

# **Master thesis:**

## **Implementation of the heating sector in PyPSA-Eur and analysis of a decarbonisation technology.**

### **Overview**

With the new climate protection law, it was determined across all sectors that green-house gas emissions in Germany should be reduced by 65% by 2030 compared to 1990, by 100% in 2045, and that additional CO<sub>2</sub> should be removed from the atmosphere from 2050 on. Since the agricultural sector produces so-called unavoidable emissions from land use and livestock farming, the intersectoral target for agriculture was softened to only a 30% reduction by 2030, which means that the energy sector will have to additionally compensate for these emissions.

The goal of the Landgewinn project is to design and implement a holistic intersectoral energy system model that provides regionally high-resolution results for increasing decarbonization of the agriculture sector in interaction with the other sectors. For this purpose, PyPSA-Eur energy system model will be used and further developed. The challenge is to adequately represent the diverse and varied nature of the agriculture sector and to integrate 3 selected agriculture-based decarbonization technologies. The potential of these technologies will be investigated and evaluated in different scenarios up to the year 2050.

Currently PyPSA-Eur only covers the electricity sector and the goal of this master thesis is to create the heating sector for Germany and integrate it in the modelling software. It is of a high importance to represent all the sectors in the energy sector in order to get more accurate results. For this task, research on the heating demand in Germany would need to be done, as well as, acquiring knowledge on how PyPSA-Eur workflow and components work. Moreover, the pyrolysis model will need to be further developed in order to have a heat output and cover the heating demand from Germany.

### **Structure of the master thesis**

- Literature review of the existing energy system modelling software: PyPSA, PyPSA-Eur and PyPSA-Eur-Sec
- Literature review on the heating sector in Germany
- Modelling task:
  - Implementation of the heating sector in PyPSA-Eur
  - Further development of pyrolysis model in order to have a heat output.
- Scenario analysis:
  - Analyse the impact of having more than one sector in the energy systems modelling software. Furthermore, investigate what is the role of pyrolysis in the heating sector. Scenarios should be based on the lastly government instructions for the energy transition.

## Requirements

- Programming language: Python
- German and English
- Energy system knowledge
- Energy economics knowledge

## Contact details for an application

If you have interest in the master thesis position please e-mail [merixell.domenech@hs-offenburg.de](mailto:merixell.domenech@hs-offenburg.de) and attach the CV and transcript of grades.

We will get in touch with you to set another meeting and talk with more detail about the task.