

# LNG Fuelling

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## Egypt advances plans for Suez LNG bunker hub

Egypt's state-owned gas company has advanced plans for an LNG bunkering hub in the Suez canal, signing an agreement to boost fuel supply in the region.

Egyptian Natural Gas Holding Company (EGAS) has announced it will extend and deepen its partnership with Norwegian fuel specialist Kanfer Shipping and cargo firm Leth Suez Transit, building on a Memorandum of Understanding signed in February this year.

Following initial exploratory work, the partners will now establish a joint venture company that will charter an LNG bunker vessel from Kanfer and manage its daily operation in Egypt.

"Egypt is a strategic location for international shipping and will be an important location for LNG bunkering calls between Europe and Asia. It is also important to make environmentally friendly fuel available for the maritime industry in inner Mediterranean and in the heart of the Middle East," a spokesperson for Kanfer said.

### Gas transit opportunities

Not only is Egypt home to sizeable gas reserves of its own but in June, the country's energy minister signed a trilateral memorandum of understanding with Israel and the European Union, to enable Israeli natural gas from the Mediterranean

Sea to be exported to Europe via Egypt.

EGAS predicts that Egypt's 'unique and competitive position' will help to establish the Suez Canal as one of the 'key LNG bunkering hubs of the world' and notes that improved infrastructure would not only serve the more than 20,000 ships that transit the canal every year but would strengthen LNG fuelling the wider Mediterranean and Red Sea.

"This will be an important step for Egypt and attract more business to the Suez Canal," Admiral Osama Mounier Mohamed Rabie, Managing Director of the Suez Canal Authorities, said.

### Catalyst for growth

The new joint venture proposed by EGAS and partners is expected to act as a catalyst for construction of new LNG infrastructure in the country as shipping lines increasingly seek to minimise costs and focus operations around regional bunkering hubs.

"The key LNG hubs of the world must import the LNG to their terminals which adds considerable cost to the end-users. We are con-

fident that the J/V can provide competitive prices towards the key ports and hubs such as Singapore and ARA," Stig Hagen, managing partner at Kanfer, commented. "We believe that this will attract shipowners and influence their decision-making on where they will replenish LNG."

Since it was founded in 2013, Kanfer has been at the forefront of efforts to develop alternative fuelling infrastructure and has developed a number of LNG technologies as well as exploring the use of non-fossil fuels, such as ammonia and hydrogen.

Currently Egypt has two land-based LNG terminals - Damietta and IDKU - as well as a Floating Storage and regasification Unit (FSRU) stationed in Ain Sokhna. To enhance the value of the new joint venture, the firms plan to enlist further partner(s) with experience in bunkering or commodity trading.

"The parties have in mind creating a fast-track solution and have an ambition to have the bunkering infrastructure in operation by late 2025," a spokesperson for the consortium said.

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Kanfer vessel

## LNG bunker sales fall sharply at Rotterdam

Sales of LNG bunker fuel at the Port of Rotterdam declined significantly in the second quarter of the year, according to the latest figures from the Rotterdam Port Authority.

The port saw overall sales of just 63,497 cubic metres of LNG in the second quarter, compared with 111,804 cubic metres in the previous three-month period. This slide is in part due to record price rises of fuel and European concerns around gas scarcity in the wake of the Russian invasion of Ukraine.

Discussing the first half performance, Allard Castelein, CEO of the Port of Rotterdam Authority, noted that “the current geopolitical situation makes Europe very vulnerable” and that “availability of energy and raw materials at reasonable prices cannot be taken for granted.”

### Shifting fuel landscape

The fall in LNG bunker sales was equivalent to a 59.6% decline compared to the first quarter last year and a decrease of 43.2% com-

pared to the first quarter of this year. This drop was far steeper than the 1.1% fall in conventional bunker sales and the comparative decline suggests that many shipping lines have elected to switch away from LNG to traditional fuels as prices have risen.

Despite the fall in bunker sales, the port reported a huge increase in energy trade, with imports of both LNG and coal rising ‘very sharply’ as an alternative to reduced European imports of Russian gas by pipeline.

Overall bunker fuel sales were 2.4 million tonnes in the second quarter of which conventional fuels accounted for 2.3 million tonnes.

### Strong demand for LNG

“There is very strong demand for LNG as an alternative to the natu-

ral gas entering Europe by pipeline from Russia,” a spokesperson for the port said. “It was possible to see a shift in the origin of imports of coal, crude oil, oil products and LNG in the second quarter. Companies are sourcing these energy carriers and raw materials less and less from Russia and purchasing them elsewhere in the world.”

This shift is in part responsible for the discontinuity in LNG bunker sales as gas is increasingly sourced from imported LNG, causing price disruption due to the current lack of infrastructure in Europe.



Port of Rotterdam

High Sulphur Fuel Oil (HSFO) sales were one of the bright spots, rising from 708,131 tonnes to 737,004 tonnes, while Very Low Sulphur Fuel Oil (VLSFO) volumes were relatively stable, changing from 1,067,532 tonnes in the first quarter to 1,039,397 tonnes. HSFO sales were supported by an improved price differential as well as growing number of scrubber-equipped vessels coming to market. ■

## EPS completes first Suezmax LNG bunkering

Singaporean shipping group Eastern Pacific Shipping (EPS) has completed the inaugural LNG refuelling operations for the world's first dual-fuel LNG Suezmax tanker vessel, *Greenway*.

The record bunkering operation was carried out in Malaysia following the vessel's delivery from China at the end of June.

“The delivery and LNG bunkering were completed with support from various industry partners, including the leading marine fuel supplier, Peninsula, who partnered

with Petronas Marine to perform the LNG bunker supply,” a spokesperson for EPS said.

### Maiden voyage

The *Greenway* was delivered directly from construction at Guangzhou Shipyard International and was chartered by India's Re-

liance Industries for her maiden voyage. The vessel was carrying a cargo of Ultra Low Sulphur Diesel due to be loaded at Jamnagar terminal in northwest India.

“The 158,000-deadweight-tonne tanker *Greenway* embarked on her maiden voyage to Malaysia for the historic bunkering operations,” a spokesperson for EPS commented.

In total, 1,500 tonnes of LNG were transferred to the vessel at the Port of Pengerang by the LNG bunker vessel *Avenir Advantage*. With capacity of 7,500 cubic metres of LNG and two Type C tanks, the *Avenir Advantage* is one of a growing fleet of bunker vessels operated by Avenir in Singapore.

### Expanded LNG use

EPS now operates dual-fuel vessels across all three of its core segments - containerships, dry bulk carriers, and tankers - and hailed the bunkering of the first Suezmax as proof that utilising LNG for this segment is ‘achievable, viable, and sustainable’.

“Adding *Greenway* to EPS’ fleet further strengthens the company's position at the forefront of the industry's energy transition,” a spokesperson for the firm said.

*Greenway* is the first of two dual-fuel LNG Suezmaxes ordered by the firm, with its sister vessel, *Starway*, set to be delivered in August 2022. ■



The *Greenway* bunkering with LNG

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## Shell, CMA CGM partner for LNG pathway to decarbonisation

Energy firm Shell has signed a multi-year agreement with shipping line CMA CGM Group to provide LNG bunkering in Singapore and accelerate decarbonisation in global maritime supply chains.

The deal will see Shell supply LNG for CMA CGM's containerships with capacity for 13,000 twenty-foot equivalent unit (TEU) and bunkering operations will commence from the second half of 2023.

Tahir Faruqi, General Manager, Head of Downstream LNG at Shell, commented: "CMA CGM continues to see the potential in LNG as a marine fuel, so it is a hugely positive step to be extending our supply commitments in this area."

### SIMOPS bunkering

Bunkering will be provided by FueLNG, a joint venture between Shell and Keppel Offshore & Marine, and will be carried out by the firm's existing *FueLNG Bellina* vessel as well as a new 18,000-cubic-metre-capacity LNG bunker vessel due to come into service in 2023.

"By using LNG as a marine fuel, the industry immediately places itself on a decarbonising pathway, starting today. LNG is a fuel in transition and offers a credible pathway to liquefied biomethane and the hydrogen-based fuel liquefied e-methane; both having the potential of being net zero," Faruqi added.

Both vessels will conduct simul-



LNG-fuelled CMA CGM containership

taneous operation (SIMOPS) LNG bunkering.

### Steel cutting ceremony

Construction of CMA CGM's second 13,000-TEU dual-fuel boxship began in mid-July, with Chinese shipbuilder Hudong Zhonghua conducting a steel cutting ceremony at its Changxing Shipbuilding Base.

