

LNG Fuelling

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DNV GL predicts acceleration in LNG fuelling

Uptake of LNG as a fuel for shipping has so far proven slower than expected but is now primed to accelerate, according to the latest research from standards agency DNV GL.

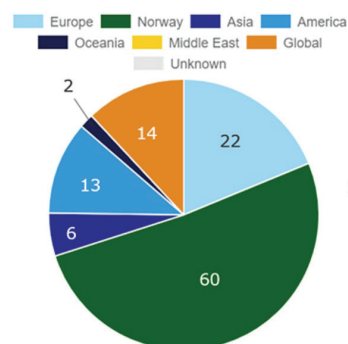
The firm had previously estimated the worldwide LNG fleet to reach 1,000 vessels by 2020 but as of the end of 2017 there are currently just 117 vessels burning LNG, making this target unlikely in the next two years.

Conditions for bunker growth in place

Despite this slow initial uptake, the findings suggest that the “conditions needed for an acceleration” are now in place following constraints from low oil prices and slower than expected development of bunkering infrastructure.

“Bunkering options are expanding on a global scale. Today, there are 60 supply locations worldwide, including Singapore, the Middle East, the Caribbean as well as Europe, according to the latest data in DNV GL’s LNGi business intelligence portal. A further 28 facilities have been decided and at least 36 are under discussion,” Martin Christian Wold, Senior Consultant at DNV GL, commented.

Wold forecasts that six LNG bunker vessels will be in operation globally by the beginning of 2018, with four more projects confirmed and



Operating areas of 117 LNG vessels in operation

backing in place from major players including Total, Shell, Gas Natural Fenosa, ENN and Statoil.

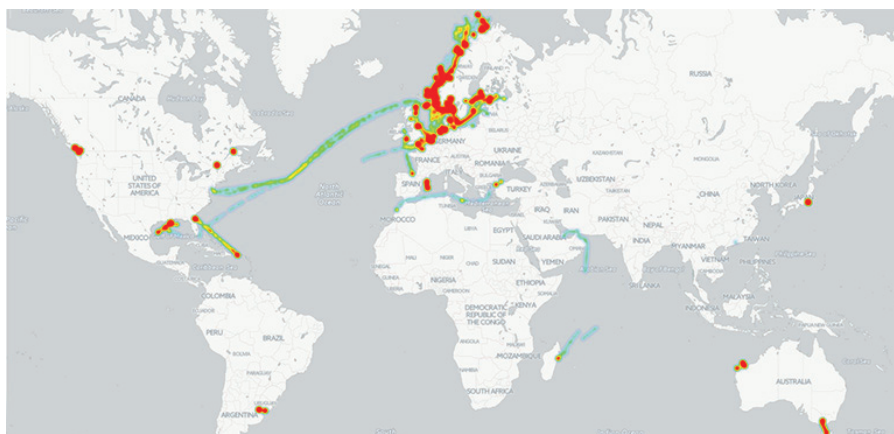
Timing uncertainty still creating constraint

DNV GL notes that while a confirmed order book of 111 LNG-fuelled vessels, with an additional 114 vessels already classified as LNG-ready, will help boost “a quicker uptake” of LNG there is still too much uncertainty over regulatory changes

“Evaluating whether LNG as a fuel will provide a competitive edge is difficult enough for ship owners. Having to anticipate various regulatory scenarios on top of that complicated matters further... For suppliers, it’s very much a question of timing. They won’t bring these facilities online until they see sufficient confirmed orders for LNG-fuelled tonnage to justify the investment.” Wold explains

Wold points to the benefits of multi-sector industry coalitions, such as SEA\LNG and the Society for Gas as a Marine Fuel (SGMF), in the short term to help drive knowledge sharing and deployment of new technology.

“Advances in dual fuel technology and propulsion, enhanced control systems and future use of gas turbines present further opportunities for greater GHG reductions,” Steve Esau, General Manager of SEA\LNG, said.



