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Siemens Wind Power Blade De-Icing

25 years of experience with turbines
in cold climate

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Technology and Innovation

WinterWind 2013

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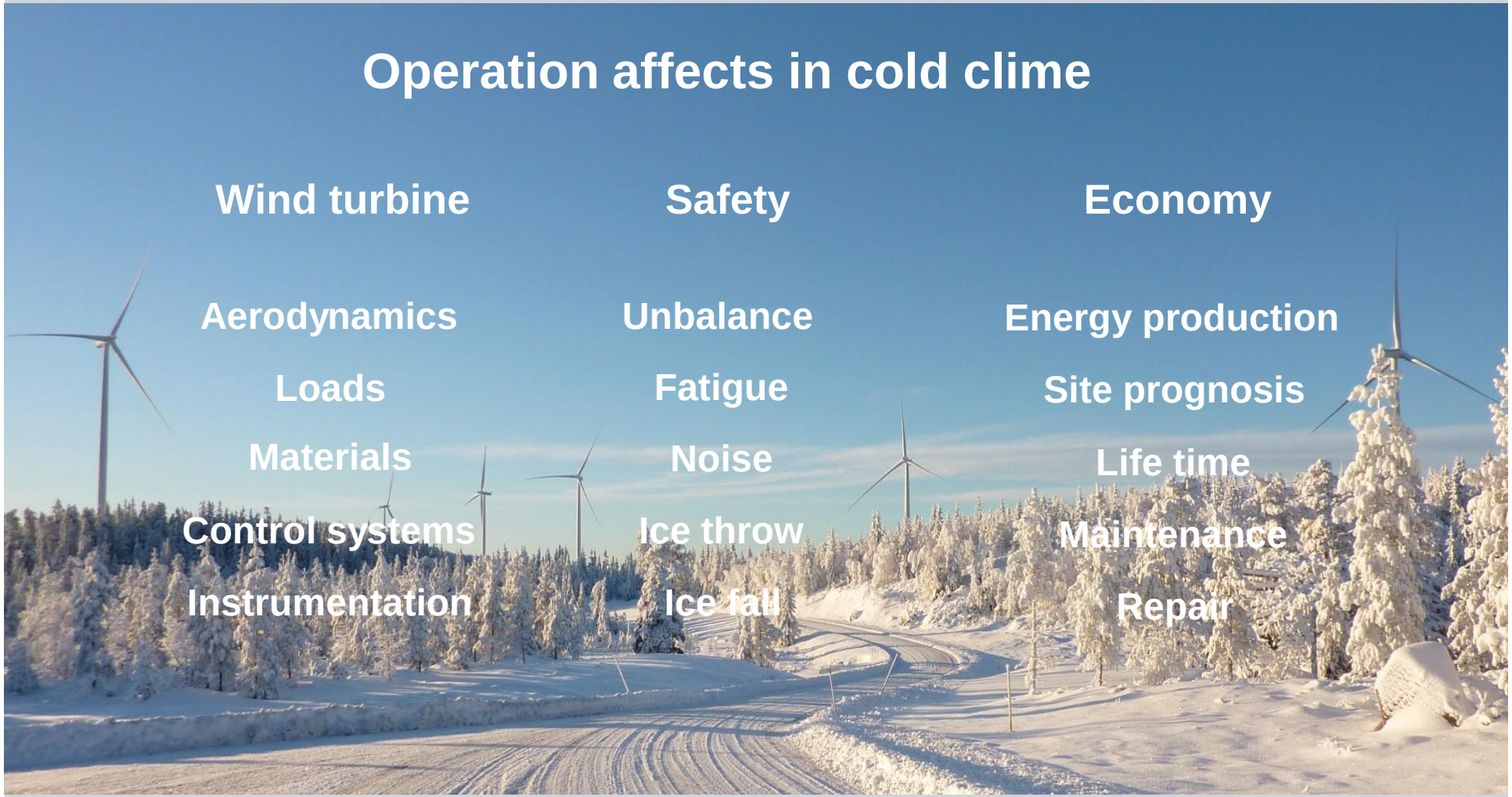
So beautiful and at the same time so problematic



Long experience with turbines in cold climate areas

Canada

Siemens (Bonus) first cold climate turbine.
Quebec in Canada 1986 - 65 kW

- Cold-resistant steel for turbine tower
- Heating elements for gearbox and hydraulic units.
- Sensors with integrated heating.

