitsubishi Corp/Kawasaki Kisen Kaisha Ltd (K Line) and GasLog,

had sought several amendments to the tender conditions, which were not agreeable to GAIL.

In the tender, GAIL sought to timecharter nine newly built LNGCs of between 150,000-180,000 cu m to ship gas from Sabine Pass and Cove Point LNG projects in the US, with shipments due to start from January, 2018.

Bids were sought in lots of three, with the condition that one of the three ship will be built at an Indian shipyard.

Pradhan said GAIL has initiated the charter of LNGCs on short term basis for a period of three to four years to lift the LNG from the US.

"GAIL has informed that supply of US LNG is expected to commence from January, 2018," he said, adding a committee headed by NITI Aayog vice chairman has been asked to look into the issues of desirability of acquiring shipbuilding technology/capacity for LNGCs, PTI said. ■

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GLS floating platform comes closer

Global LNG Services (GLS) has reached a cost breakthrough for its floating liquefaction platform, the patented LIQUI-MAX vessel for the Main Pass Energy Hub project, also patented.

The Norwegian company claimed that it will be able to offer floating tolling fees at a level as low as \$1.75 per MMBtu.

Established in 2013, GLS operation is centred around the development and operation of a safe, cost effective, floating liquefaction solutions for the global 'plug and play' market.

The standardised LIQUI-MAX vessels require minimum customisation and enable developers of LNG export projects in remote locations without infrastructure to achieve low costs and high cost control, GLS claimed.

GLS patented technology enables large-scale, commercially attractive production of LNG worldwide. LIQUI-MAX is 380 m in length and will produce 12 mill tonnes per annum. The budgetary quotes for this type of vessel are

less than \$3.5 bill, or less than \$300 per tonne of LNG per annum.

It uses air cooling and nitrogen coolant to ensure full compliance with the strictest environmental and safety standards. Pre-cooling enables efficiency at the same level as any mixed-refrigerant liquefaction process, GLS said.

It is a fully standardised vessel using only field-proven components, with pre-processing of the gas being done off the vessel. Construction costs for LIQUI-MAX will benefit from series production, enabling further cost reduction. The global market for the vessels is estimated at 20-40 vessels producing 6-12 mill tonnes per annum, based on projects currently considered for development.

The GLS technology and cost

advantage is protected through a carefully designed patenting programme. The contracting and project execution strategy includes long-term frame agreements with key partners.

For example, Siemens and GLS are in discussions to agree a Memorandum of Understanding, which is expected to be signed in the next few weeks. GLS is also in discussions with Sembcorp Marine regarding another MOU, also expected to be signed soon.

"Sembcorp Marine is very pleased to collaborate with GLS on the development of the LIQUI-MAX vessel," said Sembcorp Marine Head of Rigs & Floaters, William Gu. "We believe this floating liquefaction solution can contribute to making LNG more globally accessible as a greener fuel alternative. With our engineering

expertise and integrated production capabilities at the Sembcorp Marine Tuas Boulevard Yard, we look forward to supporting the construction of the LIQUI-MAX vessels."

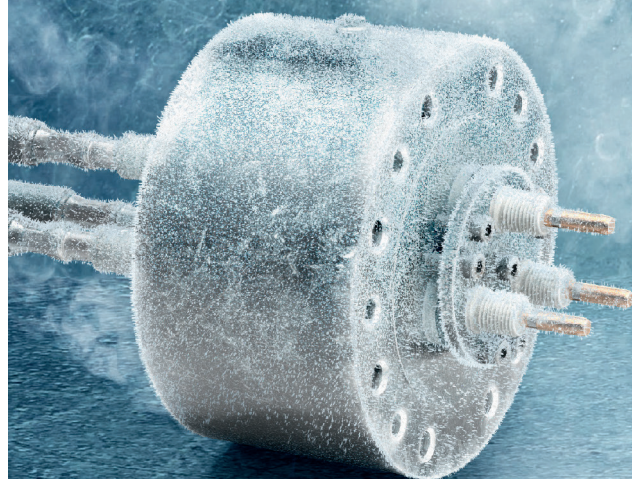
"I am very pleased to share the progress we are making with the (patented) Main Pass Energy Hub project and our Global LIQUI-MAX programme," said Dr Paul Eckbo, CEO and founder of GLS. "Teaming up with Siemens and SembCorp Marine provides the experience, competence and capacity we need to ensure efficient, low risk project execution. The global GLS approach will contribute to LNG becoming the stable, low cost energy source to replace coal and provide back-up for renewables. The GLS innovations will enable the 'global virtual LNG pipeline' to expand faster."

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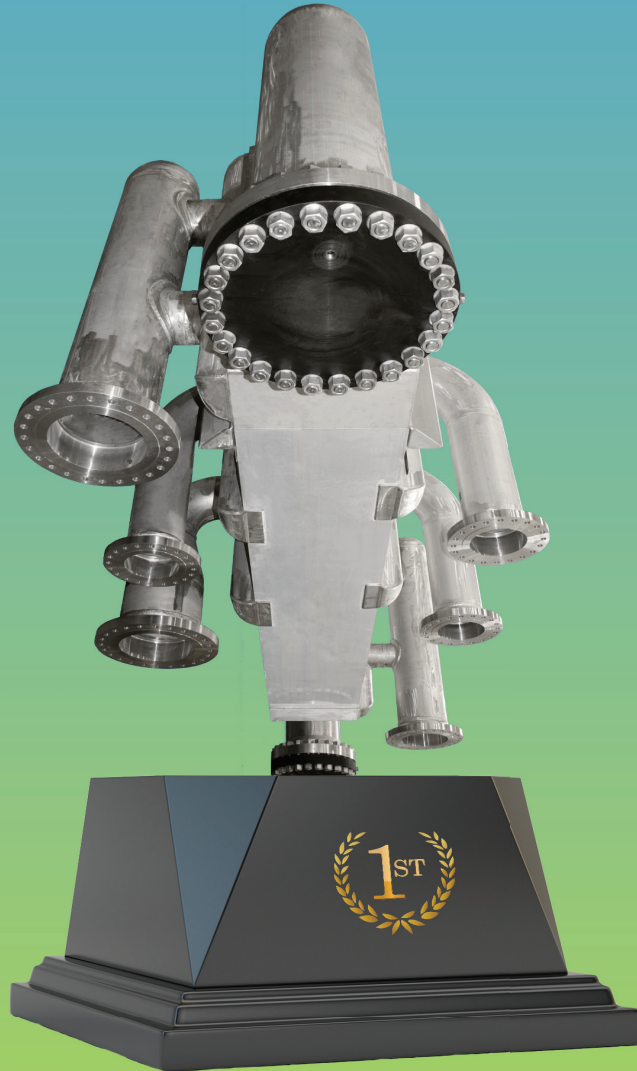
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Cheniere hits milestone

Cheniere Energy Partners, a subsidiary of Cheniere Energy, has shipped its 100th LNG cargo from its Sabine Pass liquefaction facility.

