

12th CIMAC CASCADES 2021

22 SEPTEMBER 2021 | GRAZ, AUSTRIA

**On the Way towards Decarbonization – Green Fuels,
Hybridization and Digitalization in Large Engine Applications**

Zero Emission Shipping – from Vision to the HyMethShip Technology Demonstrator

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It is expected that marine transport will continue to increase in the future and without any abatement measures its greenhouse gas emissions will do so. One possibility for emission reduction is the use of new fuels, such as ammonia, methanol or hydrogen. The latter two are used within the HyMethShip concept, a project funded by the European Union's Horizon 2020 program.

The HyMethShip combines on-board methanol steam reforming with a pre-combustion CO₂ capture system as well as a hydrogen-fuelled large bore internal combustion engine. With this system a reduction in CO₂ emissions of approximately 97 % and an almost complete elimination of particulate matter and SO_x emissions is possible. In the HyMethShip concept, engine exhaust gas enthalpy is used to provide heat for the methanol steam reforming process which in turn produces the hydrogen for the engine combustion. This interaction results in a rather unique set of requirements for the engine combustion system. Like in other engine applications, high efficiency and low engine-out NO_x emissions are desired. In addition, there are requirements for engine exhaust gas temperature and exhaust enthalpy flow rate.

The aims of this contribution are to give a deeper insight into the HyMethShip concept and its technology demonstration. For this, the overall concept will be explained and the two key components of the technology demonstrator will be described in more detail: First, the membrane methanol reformer, its design and the working principle will be shown. Second, the combustion engine, especially the needed modifications for enabling hydrogen operation and some development work will be outlined. Finally, the current status of the technology demonstration will be summarized.