



**WHY LNG  
REPRESENTS  
A BRIDGE OF  
PRAGMATISM ON  
SHIPPING'S  
ROAD TO  
DECARBONISATION**



**In December 2017, a declaration launched at the “One Planet” climate summit hosted by French president Emmanuel Macron urged the shipping industry to work towards meeting the Paris climate goals.** The “Tony de Brum” declaration – named after the former Marshall Islands Foreign Minister and climate advocate who died in 2017 – calls for shipping to take “urgent action” to contribute to meeting the 2°C and 1.5°C goals of the Paris (COP21) accord. This is an example of the growing pressure on the industry, from governments, regulators and also the changing expectations of its customers and society at large.

Shipping is the invisible backbone of the global economy and is the most energy efficient way of moving goods. Seaborne transportation accounts for approximately 90% of international trade (measured by tonne-miles) and is forecast to grow significantly – DNV GL estimates by about 60% by 2050. This growth plus replacement of existing tonnage implies huge investments by the shipping industry.

**The challenge the industry faces is making the right investment decisions now to enable it to comply both with short-term local emissions regulations e.g. the IMO 2020 sulphur cap, and the long-term climate legislation under consideration by the IMO, while remaining economically competitive.**

Shipping companies and investors need to be sure that the long-lived assets in which they are investing will not require major additional investment to comply with future regulations, or in the worst case be rendered obsolete by them – the so-called stranded asset issue.



## THERE IS NO SILVER BULLET

**The energy transition is complex and there is no silver bullet to decarbonise the shipping industry.** Decarbonisation of shipping will require a combination of fuelling solutions; plus more efficient ships; plus an increased role for renewable energy; plus gradual substitution and blending of fossil fuels with biofuels and renewable fuels; and gradual introduction of longer term technology solutions such as synthetic fuels produced from renewable energy. Clearly, LNG is not a panacea for the emissions challenge faced by the maritime sector. However, SEA\LNG believes that using today's technology it can and currently does play a significant bridging role in this decarbonisation process, while at the same time improves air quality by addressing the problem of harmful local emissions.

LNG far outperforms conventional marine fuels in terms of minimising local emissions to improve air quality and can significantly reduce GHG emissions. LNG emits zero sulphur oxides (SOx) and virtually zero particulate matter (PM). Compared to existing heavy marine fuel oils, LNG emits 90% less nitrogen oxides (NOx) and through the use of best practices and appropriate technologies to minimise methane leakage, realistic reductions of GHG by 10-20% are achievable<sup>1</sup>, with a potential for up to 25% or 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. And there are clear technology pathways which will allow further emissions savings to be realised.

<sup>1</sup> Sources include NGVA Europe, 2017. Greenhouse Gas Intensity from Natural Gas in Transport; DNV GL, 2015. In Focus - LNG as a ship fuel; Corbett, J.J., Thompson, H., Winebrake, J.J., 2015. Methane Emissions from Natural Gas Bunkering Operations in the Marine Sector: A Total Fuel Cycle Approach



## LNG IS AVAILABLE NOW AND SCALABLE TO MEET THE INDUSTRY'S NEEDS

**LNG is a proven marine fuelling solution and is available now.** LNG offers the shipping industry a credible, safe, competitive, and environmentally beneficial fuel.

**Compared to existing alternatives and other unproven technologies, LNG provides a means to address key environmental needs today. It is in use now and has proven itself to be an effective and safe marine fuel and has the capacity to scale rapidly to meet the needs of the marine industry.**

Hydrogen is often touted as a destination fuel for the marine industry as its combustion, or use in fuel cells, produces no GHG emissions, only water. However, its use as a marine fuel faces a slew of technical, operational, and commercial challenges which are likely to take decades to overcome, as even its most enthusiastic supporters would admit.

Current hydrogen storage and propulsion systems for the marine sector are immature technologies and extremely expensive. The liquid hydrogen needed by the shipping industry has to be kept at temperatures of  $-253^{\circ}\text{C}$ , making it difficult to handle and there are also significant safety issues associated with the use of hydrogen on board ships. Additionally, it has a low energy density and consequently its large storage tanks displace a great deal of space.

Hydrogen is not available in the locations or volumes needed by the shipping industry. Its production and supply chains are undeveloped, requiring huge amounts of capital investment in hydrogen plants and transportation and distribution infrastructure.



