

Consultation on an EU Strategy for Liquefied Natural Gas and Gas Storage

Question 11: *What technological developments do you anticipate over the medium term in the field of LNG and how do you see the market for LNG developing? Is there a need for additional EU action in this area to reduce barriers to uptake, for example on technology or standards, including for quality and safety?*

The use of natural gas as a fuel is not new and many technologies exist today to take advantage of natural gas either in the form of compressed natural gas (CNG) or liquefied natural gas (LNG). Rolls-Royce as a power systems company offers technology solutions for both on Land and at Sea, with a specific focus in the marine sector on LNG.

Despite the commercial availability of the technology today, forecasted LNG penetration - whilst growing gradually, will not account for a large part of the transportation fuel mix in the medium term. For example, in the marine sector Lloyds estimates LNG to account for 15% of the marine fuel mix by 2030¹. The concluding statement from Lloyds is that *"There is no tipping point, only evolutionary process. 16 years is less than a ship's lifetime and a dramatic overturn of the marine fuel landscape may not be realistic."* In the road transportation sector the US Energy Information Administration estimates that natural gas will account for only 7% of heavy duty vehicle energy consumption in 2040². During the period 2013-2040 growth of natural gas in transportation (includes motor vehicles, trains, and ships) is estimated to be 10.3% annually. The recent drop in oil price will only act to slow the penetration of LNG until such time that a corresponding price drop in LNG is realised.

Whilst the LNG fuel price differential to oil price is a key driver in penetration rate it is not the only one. Capital expenditure (CAPEX), redundancy, regulatory/financial incentives and, bunkering availability all have a role to play.

The marine industry (both in offshore and commercial) is actively working to reduce the CAPEX of LNG systems and to convince the offshore industry (where redundancy is key) to move away from Dual Fuel applications to a pure LNG solution. As the introduction of LNG newbuilds has only been recent - entering into service in certain sectors, such as the containerised and cruise fleets, experience is limited. However, with increased service experience, the benefits of a lower fuel costs and improved environmental performance relative to HFO will become apparent and are likely to trigger a larger uptake of LNG in these ship types.

The lower fuel costs of LNG fuel outweigh the initial larger CAPEX and for a marine vessel switching to LNG the payback period is estimated to be between 3 to 6 years (based on June 2015 prices of MDO). Further to lower operating costs, gas engines exhibit up to a 5% efficiency improvement over diesel engines and, as natural gas has a lower carbon-hydrogen ratio it will result in CO₂ reductions in excess of 30% for the same energy output. Further to the reduction in CO₂, combustion of LNG fuel results in near zero SO_x emissions, reduced Particulate Matter emissions, and NO_x emissions that meet the stringent IMO Tier III NO_x standards - without the need for costly exhaust gas cleaning systems. The large environmental benefits have been recognised by Norway which, by actively encouraging the adoption of LNG through the national NO_x fund, have seen the largest share of LNG fuelled marine vessels in the world.

Despite the steady progress and environmental benefits, assistance is required from the EU in increasing the LNG bunkering availability and putting in place the correct regulatory and financial incentives. As LNG bunkering is not widely available operators are forced to either plan a restricted

¹ Lloyds, Global Marine Fuel Trends 2030

² EIA, 2015 Energy Outlook

number of routes (hence why LNG uptake is popular for ferries) or consider a dual fuel (LNG and Diesel) option. The dual fuel option exacerbates the CAPEX issue and results in operators opting for diesel engines with after-treatment technologies, when the superior technical solution (that is commercially available) is the gas fuelled engine that does not require after-treatment technology.

The EU is asked to consider the promotion of more LNG bunkering facilities and to examine the steps taken by the Norwegian NOx fund to help develop its national marine LNG market.