AIS data from LNGi showing operation of LNG-fuelled ships

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UK launches first LNG ferry

The Scottish First Minister Nicola Sturgeon has presided over the launch of the UK's first LNG passenger ferry on the Clyde in Scotland.

The 102-metre, roll-on/roll-off vehicle passenger ferry has dual-fuel capabilities for LNG or marine gas oil and is named *Glen Sannox*. Launched at Ferguson Marine Engineering Limited's (FME) Port Glasgow shipyard the ship is the first of two LNG ferries to be built on behalf of Caledonian Maritime Assets Limited (CMAL).

"The launch of any vessel is an



The *Glen Sannox* launch ceremony

exciting time in its construction and we are pleased to see the first of the new ships being built at Port Glasgow reach this important milestone. As the end-customer for the *MV Glen Sannox*, we are looking forward to welcoming her to our fleet in due course," Robbie Drummond, CalMac's Service Delivery Director, said.

CMAL invests £97 million in LNG growth

CMAL is investing £97 million in its two newbuild LNG ferries and expects use of the fuel to grow significantly in Scotland in coming years.

"The use of LNG in maritime transport is a sign of our ongoing

commitment to exploring new fuel technologies for ferries, as well as a wider commitment to innovation in Scotland and consideration for the environmental impact of transport," Kevin Hobbs, chief executive, CMAL said.

Designed to carry up to 1,000 passengers as well as 127 cars or 16 heavy-goods vehicles or a combination of both. It is the first such vessel fabricated by Clyde Blowers, the owner of FME's yard.

"The successful launch of the *MV Glen Sannox* marks an important milestone in Ferguson Marine's journey to becoming a world-class shipyard. As this is the first ferry in the UK capable of being run on LNG and marine gas oil, not only has this been an

extremely exciting and ambitious project for both FME and CMAL, but it has been an extremely complex one as well," Jim McColl, CEO of Clyde Blowers, said.

The pursuit of tough emissions reductions has been at the centre of Scottish government targets and during the launch Sturgeon praised the "state of the art ferries" for "contributing to Scotland's world-leading climate change goals".

"The experience and knowledge gained during this project will be of enormous benefit to the competitiveness of Scottish shipbuilding in the future as technology continues to develop to meet tightening clean energy legislation," McColl added.

Petronas inks LNG bunker deal

Malaysian oil major Petronas has signed an agreement with Argo Engineering and Eastport Marine to provide LNG services in Labuan, Malaysia.

The deal marks the first time Petronas has provided LNG bunkering operations beyond wholesale of fuel.

Two-year service agreement

The two-year service agreement covers ship-to-ship transfer and will be carried out by Petronas subsidiary Petronas LNG (PLL). The deal was signed by PLL Chairman, Ahmad Adly Alias, Managing Director of Argo Ir. Kamarulbahrin Saidin, and Managing Director of Eastport Datuk Captain Walter Nair.

"This ship-to-ship transfer service agreement is Petronas' first collaboration in providing flex-

ible delivery solutions that goes beyond the conventional selling and delivering of LNG," Adly said.

LNG ship-to-ship transfer services "emerging trend"

PLL hopes the new agreement will act as a springboard for further LNG bunkering operations and aims to build on Argo and Eastport's shipping expertise "to enable PLL to respond to new market requirements" and develop future bunkering solutions in the changing LNG industry landscape.

"LNG ship-to-ship transfer services is an emerging trend to cater to the needs of small scale LNG requirements... Argo has vast



Ahmad Adly Alias

experience in LNG shipping operations supported by a network of experienced technical personnel in the LNG shipping industry, while Eastport have expertise in handling bunkering and ship-to-ship

operations," Adly commented.

Headquartered in Kuala Lumpur, Argo provides LNG integration, ship's management services and related marine supply services. Eastport Marine is based in Singapore and provides shipbrokerage worldwide as well as possessing the sole license to provide LNG bunkering and ship-to-ship services at Brunei Bay, Labuan.

