Predictions on PV power production with machine learning techniques

Background

The global demand for energy is huge and presents major challenges in terms of its growing rhythms. In that case, we need an energy portfolio that meets the criteria of being an efficient yet clean resource. Solar energy output for one hour equals the earth's energy demand for an entire year, in other words, a massive energy source with untapped potential, but the solar power is highly intermittent.

SINTEF Energy is working on a project, *PRESAV,* with the intention of finding the best predictive controlling system for energy storage by collecting information from the electricity market, district heating, weather forecasting and the local heat demand in PV-installed buildings. These prediction strategies will be tested in the ZEB-laboratory, with the goal of finding the best strategy to reduce energy consumption and gas emissions from construction works.

Task

The purpose of this project is to apply machine learning techniques such as XGBoost, Random Forest, Support Vector Regressor, and Multiple Linear Regression to identify the best solution for predicting PV power for energy storage in ZEB-lab utilizing historical weather data and previous PV generation as input.

Bachelor thesis
IELET2910 Electric Power Engineering

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The activities in the given task were:

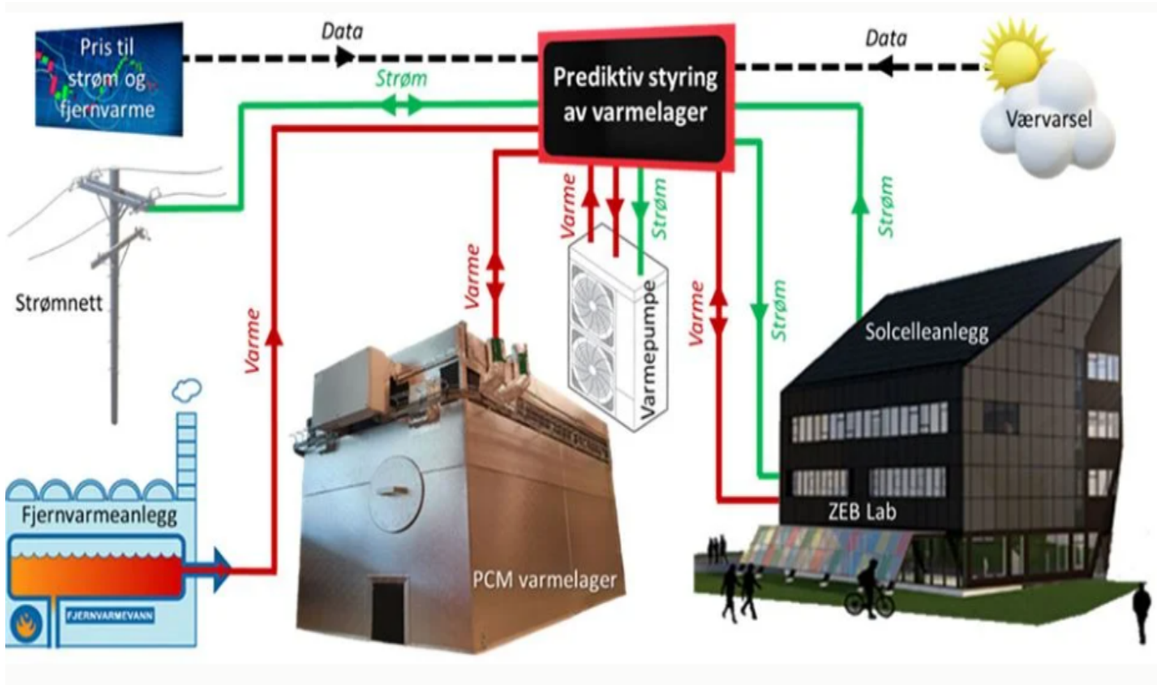
- Reading of the data
- Data pre-processing
- Data visualization
- Design of a forecast model based on machine learning algorithms
- Apply these algorithms to the data set and analyse how well they perform
- Training and testing the dataset
- Forecasting and documenting of outcomes

Result and Conclusion

After the grid searching each model, we notice that "all features" have no value, because the operator only works on models that have completed the grid search. We find that Random Forest performs good in both training for this cross-validation algorithm, and for Support Vector Regressor and XGBoost we experience significant improvements, when it comes to the phase shift between training to testing. It is quite reasonable to assume that the cross-validation process using 5-fold technique responds well to these models.

In the end, XGBoost provided the best prediction by delivering impressive results for this dataset, having a stable outcome when removing the solar radiation weather parameter.

By improving the efficiency of energy storage in ZEB-lab, this new understanding of future PV generation may perhaps improve on energy flow. This is particularly necessary in Trondheim due to the obvious unstable weather.



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8 June 2022