Lehrstuhl für Wirtschaftliche Staatswissenschaften, insbesondere Energiewirtschaftslehre

Bachelor Thesis

Energy vector iron

The spatial and temporal distribution of renewable energies, particularly wind and solar, increases the need for non-fossil energy transport and storage technologies (Handelsblatt, 2024). While hydrogen and its gaseous derivatives dominate the public discussion around potential energy vectors, other alternatives for addressing storage and transport challenges exist. The research project Clean Circles (2024) promotes the utilization of iron as energy vector. Due to its chemical properties – such as high volumetric energy density, non-toxicity, non-corrosiveness, and form stability during combustion – iron presents a suitable candidate for low-emission transport and storage (Clean Circles, 2024; Neumann, 2023;). Research not only evaluates its use within the steel supply chain (EWI, 2022) but also as an energy carrier for electricity generation (Jansen, 2023).

The aim of this thesis is to identify and describe the current economic state of iron as an energy vector. The analysis includes a comprehensive review of the literature, examining aspects such as cost trends, transport and storage potential, and end-use applications. The thesis will primarily focus on the role of iron in electricity generation.

Key tasks and objectives of the thesis

- Review literature and reports on the economics of iron as energy vector
- Identify current economic conditions, potentials, and projections
- Illustrate developments and key figures

Your profile

- Economics major, best with a focus on energy
- Analytical thinking and the ability to carry out independent scientific work

Literature

- Handelsblatt (2024): *Wie sich in Zukunft Energie speichern lässt,* https://www.handelsblatt.com/unternehmen/energie/eisen-statt-kohle-wie-sich-in-zukunft-energie-speichern-laesst-01/100035887.html
- Clean Circles (2024): *Erneuerbare Energien in Eisen speichern*. https://www.tu-darmstadt.de/clean-circles/about_cc/publications_cc/index.de.jsp
- Neumann, J., Da Rocha, R. C., Debiagi, P., Scholtissek, A., Dammel, F., Stephan, P., & Hasse, C. (2023). Techno-economic assessment of long-distance supply chains of energy carriers: Comparing hydrogen and iron for carbon-free electricity generation. Applications in Energy and Combustion Science, 14, 100128.
- Jansen, E., Schuler, J., Ardone, A., Slednev, V., Fichtner, W., & Pfetsch, M. E. (2023). Global logistics of an iron-based energy network: A case study of retrofitting german coal power plants (No. 70). Working Paper Series in Production and Energy.
- EWI (2022): *Low Carbon Steel – A global cost comparison*. https://www.ewi.uni-koeln.de/cms/wp-content/uploads/2022/12/221209_EWI_H2-Steel_Low-carbon-steel.pdf

Contact

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Topics

- Iron in energy systems
- Energy vector economics

Methods

- Literature review
- Economic analysis