Earlier this year, Petronas signed a memorandum of understanding with LNG industry consortium Gas4Sea and recently diversified its LNG supply portfolio with the addition of Australia Gladstone LNG and Petronas' First Floating LNG Facility in offshore Sarawak.

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France backs LNG-powered maritime sector

The French government has backed a strategy that places LNG at the centre of maritime policy and focuses on new energy solutions to improve competitiveness of the country's ports.

Outlining a vision for a “revitalised French maritime sector”, French Prime Minister Édouard Philippe called for “new thinking, supportive policy and a clear focus” to help support the uptake of LNG within French waters.

“I will not offend anyone if I say that France does not have port traffic worthy of its coastline, its internal market and its place in Europe. And I will not surprise anyone if I say that if we do nothing, it will not work out,” Philippe said.

Greater oversight at Le Havre, Marseille and Dunkirk

The minister called for greater policy focus and oversight of the port regions of Le Havre, Marseille and Dunkirk as a preliminary step to build up the country's LNG infrastructure. It is hoped that revisions to tax legislation will be forthcoming to stimulate investment and intermodal development and optimize for greater LNG deployment.

The North Sea ports of Le Havre, Marseille and Dunkirk face tough competition from the neighbouring ports of Antwerp, Rotterdam and Amsterdam, all of which have advanced their LNG infrastructure considerably in recent years.

“We have to move. Quick. And not a little. Because without powerful ports, no maritime power. No port industry, no jobs, no future for Le Havre, Marseille, Dunkirk. No France in globalization,” Philippe added.

Praise for CMA CGM order

Following the success of world-first deployments of LNG bunkering equipment and barges at Antwerp and Rotterdam, the French government is keen to play on its own domestic shipping strengths to spur the next phase of growth.

French shipping lines Brittany Ferries and CMA CGM were praised by Philippe for their recent high-profile orders for LNG-fuelled vessel. CMA CGM Group announced this month that nine newbuild vessels – the largest containerships in the world – will all be powered by LNG.

“I welcome the lead... We must make this transition a differentiating element in the marketplace. On transportation and port supply.



French Prime Minister Édouard Philippe

Because standards evolve very fast. Because public opinion, and so much the better, is more and more sensitive. Because not preparing a predictable evolution is already falling behind. That is why

the State will adapt the regulations on this fuel to facilitate the supply of ships in ports,” Philippe commented.



The port of Le Havre

“By choosing LNG, CMA CGM confirms its ambition to be a leading force in the industry in environmental protection by being a pioneer in innovative and eco-responsible technologies,”

