

LNG Fuelling

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DNV GL launches LNG fuel finder tool

Standards agency DNV GL has launched a new LNG Fuel Finder service which allows shipowners and charterers to connect with LNG suppliers and register demand.

Interested parties can register to use the tool free of charge and receive updates on availability of LNG as a fuel in their operating region. The tool will capture information about location, volume and dates that are in demand for LNG bunkering and is designed to feed into feasibility planning for newbuild fleets.

The new service forms part of DNV GL's paid-for LNGi business intelligence portal and will be first demonstrated at the Nor-Shipping trade fair in Oslo.

"The question of bunkering availability is still a major stumbling block for shipowners looking to make their first moves in LNG as a marine fuel," Martin Wold, Senior Consultant Environmental Advisory at DNV GL, said.

Overcoming LNG fuelling entry barriers

With LNG fuelling infrastructure still in its infancy in many regions the ability for shipowners to make bunker operators aware of their interest is expected to benefit both parties and help justify new investment in facilities by identifying demand hotspots.

"Many LNG suppliers find it difficult to aggregate sufficient demand to justify investment decisions... The LNG Fuel Finder



The LNGi portal displays LNG bunkering map of Europe

helps these two parties come together, by providing shipowners with the opportunity to show the supply industry their interest in LNG bunkering. It also helps to overcome the high entry barrier for new suppliers to the market," Wold added.

Next phase to incorporate AIS tracking

DNV GL's LNGi portal launched in March this year and now has 20 members including industry coalition SEA/LNG, Shell, Rolls-Royce and MAN. The firm is currently working on a suite of features to expand the information sharing capabilities of the service.

"In the future, we plan to incorporate additional market intelligence features in the tool... Other new features include AIS tracking of LNG bunker vessels, additional data on LNG-fuelled ships, insights on the most frequently visited ports as well as the new lean version of LNGi, which is free of charge," Wold said.

DNV GL is the world's largest classification society responsible for 13,175 vessels and mobile offshore units. Headquartered in Bærum in Norway the organization also provides technical consultancy to the energy and transport sectors.

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Petronas joins Gas4Sea LNG consortium

Malaysian energy major Petronas has signed a memorandum of understanding with industry consortium Gas4Sea.

The non-binding will see Petronas join the collaborative platform to promote LNG as a preferred marine fuel and explore new opportunities in the sector.

The firm will join founding members of the consortium: French electric utility Engie, Japanese technology firm Mitsubishi Corporation and shipping group NYK Line.

"The collaboration is expected to enhance Petronas' strong presence in the integrated LNG value chain and diversified LNG market portfolio. Petronas is looking at ways to further promote the consumption of LNG beyond the existing markets portfolios, and advocating LNG as marine fuel is a new frontier for the LNG sector," Ezhar Yazid Jaafar, CEO of Petronas, said.

Diversified portfolio to add proficiency

Petronas will bring over 40 years of experience in the oil and gas industry and is expected to help improve the LNG value chain for the partners via its understanding of globally integrated oil and gas operations.

Petronas has diversified its LNG supply portfolio in recent years with the addition of Australia Gladstone LNG and Petronas' First Floating LNG Facility in offshore Sarawak.

Gas4Sea to expand on Zeebrugge LNG operations

The Gas4Sea initiative was launched last year and bunkered its first vessel with LNG at Fluxys'



Representatives from Petronas, Engie, Mitsubishi, NYK and MISC at the MoU signing ceremony (from left)- Yuji Toshima from Mitsubishi Corp's, Denis Bonhomme (Engie SA), Takahiro Nito (NYK), Faizul Ismail (MISC Bhd), and Ezhar Yazid Jaafar

LNG terminal in the Belgian port of Zeebrugge in February. The vessel - *Engie Zeebrugge* - is the first to operate under the Gas4Sea brand and supplies LNG fuel for United European Car Carriers' new dual fuel car carriers operating in the North Sea and Baltic Sea.

Members of the Gas4Sea

partnership have signed a wide range of ancillary agreements for the development of LNG fuelling with ENGIE having signed a Memorandum of Understanding with French shipping line CMA CGM to explore the use of LNG as an alternative to heavy fuel oil for maritime transportation.

MOL to build LNG-fuelled tug

Japanese shipping conglomerate Mitsui O.S.K. Lines (MOL) has announced plans to develop and build an LNG-fuelled tugboat.

The proposed vessel will be the first LNG-fuelled tugboat in Japan and is slated for construction at Kanagawa Dockyard. The tugboat will be designed in accordance with IGF code and will feature engines supplied by manufacturer Yanmar.

