Optimization of Balancing Reserve Market Participation for a Synergetic Waste Incineration CHP Plant

→ Also available in the scope of a ‘Studienarbeit’ or Master Thesis

Background
In addition to recycling, waste incineration is a central component of modern waste processing. Through incineration, environmentally harmful landfills are avoided. In addition, the incineration plants produce electricity and heat. In order to remain competitive in a changing electricity landscape, these plants should be operated as flexibly as possible and participate in system services such as the balancing reserve markets, in which powerplants offer so-called balancing energy to the grid in order to keep the electricity demand and production balanced. The traditional operating mode of a waste incineration plant is not suitable for offering balancing energy, however, using an electric battery - which can quickly store and release electric energy – combined with a CHP plant offers new possibilities which allow waste-to-energy plants to participate in these markets.

Objective
Within this work, you will expand an existing optimization algorithm for intelligently choosing the operation point schedule (unit commitment) of a real cogeneration power plant in Thüringen and several storage facilities. Where the existing algorithm is now able to choose the optimal operation point of the system when selling electricity on the ‘regular’ markets, the extension will enable it to also trade on the balancing markets. Using the algorithm, it will be possible to judge under which conditions balancing market participation is profitable for this powerplant. By taking the point-of-view of a plant operator, you will work at the interface of engineering, economy and mathematics. During your thesis, you will learn about cogeneration plants, optimization algorithms, the electricity market, energy storage and more.

Approach and tasks
1. Literature review
2. Development/Extension of a unit commitment optimization algorithm
3. Evaluation of the results

Requirements
- Ability to work independently
- Interest in power generation, the electricity market and thermodynamics
- Basic knowledge of linear algebra
- Basic programming skills (e.g., MATLAB, Python)

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