Including the 100th cargo, which departed earlier this month, since the first shipment on 24th February, 2016, Cheniere has delivered cargoes to 18 countries on five continents.

"This milestone for Cheniere is a testament to the global demand for American LNG, the hard work and dedication of Cheniere's workforce, and our unique business model that enables customers large and small to access this fuel," said Jack Fusco, Cheniere's President and CEO. "Our entire workforce shares in this milestone and in Cheniere's future success."

In February, 2016, Cheniere became the first company to ship LNG from the contiguous US in over 50 years, and is currently the only exporter of US LNG.

In addition to three fully-operational LNG trains at Sabine Pass, train four has entered the com-



Cheniere has reached a milestone in shipping the 100th cargo

missioning process and is expected to reach substantial completion in the second half of 2017, while train five is currently under construction, and is expected to become operational in 2019, and train six is fully permitted and being commercialised. Cheniere Energy also has two trains under construction at its liquefaction project near Corpus Christi, Texas

with operations at both trains expected to begin in 2019.

Including the liquefaction projects at Sabine Pass and Corpus Christi, Cheniere and its subsidiaries are expected to invest around \$30 bill in US energy infrastructure, create tens of thousands of jobs, promote domestic energy production, and reduce US trade deficit, the company claimed. ■

Höegh LNG contracts Wärtsilä

Wärtsilä has been contracted to provide both equipment and maintenance for Höegh LNG's FSRUs and LNGCs.

Two new 170,000 cu m FSRUs being built for Höegh LNG at Samsung Heavy Industries (SHI) and Hyundai Heavy Industries (HHI) will each be powered by four Wärtsilä 50DF dual-fuel engines. There is an option for a further three vessels in the SHI series.

The two vessels will also feature the latest Wärtsilä regasification technology thus enabling them to operate as FSRUs. The regasification solution is based upon the use of seawater and glycol as the intermediate heating medium, a lighter and less space demanding alternative than earlier systems with a propane based heating system.

By using seawater as opposed to steam heated solutions, the CO2 emissions are notably reduced, Wärtsilä claimed. Furthermore, they will be delivered as a complete module, thereby making

installation easy. Typically the value of regasification projects is between €20 to 40 mill, based on the equipment's size, scope, capacity and operational profile.

Under a new five-year technical management agreement, Wärtsilä will provide support for eight ships out of the company's existing fleet, as well as for its two new vessels currently under construction. Services include condition based maintenance (CBM) to optimise the availability, reliability, and performance of the Wärtsilä engines.

Also included are the maintenance planning and advisory services involving the combined technical expertise of both Wärtsilä and Höegh LNG specialists. The customer will also have access to Wärtsilä's global service network.

"Our long-standing relationship with Höegh LNG is again strength-

ened through this supply of our state-of-the-art engines and regasification systems, as well as the technical management agreement that will ensure optimal performance of the company's entire fleet," said Cato Esperø, Sales Director, Wärtsilä Norway.

"We have confidence in Wärtsilä as a provider of well designed and engineered solutions, and are pleased with the choice of a strong provider as regards to the engines and regasification systems," said Øivin Iversen Höegh LNG CTO.

"The technical management agreement is also very important. Wärtsilä's CBM service enables excellent predictability of the engines' condition and maintenance requirements, which is of great value to our operations," said Gorm Hillgaard, Höegh LNG's Senior Vice President Fleet Management. ■

NEWS NUDGE

HHI uses glycol for FSRUs

Hyundai Heavy Industries (HHI) has demonstrated the installation of LNG regasification system using glycol on a 170,000 cu m FSRU.

The demonstration, attended by shipowners and major class societies, was held at HHI's Ulsan shipyard.

As the glycol regasification process is salt free, unlike systems that use seawater, it can minimise equipment corrosion, including heat exchangers and it can also lower the risk of explosion that a propane system may be exposed to, the company claimed.

Following the granting of an AiP from Lloyd's Register last month and both internationally and domestically patented recently, HHI is also in the process of receiving recognition from other major class societies.

Daewoo to deliver two Yamal LNGCs this year

Daewoo expects to deliver two more ice class LNGCs for Russia's Yamal LNG project this year, a company spokesman told Reuters.

The first 'Christophe de Margerie' was recently delivered to Sovcomflot (see page 2).

The remaining 14 LNGCs for Yamal are all due to be delivered by 2020, including two this year, the spokesman reportedly said.

The Yamal LNG project, which is scheduled to start production in October this year, is jointly owned by Russian gas producer Novatek, Total, China's CNPC and the Silk Road Fund.

It is expected to produce 16.5 mill tonnes of LNG per year at three production trains of 5.5 mill tonnes capacity each. LNG will be shipped to Asia from July to December via the Northern Sea Route, but can be delivered to Europe year-round.

Exmar's profit triples - revenue drops

LNG and LPG carrier owner and operator, Exmar reported an overall consolidated result after tax of \$35.8 mill for 2016, compared to \$11.2 mill recorded the year before.

Exmar said that this result was positively influenced by \$14.3 mill in 'badwill' (non-cash) recognised on the acquisition of 50% of the pressurised fleet held by Wah Kwong and a \$9 mill termination fee paid by Pacific Exploration and Production (PEP) on the Caribbean FLNG (CFLNG) project.

Cash flow from operations (EBITDA as per proportionate consolidation method) for 2016 was \$116.5 mill, compared with \$99.5 mill in 2015, while EBIT was \$70.4 mill, compared with \$40.2 mill for the previous year.

The LNG division's EBIT in 2016 was \$41 mill, compared to \$20.9 mill in 2015. EBIT for 4Q16 was \$9.7 mill.

The existing LNGC and LNG regasification fleet performed in accordance with the timecharter contracts and the same is expected for 2017, with the exception of 'Excel', which is operating under a short-term contract for up to one year at today's low market rates for steam-turbine vessels, the company said.

With the financial restructuring of PEP, Exmar said that no other option was available in early 2016 than to cancel the employment contract under the best possible terms. PEP's cancellation of the project caused a revisiting of the

arrangements with the shipyard and of the finance to be made available at delivery.

With commissioning successfully accomplished, final acceptance was reached on 31st January, 2017 and complementary support from Wison Shipyard has now been agreed during the lay-up period at the yard until the unit will be towed to its place of employment.

The delivery will take place before the end of this month, at which time the last instalment (\$200.5 mill) is due to the yard. In the meantime the documentation for the \$200 mill financing of the CFLNG from Bank of China and a leading European financial institution with a term of 12 years has been finalised and signing, subject prior Sinosure approval, is foreseen for mid-April. Discussions on future employment with different parties are progressing; however, no revenues are expected before early 2018. The order for a second FLNG at Wison shipyard was cancelled.

