

Bachelor- / Semester- / Masterarbeit

(Theoretical)

Evaluation of Uncertainties in Energy System Simulation using Modeling to Generate Alternatives

Description:

Energy system optimization models are a widely used tool to provide useful information on the pathway to achieve carbon reduction targets. Based on the given assumptions as well as the defined boundary conditions of the model, the most cost-effective pathway to reach climate goals is determined. Accordingly, these models are often used to support regional energy planning. Due to the high uncertainties in the development of certain input values such as energy carrier and investment costs, the investment decisions in models do not consider the reality of uncertainty. In the real world, decision-makers do not have accurate information about the development of future prices and costs. Especially because of the increasing coupling of the electricity, heating, cooling, and mobility sectors and the volatility of renewable energy supply, conventional energy system planning methods used in practice are reaching their limits. Monte-Carlo Optimization is a popular method that is used to model systems that contain a high level of uncertainty. In the context of this work, Modeling to Generate Alternatives Approach should be implemented in PyPSA for a small regional energy system, e.g. the campus Garching. Based on this, the results of the optimization should be evaluated. The aim is to assess the influence of the various uncertainty factors. And to make a statement about the relevance of the various factors to the resulting energy system.

Prerequisites:

- Interest in energy systems optimization,
- High motivation and independent, structured way of working.
- Experience in programming with Python (PyPSA) and knowledge of optimization is a plus.

Arbeitspakete:

- Literature research on uncertainty characterization and monte carlo simulation
- Implementation of a Modelling to Generate Alternative approach in PyPSA <https://github.com/PyPSA/pypsa-eur-mga/tree/master/scripts>
- Analyzing and evaluating the results

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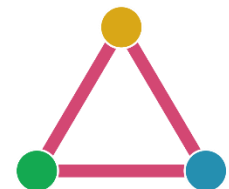


Fig. 1 Python-Package: PyPSA Python for Power System Analysis