PROJECT REPORT

Revision 0

SUMMARY

This document describes processes in achieving task deliverable in WP 6.1. This task deliverable focuses on developing forecast algorithms for both the electricity load, PV generation and heat demand to be used as inputs for the optimization of the local energy communities (LECs) building energy management systems (BEMSs).

Impressum

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Abstract

In this report, advanced forecasting algorithms for both the electricity load, PV generation and heat demand of the local energy communities (LECs) are described. The expected building energy management system for the LECs resources optimization would leverage this short term forecast for the management of all energy-related services. Accordingly, advanced AI based forecast algorithms with two different time steps of 1-hour ahead with 10-minutes resolution and 24-hours ahead with 1hour resolution are provided for the prediction of the PV generation, building loads and heat demands of the LEC demonstrated using HSB Living Lab (HSBLL), Chalmers University of Technology Sweden. In principle, observed weather conditions, and historical data (outputs of PV, Electricity, and heat loads), from previous hours were used to forecast for an hour and 24-hours ahead.

Developing the machine learning models for the prediction of stochastic entities such as load demand and PV production requires historical data for a period to provide trends and patterns. The measurement data for this project is collected from Chalmers HSBLL building, while weather related data are retrieved from a Numerical Weather Prediction (NWP) model. For each forecasting algorithm tested based on the stated data, an individual forecasting method and performance optimization concept applied for the prediction is presented. The forecast for short term and very short term (1-hour ahead with 10 minutes resolution) are based on Long Short-Term Memory (LSTM) architecture while the 24-hours ahead with 1hour resolution is on Gated Recurrent Unit (GRU) and ConvLSTM – a combination of convolutional neural networks and LSTM.

The results of the best performing model showed an accuracy of 97.29% when compared with the actual data. The models were further validated and compared with the other state-of-art methods, hence the justification for their selection for deployment in GENTE project. Furthermore, the realization and future exploitation of the forecast system is briefly described. The presented forecast methods utilized predictions on weather variables instead of their real-time measurements. Therefore, the accuracy of the weather predictions highly influenced the predictions made especially that of the PV. This implies that the results of this forecasts are more viable in real time exploitation where weather variables may not be required as factor.