The construction of the barge-based FSRU at Wison shipyard has resumed after a backlog was suffered in 2015. The unit was launched in January, 2017 and delivery is planned by mid-2017 at which time the final instalment (\$83.6 mill) will be due.

Three commercial leads are



The Caribbean FLNG is currently laid up at the Wison shipyard awaiting employment

being actively developed, which foresee mobilisation and commissioning on site after delivery from the yard. Financing will be developed in parallel with employment negotiations. Interest from several financiers has been received.

In addition to the FSRU, Exmar has two newbuild LNG import infrastructure projects under development with technical and permitting field work being performed and with a target for investment decision in 2017. For the Swan Energy import terminal, parties have reduced the co-operation to development of floating regasification services only.

On 21st December, 2016 an

agreement was signed with VOPAK to buy Exmar's FSRU business, as well as for co-operation between the two companies in future projects. Exmar and VOPAK are still working on closing this transaction, the company explained.

In July, 2014, a NOK700 mill senior unsecured bond was issued (swapped to \$114 mill). During 2015, an additional amount of NOK300 mill was issued and added to the original bond (swapped to \$38 mill). The total nominal amount of NOK1 bill (\$152 mill) matures in July, 2017.

Exmar said it was pursuing several alternatives for the bond's refinancing. ■

Fluor and HiLoad LNG to co-operate

Fluor has entered into a co-operation agreement with HiLoad LNG, a subsidiary of Sevan Marine, aimed at global projects that could use HiLoad's floating regasification dock (FRD) LNG technology.

"This agreement gives us the capability to evaluate and deliver both marine- and land-based LNG storage and regasification solutions," said Pierre Bechelany, Fluor's senior vice president of pipelines and LNG. "Our industry-leading global sourcing and fabrication yard capabilities, including our COOEC-Fluor Heavy Industries joint venture fabrication yard in China, allow us to uniquely deliver capital efficiency and schedule certainty to the LNG marketplace.

With this agreement, we can better deliver those results to the floating LNG storage and regasification market."

"We are proud to announce the co-operation with Fluor," said Reese McNeel, Sevan Marine CEO. "This is a strong acknowledgment of the development work done by HiLoad LNG to introduce a cost-efficient technology for LNG regasification and LNG transfer applications. The agreement will grow our businesses by com-

plementing each company's strengths for unique customer solutions for floating LNG storage and regasification units. We are excited to start working with Fluor and look forward to exploring the opportunities in the regasification market that this agreement creates."

The FRD technology provides a competitive alternative to conventional units and is applicable to floating LNG receiving, storage, transshipment and regasification

terminals. The solution is applicable for facilities that deliver 50 to more than 400 mill standard cu ft per day of gas and allows for use of a conventional LNGC, as the floating storage unit with a minimum of modifications and installation costs, Fluor claimed.

LNG regasification systems may be kept offshore, without the requirement for port facilities, while also maintaining operation during challenging weather and ocean conditions. ■

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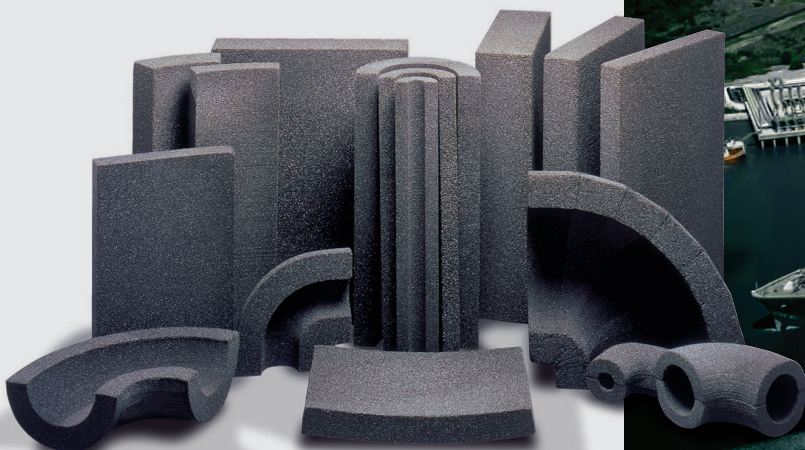
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MR reliquefaction system wins LR AiP

Babcock's LGE Process received an 'Approval in Principle' (AiP) from Lloyd's Register at this year's Gastech 2017.

This AiP was awarded for its LNG MR reliquefaction system, the patented ecoSMRT.

Designed in response to the increasing issue of excess boil-off gas (BOG) resulting from the introduction of dual-fuel propulsion engines (ME-GI/X-DF) with high efficiency, the ecoSMRT LNG reliquefaction plant is designed for application on LNGCs to save excess BOG by reliquefaction.

"We are pleased to present the Approval in Principle certificate to representatives of Babcock here today at Gastech," said Jose Navarro, LR's Principal Gas Tech-

nology Specialist at the signing ceremony. "There is lots of discussion at the show around efficiency, so it is very fitting to be able to recognise Babcock's LNG reliquefaction system, ecoSMRT."

The LNGC optimised scalable system uses mixed refrigerant (MR) refrigeration technology and is based on a new arrangement of the components. The improved single mixed refrigerant LNG reliquefaction system reduces complexity, minimises overall footprint and reduces cost at initial investment, as well as during operation, Babcock claimed.

Alan Duckett, Babcock LGE Process Technical & Sales Director, said: "As innovators in the field of LNG technologies it is a real privilege for Babcock to be recognised this way and to be presented with an 'Approval in Principle' from Lloyd's Register.

"Our ecoSMRT technology can provide significant operational benefits to LNG carriers and is a testament to our ground-breaking design capabilities, developed along with long standing partner, HHI (Hyundai Heavy Industries), and with valuable input from LR.

"It is an exciting time for Babcock, as we introduce new technological solutions for LNG carriers as well as shuttle tankers (ecoVOCC) and LNG GSV (FGSV0)," he said.

The presentation by LR closely follows the announcement that Babcock's LGE Process could be used, in a collaboration with

ExxonMobil, Bernhard Schulte Shipmanagement (BSM), Calor and Orkney Islands Council, in the Caledonia LNG project, that will explore provision of LNG for Northern UK and North Sea customers.

“Our ecoSMRT technology can provide significant operational benefits to LNG carriers and is a testament to our ground-breaking design capabilities”

- Alan Duckett, Babcock LGE Process Technical & Sales Director

Approval in principal (AiP) for barge power plant started

Lloyd's Register and Hyundai Heavy Industries (HHI) signed a joint development project (JDP) at Gastech to commence an approval in principal (AiP) for a barge mounted power plant, the patented Hi-Floating Power.

