Master thesis

Analysis of the European carbon market and carbon capture utilization and storage potential (German or English)

Motivation and background
The overarching goal of the “H2-Reallabor Burghausen – ChemDelta Bavaria” is the climate-neutral transformation of the local chemical industry towards a sustainable hydrogen-based chemistry. This transformation is essential not only to secure the strong position of the chemical industry in the region for the future, but also to contribute to the achievement of Germany’s climate and energy policy targets. In the coming years, companies will face important decisions regarding the optimal location in terms of costs, energy availability and regulatory requirements (e.g., CO₂ emission regulations). Electricity will become more important as a final energy source, while new energy sources such as hydrogen will be added, and current processes will be required to reduced CO₂ emission by shifting to sustainable production routes or utilizing carbon capture & storage (CCS) technologies. As a partner in the “H2-Reallabor Burghausen”-project, the Chair of Renewable and Sustainable Energy Systems (TUM-ENS) is analyzing the German and European energy and material system with the help of a linear optimization model.

Research focus
The master thesis will be focusing on the emission reduction potential through carbon capture & storage technologies in Europe as well as the impact of capturing technologies on traditional production routes across different industries in Europe. It aims to provide insights into various research questions, including:
- What is the existing and anticipated legislation regarding CCU/CCS in Europe?
- What technologies are utilized today, and what are the expected costs per technology/process?
- What is the overall storage capacity now, and what additional capacity has already been announced?
- How does CC(U)S impact the European Trading Scheme (ETS) and ETS certificates?

Tasks
As part of the thesis, you will develop an urbs model focusing on the integration and expansion of CC(U)S capacity in the existing European energy system to help you answer the above-described research questions. The work includes the following steps:
1. Development of an overview of current CC(U)S legislation and carbon management strategies in Europe?
2. Aggregation of technologies, technological specification, existing and announced projects and potential and techno-economic data
3. Extension of the European urbs model with CC(U)S capacity and potentials
4. Analysis of different scenarios and implications on the model results

The model will be based on an existing model of the European energy system which will have to be further extended. Upon the completion of the model, the results will be incorporated into the overarching energy and material model used in the “H2-Reallabor Burghausen” project.
Requirements

- Enthusiasm to drive the analysis of the European carbon and CCUS market forward independently
- Strong problem-solving skills and the ability to work independently in a structured manner
- Experience with Python programming desirable
- Basis knowledge for energy system desirable

Application

If you are interested in working on this or a related topic, please send your comprehensive application documents, including your CV and transcript of records to Laura Honig (laura.honig@tum.de). Please include your motivation, as well as relevant prior knowledge and qualifications. Feel free to contact me in case of any questions! I look forward to receiving your application!

Contact

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