The new vessel will be 336 metres long and 51 metres wide and will be equipped with a 14,000-cubic-metre MARK III LNG cargo

tank. It is part of a US\$2.3 billion investment programme by CMA CGM in LNG-powered containerships.

The latest figures from Shell's LNG Outlook report suggest that global trade in liquefied natural gas rebounded strongly last year, with volumes increase by six per cent compared to 2020, reaching 380 million tonnes.

### Low-carbon partnership

Alongside the LNG bunker agreement, the two firms have also

signed a Memorandum of Understanding (MoU) to advance low-carbon marine fuels, such as liquid biofuels, bio/e-methane (to LNG), bio/e-methanol, for new and existing vessels.

"Collaboration and partnership are critical in paving the way, which will include a mosaic of lower-carbon fuels, technology sharing and partnership projects to realise a net zero future in shipping," Melissa Williams, Vice President Marine, Sectors & Decarbonisation at Shell, said, "Thus, I am excited about our agreement with CMA CGM as it allows both businesses to bring their respective scale and size to drive impactful change in the industry - helping our customers to overcome their challenges and meet their ambitious decarbonisation goals in the process."

This partnership will involve delivery of innovative technical solutions, such as LNG and hydrogen blending, methane slip abatement technologies and fuel cell technology development. The firms will also explore new business models incorporating frameworks voluntary and mandated trading mechanisms for carbon credits.



Representatives of Shell and CMA CGM



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# Navios orders duo of LNG-powered containerships

Greek shipping line Navios Maritime Partners has placed an order for two new LNG-fuelled containerships as part of its strategy to expand its use of LNG across its fleet.

The firm announced it would spend US\$241.2 million on the two new vessels, with delivery expected in the fourth quarter of 2024.

“The two containerships have been chartered-out for 12 years, at an average net rate of \$42,288 per day,” a spokesperson for Navios Partners said.

The charterer for the vessels has agreed to amend existing charters on two 6,800 TEU containerships currently expiring in the fourth quarter of 2023 and under amended terms, will now extend the charter period for seven months at \$43,944 net per day.

## Move towards resilience

Navios Partners also maintains an existing option to extend the charter term for five years, at a net rate of \$21,083 per day, in which case the charter would be ex-

tended for eight- and one-half months at \$30,119 per day.

The charter agreement provides for de-escalating payments, falling from USD 57,213 net per day in the first year to USD 24,875 net per day in the eleventh.

Publicly listed on the New York Stock Exchange, Navios Partners owns and operates a fleet of 150 vessels - including Ultra-Handymax, Panamax, Capesize Vessels, Containerships, Crude, Product and Chemical Tankers.

Chief executive of the group, Angeliki Frangou, voiced cautious optimism for the sector noting that global supply chains “are evolving from a world of ‘just in time’ manufacturing to ‘just in case’ where countries and companies purposefully build redundant systems... from a shipping perspective, building for resilience trans-



Navios containership

lates into more tonne miles as things are duplicated.”

## HJSC selected for shipbuilding

The shipbuilder for the new vessels was reported to be South Korean firm HJ Shipbuilding & Construction (HJSC). The new vessels will both be dual fuel and feature capacity for 7,700 TEU.

“The closing of the transaction is subject to completion of custom-

ary documentation. Navios Partners has been granted a two-month option for two additional LNG dual fuel 7,700 TEU containerships at the same terms, delivering in the second quarter of 2025.”

Previously known as Hanjin Heavy Industries & Construction, HJSC is the operator of South Korea’s oldest shipyard. Originally established in 1937, the shipyard is located in Busan in the south-east of the country. ■

# GTT to supply LNG fuel tanks for HJSC

French cryogenic specialist Gaztransport & Technigaz is to supply LNG fuel tanks for two containerships under construction by South Korean shipyard HJ Shipbuilding & Construction.

The vessels, ordered by Navios Partners, will each be equipped with an LNG fuel tank with capacity of 6,100 cubic metres.

Philippe Berterroitière, Chairman and CEO of GTT, welcomed the news stating, “We look forward to working with our long-time partner HJ Shipbuilding & Construction again.”

The vessels are expected to be built to specifications submitted by HJSC for a 272-meter-long

dual-fuel vessel. Basic design approval was granted by Lloyd’s Register (LR) in April follows the signing of a memorandum of understanding with LR last year. Designs indicate a cruise speed of 22 knots for the vessels and HJSC has emphasised the “highly-efficient” power chain.

## Mark III membrane technology

Both vessels will feature GTT’s

Mark III membrane containment technology. This cryogenic liner systems, allows for containment of liquefied gas at low temperatures during shipping, onshore and offshore storage, at atmospheric pressure.

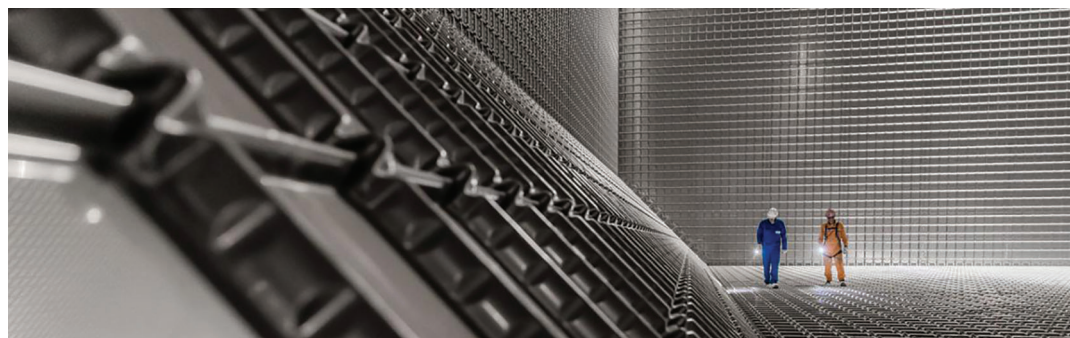
A modular containment and insulation system, the Mark III membrane technology works in tandem with the ship’s hull structure. Composed of a primary corrugated stainless-steel membrane, posi-

tioned on top of prefabricated insulation panels, the tank is reinforced by a complete secondary membrane made of composite material.

“This technology and its evolutions equip more than 200 vessels in operation and under construction and benefit from more than 50 years’ experience at sea,” a spokesperson for GTT said.

Headquartered in Saint-Rémy-lès-Chevreuse in north-central France, GTT is one of the world’s largest manufacturers of membrane containment systems for the storage and transportation of marine LNG fuel.

“With this new order, the total number of container ships equipped, or under construction, with GTT technology amounts to 76 vessels, confirming the attractiveness of our cutting-edge technological solutions for LNG used as fuel,” Berterroitière concluded. ■



GTT’s Mark III membrane containment system

# Avenir ramps up LNG fuelling in Europe

Energy company Avenir LNG has ramped up LNG bunkering activity in Europe, signing a three-year LNG bunkering supply agreement with Swedish ferry-line Destination Gotland.

The agreement will see wholly owned subsidiary Avenir Marine supply up to 40,000 tons of LNG per annum as fuel for the vessels Gotland and Visby.

“Avenir Marine has been established to focus on providing competitive and flexible supply solutions for LNG and BioLNG as a marine fuel,” a spokesperson for Avenir said. “The first Bunker delivery under this new agreement was successfully conducted on 8th June 2022 and deliveries will continue through to Q2 2025.

## Strengthening Baltic operations

Refuelling operations will be carried out by the bunker vessel *Avenir Ascension* which will deliver LNG via ship-to-ship transfer in the vicinity of Visby, on the west of the island of Gotland in the Baltic Sea.

“We are delighted to have entered into this agreement with Destination Gotland who have been a pioneer in the adoption of LNG as a marine fuel since 2018,” Peter Mackey, CEO of Avenir LNG Limited, commented, “In the coming months we will continue to ex-



*Avenir Ascension*

pand our operations across the Baltic Sea. We look forward to building this long-term partnership with Destination Gotland and for many safe and reliable deliveries going forward.”

The *Avenir Ascension* was delivered earlier this year and features capacity to store 7,500 cubic metres of LNG.

Destination Gotland is a wholly owned daughter company of Rederi AB Gotland and operates a fleet of four high-speed Ro-Pax ferries. It runs state-subsidised domestic ferries from Nynäshamn and Oskarshamn to Visby.

