ACCELERATING THE ADOPTION OF LNG AS A MARINE FUEL

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SEA-LNG.ORG
SEA\LNG is a multi-sector industry coalition, created to accelerate the widespread adoption of liquefied natural gas (LNG) as a marine fuel. Our vision is of a competitive global LNG value chain for cleaner maritime shipping by 2020.

We will focus on addressing the commercial barriers to LNG, particularly in the deep-sea shipping segment. These barriers include LNG infrastructure and market maturity; the lack of understanding of LNG’s benefits among end users, investors and governments and civil society; higher capex levels for gas equipment such as LNG tanks; and fragmented and uncertain regulation.

SEA\LNG unites key players from across the marine value chain for a common purpose. From LNG suppliers, bunkering companies, shipping lines, and shipyards, to OEMs (original equipment manufacturers), classification societies, and port authorities, SEA\LNG will act collectively to drive the change needed across the entire marine transportation system.

To date, SEA\LNG members include ABS, Bureau Veritas, Carnival Corporation & plc, Clean Marine Energy, DNV GL, Eagle LNG Partners, ENGIE, ENN Group, Gas Natural Fenosa, GE, GTT, Keppel Gas Technology Development, Lloyd’s Register, Mitsubishi Corporation, NYK Line, Port of Rotterdam, Qatargas, Shell, Total, TOTE Inc., and Wärtsilä. The coalition will continue to recruit a critical mass of members to ensure genuine representation from around the world and across the marine value chain.
Why LNG and why now?

OCEAN SHIPPING IS ESSENTIAL FOR GLOBAL TRADE. TRADE WILL INCREASE SIGNIFICANTLY AS THE WORLD’S POPULATION GROWS AND INCOME LEVELS RISE. THE SHIPPING INDUSTRY WILL NEED TO EXPAND AND CONTINUE TO STRIVE FOR GREATER EFFICIENCIES TO MEET THIS GROWING DEMAND.

Shipping remains the most efficient form of transporting freight on a tonne per kilometre basis. However, shipping companies must take measures to improve their emissions performance as ocean-going vessels can emit levels of sulphur oxides (SOx), nitrogen oxides (NOx) and particulate matter (PM) that have the potential to impact populations living near ports and coastlines, as well as those living further inland.

To address these issues, in October 2016 the International Maritime Organisation (IMO) affirmed its decision to implement a much tighter global sulphur cap of 0.5% on marine fuels from January 2020. This action is designed to dramatically reduce the emissions produced by vessels using heavy marine fuel oils. Ship owners and operators and the associated supply chains will need to make major investments to comply with these new global limits. Potential compliant solutions for the deep-sea shipping industry include LNG, the continued use of high sulphur fuel oil (HSFO) with exhaust gas cleaning systems (also known as scrubbers); and new formulations of low sulphur marine fuels such as low sulphur fuel oil (LSFO) and marine gas oil (MGO). Of these, LNG provides an essential solution for the long term, as it addresses the core issue: the fuel itself.

A key consideration for ship owners when evaluating these solutions is the investment required for new marine fuel systems and emission abatement solutions such as scrubbers, and the possibility that these investments may not be adequate to meet more stringent regulation. Emissions limits are almost certain to become more stringent over time (see Figure 1). The European Union (EU) has already agreed that, outside of existing ECAs, in 2020, the 0.5% sulphur requirement will apply within 200 miles of EU Member States’ coasts. In September 2015, China announced a five-year scheme to reduce SOx and NOx by up to 65% in three ECAs, which includes some of China’s major ports. And, in addition, designation of many more ECAs is expected from the IMO, including countries and regions such as Mexico, Central America, the Mediterranean, the northern coast of Norway and the Barents Sea, the Strait of Malacca, the coast of China, the territorial waters of Japan and Australia, and the Arctic and Antarctica.

LNG provides a future-fit solution for the deep-sea shipping industry. LNG far out-performs conventional marine fuels on a local emissions basis, effectively insulating companies from the impact of future, more demanding, regulation. LNG emits zero SOx and virtually zero particulate matter. Compared to existing heavy marine fuel oils, LNG can, depending on the technology used, emit 90% fewer NOx emissions.

LNG’s greenhouse gas (GHG) performance represents a major step forward when compared with traditional marine fuels. Utilising best practices and appropriate technologies to minimise methane leakage, realistic reductions of GHG by 10-20% are achievable, with a potential for up to 25% compared with conventional oil-based fuels.

In the longer term, as pressure grows on the shipping sector to contribute even more to global GHG reductions, LNG-fuelled vessels and bunkering infrastructure provide an obvious potential decarbonisation pathway through the substitution of conventional (fossil fuel) LNG with bio-LNG, as technology developments allow.