It is scheduled to enter service in Osaka Bay in April 2019 and will be operated by Kobe-based ship management firm Nihon Tug-Boat. LNG fuel for the vessel will be supplied by Osaka Gas.

"[It] will be the first LNG-fueled tugboat to escort large-scale freighters in Osaka Bay and the Seto Inland Sea. The development of this tugboat will also spur the initial development of an LNG fuel supply system for vessels in Osaka Bay," a

spokesperson for MOL commented.

Design to build on Ishin Next concept

The engines supplied by Yanmar will be dual fuel compliant and capable of high-speed operation and the overall design will form part of MOL's Ishin Next Smart Ship Project that is focused on technology development along the two axes of improving vessel safety and re-

ducing environmental impact.

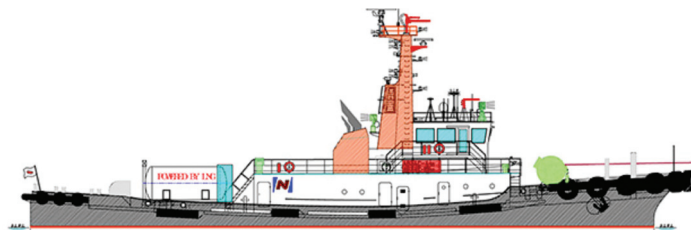
"MOL continually strives to promote and expand its environment and emission-free businesses, seizing opportunities presented by efforts to reduce the environmental impact of the global shipping industry," MOL said in a statement.

As a subsidiary of Mitsui, one of Japan's largest corporate groups, MOL has consistently backed a strategy for increased LNG fuelling

within its own fleets. Last year subsidiary Mitsui Engineering & Shipbuilding acquired German LNG tank and systems manufacturer and designer TGE Marine to further its growth.

In February this year MOL established its Bunker Business Office to accelerate LNG initiatives and solutions for refuelling vessel. This new division is spearheading a number of initiatives to establish MOL's presence in the LNG fuelling sector.

"[The Bunker Business Office] will accelerate initiatives concerning vessels with engines that use alternative fuel such as LNG [and] participate in LNG and other fuel supply businesses in an integrated fashion," a spokesperson for MOL said.



Artist's rendition of LNG-fuelled tugboat

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Port of Montréal launches LNG bunker facility

Energy provider Gaz Métro and the Montréal Port Authority have announced the opening of new LNG fuelling facilities at the Port of Montreal.

Canadian shipping firm Groupe Desgagnés will be amongst the first adopters of the service as it rolls out a fleet of newbuild LNG-fuelled vessels. Gaz Metro will deliver LNG under a long-term supply agreement and will operate the facility via a subsidiary.

"This system will be available to all owners in Quebec whose fleet passes through the Port of Montreal. In sum, this is an important milestone for the entire shipping industry," a spokesperson for Gaz Metro said.

Damia Desgagnés to mark first bunkering operations

LNG fuelling operations at the new facility will commence with the vessel *Damia Desgagnés*, the first dual-fuel asphaltbitumen-chemical tanker in the world.

"The addition of the *Damia Desgagnés* to our fleet is the result of tremendous work, many innovations and a good dose of audacity; she is a source of great pride," Louis-Marie Beaulieu, CEO of Desgagnés, said, adding that the ship



LNG vessel at the port of Montreal

was a "tangible demonstration" of Desgagnés's global vision and commitment to "environmentally-friendly marine transportation".

The ship represents an investment of \$55 million and is one of four similar vessels recently purchased by Groupe Desgagnés. It is the first Canadian-flagged dual-fuel tanker vessel and the only Canadian-flagged asphalt tanker.

"I praise Groupe Desgagnés' forward thinking, which is very inspiring for Québec's maritime

industry. The Port of Montreal shares this vision to exercise positive leadership in sustainable development practices and, in this context, the LNG fuel supply solution that will be available on our docks is another significant and concrete action toward making commercial shipping even more environmentally friendly," Sylvie Vachon, CEO of the Montreal port Authority, said.

Damia Desgagnés features 15,000 m³ tanks

The *Damia Desgagnés* incorporates tanks with capacity of almost 15,000 cubic metres and was built at the Besiktas shipyard in Turkey. It features a double-hull and Polar 7 certification for navigation in ice-laden waters,

and is equipped with a variable pitch propeller as well as bow and stern thrusters.

Gaz Metro and the Port of Montreal recently completed the US\$120 million expansion of their LNG liquefaction plant in Montreal in partnership with contractor Linde. The expansion has tripled the plant's capacity, which now has a total annual production capacity of over nine-billion cubic feet of LNG.