Rodolphe Saadé, CEO of CMA CGM Group



LNG VALUE CHAIN SOLUTIONS

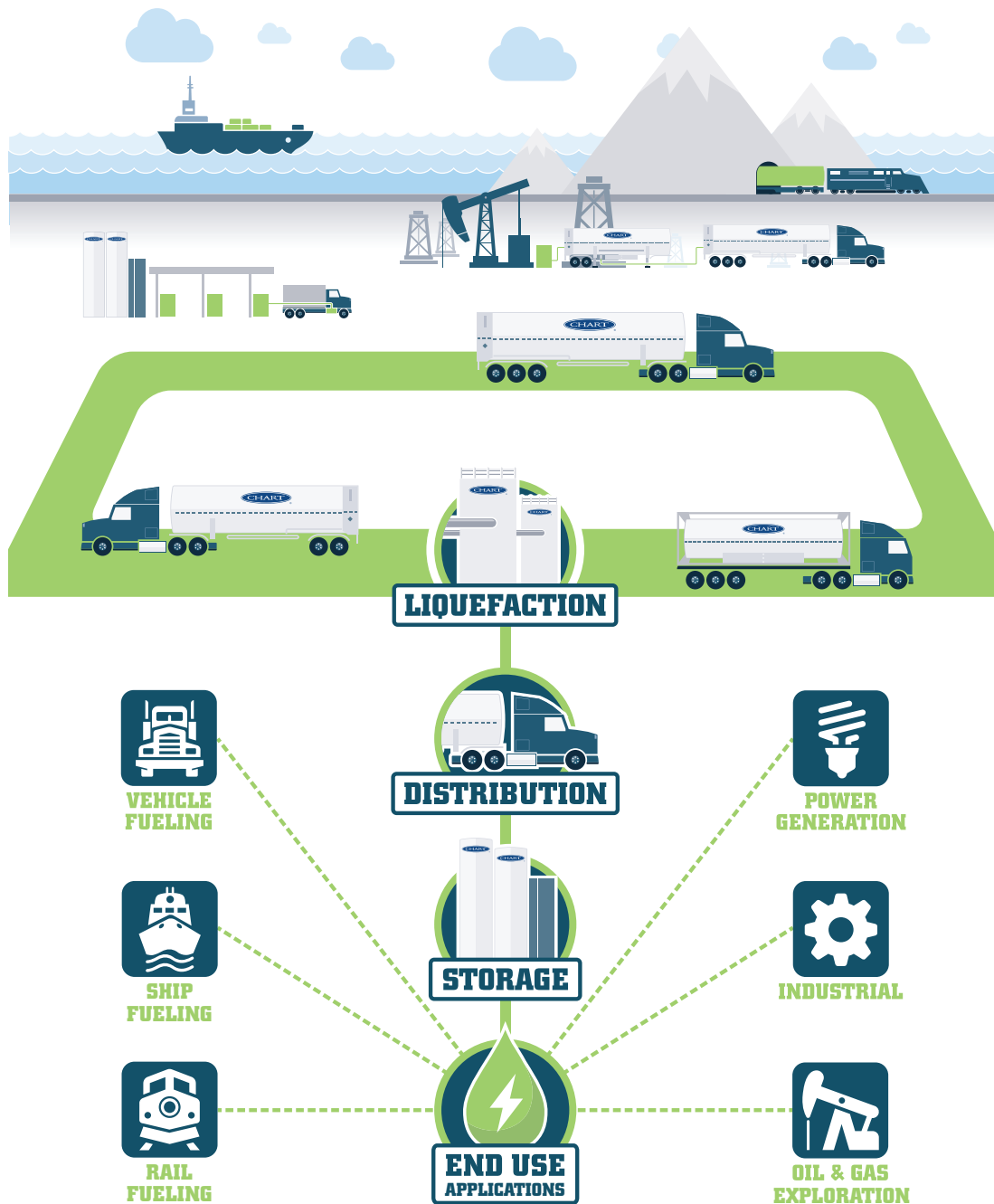


Chart is pioneering the adoption of LNG as a clean-burning, safe and economical fuel alternative for energy, transportation and industry.

www.ChartLNG.com

Carnival extends LNG bunker agreement with Shell

Cruise ship operator Carnival Corporation has signed an LNG supply deal with Shell for two next-generation cruise ships as it hailed the fuel as the “technology of the future”.

The agreement will see Shell NA LNG supply fuel for the two new ships expected to launch by Carnival Cruise Line in 2020 and 2022. They will be homeported in North America and fuelled by Shell’s ocean-going LNG Bunker Barge (LBB) designed to support growing cruise line demand for LNG along the southern U.S. East Coast.

“We are looking at technology for the future... LNG has the best emissions profile of any fossil fuel and meets and exceeds all current requirements and those in the foreseeable future,” Tom Strang, senior vice-president for maritime affairs at Carnival, said.

Fully powered by LNG

Both new vessels will be fully powered by LNG both while in port and at sea - an industry first and are expected to be the most efficient ships in company history. The 180,000-ton ships will also be the largest ships in Carnival’s



Artist's rendition of LNG-fuelled Carnival Cruise Line vessel

fleet with approximate passenger capacity of 5,200 based on double occupancy.

