1. WHAT IS SEA\LNG?
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 IN SUPPORT OF THE IMPLEMENTATION OFIMO’S 2020 SULPHUR CAP REGULATIONS AND ITS DEVELOPING CLIMATE STRATEGY.

We 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, governments and civil society; higher capex levels for gas equipment such as LNG tanks; and fragmented and uncertain regulation.

For LNG to play a significant role as a marine fuel, it requires collaboration across the entire marine LNG value chain. SEA\LNG unites key industry players from major LNG suppliers, bunkering companies, shipping lines, infrastructure providers, and shipyards, to OEMs (original equipment manufacturers), classification societies, port authorities, and investors. The coalition is acting collectively as a driving force behind the uptake of this environmentally and commercially important fuel.

The coalition has grown rapidly from 13 founding members in July 2016 to more than 30 by the end of 2017. And in January 2018, we welcomed our first member from the banking sector.

Investments in LNG as a marine fuel are widespread and our organisation spans the globe, with members from Europe, India, Japan, North America, Russia, and Singapore.

We are proud that our members have been at the forefront of industry developments during 2017, which will continue through 2018 and the years ahead. As recognition of LNG as a viable, sustainable marine fuel gathers momentum, we anticipate the coalition will continue to expand with the addition of major shipping lines, bunkering companies, and ports from across the globe expected in the coming year.
2. DEVELOPMENTS IN LNG AS A MARINE FUEL OVER THE PAST YEAR

The longer term regulatory trends are also becoming clearer. The sulphur content limit for automotive diesel, at 10ppm and in force in the European Union since 2009, is 500 times lower than the IMO 2020 sulphur cap. Many other countries either have, or are in the process of introducing, similar limits. Additionally, public concerns continue to grow in relation to the negative health impacts of fine particulate matter emissions (related to sulphur content) and also the nitrogen oxides (NOx) emissions produced by diesel engines. This has not been helped by the recent (2014 onwards) “diesel scandal”.

It seems certain that sulphur limits for marine fuels will tighten and there will also be more regulation in relation to NOx and particulate matter. Black carbon, another by-product of marine fuels with relatively high sulphur content, is also rising up the regulatory agenda. In addition to tightening regulation in international waters, we may also see the expansion of existing Emission Control Areas (ECAs) which have more stringent emissions regulations. We expect the development of new ECAs, for example the Mediterranean ECA proposed by the French government in 2017 and the Chinese ECAs which are gradually being rolled out in key port areas in the northeast of the country.

These regulatory trends strongly favour the choice of LNG as a marine fuel. It 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 sulphur oxides (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.

After the 2015 COP21 (Paris) agreements, pressure has been growing on the shipping sector to contribute to global greenhouse gas (GHG) reductions and the emissions performance of different marine propulsion systems is coming under greater scrutiny. Furthermore the IMO has developed its initial strategy for reducing GHG emissions from international shipping, which aims for a 50% reduction by 2050 compared to 2008.

Decarbonisation of the shipping sector is likely to require a portfolio of solutions, including different fuelling solutions, more efficient ships, and an increased role for renewable energy e.g. batteries, solar, Flettner rotors, and kites.

SEA LNG supports its own initiatives, as a fair and equitable regulatory environment across the globe is essential.

The decision by the IMO in October 2016 to introduce a global 0.5% sulphur cap on marine fuels dominates the regulatory agenda. The industry is gradually moving from a state of “wait and see” to acceptance as the IMO, Flag, and Port States focus increasingly on compliance. Indeed, a number of major shipping industry organisations including BIMCO, Cruise Lines International Association, International Chamber of Shipping, Cruise Lines International Association, International Parcel Tankers’ Association, INTERTANKO, and World Shipping Council are calling for a ban on the carriage of non-compliant fuels.

Shorter term regulatory trends are clearly driving growth in LNG-fuelled shipping. In the northeast of the country.

