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Methanol as fuel: creating a pathway to a cleaner shipping industry

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The maritime and ports industries are facing a future increasingly defined by environmental regulations, the impact of which will be felt along the supply chain. This change will require progressively cleaner fuels not just to improve air quality in the short term, but as part of a drive towards a decarbonised future.

The maritime industry is already embracing alternatives, in particular LNG, as a fuel that can meet 2020 SOx and NOx emissions requirements. While the concept has been proven, wider take-up has been slow for several reasons.

This has encouraged the industry to consider other fuels that can deliver not just 2020 compliance but potentially provide a pathway for a low carbon future. Chief among these is Methanol, which is compliant with 2020 sulphur regulations and ready for future carbon emission targets.

Short sea shipping, ferries, workboats and harbour craft – sectors that have flirted with LNG as a fuel – are all potential markets for Methanol. The environmental argument is irrefutable: like LNG Methanol addresses the SOx and Particulate Matter (PM) emissions problem but also offers a future pathway to a low- and zero-carbon emissions profile, allowing shipping to be part of the solution to global warming.

This biodegradable alcohol, which does not produce soot because it has no carbon-to-carbon bonds, would be an ideal alternative to heavy fuel oil in polar shipping.

Available and Suitable

As the world's most widely shipped chemical commodity, Methanol's further advantage is its availability at port locations around the world. Wherever you see tank farms at port facilities, you are likely to find Methanol storage capacity.

Its low emissions profile and ready availability mean Methanol has potential application as fuel for short-sea, inland and offshore ferry and even cruise tonnage, providing a simple roadmap for improving air quality and reducing greenhouse gas emissions at sea and ashore.

Because Methanol is liquid at ambient temperature, it is easy to handle and does not require the cryogenic storage necessary with LNG. This means that Methanol can be stored in conventional shoreside tanks and in ballast tanks onboard ship, so no dedicated storage capacity is needed.

Methanol as marine fuel has a safety profile that deserves to be better understood. Its safe handling practices draw on a long history and experience in shipping and industrial use.

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Methanol is miscible in water and so is far less hazardous to the environment than diesel or heavy fuel oil. In the event of an accidental spill during bunkering, Methanol will biodegrade rapidly and will vent with gravity, unlike LNG which vents directly into the atmosphere as a gas.

As a low flashpoint fuel, Methanol is subject to the revision of the IGF Code and should have full regulatory approval by 2023. Equipment manufacturers have responded, with engine maker MAN Energy Solutions investing substantially in a dual fuel main engine capable of burning a range of low sulphur fuels efficiently and safely, with an impressive emissions scorecard for the vessels already running on Methanol.

The eight ships already trading internationally on Methanol as fuel include the Stena ropax Stena Germanica and seven Methanol tankers operated by Waterfront Shipping - with four more set to enter service in 2019.

A Low Carbon Future

Methanol and LNG share the advantages of low SOx, NOx and PM emissions but LNG is still the source of high CO2 emissions in everyday operations – both in its transportation and as a fuel, due to methane slip, which can be as high as 4%.

Methanol on the other hand has close to zero 'in sector' CO2 emissions, which means it can be used as a solution to the IMO's recently agreed targets to reduce CO2 emissions by at least 50% of 2008 levels by 2050.

The higher cost of conventional fuel expected post-2020 will begin to make Methanol increasingly price-competitive as a marine fuel, it also de-risks the investment in newbuilds and conversions, because owners can use conventional Methanol for 2020 compliance then progressively blend in Biomethanol as more becomes available.

Biomethanol can be produced renewably from landfill gas, biomass, or by utilizing concentrated solar energy in a thermo-chemical reactor to re-energize CO2 into CO to produce syngas (a mixture of CO and Hydrogen), to then feed a methanol synthesis reactor, providing a very low/zero carbon fuel 'from well to wake'.

Several existing plants are already producing low-carbon methanol through a carbon capture/re-injection production loop. Methanol production offers a wide range of feedstock and process technologies for 'future proof', zero-carbon marine fuels.

Industry Acceptance

The shipping industry is already beginning to undertake the research it needs to drive the development of next-generation biofuels, including Biomethanol.

UK-based E4Tech was commissioned by the Platform for Sustainable Biofuels to draw up a master plan for CO2-reduction in the Dutch shipping sector using biofuels. It concluded that Biomethanol is highly attractive to the inland and short-sea shipping sectors because its energy density suits vessels with regular port calls, suggesting close dialogue with ports will be necessary to drive change.

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Research undertaken by Lloyd's Register and University Maritime Advisory Services for the Sustainable Shipping Initiative (SSI) concluded that biofuels could be the most feasible and cost effective means of compliance for some ship types.

The Sustainable Marine Methanol (SUMMETH) project backed the increased use of Methanol as a marine fuel, concluding that there are no obstacles to its use in a converted diesel engine. It found that small vessel conversion project is both feasible and cost-effective, with levels of safety that easily meet existing requirements.

The MethaShip project, conducted under the auspices of the Research and Development Department at the Meyer Werft shipyard in partnership with Flensburger Schiffbau-Gesellschaft and Lloyd's Register, considered prospects for a Methanol-powered cruiseships and ro-pax ferries. Its central conclusion is that Biomethanol is a fuel with a future, one which offers the potential for implementing an ambitious maritime climate protection strategy.

Most recently, the Methanol Institute and Nanyang Technological University (NTU) of Singapore announced co-funding for the first pilot project in Asia to evaluate the use of Methanol as a marine fuel with bench testing followed by a six-month sea trial onboard a local harbour craft.

Beyond 2020

While achieving compliance with 2020 will be painful in the short term, realising the IMO's ambitions for carbon reduction by 2050 will be a far greater challenge for the ports and shipping industries.

It will require the adoption of new fuel technologies and processes that will require co-operation between shipbuilders, engine manufacturers and classification societies, with research into new propulsion systems facilitated by governments within an IMO framework.

What is clear is that new fuels such as Methanol and Biomethanol will play a significant role in helping these industries achieve that change and help shape a cleaner, more sustainable future.

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