



M²ARE: Maritime Methanol - Adaptable, Renewable and Environmentally friendly: Reducing marine fuel CO₂ emissions by more than 80%

The consortium consisting of Air Liquide, MAN, ETA Florence Renewable Energies and four academic partners (CERTH, Sant'Anna, LRGP and TU Delft) announces the official launch of the **M²ARE** project on December 1, 2023. The project aims to develop and demonstrate a novel process for “Maritime Methanol”, a new grade of low-cost low-carbon methanol based on biogenic CO₂ and renewable H₂, to support the needs of the global shipping sector in reducing their CO₂ emissions.

Today, waterborne transport is driven primarily by diesel engines (around 99%), using mainly heavy fuel oil (HFO), which tends to be high in sulphur, and middle distillate fuel (MGO). In 2019, shipping represented around 3-4% of all EU GHG emissions and around 13% of the transport sector.

In response to the high demand for maritime decarbonized fuel, **M²ARE** project will deliver a **methanol synthesis** demonstration plant **by mid-2027**, using the existing pilot plant located at the Air Liquide Innovation Campus Frankfurt, Germany. This “Maritime Methanol” will be suited specifically to engine usage and aims at a CO₂ emission reduction by more than 80% compared to conventional maritime fuels on a well-to-wake basis (the entire process of fuel production, delivery and use onboard ships, and all emissions produced therein).

The expected outcomes of the M²ARE project include:

- The assessment and qualification of bio-CO₂ from sources such as biogas, biomass combustion, bioethanol, and pulp & paper plants for their feasibility in the methanol synthesis.
- An improved methanol process using a new reactor system based on process intensification and a simplified methanol purification.
- A unique process to convert bio-CO₂ with fluctuating H₂ coming from renewable energy sources into flexible grades of Maritime Methanol that will be validated through a series of engine tests.
- A digital model of the whole value chain from CO₂ and H₂ through to the maritime fuel will be developed to de-risk the technology and boost its scale-up.

The M²ARE project is launched by a consortium with broad expertise across the entire value chain. With this project, the consortium is pushing the boundaries of the current state-of-the-art technology and knowledge required to deliver new solutions to meet ambitious economic and environmental targets for using low-carbon methanol in the maritime sector. The project also contributes to achieving five of the United Nations Sustainable Goals.

About M²ARE:

Maritime Methanol - Adaptable, Renewable and Environmentally friendly

The consortium is coordinated by Air Liquide (represented by R&D and Engineering and Construction). Other partners are: CERTH (Greece), SSSA (Italy), LRGP (Joint Research Unit of CNRS and University of Lorraine, France), DELFT University of Technology (The Netherlands), MAN Energy Solutions (Germany), and ETA-Florence Renewable Energies (Italy).



M²ARE Group picture during the first Kick-Off meeting in Frankfurt, 5-6 December 2023.

The consortium is supported by an advisory board consisting of Clariant (Switzerland / Germany), Metsä Group (Finland), the Port of Rotterdam (The Netherlands) and A.P. Møller Maersk A/S (Denmark).

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