A Literature Survey

Predict the Energy Output of Wind Turbine based on Weather Condition

Abstract:

• Wind speed/power has received increasing attention around the earth due to its renewable nature as well as environmental friendliness.
• With the global installed wind power capacity rapidly increasing, the wind industry is growing into a large-scale business.
• Reliable short-term wind speed forecasts play a practical and crucial role in wind energy conversion systems, such as the dynamic control of wind turbines and power system scheduling.
• A precise forecast needs to overcome problems of variable energy production caused by fluctuating weather conditions.
• Power generated by wind is highly dependent on the wind speed.
• Though it Is highly non-linear, wind speed follows a certain pattern over a certain period of time.
• We exploit this time series pattern to gain useful information and use it for power prediction.

Review:

This study critically reviewed investigations regarding wind power forecasting models, focusing On methods of analysis, prediction time scales, error measurements and accuracy improvements. It was Concluded that under the same conditions, physical methods are more complex and need considerable Computing resources, but suitable for medium to long-term prediction. On the other hand, statistical Methods, which performed better in short to medium term periods, were easy to be modelled and Inexpensive. A combination of these two major methods with their merits led to the promising hybrid Methods. Besides wind speed, temperature, wind direction, relative humidity and air

pressure were the Most often used input features in reviewed studies. Additionally, the one-year period and the sampling Rate of 10 min were the most common features used for input data. Based on the discussions in this Paper, a flowchart for wind power prediction is put forward, allowing the users to select appropriate Prediction procedure based on different time horizons, analysis methods, error measurements,etc.

(1). With the continuous development of high-rated wind turbines, power forecasting will keep Increasing its significant role in wind turbine operating stages. More advanced and cost-effective Prediction methods need to be developed to better forecast generated power from large-scale wind Farms.

(2). The development of modern computers and storage methods allow handling a larger amount of Database. Meanwhile, the larger size of the database has generated new challenges in terms of Data preprocessing and error post-processing. Future studies should focus on developing less Computational-extensive methods and removing the noise of the raw data.

(3). Future wind farms are gradually moving from onshore sites to offshore ones. Offshore wind Turbines, especially floating wind turbines, are operating in a different weather condition and Terrain. Future wind power prediction methods should focus on developing appropriate methods For offshore wind prediction, especially the selection of features in coastal and offshore zones to Balance between accuracy and efficiency.

(4). To solve wind power forecasting (a typical regression problem), the perfect predictive model will Provide zero error, which is the best performance. However, all wind power forecasting models Contain errors due to the stochastic nature of wind and therefore, a perfect score does not exist in Practice.

(5). Many factors can influence the accuracy of a predictive model, such as specific sizes and Sampling rates of training/testing/validation datasets, used algorithms and model optimizations.Overall, the performance of predictive models is relative and need to be evaluated through a Baseline model.

(6). Based on the reviewed literature, most investigators used diverse robust baseline Models to compare the performance of their newly developed methods. Nevertheless, a widely Accepted baseline method of wind power forecasting has not reached a common view in the Current research community.

(7). A further investigation is still required in developing a baseline Model that works reliably in benchmarking other forecasting methods.More specifically, new hybrid methods, including incorporating numerical simulations And neural network, and more advanced combination, such as ensemble learning methods,Are recommended.