HHI's Hi-Floating Power is capable of generating maximum power of 221 MW by running 13 units of HiMSEN dual fuel engines, upgradeable up to 400 MW through the addition of extra engines.

By separating dual fuel engines into two independent compartments, it provides more reliable operation, even in the case of emergencies, such as fire and/or shut-down of either compartment, LR claimed.

It can produce power with barge-mounted generators using natural gas received from an adjacent LNG FSRUs via a jetty or marine gas oil stowed on board as a back-up fuel. By removing the need for LNG storage and regasification facilities on board, design

and build time is shortened with simpler configuration and improved safety features.

The mobility feature allowing the generation of electricity in collaboration with LNG FSRU only when needed and being independently stationed when not in operation, brings increased economic solutions to operators. The three different types of 4-stroke dual fuel engines model of Hi-Floating Power, which can be selected as per the client's preference, will allow operators to enjoy operational flexibility as well, the companies said.

Mr Chang, HHI Executive Vice President, said, "Since we have been given a list of inquiries of much more economical and flexible floating power generating

plants from the market, we come to conclusion that there will surely be demand for the new concept of floating power plant. And that's the rationale behind the JDP signed by HHI and Lloyd's Register today. We do believe the JDP will bring a win-win solution for both companies and will surely lay a solid foundation for the era of new floating power generating plants."

In response, Jin-Tae Lee, LR's South Korea Chief Representative & Marine Manager, said "We are very pleased to be able to work with HHI on Hi-Floating Power. Gastech is the perfect platform to be able to announce the commencement of the approval in principle and we look forward to supporting HHI in this process". ■

NEWS NUDGE

Petronas FLNG loads first cargo

Petronas 'PFLNG Satu' loaded its first cargo at the Kanowit gas field, offshore Miri, Sarawak on 1st April.

The first cargo was shipped on board the LNGC 'Seri Camellia', which was due to deliver the cargo to a South Asian terminal.

"This accomplishment effectively demonstrates Petronas' proven technology and capability of adapting a conventionally land-based installation to a floating LNG facility, a game-changer in today's LNG business landscape," said Petronas President and Group CEO, Datuk Wan Zulkiflee Wan Ariffin.

'PFLNG Satu' was designed to operate in water-depths of between 70 and 200 m. She has a processing capacity of 1.2 mill tonnes per annum.

Petronas has another FLNG under construction in South Korea, which was initially scheduled for delivery in 2018 but was subsequently postponed to an undisclosed date.

Teekay LNG in cash distribution

Teekay GP, the general partner of Teekay LNG Partners, has declared a cash distribution of \$0.14 per unit for the quarter ended 31st March, 2017.

The cash distribution is payable on 12th May, 2017 to all unit holders of record on 5th May, 2017.

DSME joins DNV GL in LNGC design concept

Also at Gastech 2017, DSME and class society DNV GL presented the results of a joint development project (JDP) for a new LNGC design.

The project focused on delivering a design, which an owner can take directly to the yard and is ready for upcoming market trends and incoming regulations, with an optimal size, hull form, and machinery and electrical systems.

"When we look at today's LNG market we predict that in the years to come we will see the rise of post-Panamax LNGC designs, which are dimensioned to fit of the new Panama Canal. Capacities of over 175,000 cu m are feasible given the new restrictions," said Johan Petter Tuttoren, DNV GL - Maritime Business Director Gas Carriers.

An important design consideration was the shift towards lower, more energy-efficient transit speeds. The hull and propulsion

system were optimised for three different operating profiles on a standard transpacific route (19.5, 16 and 12 knots). Calm water optimisation resulted in gains of 6%, 2% and 5% over the reference design at each of the three operating profiles.

These calculations were performed using the DNV GL hydrodynamic analysis software Wasim as well as statistics and Reynolds-averaged Navier-Stokes (RANS) simulations for determining wave resistance.

The design uses direct-coupled, 2-stroke dual-fuel (DF) main engines and DF auxiliary engines, with LNG as the primary fuel. A combined gas turbine, electric and steam (COGES) propulsion system was chosen for the machinery.

For the portion of the boil-off gas (BOG) used as LNG fuel a high manganese steel cargo tank Independent Type B was chosen and underwent closed mock-up testing using liquid nitrogen (LN2). This was selected for its tensile properties, high performance and product capacity at low cost, and allows flexible tank shapes while being slosh-free without imposing any filling limitations, DNV GL said.

The design also incorporates DSME's patented SloT (Ship Internet of Things) technology and its wireless computer network and integration system Smartship 4.0. In addition, the entire on board computer environment underwent thorough testing to improve its cybersecurity.



DNV GL's Johan Petter Tuttoren, Maritime Business Director Gas Carriers

A large blue and white LNG carrier ship is docked at a port. The ship is surrounded by industrial infrastructure, including cranes and storage tanks. The background shows a hilly coastline under a clear sky.

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Damen completes 'Gaselys' maintenance

Damen Shiprepair Brest (DSBr) has completed a renewal survey maintenance programme on the LNGC 'Gaselys'.

Co-owned by NYK Line and ENGIE, operated by Gazocéan and chartered by ENGIE, the 10-year old vessel arrived at Brest for her period docking.

DSBr is claimed to be one of the most experienced European yards in LNGC repair and maintenance. It has some of the largest drydocks in the region, measuring

up to 420 x 80 m. The 'Gaselys' arrived in February and was placed in dry dock No 2.

The maintenance programme included servicing the cargo pumps, overboard valves, thrusters, mooring winches and the cargo cranes. Two of the main compensators were also replaced, the fans overhauled, and assis-

tance given to the specialist sub-contractors responsible for maintaining the LD HD compressors, while new insulation was fitted to the piping areas. Additional works included removing mud from the ballast tanks and blasting and re-coating the hull and superstructure.

Diego Groenendijk, DSBr's

commercial manager, commented, "The docking was completed on time and on budget thanks to excellent co-operation between all the parties involved. Extensive preparations at the yard before the 'Gaselys' arrived also ensured that work got underway immediately and continued without interruption."

DSBr has worked on other ENGIE LNGCs in recent years, including the 'Provalys', 'GDF SUEZ Global Energy' and 'Tellier'.

Nicolas Barnaud, president of NYK Armateur, said: "The choice of a shiprepair yard for a scheduled technical stop is always the result of a tender, in which are taken into account the competitiveness and clarity of the commercial offer, as well as the previous track record of the owner with the repair yard and its facility. Damen was selected on these grounds.

"The high commitment of the Damen teams, combined with that of all the crew members, the Gazocéan vessel manager and the procurement team, confirmed that this choice was the good option," he concluded. ■



Damen's Brest shiprepair yard recently docked the LNGC 'Gaselys'

Wison unveils new design

Shanghai-based Wison Offshore & Marine (Wison) has unveiled a multi-functional LNGC design.