“We appreciate Avenir Marine establishing operations in the Baltic Sea area providing new op-

portunities for LNG and BioLNG bunkering using their recently delivered Bunker Vessel,” Marcus Risberg, CEO of Destination Gotland, said. “Following the first successful bunker deliveries during the past days we look forward to develop a long-lasting partnership with Avenir Marine.”

## Expansion at Lübeck

Avenir Marine also announced the first delivery of LNG and BioLNG to the Port of Lübeck in Germany in June. The RoPax ferry *Nils Holgersson* was refuelled at the Baltic Sea port with a fuel mix containing 10% BioLNG.

Bunkering was completed in partnership with German LNG

infrastructure provider LIQUIND 24/7 and biomethane trader Landwärme. It was the first step in a long-term cooperation between Avenir LNG and the vessel operator TT-Line for the supply of LNG and BioLNG for two new RoPax ferries that will operate in Sweden, Germany, and Poland.

“We are excited about this successful first delivery of LNG to TT-Line in Lübeck. The fact that 10% of the delivery was Bio-LNG underlines the commitment of all parties involved to reduce emissions and increase the sustainability of shipping even further through the development of a suitable small-scale LNG infrastructure,” Mackey commented. ■



TT Line ferry bunkering with LNG

## NEWS NUDGES

### CMB FL orders LNG-fuelled PCTCs

Chinese banking firm CMB Financial Leasing (CMB FL) has reportedly placed an order for six LNG dual-fuel pure car/truck carrier (PCTC) vessels.

The deal was agreed with state-owned Xiamen Shipbuilding and was valued at US\$516 million. The vessels will be deployed for charter to Cosco Shipping Specialised Carriers and will each feature capacity for 7,500 car equivalent units (CEU).

CMB FL is a wholly-owned subsidiary of China Merchants Bank, one of China's top commercial banks.



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# Titan expands LNG bunker fleet

Fuel supply firm Titan has added a fifth LNG bunker vessel to its fleet, signing a charter agreement with Estonian firm Elenger.

The deal will see Titan operate the bunker vessel *Optimus* to supply LNG and liquefied biomethane (LBM) at the ports of Amsterdam, Rotterdam, Antwerp and Zeebrugge.

“Titan has expanded its controlled fleet with the charter of a fifth vessel in a long-term agreement with Elenger,” a spokesperson for Titan said. “The *Optimus* arrived at the Port of Amsterdam on July 6th, giving Titan the opportunity to meet the crew and prepare them for bunkering in the ARA region.”

The *Optimus* has capacity for 6,000 cubic metres of fuel and will serve the Titan fleet alongside its other chartered and owned vessels such as *FlexFueller001*, *FlexFueller002*, *Green Zeebrugge*, and *Coral Fraseri*.

## Rebrand to focus on decarbonization

As well as delivering LNG bunker fuel all of Titan’s fleet can also handle LBM and this commitment to renewable fuels was behind the

firms recent rebranding from Titan LNG to simply Titan.

“As one of the first companies in Europe to provide safe delivery of LNG and LBM, we have proven ourselves to be pioneers in the market and continue to expand our services globally. Dropping the single product focus from our name reflects how we will use our expertise for other fuels that will emerge after LNG,” Niels den Nijs, CEO of Titan said. “Our extensive investment program for the immediate and long-term future is 100% dedicated to carbon neutral fuel infrastructure, such as LBM production plants and LBM bunker vessels.”

As well as a renewed focus on LBM the firm is also exploring the supply of name other fuels that decarbonize shipping and industry in a substantial way, such as hydrogen-derived green fuel.

## Decentralized LBM production

The firm is also investing in a new-build program on the back of the



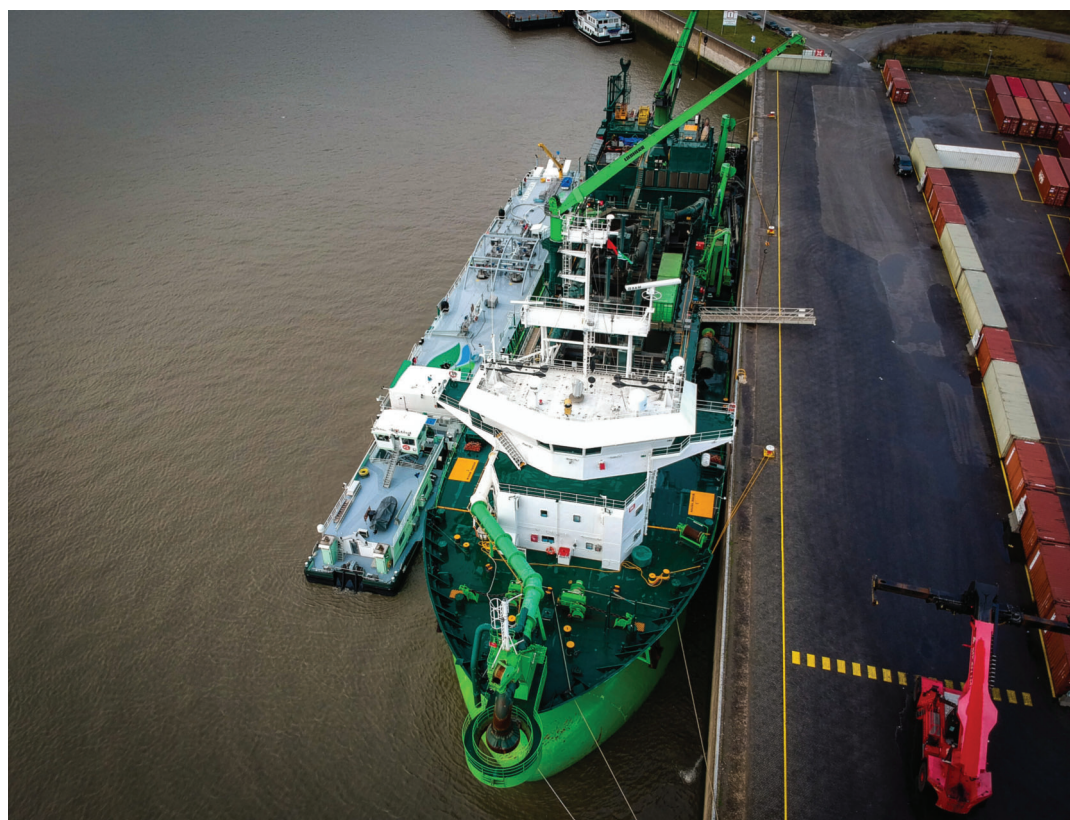
*Optimus* LNG vessel

long-term contracts and expects the first vessel from its Krios and Hyperion series to join the fleet in late 2024.

“Titan will only produce, source, and supply carbon neutral products that originate from second generation residues or renewable electricity to produce hydrogen from electrolysis, e-fuels, including hydrogen-derived e-methane, green methanol, and green ammonia,” a spokesperson for the firm said.

Titan recently partnered with Attero and Nordsol to secure €4.3 million in funding for a LBM production plant in Wilp in the Netherlands. This ambitious project, dubbed FirstBio2Shipping, aims to deliver the first decentralized production of LBM designated for use in the maritime industry next year.

Headquartered in Amsterdam, Titan is ISO certified and has been operating in the small-scale LNG sector for 10 years.



Titan bunker vessel

## NEWS NUDGES

### LNG price approaches record high

LNG bunker fuel is on track to hit record highs despite faltering demand in some core markets. LNG bunker sales fell significantly at the Port of Rotterdam in Q2 as Europe’s top bunkering hub also saw prices fast approaching all-time highs of \$3,319 per tonne set in March this year.

Ishaan Hemnani, CEO of BunkerEx, notes that the firm is currently seeing a “little more demand” but adds that this is “probably just the market building out or people expecting the spread to get even worse come winter”.

# DNV approves new LNG fuel supply system

Standards agency DNV GL has awarded Approval in Principle (AiP) for a new waste heat-derived LNG fuel supply system designed by Korea Shipbuilding & Offshore Engineering (KSOE).

The design utilises waste heat from engine cooling water as a heat source for LNG-fuelled ships and offers the potential for higher efficiency and lower emission profiles in future.

"I believe that AiP of this technology, proven by DNV, can provide more confidence in stakeholders' choices and support shipping industries to lower fuel price and CO2 emissions," Byeongyong

Yoo, Vice president of KSOE, said.

## Hi-eGAS platform

The Hi-eGAS system proposed by KSOE subsidiary Hyundai Heavy Industries (HHI) utilizes a novel heat exchanger with low freezing risk, developed in cooperation with domestic equipment companies.

