

Vestas[®]

Vestas **Anti-Icing** System[™]

Part of Vestas Cold
Climate Solutions

Wind. It means the world to us.[™]





Vestas Anti-Icing System™ efficiently removes ice formation on blades during operation to maximise energy production. As part of Vestas' portfolio of cold climate solutions, it helps address performance challenges associated with operation in cold climate conditions.

Targets icing where and when it's needed

Certain weather conditions result in ice building up on rotating turbine blades; this changes the blades' aerodynamic properties and negatively impacts energy production performance. Vestas Anti-Icing System™ continuously monitors the effects of ice formation and intelligently engages to remove ice and secure continued operation to maximise performance. The combination of several independent heating elements and levels result in targeted and effective anti-icing action tailored to the specific icing event. Targeting icing only where and when it is needed minimises the system's power consumption and maximises the effective climatic operating range.

Rapid heating response

Covering a large area and embedded in the laminate directly below the blade's surface, the system has a fast response time. During the most common icing events, Vestas Anti-Icing System™ engages while the turbine is in operation and ensures a minimum of 90% production retention*. A large operational envelope secures high energy production in extreme cold climate conditions, making it the optimal cold climate solution for sites ranging from low to high ice severity.

Improved business case certainty

Vestas Anti-Icing System™ improves business case certainty by reducing lost production due to icing events, while minimizing risks. Vestas Anti-Icing System™ complies with the latest warranty guidelines**.

No stranger to cold climates and icing

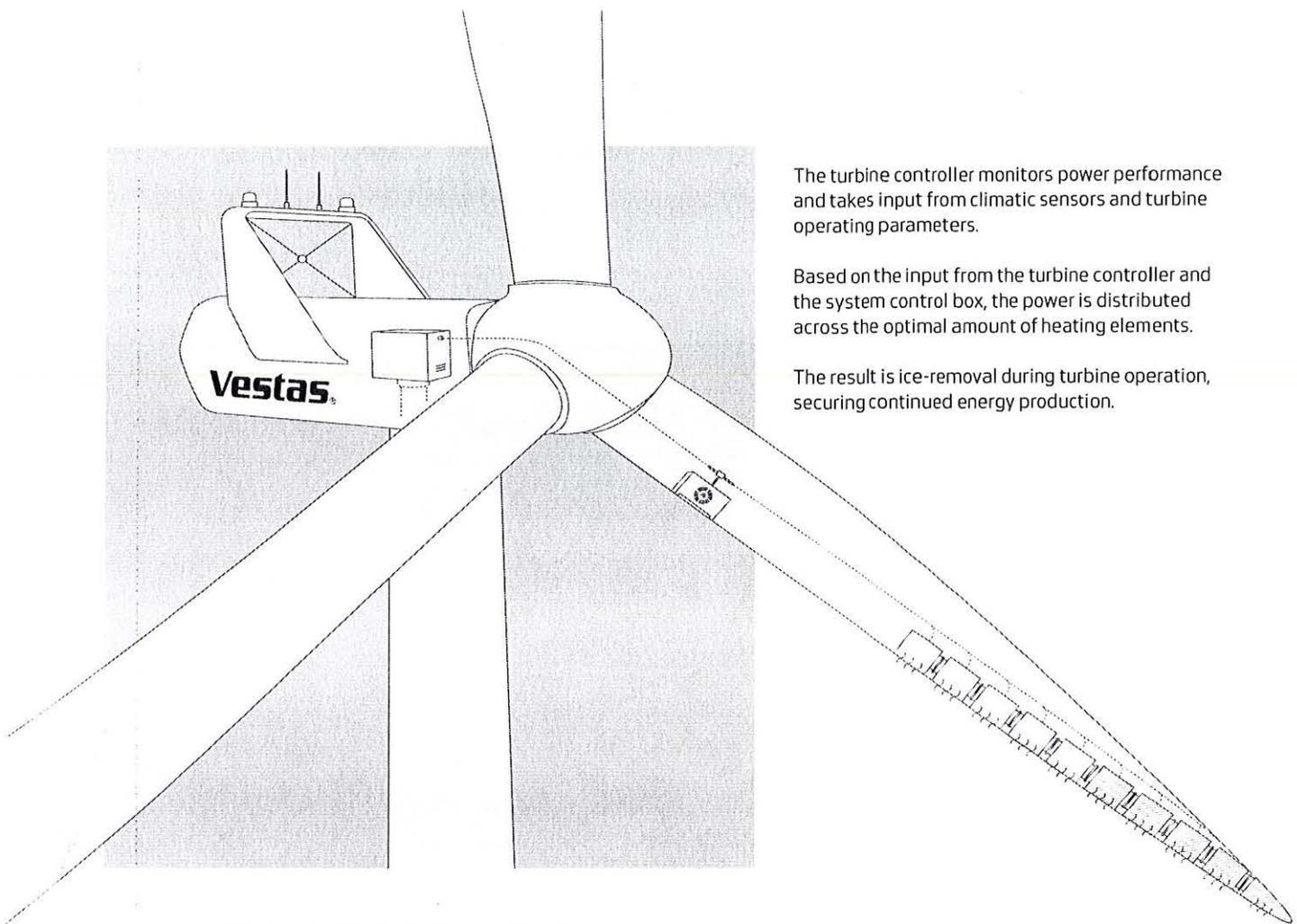
Vestas Cold Climate Solutions build upon 16 years of experience within cold climates. With more than 4 GW of installations in ice prone sites***, Vestas has a strong track record and extensive experience with installing and servicing turbines in these harsh conditions.

