Virtual Met Mast™ Plus

Setting the standards for reducing uncertainty in wind assessments for medium wind projects

Reduce the uncertainty in the long-term wind speed for any site by using the Met Office Virtual Met Mast Plus™, a fast and cost effective solution to producing a reliable wind assessment for any site.

The old adage that money equals power is certainly relevant to the small and medium wind industry. The Feed-in-Tariff (FIT) scheme, introduced in April 2010 in the UK, is designed to provide attractive financial rewards for both generating electricity for own use, as well as exporting surplus electricity back to the National Grid. Developers are therefore naturally keen to take advantage of this incentive with minimum delays.

Theoretically, small and medium wind projects may range up to 5MW but in practice the majority of projects range between 50KW and 500KW. Such projects however will still require significant investments in planning, environmental surveys, radar interference studies and grid applications by the developer.

Importantly, the projected income and return on investment for any site is directly related to the power produced by the turbine, which in turn is critically dependent on the long-term wind speed at that site. Having an accurate wind speed assessment is therefore essential in ensuring that all stakeholders can be confident of the longer-term viability of any project, especially when financing is structured around the project cash flows. In this case, uncertainty around long-term average wind speeds must be reduced to a minimum. However, traditional wind assessments are expensive and can take a year or more to complete.
Impacts of wind shortfalls on power generation

Once a site is operational, realised wind speeds that are lower than initially estimated can result in shortfalls in power yields. The graph below highlights the severe impacts on annual energy production (AEP) and therefore real income, of various shortfalls in average wind speeds. Notably, shortfalls in long-term average wind speeds of just 0.5 m/s can reduce AEP by around 20% whilst shortfalls of 1.0 m/s can cut income by up to 50%. Therefore, differences of 1 m/s and greater between different sources of wind data should be of particular concern.

The solution

Improving confidence in wind speeds at hub heights of 20 to 40 metres is critical to the small and medium wind markets. This is especially relevant as the influence of the ground can have a considerable effect on low hub-height wind speed and turbulence. It will be seen through the facts presented in this paper that Virtual Met Mast Plus™ provides a representative assessment of the long-term wind conditions for these small and medium scale projects at lower hub heights.

Virtual Met Mast Plus™ combines initial wind estimates from Virtual Met Mast™ with on-site mast observations using innovative and robust scientific techniques, to provide revised wind speed statistics with higher levels of confidence. A feature of Virtual Met Mast Plus™ is that satisfactory results, with quantified uncertainty, can typically be achieved in less than 12 months, which is an important benefit for smaller projects.
How Virtual Met Mast Plus™ can help small and medium wind projects

The following scenarios demonstrate just two ways that Virtual Met Mast Plus™ can help developers to critically assess the long term wind risks in order to move forward with any project.

Scenario 1: Producing evidence to secure funding

A land owner is looking to spend a considerable sum of money on installing a 500KW turbine in highly complex terrain. Due to the scale of the investment, she has been asked by her bank to reduce the uncertainty in the long-term power yield to an acceptable level. This requires ensuring that the uncertainty in the long-term mean wind speed is less than 0.3 m/s.

The initial Virtual Met Mast™ report produced a long term average wind speed of 7.7 m/s, but with an associated uncertainty of plus or minus 1.0 m/s because of the high complexity of the terrain. As a next step a calibrated met mast is installed to collect observation data. The graph shows that after just three months of using site observations the associated uncertainty drops to 0.4 m/s with a long-term mean wind speed of 7.2 m/s. After six months of monitoring, the long-term mean wind speed is now 7.3 m/s, but most importantly, the uncertainty in this estimate has reduced to below 0.3 m/s. As a result, she can produce the required evidence to her bank and financing is agreed.

Scenario 2: Increasing confidence in the viability of a wind farm

A farmer wants to install a small wind turbine on his land in a county where many of the wind sites are marginal. Long-term mean wind speeds of 6.0 m/s or greater are required for a satisfactory return on investment for any small and medium wind project but the county average long-term mean wind speed is just 5.8 m/s.

Although the site selected is on top of a hill where the wind is stronger than the county average, he needs evidence of the site’s long-term mean wind speed to determine whether the site will meet the required threshold before he continues to invest in the project.

The farmer first uses Virtual Met Mast™ to assess the site. The initial wind speed generated by Virtual Met Mast™ is 5.7 m/s and the associated uncertainty is 0.7 m/s (medium complexity site). This means that there is 90% probability that the long-term mean wind speed will be greater than or equal to 5.0 m/s – and just a 29% probability of being greater than or equal to 6.0 m/s.

By installing a calibrated met mast at his site he begins to collect site observation data. After one month, he uses Virtual Met Mast Plus™ and finds that the average observed wind speed is greater than 5.7 m/s so he continues to monitor the observations. After three months, the Virtual Met Mast Plus™ results show that the long-term average mean wind speed has increased to 6.5 m/s with the associated uncertainty decreasing to 0.3 m/s. This means that there is now a 90% probability that the long-term mean wind speed will exceed 6.2 m/s. So after just three months of monitoring in conjunction with an updated Virtual Met Mast Plus™ report from the Met Office, the farmer is confident that his site will meet the minimum threshold of 6.0 m/s for a successful project.
Supporting critical decisions

It is therefore clear from the above scenarios, that Virtual Met Mast Plus™ generates a representative long-term assessment of wind resources and therefore the most realistic expectations of return on investment for any project. As a result, detailed discussions and agreements between all stakeholders can be conducted with confidence.

Over the last few years, Virtual Met Mast™ has been setting the standards for wind assessment reports for small and medium wind projects in the UK and Europe. Virtual Met Mast Plus™ offers a further level of confidence to all project stakeholders. The Met Office continues to invest in research and development to ensure that we meet the industry’s increased demand for accuracy and reliability.

For more information or to order your Virtual Met Mast Plus™ report, please call +44(0)1392 885680 or email to renewables@metoffice.gov.uk