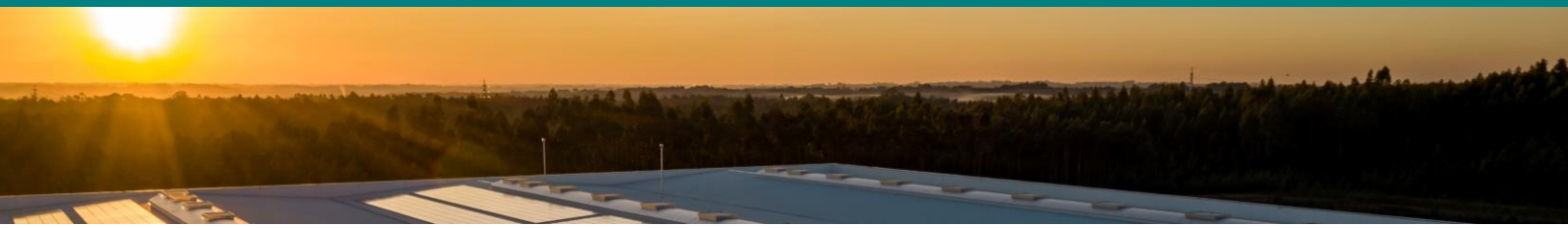
Institut für Elektrizitätswirtschaft und Energieinnovation

TU Graz

Master thesis

Critical scenario identification in energy system planning under uncertainty using decomposition methods



Motivation

The planning and operation of energy systems are facing many uncertainties, e.g., the availability of wind and solar energy. Those uncertainties can be considered in the decision-making process using scenario-based stochastic programming methods (Birge and Louveaux, 2011). When considering many scenarios, the resulting optimization problems become huge. One option to tackle those is decomposition techniques (Conejo et al., 2010). Additionally, not all scenarios may be critical for the decision-making process. Those that are not, may be excluded from the optimization model without changing the solution (too much). This thesis shall tackle the question of how to identify critical scenarios and how to aggregate them efficiently to improve the performance of the decomposition method. If time allows, we would like to investigate in a subsequent step how to use information about the relevance of scenarios obtained from the optimization problem in the scenario generation process.

Birge and Louveaux (2011). Introduction to Stochastic Programming
Conejo et al. (2010). Decomposition Techniques in Mathematical Programming

RESEARCH QUESTIONS

- How to solve large scenario-based stochastic program using decomposition?
- How to evaluate the similarity and criticality of individual scenarios?
- How to best aggregate scenarios within the decomposition process?
- How to utilize information from the decomposition in the scenario generation process?

TASKS & METHODS

- Literature research on existing decomposition techniques to solve stochastic programs
- Data gathering, processing, and analysis
- Modeling in Python/Julia/GAMS
- Deriving a mathematical formulation for a stochastic energy system planning problem
- Developing a mathematical solution approach

ORGANIZATIONAL

- Start: As soon as possible
- Work as part of the motivated and helpful IEE team
- Close cooperation with supervisors
- Modern workspaces at IEE available
- Remote work is possible (partly)
- German/English possible (latter recommended)

Contact

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