Lehrstuhl für Wirtschaftliche Staatswissenschaften, insbesondere Energiewirtschaftslehre

Master Thesis

Identifying and comparing use cases for a large-scale deployment of plasma cracking as a source of clean hydrogen (in cooperation with iplas GmbH)

Hydrogen is expected to play a pivotal role in the transformation of energy systems. The greenhouse gas emission intensity of hydrogen depends on the primary energy source and the applied conversion technology. While much focus currently lies on electrolysis using electricity from volatile renewable energy sources (RES), such as wind and solar PV, other technologies are being explored.

Plasma Cracking invented by IPLAS GmbH is one example for such an alternative technology. It has the advantage of being independent from volatile RES and can potentially produce hydrogen at lower costs. Since carbon black is produced instead of gaseous CO_2, emissions can be effectively and sustainably reduced.

Today, hydrogen is being used for mineral oil refining and in the chemical industry at large scale. Here, it is mostly produced from methane reforming, generating significant CO_2 emissions. Plasma Cracking could both replace existing hydrogen production and be used in new applications, such as for steel production and as a backup energy carrier in the electricity sector.

The thesis is written in cooperation with iplas GmbH (https://www.iplas.de/de/green-hydrogen).

Key tasks and objectives of the thesis

- Identification of use cases for large-scale deployment of plasma cracking to produce hydrogen
- Concept development to compare different use cases of plasma cracking
- Definition of a set of plausible scenarios regarding the development of technology costs, commodity costs and other relevant parameters for the use cases
- Parameterization and comparison of use cases considering different hydrogen production technologies

Your profile

- Student in economics, focus and interest in energy and techno-economic analysis

Literature

- Dincer, I. and Canan A. "Review and evaluation of hydrogen production methods for better sustainability." *International journal of hydrogen energy* 40.34 (2015): 11094-11111.
- Neuwirth, Marius, et al. "The future potential hydrogen demand in energy-intensive industries-a site-specific approach applied to Germany." Energy Conversion and Management 252 (2022): 115052.

Contact

Contact

E-Mail: david.schlund@ewi.uni-koeln.de

Topics

- Hydrogen production and utilization
- Technology cost

Methods

- Levelized Cost of Hydrogen
- Scenario analysis
- Use case analysis