



Vestas[®]

Wind. It means the world to us.[™]

Vestas Cold Climate Solutions and next steps

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PUBLIC

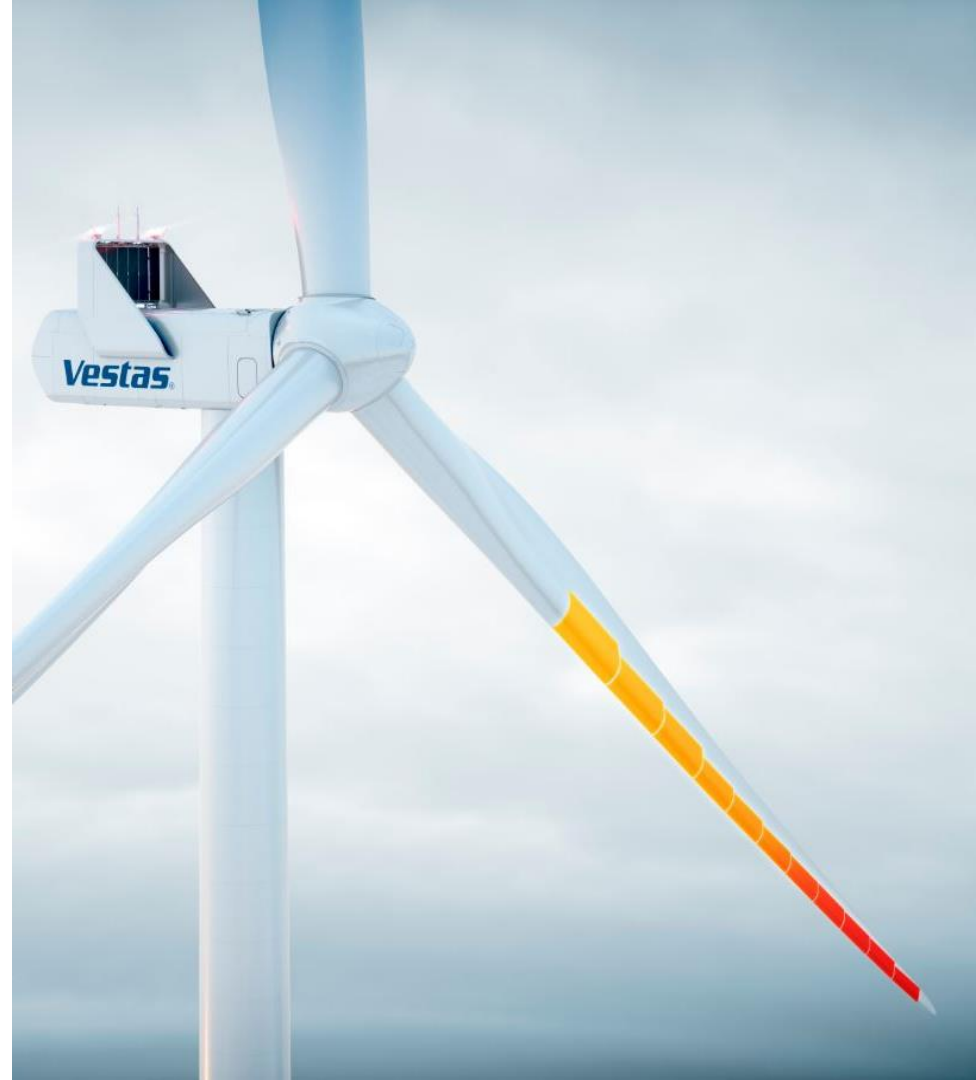
Introducing Vestas Anti-icing System™

Efficiently removes ice built-up on blades during operation to maximise energy production.