KSOE completed a successful 24-hour demonstration test last year at the LNG Cryogenic Me-

chanical Testing Certification Center of the Korea Institute of Machinery and Materials. This test simulated the conditions a large vessel under maximum fuel supply. The AiP will now allow the partners to progress to the next stage of development and testing.

"KSOE and HHI are leading the development of reducing carbon emissions and high-efficiency ship technology that increases the

competitiveness of LNG fuel propulsion ships," Yoo added.

## LNG demand swells

DNV predicts that LNG is expected to become a primary fuel for ships in the coming years with a total of 805 LNG-fuelled vessels currently on order or in operation, and a further 229 LNG-ready vessels, according to the firm's Alternative Fuels Insight (AFI) platform.

"DNV aims to support the transition of the shipping and shipbuilding industries to a cleaner, green future. Our role is to ensure the new technology will offer better solutions to the maritime industry in a continually evolving fuel landscape," Vidar Dolonen, Regional Manager DNV Maritime Korea & Japan, commented.

DNV reports that more than 150 LNG-fuelled vessels have been ordered so far in 2022 alone. ■



Hi-eGas LNG fuel supply system

# MAN signs LTSA for Nantes Saint-Nazaire LNG dredger

Engine manufacturer MAN Energy Solutions has signed a long-term service agreement (LTSA) with GIE Dragages-Ports for maintenance of its first LNG-fuelled dredger.

The *Samuel de Champlain* dredger is operated by Grand Port Maritime de Nantes Saint-Nazaire and operates in the Loire and Seine estuaries in the northwest of France. The vessel features MAN 6L35/44DF engines and has capacity for 8,500 cubic metres of LNG.

"Based on the experience we had with MAN Energy Solutions when converting the dredger, we wanted to renew our trust in the MAN Energy Solutions team that has a great deal of expertise," Hubert Louys, Maintenance Manager for Dragages-Ports, said.

## Optimised maintenance plans

The contract will see MAN PrimeServ, the firm's after-sales service brand, supply spare parts and provide preventative-maintenance services for a provisional eight-

year period.

"We are happy to continue our partnership on this project beyond the installation of the new engine, carried out in 2019. Work to optimise maintenance plans has since been carried out in close collaboration with GIE to ensure the dredger's increased availability," Jordan Morvan, Project Manager, MAN Energy Solutions France, said.

The vessel was initially converted from diesel to LNG with the installation of three MAN dual-fuel engines and was the first retrofit of its kind in Europe as well as the first French-flagged LNG-fuelled dredger.

MAN will now provide inspection kits and preventative maintenance services as well as remote assistance, via PrimeServ Assist, and engine-fluid analysis, via PrimeServ LAB.



Samuel de Champlain dredger

## Outstanding load capacity

The new contract highlights both partners commitment to LNG as a fuel of choice for heavy-lift operations.

"The MAN 35/44DF propulsion solution has exceptional performance criteria and a small environmental footprint. Its selection was due to certain, crucial characteristics," a spokesperson for GIE

Dragages-Ports said, emphasizing the 'outstanding load capacity' and the ability to 'start in gas mode' as well as dredge 'continuously in gas mode'.

Headquartered in Rouen, France, GIE Dragages-Ports owns a fleet of seven dredgers, and conducts operations in eight major ports along France's Atlantic, English Channel and North Sea coastlines. ■



# Power Play AWARDS

Presented by **ExxonMobil**

## Thank you to all who submitted nominations for the 2022 Power Play Awards!

This year's Power Play Awards will mark ExxonMobil LNG's fourth year supporting inclusion and diversity by connecting and celebrating women and men across the LNG industry. With nominations now closed, we are grateful for the expertise and time of our esteemed panel of judges to evaluate this year's nominees:



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**Célia Correia**  
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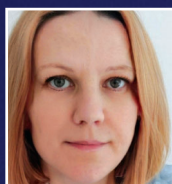
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**Jillian Evanko**  
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**Dr. Tolulupe Ijirona**  
*Electrical Engineer,  
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**Dena E. Wiggins**  
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# LNG

# ExxonMobil

# KR approves LNG-fuelled carbon dioxide carrier designs

Shipbuilding firm Hyundai Heavy Industries has received Approval in Principle from classification society Korean Register (KR) for its designs for a large LNG-fuelled carbon dioxide carrier.

The novel design is a concept only at this stage but KR and Hyundai predict that growing demand for carbon capture and storage may drive a new wave of vessels to transport the compound to designated sequestration sites.

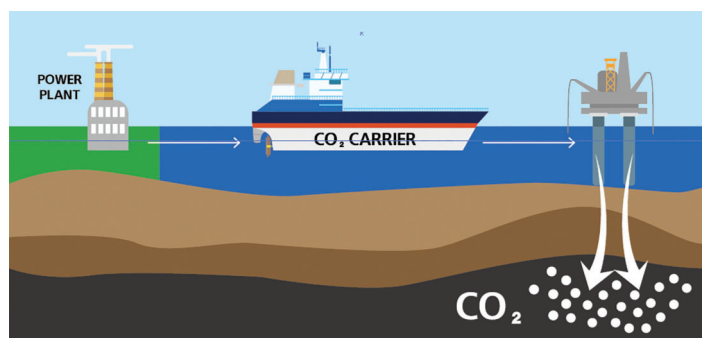
“This AIP is a significant achievement, bringing the commercialisation of large LCO2 carrier technology even closer,” a spokesperson for KR commented.

## Joint development project

Hyundai and KR worked closely on the design phase, with Hyundai creating the structural design, while KR verified safety and conformity as well as reviewing the class rules and international conventions.

The proposed vessel will feature a pressure C-Type cargo tank capable of carrying 40,000 cubic metres of liquefied carbon dioxide and withstanding vapour pressure of more than five atmospheres.

“KR will continue to support the industry’s work to develop CO2 capture, storage and burial-



LCO2 carrier

related technologies,” A KR official add, noting that the partners would work proactively “to address the industry-wide challenge of decarbonization.”

## Technical challenges

Approval for the design brings the vessel one step closer but KR cautions that a number of challenges remain in handling liquefied carbon dioxide.

“There are technical difficulties in enlarging the size of the tank to meet the market need to transfer a larger amount of CO2 to storage facilities,” a spokesperson for KR said. “In addition, the tanks and supporting structures of LCO2

carriers must be designed with the greatest care because of the high specific gravity of liquefied CO2.”

To create CO2 storage tanks of sufficient size, special materials with low-temperature and high-tensile will be used instead of ordinary steel, adding challenges in controlling the thickness and weight of the tanks. KR relied on its SeaTrust-HullScan software solution to verify and approve the safety of the carrier’s cargo hold, cargo tank and supporting structure.

Hyundai Heavy Industries is the world’s largest shipbuilding company and a major heavy equipment manufacturer. ■

