Feasibility of flexible CO2 conversion technologies powered by renewable electricity

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Project term	April 2020 – April 2024
Financed by	TKI and Shell

Project Description

This project explored the impact of intermittency of renewable electricity on the design and upscaling of a novel CO_2 electrochemical plant. We first developed a conceptual framework for designing and assessing future novel flexible chemical processes against various uncertainties. Then, we used a case study on hexanoic acid production via microbial electrosynthesis (MES) as a representative of novel CO_2 electrochemical conversion technologies to explore the impacts of intermittency on the design and performance of a CO_2 electrochemical plant and design strategies for improving its flexibility and evaluating its economic and environmental performances.

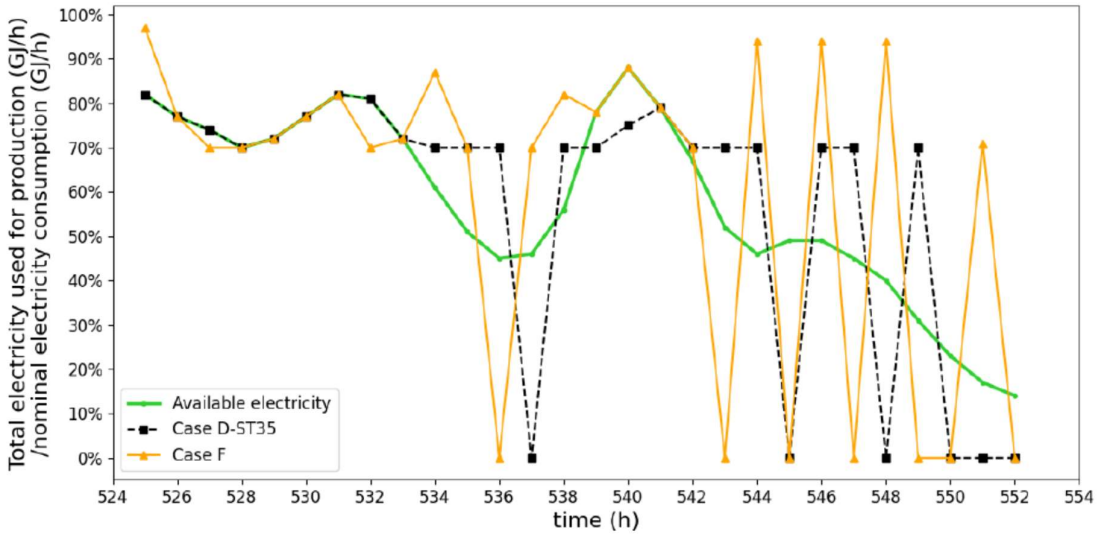

Figure: Snapshot of a day of optimized production.

Dissertation

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http://resolver.tudelft.nl/uuid:eeb47520-f31d-44c1-a308-ec178174a6fa

Publications

1. J. Liu, Pérez-Fortes, P. Ibarra-Gonzalez, A.J.J. Straathof, A. Ramirez (2024) Impact of intermittent electricity supply on a conceptual process design for microbial conversion of CO_2 into hexanoic acid. Chemical Engineering Research and Design 205:364–375 https://doi.org/10.1016/j.cherd.2024.04.005

2. J. Liu, Pérez-Fortes, P. Ibarra-Gonzalez, A.J.J. Straathof, A. Ramirez (2024) Life cycle assessment of hexanoic acid production via microbial electrosynthesis and renewable electricity: Future opportunities. Journal of Environmental Chemical Engineering 12, Issue 5, 113924 https://doi.org/10.1016/j.jece.2024.113924
3. J. Liu, Pérez-Fortes, P. Ibarra-Gonzalez, A.J.J. Straathof, A. Ramirez (2024) Understanding the flexibility challenges of a plant for microbial CO_2 electroreduction with hexanoic acid recovery. Industrial and Engineering Chemistry Research 63, 17236−17251. https://doi.org/10.1021/acs.iecr.4c01385