Vestas Anti-Icing System™ is developed and optimised based on this experience and extensive performance data insights, gathered from thousands of turbines in cold climate sites. Vestas Anti-Icing System™ is designed and engineered by Vestas, specifically for Vestas blades and control systems.

Vestas Anti-Icing System™ is available for V136-4.2 MW™[†] and V150-4.2 MW™[†]

Vestas Ice Assessment™

Vestas' wide suite of siting tools, including the improved Vestas Ice Assessment™, allow us to use highly advanced metrological models and algorithms to assess icing challenges. On a specific site, it predicts icing exposure for each individual turbine, with a precision of ~300 m. Vestas Ice Assessment™ can predict the specific icing conditions, ice formation on blades and expected icing loss to assess the total energy production of a cold climate site - and how icing events will affect the customer's business case. This means we ensure that only those turbines likely to be effected by moderate to severe icing events are installed with the Vestas Anti-Icing system™

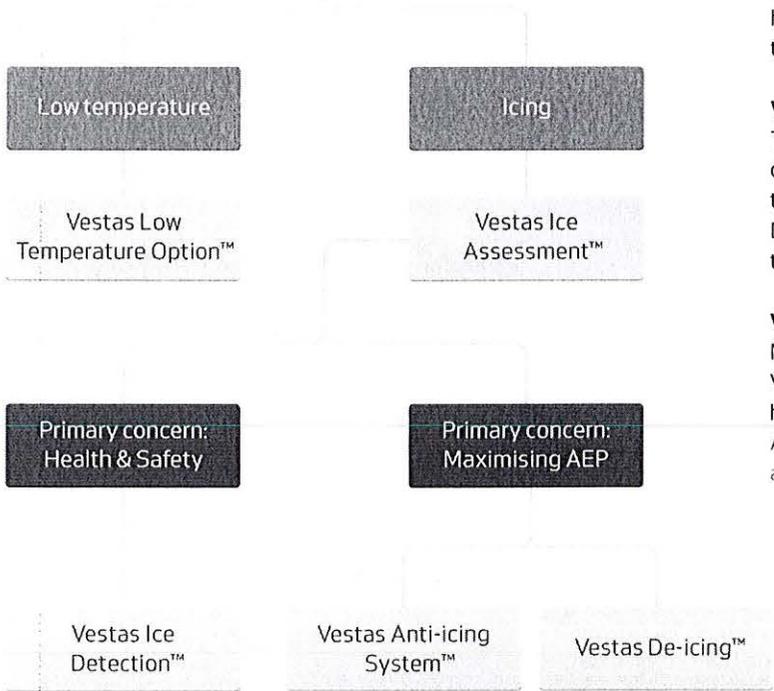


The turbine controller monitors power performance and takes input from climatic sensors and turbine operating parameters.

Based on the input from the turbine controller and the system control box, the power is distributed across the optimal amount of heating elements.

The result is ice-removal during turbine operation, securing continued energy production.

Vestas Cold Climate Solutions



Vestas Low Temperature Option™

Enabling turbine operation in ambient temperatures as low as -30°C, Vestas Low Temperature Option™ employs heating elements to ensure the continued operation of temperature-sensitive components.

