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Day ahead Forecasting of Solar PV Generation: Case of Sri Lanka

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ABSTRACT

In Sri Lanka, the Ministry of Power and Renewable Energy (MPRE) is working towards achieving the status of carbon neutrality by 2050 and the total energy demand of the country by using renewable sources by 50%. Hence, there has been a substantial increase in the penetration of renewable energy resources, mainly solar and wind. However, grid integration of renewables is challenging due to the intermittent and uncontrollable nature of renewable energy resources. Integration of Photovoltaic (PV) systems to the utility grid introduce significant volatility to the grid, resulting in system instability, electrical power imbalances, variation in frequency response in the modern electric grid. As a result, customers are allowed to consume electricity in arbitrary quantities at any time. However, when aggregating all the buildings and households, the demand variation is highly predictable. This demand variation is constantly monitored, and the generators are dispatched according to the requirement to satisfy the demand. This research work is conducted to forecast day-ahead PV power output of solar arrays installed in the Faculty of Engineering, the University of Ruhuna, considering the effect of solar irradiance and cell temperature of the solar panels as variables. These two parameters are directly affected by the power generation efficiency of PV panels. The input data set with 5-minute interval data points were pre-processed by interpolation and exponential smoothing to fill in the missing values caused by the system faults. These data cleaning methods are proven to be resourceful in the short-term time series forecasting models. This research work used an Artificial Neural Network (ANN) to create a day ahead solar forecasting model. The model was trained and tested using January and February data sets and verified with the March data set. The ANN uses three input parameters: the previous day output power, irradiance, and temperature. The final result shows that the monthly average mean absolute error (MAPE) of output power is 2.069 %.

Keywords: *ANN, day ahead solar forcasting; solar PV integration*