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 renewable natural gas, including power-to-gas and bio-LNG, as technology developments allow.

LNG FACT BOX

LNG IS ECONOMIC: LNG-fuelled propulsion is already proving to be a cost-effective solution to meeting emissions limits in 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 implementation of the IMO’s 0.5% global sulphur cap in 2020 will support LNG’s use in deep sea shipping as the subsequent increase in demand for low sulphur fuels will allow LNG to demonstrate its competitiveness versus others such as MGO and LSFO. The use of scrubbers which enable the use of traditional high sulphur fuels is challenged by additional capital expenditure (capex), operational complexity, and waste management issues.

LNG IS SAFE: LNG has an excellent safety record as a bulk commodity and a transportation fuel. 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.

LNG IS AVAILABLE: LNG is a global commodity. It is already available, in large volumes, at about 150 locations worldwide through existing liquefaction plants and regasification terminals. This bulk infrastructure continues to grow with some 50 more plants currently under construction. Of the top 25 global ports ranked by volume of trade bulk, LNG is already available in, or in close proximity to, 24 of them.

LNG IS ECOLOGIC: LNG’s use in deep sea shipping as the subsequent increase in demand for low sulphur fuels will allow LNG to demonstrate its competitiveness versus others such as MGO and LSFO. The use of scrubbers which enable the use of traditional high sulphur fuels is challenged by additional capital expenditure (capex), operational complexity, and waste management issues.

Sources include: NOAA, Europe 2017 Greenhouse Gas Inventory from Natural Gas in Transport, ING-VL, 2015, St Frount – LNG as a ship fuel, Corbett, J.T., Theophilus, H., Winstead, J.L., 2015, Methane Emissions from Natural Gas bunkering operations in the Marine Sector: A Total Fuel Cycle Approach. In Focus – LNG as a ship fuel; Corbett, J.J., Thompson, H., Winebrake, J.J., 2015, with a potential for up to 25% on more as technology develops, compared with conventional oil-based fuels. LNG, in combination with efficiency measures being developed for new ships in response to the IMO’s Energy Efficiency Design Index (EEDI), will provide a way of meeting the IMO’s decarbonisation target of a 40% decrease by 2030 for international shipping.

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 renewable natural gas, including power-to-gas and bio-LNG, as technology developments allow.

These regulatory trends strongly favour the choice of LNG as a marine fuel.
As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months.

THE NEWBUILD PICTURE

Despite a complicated jigsaw when it comes to the future fuel matrix, prices, and availability, ship owners are continuing to bet on LNG’s potential by ordering LNG-fuelled vessels. A survey conducted by German trade fair organiser, Hamburg Messe and Congress revealed that 44% of respondents cited LNG as their first choice when contemplating newbuild orders. And evidence shows that this is being acted upon.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months. The passenger and cruise segment has been leading the charge and stimulating the demand for LNG bunkers. A headline from Interferry 2017 – “From Ferry-tale to Reality” – captures this sentiment well. This trend continues with Carnival’s nine newbuilds on order, plus new buildings announced in January 2018, that it is considering further orders of LNG-fuelled ships. Like a game of chess, this decision by CMA CGM is so significant as it tips the balance for so many that may have – until now – been contemplating their next move, waiting to see how the largest industry actors will influence 2020 game plans.