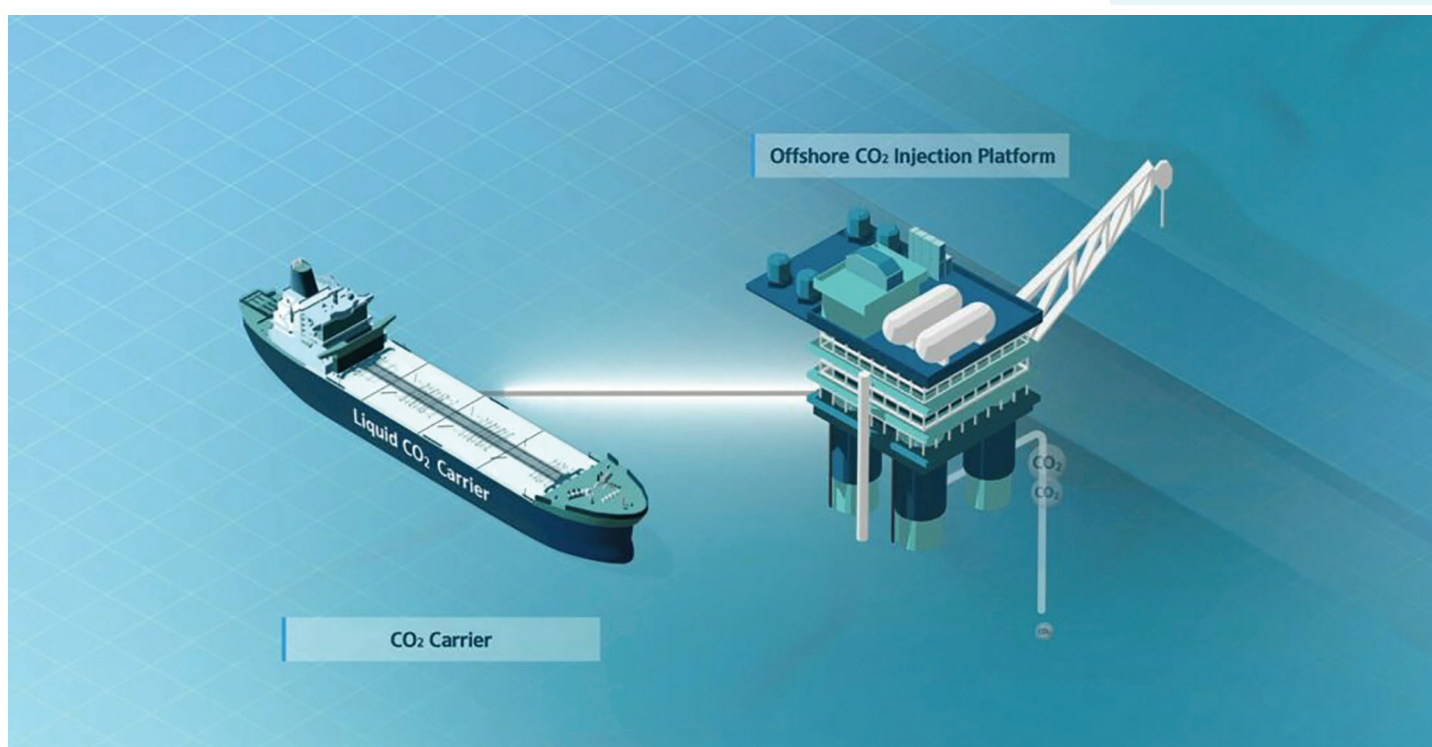
## NEWS NUDGES

### Yangtze receives Zhongyi 001

Chinese authorities have welcomed a new LNG bunkering barge, the *Zhongyi 001*, in the Three Gorges Reservoir in Hubei province, central China.

Measuring 90 metres in length, with a beam of 16 metres, and a depth of three metres, the *Zhongyi 001* was designed and built in compliance to China Classification Society (CCS) rules.

It will serve LNG-fuelled vessels passing through the Yangtze River and will be used for bunkering of both LNG and conventional fuel oil. The vessel has capacity for 500 cubic metres of LNG and can operate with fuels with a flash point greater than 60 degrees Celsius. The barge also features onboard cargo tanks for the transport of recovered sewage from other vessels.



CO2 carriers may drive a new wave of offshore infrastructure

## KNOT receives first LNG-fuelled shuttle tanker

Shipping firm Knutsen NYK Offshore Tankers (KNOT) has taken delivery of its first LNG-fuelled shuttle tanker, the *Frida Knutsen*.

The dual-fuel vessel was constructed by Daewoo Shipbuilding & Marine Engineering and will be chartered by ENI Trade & Biofuels, a subsidiary of Ente Nazionale Idrocarburi.

"The vessel will be KNOT's first dual-fuel shuttle tanker that can use not only heavy fuel oil but also LNG," a spokesperson for KNOT said, adding that the vessel will primarily use LNG fuel, as it is more environmentally friendly."

The vessel has gross tonnage of 85,500 tonnes, and measures 278 metres in length and 46 metres in breadth. It will sail under a Norwegian flag and registered by the Norwegian International Ship Register.

### Flexible power

The *Frida Knutsen* will be equipped with a VOC recovery system, to

collect volatile organic compounds generated from crude oil and limit their release into the atmosphere.

The new vessel will also feature a bespoke energy storage system (ESS) to control and optimise operation of shaft generator power. This system has been designed to improve engine responsiveness and reduce fuel consumption by increasing flexibility and reducing the frequency with which auxiliary equipment is required.

"Because ESS also works with the battery system, excess power from the shaft generator, when it generates more power than needed, is used to recharge the battery," a spokesperson for KNOT explained.

Designed for fuel transport from offshore oil fields, the shuttle tanker is used as an alternative to



The *Frida Knutsen*

construction of oil pipelines and will also offer KNOT the opportunity to interface with floating production, storage, and offloading (FPSO) units in deep water ocean fields.

Established in 2010, KNOT is a joint venture between family-run firm TS Shipping Invest (TSSI) and Japanese shipping giant Nippon Yusen Kaisha (NYK). TSSI is owned by CEO Trygve Seglem and his family and is parent com-

pany of Norwegian offshore specialist the Knutsen Group, which is headquartered in Haugesund, Norway. NYK is one of the largest shipping companies in the world with a fleet of more than 800 vessels.

The acquisition of the *Frida Knutsen* is part of NYK's sustainability strategy which aims to transform the firm into a sustainable solution provider by promoting low-carbon marine fuel. ■

## Keppel delivers first LNG-fuelled ship to Hawaii

Shipbuilder Keppel AmFELS has delivered the first LNG-fuelled ship to Hawaii, with cargo shipping firm Pasha Hawaii adding the containership *George III* to its fleet.

The new addition measures 235 metres in length and has capacity for 2,525 twenty-foot-equivalent (TEU) containers. It is the first of two new 'Ohana Class container-ships to join Pasha Hawaii's fleet. The new vessels are named in honour of George Pasha III and Janet Marie, the parents of the current CEO George Pasha IV.

"Today marks a moment in time that will be remembered by many of us, including my family and our incredible team members

at Pasha Hawaii who worked tirelessly to bring *MV George III* to life," George Pasha IV commented.

Established in 1999, the company has been family-run for three generations and developed strong shipping links between the US Pacific Coast and Hawaii. The new vessels will continue this tradition serving the Hawaii/Mainland trade lane.

### First IGF compliant vessel

The *George III* was built at Keppel

O&M's yard in Brownsville, Texas and will be one of the first LNG-powered vessels to serve the West Coast of the US.

"We are pleased to deliver Pasha Hawaii's first LNG-powered containership, which extends Keppel O&M's track record in providing solutions for the gas value chain. By working closely with Pasha Hawaii, we were able to resolve operational challenges posed by COVID-19 and deliver the vessel to their satisfaction. Built to Keppel O&M's proprietary design, the *M/V George III* exemplifies our engineering and design expertise as well as our in-depth experience in LNG," David Wedgeworth, President of Keppel AmFELS, said.

Fully Jones Act-compliant, the new vessel is the first IGF compliant vessel certified by the United States Coast Guard and surpasses International Maritime Organization (IMO) 2030 emission standards.

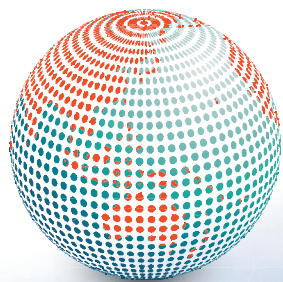
"We stand incredibly proud of the perseverance and commitment of our partners at Keppel AmFELS, and the skilled men and women at the shipyard on this tremendous accomplishment. We look forward to beginning service to Hawaii in August and taking delivery of the Janet Marie later this year," George Pasha IV added.

Keppel AmFELS is currently building Pasha Hawaii's second LNG-fuelled containership, as well as the first wind turbine installation vessel in the U.S for Dominion Energy, and a high-specification Trailing Suction Hopper Dredger for Manson Construction.

A wholly owned subsidiary of Singaporean group Keppel Offshore & Marine (Keppel O&M), Keppel AmFELS is involved in construction for the offshore, marine and energy industries as part of the group's global network of yards and offices. ■



The LNG-fuelled *George III*



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# LNG bunkering ports continue global expansion

The number of ports capable of bunkering LNG worldwide could top 200 within two years, according to the latest forecasts from shipping services company Clarksons Research.

The firm reports that there are already 147 ports offering LNG bunkering services around the globe and predicts that this number will rise rapidly as the energy transition accelerates over the next decade.

The findings, published in Clarkson's most recent LNG Trade & Transport report, suggest that geopolitical tensions may have helped to accelerate certain trends in the LNG sector as governments have scrambled to develop energy infrastructure.

"The LNG industry is experiencing a significant expansion phase, with recent focus on energy security enhancing an underlying growth outlook supported by Asian gas demand, energy transition dynamics and a significant LNG export project program," Steve Gordon, Managing Director of Clarksons Research, said.

## Record LNG-ready newbuild orders

The report estimates that 37% of all newbuild capacity currently under construction is LNG-ready, with a far higher share of LNG ves-



LNG bunkering in Singapore

sels amongst those ordered in the last six months.