Siemens (Bonus) first turbine with de-icing.
Yukon Canada in 1994 1x150 KW

- Blade equipped with heating mats about 6” width
- Running along the entire length of the leading edge
- 1,700 watts for all three blades

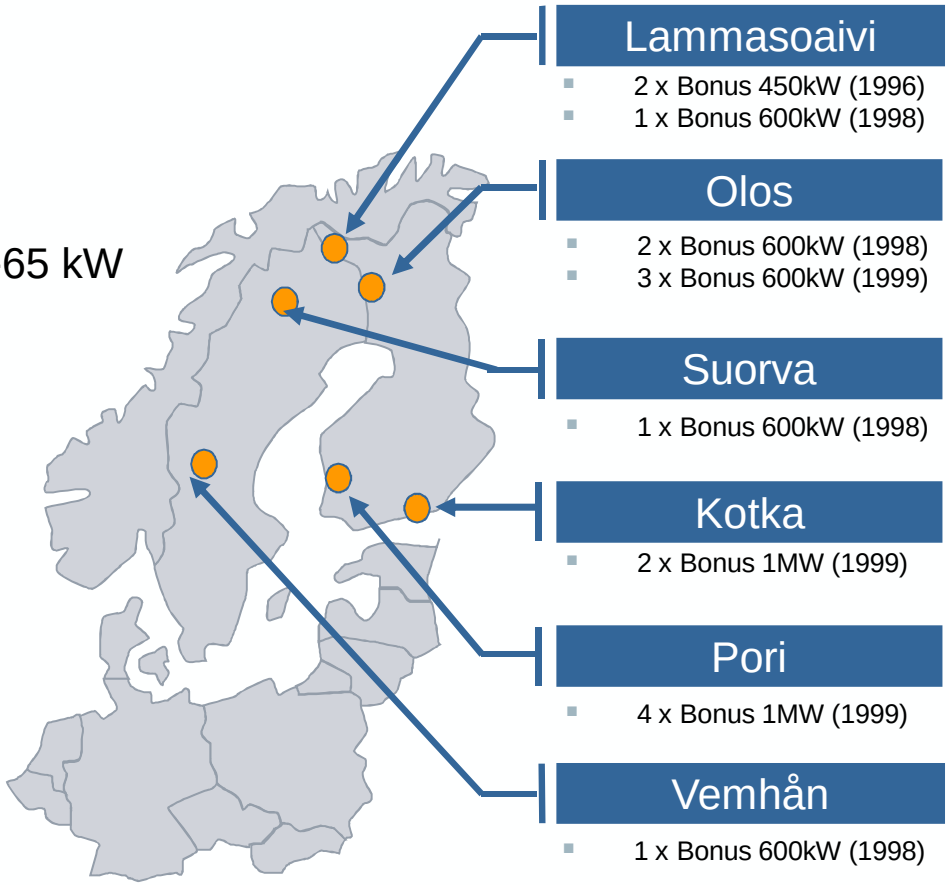
Long experience with turbines in cold climate areas

Scandinavia 1996 to 1999

Siemens (Bonus) Next generation with blade de-icing

16 installed turbine with blade de-deicing

- Blade length 21 Meter
- Energy consumption around 50 -65 kW

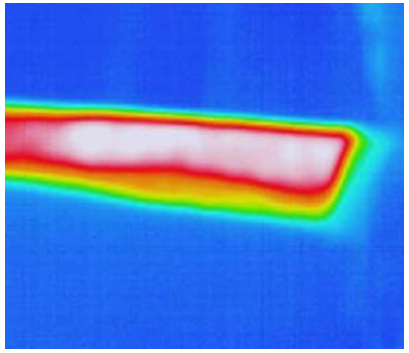


Siemens Think Tank

A new start

3 years ago started a Think Tank project in Siemens Wind Power.