And evidence shows that this is being acted upon.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months. The passenger and cruise segment has been leading the charge and stimulating the demand for LNG bunkers. A headline from Interferry 2017 – “From Ferry-tale to Reality” – captures this sentiment well. This trend continues with Carnival’s nine newbuilds on order, plus new buildings announced in January 2018, that it is considering further orders of LNG-fuelled ships. Like a game of chess, this decision by CMA CGM is so significant as it tips the balance for so many that may have – until now – been contemplating their next move, waiting to see how the largest industry actors will influence 2020 game plans.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months. The passenger and cruise segment has been leading the charge and stimulating the demand for LNG bunkers. A headline from Interferry 2017 – “From Ferry-tale to Reality” – captures this sentiment well. This trend continues with Carnival’s nine newbuilds on order, plus new buildings announced in January 2018, that it is considering further orders of LNG-fuelled ships. Like a game of chess, this decision by CMA CGM is so significant as it tips the balance for so many that may have – until now – been contemplating their next move, waiting to see how the largest industry actors will influence 2020 game plans.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months. The passenger and cruise segment has been leading the charge and stimulating the demand for LNG bunkers. A headline from Interferry 2017 – “From Ferry-tale to Reality” – captures this sentiment well. This trend continues with Carnival’s nine newbuilds on order, plus new buildings announced in January 2018, that it is considering further orders of LNG-fuelled ships. Like a game of chess, this decision by CMA CGM is so significant as it tips the balance for so many that may have – until now – been contemplating their next move, waiting to see how the largest industry actors will influence 2020 game plans.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months. The passenger and cruise segment has been leading the charge and stimulating the demand for LNG bunkers. A headline from Interferry 2017 – “From Ferry-tale to Reality” – captures this sentiment well. This trend continues with Carnival’s nine newbuilds on order, plus new buildings announced in January 2018, that it is considering further orders of LNG-fuelled ships. Like a game of chess, this decision by CMA CGM is so significant as it tips the balance for so many that may have – until now – been contemplating their next move, waiting to see how the largest industry actors will influence 2020 game plans.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months. The passenger and cruise segment has been leading the charge and stimulating the demand for LNG bunkers. A headline from Interferry 2017 – “From Ferry-tale to Reality” – captures this sentiment well. This trend continues with Carnival’s nine newbuilds on order, plus new buildings announced in January 2018, that it is considering further orders of LNG-fuelled ships. Like a game of chess, this decision by CMA CGM is so significant as it tips the balance for so many that may have – until now – been contemplating their next move, waiting to see how the largest industry actors will influence 2020 game plans.

As of December 2017, there are 119 LNG-powered vessels in operation with a further 125 on order, representing an increase of 23% and 37% respectively over the previous 12 months.

The lack of infrastructure is always on top of the list for those citing the largest hurdles to uptake of LNG as a marine fuel. However, this argument is being steadily eroded and it’s fair to say that 2017 represents a tipping point for LNG infrastructure. Indeed, one respected industry publication recently reported “a blizzard of LNG bunkering developments in 2017.” And it certainly seems that way - of the world’s top oil bunkering ports, nine of the top ten (the exception being Los Angeles / Long Beach but indications are this is changing) offer LNG bunkering, or will do so by 2020. LNG is now readily available in bulk at approximately 150 locations worldwide, and there is a huge bulk LNG infrastructure of regasification terminals and liquefaction plants globally. Of significance, this infrastructure is already well aligned with many deep-sea trade routes. It is the movement of LNG from bulk facilities to the ships, more commonly known as the ‘last mile’, where efforts are being concentrated to enable easy access to LNG as a marine fuel.

Ship-to-ship (STS) transfers, identical to current heavy fuel transfer, are a much quicker and more efficient operation than jetty-side truck-to-ship (TTS) bunkering. Developments accelerated through 2017, the Gas4Sea (partners Engie, NYK and Mitsubishi) Engie Zebrugge, its Zebrugge-based 5,000m³ LNG bunker vessel was delivered in April 2017 and was the first purpose-built LNG bunker vessel to enter into operation; in August 2017, Shell took delivery of the 6,500m³ Cardissa, an LNG bunker tanker that is being operated from Rotterdam; Skangas also took delivery of a purpose-built LNG bunker vessel this summer – the 5,800m³ Corallius; and outfitting is currently being completed on the Clean Jacksonville – North America’s first ocean-going, 2,200m³ LNG bunker barge owned by TOTE, Inc. By early 2018 a total of six LNG bunker vessels are scheduled to be in service in Europe and North America.