“This agreement is a significant stepping stone in our relationship with Carnival Corporation building upon our previous LNG marine fuel supply agreements in Europe... It also marks a milestone as we continue to establish the marine LNG fuel market in the U.S. as a credible part of the global marine fuel mix,” Tahir Faruqi, president, Shell NA LNG, said.

The new agreement builds on the existing partnership between Carnival Corporation’s AIDA Cruises brand and Shell to supply its AIDAprima ship with LNG to power the vessel while docked. The partnership will also supply the world’s first fully LNG-powered cruise ships when they enter service in 2018 and 2019.

“What was the biggest factor in Carnival opting for LNG as a fuel? Clearly environment plays a huge part in the decision but...

we needed to have a fuel that was economic ... and we wanted to future-proof our vessel... LNG we see as a fuel for the future. ... it will have a big impact on the industry...the whole maritime sector... we think LNG is the best way forward,” Strang said.

Seven LNG vessels on order

Carnival currently has agreements in place with shipbuilders Meyer Werft and Meyer Turku to build a total of seven LNG-powered cruise ships across four of its 10 global cruise brands with delivery dates between 2018 and 2022.

These include two for AIDA Cruises, scheduled to launch in 2018 and 2021, two for Costa Cruises due for delivery in 2019 and 2021, one for P&O Cruises UK with an expected delivery date in 2020 and two for Carnival Cruise Line with expected delivery dates in 2020 and 2022. ■

Wärtsilä to supply LNG systems for ATB

Finnish equipment manufacturer Wärtsilä is to supply control systems and storage solutions for a new LNG-fuelled articulated tug barge (ATB) on behalf of fuel specialist Q-LNG.

The ATB will be built by VT Halter Marine shipyard in Pascagoula, Mississippi and will be operated under a long-term charter with Shell Oil. The proposed design includes capacity for 4,000 cubic metres of LNG.

LNG “at the core” of Wärtsilä global strategy

Wärtsilä will supply and fit its proprietary LNG cargo storage, handling, and control system

for the barge as well as barge automation, power management, bow thruster and ballast water management systems. A separate tug unit will include Wärtsilä main propulsion steerable thrusters, tug automation and shaft lines along with Wärtsilä NACOS Platinum dynamic positioning system and ancillary navigation and communication equipment.

“Wärtsilä is very grateful for the confidence placed in our solu-

tions by VTHM, Q-LNG and Shell... Increasing the use of LNG as a marine fuel is at the core of our global business strategy, and this project represents an important step towards realising that aim,” Hanno Schoonman, General Manager at Wärtsilä Marine Solutions, said.

Wärtsilä expects to start making the first deliveries to VT Halter in 2018 and throughout 2019, with the vessel scheduled to commence operations in 2020.

Q-LNG extends Wärtsilä links

The deal will see Q-LNG extend its existing links with Wärtsilä following supply of LNG solutions for vessels under construction and in operation by parent stakeholder Harvey Gulf International Marine.

Q-LNG is owned 70% by Shane Guidry and 30% by Harvey Gulf.

“Q-LNG is very pleased to again be partnering with Wärtsilä on yet another ground-breaking project. Wärtsilä’s expertise in LNG systems, its solid reputation for top quality marine equipment, and its commitment to customer service fits in very well with Q-LNG’s plan to advance the development of LNG as a marine fuel in North America,” says Chad Verret, President of Q-LNG.

Headquartered in Helsinki, Finland, Wärtsilä’s core products include large combustion engines used in cruise ships and ferries alongside reciprocating internal combustion (IC) engines that can burn a variety of fuels, including natural gas. ■



Q-LNG ATB vessel rendering

Rolls-Royce Unveils LNG-fuelled yacht concept

Engineering firm Rolls-Royce has unveiled designs for a hybrid luxury yacht powered by LNG and attendant bunkering barge featuring advanced ship intelligence.