Available for:

- **V136-4.2 MW™**
- **V150-4.2 MW™**

Ready for **delivery in 2019**



Introducing Vestas Ice Assessment™

Siting tool with **industry-leading accuracy**

- Ice loss assessment
 - Individual pad level
 - In-house design input tool
- = Improved value engineering**



No stranger to cold climates

Strong track record

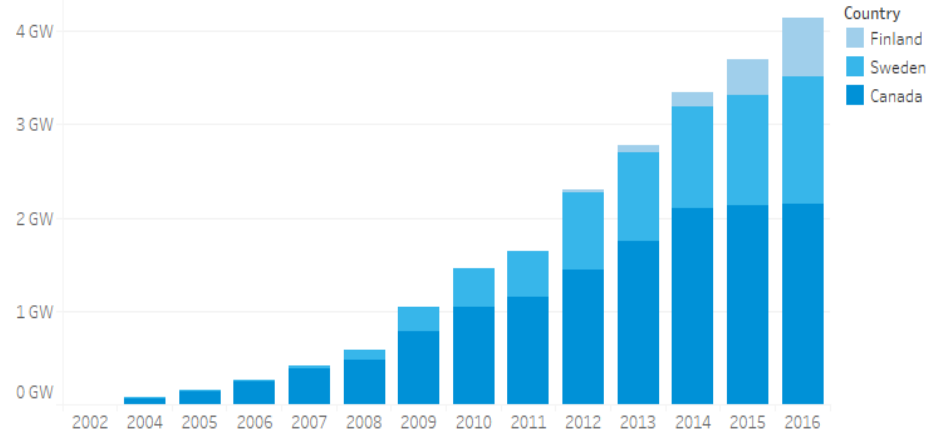
- **+ 17GW** installed with Vestas Low temperature option
- **+ 3GW** with Vestas Ice detection™
- **+ 1GW** with Vestas De-Icing™

- Vestas Cold Climate Solutions are continuously producing valuable data
- Systematically incorporating into Cold Climate solutions

