Karlsruher Institut für Technologie

Elektrotechnisches Institut

Master thesis

Multivariate and combined electrical and thermal load forecasting of a student residence using machine learning techniques

Topic

Simulation

Focus

- ☒ Theory
- ☒ Literature
- ☒ Simulation
- ☒ Programming
- ☐ Construction
- ☐ Hardware
- ☐ Experiments

Courses of Study

- ☒ Electrical Engineering
- ☒ Mechanical Engineering
- ☒ Mathematics
- ☒ Process Engineering

Starting Date

As soon as possible

Please send your application to:

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Motivation

As a part of the project, BiFlow an innovative stationary hybrid energy storage system of Lithium-Ion battery (LIB) and Vanadium Redox Flow battery (VRFB) is researched, for a student residence: Stage76, Bruchsal. In addition to storing electrical energy, the VRFB also act as thermal storage and support the heating system of the residence.

In order to optimally control this conglomerate an Energy Management System (EMS) is developed. One of the main functionalities of the EMS is energy requirement forecasting, with which operation strategies are derived on an hourly basis. Unlike normal households, students keep moving in and out of their accommodation for various reasons, thus leading to non-linear energy consumption behaviour. The electrical load and thermal load of the building are inter-dependent to each other, as they both are influenced majorly by the residents. Additionally, electrical and thermal load at a student residence is also influenced by holidays, exam periods, weekday, season, and others.

Tasks

As a part of this master thesis a framework for recursive short-term electrical and thermal load forecasting would be developed using historical data from Stage76. As a first step the relationship between the electrical and thermal load would be modelled. Secondly based on the model both electrical and thermal load would be forecasted using a single forecasting algorithm, viz. multi-time series forecasting. Within the framework various state-of-the-art machine learning techniques would be implemented and their performances would be compared. A rough scope of the tasks are as follows: 1) Literature review of various machine learning techniques for multivariate short-term electrical and thermal load forecasting of buildings, 2) Research and selection of various plausible parameters influencing the electrical and thermal load for a student residence, 3) Selection, implementation and training of at minimum two and maximum four different ML techniques, 4) Comparison and inference of outcomes from the developed methods using common evaluation methods.