We are now seeing announcements for investments in the next tier of bunker vessels focused on NW Europe, Spain, the US East Coast, China, and South Korea.
The growth of LNG infrastructure on a global basis will underpin the growth of this important marine fuel.

Shell has announced a cooperation with Anthony Veder on the conversion of the Dutch shipowner’s 7,500m³ coastal LNG carrier Coral Methane into a bunker vessel, with plans for long-term charters of bunker barges serving the Amsterdam, Rotterdam, and Antwerp (ARA) region in North West Europe and the southeast coast of the US (the Q-LNG barge). Also in Europe Titan LNG will introduce its first LNG bunker vessel, the FlexFueler001 pontoon, in mid-2018 to enable the delivery of LNG fuel to vessels throughout the ARA region. Gas Natural Fenosa plans to deploy a dedicated bunker vessel in the port of Barcelona, and Total awarded a contract for an 18,000m³ bunker vessel which it will charter to meet the needs of CMA CGM’s newbuild container ships.

In China, the ENN Group has announced plans to develop an LNG bunkering hub at Zhoushan, near Shanghai, which includes plans for an 8,000m³ LNG bunker-supply ship while in South Korea, Korea Line has ordered two small-scale 7,500m³ LNG carriers from Samsung Heavy Industries (SHI) for delivery in May and December 2019, to be deployed on domestic coastal trades. The first vessel will deliver small-scale shipments of LNG to Jeju island for a 20-year contract and the second will supply LNG as marine fuel. Estimates vary considerably but some industry participants anticipate that up to 30 LNG bunker vessels could be operating globally within the next five years.

With the majority of LNG bunkering stations currently located in Europe - a result of the early implementation of ECAs - the region currently dominates the LNG bunkering market. But with high marine trade and home to Singapore - the world’s largest bunkering location - Asia-Pacific is expected to catch up quickly. Ports play a crucial role in facilitating this uptick in confidence, not only in relation to infrastructure, but also through incentives and the development of operational guidelines and support. In 2017, for example, the Maritime and Port Authority of Singapore (MPA) commenced its LNG bunkering pilot project, which provides various companies grants of up to S$2 million per LNG-powered vessel constructed. It also recently announced plans to co-fund the building of a number of new LNG bunker vessels. In Japan, the Yokohama-Kawasaki International Port has initiated an ambitious LNG bunkering programme.

In parallel, the vital enabling work on regulation and guidelines proceeds apace. We are seeing a push to develop uniform bunkering standards, informed by the work our partner association, the Society for Gas as a Marine Fuel (SGMF), is doing. Striving for harmonisation of regulations on a global level is critical to the long-term success of LNG. Ports, for example, are learning from early adopters, such as the Ports of Rotterdam and Jacksonville, and sharing knowledge and best practice to create uniform local regulation.

**IN SUMMARY**

As the regulatory process continues and its likely trajectory becomes clearer, shipping lines and owners are increasingly seeing LNG as a long-term, compliant solution for their operations. As the actions of industry leaders such as CMA CGM and TOTE illustrate, LNG is a vital element of the future fuel mix for shipping.

The supply-side is responding. The bulk LNG infrastructure is largely built, what remains is the last mile, in which the industry is showing a growing appetite to invest. The number of LNG bunkering vessels has grown from one, at the beginning of 2017 to six in early 2018, with these numbers are expected at least to double by 2020.

As the world’s shipping markets continue to recover, the growth of LNG infrastructure on a global basis will underpin the growth of this environmentally and commercially important marine fuel.

