

MEMETH – Intensified MEMbrane reactor technology for renewable dimethylETHER

Publieke samenvatting / Public summary

Aanleiding

Europe's Fit-for-55 climate package and the Dutch Climate Act mandate a net greenhouse gas emissions reduction of ~55% by 2030 and climate neutrality by 2050. The Dutch industrial sector, responsible for a significant share of national emissions, must cut emissions by approximately 59% by 2030 and transition away from fossil fuels, while remaining internationally competitive. Green hydrogen is seen as a key enabler of industrial decarbonisation in the Netherlands, requiring substantial scale-up to replace fossil feedstocks and fuels. Concurrently, CO₂ utilisation through Power-to-X pathways can transform captured emissions into valuable intermediates. Dimethyl ether (DME) is a compelling Power-to-X product: it can serve as a low-carbon fuel for appliances and engines and as an intermediate feedstock that can be upgraded to Sustainable Aviation Fuel (SAF), aligning with the ReFuelEU Aviation mandate for increasing SAF supply. By integrating renewable hydrogen with CO₂ conversion to DME, MEMETH addresses national decarbonisation needs, supports industrial transformation, and helps meet both EU and Dutch climate targets.

Doelstelling

The MEMETH pre-feasibility study aims to assess the technical and economic viability of converting renewable hydrogen and captured CO₂ into liquid dimethyl ether (DME) as an intermediate for Sustainable Aviation Fuel (SAF). The study will remain at concept level and deliver process flow

Projectinformatie / Project information

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Algemene informatie / General information

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diagrams, preliminary mass and energy balances, and indicative CAPEX/OPEX estimates defining the boundary conditions for a future Dutch pilot plant. It will also determine the potential production cost of SAF derived from DME and analyse the market opportunities for both SAF and DME within the Dutch energy and transport sectors, considering policy instruments such as the ReFuelEU Aviation and national SAF mandates. Comparative techno-economic and environmental screening will identify cost drivers, efficiency limits, and potential for scale-up. By validating this Power-to-X pathway, MEMETH supports the TSE-Industrie “Waterstof en Groene Chemie” programme by promoting electrification, green-hydrogen use, and CO₂ valorisation as key levers for industrial decarbonisation.

Korte omschrijving

The MEMETH pre-feasibility study is structured into five work packages. WP1, led by ZEFIRA, defines the system boundaries, feedstocks, and integration routes for Power-to-DME and DME-to-SAF conversion under Dutch industrial conditions, establishing input data, utilities, and baseline scenarios. WP2, led by Modelta, will model the membrane reactor, simulate the electrolyser and DME-to-SAF bricks, assess efficiencies, and provide economic data for these units. WP3, led by ZEFIRA, will deliver a FEL 0-1 engineering package for the DME island—from CO₂ + H₂ feed at 35 bar to DME storage—covering process simulation, conceptual layout, and cost estimation. WP4 combines all outputs into a techno-economic analysis (TEA), life-cycle assessment (LCA), and market and regulatory study for the whole Power-to-DME-to-SAF value chain. ZEFIRA leads TEA, Modelta LCA, and SHV Energy contributes market, logistics, and offtake insights. The study will conclude, in WP5, with a final integrated concept, investment case, and roadmap toward pilot-scale demonstration in the Netherlands.

Resultaat

The MEMETH pre-feasibility study will deliver a complete concept-level design package and strategic analysis for a Dutch Power-to-DME-to-SAF

value chain. Main outputs include simplified process flow diagrams, preliminary mass and energy balances, and indicative cost figures for CO₂-to-DME conversion and downstream SAF synthesis. The study will define the CAPEX and design basis for a 1 MW-equivalent Power-to-DME pilot plant in the Netherlands, providing technical input for a future demonstration. Levelised cost analyses for 100 MW electrolysis-equivalent plants will offer cost perspectives for off-takers and investors. The market and regulatory analysis will identify key partners for the pilot phase (electrolyser manufacturers, project developers), assess permitting conditions, grid access, and potential hydrogen and refinery hubs suitable for deployment. The final report will deliver an integrated concept, investment case, and roadmap directly supporting the TSE-Industrie goal of cost-effective industrial decarbonisation.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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