Called Wison-LNG-Distributor (LNGD), the concept has a scalable capacity of between 5,000 and 20,000 cu m.

The LNGD integrates LNG loading, bunkering and container delivery and could make regional LNG redistribution more affordable and efficient, Wison said.

While conventional LNG carriers are designed to load, transfer and unload full cargoes between two terminal points, the LNGD is designed to distribute partial loads to coastal areas in areas, such as the Indian sub-continent,

Southeast Asia, the Caribbean, and Northern Europe.

It can operate at a shallow draft of down to 4.5 m thus deliver cargoes in areas where LNGCs with similar capacity cannot access, the company claimed. In addition, an azimuth thruster propulsion system eliminates the need for tug assistance.

The design features a bunkering arm, which enables a quick connection with the receiving unit and a short turnaround time. The loading arm will connect to the other vessel or facility's manifold,



Wison has designed an LNG distributor vessel, which can be built with a capacity of between 5,000 and 20,000 cu m

thereby eliminating the need for a hose transfer system at each receiving point.

"Our LNGD solution will become a key enabler for small-scale FSRU and FSRP development in the

areas that are either inaccessible or too small to be commercially feasible served by a large-scale floating unit or land facility," Cui Ying, Wison Offshore and Marine CEO, said. ■

ClassNK develops hydrogen carrier guidelines

Class society ClassNK has released its Guidelines for Liquefied Hydrogen (LH2) Carriers, based on provisions of the IMO interim recommendations.

Although not strictly natural gas, as a low carbon energy source, the use of hydrogen as a fuel is seen as a major possible solution to environmental problems caused by fuel emissions. As only water is discharged at the time of power generation, and can be manufactured from many different feed materials, such as fossil fuel, water, and others, hydrogen is a prime candidate for the fuel of the future, ClassNK said.

However, in order to realise the best and practical use of hydrogen, its production in economically viable and environmentally friendly method and the secure supply chain

to transport hydrogen to the place of consumption is essential. As the most efficient way for long distance and large volume transportation, carriage of LH2 by a ship is anticipated to expand and the relative technologies are developed.

Currently, the International Code for the IGC Code outlines safety requirements for gas carriers, such as LNG. However, there are no specific requirements in the code applicable for LH2 carriers that take into account the hazards associated with its handling and transport.

Hydrogen must be kept at temperatures below -253 deg C in

order to maintain its liquid state under atmospheric pressure, presenting an even tougher challenge than LNG. In response to growing interest in LH2 transportation, IMO developed 'Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk', which was adopted at MSC 97.

ClassNK has developed its guide, which provides safety requirements for the design and construction of LH2 carriers. The guidelines consist of safety requirements applicable to this type of ship based on the IMO Interim Recommendations, various international standards, as well as addi-

tional requirements taking specific hazards arising from the handling of LH2 into consideration.

Speaking at the Guide's launch, Hayato Suga, General Manager of ClassNK's Natural Resources and Energy Department, said: "The advent of liquefied hydrogen carrier technology opens the door to new and exciting possibilities, but as with all new technologies, proper guidance must be in place to ensure its safe application.

"ClassNK developed these guidelines to help ensure the safe design and construction of LH2 carriers and support this sector of the industry," he said. ■

ABS publishes LNG regas vessel guide

Class society ABS has published the 'Guide for Building and Classing LNG Regasification Vessels'.

"ABS has developed this industry-leading guidance based on extensive experience with the classification of LNG carriers," said ABS Chairman, President and CEO Christopher Wiernicki. "As the world moves toward cleaner fuels and becomes more dependent on gas, ABS will continue to play a key role in advising industry on the development of a safer and more sustainable fleet."

Floating LNG regasification (FSRUs) are specialised ships, which offer a flexible and effi-

cient way to deliver LNG to new and expanding markets. This Guide covers both purpose-built FSRUs and existing LNGCs that are converted to operate with regasification plants on board.

Whereas the latest IGC* Code update provides high-level requirements for ships with regasification plants, the ABS guide for regasification vessels presents clear guidance to designers and shipyards developing these types of ships, the class society said.

Recognising the unique opera-

tional characteristics of such vessels, ABS has included provisions that allow Underwater Inspection in Lieu of Drydocking (UWILD) for extended periods of time in the Guide.

"As the LNG supply chain expands, industry is considering its options for getting gas to demanding markets," said ABS Vice President for Global Gas Solution Patrick Janssens. "This Guide provides best-in-class guidance and promotes safety in the expanding LNG market."

Recognising the changing landscape and increased industry focus on gas, ABS launched its Global Gas Solutions team in 2013 to support industry in developing gas-related projects. ABS classed the world's first LPG carrier conversion, the first LNGC conversion, 'Methane Pioneer', in 1959, as well as the first newbuilding LNGC, 'Methane Princess', in 1964.