"With the 'Fuelling Transition' gaining momentum, alternative fuel capable vessels have accounted for 62% of orders in 2022 so far in CGT terms, a record share, while the alternative fuel capable orderbook is now larger than ever before," James Allen, research analyst at Clarksons notes.

Increased demand for LNG fuel is expected to drive unprecedented

growth in global LNG trade, with Clarksons forecasting a 'positive and improved long-term outlook' with volumes projected to reach around 620 million tonnes by 2030.

## Multi-billion newbuild investments

This equates to an uplift of around 40 million tonnes compared to previous forecasts and is supported in part by a downgrade of European imports of Russian pipeline gas as well as continued Asian

demand growth, growth in liquefaction capacity and greater energy security necessities.

In combination these factors are expected to drive a new wave of investment in LNG infrastructure, with Clarkson forecasting a potential requirement for around US\$99 billion of newbuild investment between 2023 and 2030.

Headquartered in London, Clarkson is a provider of ship-broking service as well as maritime consultancy and research. ■



LNG bunkering at Port of Rotterdam



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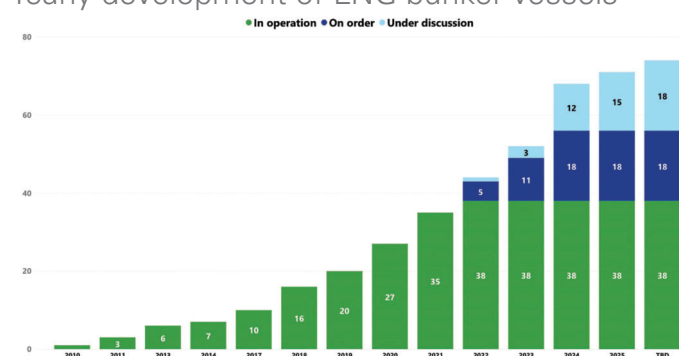
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## LNG BUNKER VESSELS

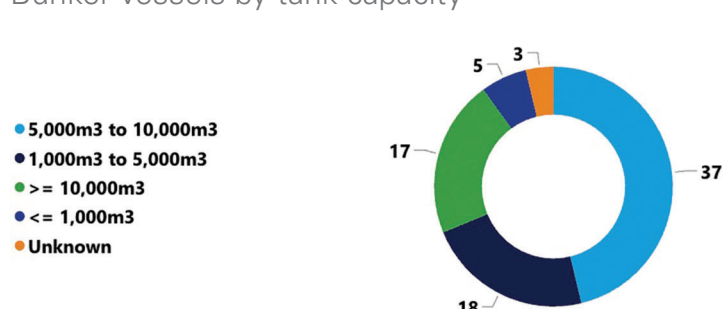
| Vessel Name                           | Home Port            | Project status   | Delivery year | Country         | LNG Tank Capacity | Owner                                                             | Operator                         |
|---------------------------------------|----------------------|------------------|---------------|-----------------|-------------------|-------------------------------------------------------------------|----------------------------------|
| Yidu inland river LNG bunker barge    | Yidu port            | In operation     | 2014          | China           | 500               | Xilan Natural Gas Group                                           | Xilan Natural Gas Group          |
| Gas Vitality                          | Marseille            | In operation     | 2021          | France          | 18600             | MOL                                                               | V Ships                          |
| FlexFueler 001                        | Amsterdam            | In operation     | 2019          | Netherlands     | 1480              | Titan LNG                                                         | Titan LNG                        |
| FlexFueler 002                        | Antwerp              | In operation     | 2021          | Belgium         | 1480              | Titan LNG                                                         | Titan LNG                        |
| Titan Hyperion                        | TBD                  | Under discussion | 2024          | Netherlands     | 8000              | Titan LNG                                                         | Titan LNG                        |
| Titan Krios                           | Zeebrugge            | Under discussion | 2024          | Belgium         | 4200              | Titan LNG                                                         | Titan LNG                        |
| PRO1                                  | Houston              | Undefined        | Q42022        | United States   | 7600              | LNG PRO Bunkers                                                   | TBN (Probunkers group company)   |
| PRO2                                  | Hong Kong            | Undefined        | Q12023        | Hong Kong       | 7600              | LNG PRO Bunkers                                                   | TBN (Probunkers group company)   |
| Coralius                              | Risavika             | In operation     | 2017          | Norway          | 5600              | Sirius Veder Gas                                                  | Sirius Rederi                    |
| Coral Methane                         | Rotterdam            | In operation     | 2018          | Netherlands     | 7551              | Anthony Veder                                                     | Shell                            |
| Crowley/Shell LNG bunker barge        | U.S. East Coast      | Decided          | 2024          | United States   | 12000             | Crowley Maritime Corporation                                      | Shell                            |
| New Frontier 1                        | Rotterdam            | In operation     | 2017          | The Netherlands | 6500              |                                                                   | Shell Shell                      |
| Seaspan LNG bunker vessel             | Vancouver            | Decided          | 2024          | Canada          | 7600              | Seaspan Marine Transportation                                     | Seaspan Marine                   |
| Seaspan LNG bunker vessel 2           | Vancouver            | Decided          | 2024          | North America   | 7600              | Seaspan Marine Transportation                                     | Seaspan Marine                   |
| Seaspan LNG bunker vessel 3           | Vancouver            | Under discussion | 2024          | North America   | 7600              | Seaspan Marine Transportation                                     | Seaspan Marine                   |
| Petronas LNGBV                        |                      | Under discussion | 2024          | Malaysia        | 13000             | Petronas                                                          | Petronas                         |
| Peninsula/Enagas LNG bunker vessel    | Port of Algeciras    | Decided          | 2023          | Gibraltar       | 12500             | Peninsula/Enagas                                                  | Peninsula/Enagas                 |
| Hai Gang Wei Lai                      | Yangshan Port        | In operation     | 2022          | China           | 20000             | Shanghai International Port                                       | Pacific Gas                      |
| Green Zeebrugge                       | Zeebrugge            | In operation     | 2017          | Belgium         | 5200              | NYK                                                               | NYK                              |
| Kairos                                | Lithuania            | In operation     | 2018          | Lithuania       | 7500              | Bernhard Schulte                                                  | Nauticor                         |
| Naturgy LNG bunker vessel             | Barcelona            | Undefined        | 2022          | Spain           | 6000              | Naturgy                                                           | Naturgy                          |
| Gas Agility                           | Northern Europe      | In operation     | 2020          | Netherlands     | 18600             | Mitsui OSK Lines Ltd                                              | Mitsui OSK Lines Ltd             |
| SM JEJU LNG2                          | Busan                | In operation     | 2020          | South Korea     | 7500              | Korea Line                                                        | Korea Line                       |
| Korea Gas (KOGAS) LNG bunker vessel   |                      | Decided          | 2023          | South Korea     | 7500              | KOGAS                                                             | KOGAS                            |
| Pioneer Knutsen                       |                      | In operation     | 2020          | Norway          | 1100              | Knutsen OAS Shipping                                              | Knutsen OAS Shipping             |
| LNG bunker barge shell                | Barcelona            | Decided          | 2022          | Spain           | 5000              | Scale Gas / Knutsen JV                                            | Knutsen OAS Shipping             |
| Q-LNG 4000                            | Port Canaveral, FL   | In operation     | 2020          | United States   | 4000              | Q-LNG                                                             | Harvey Gulf International Marine |
| Q-LNG ATB Bunker Barge 8000 TBD       |                      | Under discussion | TBD           | United States   | 8000              | Q-LNG                                                             | Harvey Gulf International Marine |
| Dmitry Mendelev                       |                      | In operation     | 2021          | Europe          | 5800              | Shturman Koshelev LLC                                             | Gazpromneft Marine Bunker Ltd    |
| FueLNG Bellina                        | Singapore            | In operation     | 2020          | Singapore       | 7500              | FueLNG (JV Keppel and Shell)                                      | FueLNG                           |
| Fratelli Cosulich Mediterranean Sea   | Mediterranean Sea    | Decided          | 2023          | Italy           | 8000              | Fratelli Cosulich                                                 | Fratelli Cosulich LNG            |
| Fratelli Cosulich Mediterranean Sea 2 | Mediterranean Sea    | Decided          | 2024          | Italy           | 8000              | Fratelli Cosulich                                                 | Fratelli Cosulich LNG            |
| Clean Jacksonville                    | Jacksonville Jax LNG | In operation     | 2018          | United States   | 2200              | TOTE                                                              | FOSS Maritime                    |
| Xinao Putuo Hao                       | Zhoushan             | Decided          | 2022          | China           | 8500              | ENN Energy                                                        | ENN Energy                       |
| Optimus                               |                      | In operation     | 2021          | Europe          | 6000              | Eesti Gaas                                                        | Elenger                          |
| Ecobunker Tokyo Bay                   | Yokohama             | Decided          | 2022          | Japan           | 2500              | Ecobunker shipping                                                | Ecobunker shipping               |
| Kaguya (Central Japan)                | Chubu region         | In operation     | 2020          | Japan           | 3500              | CLS (JV established by K Line, JERA, NYK and Toyota Tsusho Corp.) | CLMF (JV by CLS partners)        |
| Oizmendi                              | Huelva               | In operation     | 2018          | Spain           | 600               | Cepsa                                                             | Cepsa                            |
| Seagas                                | Stockholm (Louden)   | In operation     | 2013          | Sweden          | 187               | Gasum                                                             | AGA                              |
| Avenir Accolade                       |                      | In operation     | 2021          | Brazil          | 7500              | Avenir LNG                                                        |                                  |
| Avenir Achievement                    | Caribbean-US Region  | Decided          | Q2 2022       | America         | 20000             | Avenir LNG                                                        |                                  |
| Avenir Advantage                      |                      | In operation     | 2020          | Malaysia        | 7500              | Avenir LNG                                                        |                                  |

