

Term Project

(Theoretical)

Investigating Temporal Clustering Methods to Reduce Optimization Complexity in Python

Description:

Energy system optimization can contribute to comparing different transformation pathways toward CO₂ neutrality from global, country-specific, or local perspectives. Since future energy systems will heavily depend on renewable energy sources, modeling approaches usually require a high temporal resolution to cover the fluctuating availability of renewables. However, high temporal resolution (e.g., hourly) increases computational times, leading to challenges in running long-term expansion planning models. One approach to reduce the complexity of such models could be temporal clustering. Hereby, representative type days or weeks are chosen instead of optimizing a full year by applying specific clustering methods. This, however, raises the question of how the results of these simplified models compete with high temporal resolved models.

In this term project, different methodologies for clustering demand and renewables capacity time series will first be researched in the literature. After getting familiar with the optimization tool PyPSA, one or more approaches will be applied to an existing optimization model. The influence of the clustering methods on the computational time and the deviation of the results compared to the default highly resolved model is to be carried out. Finally, a detailed discussion of the advantages and limitations of temporal clustering will be presented.

Prerequisites:

- Python knowledge is strongly recommended

Work packages:

- Literature research on temporal clustering methods
- Familiarization with the modeling tool PyPSA and the model
- Applying several clustering methods to the model and investigating the influence on the computational time and the results of the optimization
- Discussion of the results

Beginn ab: sofort

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