*Above IEA ice class II

+4 GW
installed in
ice prone
areas*

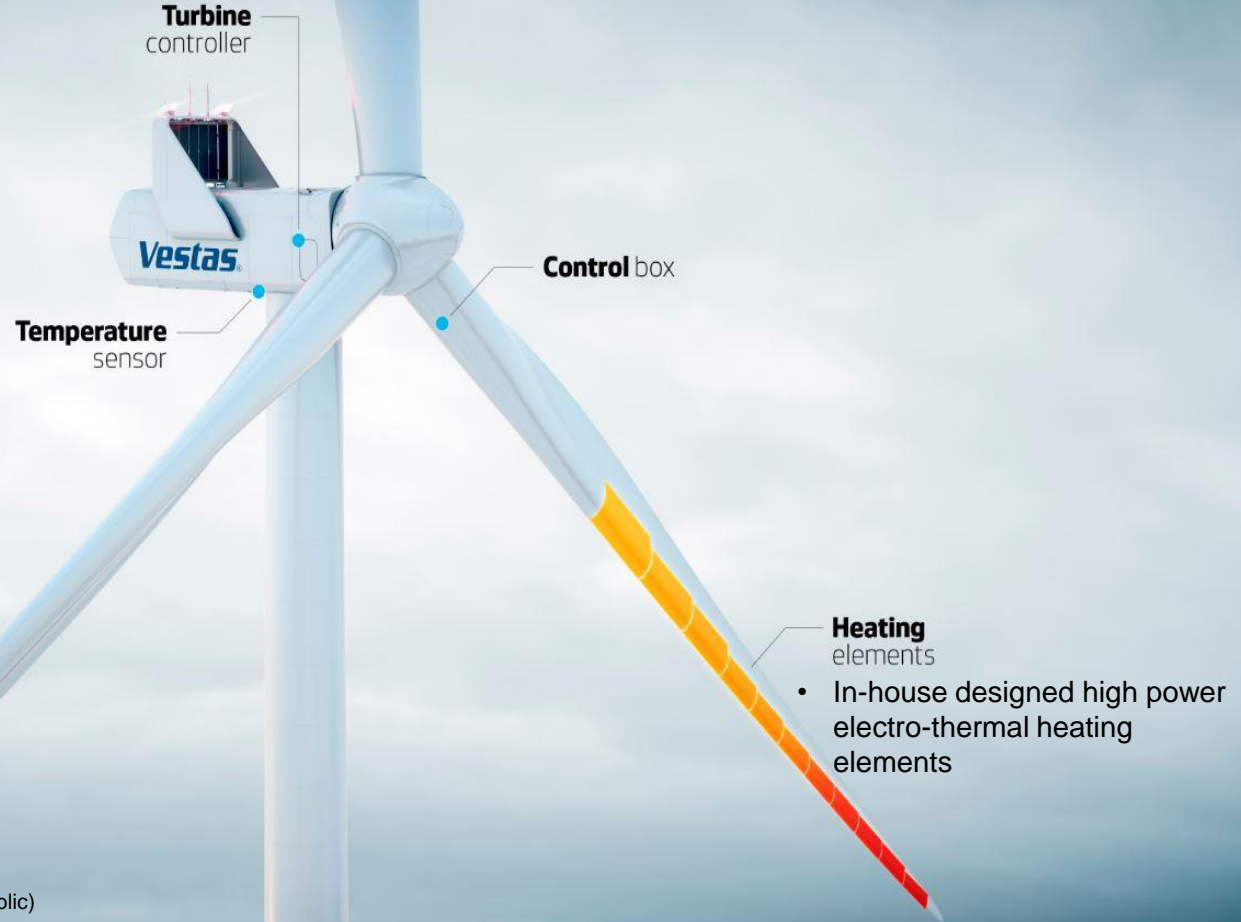
16 years
Of
experience
in cold
climates



Vestas Anti-Icing System™

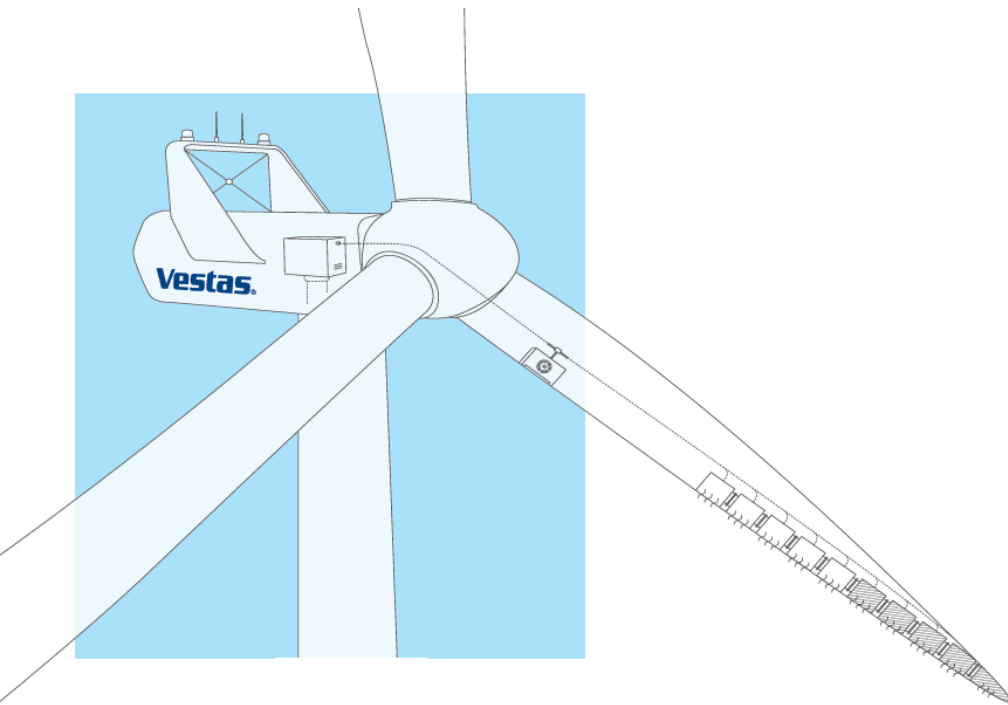
Where and when it's needed

- **Automatic anti-icing modes** adaptive to climatic conditions for **optimising efficiency** per icing event
- **Covering a large area and embedded in the laminate** directly below the blade's surface, the system has a **fast response time**
- **Optional control features** to fit site conditions through SCADA
- Compatible with Vestas Ice Detection™



