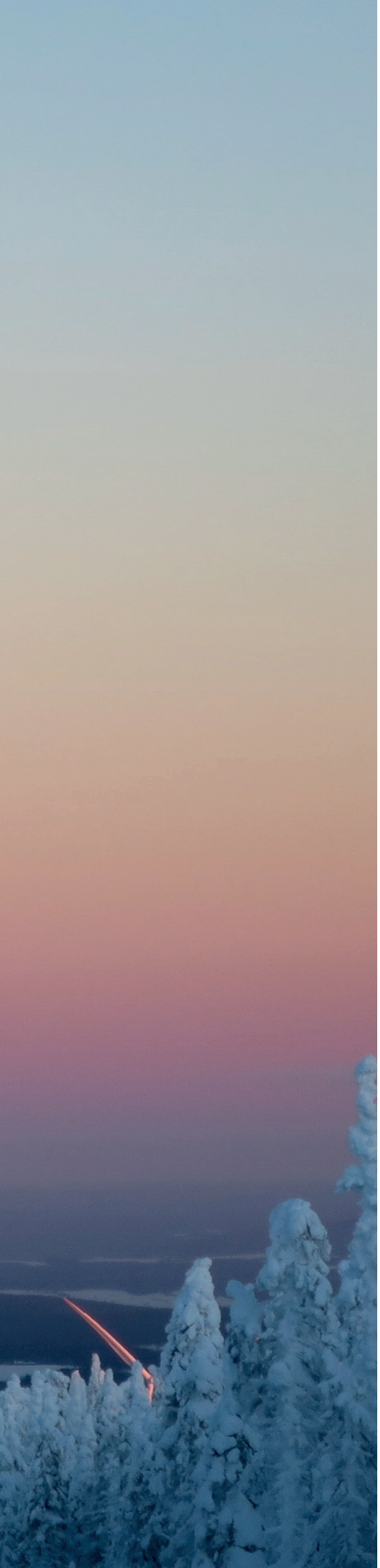
Ensuring wintertime profits with blade heating

Words: Lasse Hietikko



The anti-icing blade heating technology is the enabler for windfarm power production in extreme icy conditions in Quebec, Canada. The efficient use of heat keeps the turbines operating up in the mountains, in the most demanding, freezing conditions, such as Lac Alfred wind farm.

It consists of 150 wind turbines, with total capacity of 300MW and is located up in the mountains of Gaspe peninsula, Quebec. The wind farm is heavily influenced by the proximity of the Atlantic Ocean. It has vast wind resources, but the combination of moisture rising out of the sea that stays open the whole wintertime, high altitudes and the cold weather means the environment is prone to icing conditions.

The winter is long and usually starts in October and ends in April. The turbines tend to stop easily if any ice is detected by their sensors. Many of the turbines here suffer heavy icing, which leads to long periods of complete standstill. This leads to losses of about 15% of the annual energy production, AEP. It was obvious that something needed to be done in order to save the investment.

'Until the summer of 2016 we had only used our blade heating technology on new turbines,' explains Tomas Wallenius, CTO and co-founder of Wicetec. He continues: 'many installation steps can be carried out more easily at the blade factory, when installing such technology on new turbines during the manufacturing process. Now we have had to accept the constraints for retrofitting the installation on existing turbines. However, we have not compromised the blade heaters performance, quality, or the safety of the system.'

The first two retrofit blade heating systems were installed and commissioned in the end of year 2016, just before Christmas holidays. This was due to Wicetec's 'can do' attitude, mutual efforts and co-operation with the local service company and the wind farm owner. The site installation teams and the supporting engineers together with the managers were celebrating the achievement in the darkening hours of that cold winter day in temperatures of -20°C.

The two retrofit systems turned out to be a success. The results were analyzed by an independent third-party company. Based on the good results and operating experiences the technology was further rolled out to the turbines that were most affected by icing. As one of the site technicians said, 'The least productive turbine became the most productive turbine after the blade heating retrofit!' Today the total number of retrofitted turbines has increased to 28 units.

Lasse Hietikko

Over the years the Wicetec heating technology has evolved from a stand-alone to a system that is integrated into the wind farm SCADA system. We have also developed a monitoring tool which immediately shows the status of all anti-icing systems. This gives real-time, online information on the operating condition and for example icing conditions at the site.