We took all the knowledge from the past and built it into a new Siemens Blade De-icing system.



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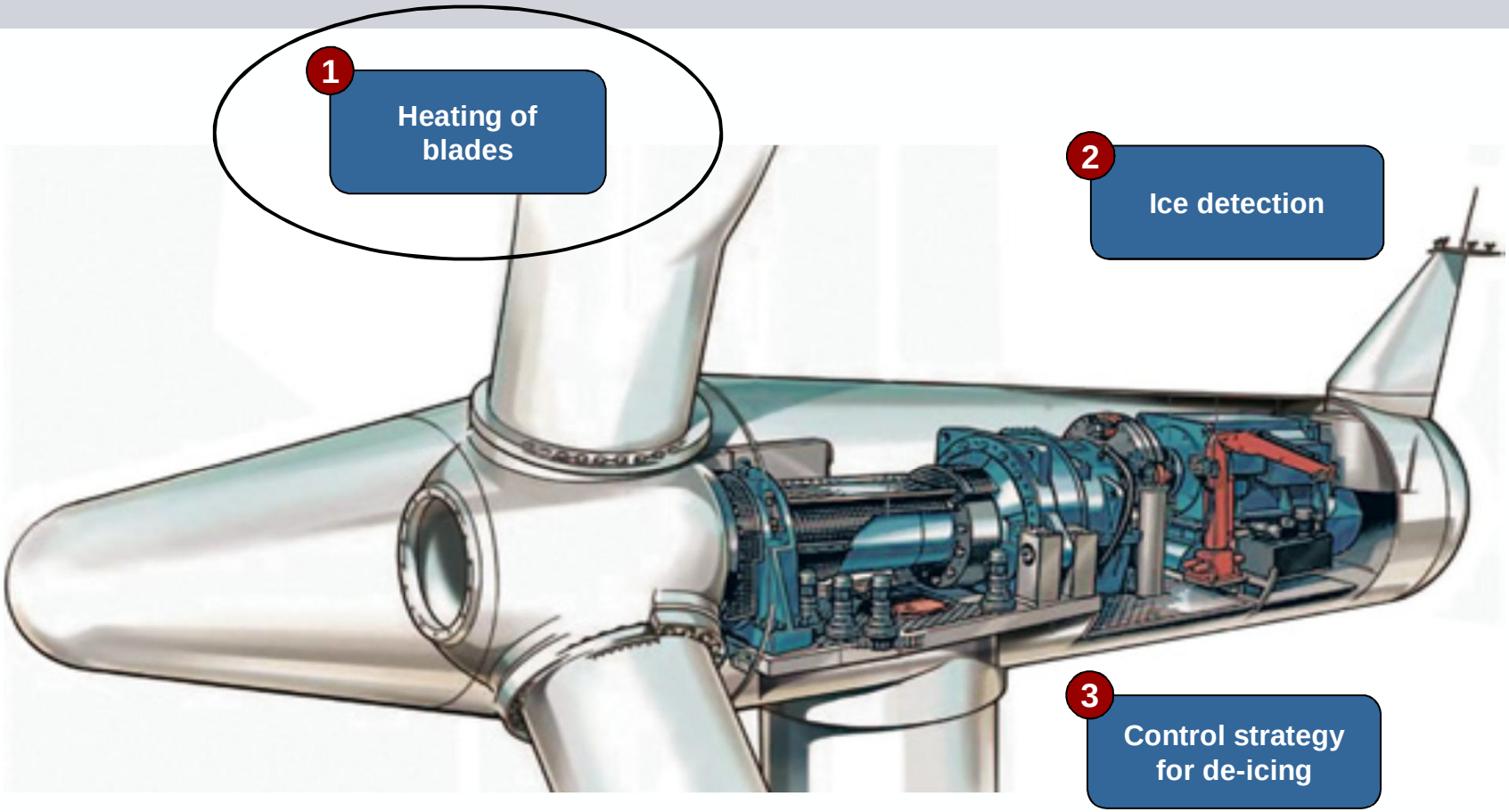
The SWP blade de-icing system consists of three elements