LNG has a much better emissions performance than conventional fuels and solutions.

The coalition will continue to recruit a critical mass of members to ensure genuine representation from around the world and across the marine value chain.

Members

To date, SEA-LNG members include:

The MARPOL treaty is the primary international agreement covering all types of pollutants from ships. It was developed through the International Maritime Organisation (IMO), a United Nations agency that deals with maritime safety and security, as well as the prevention of marine pollution from ships.

Annex VI of the MARPOL treaty addresses air pollution from ocean-going ships with two sets of emission and fuel quality requirements: global requirements and more stringent requirements applicable to ships in Emission Control Areas (ECAs).

An ECA can be designated for SOx and PM, or NOx, or all three types of emissions from ships.

The current and future sulphur emissions regulations (Source: DNV GL)

<table>
<thead>
<tr>
<th>Area</th>
<th>Sulphur limit</th>
<th>Scrubbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>0.5% (2020)</td>
<td>Yes</td>
</tr>
<tr>
<td>EU</td>
<td>0.1% in all ports, Open-loop restricted in some countries</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>0.5% in selected areas</td>
<td>Yes</td>
</tr>
<tr>
<td>California</td>
<td>0.1% within 24 nm, No, only through research exemption</td>
<td></td>
</tr>
</tbody>
</table>

0.5% global limit (MARPOL, 2020)
0.5% EU Sulphur Directive limit (2020)
0.1% Emission Control Area limit (MARPOL)
0.5% local limit (Hong Kong, China)

* Note that China and Hong Kong may go down to 0.1% before 2020
LNG is economically viable

LNG-fuelled propulsion is already proving to be a cost-effective solution to meeting emissions limits in certain US and European ECAs. It can also be an economic solution for deep-sea shipping trades where vessels spend an estimated 50% or more of their time in ECAs.

The economics are currently more challenging in the deep-sea container and bulk commodity shipping sector. However, the implementation of the IMO’s 0.5% global sulphur cap will support LNG use, as it is likely to drive up demand and therefore prices for MGO and LSFO.

By contrast, scrubbers require significant additional capital expenditure (capex), are operationally complex and have waste management issues.

It is SRA/LNG’s view that there is considerable scope to drive down capex costs for key LNG gas equipment, for example tanks and new vessel designs. This will be driven by scale, experience, OEM investments in R&D and shipyard innovations in designs for both new-build and retrofit as confidence grows in demand and participants better plan and co-ordinate their investments.

LNG is widely available

LNG is a global commodity with 20 countries exporting to 35 importing countries. It accounts for approximately 10% of global gas consumption and represents 32% of internationally traded natural gas. Market penetration is increasing in areas such as Latin America, the Middle East, Africa and parts of south-east Asia, while around 20 countries have plans for import terminals, facilitated by new technologies such as floating storage and regasification units (FSRUs).

The LNG market is currently heading into oversupply, with approximately 150 million tonnes per annum (Mtpa) of new export capacity due to come on line between 2015 and 2020 - a 50% increase over current capacity. New liquefaction projects in Australia, Russia, Malaysia and Indonesia have been joined by a rush of LNG export projects in the US, stimulated by extensive shale gas developments.

There have also been structural changes in the LNG market. The expansion of the LNG trade has been accompanied by an increase in the number and diversity of LNG players in the upstream sector. There is an increase of investment in LNG solutions for transportation and changes in the marketing and trading of LNG. Small to mid-scale LNG has taken off, increasing market penetration and servicing demand from power projects in areas not covered by power grids. For example, from surface transportation such as heavy duty trucks, buses and trains, from industries such as mining, and from the maritime sector. As a consequence of the new entrants and the added competition, a more flexible approach to LNG contracting and pricing is emerging.

More LNG bunkering facilities are being built

Serving existing ECAs, the LNG bunkering infrastructure is currently concentrated in north west Europe (for example, in the ports of Rotterdam, Stockholm and Zeebrugge) and the US Gulf and East coast (including the ports of Jacksonville, FL and Fourchon, LA). These will make up the bunkering nodes around which a global LNG-fuelled shipping industry will be developed (see figure 2). We see signs of this in the growing number of bunkering initiatives. Key Asian ports serving deep-sea shipping routes are in the process of establishing LNG bunkering facilities and looking to co-ordinate activities with their European and North American counterparts. This is most evident in the infrastructure being developed by the world’s busiest bunker port, Singapore and in the activities in ports in eastern China, for example Ningbo-Zhoushan, the world’s biggest cargo port.
Current EU policy will require at least one LNG bunkering port in each member state. About 10% of European coastal and inland ports will be included, a total of 139 ports. Coastal port LNG infrastructure will be completed by 2020 and for inland ports by 2025. There are several ports under development in North America, mostly in the south east, the Gulf of Mexico and around the Great Lakes, but also for ferry and deep-sea operations in the Pacific Northwest. China is extending LNG bunkering infrastructure from inland waterways to coastal areas and is expected to be able to service the LNG demand of all vessel types. South Korea offers LNG bunkering in the port of Incheon and is considering a second facility in Busan. Elsewhere in Asia, in addition to Singapore, Japan and Australia are also working to develop LNG bunkering facilities.