"We are now in a position to maximize the potential of LNG and are more capable than ever of meeting the energy needs of mines and industries far from the gas network as well as those in the heavy road and maritime transportation sector," Brochu said.

“... the *Damia Desgagnés* is a “tangible demonstration” of Desgagnés’s global vision and commitment to “environmentally-friendly marine transportation”

Louis-Marie Beaulieu, CEO, Desgagnés

NEWS NUDGES

SHI eyes bunker markets with LNGC contract wins

Shipbuilder Samsung Heavy Industries has signed a contract to build two small-scale LNGCs at a total of US\$100 million and announced its intention to develop its offering in LNG fuelling.

"Increase in LNG demand in China and Southeast Asia is expected to call for demand for near-sea transport utilizing small-scale LNGCs...The contract

also signifies SHI's entering into promising small-scale LNGCs and LNG-bunkering markets," a spokesperson for SHI said.

The LNG carriers will be equipped with KC-1 cargo containment system designed in Korea and will feature capacity for 7,500 cubic metres of LNG. Both vessels will be built for energy major KOGAS and will be used to transport LNG from Tongyeong, Gyeongsangnam-do, to Jeju Island.

LNG bunker vessel Coralius named in ceremony

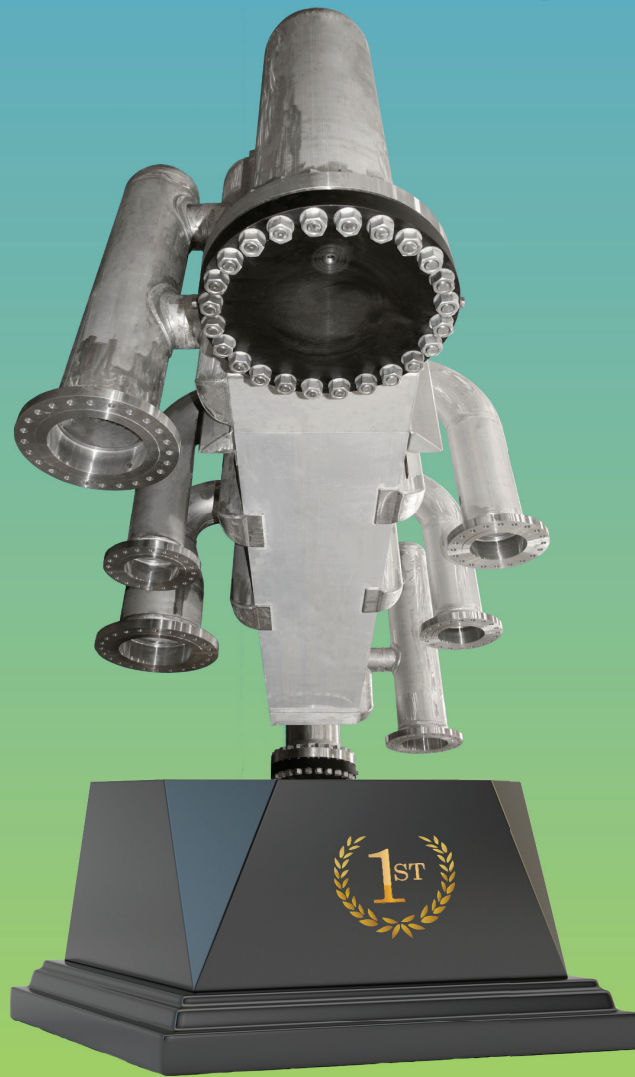
Officials from Nordic gas specialists Skangas and Gasum have held a naming ceremony for the first European built LNG bunker and distribution vessel, *Coralius*.

The 1A Ice Classed *Coralius* is designed to safely discharge large quantities of LNG to its receiving vessel in a short period of time and is equipped

with La flat working deck is engineered for safe side-by-side operations.

"It is a very valuable add-on to our existing bunkering methods of truck and terminals along the coast. Thanks to *Coralius*, from July onwards, our customers are going to experience swifter and more flexible bunkering operations than ever before," Kimmo Rahkamo, Chief Executive Officer of Skangas, said.

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TMC Launches boil-off compressor for LNG vessels

Equipment manufacturer TMC Compressors has launched a boil-off gas compressor that can be used to supply LNG fuel for vessels.

The system works by capturing gas that would naturally evaporate from LNG fuel tanks onboard a ship due to the temperature difference between the ultra-cooled storage and the outside environment.