The 62-metre Crystal Blue is designed to carry 12+ passengers and 12 crew and is based on a composite or aluminium hull operating on Rolls-Royce hybrid LNG/Battery SAve-CUBE system configuration.

Blue Shadow to double as LNG bunker barge

Along with the concept designs for the Crystal Blue, Rolls-Royce also launched plans for a custom-built support vessel Blue Shadow. This remotely-controlled, steel-hulled support vessel will be used to transport and launch the mother ship's tender, helicopter and any other "toys" that the yacht owner may have as well as acting as a personal LNG bunkering barge for the yacht,

"Although LNG fuel is increasingly specified for commercial vessels, particularly coastal ferries, the size of the fuel tanks and a lack of LNG bunkering infrastructure has been a major barrier to the yacht sector embracing the cleaner, odourless fuel," Henrik Alpo Sjöblom, Project Manager in the Rolls-Royce Blue Ocean team, said.

Operating in convoy, Blue Shadow allows designers to make better use of the aft area of Crystal Blue for guests, such as



Render of the Crystal Blue and Blue Shadow

by including an infinity pool, or a beach area and means the yacht can enter otherwise prohibited ecologically sensitive waters.

"We have dimensioned Crystal Blue fuel tanks for a range of 3000 nautical miles without refuelling but with the Shadow's additional fuel capacity, the range increases to 4400 nautical miles, meaning that most of the typical yachting areas are accessible," Sjöblom added.

Twin LNG-fuelled gensets

Powered by twin LNG-fuelled 16V4000 MTU M65-N generator sets working in parallel the Crystal Blue also features a battery bank to provide 1MWh of genset-free power during port

stays. Two low-weight carbon Azipull thrusters provide propulsive power to achieve maximum service speeds of 20 knots.

The Blue Shadow will also utilize technology from the offshore oil and gas sector, with the implementation of an intelligent dynamic positioning system to provide automatic controls for twin azimuthing thrusters and a TT1100 bow thruster, allowing the vessel to maintain position to within a couple of metres of the main vessel.

"Our ship intelligence and remote-control concepts have allowed us to design a yacht for the future that has the bridge located below the bow, inside the vessel. The crew is able to monitor and control the vessel using sophisticated sensors, cameras, display screens and situational awareness technologies; but an internal bridge frees up the traditional area of the bridge in the forward part of the superstructure to let owners and guests enjoy a panoramic vista that is traditionally only enjoyed by the crew," Oskar Levander, Rolls-Royce SVP Concepts and Innovation at Rolls-Royce, said.



Artist's rendition of Rolls Royce LNG/battery super yacht

NEWS NUDGE

Hudong-Zhonghua places LNG tank order with GTT

French LNG specialist Gaztransport & Technigaz (GTT) has received an order for two membrane cryogenic containment systems from Chinese shipyard Hudong-Zhonghua Shipbuilding.

The order covers equipment for two dual purpose Floating Storage and Regasification Unit (FSRU) vessels. The GTT LNG tanks for both units, will have a capacity of 174,000 cubic metres.

"We are pleased to once again accompany the ship-owner Dynagas in its continued development in the LNG industry and to contribute to the very first FSRUs built by our Chinese partner Hudong-Zhonghua. This new order highlights the trusting relationships GTT maintains with this shipyard, which is part of the biggest shipbuilding group in China", Philippe Berterottière, CEO of GTT, said.

Small-scale LNG forecast for 2.81% CAGR

The small scale LNG market is predicted to see a compound annual growth rate of 2.81%, to reach US\$43.5 billion by 2023, according to consultancy Energias Market Research.

The firm cites the growing global natural gas reserves, favorable gas prices and stricter emission regulation as underpinning growth.

