technische universität dortmund

Institute of Energy Systems, Energy Efficiency and Energy Economics

invite

Masterarbeit

Robust models for the Energy Supply of the Future in the Process Industry

---

Climate change and the associated transition to a fully sustainable energy supply will lead to major challenges. A chemical site with several chemical plants is an ideal testing ground to explore these challenges and to develop solutions at an early stage.

On chemical sites today, the generation and distribution of both electrical and thermal energy (mostly in the form of steam) are usually centrally controlled. The primary energy sources are mainly fossil fuels, which ensure a high level of supply security due to the fact that they can be stored and transported easily. By the transition to green energy this is changing. The availability of wind, sunlight and meltwater is not constant and can only be predicted to a limited extent. In the future, the supply of electricity will be subject to increasing fluctuations that are not correlated with the demand for electricity. In addition, the transition from fossil heat generation to green alternatives is largely based on direct or indirect electrification which is expected to lead to an increased demand for electricity. In order to be able to guarantee the security of supply within a chemical park in the long term, it will be necessary to restructure the site's own energy systems. Consequently, possible investment options and modes of operation must be investigated at an early stage.

To explore a future scenario with 100% green energy supply, robust models are needed. With their help, optimizations and sensitivity analyses can be carried out. There are various simulation methods available for this modeling, whereby a combination of different approaches may be necessary for a holistic approach. In this context, it is to be expected, for example, that optimization models would are well suited for the evaluation of different configurations of technologies, while discrete models have to be used for resilience analyses.

The aim of the master thesis is to perform a simplified modeling of a chemical site and to evaluate the suitability of the chosen simulation methods for the application case.

Suggested structure of the thesis:

- Literature research regarding potentially suitable models with focus on the process industry
- Conceptual modeling of a site limited to the energy flows CO_2, electricity, and heat
- Implementation of the site model with the help of an existing modeling tool and simulation of different scenarios (today's situation, exclusive green energy production)
- Generation of an optimization model for the energy supply of a site and determination of an optimal configuration
- Evaluation of the model, elaboration of advantages and disadvantages, as well as assumptions

The thesis is supervised together with the Invite GmbH, as well as another partner from the chemical industry. Following this work, the results are to be reported in a presentation

Supervision: Simon Kammerer, TU Dortmund (Simon.Kammerer@tu-dortmund.de)

Roman Heumann, Invite GmbH