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

Master's Thesis

(Theoretical)

Investigating the Potential of Demand-Side Flexible Production in a Future German Sector-Coupled Energy System with PyPSA

Description:

For Germany to reach climate neutrality by 2045, a comprehensive transformation of the energy-intensive industry is necessary. In these industries, heat and electricity generation on site are mainly based on fossil fuels. Direct and indirect electrification will play an important role in covering these requirements in the future in a CO_2-neutral manner. However, rising electricity demands will pressure the electricity grid and storage infrastructure. As a counterpart to this, demand-side flexibility can be a practical solution for the residential, transport, and industrial sectors.

In this Master Thesis, the potential of demand-side flexibility focusing on the energy-intensive chemical industry will be investigated and compared with the potentials of the private and transport sectors. To do so, the Python-based energy system modeling tool PyPSA will be used to build up a representative model of Germany covering electricity, heat, and base chemical demands, taking into account the private, industry, and transportation sectors. Furthermore, grid capacities for neighboring countries to import or export energy are considered. Different technologies to meet the demands will be added to the system. In addition, storage technologies are included. By varying the maximum flexibility of each sector-specific demand, its influence on the optimized sector-coupled system can be determined. Supplementary, a global sensitivity study may be carried out to identify the most influential parameters of the system.

Prerequisites:

- Python knowledge is strongly recommended

Work packages:

- Familiarization with PyPSA and the existing model of an ideal chemical park
- Implementing the model of Germany with its neighboring countries
- Investigating the potential of flexible demands for the different sectors
- Global Sensitivity study to identify the most influential parameters

Beginn ab: sofort

Kontakt: M. Sc. Maximilian Kerschbaum

Raum: MW 3737

Tel.: 089 289 16315

Email: maximilian.kerschbaum@tum.de