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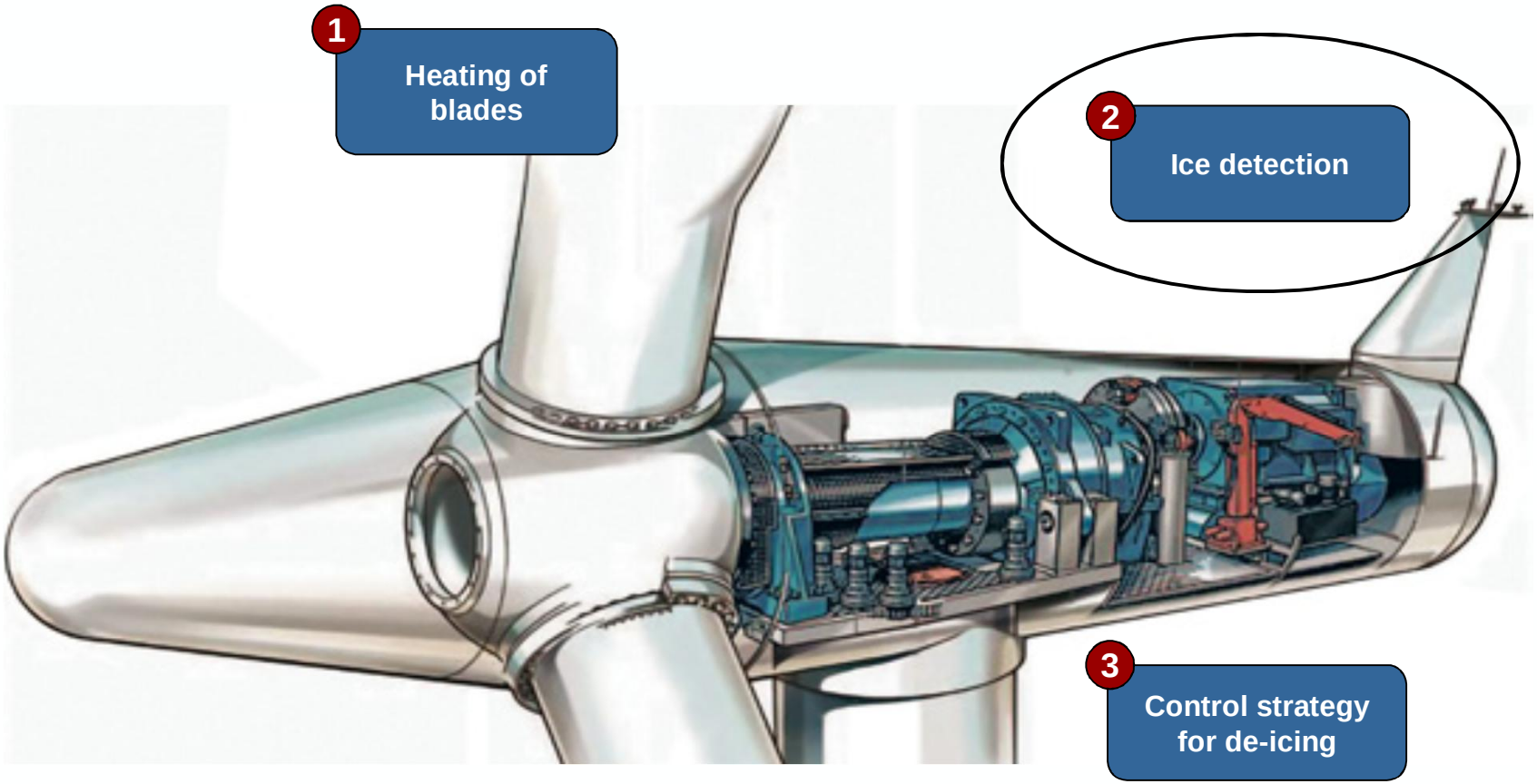
