

ICODOS – Intelligent Carbon Dioxide Solutions

Efficiently Combined Carbon Dioxide Capture and Methanol Synthesis

Background

The climate crisis is coming to a head. Global warming, greenhouse gas emissions, and deforestation lead to weather extremes, food shortages, and health problems. Emissions mainly come from burning fossil fuels such as coal, oil, and natural gas. Commercially competitive solutions are needed to manage the transition to renewable fuels. Currently, e-fuels and biofuels are many times more expensive than fossil fuels and therefore not economically attractive. This challenge is addressed by the planned KIT spinoff ICODOS with an innovative solution.

ICODOS - Intelligent Carbon Dioxide Solutions - has developed a process to recycle biogas from waste streams such as sewage sludge and biological waste in combination with renewable electricity to produce biomethane and e-methanol: Carbon dioxide (CO_2) is captured from the biogas and converted to methanol with additional

green hydrogen (H_2) from water electrolysis in a combined process. Biogas is a carbon-neutral source of energy and CO_2 , but processing the gas for use as fuel is expensive. On the other hand, a CO_2 source is needed to produce e-fuels, which drives up costs. With the technology developed by ICODOS, biogas can be upgraded to high-quality biomethane; at the same time, green e-methanol can be produced from the resulting CO_2 . This is a win-win situation. The unique KIT patent-pending combination of CO_2 capture and methanol synthesis is the most efficient CO_2 capture technology and the ultimate tool for achieving a circular bioeconomy, where CO_2 previously captured from the air by plants is converted into e-fuels. ICODOS will initially focus on biogas to implement the technology, but plans to make it available for other CO_2 point sources, such as the cement industry. Figure 1 shows the value chain with ICODOS' integrated technology.

