

## *Briefing Paper*

# LNG for the shipping sector: air quality and climate protection

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### **1. Introduction**

Given the increasingly intensifying national and international discussions about climate change and climate protection in politics and society at large, especially regarding the climate impact of various modes of transport, the shipping sector now needs to specify its contribution to reducing global greenhouse gas emissions. Shipping emits 2.2% of global CO<sub>2</sub> emissions, increasing by 14–25% until 2030 and by 50–250% until 2050 if no action is taken, according to a study by the IMO (International Maritime Organization, 2015).

Whereas past discussions mostly revolved around road transport, an ever more pro-active and critical public now demands clear answers and commitments from all transport sectors. This means that shipping is now obliged to demonstrate how it will contribute to global climate protection commitments and reach sectoral goals.

This briefing paper outlines the contribution of (fossil) LNG to reaching global climate protection goals in shipping thereby clarifying the role LNG plays in the maritime energy transition. Equally, this paper demonstrates that LNG is only part of a bigger solution and that LNG's main advantage is the massive reduction of air pollutants emissions (nitric oxide, sulphur oxide, particulate matter). As a result, this should be central in the discussion of the use of LNG in the maritime sector.

## 2. Climate ~protection goals in shipping

Like other transport sectors, shipping – both sea and inland – will stop using fossil fuel at some point in the future. The transition to climate-neutral fuels has already started.

Inland shipping needs to reduce greenhouse gas emissions by 80–90% until 2050 as compared to 1990 levels according to the federal climate protection plan of the German federal government. In 2050, inland shipping must be climate-neutral (Die Deutsche Bundesregierung, 2016).

The IMO as the responsible regulatory body for global sea shipping has declared in its „Initial IMO Strategy on the reduction of GHG emissions from ships“ that greenhouse gas emissions are to be reduced to zero as soon as possible during this century: 50% of all greenhouse gas emissions have to be reduced by 2050. The IMO emphasises that the reduction of greenhouse gas emissions in shipping must be in accordance with the goals of the Paris Agreement on climate protection. Annex VI MARPOL (International Convention for the Prevention of Marine Pollution) already specifies several binding energy efficiency measures to reduce greenhouse gas emissions.

## 3. LNG’s contribution to reducing emissions: improving air quality and climate protection

LNG is a clean marine fuel as it massively reduces local air pollution as compared to oil-based fuels, especially as compared to HFO (Heavy Fuel Oil) which is used outside emissions control zones. LNG’s potential to reduce air pollutants emissions is considerable: it reduces SO<sub>x</sub> and particulate matter by up to 100%, NO<sub>x</sub> by up to 80%. This results in a significant improvement in local air quality in ports and coastal towns as well as in coastal regions and along the main inland shipping routes.

However, the main component of fossil LNG is methane (CH<sub>4</sub>) which is more harmful to the climate than CO<sub>2</sub> if it leaks into the atmosphere unburnt. This so-called methane slip can occur in the entire LNG supply chain, i. e. production, liquification, transport, and during ship operations. Each step of the maritime LNG supply chain must be evaluated to specify and quantify the methane slip: where the LNG is produced, how innovative the liquification technology used is, how it is transported and on which route, what type of ship engine is employed (Two or Four Strokes Engine, Dual Fuel or LNG only). This means that generalised assumptions about the extent of the methane slip and of fossil LNG’s potential to reduce greenhouse gas emissions are not possible. Moreover, all these factors must be accounted for before a comprehensive and reliable assessment can be made.

Several studies have analysed the CO<sub>2</sub> emissions potential of fossil LNG, based on various assumptions: Madrid Forum (2019), The Natural & bio Gas Vehicle Association (NGVA Europe) (2017), CE Delft et al. (2013), Ricardo et al. (2013) – see below for details. These studies conclude that CO<sub>2</sub> emissions can be lowered when using LNG as a marine fuel as compared to HFO which is mainly used on the world’s oceans. The extent of CO<sub>2</sub> reduction depends on the assumptions made, e. g. regarding the methane slip in the pre-operation supply chain, methane slip occurring during operation, the size of ship/cargo. These reports demonstrate that LNG used as a fuel can reduce CO<sub>2</sub> emissions by up to 20%.

The gas sector contributes 0.6% to the EU's greenhouse gas emissions, mostly in production and transport. In a recently published report (June 2019), the European gas sector outlines the current status of initiatives to report and reduce all the sector's greenhouse gas emissions. The report also proposes a range of measures to identify the sources of greenhouse gas emissions, quantify, monitor and report them as well as harmonise measures to do so across the EU to improve transparency and comparability. In addition, ship engine manufacturers continuously work on optimising their LNG fuelled ship engines and minimise the methane slip during ship operation.

