Lehrstuhl für Energiesysteme
TUM School of Engineering and Design
Technische Universität München

Master's Thesis

(Theoretical)

Techno-Economic Optimization of Pressurized Solid-Oxide Electrolysis for Green Hydrogen and Power-to-X Technologies

Description:

Reversible solid oxide cells (rSOC) have the capacity to produce hydrogen using the electricity generated from the intermittent renewable sources, and to reverse the process within the same system for generating electricity as well. Namely, the technology has the potential to play a central role in green energy systems due to the highest efficiency, broad feedstock options and operational flexibility compared to PEM and alkaline technologies.

Green hydrogen is especially interesting for chemical and energy conversion technologies to either manufacture platform chemicals, energy intermediates or support the flexibility of the energy sector. Therefore, the integration of rSOC systems in commercial Power-to-X (PtX) technologies like methanol synthesis, Fischer-Tropsch-synthesis or chemical-storage shows a significant potential for increases in performance and economic viability. A multitude of commercial PtX technologies is operated at higher pressures to either increase efficiencies, volumetric energy densities or shift reaction equilibria towards certain products. However, pressurized rSOC systems are not state-of-the-art and require further research and development.

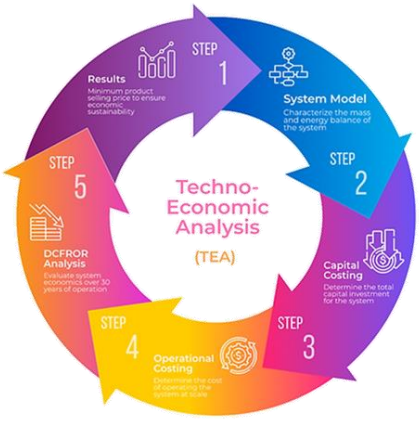
Therefore, this work focuses on the determination of the economic and efficiency sweet spot of pressurized rSOC operation for various commercial process integration options. In this thesis, a techno-economic optimization model regarding the relevant operational and design parameters is to be built up from a pre-existing 0-D rSOC model. The goal is to determine the optimal system configuration for maximizing the efficiency and economic viability.

Requirements

- Interest in system studies and their economics
- Basic knowledge in python programming and optimization
- Basic knowledge about energy conversion technologies

Work packages:

- Study of existing python model for rSOC
- Implementation of pressurized operation in model
- Development of periphery model to couple rSOC operation to energy conversion technologies
- Evaluating different setups on economic and efficiency level



Start: immediately

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