World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:16, No:12, 2022

Reducing the Imbalance Penalty Through Artificial Intelligence Methods Geothermal Production Forecasting: A Case Study for Turkey

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Abstract : In addition to being rich in renewable energy resources, Turkey is one of the countries that promise potential in geothermal energy production with its high installed power, cheapness, and sustainability. Increasing imbalance penalties become an economic burden for organizations since geothermal generation plants cannot maintain the balance of supply and demand due to the inadequacy of the production forecasts given in the day-ahead market. A better production forecast reduces the imbalance penalties of market participants and provides a better imbalance in the day ahead market. In this study, using machine learning, deep learning, and, time series methods, the total generation of the power plants belonging to Zorlu Natural Electricity Generation, which has a high installed capacity in terms of geothermal, was estimated for the first one and two weeks of March, then the imbalance penalties were calculated with these estimates and compared with the real values. These modeling operations were carried out on two datasets, the basic dataset and the dataset created by extracting new features from this dataset with the feature engineering method. According to the results, Support Vector Regression from traditional machine learning models outperformed other models and exhibited the best performance. In addition, the estimation results in the feature engineering dataset showed lower error rates than the basic dataset. It has been concluded that the estimated imbalance penalty calculated for the selected organization is lower than the actual imbalance penalty, optimum and profitable accounts.

Keywords : machine learning, deep learning, time series models, feature engineering, geothermal energy production forecasting
Conference Title : ICGEPP 2022 : International Conference on Geothermal Energy and Power Production
Conference Location : Istanbul, Türkiye
Conference Dates : December 20-21, 2022