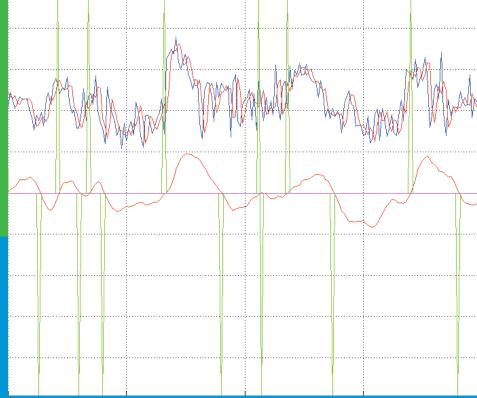# Wind Predictor

A Wind Power Prediction Software

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Wind Prediction Using Non-gaussian Forecasting

Researchers in DIT's Energy Resource Group have developed a new software tool which aims to estimate wind power more accurately than present solutions.

Wind power is presently difficult to predict accurately due to inaccuracy of forecasting techniques. DIT's Wind Predictor software estimates the power generation of 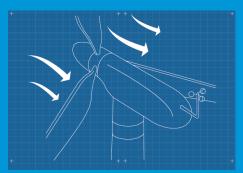wind energy technologies based on measurements of the wind velocity and associated variables by using new statistical modelling methods.

Current analytical methods of wind speed data are based on the use of a normally distributed model for the velocity gradient or wind force. However, it is well known that normal or 'Gaussian' distributed models are inaccurate. Thus, any power quality estimate and/or prediction based on this model may be prone to inaccuracy. This has been shown to be the case in many instances relating to the location and construction of wind farms when the output power has been significantly less than predicted.

The methodology applied by Wind Predictor is based on Levy distributions to model the statistical characteristics of the wind. Research shows that the average power output is inversely related to the Levy index computed from the wind velocity. Coupled with advanced statistical modelling methods, this fundamental result can be used to more accurately monitor and predict the 'quality of power' generated by wind farms.

Applications

Wind Predictor is principally a wind power prediction tool. The software can be integrated with any wind data collection system or tool and may be of particular interest to wind farm owners, investors, site developers and consultants.

While the software has potential applications in wave energy, the current focus is wind energy prediction, providing a unique resource for the planning, development and on-going monitoring of wind energy farms.

During site selection the software can be used to provide more accurate data on estimated energy yield. This will allow a quick and accurate assessment of potential future energy gains.

This enhanced analytics tool will significantly help users to:

- quickly evaluate optimum geographic locations for wind farm sites

- estimate quickly the likely output power from wind farms

- monitor the site and hardware on an on-going basis

Opportunity

Accurate analysis of the wind speed is critical and costly exercise for wind farm developers, operators and investors. Determining the ideal location for constructing a wind or wave farm, monitoring the power output of the farm and providing estimates of future power quality all require accurate forecasting.

A small error in wind resource assessment can have a huge impact, as the power produced by a wind turbine varies with the cube of the wind speed. Many Wind farms are underperforming their pre-construction energy yield estimates by at least 10%. For example with an installed capacity of 500GW and with an average cost per unit of 10 cent on the market this equates to an annual loss of €5 billion to investors.

An installed capacity of 40GW is being developed annually, this means that approximately 30,000 new sites are being developed annually worldwide. Currently installed capacity also means that there are also an estimated 285,000 sites worldwide which could benefit from the use of the software for on-going power prediction.

Advantages

The primary difference between Wind Predictor and existing solutions is the non-gaussian model upon which it is based, this means:

- Accurate power output forecasting – enables better synchronisation with the grid

- Better location decision-making – enables quick and accurate location or site selection

- Control & monitoring – enables on-going output monitoring and performance optimisation

- High statistical accuracy – accuracy of 90% has been achieved using this model

"The software can be integrated with any wind data collection system or tool and may be of particular interest to wind farm owners, investors, site developers and consultants"

Stage of Development

The Wind Predictor software has been developed by researchers from DIT's Energy Resource Group supported by funding from Enterprise Ireland.

A windows based prototype executable has been designed, built and tested. Initial test data has been collected which confirms the high degree of accuracy from the software. Further development work may be required to productise the technology for end-users. In particular GUI development will be required.

The prediction methodology, software specifications and software code are protected as secret know-how.

Research is currently on-going. The software is also being integrated with improved wind data collection technology.

DIT is currently seeking expressions of interest from potential business partners interested in developing the technology via a new spin-out company, and/or potential collaborators interested in developing the prototype software further under licence into a market ready product.