Vestas Anti-icing System™

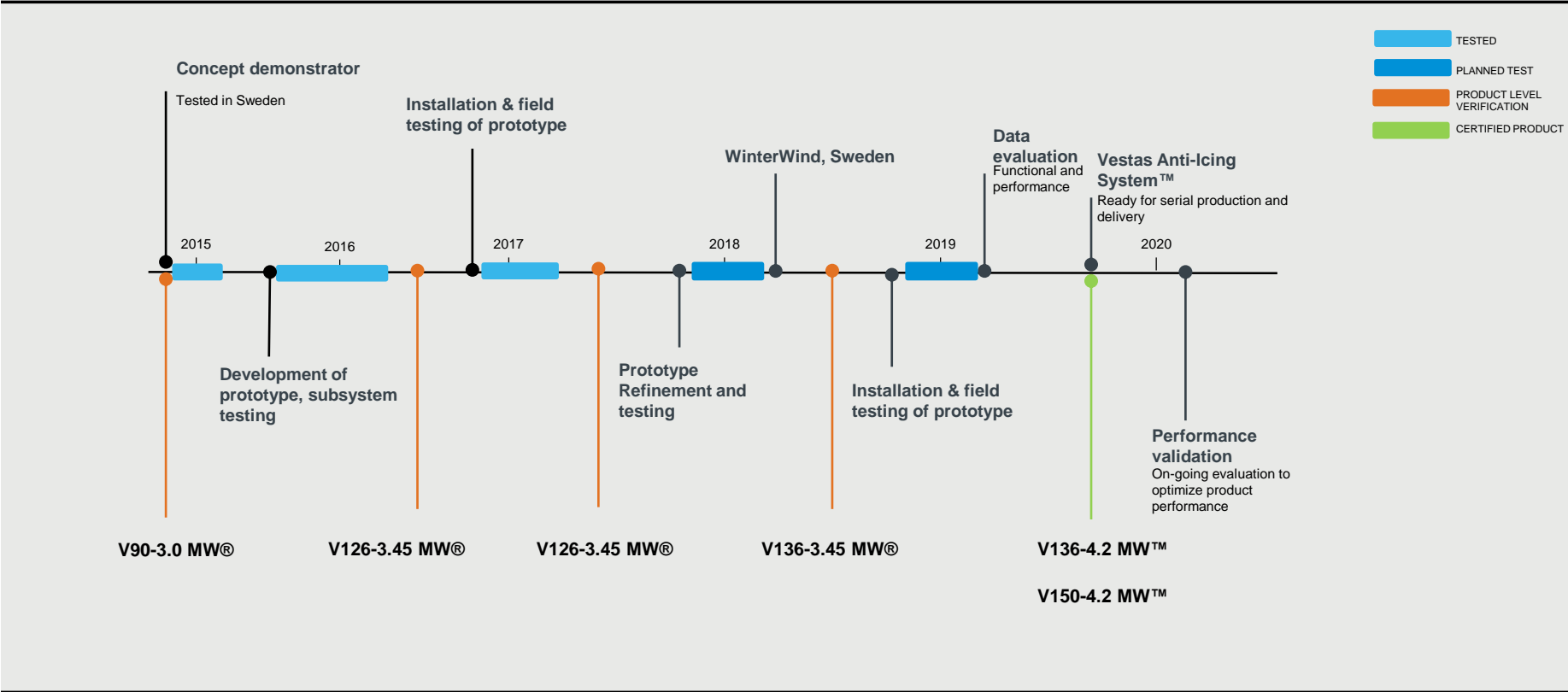
Where and when it's needed



- **Individual powering** of heating elements to **secure equal power distribution where it is needed**
- Serviceability: **Robust** system to **secure operation** even in unlikely event of failure mode of the elements
- Optimal tradeoff; Close to surface for rapid heating response but high robustness in transport/handling
- Embedded **certified level 1 lightning protection**
- **Fully integrated** into the turbine from design and production

Vestas Anti-icing System™

4 years of product development to secure high reliability & performance



Vestas Anti-Icing System™

Summary

- Available for **V136-4.2 MW™** & **V150-4.2 MW™** -delivery in 2019
- Designed for maximising production
 - Multiple anti-icing modes
 - Large heating area
 - Large operational envelope
- Comprehensive development & validation program
- Complies with latest warranty guidelines



The image shows a winter landscape with snow-covered ground and trees. In the background, several wind turbines are visible against a sunset sky. The sun is low on the horizon, creating a warm glow and long shadows. The overall scene is serene and peaceful.

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Thank you for your attention

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