*The International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code). ■

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WORLD LNG CARRIER ORDERBOOK

Name	Segment	Status	Yard	Design	Prop	Capacity	Delivery Date	Ordered	Imo	Hull No
Ougarta	LNGC	Order	Hyundai Heavy	TZ Mk. III	TFDE	170000	Feb-17	Jul-05	9761267	2814
Mitsubishi Nagasaki 2310	LNGC	Order	Mitsubishi H.I.	Moss	STRH	155300	Feb-17	Jul-05	9698111	2310
Seri Cempaka	LNGC	Order	Hyundai Heavy	Moss	STRH	150000	Feb-17	Jul-05	9714290	2731
Kawasaki Sakaide 1718	LNGC	Order	Kawasaki	Moss	TFDE	180000	Mar-17	Jul-05	9698123	1718
Murex	LNGC	Order	DSME	GT NO 96	MEGI	173400	Mar-17	Jul-05	9705641	2416
Hudong-Zhonghua H1718a	LNGC	Order	Hudong-Zhonghua	Membrane	TFDE	174000	Mar-17	Jul-05	9694749	H1718A
Daewoo 2452	LNGC	Order	DSME	GT NO 96	TFDE	174000	Mar-17	Jul-05	9761853	2452
Asia Venture	LNGC	Order	Samsung	TZ Mk. III	TFDE	160000	Apr-17	Jul-05	9680190	2070
Hyundai Princepia	LNGC	Order	DSME	GT NO 96	TFDE	174000	Apr-17	Jul-05	9761841	2451
SM Eagle	LNGC	Order	DSME	GT NO 96	TFDE	174000	Apr-17	Jul-05	9761827	2449
Daewoo 2450	LNGC	Order	DSME	GT NO 96	TFDE	174000	May-17	Jul-05	9761839	2450
Jmu Tsu 5070	LNGC	Order	Japan Marine United Corp (Jmu)	SPB	TFDE	165000	May-17	Jul-05	9736092	5070
Castillo De Merida	LNGC	Order	Imabari	TZ Mk. III	MEGI	178000	May-17	Jul-05	9742807	8177
Castillo De Caldelas	LNGC	Order	Imabari	TZ Mk. III	MEGI	178000	Jun-17	Jul-05	9742819	8188
Hudong-Zhonghua H1717a	LNGC	Order	Hudong-Zhonghua	Membrane	TFDE	174000	Jun-17	Jul-05	9672844	H1717A
Hudong-Zhonghua H1719a	LNGC	Order	Hudong-Zhonghua	Membrane	TFDE	174000	Jun-17	Jul-05	9694751	H1719A
Daewoo 2462	LNGC	Order	DSME	GT NO 96	TFDE	180000	Jul-17	Jul-05	9771913	2462
Bishu Maru	LNGC	Order	Kawasaki	Moss	TFDE	164700	Aug-17	Jul-05	9691137	1713
Seri Camar	LNGC	Order	Hyundai Heavy	Moss	STRH	150000	Aug-17	Jul-05	9714305	2732
Jmu Tsu 5071	LNGC	Order	Japan Marine United Corp (Jmu)	SPB	TFDE	165000	Aug-17	Jul-05	9752565	5071
Daewoo 2417	LNGC	Order	DSME	GT NO 96	MEGI	173400	Aug-17	Jul-05	9705653	2417
Daewoo 2421	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Aug-17	Jul-05	9768368	2421
Samsung 2153	LNGC	Order	Samsung	KC-1	TFDE	174000	Sep-17	Jul-05	9761803	2153
Samsung 2154	LNGC	Order	Samsung	KC-1	TFDE	174000	Sep-17	Jul-05	9761815	2154
Daewoo 2426	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Sep-17	Jul-05	9750658	2426
Flex Endeavour	LNGC	Order	DSME	GT NO 96	MEGI	172400	Oct-17	Jul-05	9762261	2447
Flex Enterprise	LNGC	Order	DSME	GT NO 96	MEGI	172400	Oct-17	Jul-05	9762273	2448
Mitsubishi Nagasaki 2316	LNGC	Order	Mitsubishi H.I.	Moss	STRH	153000	Oct-17	Jul-05	9743875	2316
SK Resolute	LNGC	Order	Samsung	TZ Mk. III	XDF	182000	Oct-17	Jul-05	9693173	2081
Hudong-Zhonghua H1720a	LNGC	Order	Hudong-Zhonghua	Membrane	TFDE	174000	Oct-17	Jul-05	9672818	H1720A
Jmu Tsu 5072	LNGC	Order	Japan Marine United Corp (Jmu)	SPB	TFDE	165000	Oct-17	Jul-05	9758832	5072
Eduard Toll	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Oct-17	Jul-05	9750696	2423
Seri Cemara	LNGC	Order	Hyundai Heavy	Moss	STRH	150000	Dec-17	Jul-05	9756389	2735
Kawasaki Sakaide 1731	LNGC	Order	Kawasaki	Moss	TFDE	177000	Dec-17	Jul-05	9774135	1731
Daewoo 2453	LNGC	Order	DSME	GT NO 96	MEGI	173400	Dec-17	Jul-05	9770921	2453
Rudolf Samoylovich	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Dec-17	Jul-05	9750713	2425
Daewoo 2422	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Dec-17	Jul-05	9768370	2422
Daewoo 2424	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Dec-17	Jul-05	9750701	2424
SK Audace	LNGC	Order	Samsung	TZ Mk. III	XDF	182000	Jan-18	Jul-05	9693161	2080
Hudong-Zhonghua H1664a	LNGC	Order	Hudong-Zhonghua	GT NO 96	TFDE	174000	Jan-18	Jul-05	9750232	H1664A
Pan Asia	LNGC	Order	Hudong-Zhonghua	GT NO 96	TFDE	174000	Jan-18	Jul-05	9750220	H1663A
BW Tulip	LNGC	Order	DSME	GT NO 96	MEGI	173000	Jan-18	Jul-05	9758064	2435
Samsung 2107	LNGC	Order	Samsung	TZ Mk. III	MEGI	174000	Jan-18	Jul-05	9709025	2107
Daewoo 2460	LNGC	Order	DSME	GT NO 96	MEGI	174000	Jan-18	Jul-05	9766889	2460
Teekay NB-6	LNGC	Order	DSME	GT NO 96	MEGI	173400	Feb-18	Jul-05	9770933	2454
Hyundai Ulsan 2800	LNGC	Order	Hyundai Heavy	TZ Mk. III	XDF	174000	Feb-18	Jul-05	9748899	2800
Daewoo 2443	LNGC	Order	DSME	GT NO 96	MEGI	173400	Feb-18	Jul-05	9766554	2443
Jmu Tsu 5073	LNGC	Order	Japan Marine United Corp (Jmu)	SPB	TFDE	165000	Feb-18	Jul-05	9758844	5073
Samsung 2130	LNGC	Order	Samsung	TZ Mk. III	XDF	174000	Mar-18	Jul-05	9744013	2130
Daewoo 2442	LNGC	Order	DSME	GT NO 96	MEGI	173400	Mar-18	Jul-05	9766542	2442
Hyundai Ulsan 2801	LNGC	Order	Hyundai Heavy	TZ Mk. III	XDF	174000	Mar-18	Jul-05	9748904	2801
Samsung 2108	LNGC	Order	Samsung	TZ Mk. III	MEGI	174000	Mar-18	Jul-05	9709037	2108

