

## BODA development

Proof of concept development for a biomethanation reactor

<b>Programm / Ausschreibung</b>	IWI 24/26, IWI 24/26, Basisprogramm Ausschreibung 2024	<b>Status</b>	laufend
<b>Projektstart</b>	04.01.2025	<b>Projektende</b>	03.07.2026
<b>Zeitraum</b>	2025 - 2026	<b>Projektlaufzeit</b>	19 Monate
<b>Keywords</b>			

### Projektbeschreibung

Vertus Solutions nutzt die Kraft von Mikroben als Katalysatoren und nutzt grundlegende elektrochemische Prinzipien für verschiedene Anwendungen. Konkret liegt der Fokus bei BODA auf der Nutzung von Gasen wie CO<sub>2</sub> und Wasserstoffquellen zur Erzeugung von Biomethan. Erste Erkenntnisse zu einzelnen Komponenten des Systems deuten auf die technische Machbarkeit hin, doch das Projekt befindet sich derzeit auf einem Technology Readiness Level (TRL) von 2 oder 3. Ziel ist es, diesen durch die Entwicklung und den Prototypenbau eines umfassenden Reaktors auf TRL 5 oder 6 zu erhöhen. Wenn möglich, können Rohgase wie Biogas in den Prozess einbezogen werden.

### Endberichtkurzfassung

This project investigated the feasibility of microbial electrolysis cell (MEC)-assisted biomethanation as a pathway for converting CO<sub>2</sub> and H<sub>2</sub> — sourced from agriwaste-derived biogas and waste-derived syngas respectively — into biomethane (working with pure component at laboratory scale), with the dual objective of valorising waste streams and producing a renewable gas capable of displacing fossil methane.

The project successfully developed and implemented a dynamic gas-liquid biomethanation model incorporating MEC functionality, pH buffering, inhibition kinetics, mass transfer parameters, and a sensitivity analysis of key operational variables including maximum growth rate, volumetric mass transfer coefficient and gas recycling. This model represents the primary scientific output of the project and provides a functional computational framework for scoping operational windows and analysing system behaviour under varying conditions.

On the experimental side, the bioreactor system was assembled, including the MEC electrodes and gas diffusion systems, safety-modified for hydrogen handling, and brought to operation with an adapted inoculum. The microbial community demonstrated biological activity under relevant operational conditions, confirming the viability of the biological component of the system. Three-dimensional geometric models of alternative MEC prototype configurations were also developed, providing a conceptual design basis for future reactor optimisation work.

Despite these advances, the project encountered persistent technical limitations that prevented full validation of the system. Hydrogen containment and instrumentation failures rendered reliable mass balance measurements unachievable, and the methanation performance observed — in terms of H<sub>2</sub> and CO<sub>2</sub> conversion to CH<sub>4</sub> — did not reach the threshold required to justify progression to subsequent development stages. The project is therefore concluded at this stage, with the experimental and modelling findings documented as the foundation for any future development effort in this technology area.

The key technical barrier identified through this work — safe, stable, and instrumentable hydrogen handling at bioreactor scale — is expected to be of direct relevance to other groups working on power-to-gas and biological methanation systems.

### **Projektpartner**

- Vertus Energy AG