Internship & thesis opportunities at Zero Emission Fuels

ZEF (Zero Emission Fuels) develops a small scale chemical factory (the micro-plant) which converts CO2 from air into methanol. This renewable methanol can either be used as a fuel or as feedstock in the chemical industry. Each micro-plant is the size of a coffee machine and will be fully powered by three solar panels (Figure 1 shows a mock-up).
By building a small unit, mass production technologies become an option, development costs stay low while handling and testing the product remains manageable. Consequently large numbers of units can be produced at low cost, driving down the price of renewable methanol to competitive levels.
The ultimate aim of ZEF is to install large numbers of micro-plants in solar-to-methanol-farms thereby producing large quantities of cost competitive methanol.


Figure 1: Mock-up of the micro-plant.

ZEF: A combination of entrepreneurs, experts and students.

Three experienced entrepreneurs supported by numerous top experts form the core of ZEF. These experts work at research organizations such as TU Delft, TNO and University of Twente, and companies such as Nouryon, Promolding and NPK.
In addition over 150 talented students have participated in the ZEF project. From the start ZEF had the aim to funnel talented students into this field. These students study at educational institutions such as TU Delft, Haagse Hogeschool, Leidse Instrumentmakers School, Twente University and Groningen University (MBO, HBO & University level).
ZEF works in development cycles of 3-6 months. During each cycle new subteams of students (internships & graduation projects) work on the systems such as direct air capture, electrolysis, methanol synthesis, distillation, pumps/compressors and simulations.

Figure 2A: ZEF works with top experts.


Figure 2B: ZEF works with student teams.

Technology overview

The electrical energy needed to run the process is delivered by three 300 [W] solar panels. The air contains the feedstocks needed to produce methanol: CO2 and water. After the CO2 and water are filtered from the air the water is fed into an alkaline electrolyser and is split into hydrogen and oxygen. Finally, the CO2 and hydrogen are fed into a methanol reactor which converts the feedstock into a mixture of methanol and water. This mixture can be separated by using the concept of a heat pipe to distillate the mixture into a stream of water and high-quality methanol.

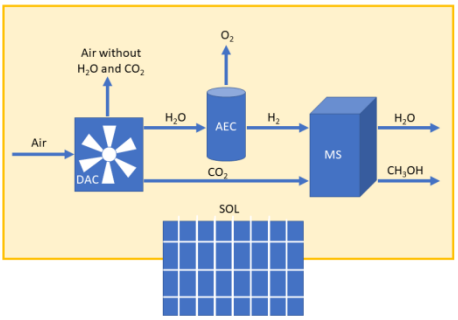

Figure 3: schematic overview of the process.

Join team ZEF now (projects on the next page)!

Several vacancies are available for both internships (3, 6 or 9 months) and thesis projects. An overview of topics is given on the next page. Starting times are determined together based on the ZEF planning. If you want to work on something meaningful that will be implemented in real life you can contact Ulrich Starke to discuss the opportunities more in depth: students@zeroemissionfuels.com / 06-14680887. Also check students.zeroemissionfuels.com for more about the company. We are located in the Process & Energy lab of the TU Delft: Leeghwaterstraat 39 in Delft.

Team direct air capture assignments

#	Type	Topic
1	Internship / Graduation	Economic analysis and comparison of the ZEF direct air capture system to other systems in the field.
2	Graduation	Sorbent selection for high performance direct air capture.
3	Internship	Direct air capture absorber engineering intern.
4	Internship	Direct air capture desorption engineering intern.
5	Internships	Direct air capture life cycle / lifetime analysis intern.

Team electrolysis assignments

#	Type	Topic
6	Graduation	System integration and process design.
7	Internship	Engineering and operation of a high pressure alkaline electrolysis setup (position 1).
8	Internship	Engineering and operation of a high pressure alkaline electrolysis setup (position 2).

Team methanol synthesis assignments

#	Type	Topic
9	Graduation	Continued experimental study of the dynamic behavior of a convection driven methanol synthesis reactor including lifetime analysis.
10	Internship	Experimental work on the methanol synthesis reactor (implementing improvements and system characterization).

Team distillation assignments

#	Type	Topic
11	Graduation	Build a small scale distillation column, test efficiency and dynamics and deliver a validated model.

Team compressor (fluid machinery) assignments

#	Type	Topic
12	Internship	Development & experimental analysis of the drying system.
13	Internship	Testing and analysis of a water pump and pressure booster.

Team integration assignments

#	Type	Topic
14	Internship	Process control, electronics upgrade, graphical user interface redesign.
15	Graduation	Life cycle analysis of the ZEF micro-plant.