3. WHAT ARE WE DOING AND WHY? SEA\ LNG’S WORK AS AN ADVOCACY ORGANISATION IS BASED ON THREE STRATEGIC PILLARS, NAMELY:

**COLLABORATION**

- MOVING AWAY FROM FRAGMENTED INITIATIVES TO UNITE AND LEVERAGE OUR MEMBERS’ KNOWLEDGE, EXPERTISE, AND NETWORKS

**DEMONSTRATION**

- SHARING REAL-LIFE EXAMPLES AND CASE STUDIES FROM MEMBERS AND THE BROADER INDUSTRY

**COMMUNICATION**

- IMPACTING AND INFLUENCING KEY STAKEHOLDERS IN THE SHIPPING INDUSTRY

To effectively incentivise the developments needed to realise a competitive global LNG value chain for cleaner maritime shipping by 2020, we need to make the credible, fact-based case for LNG as a marine fuel to the shipping industry - to investors, bankers, shipping lines, bunkering companies, ports and other enabling stakeholders such as shippers, governments, regulators and local communities.

Streered by our members, we have prioritised the following areas of work for 2018. First, to better understand our stakeholders in different geographies; who they are, what are their (informational) needs, and how can we communicate with them most effectively to make the case for LNG as a marine fuel? Second, to develop content. The industry continues to require credible, fact-based material, backed-up by academic research as necessary, on the emissions, investment and infrastructure case for LNG.

**EMISSIONS CASE:**

While the environmental benefits of LNG as a marine fuel are clear with respect to air quality improvements in relation to ‘local emissions’ such as SOX, NOX and PM (particulate matter), and various studies show that LNG offers serious GHG emissions reductions, there are questions relating to the global warming implications of methane emissions in natural gas production and transportation and methane slippage in marine engines. In collaboration with partners such as SGMF, SEA, LNG is sponsoring a comprehensive, academically validated analysis which compares full lifecycle, well-to-wake GHG emissions of LNG-fueled propulsion systems with IMO 2020 compliant oil-based solutions such as low sulphur fuels and high sulphur fuels with exhaust abatement i.e. scrubbers.
INVESTMENT CASE:
Unfortunately, there continues to be a lack of clarity around the potential for LNG by many shipping lines and investors. New build investment decisions may often be predicated upon incomplete analysis and inappropriate or incomplete metrics. The investment case work will consist of two complementary phases. Phase I will involve a comparative analysis of the qualitative factors that should help inform new build investment decisions. This includes operational considerations, such as waste disposal, technology maturity and supply chains, availability of fuel suppliers and bunkering infrastructure, bunkering logistics, and the likely impact of future regulation.

In Phase II we will use a sophisticated investment model capable of evaluating specific vessel types, servicing different global shipping routes, using different propulsion systems to explore newbuild investment choices under a range of scenarios, such as fuel prices and capes. This will be based on operational data and assumptions agreed by SEA\LNG members using publicly available sources.

INFRASTRUCTURE CASE:
This work consists of two streams and is currently in the early phases of implementation. The first attempts to answer the question asked by shipping lines, if I invest in LNG-fuelled systems for my fleet, will the LNG be available where I need it? This takes the form of an online, map-based tool called Bunker Navigator using a variety of member data, publicly available data, and marine information services. It provides an overview of key LNG bunkering developments and how this growing infrastructure relates to major global shipping routes, traditional oil bunkering ports, and the bulk LNG infrastructure which will provide the foundation for future bunkering services.

The second, is to share insights from actual infrastructure projects in the form of member case studies. These set out the key lessons learned and provide insights into some of the practical challenges members have faced, and how they have harnessed collaboration and partnerships to achieve their objectives.

SEA\LNG is confident that once the fact base is set out in a clear and credible manner for the global shipping industry, LNG will move from the ‘chicken and egg’ to the ‘virtuous circle’ as investment confidence grows throughout the marine value chain and knowledge spreads to key enablers such as bankers, ports, regulators, and local authorities.

2018 will be an important year in the history of shipping as the industry begins to more readily embrace the transition from heavy fuels to the new reality of cleaner, more socially and environmentally conscious maritime fuels such as LNG.