Hydrogen itself is expensive. Hydrogen produced from electrolysis, using renewable energy is three to seven times more expensive than crude oil (on an energy equivalent basis); while that produced from fossil fuels (most hydrogen is produced from the steam reformation of natural gas) is necessarily more expensive than gas. Further, liquefaction of hydrogen is an energy intensive process, consuming more than 30% of its energy content.

Finally, but very much importantly, emissions savings from hydrogen depend on the process used to produce it.

### **On a well-to-wake basis ships fuelled by liquid hydrogen produced from natural gas produce about 30% more CO2 emissions than LNG.**

Electrification, inspired by progress in the automotive sector, is more frequently being discussed as a solution. Batteries have a role in hybrid propulsion systems and are potentially suitable for some short-sea shipping operations. However, as DNV GL has recently stated, commercial vessels sailing on the major routes will not be battery-driven by 2050 – “It’s not possible to store enough energy for deep sea voyages”.

Hydrogen, battery-based and other propulsion systems, such as ammonia, may prove to be long-term zero-emission technology solutions for the shipping industry, but they will require huge investments by industry and governments over decades to realise their potential. By contrast, LNG is a commercially viable technology, with global supply chains, and is available now.



## AND WHAT ABOUT STRANDED ASSETS?

**The shipping industry is capital intensive and assets such as ships and the supporting bunker supply infrastructure are long-lived.** Investors are rightly concerned that the assets in which they are investing are at risk of being stranded by future, more stringent, climate regulation. However, it is important that the stranded asset question is considered thoughtfully, based on the facts rather than conjecture.

It should be noted that almost all LNG propulsion systems are dual-fuel, meaning they are highly flexible, able to utilise a wide range of fuels, from fossil fuels including marine gasoil, fuel oil and LNG to low carbon fuels such as biofuels and renewable LNG. This flexibility provides a hedge against future climate legislation, allowing ship owners to transition with minimal cost i.e. using the same engines, to low emission fuels.

The infrastructure for LNG is already there – the focus is on investments in the ‘last mile’, or LNG bunkering assets to take it from bulk facilities to the ships. LNG is available in about 150 locations worldwide through existing liquefaction and regasification terminals. Of the top 25 ports ranked by volume of trade, LNG is already available in, or near, 24 of them and LNG bulk infrastructure is well aligned with the major shipping trade lanes. Investments in bunkering vessels, jetties and small-scale liquefaction and storage facilities are in the several to 10s of millions of Euros (versus €several hundred to €1bn for a new regasification terminal). For example, a recent study by DNV GL shows that to enable LNG bunkering at over 40 Iberian ports, an investment of just over €1bn is needed (by 2030).

Investments are already under way. Of the top 10 conventional oil bunkering ports, nine offer LNG bunkering or have firm plans and proposals to offer it by 2020. Importantly, almost all the required infrastructure investment will come from the private sector and does not rely on government funding.



## WHY LNG MAKES SENSE AS A LONG-TERM, BRIDGING SOLUTION FOR THE MARINE ENERGY TRANSITION

**There remain many unknowns, not only for LNG, but also for any alternative solutions.** It is critical that we, the shipping industry and other related stakeholders, share – and are honest about – what we know; what we don't know; where the opportunities are; and commit to exploring them as transparently and objectively as we can.

**SEA\LNG believes that LNG offers a commercially viable bridging solution to a zero-emissions shipping industry, with immediate local and GHG emissions benefits.**

LNG-fuelled vessels and bunkering infrastructure can easily switch from fossil-fuel LNG to renewable, or zero-emissions LNG, meaning that investment in LNG-fuelled ships and bunkering infrastructure today does not lock the shipping industry into a high GHG emissions trajectory. In the medium term, bioLNG (from biogas) could become a 'drop-in' fuel, significantly reducing GHG emissions. While longer term, 'power-to-gas' is a key technology with the potential to produce large volumes of renewable LNG.

Despite many unanswered questions, what's clear is that – to remain commercially practicable - pragmatism must prevail when it comes to navigating the road to a decarbonised future for shipping. There may be multiple pathways to reaching the desired end point, but many of them are going to be bumpy for a long while yet. Getting from A to B is going to require an economically and environmentally viable bridge that can carry the industry forward and evolve along the way. That's why LNG as a marine fuel offers such unrivalled potential for achieving shipping's short and long-term energy transition goals.

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