

Alternative fuels - commentary

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What do we have now

- LNG – good for SO_x, NO_x and PM but not for GHG (a fossil fuel with issues over methane slip).
- Methanol – good for SO_x, NO_x and PM but not for GHG (made from coal or natural gas).
- Bio fuels (SVO, FAME, HVO) - good for SO_x. Emissions dependent on feedstock and process used. Generally considered renewable.
- LPG (Propane, Butane) - good for NO_x good for SO_x. Emissions dependent on feedstock and process used.

What is coming down the line

- Gaseous Bio fuels – Bio Methane generally good for SO_x, NO_x and PM. Better than LNG for GHG but still with issues over methane slip.
- Ammonia – non hydrocarbon fuel but currently manufactured from hydrogen and nitrogen but that hydrogen is predominantly from coal or natural gas causing considerable GHG emissions. There are technical issues for its use in marine engines but we expect the first large marine engines in 2024.
- Hydrogen - non hydrocarbon fuel but currently manufactured predominantly from coal or natural gas causing considerable GHG emissions. Unlikely to be used in large marine engines. If made by electrolysis using renewable source electricity it is a “green” fuel.

And the future?

- Synthetic fuels manufactured from captured CO₂, Hydrogen, Nitrogen to make –
 - Methanol,
 - Methane,
 - Ammonia.
- The process involves manufacture of “Syngas” which requires the use of expensive catalysts and large amounts of renewable energy.

Technical issues

- LNG, works well in engines (Otto cycle and Diesel cycle). Special storage and handling requirements and needs 3 times the volume on board to match VLSFO for range.
- Methanol works well in engines (Diesel cycle). Some storage requirements (toxicity) and needs 2.5 times the volume on board to match VLSFO for range.
- Liquid Biofuels work well in engines (Otto cycle and Diesel cycle). Some storage requirements (shelf life) otherwise simple replacement fuel.
- Ammonia has some difficulties with combustion system (Diesel cycle). Special storage and handling requirements (very toxic), will require exhaust aftertreatment and needs 3 times the volume on board to match VLSFO for range.
- Hydrogen will have some difficulties with combustion system (Diesel cycle). Has been used in automotive (Otto cycle) engines. Special storage and handling requirements (very explosive) and needs 5 times the volume on board to match VLSFO for range.

Non traditional applications.

- The most useful are fuel cells which use fuel such as Methane, Methanol or Hydrogen and produce electrical energy and virtually no harmful emissions (tank to wake). Currently size limited to the low MW output range.
- These cells are likely to find application as part of hybrid installations with conventional engines, battery systems or as propulsion on specialist small vessels.
- There are already small submarines (in use since 2005) which use fuel cells rather than batteries for propulsion whilst submerged. There are also some installations providing auxiliary power for ferries and OSV.