Real time solar irradiance forecasting using NWP and machine learning for renewable energy management

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As the penetration of renewable energy is growing in South Korea, the need for reducing risk caused by variability is increasing rapidly. For this reasons, TSO(Transmission System Operator) is developing the new system for stable power grid operation and energy companies are preparing the new business for power market. The key factor is the variability of renewable energy and the representative technique is the real time power forecasting.

We are developing the solar power forecasting system for VPP(Virtual Power Plant) demonstration project in South Korea. There are two main factors related to the solar power forecasting directly.

One is the accurate forecasting of solar irradiance and the other is the plant environment, such as the surface temperature and the design of solar modules etc. Of these factors, it is the most important and necessary to forecast solar irradiance.

This study is on the real time solar irradiance forecasting using NWP(numerical weather prediction) and machine learning. NWP models are the most general method for forecasting several hours or days in advance.

We have used NWP as the baseline value and improved forecasting accuracy in conjunction with machine learning.

In this study, we used UM-LDAPS(Unified Model Local Data Assimilation and Prediction System) from KMA(Korea Meteorological Administration) as NWP data. In machine learning, 5 algorithms, such as decision tree, conditional inference tree, random forest, logistic regression, support vector machine, were used.

We analyzed measured and forecasted value up to 48 hours ahead.

Forecasting performance was evaluated in terms of the mean bias error (MBE), the mean absolute error (MAE), the root mean square error (RMSE).

This technique is a key part of the big data platform for renewable energy management system. We have plan to do an empirical study on this system in demonstration project.