| Vessel Name                                          | Home Port                   | Project status   | Delivery year    | Country       | LNG Tank Capacity | Owner                              | Operator |
|------------------------------------------------------|-----------------------------|------------------|------------------|---------------|-------------------|------------------------------------|----------|
| Avenir Ascension                                     | Oristano, Sardinia          | Decided          | 2022             | Europe        | 7500              | Avenir LNG                         |          |
| Avenir Aspiration                                    | Oristano, Sardinia          | In operation     | 2021             | Europe        | 7500              | Avenir LNG                         |          |
| Bergen LNG                                           | Bergen                      | In operation     | 2021             | Norway        | 850               | Bergen Tankers                     |          |
| Brassavola                                           | Singapore                   | Decided          | 2022             | Singapore     | 12000             | Mitsui OSK Lines Ltd               |          |
| Bunker Breeze                                        | Algeciras                   | In operation     | 2018             | Spain         | 1200              | Suardiaz Energy Shipping           |          |
| Clean Canaveral                                      | Jacksonville, FL            | In operation     | 2021             | United States | 5400              | Polaris New Energy                 |          |
| Coral Anthelia                                       |                             | In operation     | 2013             | Jamaica       | 6500              | Anthony Veder                      |          |
| Coral EnergiCE                                       | Risavika                    | In operation     | 2018             | Europe        | 18000             | Anthony Veder                      |          |
| Coral Energy                                         | Risavika                    | In operation     | 2013             | Europe        | 15000             | Anthony Veder                      |          |
| Coral Favia                                          |                             | In operation     | 2010             | Russia        | 10000             | Anthony Veder                      |          |
| Coral Fraseri                                        | Unknown                     | In operation     | 2019             | Global        | 10000             | Anthony Veder                      |          |
| Coral Fungia                                         |                             | In operation     | 2011             | Russia        | 10000             | Anthony Veder                      |          |
| Coral Furcata                                        |                             | In operation     | 2011             | --            | 10000             | Anthony Veder                      |          |
| Cryopeak LNG                                         | Vancouver                   | Under discussion | 2022/3           | Canada        | 4000              | Cryopeak                           |          |
| DEPA Limassol                                        | Limassol                    | Undefined        | 2022             | Greece        | 4000              | DEPA                               |          |
| DEPA Piraeus                                         | Piraeus                     | Undefined        | 2022             | Greece        | 4000              | DEPA                               |          |
| Domestic LNG Bunkering Vessel in China               | To be decided (China)       | Decided          | 2024             | China         | 12000             | CNOOC                              |          |
| Domestic LNG Bunkering Vessel in China               | To be decided (China)       | Under discussion | 2024             | China         | 6000              | CNOOC                              |          |
| FlexFueler 003                                       | Zeebrugge                   | Under discussion | TBD              | Belgium       | 1480              | Titan LNG                          |          |
| FlexFueler 004                                       | Lubeck                      | Under discussion | TBD              | Germany       | 1480              | Titan LNG                          |          |
| FSU and Bunker Barge                                 | Port of Coega / Algoa Bay   | Under discussion | 2023             | South Africa  | 144994            |                                    |          |
| FSU and LNG Bunker Barge Port of Coega, South Africa | Port of Coega               | Under discussion | 2023             | South Africa  | 10000             | DNG Energy                         |          |
| K. Lotus                                             | Rotterdam                   | In operation     | 2022             | Europe        | 18000             | Korea Line                         |          |
| Kanfer Shipping LNG bunker vessel 1                  | Not yet decided             | Under discussion | 2024             | --            | 6000              | Kanfer Shipping                    |          |
| KEYS Bunkering West Japan LBV                        | Kyushu and Setouchi regions | Decided          | 2024             | Japan         | 3500              | KEYS Bunkering West Japan Co       |          |
| Korea Line/Shell LBV                                 | Singapore                   | Decided          | 2023             | Singapore     | 18000             | Korea Line                         |          |
| LNG bunker barge GALP                                |                             | Under discussion | 2024             | Portugal      |                   | GALP                               |          |
| LNG bunker vessel Swinoujscie                        | Swinoujscie                 | Under discussion | 2025             | Poland        |                   | Polskie LNG                        |          |
| LNG London                                           | Rotterdam                   | In operation     | 2019             | Netherlands   | 2998              | LNG Shipping (Victrol & Sogestran) |          |
| Oceania Marine Energy                                | Dampier                     | Under discussion | 2025             |               |                   | Kanfer Shipping                    |          |
| Oceania Marine Energy LBV                            | Dampier                     | Under discussion | 2024             | Australia     | 6000              | Kanfer Shipping                    |          |
| Polaris ATB No. 2                                    | Jacksonville, FL            | Decided          | 2024             | United States | 5500              | Polaris New Energy                 |          |
| Poseidon Med II bunkering barge                      | Revithoussa                 | Under discussion | 2024             | Europe        | 4000              | Venture led by DEPA                |          |
| Scale Gas Algeciras                                  | Algeciras                   | Undefined        | 2023             | --            | 12500             | Scale Gas                          |          |
| Shell LBV Gulf of Mexico                             | Gulf of Mexico              | Decided          | 2023             | United States | 18000             | Pan Ocean                          |          |
| SM JEJU LNG1                                         |                             | In operation     | 2019             | --            | 7500              | Korea Line                         |          |
| Small LNG bunkering vessel in South Korea            |                             | Decided          | 2023             | South Korea   | 500               | Ministry of Oceans and Fisheries   |          |
| Woodside Western Australia LNG bunker vessel         |                             | Dampier          | Under discussion |               | 2025              | Australia                          | 12000    |