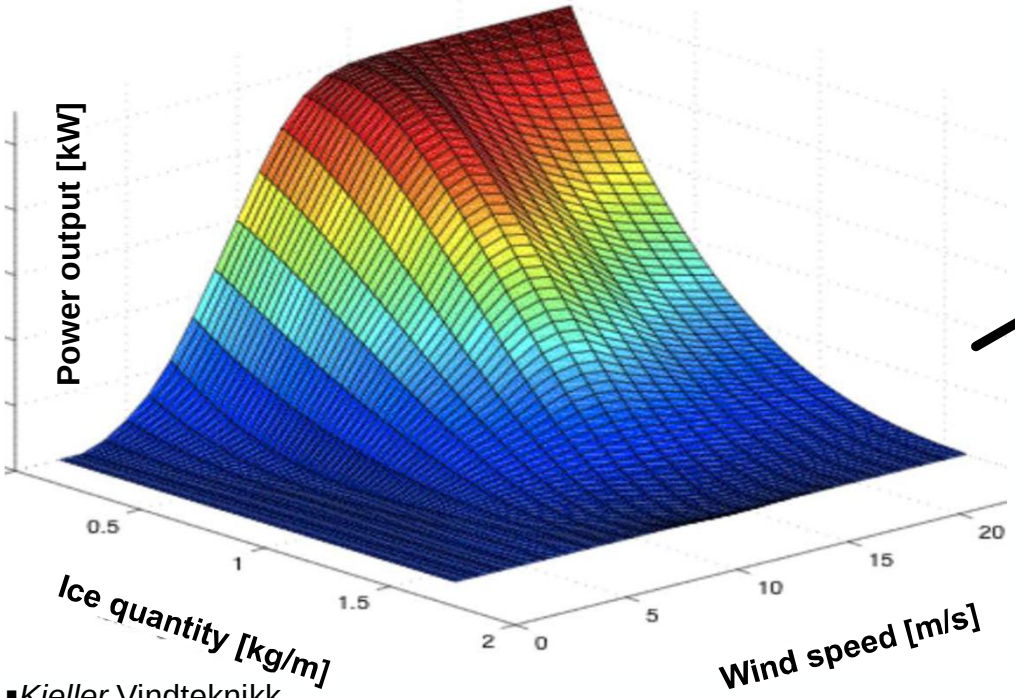
The SWP blade de-icing system consists of three elements