LNG, also fossil LNG, has lower greenhouse gas emissions than traditional, oil-based marine fuels, including MDO (Marine Diesel Oil). Therefore, it contributes to reaching climate protection goals and to global climate protection. The choice of marine fuel is one of a range of measures to improve the climate record of shipping. Other measures are, for example, energy efficiency measures and the reduction of speed. Likewise, LNG suppliers and ship engine manufactures continuously address the methane slip which has led to considerable success, especially reducing the methane slip during ship operations.

LNG plays a valid role in the current climate protection discussion in the maritime sector: it serves as an important transition technology and is therefore an important part of an ambitious maritime climate protection policy that seeks to implement the goals of the Paris Agreement. However, we should not lose sight of the main advantage of LNG: the massive reduction of air pollutants resulting in a considerable improvement of local air quality for the people in port and coastal towns, in coastal regions and along the major inland shipping routes.

#### **4. Climate-neutral fuels**

LNG can be produced climate-neutral, i. e. without CO<sub>2</sub> emissions. Firstly, LNG can be produced on the basis of biogenic sources (Bio-LNG); secondly, it can be produced on the basis of renewable power, using the power to x technology (here: power to LNG technology) resulting in synthetic LNG. Bio-LNG can be produced in the short-term and in smaller quantities, as already happens, e. g. in Scandinavia. In the future, synthetic LNG will be a climate-neutral fuel that can be produced for the majority of the global shipping fleet as surplus offshore wind energy can be converted into synthetic methane using the power to x technology before being liquified. Initial testing facilities have been established in Germany, e. g. the Audi testing facility in Werlte, Lower Saxony.

Batterie-propulsion is a likely solution for ferries on shorter routes, but not for container ships which make up the bulk of global shipping. Hydrogen propulsion is not economically efficient for the foreseeable future. In addition, the necessary infrastructure for using it as a fuel is yet to be established. In Glasgow, the world's first sea-going hydrogen fuel cell powered Ropax ferry is currently being developed to be used on routes between the Scottish islands Orkney and Shapinsay. Battery-powered ferries are also increasingly being used in Norway.

## 5. Support Measures

- Comprehensively and continuously addressing the methane slip at each step in the entire maritime LNG supply chain – by suppliers and ship engine manufactures alike
- Intensifying existing initiatives and measures
- Considering the certification of fossil LNG to establish transparency given its widely varying climate record because of variation in source, production, and transport: a first important step in this direction is the harmonisation of monitoring and reporting mechanisms, as called for in the Madrid Report. Accordingly, a certification system should be developed by gas associations, i. e. this should be progressed by the sector itself to be adopted by the EU.
- Improving the statutory framework conditions for climate neutral LNG, produced from renewable power: the exemption from the EEG reallocation is a key step
- Conducting further research and analysis into the advantages of renewable LNG

## 6. Conclusion

Given the transport sector's ambitious climate protection goals shipping must now rapidly and consistently start and implement the maritime energy transition. Like other modes of transport, shipping has an obligation to drastically reduce greenhouse gas emissions to become climate neutral as fast as possible.

LNG as a marine fuel is the way to get started with this maritime energy transition as it is a mature technology that is immediately usable – as a fossil fuel in the beginning but increasingly renewable. This means that today's investments into an LNG infrastructure are a vital requirement for a climate neutral shipping sector as this infrastructure can be used for renewable LNG in the future.

Fossil LNG is a marine fuel that can massively contribute to air pollution control because of its low air pollutants emissions. Renewable and therefore climate neutral LNG needs to play a key role in any ambitious climate protection policy for the shipping sector that takes the goals of the Paris Agreement seriously.

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## 7. About the German Maritime LNG Platform

The German Maritime LNG Platform has worked towards establishing LNG as a marine fuel in sea and inland shipping and as an energy source in ports since 2014, specifically with a view to creating favourable framework conditions for the use of LNG in the maritime sector. The Platform has nearly 100 members and partners, among them ports, shipping companies, engine manufacturers, technology, logistics and infrastructure providers, LNG suppliers, classification societies, shipyards and shipping and environmental organisations and associations. It successfully operates as a partner to both political and sector stakeholders, often acting as a broker between them. The Platform closely co-operates with the German Federal Ministry for Transport and Digital Infrastructure and the German Federal Ministry for Economic Affairs and Energy to further develop the strategy for the maritime use of LNG in Germany.

For more information, please visit our website: [www.lng-info.de](http://www.lng-info.de).

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