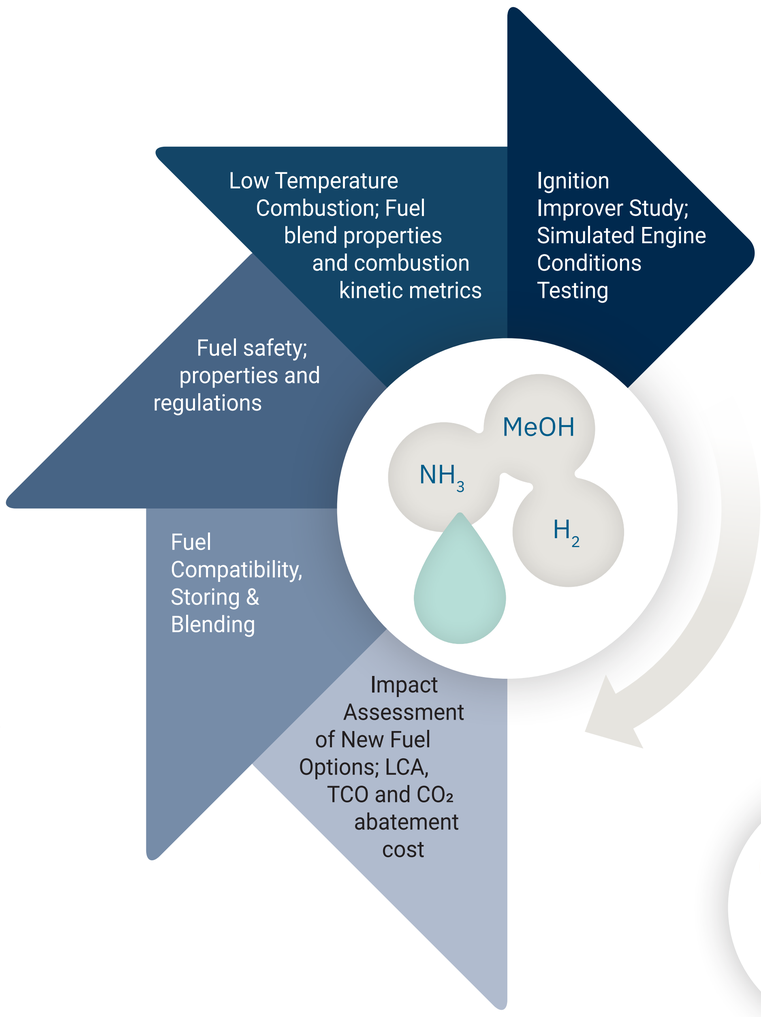
Advancing Sustainable Fuel Technologies for Decarbonising Marine and Off-road Sectors

In the marine and off-road sectors, decarbonization means embracing all new zero-carbon fuel options, like hydrogen and ammonia, alongside more mature low-carbon choices such as methane, methanol, biodiesel and renewable diesel. Usability of these fuels require research about their handling and storing in already available engine infrastructure as well as their economical feasibility.

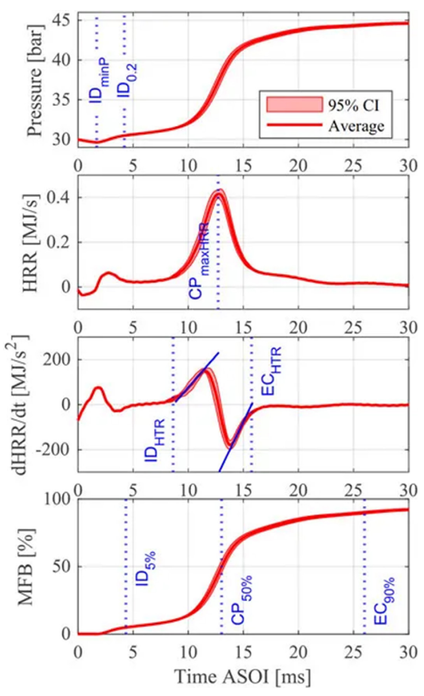


Dual/Multi-Fuel Combustion Strategy/Chemistry

Ignition delay measurement

Heat Release Rate Analysis

Pollutant/Emission formation analysis



Ignition delay/HRR graphs adapted from; Wang Y. et al. 2022. https://doi.org/10.3389/fenrg.2022.832509

Current Key Findings

Properties of new fuel blends

- Methanol-HVO fuel blends can be stabilized with several additives such as 1-dodecanol, 1-octanol, and methyl butyrate.
- 1-dodecanol had the highest solubilizing capacity.
- Additives increased density, reduced viscosity, and slightly affected surface tension.
- Storage temperature has an effect on the blends' stability.
- **Next:** The ignition and combustion properties will be studied for the blends. Ignition improvers will be reviewed and their effect on certain fuels' ignition will be studied. The fuels will be tested under engine-relevant conditions in a combustion research unit (CRU) and by simulating the engine conditions.

Compatibility of new fuel blends with chosen steels and aluminum

- Methanol-HVO fuel blends and additives seem to be compatible with aluminum, carbon steel, stainless steel, or alloy samples after 60 days of immersion.
- Methanol slightly dissolved aluminum and carbon steel but this did not alter the fuel properties.
- **Next:** Safety regulations of new fuels will be reviewed. The aim is to investigate how different fuels can be stored and handled in a safe way.

Publications:

Wang-Alho et al. Properties of Chemically Stabilized Methanol–HVO Blends. *Energies* **2024** 17(15), 3724: https://doi.org/10.3390/en17153724

Balogun et al. FTIR Analysis for Determining Stability of Methanol–HVO Blends for Non-Road Engine Application. *Energies* **2024**, 17(16), 3921; https://doi.org/10.3390/en17163921

Wang-Alho et al. Compatibility of Methanol-Hydrotreated Vegetable Oil Blends with Chosen Steels and Aluminum. *Energies* **2024**, 17(14), 3423; https://doi.org/10.3390/en17143423

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Flex-CPT

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