

Green Shipping

Highlighting
the Issues

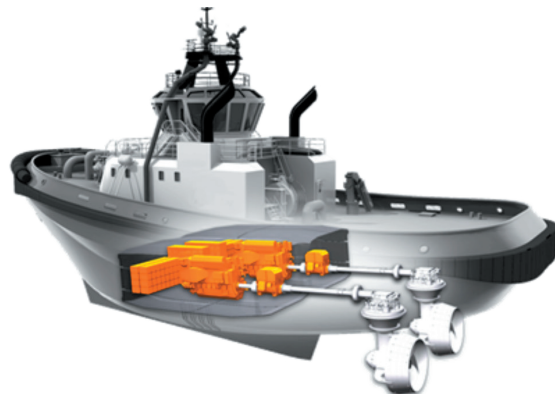


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Alternative Fuels: What are the options?

Introduction The purpose of this second paper is to briefly discuss one of the main routes to achieve decarbonization: the use of alternative fuels which can be defined as advanced fuels that are derived from sources other than petroleum or from renewable energy.



Nowadays, there is a variety of alternative fuel types available for the shipping industry, such as hydrogen, ammonia, methanol, ethanol, liquefied natural gas (LNG), liquefied biogas (LBG), hydrotreated vegetable oil (HVO), batteries, etc. In addition, it is important to remark that the shipping sector will choose the future fuels by evaluating the following factors: environmental impact, technical performance, safety, cost, availability and infrastructure.

We will now take a look at some of the most interesting options of alternative fuels, analyzing their main characteristics, advantages and disadvantages and mentioning recent examples in the industry.



1 Hydrogen

Hydrogen can be produced in several ways: by electrolysis of renewable matter and by reforming natural gas. Hydrogen is the lightest of all gas molecules, consequently offering the best energy to weight storage ratio among all fuels. Green hydrogen is one of the cleanest marine fuels with zero carbon emission that is produced by using renewable energy, but is not yet as cost competitive as hydrogen produced from natural gas. To sum up, Hydrogen is an attractive option and it can be a solution for decarbonization, although further research, risk assessment and development is needed.



2 Ammonia

Ammonia is a promising option as well. It is one of the most viable zero carbon fuels for shipping. It is produced commercially via the Haber process, that combines hydrogen and nitrogen with the help of high temperatures and a catalyst. Green ammonia can be produced by employing renewable energy sources such as solar or wind energy that gives ammonia a comparative advantage compared to the production of heavy fuels oils (HFO). Nevertheless, producing green ammonia is not yet cost competitive compared to conventional ammonia. There are several global initiatives to produce green ammonia.



3 Methanol

Experts consider that methanol may be one of the best alternative fuel, bearing in mind price, prompt availability, use of existing infrastructure and simplicity of engine design and ship technology. Also, methanol offers simpler handling and lower investment costs. Methanol can be produced from methane and it can offer a 25% CO₂ emissions reduction compared to heavy fuels oils (HFO). In addition, methanol can reduce SO_x, NO_x and PM. Nevertheless, methanol can also be produced from renewable energy resources, such as CO₂ capture, industrial waste or biomass, therefore, the GHG effect can be significantly reduced. Methanol is an attractive fuel because it is low in carbon and sulfur free. Also the methanol international market is going through a phase of huge expansion. Stena Germanica was the first methanol powered RoPax ferry that operates on the Gothenburg-Kiel route. This RoPax vessel was converted into a methanol powered vessel by a project supported by the EU Motorways of the Seas Program. Moreover, Maersk has announced plans for a green methanol powered vessel by 2023.

4 LNG

LNG (Liquefied Natural Gas) is an odorless and colourless mixture of gases, mainly methane (usually 80-95%), cooled to condense into a liquid. It is obtained from natural gas, that is extracted from gas fields. LNG is non-corrosive and non-toxic; it will not burn as a liquid. The shipping industry has ranked high LNG as a fuel alternative. LNG is an appealing alternative to meet the regulations on sulphur content in marine fuels, as sulphur levels in LNG are less than 0.004% of sulphur by mass. Vessels which are built to run on LNG emits approximately 25% less CO₂ than conventional marine fuels in providing the same amount of propulsion power.



However, it has had a 150% increase in methane emission due to the increasing number of LNG-powered vessels in operation. LNG is cheaper than HFO. In recent times, the bunkering infrastructure has grown. LNG can now be delivered to ships at more than 95 ports, including most of the main bunkering ports. According to the IMO, LNG is only a good option for ships in the short term.

5 Batteries

Batteries can store electricity for the use of ship propulsion. Lithium-ion batteries have made it possible for battery-powered propulsion systems to be engineered for smaller ships. The greater weight and lower power density limit the usage for many applications. Therefore, for bigger ships, engine manufacturers focus on hybrid electric solutions. However, nowadays it is not possible to use batteries as a standalone solution; it has to be combined with other renewable sources of energy such as wind and solar energy.

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Hydrogen, ammonia, methanol, LNG and batteries are some of the alternatives recommended by engineers as a better retrofit for ships. All of these fuel options are promising, however, there are still many challenges to overcome: fuel availability is uncertain, a huge investment of money has to be done and technology is not fully proven. The challenge is to narrow down the options to make the best decision on the path towards a greener sector!