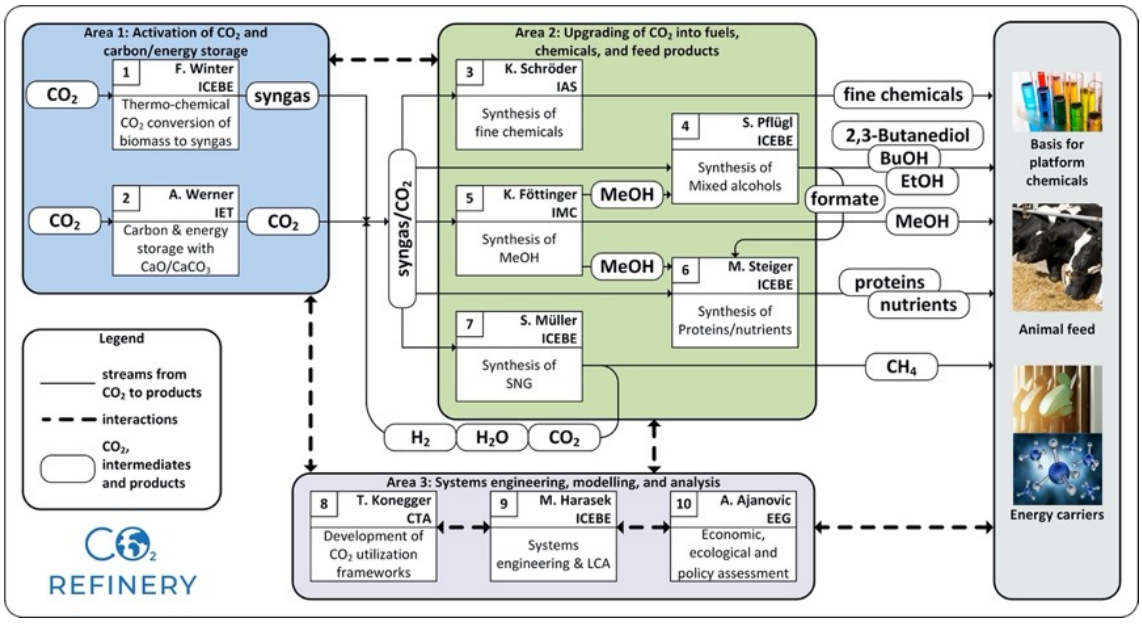
Open Position PhD #4: Autotrophic and mixotrophic upgrading of CO_2 for chemical production

General

The TU Wien doctoral school **CO_2Refinery** covers a wide range of methods and will integrate multiple disciplines required to implement a fully functional facility for refining and upgrading CO_2 on a technical center scale. With its integrated research and training program, the doctoral school targets to train "**one carbon engineers**" will work together on the development of technologies to efficiently utilize CO_2 as a carbon source to make a broad variety of products using chemical and biological catalysts. In addition to synthesis of products from CO_2, **CO_2Refinery** will focus on the activation of CO_2 for utilization as a carbon source in synthesis processes. Moreover, using renewable resources such as biomass and energy, and energy storage with CO_2 as the scaffold will be investigated. The strategy of **CO_2Refinery** is complemented by research on systems engineering, modelling, and analysis to provide the framework of the individual unit operations. Additionally, life cycle analysis will be used as a powerful tool to evaluate performance of the refinery on an economic scale. The research topics are structured into three research areas as shown below.



Within the proposed research framework, the members of the TU Wien doctoral school will be trained interdisciplinary to obtain a unique skillset. Graduates are envisioned to work at the forefront of groundbreaking research, but also to implement the concepts and ideas of a CO_2 refinery in industry. **CO_2Refinery** offers excellent scientific research, combined with a multi- and interdisciplinary curriculum (lectures and lab rotation) and a dedicated supervision and mentoring program. The PhD students are in the center of attention and their training and scientific advancement is the key to a successful implementation of this program. Research training will be obtained through work embedded into high-quality scientific research environments provided by supervisors that are internationally recognized experts in their fields and the close support through junior faculty members.

Project description:

A variety of microorganisms can utilize CO_2 as source for biomass growth and metabolite formation. This project will use CO_2, CO and H_2 from gasification of plant biomass and industrial sources as alternative carbon and energy sources to produce value-added chemicals and fuels. In addition, CO_2-derived methanol obtained via chemical synthesis will be used as a co-substrate in microbial fermentations. Finally, wildtype and genetically engineered acetogenic hosts will be used to develop continuous bioprocessing strategies for efficient autotrophic and mixotrophic production of chemicals.

Key goals and tasks:

The primary aim of this PhD thesis is the development of bioprocesses and microbial hosts to produce fuels and chemicals from gaseous and miscible C1 compounds. The focus of the thesis will be a combined process and strain engineering approach.
To achieve this goal, the successful candidate will develop continuous bioprocesses in small scale parallel and 21-liter bioreactors. To analyze cultivations, advanced process analytics (GC, HPLC, etc.) will be employed. To develop recombinant host organisms, state-of-the-art molecular biology methods (e.g. Golden Gate cloning, CRISPR/Cas9) will be used. As a member of the doctoral school CO_2Refinery, the successful candidate will closely cooperate and interact with the fellow PhD students. Results will be published and presented in scientific journals and at conferences. Supervising students and teaching activities will also be part of the responsibility.

Experience and skills:

- MSc degree in biotechnology, microbiology, biochemistry or similar
- Experience in cultivation of microorganisms (ideally continuous cultivations)
- Experience in handling of microorganisms (ideally handling of anaerobes)
- Experience in genetic/metabolic engineering of bacteria (gram positives as a plus)
- Ability to work independently and in a team is crucial
- Strong ability to self-organization, excellent written and verbal communication skills, and a safe command of English
- Willingness to participate in tutoring and teaching activities

Supervisors:

Stefan Pflügl / Matthias Steiger