Vestas Ice Detection™

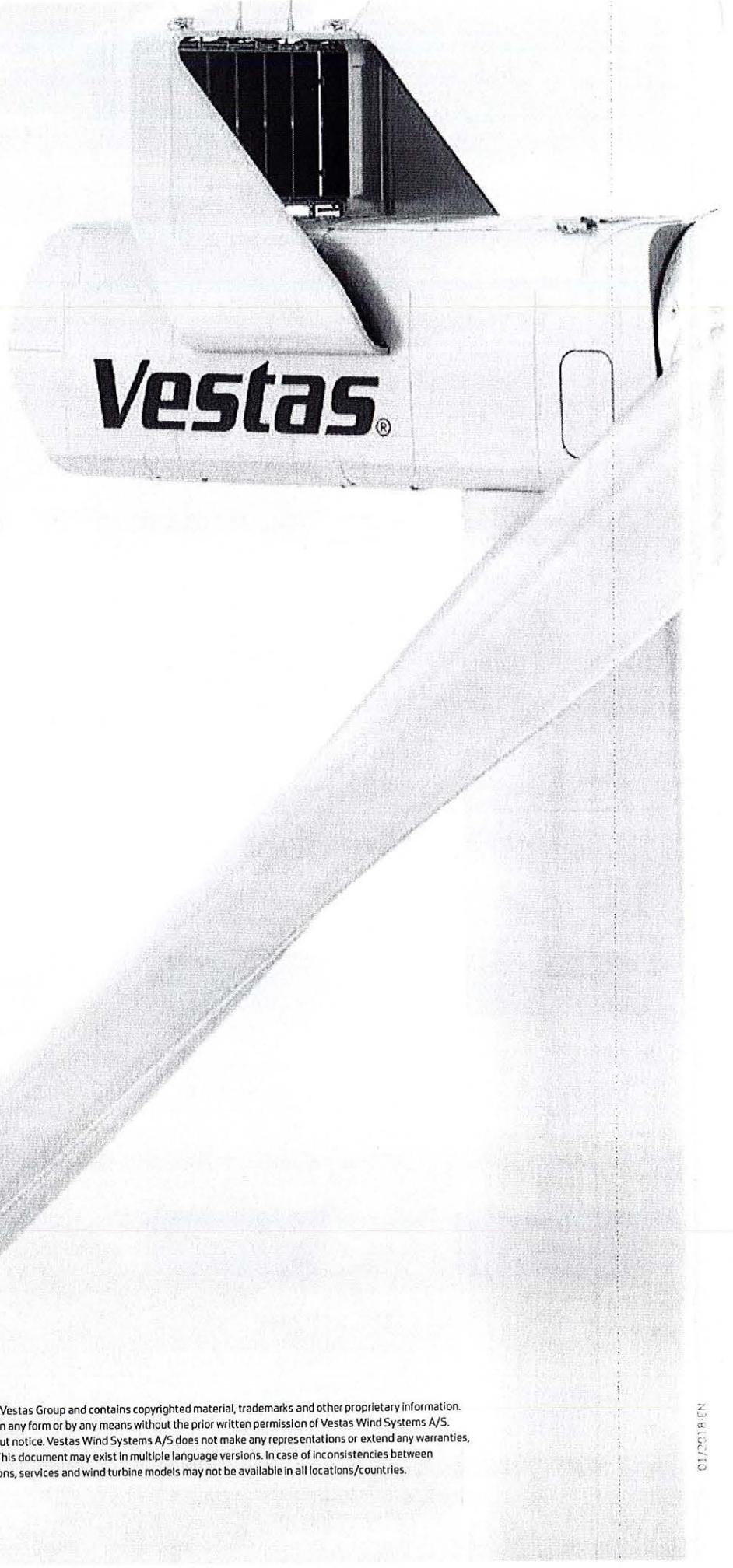
The Vestas Ice Detection™ system detects ice build-up on turbine rotors and helps to limit the risk of ice throw. The Vestas Anti-Icing System™ and Vestas Ice Detection™ can be combined in safety regulated sites to reduce downtime caused by the risk of ice throw.

Vestas De-Icing™

Maximizing energy production in icy conditions, the Vestas De-Icing™ system uses air heaters to circulate hot air within the turbine blades during standstill. Available for V112-3.45 MW*, V117-3.45 MW* and V126-3.45 MW**

* Depending on siting and climatic conditions. The system retains 90% in climatic and operating conditions within the maximum performance operating envelope.
 ** IEA task 19 IPS warranty guideline
 *** Above IEA class II

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