"Further, flexible supply volume; growing demand from marine, heavy-duty trucking, rail and high-horsepower industrial equipment tends to support the growth of the small scale LNG market," an Energias spokesperson said.

WinGD to supply CMA CGM engines

Equipment manufacturer Winterthur Gas & Diesel (WinGD) will provide 12-cylinder X92DF engines to power new LNG-fuelled containerships for Shipping line CMA CGM.

The 12X92DF engines are rated of 63,840 kilowatts and Emission Control Areas (ECAs) restrictions.

"With this move to LNG energy, CMA CGM is moving ahead for a greener shipping. We selected WinGD engines for the main propulsion on the grounds of their experience in dual-fuel engines and our positive feedback on the two-stroke Generation X engines," Ludovic Gérard, Vice President at CMA CGM, said.

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	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	Samsoe 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

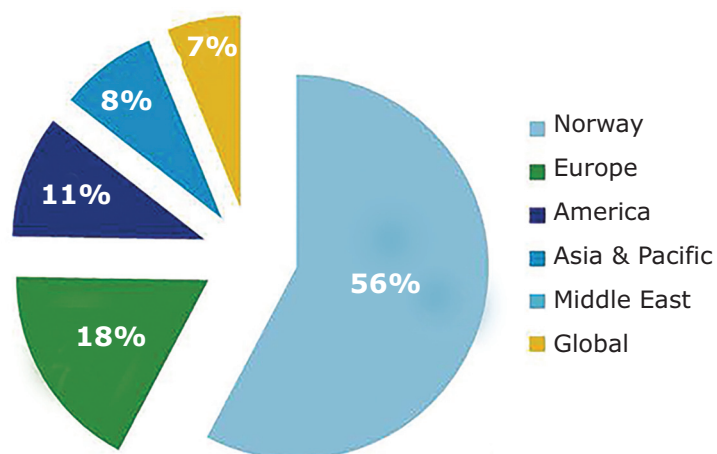
Data last updated: 15 February 2017

* = conversion projects

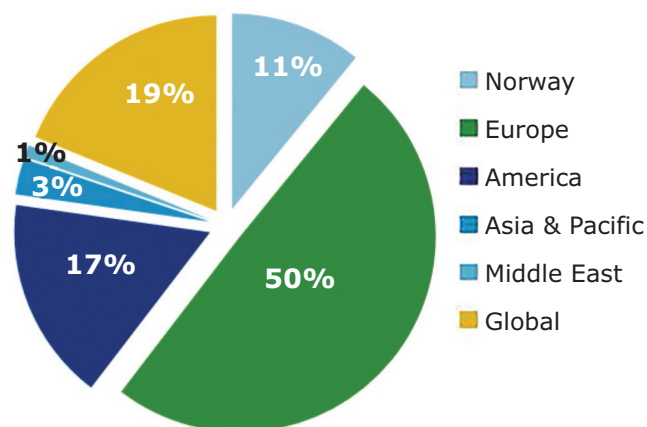
Year	Type of Vessel	Owner	Class
2015	Gas carrier	Evergas	BV
2015	Gas carrier	Evergas	BV
2015	Tug	CNOOC	CCS
2015*	Car/passenger ferry	AG Ems	DNV GL
2015	Tug	NYK	NK
2015	Gas carrier	Chemgas Shipping	BV
2015	Gas carrier	Evergas	BV
2015	PSV	Harvey Gulf Int.	ABS
2015	Container ship	TOTE Shipholdings	ABS
2015	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	Triputra (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 = 16th November 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
2017	Cardissa	6,500	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	Coralius	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	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
2018	Shell Bunker Barge TBN 4	3,000	LNG	Northwest Europe	Yes	Shell
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
2020	Shell Bunker Barge	4,000	LNG	US Coast	Yes	Q-LNG Transport / Harvey Gulf
2021	Stolt TBN (option)	7,500	LNG		Yes	Stolt-Nielsen Gas

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