Typically LNG storage tanks are designed to carry natural gas in liquid form at a temperature of around -163°C, and as a result loss rates can be 0.1 percent per day or more depending on tank type. By capturing and compressing this boil-off gas with a TMC compressor the system can instead inject it directly back into the main engine as fuel.

“By compressing the boil-off gas to the required pressure in order to supply it as fuel directly into the ship’s engine, you will have an optimal system with regards to energy efficiency,”

Hans Petter Tanum, director of sales and business development at TMC, said.

Boil-off gas escaping can be a major cost issue for operators of LNG fleets and as a result the new TMC system is expected to offer significant financial benefits for operators as well as providing cleaner operation by reducing overall fuel burn.

Engine range from 30 kW to 450 kW

TMC will offer a range of different boil-off gas compressor units, ranging from 30 kilowatts to 450 kilowatts. The system will be compliant with all LNG vessel designs including dual-fuel ships.

“Using LNG as fuel is becoming increasingly popular because it has lower levels of harmful emissions



The TMC compressor system

to air compared with conventional marine fuels. However, the biggest bonus with boil-off gas is that you are able to reduce the vessel’s fuel costs quite significantly,”

Tanum added.

Headquartered in Oslo, TMC designs and supplies compressed air systems for marine and off-shore use worldwide. ■

Titan LNG Completes T-piece bunkering in Amsterdam

Technology developer Titan LNG has announced the first successful bunkering operations utilizing its T-piece technology to provide LNG refuelling at the port of Amsterdam.

The T-piece system was used to re-fuel the *Fure West* in the Netherlands and achieved a combined pumping rate of 28 tonne per hour.

“The T-Piece reduces the bunkering time for our vessel significantly, we look forward to have Titan LNG make it available in other ports as well,” Hans Lindgren, vessel operator, Furetank, said.

Combined flow cuts refueling time

The T-piece system is designed to combine the flow from two trucks into one bunkering hose, speeding up the refuelling operation and improving logistics. For the operation with *Fure West* a total of six trucks were used.

“The procedure was permitted at the ‘Groene Kade’ LNG quay by the Port of Amsterdam Harbour-master based on a quantitative risk assessment. We are very

pleased to be the first port in the wider region that is able to approve the simultaneous discharging of two trucks. We welcome this advance in efficiency, which will hopefully further accelerate the transition to LNG as a marine fuel with the associated environmental benefits,” Didier de Beaumont, Commercial Manager, at the Port of Amsterdam, commented.

The T-piece system was developed and implemented by Titan LNG in partnership with Dutch

logistics firm Nijman/Zee-tank and AMS.

FlexFueller to launch in Q118

“Speed is important to reduce the downtime of the vessel so that LNG can compete in every way with conventional bunker fuels. The T-piece is an important innovative step on the road to launching our FlexFueller bunkering pontoon next year,” Michael Schaap of Titan LNG, said.

The Titan LNG FlexFueller is designed to supply both inland waterway vessels and larger sea-going vessels and is scheduled to be deployed in the first quarter of 2018 in the Amsterdam-Rotterdam-Antwerp (ARA) region.

The vessel will feature a double bottom, double hull with up to four tanks, to deliver a capacity of 300 cubic metres (cbm). It will measure 70 metres in length and will include two cranes to be used for flexible hose guidance. ■



Titan LNG trucks during refuelling operations

Cryoline technology promises savings for LNG fuelling

Cryoline hose technology for LNG transfer offers “a recalibration of thinking” around ship to shore fuelling and the opportunity for operators to significantly cut costs, according to developer Trelleborg.

The Swedish engineering group has developed a hose which combines existing technologies such as the composite hose and rubber bonded hose with technology developed for oil transfer applications. The result is a floating hose which comprises an inner cryogenic hose, an outer protective hose, an efficient insulation layer and an integrated leak monitoring system.

“Cryoline is a safe, flexible option that can drastically reduce capex and opex, making otherwise unfeasible projects viable and bringing LNG energy generation to new markets,” Vincent Lagarrigue, Director, Trelleborg Oil and Marine, said.

Capex savings of US\$100 million

Trelleborg states that the system can achieve typical flow rates for ship-to-shore transfer in up to 12,000 cubic metres per hour as

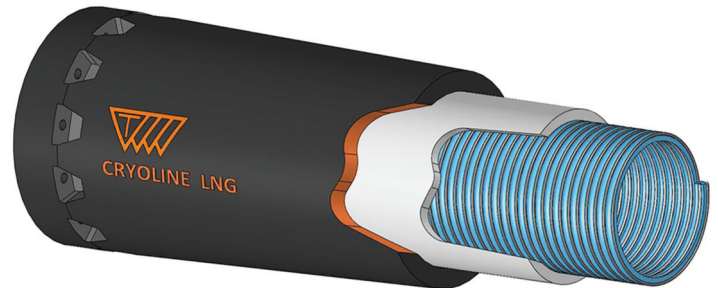
compared to 8,000 m³/h for traditional systems and can be up to 80% more cost effective.