Company

Wicetec Oy is a company with long history despite the company's rather short 5 year existence. The research and development of the surface based electrothermal blade heating technology started nearly 30 years ago at the VTT Technical Research Centre of Finland from where Wicetec is a spinoff company. It independently owns the patents, other IPR and technology know-how.

Our founders and the key personnel were previously in key position in the related research work, as well as in piloting the blade heating technology to different wind turbines. This means we have over 25 years of experience of wind turbine icing onboard!

Today Wicetec is the leading independent blade heating provider. The technology is

These photos were taken on the same day. The turbine on the left is without any blade heating. The turbines on the right have retrofit blade heating and thus, aerodynamically critical areas are free of ice and snow.

field proven and implemented in several wind turbine types, the oldest carbon fabric blade heaters have been in use for 22 year and are still in operation.

Currently 1000MW of wind power uses this patented technology. Everything in our technology is based on scientific research and persistent development, which makes Wicetec the key player in the market. Our core knowledge is in the heating element design, manufacturing, blade integration and control software algorithm. We are proud to say that we are the company with the most experience in the wind turbine icing and turbine blade heating worldwide!

Our technology

The Wicetec Ice Prevention System (WIPS) is an automatic blade heating system where the carbon fabric-based electrothermal heating elements are installed on the blade surface. The operating principle of our technology is anti-icing, which means that the blades are heated while the turbine is in operation and prevents ice accumulating on the aerodynamically critical areas of the blades. This leads to no standstills due icing and furthermore to no de-icing cycles, as the turbine stays operational regardless of the icing conditions. The WIPS consists of blade heating elements, automation control cabinets, ice detector, and intelligent control software.

The intelligent control software enables continuous automatic operation throughout the winter season. The software includes web based graphical user interface that visualizes the WIPS operational states. It also allows manual operation of the WIPS, as well as shutting down the system, for example for maintenance.

The WIPS prevents up to 90% losses due to icing. The WIPS significantly reduces the Levelized Cost of Energy (LCOE) over the turbine lifetime, compared to a turbine without the technology in icing conditions.

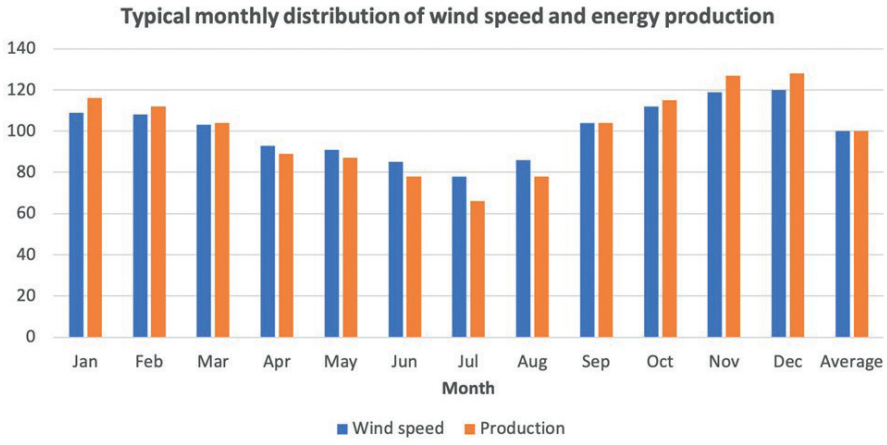
The turbines are designed to spin 24/7 and when they are not spinning it is not good for the bearings, nor for the whole drivetrain.

Based on bearing company experts' input, two hours of standstill is enough for the oil film to disappear between the metal surfaces in the bearings under the pressure. This leads to micro pitting and corrosion and further to premature failure of the components.

In some cases, there is a risk of losing the corporate Power Purchase Agreement (PPA) if the turbines do not generate enough power throughout the year. Additionally, there is a risk that this will also incur penalty payments. This can all be avoided with our well-functioning and efficient electrothermal blade heating technology!

Why wintertime production matters

In the cold climate areas wintertime is indispensable for the wind farm owner. In fact, the turbines produce double compared to summer. This is explained by more wind, with the higher density of the air. Electricity prices tend to be higher as well. The size of the turbines is growing continuously and they are becoming taller and taller. The blades sweep higher, more often hitting the clouds and therefore are more affected by icing. Thus, the need for blade heating is also growing rapidly.



In cold climate areas wintertime production is double compared to summertime. Modified from Suomen Kuvalehti (01/2019)

www.wicetec.com