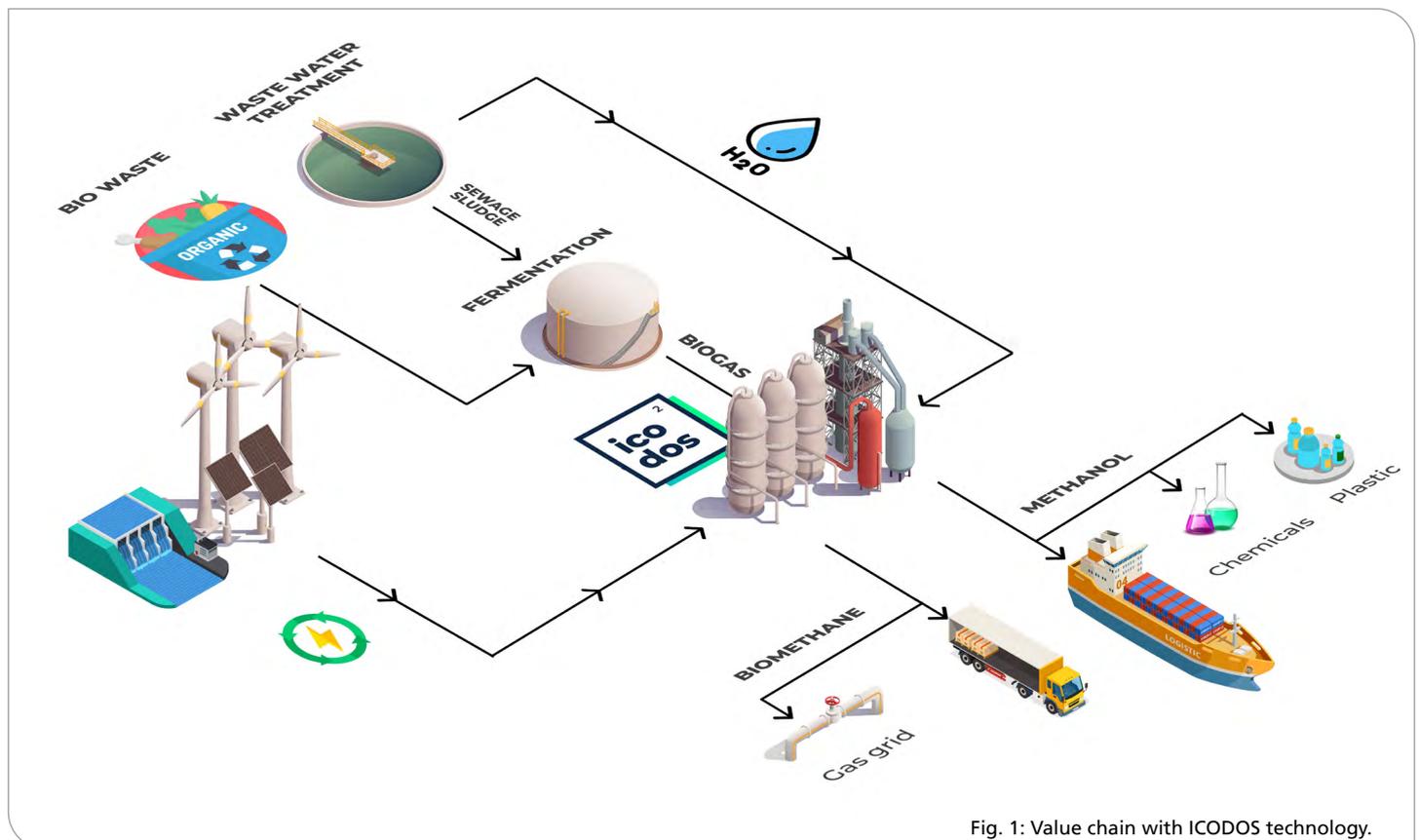


Fig. 1: Value chain with ICODOS technology.

Brief Description of the Technology

The ICODOS innovation is the most efficient CO₂ capture technology available today. It is planned to use it in highly automated and mass-produced facilities. In the processes known to date for the production of e-methanol, CO₂ capture and methanol synthesis are separate. In the new process, for which a patent application has been filed, the two processes are combined to form a so-called hybrid process. Figure 2 shows the combined process integrated into the other plant components. The novel process lowers investment and operating costs by reducing the energy required for compression as well as the overall equipment needed. The product of the methanol synthesis is used as a solvent for CO₂, and the process regenerates it continuously. Therefore, there is no performance degradation over time due to solvent degradation or loss, as is the case with competing amine-based CO₂ capture. The life of the system is increased and maintenance is reduced because the problems common to amine scrubbing, such as corrosion or solvent degradation, do not occur. In addition, the integration of the two processes reduces the number of instruments and interfaces. These advantages also facilitate the implementation of full automation of the process.

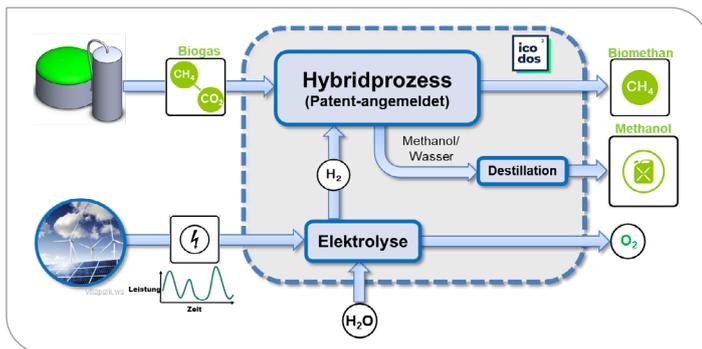


Fig. 2: Illustration of the hybrid process: In the example shown, the CO₂ contained in the biogas is separated, upgraded to biomethane, and then used for methanol synthesis.

Status of the Technology and the Spinoff

Funding of more than one million euros has already been generated for the validation of the integrated technology - hybrid process, distillation, and electrolysis - for a pilot plant with a capacity of approximately 50 liters of methanol per day. The plant is currently under construction and will be integrated into the Energy Lab 2.0 at KIT. The current plan is to commission the plant at the end of 2022 in order to be able to validate the technology in a realistic environment at the end of 2023.

The founding team of ICODOS is currently looking for startup funding for the project in order to be able to start business activities in addition to the validation and further scaling of the technology as well as the preparation of the manufacturing of the plant.

In order to support the intended seed funding, the ICODOS team would like to network and exchange ideas with stakeholders from the entire value chain.

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