Ice detection methods

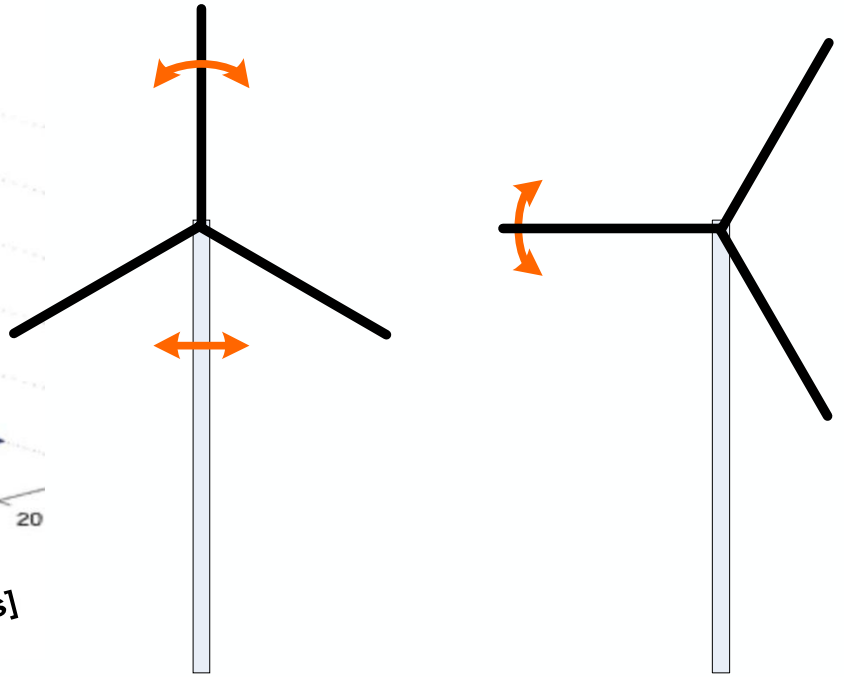
Detection methods

Power curve detection



- *Kjeller* Vindteknikk

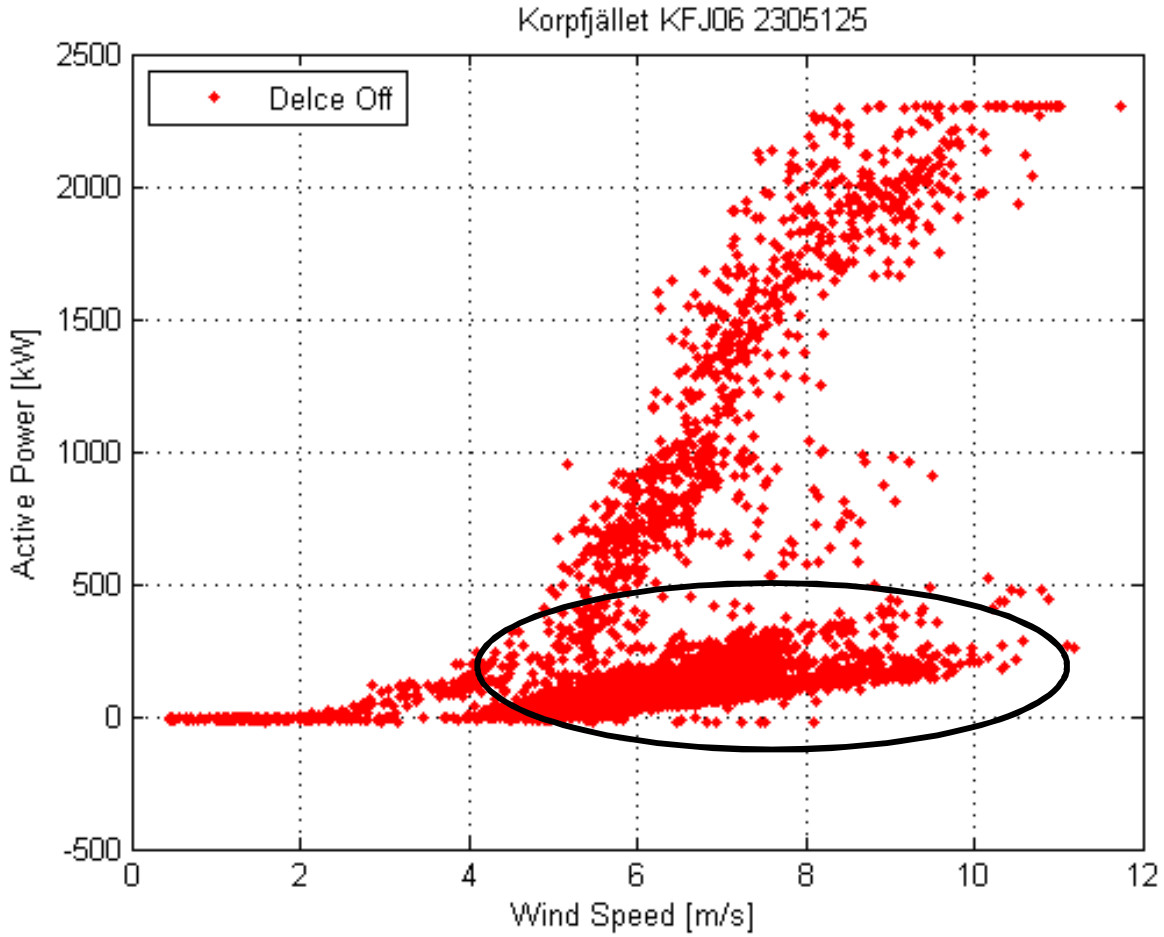
Changes in blade edge frequency



Further possible ice detection methods: frozen anemometer/wind vane, ice detectors on nacelle, drive-train blade -vibrations, etc.

