MAST30034 Project 2

Energy Market and Battery Optimisation Bonus Task Short Answer

Zhi Hern Tom, Haonan Zhong, Kaixin Yu, Lissy Xun, Jiabao Zhang
Group Name: Group 40

October 11, 2021

Overall approach to optimise battery in the absence of future prices

To optimise the battery in the absence of future prices, we have chosen to forecast future prices using the ARIMAX[1] model, which is suitable for predicting data. We find that the electricity demand might have a seasonal impact on the spot price. Here, we have performed feature selection through trial and error. We discover that using VIC demand and VIC intermittent generation amount as predictors can achieve the most optimal prediction.

We have built our forecasting model under two scenarios, which takes both accuracy and practicality into account. In the first scenario, we assume that future electricity demand and intermittent generation volume are known and used these two as exogenous to forecast spot price, which has decent accuracy. However, we may not know the future electricity demand and intermittent generation volume in reality. In the second scenario, we will first predict future electricity demand using Random Forest Regression, and use the predicted demand as exogenous to train the ARIMAX model.

Given that long-term prediction is not practical as the performance may get worse as time progresses. Therefore, 48-period ahead method is applied to this algorithm, which is, only the next [t: t+48] periods spot price are predicted, and the model will be re-trained every 48 half-hour period with actual data.

Lastly, we apply the predicted price to the mandatory task algorithm to determine the dispatch behaviour.

Challenges of task comparing to having pure foresight

Given the spot price is volatile, it will be hard to determine the dispatch behavior of the battery without having pure foresight. However, predict future spot price is difficult due to the following uncertainty, such as demand, renewable resource volume, coal and gas development policy, and other states' electricity consumption.

To enhance the accuracy of prediction, the 48-period ahead method is used, as mentioned above. One of the limitations is that the model needs to re-train for each period, which might lead to a high cost of maintenance since the model needs to keep running. The other challenge is that it is hard to predict the extreme value. Therefore, the battery might miss the optimal charge or discharge opportunity.

[1] Auto-Regressive Integrated Moving Average with exogenous factors