Name	Segment	Status	Yard	Design	Prop	Capacity	Delivery Date	Ordered	Imo	Hull No
MOL E.On.	LNGC	Order	DSME	GT NO 96	TFDE	179900	Apr-18			TBN
Kawasaki Sakaide 1720	LNGC	Order	Kawasaki	Moss	TFDE	164000	Apr-18	Jul-05	9749609	1720
Mitsui NB 2 Cameron	LNGC	Order	Kawasaki	Moss	STRH	155000	Apr-18	Jul-05	9759252	1729
Daewoo 2441	LNGC	Order	DSME	GT NO 96	MEGI	173400	Apr-18	Jul-05	9766530	2441
Mitsui Cameron Shi NB 1	LNGC	Order	Samsung	Mark III Flex	TFDE	177000	May-18	Jul-05	9760768	2148
Samsung 2149	LNGC	Order	Samsung	Mark III Flex	TFDE	177000	May-18	Jul-05	9760770	2149
Mitsui KHI NB 1	LNGC	Order	Kawasaki	Moss	STRH	155000	May-18	Jul-05	9759240	1728
Daewoo 2432	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	May-18	Jul-05	9750660	2432
Daewoo 2430	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	May-18	Jul-05	9750725	2430
Daewoo 2455	LNGC	Order	DSME	GT NO 96	MEGI	173400	May-18	Jul-05	9770945	2455
Daewoo 2464	LNGC	Order	DSME	GT NO 96	MEGI	173400	May-18	Jul-05	9785158	2464
Mitsubishi Nagasaki 2324	LNGC	Order	Mitsubishi H.I.	Moss	STaGE	165000	Jun-18	Jul-05	9779226	2324
Daewoo 2458	LNGC	Order	DSME	GT NO 96	MEGI	173400	Jun-18	Jul-05	9767950	2458
Daewoo 2444	LNGC	Order	DSME	GT NO 96	MEGI	173400	Jun-18	Jul-05	9766566	2444
Daewoo 2427	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Jun-18	Jul-05	9768382	2427
Hudong-Zhonghua H1665a	LNGC	Order	Hudong-Zhonghua	GT NO 96	TFDE	174000	Jun-18	Jul-05	9750244	H1665A
BW Lilac	LNGC	Order	DSME	GT NO 96	MEGI	173000	Jul-18	Jul-05	9758076	2436
Daewoo 2445	LNGC	Order	DSME	GT NO 96	MEGI	173400	Jul-18	Jul-05	9766578	2445
Samsung 2150	LNGC	Order	Samsung	Mark III Flex	TFDE	177000	Jul-18	Jul-05	9760782	2150
Daewoo 2446	LNGC	Order	DSME	GT NO 96	MEGI	173400	Aug-18	Jul-05	9766580	2446
Mitsubishi Nagasaki 2323	LNGC	Order	Mitsubishi H.I.	Moss	STaGE	180000	Aug-18	Jul-05	9774628	2323
Daewoo 2431	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Sep-18	Jul-05	9750737	2431
MOL NB 2 Freeport	LNGC	Order	Kawasaki	Moss	STaGE	177000	Oct-18	Jul-05	9791200	1734
Mitsubishi Nagasaki 2325	LNGC	Order	Mitsubishi H.I.	Moss	STaGE	165000	Oct-18	Jul-05	9779238	2325
Mitsubishi Nagasaki 2326	LNGC	Order	Mitsubishi H.I.	Moss	STaGE	180000	Oct-18	Jul-05	9796781	2326
Daewoo 2428	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Nov-18	Jul-05	9768394	2428
NYK NB 2 Freeport	LNGC	Order	Kawasaki	Moss	STaGE	177000	Dec-18	Jul-05	9791212	1735
Mitsubishi Nagasaki 2327	LNGC	Order	Mitsubishi H.I.	Moss	STRH	180000	Dec-18	Jul-05	9796793	2327
Daewoo 2429	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Dec-18	Jul-05	9768526	2429
Daewoo 2456	LNGC	Order	DSME	GT NO 96	MEGI	173400	Jan-19	Jul-05	9753014	2456
Pan Africa	LNGC	Order	Hudong-Zhonghua	GT NO 96	TFDE	174000	Jan-19	Jul-05	9750256	H1666A
Daewoo 2433	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Jan-19	Jul-05	9750749	2433
Daewoo 2459	LNGC	Order	DSME	GT NO 96	MEGI	173400	Jan-19	Jul-05	9767962	2459
SK Shipping SK E&S NB1	LNGC	Order	Hyundai Heavy	TZ Mk. III Flex	XDF	180000	Feb-19	Jul-05	9810549	2937
Hyundai Samho S856	LNGC	Order	Hyundai Samho	TZ Mk. III	MEGI	174000	Feb-19	Jul-05	9781918	S856
Mitsubishi Nagasaki 2332	LNGC	Order	Mitsubishi H.I.		STaGE	165000	Feb-19	Jul-05	9810020	2332
Samsung 2131	LNGC	Order	Samsung	TZ Mk. III	XDF	174000	Mar-19	Jul-05	9744025	2131
Hyundai Samho S857	LNGC	Order	Hyundai Samho	TZ Mk. III	MEGI	174000	Mar-19	Jul-05	9781920	S857
Mitsubishi Nagasaki 2321	LNGC	Order	Mitsubishi H.I.	Moss	STaGE	177000	Apr-19	Jul-05	9770438	2321
Daewoo 2457	LNGC	Order	DSME	GT NO 96	MEGI	173400	Apr-19	Jul-05	9753026	2457
SK Shipping SK E&S NB2	LNGC	Order	Hyundai Heavy	TZ Mk. III Flex	XDF	180000	May-19	Jul-05	9810551	2938
Mitsubishi Nagasaki 2322	LNGC	Order	Mitsubishi H.I.	Moss	STaGE	177000	Jun-19	Jul-05	9770440	2322
Nb Gaslog - Centrica	LNGC	Order	Samsung	GTT Mark V	XDF	180000	Jul-19	Jul-05	9816763	2212
Samsung 2212										
Samsung 2213	LNGC	Order	Samsung	GTT Mark V	XDF	180000	Sep-19	Jul-05	9819650	2213
Daewoo 2489	LNGC	Order	DSME	GT NO 96	MEGI	173400	Nov-19	Jul-05	9792606	2489
Daewoo 2434	LNGC	Order	DSME	GT NO 96	TFDE - Azipod	172410	Nov-19	Jul-05	9750672	2434
Maran Gas NB1	LNGC	Order	DSME	GT NO 96	MEGI	173400	Nov-19	Jul-05	9810379	2467
Maran Gas NB2	LNGC	Order	DSME	GT NO 96	MEGI	173400	Nov-19	Jul-05	9810367	2466
Trinity J/V (Mitsui & Co.)	LNGC	Order	Imabari	GTT Mark III Flex	MEGI	178000	Jan-20			TBN
Imabari Saijo 8200	LNGC	Order	Imabari		MEGI	178000	Oct-21	Jul-05	9778923	8200

