SEA-LNG

CE Delft:

Availability and costs of liquefied bio - and synthetic methane - the maritime shipping perspective

INTRODUCTION

SEA-LNG commissioned this study on the availability and costs of liquefied biomethane (LBM) and liquefied synthetic methane (LSM). CE Delft conducted the study based on a comprehensive review of the latest academic and industry literature – some 150 publications were analysed in total. It focuses on 2030 and 2050, years in which important milestones in the GHG emissions from shipping will have to be met.

Decarbonisation of the shipping industry will require the use of zero or low carbon fuels. A potential decarbonisation pathway for shipping is to use liquefied biomethane, produced from biomass or liquefied synthetic methane, produced from renewable electricity, often referred to as 'power-to-gas'. The growing LNG-fuelled fleet could use LBM or LSM **without** major modifications and the existing supply infrastructure could be used for bunkering.

The viability of this pathway depends on the volumes of LBM and LSM that will become available to the shipping industry and the relative costs of these fuels compared to other future, as yet unquantified, zero / low carbon fuels.

KEY FINDINGS

Key points

- LBM is scalable
- LBM is globally available
- Availability of LSM will depend on build-out of renewable electricity capacity
- LBM and LSM are likely to be commercially competitive
- LBM and LSM can be used now

LBM IS SCALABLE

- Four main biomass streams are available for the production of LBM: energy crops (grown solely for energy purposes); agricultural residues; forestry products and residues; and aquatic biomass.

- If the global maximum conceivable supply of biomass was to be converted into biomethane, and if all the biomethane became available for maritime shipping, it would significantly exceed the global total energy demand of the sector.

- The sustainable potential for LBM and LSM could be substantially higher in 2050 compared to 2030, even when excluding aquatic biomass which has the potential to play a dominant role in the long term.

LBM IS GLOBALLY AVAILABLE

- Sustainable biomass supply, is lower than the maximum technical supply because it rules out interference with the production of food, fodder and fibres.

- Between 25% and 33% of the global sustainable biomass resource is in Asia.

- OECD regions contribute between 25% and 55% to the total sustainable biomass resource.

- In terms of competition for biomethane from other sectors, the power sector and the industry in general can be expected to reduce their demand for methane when the economy moves away from fossil fuel. The built environment, heavy land-based transport and shipping may see a continued or increased demand for methane from renewable sources.

AVAILABILITY OF LSM WILL DEPEND ON BUILD-OUT OF RENEWABLE ELECTRICITY CAPACITY

- Current renewable electricity supplies are insufficient to produce enough LSM to power a significant share of the global shipping fleet.

- In 2050, to decarbonise the maritime transport sector using LSM would require an estimated extra 25-30% of renewable electricity production, above that required to meet global targets consistent with the scenario of limiting global warming to 2C.

- The build-out of renewable electricity capacity will also be a key driver for the development of other synthetic fuels such as green hydrogen and ammonia.

LBM AND LSM ARE LIKELY TO BE COMMERCIALLY COMPETITIVE

- Production costs for the different renewable fuels are broadly comparable, particularly for LBM, liquid ammonia and liquid hydrogen and over time should decrease.

- Liquefaction, storage and transport costs for ammonia are lower than those for LBM.

- Liquid hydrogen costs are considerably higher. However, given the global availability of LBM and the ability to produce it locally, significant savings may be available as transportation costs of biomass to local LBM production plants is expected to be relatively low.

- The bunker price cost mark-up for the bunkering of green hydrogen and green ammonia can be expected to be higher than for LBM/LSM as the bunkering infrastructure of LBM/LSM is technically mature and commercially available, whereas for liquid hydrogen and ammonia it is not.

LBM AND LSM CAN BE USED NOW

- LBM and LSM can be burned in current LNG-fuelled vessels without requiring major modifications.

- They can be transported, stored and bunkered in existing LNG infrastructure.

LNG THROUGH LBM OFFERS A CLEAR PATHWAY TO NET ZERO-CARBON EMISSIONS FROM SHIPPING, FUTURE-PROOFING SHIP OWNERS' INVESTMENTS

The shipping industry faces unprecedented challenges if they are to meet the IMO's decarbonisation targets and the even more demanding goals being discussed by the European Union.

Confusing claims and counter claims are being made for different zero-emissions technologies, all of which have decades of research and development before they are proven for safe marine operations, globally available, and commercially viable.

LNG can future proof ship owners' investments against increasingly stringent regulations on local and GHG emissions. By investing in LNG-fuelled vessels now, ship owners can realise immediate GHG benefits – up to 21% on a Well-to-Wake basis and 28%, Tank-to-Wake. These LNG based assets, with little or no modifications, can use non-fossil fuel methane such as LBM and LSM, initially as drop-in fuels. As LBM and LSM become available at scale, the carbon free future can become reality.

If we are to make effective, meaningful progress with emissions reductions, waiting for utopia and the 'perfect' solution is not an option. We must act today and LNG is the only option that moves us forward on all fronts, now.

RECENT LBM AND LSM PROJECT ANNOUNCEMENTS

There are a growing number of LBM and LSM commercial trials and projects – some recent announcements can be seen below:

SEA-LNG member GASUM supplies first LBG to a vessel at the Port of Gothenburg in June 2018

"...a successful operation that demonstrates that we are fully prepared, with routines and operating instructions for bunkering and for operating our LNG vessels using LBG. We have now run the engines and it is simply a case of noting that everything works just as well using LBG as it does using LNG..."

https://www.portofgothenburg.com/news-room/news/first-ever-bunkering-of-liquefied-biogas-in-sweden-at-the-port-of-gothenburg/

Local supplier agreement with Port of Gothenburg in 2019 makes LBG bunkering easier

"...can present Swedish shipping with the opportunity to not only make the transition to liquefied natural gas, but also to gradually increase the proportion of renewable gas. Every step towards more sustainable transport is vitally important..."

https://www.ngvglobal.com/blog/new-agreement-between-swedegas-and-fordonsgas-liquid-biogas-gives-gothenburgs-shipping-climate-benefits-0603

SEA-LNG member MAN Energy Solutions trials LSM

"Industry and governments need to make an effort now to invest in LNG infrastructure to free the way for LSM-based, climate-neutral shipping tomorrow. Any LNG-retrofitted ship can also run on LSM – that's what we want to demonstrate..."

https://theloadstar.com/unifeeder-vessel-to-trial-synthetic-natural-gas-as-a-climate-neutral-fuel-for-box-ships/