**LNG is safe**

The bulk LNG transportation industry, where LNG is commonly used as a fuel for the transporting vessel, has an excellent safety record. Over the past 50 years, more than 77,000 commercial LNG cargoes have been safely delivered and global LNG shipments have covered more than 100 million miles – about 4,000 times around the earth – without any major safety incidents in port or at sea. This is testament to the LNG industry’s rigorous design guidelines for both ships and shore facilities, as well as high standards of training and operational procedures.

The use of LNG as a marine fuel outside the LNG carrier business is a relatively new technology, as are gas only and dual-fuelled engines. However, since its introduction as a marine fuel at the turn of the century, LNG-fuelled vessels and associated bunkering operations have had an exemplary safety record. For example, the Viking Grace cruise ferry has bunkered, without incident, more than 1,000 times in Stockholm since its entry into service in 2012.

**The global LNG-fuelled shipping fleet is growing**

While marine engines capable of utilising LNG as a fuel have been used in the LNG carrier industry for decades, the first non-LNG carrier vessel - the LNG-fuelled ferry GLUTRA with gas engines and storage tanks - came into service in 2000, in Norway. As of December 2016 there were 97 LNG-fuelled ships in operation, mostly smaller vessels such as ferries, operating extensively in the ECAs of north west Europe and North America.

As of December 2016, there were 91 LNG-fuelled ships on order. There were also approximately another 70 LNG-ready ships either in service or on order. These vessels are designed for a streamlined conversion from conventional fuels to LNG when the time is deemed right. The existing order book is showing a growing number of deep-sea vessels including cruise ships, container vessels and bulk carriers being built to LNG dual-fuel standards.

The world's first dual-fuelled container vessels entered service in late 2015 for TOTE Maritime in the trade between the U.S. and Puerto Rico. Since their introduction they have been running on LNG for a vast majority of their operating hours. These vessels again prove that the technology works safely and effectively. There is growing shipper and consumer pressure for more environmentally friendly logistics.

Increasingly, major shippers are looking for environmentally friendly international supply chains in response to consumer, policy and societal pressures.

Many companies, such as Unilever, IKEA and Volkswagen (VW), have publically stated that they are aiming to ‘green’ their entire marine and land transportation logistics. For example, in January 2016, Unilever announced that, wherever possible, it intends to move its transport contracts to companies that operate LNG-powered trucks and ships. Similarly, in October 2016, the VW Group stated that, from 2019, the VW Group Logistics will use two LNG-powered charter vessels from Siem Car Carriers for the marine transport of vehicles.

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**Logistics**

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*Images*

ABOVE: LNG NATURAL GAS TANKERS
SHUTTERSTOCK.COM

BELOW: CRUISE COMPANIES ARE LEADING THE ADOPTION OF LNG AS A MARINE FUEL
What is SEA\LNG doing?

TO TRANSLATE SEA\LNG’S VISION OF A COMPETITIVE GLOBAL LNG VALUE CHAIN FOR CLEANER MARITIME SHIPPING BY 2020 INTO ACTION, WE HAVE DEVELOPED A STRATEGY BASED ON THREE PILLARS

1. Collaboration
Moving away from fragmented initiatives and leveraging our members’ knowledge and networks

2. Demonstration
Sharing real-life examples and case studies from members and the broader industry

3. Communication
Impacting and influencing key stakeholders in the shipping industry, ports and local communities, shippers, as well as governments and regulators.

Our aim is to highlight the viability of and demand for LNG across the maritime value chain, creating the necessary confidence between each link, and helping, for example:

- Shipping companies to understand the demand from the shippers and their customers;
- LNG suppliers to see growing demand from shipping companies;
- Shipping companies to have confidence that the LNG supply and bunkering infrastructure will be available;
- OEMs (original equipment manufacturers) and shipyards to have the confidence to make investments to drive down conversion and new build costs;
- Regulators, to have a better understanding of commercial drivers and the need to co-ordinate with and learn from each other;
- Port authorities to have the support of local communities; and
- Investors to have the confidence to allocate capital to LNG shipping and the related infrastructure.

For more information regarding SEA\LNG, visit sea-lng.org

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