Master Thesis - Implementation and validation of different mathematical heat sector models for energy optimization within companies

(In cooperation with Rudolf Hörmann GmbH & Co. KG)

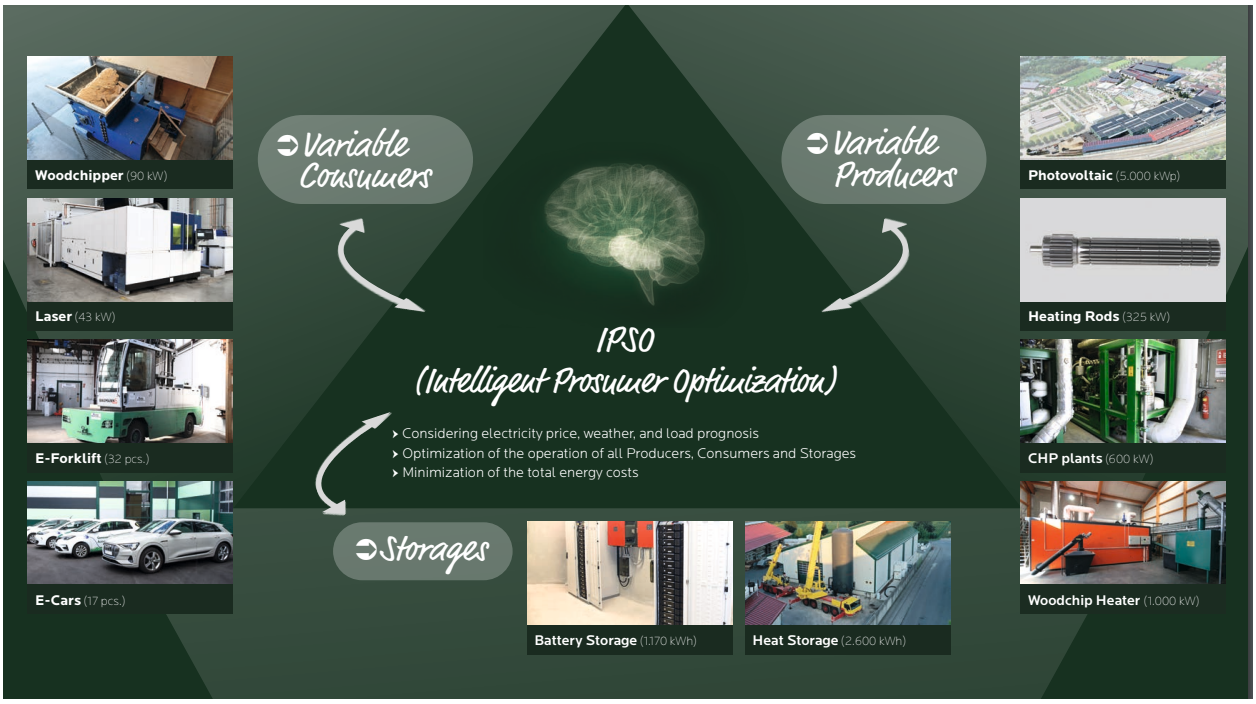

Figure 1: Principle of the IPSO-Program

Motivation

Research in energy transition predominantly focuses on macro-perspective analyses, such as envisaging the future of smart grids and their associated advantages. While the exploration of future potentials in this field is undeniably important, there is a tendency to overlook practical measures that reduce both system and societal costs and can be implemented in the immediate term. To address this disparity, our IPSO (Intelligent Prosumer Optimization) project focuses on optimizing the live operation of existing variable producers and consumers in corporate energy systems using mixed-integer linear programming. Notably, IPSO can be integrated into current energy systems without the necessity for new technical, legislative, or market structure developments. The project specifically targets companies rather than households, mainly due to the straightforward nature and comparatively minor impact of household energy optimization, as well as the disproportionate implementation costs in residential contexts compared to the limited scope for optimization.

The sector coupling of electricity and heat through chp-plants, heating rods, or heat pumps offers significant cost reduction potential. However, compared to electricity, modeling heat necessitates a more sophisticated model of the specific heat system under consideration. Since the IPSO system is intended for use across a wide range of corporate energy systems, the heat modeling process should be streamlined for ease of implementation while maintaining high quality. In this context, your task will be to implement and validate different approaches to model heat systems with an emphasis on minimal individualization effort while maintaining sufficient accuracy.

Tasks

- Deploy several modeling approaches for heat systems (generalized and in the practical example of our company)
- Implement the heat model parameters and constraints into the existing IPSO framework in a generalized fashion
- Validate the different heat models by testing the IPSO optimization framework first through simulations and then on the real-world energy system of our company
- Analyse and compare the energy cost reduction through the different heat modeling approaches

Requirements

- Student of Electrical/Mechanical Engineering, Mathematics, Informatics, or similar
- Courses about modeling and optimization (IPSO is based on Mixed Integer Linear Programming)
- Programming experience (preferably Python)
- Ability to work structured and independently but also a good team player
- Motivation to be a part of the energy transition

As you will be working on a real-world energy system, your presence at our company, Rudolf Hörmann GmbH & Co. KG located in Buchloe (40 min from Munich central station), once a week is beneficial but not mandatory.

Contact

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