Wild weather and wind turbines

In November last year, the Prime Minister of the United Kingdom, Mr Boris Johnson, announced an ambitious 10 Point Plan for a 'green industrial revolution', which is hoped will create and support up to 250,000 jobs. This plan covers clean energy, transport, nature and the use of innovative technologies. The plan will allow the UK to make a positive contribution to global climate change by eliminating the country's contribution by an anticipated date of 2050.

It is ambitious and will need continued support from the UK government and allied stake holders and will undoubtedly be amended and updated as it develops. Under this plan, investment into green energy solutions is key and increasing the pace of installations of, for example, on shore and off shore wind turbines, will be required.

BTD-350 Artwork

The UK already generates more electricity from offshore wind than any other country, harnessing the wind power our seas are well placed to produce. Government support to unleash the potential of this industry has been partly responsible for the two thirds cost reduction in offshore wind power generation in the last five years. By 2030, the UK aims to produce 40GW of offshore wind, including 1GW from the innovative and very new floating offshore turbines in the windiest parts of the seas.

This new technology will open up new areas of seas and oceans, where the deep water has not allowed the existing technology to be employed. This is an exciting development for the installation of offshore wind technologies world-wide.

To integrate clean technologies like offshore wind, we must transform our energy system, building more network infrastructure and utilising smart technologies, such as energy storage. Additionally, use of extra equipment on turbines that can monitor visibility, warn of the approach of severe weather and lower health and safety risks must also be considered.

These new structures bring with them both new engineering challenges for their manufacture and installation and for their continued efficient and safe operation. Whilst wind turbines require an energetic atmosphere to work effectively, the change in global weather patterns resulting in more frequent and more powerful storms has increased the risks posed when installing them and whilst operating them.

New and existing meteorological sensors and measurements are becoming ever more important for their installation and maintenance, whilst continuing to offer safety for passing maritime vessels and aircraft.

The importance of measuring visibility and local weather

All wind turbine parks are equipped with aviation obstruction (warning) lights, which for several years created light pollution and led to residents objecting to wind farm development. To combat this, Germany has had legislation in place since 2004 requiring developers and manufacturers to install turbines with visibility sensor-controlled obstruction lights. These visibility sensors constantly monitor the local meteorological conditions and when the visibility varies, the light intensity for the warning lights is automatically adjusted.

SWS-200 SWS-250 front right

For example, on clear days where the visibility is greater than 10km the light intensity is reduced to 10%. When the visibility is measured at 5km or higher, the light intensity is set to 30%. At all other times of lower visibility, it is set to 100%.

In addition to visibility, data being used to control the obstruction light brightness on wind turbines, present weather sensors are often installed to enhance the readings. These sensors output the specific weather conditions being experienced by the sensor at the top of the turbine in addition to the visibility information.

This is important when the turbines are subjected to freezing conditions and the blades can become coated in ice. Ice can greatly reduce the efficiency of the turbine and energy generation and in most cases, the turbines must be shut down and the blades de-iced before they can re-start. Having real-time weather data allows the operators to either plan for this eventually more proactively or to start their blade heating systems to reduce the ice build-up more effectively.

The challenges with off-shore turbine installations include their marking with beacons to meet national and international maritime laws to show other vessels the location of this potential obstruction. Once again, visibility sensors located towards the base of the turbine can control the brightness of these lights and can also be used to initiate fog warning sounders too.

Warning of approaching thunderstorms

In many applications, a thunderstorm detector is used to help protect people and equipment from the dangers of a lightning strike by providing advanced warning of a storm's approach. This is especially true of tall structures sited on either exposed or flat landscapes where they are likely to initiate a lightning strike, as is the case for wind turbines.

Systems which rely on simply detecting lightning are only effective if the storm is already producing lightning at a distance before moving closer towards the site. If the thunderstorm develops overhead, the first lightning strike of the storm will be very local and as there is no advanced warning and so they offer no real protection.

In wind turbine applications, advanced warning of overhead lightning is of enormous benefit for installation teams as well as for operation and maintenance staff located on-site. Turbines are prone to lightning strikes and all staff on-site need to be warned of a storm's approach to make their way to a safe area. The same is true of off-shore wind farms where the support vessels require warning of approaching storms to allow them to make their staff and operations safe.

These thunderstorm detectors are currently being installed onto the off-shore transformer platforms that sit alongside the wind farms. These platforms then feed the generated power back to shore and for connection to the local electricity grid network.

Some research is currently underway in the UK to determine whether such thunderstorm detectors can be successfully mounted onto the nacelles of the turbines and thereby offering better local area detection and removing the need to install equipment onto (sometimes) other owners' equipment. These trials and evaluations should continue during the summer lightning season in the UK during May to September 2021.

With wind farms set to occupy sea footprint the size of London and power 3.4 million homes, it is vital that the structures are utilised to track weather conditions to not only keep up the efficiency of the turbine but to ensure the safety of staff who may be on site. With a renewables future already under way, it is hoped that more is still to come in terms of what can be done with these structures, the next few decades are set to be very exciting.

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About Biral

Established in 1975, Biral specialises in the design, manufacture, and distribution of high-quality meteorological sensors for the professional market.

Biral manufacturers a range of visibility and present weather sensors as well as the unique thunderstorm detectors. The meteorological products are used in the most demanding applications such as aviation, offshore platforms and wind energy.