Trelleborg’s system has been designed for 500 offloading operations giving a life expectancy of ten years and the firm notes that its cryogenic hose-in-hose technology “could deliver Capex savings of more than \$100 million, depending on location”.

Greater resistance to fatigue

The Cryoline hose can be used for floating or submarine configurations, and conforms with either OCIMF or API 17K specifications, offering technical and project execution advantages for overall offloading terminal optimization.

One of the key advantages of the Trelleborg system is greater durability helped by the use of a tapered Integrated Bending Stiffener (IBS) at each end, progressively decreasing the stress



Cryoline hose technology

concentration in the connection.

Analysis of the fatigue life of the rubber-bonded hoses using Finite Element Analysis (FEA) tools has demonstrated the high stress resistance of the design and integrated monitoring systems also detect leaks using optical fibre technology.

Trelleborg identifies mini and small scale LNG power generation plants in Malaysia, Philippines, Indonesia, the Caribbean, India and Greece as key markets for the technology as the design presents an opportunity to ‘unlock’ new frontiers in clean power generation and assist offshore LNG handling, bunkering, near-shore LNG handling and as a back-up system for terminal loading arms.

“Trelleborg’s Cryoline hose-in-hose solution is an example of a technology that is making the acceptance of LNG as a marine fuel easier... LNG technologies such as Cryogenic hose-in-hose technology - that cut time and financial resources spent in ports - are certainly one way to help make this transition to greener shipping,” a spokesperson for Trelleborg added.

The next phase of research Trelleborg is conducting will look at how cryogenic flexible hoses

can be used for LNG transfer between Floating LNG units and LNG carriers. This work is currently focused on tandem offloading, where two vessels are situated approximately 100 - 150 metres apart, with a view to radically changing the safety of this critical operation and expanding the operation profile to harsher conditions. ■



Vincent Lagarrigue, director of Trelleborg Oil and Marine

NEWS NUDGES

Gondan builds LNG tug for Østensjø Rederi

Spanish shipbuilder Gondan Shipyard has delivered the first of three ultra-high performance dual fuel escort tugs to Østensjø Rederi of Norway.

The *Dux* was designed by naval architects Robert Allan and designed to work with both VSP and Z-drive propulsion.

“Built to withstand harsh environments, the vessel is shaped specifically to grant full operational availability at temperatures of 20 degrees below zero and combines environmental sustainability through the use of LNG in most of its operations - complying therefore with IMO Tier III emissions standards,” Gondan said in a statement.

“

Trelleborg’s Cryoline hose-in-hose solution is an example of a technology that is making the acceptance of LNG as a marine fuel easier

”

