Graz University of Technology
Institut of Chemical Engineering and Environmental Technology
Working Group Hydrogen and Fuel Cells, Assoc.-Prof. Viktor Hacker

☒ Master's thesis ☒ theoretical

Master's thesis

Techno-economic and environmental analysis on hydrogen production from biomass

The working group at CEET introduced the Reformer Steam Iron Cycle (RESC) as a **novel process concept to produce hydrogen for low-temperature PEM fuel cells in decentralized systems**. The process applies metal oxides to produce pure H_2 and CO_2 as products from renewable hydrocarbon feedstocks. Such concepts are referred to as chemical looping in scientific literature. However, the use of biogas and biomass for energy use is controversial because of its comparably low efficiency and dependence on public subsidies.

The **aim of the master's thesis** is to investigate if the novel RESC concept has significant benefits over existing hydrogen production technologies from biomass, which are often unfavorable because of their high capital costs and low efficiency.

The master thesis includes:

- The **adaption of an existing ASPEN Plus process simulation** of the RESC for biomass applications.
- The **definition and implementation of a reference case in ASPEN Plus,** commercial gasification and PSA technologies, based on existing scientific literature.
- The **techno-economic and environmental assessment** of both case scenarios, based on an existing techno-economic study for biogas conversion.

As a master student in the Working Group Hydrogen and Fuel Cells, you will be part in a team of experienced researchers, supportive PhD students and motivated master students working on the same topic. The research group supports you with expertise from ongoing international research cooperation and existing knowledge in techno-economic analysis and process simulation. A similar case study, discussing the conversion of biogas, which was already published in a high-impact peer-reviewed journal.

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Starting date: Upon common agreement

Literature:

Bock et al., Techno-economic analysis of fixed-bed chemical looping for decentralized, fuel-cell-grade hydrogen production coupled with a 3 MWth biogas digester, Energy Convers. Manag. 250 (2021) 114801. doi:10.1016/j.enconman.2021.114801.

Bock et al., Co-production of pure hydrogen, carbon dioxide and nitrogen in a 10 kW fixed-bed chemical looping system, Sustain. Energy Fuels. 4 (2020) 1417–1426. doi:10.1039/C9SE00980A.