Green Methanol from Solar Power

INTRODUCTION

We are Bart, Simar, Fahim, Simon, Gregory, Job, and Roel. We worked together on the S6 Green Methanol from Solar Power project for Volta Energy.

Volta Energy delivers green and sustainable energy supply solutions for construction sites and events. For them the main goal was a feasibility study for using excess solar power to create methanol. And using this to fuel their sustainable power generators.

To support this study, the Mechanical and Electrical Engineering team designed, built, and tested a small-scale methanol synthesis test reactor. The goal was to create a modular, functional system for testing methanol synthesis through CO_2 hydrogenation. This work was done in collaboration with two researchers from the HAN.

JOURNEY & LEARNINGS

At the start of the project, our focus was on understanding the methanol synthesis process. We studied technical sources, including a master's thesis, leveraged the practical expertise of our teacher-researchers, and followed advanced lessons on physical and chemical thermodynamics from the Master Engineering Systems program.

Before the project started Ruben Bruins made a concept for the small-scale test reactor based on the master thesis. Building on this and incorporating requirements from both Volta the teacher-researchers we began designing an improved version. Key priorities included features like methanol collection and internal temperature monitoring within the reactor vessel.

We compiled an order list early and planned for long delivery times, particularly for sensors and the catalyst material. While waiting for the components during the planned time we worked on other tasks: the process simulation, thermodynamic analysis, P&ID, HAZOP study, and additional design optimizations.

Once all components had arrived, we assembled the improved methanol reactor at the H2 lab at IPKW. Final testing preparations followed, and we began the experimental phase. One of our biggest challenges was managing long lead times for parts, but by planning the most critical components arrived in time.

OUTCOME & IMPACT

Our final result is a small-scale methanol synthesis test reactor which is a functional prototype that supports testing of methanol production using CO_2 hydrogenation. This reactor serves as a valuable tool for testing and optimizing the process.

The reactor's modular design based on tubing and fittings makes it adaptable and reusable, allowing future teams to continue testing and optimizing methanol synthesis. Both Volta Energy and the HAN can benefit from this system.

What we're most proud of is the test reactor itself. And that it was built within the available time. It is a well though out combination of components to enable testing and optimization of methanol synthesis.