Trelleborg spokesperson

WORLD LNG-FUELLED CONFIRMED NEWBUILDS

Year	Type of Vessel	Owner	Class
2017	Car/passenger ferry	Society of Quebec ferries	LR
2017	Car/passenger ferry	Society of Quebec ferries	LR
2017	Tug	Drydocks World	
2017	PSV	Siem Offshore	DNV GL
2017	Gas carrier	Evergas	BV
2017	PSV	Siem Offshore	DNV GL
2017*	Ro-Ro	TOTE Shipholdings	ABS
2017	Car/passenger ferry	BC Ferries	LR
2017	Gas carrier	Ocean Yield	DNV GL
2017	Gas carrier	Ocean Yield	DNV GL
2017	Gas carrier	Ocean Yield	DNV GL
2017	Gas carrier	Navigator Gas	ABS
2017	Dredger	DEME	BV
2017	Dredger	DEME	BV
2017*	Container ship	Wessels Reederei	BV
2017	Hopper Barge	Bremenports	DNV GL
2017	HSLC	Fred. Olsen	DNV GL
2017	PSV	Harvey Gulf Int.	ABS
2017	PSV	Harvey Gulf Int.	ABS
2017	Cable layer	DEME Tideway	DNV GL
2017	Gas carrier	Evergas	BV
2017	Gas carrier	Evergas	BV
2017	Tug	Østensjø Rederi	
2017	Tug	Østensjø Rederi	
2017	Tug	Østensjø Rederi	
2017*	Car/passenger ferry	BC ferries	ABS
2017	RoPax	Rederi AB Gotland	DNV GL
2017	Car/passenger ferry	Caronte & Tourist	RINA
2017	Oil/chemical tanker	Groupe Desgagnés	BV
2017	Oil/chemical tanker	Groupe Desgagnés	BV
2017	Oil/chemical tanker	Groupe Desgagnés	BV
2017	Oil/chemical tanker	Groupe Desgagnés	BV
2017	Car/passenger ferry	BC Ferries	LR
2017	Oil/chemical tanker	Terntank	BV
2017	Container ship	Crowley Maritime Corp.	DNV GL
2017	Container ship	Crowley Maritime Corp.	DNV GL
2017	RoPax	Tallink	BV
2017	Container ship	Brodosplit	DNV GL
2018	Container ship	Brodosplit	DNV GL
2018	Bulk ship	ESL Shipping	DNV GL
2018	Bulk ship	ESL Shipping	DNV GL
2018	Tug	Keppel Smit Towage	ABS
2018	Tug	Maju Maritime	ABS
2018*	Car/passenger ferry	BC ferries	ABS
2018	PSV	Harvey Gulf Int.	ABS
2018	Container ship	Brodosplit	DNV GL
2018	Container ship	Brodosplit	DNV GL
2018	Car/passenger ferry	Royal Doeksen	LR
2018	Car/passenger ferry	Royal Doeksen	LR
2018	Car/passenger ferry	CHFS	LR
2018	Car/passenger ferry	CHFS	LR
2018*	Ro-Ro	TOTE Shipholdings	ABS
2018	RoPax	Rederi AB Gotland	DNV GL
2018	General cargo ship	Nordnorsk Shipping	DNV GL
2018	Container ship	Containerships	ABS

Year	Type of Vessel	Owner	Class
2018	Container ship	Containerships	ABS
2018	Container ship	GNS Shipping	ABS
2018	Container ship	GNS Shipping	ABS
2018	Container ship	GNS Shipping	ABS
2018	Container ship	GNS Shipping	ABS
2018	Heavy lift vessel	Heerema Offshore	LR
2018	Oil/chemical tanker	Furetank Rederi	BV
2018	Oil/chemical tanker	Furetank Rederi	BV
2018	Oil/chemical tanker	Furetank Rederi	BV
2018	Dredger	DEME	BV
2018	Bulk ship	POSCO	KR
2018	Dredger	van der Kamp	DNV GL
2018	Car/passenger ferry	Torghatten	
2018	Car/passenger ferry	Torghatten	
2018	Car/passenger ferry	Torghatten	
2018	Car/passenger ferry	Torghatten	
2019	Car/passenger ferry	Torghatten	
2019	Cruise ship	Carnival Corporation	RINA
2019	Cruise ship	Carnival Corporation	RINA
2019	Oil/chemical tanker	Älvtank	BV
2019	Oil/chemical tanker	Älvtank	BV
2019	Oil/chemical tanker	Thun Tankers	BV
2019	RoPax	Baleària	BV
2019	Car carrier	Siem Car Carriers	
2019	Car carrier	Siem Car Carriers	
2019	Emergency response ship	German Transport Ministry	
2019	Emergency response ship	German Transport Ministry	
2019	RoPax	Brittany Ferries	
2019	RoPax	Baleària	
2019	RoPax	Baleària	
2019	Oil/chemical tanker	Rosneft	
2020	Oil/chemical tanker	Rosneft	
2020	Oil/chemical tanker	Rosneft	
2020	Oil/chemical tanker	Rosneft	
2020	Research ship	German Transport Ministry	
2020	RoPax	Viking Line	
2020	Cruise ship	Carnival Corporation	RINA
2020	Cruise ship	Carnival Corporation	
2021	Cruise ship	Carnival Corporation	
2021	Cruise ship	Carnival Corporation	
2022	Cruise ship	Carnival Corporation	RINA
2022	Cruise ship	MSC Cruises	
2022	Cruise ship	RCCL	
2024	Cruise ship	MSC Cruises	
2024	Cruise ship	RCCL	

Excluding LNG carriers and inland waterway vessels. For more information please visit www.dnvgl.com

