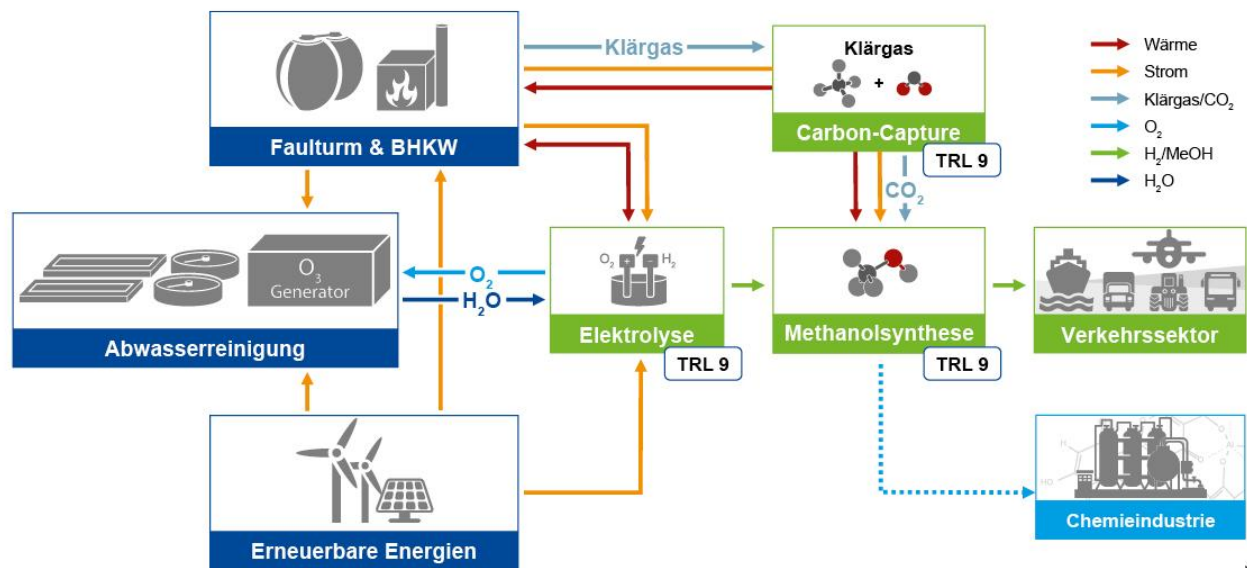


A-120

Decentralized Methanol Production at Wastewater Treatment Plants: Synergies and Regulatory Challenges in the E-BO2t Project

B. Bender¹, C. Ait Tarint¹, F. Voit², T. Lind³

¹OWI Science for Fuels gGmbH, Herzogenrath, Germany, ²Research Institute for Water Management and Climate Future at RWTH Aachen University, Aachen, Germany, ³Emschergenossenschaft / Lippeverband, Essen, Germany



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Overview of the sector coupling on the waste water treatment plant and the synergies with the plant components (Elektrolyzer, Carbon Capture and Methanol Synthesis) Copyright: FiW e.V.

The research project E-BO₂t focuses on the innovative integration of Power-to-Methanol (P2MeOH) processes within municipal wastewater treatment plants (WWTPs). By capturing CO₂ from sewage gas and combining it with green hydrogen produced via electrolysis, the project demonstrates a decentralized approach to sustainable resource utilization. This approach transforms a waste byproduct into a high-value energy carrier, facilitating the local coupling of the water, waste, and energy and transport sectors.

A critical aspect of the project is navigating the complex regulatory landscape defined by the EU's Renewable Energy Directive (RED II/III). The produced methanol must meet the criteria for Renewable Fuels of Non-Biological Origin (RFNBO) to be eligible for greenhouse gas (GHG) quota credits. However, strict requirements for additionality and temporal matching present significant economic hurdles. These regulations limit the available full-load hours of the electrolyzer and increase the "green premium," as production must be synchronized with new, unsubsidized renewable energy sources. This creates a challenging business case where the levelized cost of methanol (LCOM) is highly sensitive to fluctuating regulatory demands and bureaucratic certification overhead.

The integration of a P2MeOH plant at a WWTP offers unique technical synergies to offset these economic pressures. The electrolysis process generates high-purity oxygen, which can be utilized on-site for biological

aeration or ozonation in advanced water treatment. Furthermore, after separation, the remaining high-purity methane can be used as fuel for CHP units or upgraded for biomethane grid injection. Finally, the waste heat generated during synthesis and electrolysis is recovered for thermal processes, such as sewage sludge drying, significantly increasing the overall energy efficiency and cost-effectiveness of the facility.

The project further evaluates the downstream utilization of the synthesized methanol. Research conducted by OWI examines various pathways, including direct use as a fuel in marine engines or in biodiesel production and its chemical conversion into synthetic kerosene (Methanol to Jetfuel; MtJ) for aviation. This analysis includes a critical assessment of the "meaningfulness" of different processing routes, weighing technical complexity against market demand and the regulatory incentives required to bridge the price gap with fossil alternatives.

The E-BO2t project illustrates that while the regulatory path for RFNBOs remains economically strenuous, WWTPs can evolve into regional energy hubs. By leveraging multi-level synergies; utilizing heat, oxygen, and carbon. The project provides a scalable blueprint for decentralized methanol production at WWTPs. The findings emphasize that overcoming economic barriers requires both technical optimization and a stable regulatory framework to ensure the long-term viability of green fuels in the transport sector.