Chair of Renewable and Sustainable Energy Systems
Department of Electrical and Computer Engineering
Technical University of Munich

Master thesis

Calibration of conventional power plants in the linear optimization model urbs (German or English)

Motivation and background

In the coming years, the current energy system will undergo profound transformations driven by the urgent need for sustainability and the integration of new technologies. Electricity is poised to play an increasingly dominant role as a final energy source, mainly due to the electrification of various sectors and the decarbonization of existing processes. Simultaneously, new energy carriers such as hydrogen are expected to complement this transition by offering solutions for hard-to-electrify sectors and providing flexibility to the energy system. These changes are accompanied by the need to transition existing industrial, transport, and heating processes into sustainable alternatives, requiring innovative strategies and careful planning. Adapting to these evolving dynamics is critical to achieving ambitious climate targets and ensuring energy security.

The Chair of Renewable and Sustainable Energy Systems (TUM-ENS) conducts in-depth energy system analyses using a linear optimization model. This enables a comprehensive evaluation of future energy scenarios by simulating how various boundary conditions—such as policy changes, technological advancements, and resource availability—impact the energy system.

Research focus

The master thesis will focus on calibrating the modeling of dispatchable power plants in an energy system with an increasing share of renewable generation. It aims to provide insights into various research questions, including:

- What are plant-specific variables that impact the availability of power plants?
- What are factors that impact plant-based dispatch decisions? (e.g., when to offer power plants in the electricity market)
- How do electricity prices and dispatch decisions for conventional power plants correlate?
- How can different factors be modeled in a linear optimization model to achieve more realistic modeling results? What are the average deviations (from actual results) if the factors are disregarded?

Tasks

As part of the thesis, you will develop a specialized *urbs* model that will allow you to analyze the impact of varying input factors on modeling results. The work includes the following steps:

1. Development of an overview of factors impacting the availability and dispatch decision of power plants
2. Assessment of the impact of varying inputs on the accuracy of modeling results (compared to actuals)

Requirements

- Enthusiasm to develop a thorough understanding of the power plant's dispatch decisions
- Strong problem-solving skills and the ability to work independently in a structured manner
- Experience with Python programming desirable

- Basis knowledge of energy systems 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 with any questions. I look forward to receiving your application!

Contact

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