Data last updated : 15 February 2017

* = conversion projects

LNG-FUELLED SHIPS IN OPERATION WORLDWIDE

Year	Type of Vessel	Owner	Class
2000	Car/passenger ferry	Fjord1	DNV GL
2003	PSV	Simon Møkster	DNV GL
2003	PSV	Eidesvik	DNV GL
2006	Car/passenger ferry	Fjord1	DNV GL
2007	Car/passenger ferry	Fjord1	DNV GL
2007	Car/passenger ferry	Fjord1	DNV GL
2007	Car/passenger ferry	Fjord1	DNV GL
2007	Car/passenger ferry	Fjord1	DNV GL
2008	PSV	Eidesvik Shipping	DNV GL
2009	PSV	Eidesvik Shipping	DNV GL
2009	Car/passenger ferry	Tide Sjø	DNV GL
2009	Car/passenger ferry	Tide Sjø	DNV GL
2009	Car/passenger ferry	Tide Sjø	DNV GL
2009	Patrol vessel	Remøy Management	DNV GL
2009	Car/passenger ferry	Fjord1	DNV GL
2010	Patrol vessel	Remøy Management	DNV GL
2010	Car/passenger ferry	Fjord1	DNV GL
2010	Patrol vessel	Remøy Management	DNV GL
2010	Car/passenger ferry	Fjord1	DNV GL
2010	Car/passenger ferry	Fjord1	DNV GL
2010	Car/passenger ferry	Fosen Namsos Sjø	DNV GL
2011	PSV	DOF	DNV GL
2011*	Oil/chemical tanker	Tarbit Shipping	DNV GL
2011	Car/passenger ferry	Fjord1	DNV GL
2011	PSV	Solstad Rederi	DNV GL
2012*	Car/passenger ferry	Fjord1	DNV GL
2012	PSV	Eidesvik	DNV GL
2012	PSV	Olympic Shipping	DNV GL
2012	PSV	Island Offshore	DNV GL
2012	General Cargo	Nordnorsk Shipping	DNV GL
2012	PSV	Eidesvik Shipping	DNV GL
2012	PSV	Island Offshore	DNV GL
2012	Car/passenger ferry	Torghatten Nord	DNV GL
2012	Car/passenger ferry	Torghatten Nord	DNV GL
2012	Car/passenger ferry	Torghatten Nord	DNV GL
2013	PSV	REM	DNV GL
2013	RoPax	Viking Line	LR
2013	Car/passenger ferry	Torghatten Nord	DNV GL
2013	Tug	Incheon Port Authority	KR
2013	General Cargo	Eidsvaag	DNV GL
2013	RoPax	Fjordline	DNV GL
2013	High speed RoPax	Buquebus	DNV GL
2013	Tug	CNOOC	CCS
2013	Tug	CNOOC	CCS
2013	Car/passenger ferry	Norled	DNV GL
2014	Car/passenger ferry	Norled	DNV GL
2014	Tug	Buksér & Berging	DNV GL
2014	RoPax	Fjordline	DNV GL
2014	Patrol vessel	Finish Border Guard	DNV GL
2014	Tug	Buksér & Berging	DNV GL
2014	Gas carrier	Anthony Veder	BV
2014	Gas carrier	Anthony Veder	BV
2014	PSV	Remøy Shipping	DNV GL
2014	General Cargo	Egil Ulvan Rederi	DNV GL
2014	General Cargo	Egil Ulvan Rederi	DNV GL
2014	PSV	Siem Offshore	DNV GL
2015	PSV	Harvey Gulf Int.	ABS
2015	Ro-Ro	Norlines	DNV GL
2015	Car/passenger ferry	Samsøe municipality	DNV GL
2015	PSV	Simon Møkster Shipping	DNV GL
2015	PSV	Siem Offshore	DNV GL
2015	Ro-Ro	Norlines	DNV GL
2015*	Oil/chemical tanker	Bergen Tankers	LR
2015	Car/passenger ferry	Society of Quebec ferries	LR