## Yearly development of LNG bunker vessels



## Bunker vessels by tank capacity



## 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  | Pelita Energy            | 18,800 | LNG              | Malaysia - Japan          | Yes               | Perbadanan/NYK        |
| 2000  | Triputra                 | 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  | Coral Favia              | 10,000 | LNG/LPG/Ethylene | Worldwide                 | No                | Anthony Veder         |
| 2010  | Coral Fraseri            | 10,000 | LNG/LPG/Ethylene | Worldwide                 | No                | Anthony Veder         |
| 2011  | Coral Furcata            | 10,000 | LNG/LPG/Ethylene | Worldwide                 | No                | Anthony Veder         |
| 2011  | Coral Fungia             | 10,000 | LNG/LPG/Ethylene | Worldwide                 | No                | Anthony Veder         |
| 2011  | Akebono Maru             | 3,556  | LNG              | Japan                     | Yes               | Chuo Kaiun            |
| 2011  | Vision Spirit            | 12,000 | LNG/LPG/Ethylene | Worldwide                 | No                | Teekay                |
| 2011  | Unikum Spirit            | 12,000 | LNG/LPG/Ethylene | Worldwide                 | No                | Teekay                |
| 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     |
| 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  | PetroChina TBN           | 30,000 | LNG              | China                     |                   | PetroChina            |
| 2016  | Hai Yang Shi You 301     | 30,000 | LNG              | Bali FSU                  | Yes               | CETS (CNOOC)          |
| 2016  | Clean Jacksonville       | 2,200  | LNG              | US Coast                  | Yes               | CME                   |
| 2016  | JS Ineos Indepence       | 27,500 | LNG/Ethylene     | Markus Hook - Rafnes      | Ethane, for Ineos | Evergas               |
| 2016  | JS Ineos Innvovation     | 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         |
| 2017  | Coralius                 | 5,800  | LNG              | Northwest Europe/Baltics  | Yes, for Skangas  | Anthony Veder         |
| 2017  | Coral EnergICE           | 18,000 | LNG              | Northwest Europe/Baltics  | Yes               | Anthony Veder         |
| 2017  | Coral Encanto            | 30,000 | LNG              | China                     | Yes               | Anthony Veder         |
| 2017  | JS Ineos Invention       | 27,500 | LNG/Ethylene     | Markus Hook - Rafnes      | Ethane, for Ineos | Evergas               |
| 2017  | JS Ineos Intuition       | 27,500 | LNG/Ethylene     | Markus Hook - Rafnes      | Ethane, for Ineos | Evergas               |
| 2017  | Oizmendi                 | 600    | LNG              | Spain                     | Yes               | Itsas Gas             |
| 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  | Green Zeebrugge          | 5,000  | LNG              | Northwest Europe          | Yes               | NYK                   |
| 2017  | New Frontier 1           | 6,500  | LNG              | Northwest Europe          | Yes               | Shell                 |
| 2018  | Kairos                   | 7,500  | LNG              | Baltic                    | Yes               | Bernhard Schulte      |
| 2018  | LNG London               | 3,000  | LNG              | Northwest Europe          | Yes               | Shell                 |
| 2018  | Shell Bunker Barge TBN 2 | 6,500  | LNG              | Northwest Europe          | Yes               | Shell                 |
| 2018  | Shell Bunker Barge TBN 3 | 6,500  | LNG              | Northwest Europe          | Yes               | Shell                 |

| Built | Name                  | CBM    | Cargo Type | Trading area  | Trading in LNG? | Ship Owner / Operator        |
|-------|-----------------------|--------|------------|---------------|-----------------|------------------------------|
| 2018  | Bunker Breeze         | 1,200  | LNG        | Barcelona     | Yes             | Suardiaz Energy Shipping     |
| 2018  | HUA XIANG 8           | 13,720 | LNG        | China         | Yes             | Zhejiang Huaxiang            |
| 2019  | SM Jeju LNG1          | 7,500  | LNG        | Korea         | Yes             | Korea Line                   |
| 2019  | Gas Agility           | 18,600 | LNG        | NWE           | Yes             | MOL                          |
| 2019  | Flexfueller 001       | 1,480  | LNG        | Amsterdam     | Yes             | Titan LNG                    |
| 2020  | Avenir Advantage      | 7,500  | LNG        | Mediterranean | Yes             | Avenir LNG                   |
| 2020  | Avenir Accolade       | 7,500  | LNG        | Mediterranean | Yes             | Avenir LNG                   |
| 2020  | Avenir Aspiration     | 7,500  | LNG        |               | Yes             | Avenir LNG                   |
| 2020  | Kaguya                | 3,500  | LNG        | Japan         | Yes             | CLS                          |
| 2020  | CNTIC VPOWER Global   | 28,000 | LNG        | Myanmar       | Yes             | Dalian Inteh Group           |
| 2020  | Ecobunker Tokyo Bay   | 2,500  | LMG        | Japan         | Yes             | Ecobunkers                   |
| 2020  | Optimus               | 6,000  | LNG        | NWE           | Yes             | Elenger                      |
| 2020  | FueLNG Bellina        | 7,500  | LNG        | Singapore     | Yes             | FueLNG                       |
| 2020  | SM Jeju LNG2          | 7,500  | LNG        | Korea         | Yes             | Korea Line                   |
| 2020  | Q-LNG 4000            | 4,000  | LNG        | US Coast      | Yes             | Q-LNG Transport/Harvey Gulf  |
| 2020  | Flexfueller 002       | 1,480  | LNG        | Antwerp       | Yes             | Titan LNG                    |
| 2021  | Xin Ao Pu Tuo Hao     | 8,500  | LNG        | China         | Yes             | ENN                          |
| 2021  | Avenir Ascension      | 7,500  | LNG        |               | Yes             | Avenir LNG                   |
| 2021  | Hai Gang Wei Lai      | 20,000 | LNG        | China         | Yes             | SSES                         |
| 2021  | Bergen LNG            | 850    | LNG        | Norway        | Yes             | Bergen Tankers               |
| 2021  | Dmitry Mendelev       | 5,800  | LNG        | Russia        | Yes             | Gazprom Neft                 |
| 2021  | JMU TBN               | 2,500  | LNG        | Japan         | Yes             | JMU                          |
| 2021  | Ravenna Knutsen       | 30,000 | LNG        | Mediterranean | Yes             | Knutsen OAS                  |
| 2021  | Brassavola            | 12,000 | LNG        | Singapore     | Yes             | MOL                          |
| 2021  | Gas Vitality          | 18,600 | LNG        | Mediterranean | Yes             | MOL                          |
| 2021  | TG TBN                | 500    | LNG        | Korea         | Yes             | Trans Gas                    |
| 2021  | Titan Hyperion        | 8,000  | LNG        | Benelux       | Yes             | Titan LNG                    |
| 2022  | Coral Nordic          | 30,000 | LNG        | Worldwide     | Yes             | Anthony Veder                |
| 2022  | Avenir Achievement    | 20,000 | LNG        | Worldwide     | Yes             | Avenir LNG                   |
| 2022  | Haugesund Knutsen     | 5,000  | LNG        | Spain         | Yes             | Knutsen OAS                  |
| 2022  | Clean Cañaveral       | 5,400  | LNG        | USG           | Yes             | PNE                          |
| 2022  | K.Lotus               | 18,000 | LNG        | Korea         | Yes             | K Line                       |
| 2023  | Cryopeak TBA          | 4,000  | LNG        | West Canada   | Yes             | Cryopeak                     |
| 2023  | Knutsen TBN           | 12,500 | LNG        | Spain         | Yes             | Knutsen OAS                  |
| 2023  | SM Jeju LNG3          | 7,500  | LNG        | Korea         | Yes             | Korea Line                   |
| 2023  | Pan Ocean TBN         | 18,000 | LNG        | USG           | Yes             | Pan Ocean Co                 |
| 2023  | Krios                 | 4,200  | LNG        | Benelux       | Yes             | Titan LNG                    |
| 2023  | Fratelli Cosulich TBN | 8,000  | LNG        | Mediterranean | Yes             | Fratelli Cosulich            |
| 2023  | Kanfer TBN            | 6,000  | LNG        | Worldwide     | Yes             | Kanfer Shipping              |
| 2023  | Kanfer TBN            | 6,000  | LNG        | Worldwide     | Yes             | Kanfer Shipping              |
| 2023  | PNE TBN               | 5,500  | LNG        | USG           | Yes             | PNE                          |
| 2024  | Avenir TBN (option)   | 20,000 | LNG        | Worldwide     | Yes             | Avenir LNG                   |
| 2024  | Avenir TBN (option)   | 20,000 | LNG        | Worldwide     | Yes             | Avenir LNG                   |
| 2024  | TBN                   | 30,000 | LNG        | Australia     | Yes             | Anthony Veder ?              |
| 2024  | Crowley TBN           | 12,000 | LNG        | US Coast      | Yes             | Crowley Maritime             |
| 2024  | CNOOC TBN             | 12,000 | LNG        | China         | Yes             | CNOOC                        |
| 2024  | TBN                   | 12,500 | LNG        | Worldwide     | Yes             | ???                          |
| 2024  | Keys TBN              | 3,500  | LNG        | Japan         | Yes             | Keys Bunkering West Japan Co |
| 2024  | Seaspan TBN 1         | 7,600  | LNG        | Canada        | Yes             | Seaspan ULC                  |
| 2024  | Fratelli Cosulich TBN | 8,000  | LNG        | Mediterranean | Yes             | Fratelli Cosulich            |
| 2025  | Seaspan TBN 2         | 7,600  | LNG        | Canada        | Yes             | Seaspan ULC                  |
| 2026  | Avenir TBN (option)   | 20,000 | LNG        | Worldwide     | Yes             | Avenir LNG                   |
| 2026  | Avenir TBN (option)   | 20,000 | LNG        | Worldwide     | Yes             | Avenir LNG                   |