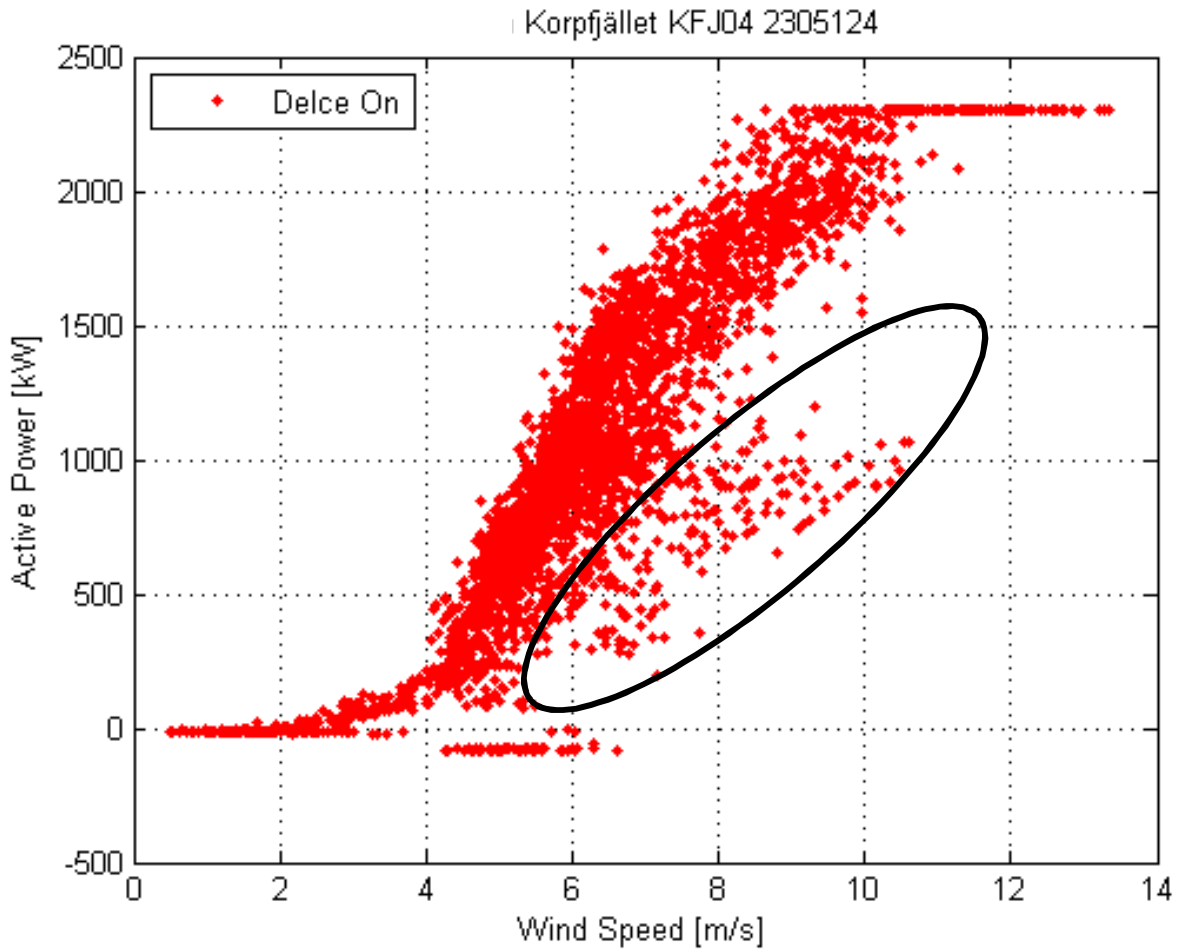
Power curve from reference turbine

Power curve from korpfjället –reference turbine



Power curve from turbine with de-icing