For more information please visit www.dnvgl.com

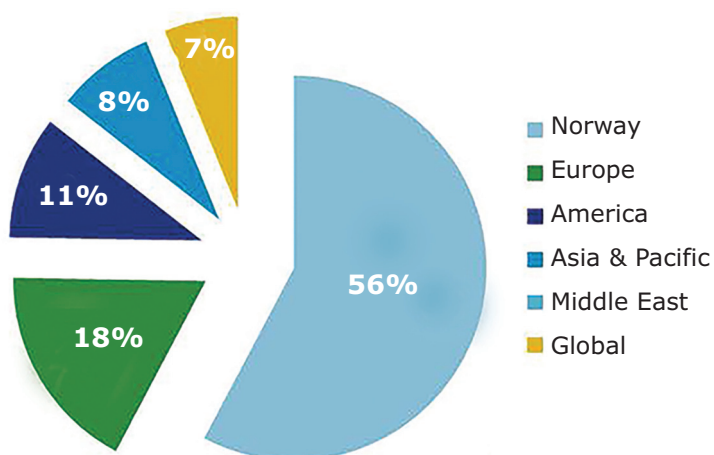
Data last updated: 15 February 2017

* = conversion projects

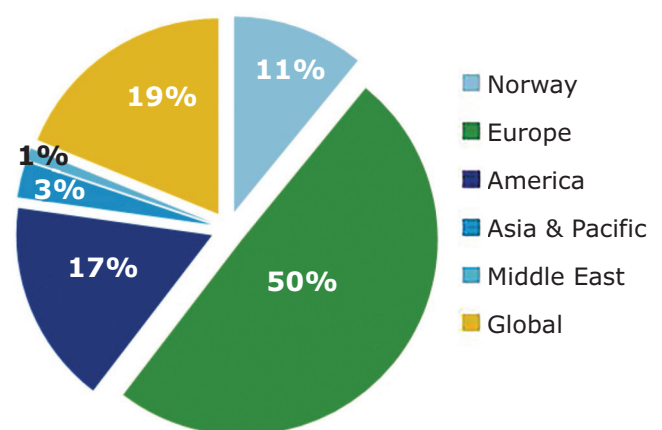
Year	Type of Vessel	Owner	Class
2015	Gas carrier	Evergas	BV
2015	Gas carrier	Evergas	BV
2015	Tug	CNOOC	CCS
2015*	Car/passenger ferry	AG Ems	DNV GL
2015	Tug	NYK	NK
2015	Gas carrier	Chemgas Shipping	BV
2015	Gas carrier	Evergas	BV
2015	PSV	Harvey Gulf Int.	ABS
2015	Container ship	TOTE Shipholdings	ABS
2015	Car/passenger ferry	AG EMS	DNV GL
2015	Bulk ship	Erik Thun	LR
2016	Container ship	TOTE Shipholdings	ABS
2016	Gas carrier	Evergas	BV
2016	PSV	Harvey Gulf Int.	ABS
2016	Bulk ship	Erik Thun	LR
2016	Oil/chemical tanker	Terntank	BV
2016	Gas carrier	Navigator Gas	ABS
2016*	Oil/chemical tanker	Furetank Rederi	BV
2016	Icebreaker	Arctica Shipping	LR
2016	Car/passenger ferry	Boreal Transport Nord	DNV GL
2016	Car/passenger ferry	Boreal Transport Nord	DNV GL
2016	Tug	CNOOC	CCS
2016	Gas carrier	Chemgas Shipping	BV
2016	Car carrier	UECC	LR
2016	Oil/chemical tanker	Terntank	BV
2016	Oil/chemical tanker	Terntank	BV
2016	Car/passenger ferry	BC Ferries	LR
2016	Gas carrier	Evergas	BV
2016	PSV	Siem Offshore	DNV GL
2016	Car/passenger ferry	Seaspan Ferries Corp.	BV
2016	Gas carrier	Navigator Gas	ABS
2016	Ro-Ro	Searoad Holdings	DNV GL
2016	Car carrier	UECC	LR
2017	Gas carrier	Navigator Gas	ABS
2017	Car/passenger ferry	Seaspan Ferries Corp.	BV
2017*	RoPax	Baleària	BV

AREA OF OPERATION OF LNG-FUELLED SHIPS

Operating area
ships in operation



Operating area
confirmed orderbook



Updated 15 February 2017
Excluding LNG carriers and inland waterway vessels

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 / Lucia Ambition	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?
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 Innvation	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	Gaschem Beluga	36,000	Ethane/Ethylene	US - Teeside	Ethane, for Sabic	Gaschem Services
2016	Gaschem Orca	36,000	Ethane/Ethylene	US - Teeside	Ethane, for Sabic	Gaschem Services

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 = 24th May 2017

Built	Name	CBM	Cargo Type	Trading area	Trading in LNG?	Ship Owner / Operator
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	Yuan He 1	30,000	LNG	China	Yes	CSR
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 Skangas	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	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
2019	KLine TBN	7,500	LNG	Korea	Yes	Korea Line
2019	KLine TBN	7,500	LNG	Korea	Yes	Korea Line
2019	Stolt TBN	7,500	LNG	Mediterranean	Yes	Stolt-Nielsen Gas
2019	Stolt TBN	7,500	LNG	Mediterranean	Yes	Stolt-Nielsen Gas
2020	Stolt TBN (option)	7,500	LNG		Yes	Stolt-Nielsen Gas
2020	Stolt TBN (option)	7,500	LNG		Yes	Stolt-Nielsen Gas
2021	Stolt TBN (option)	7,500	LNG		Yes	Stolt-Nielsen Gas

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