WORLD SMALL SCALE LNG FLEET*

Built	Name	CBM	Cargo Type	Trading area	Trading in LNG?	Ship Owner / Operator
1974	Seagas	187	LNG	Sweden	Yes	AGA
1988	Kayoh Maru	1,517	LNG	Japan	Yes	Daiichi
1993	Aman Bintulu	18,928	LNG	Malaysia - Japan	Yes	Perbadanan/NYK
1996	Surya Aki	19,475	LNG	Indonesia - Japan	Yes	MCGC
1997	Aman Sendai	18,928	LNG	Malaysia - Japan	Yes	Perbadanan/NYK
1998	Aman Hakata	18,800	LNG	Malaysia - Japan	Yes	Perbadanan/NYK
2000	Tripura (ex Surya Satsuma)	23,096	LNG	Indonesia - Japan	Yes	MCGC
2003	Pioneer Knutsen	1,100	LNG	Norway	Yes	Knutsen
2003	Shinju Maru No.1	2,540	LNG	Japan	Yes	Shinwa
2005	North Pioneer	2,500	LNG	Japan	Yes	Japan Liquid Gas
2007	Sun Arrows	19,531	LNG	Malaysia - Russia - Japan	Yes	Mitsui
2008	Kakurei Maru	2,536	LNG	Japan	Yes	Hogaki Zosen
2008	Shinju Maru No.2	2,540	LNG	Japan	Yes	Shinwa
2009	Coral Methane	7,551	LNG/LPG/Ethylene	Northwest Europe/Baltics	Yes, sometimes	Anthony Veder
2010	Norgas Creation	10,000	LNG/LPG/Ethylene	Worldwide	No	Norgas Carriers
2010	Norgas Innovation	10,000	LNG/LPG/Ethylene	Worldwide	No	Norgas Carriers
2011	Akebono Maru	3,556	LNG	Japan	Yes	Chuo Kaiun
2011	Norgas Bahrain Vision	12,000	LNG/LPG/Ethylene	Worldwide	No	Norgas Carriers
2011	Norgas Conception	10,000	LNG/LPG/Ethylene	Worldwide	No	Norgas Carriers
2011	Norgas Invention	10,000	LNG/LPG/Ethylene	Worldwide	No	Norgas Carriers
2011	Norgas Unikum	12,000	LNG/LPG/Ethylene	Worldwide	No	Norgas Carriers
2012	Coral Energy	15,600	LNG	Northwest Europe/Baltics	Yes	Anthony Veder
2013	Coral Anthelia	6,500	LNG/Ethylene			Anthony Veder
2013	JX Energy TBN	2,500	LNG	Japan	Yes	JX Energy
2013	Kakuyu Maru	2,500	LNG	Japan	Yes	Tsurumi Sunmarine
2014	LNG-Oil combi**	2,000	LNG	Germany	Yes	Veka
2014	Short Sea LNG Tanker **	4,000	LNG	Germany	Yes	Veka
2015	10 small carriers TBN**	5,000	LNG			Bimantara Group
2015	Jahre TBN**	6,200	LNG	Norway	Yes	Donsotank/Jahre Marine
2015	JS Ineos Ingenuity	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2015	JS Ineos Insight	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2015	JS Ineos Intrepid	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2015	LNG Barge TBN	3,000	LNG	US Coast	Yes	LNG America
2015	LNG bunker barge 1†	2,250	LNG	China	Yes	Anhui Huaqiang Natural Gas
2015	LNG bunker barge 2†	2,250	LNG	China	Yes	Anhui Huaqiang Natural Gas
2015	LNG bunker barge 3†	2,250	LNG	China	Yes	Anhui Huaqiang Natural Gas
2015	LNG Inland bunker**	800	LNG	Germany	Yes	Veka
2015	Norgas TBN**	17,000	LNG/LPG/Ethylene	Worldwide		Norgas Carriers
2015	Norgas TBN**	17,000	LNG/LPG/Ethylene	Worldwide		Norgas Carriers
2015	PetroChina TBN	30,000	LNG	China		PetroChina
2015	TBN	14,000	LNG	China	Yes	Zhejiang Huaxiang
2015	TBN 1	27,500	LNG	China?		Danyang?
2015	TBN 2	27,500	LNG	China?		Danyang?
2015	TBN 3	27,500	LNG	China?		Danyang?
2015	Yuan He 1	30,000	LNG	China	Yes	CSR
2016	Clean Jacksonville	2,200	LNG	US Coast	Yes	CME
2016	Dalian TBN	28,000	LNG	China	Yes	Dalian Inteh Group
2016	Hai Yang Shi You 301	30,000	LNG	Bali FSU	Yes	CETS (CNOOC)
2016	JS Ineos Indepence	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2016	JS Ineos Innovation	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2016	JS Ineos Inspiration	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2016	LNG Prime	2,250	LNG	Northwest Europe	Yes	Veka Deen LNG
2016	Navigator Aurora	35,000	Ethane/Ethylene	Markus Hood - Stenungsund	Ethane, for Borealis	Navigator
2016	Ocean Yield TBN	36,000	Ethane/Ethylene	US - Teeside	Ethane, for Sabic	Gaschem Services
2016	Ocean Yield TBN	36,000	Ethane/Ethylene	US - Teeside	Ethane, for Sabic	Gaschem Services
2016	Ocean Yield TBN	36,000	Ethane/Ethylene	US - Teeside	Ethane, for Sabic	Gaschem Services
2016	Shell Bunker Barge TBN 1	6,500	LNG	Northwest Europe	Yes	Shell
2016	Shell Bunker Barge TBN 2	6,500	LNG	Northwest Europe	Yes	Shell
2016	Shell Bunker Barge TBN 3	6,500	LNG	Northwest Europe	Yes	Shell
2016	Shell Bunker Barge TBN 4	3,000	LNG	Northwest Europe	Yes	Shell
2017	ENGIE Zeebrugge	5,000	LNG	Northwest Europe	Yes	NYK
2017	CME TBN†	2,200	LNG	US Coast	Yes	CME
2017	CME TBN†	2,200	LNG	US Coast	Yes	CME
2017	Coral EnergiCE	18,000	LNG	Northwest Europe/Baltics	Yes	Anthony Veder
2017	Coralus	5,800	LNG	Northwest Europe/Baltics	Yes, for Skargas	Anthony Veder
2017	Evergas TBN	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2017	Evergas TBN	27,500	LNG/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2017	LNG-Gorskaya TBN	7,300	LNG	Russia	Yes	LNG-Gorskaya
2017	LNG-Gorskaya TBN	7,300	LNG	Russia	Yes	LNG-Gorskaya
2017	LNG-Gorskaya TBN	7,300	LNG	Russia	Yes	LNG-Gorskaya
2017	Navigator Eclipse	35,000	Ethane/Ethylene	US	Ethane	Navigator
2017	Navigator Nova	35,000	Ethane/Ethylene	US	Ethane	Navigator
2017	Navigator Prominence	35,000	Ethane/Ethylene	US	Ethane	Navigator
2018	Bernhard Schulte TBN	7,500	LNG	Baltic	Yes	Bernhard Schulte
2018	CME TBN†	2,200	LNG	US Coast	Yes	CME
2018	Evergas TBN	32,000	Ethane/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2018	Evergas TBN	32,000	Ethane/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2018	Evergas TBN	32,000	Ethane/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas
2018	Evergas TBN	32,000	Ethane/Ethylene	Markus Hook - Rafnes	Ethane, for Ineos	Evergas

For more information please visit <http://small-lng.com>

*Includes multi-gas, ethylene and LNG bunker ships with 40,000 cubic metres LNG cargo capacity or less

TBN = To Be Nominated indicates ships are still at construction/planning stage

** = project shelved † = Data to be verified Data last updated = 22 February 2017