Power curve from korpfjället –deicing turbine



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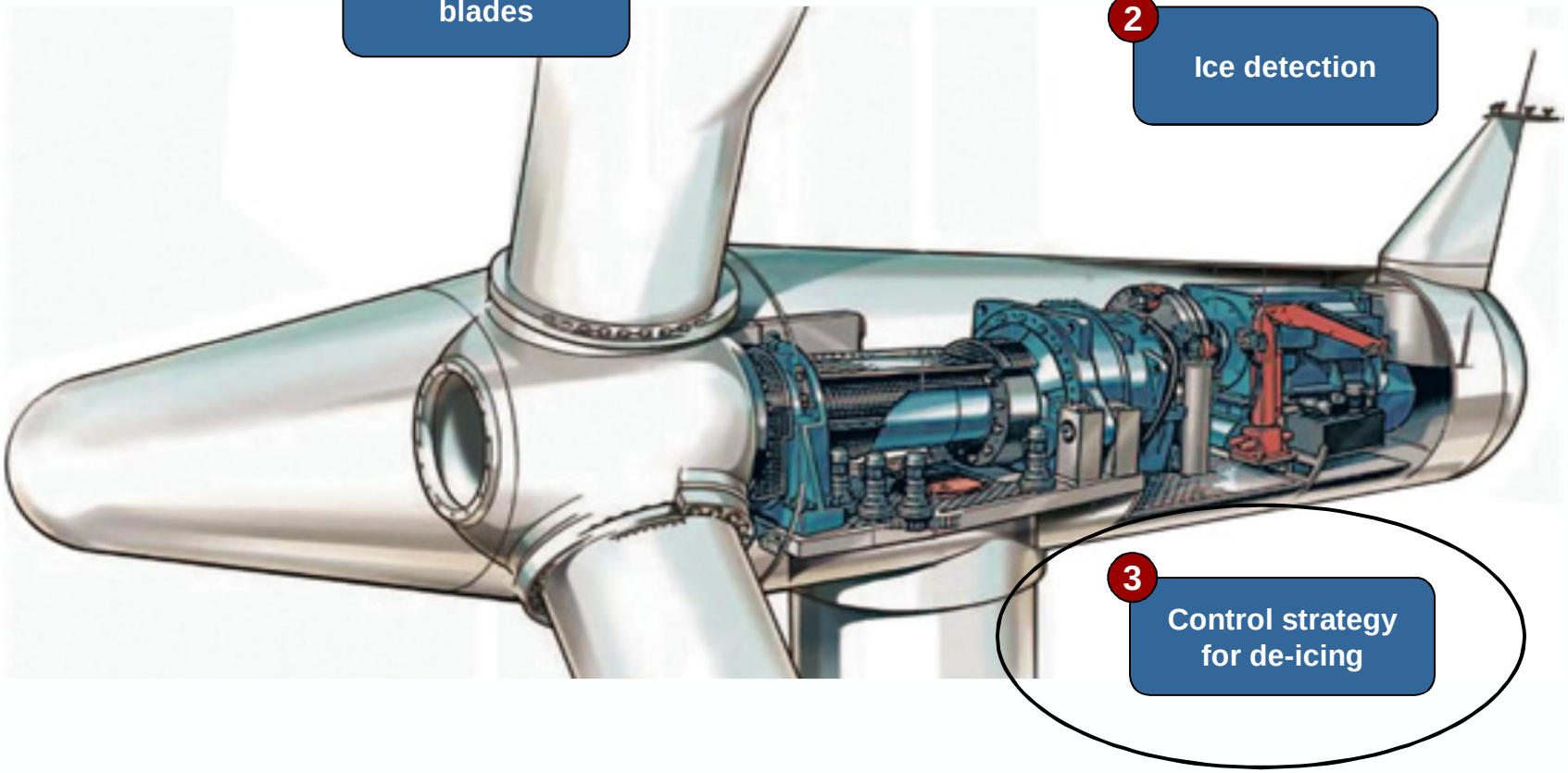
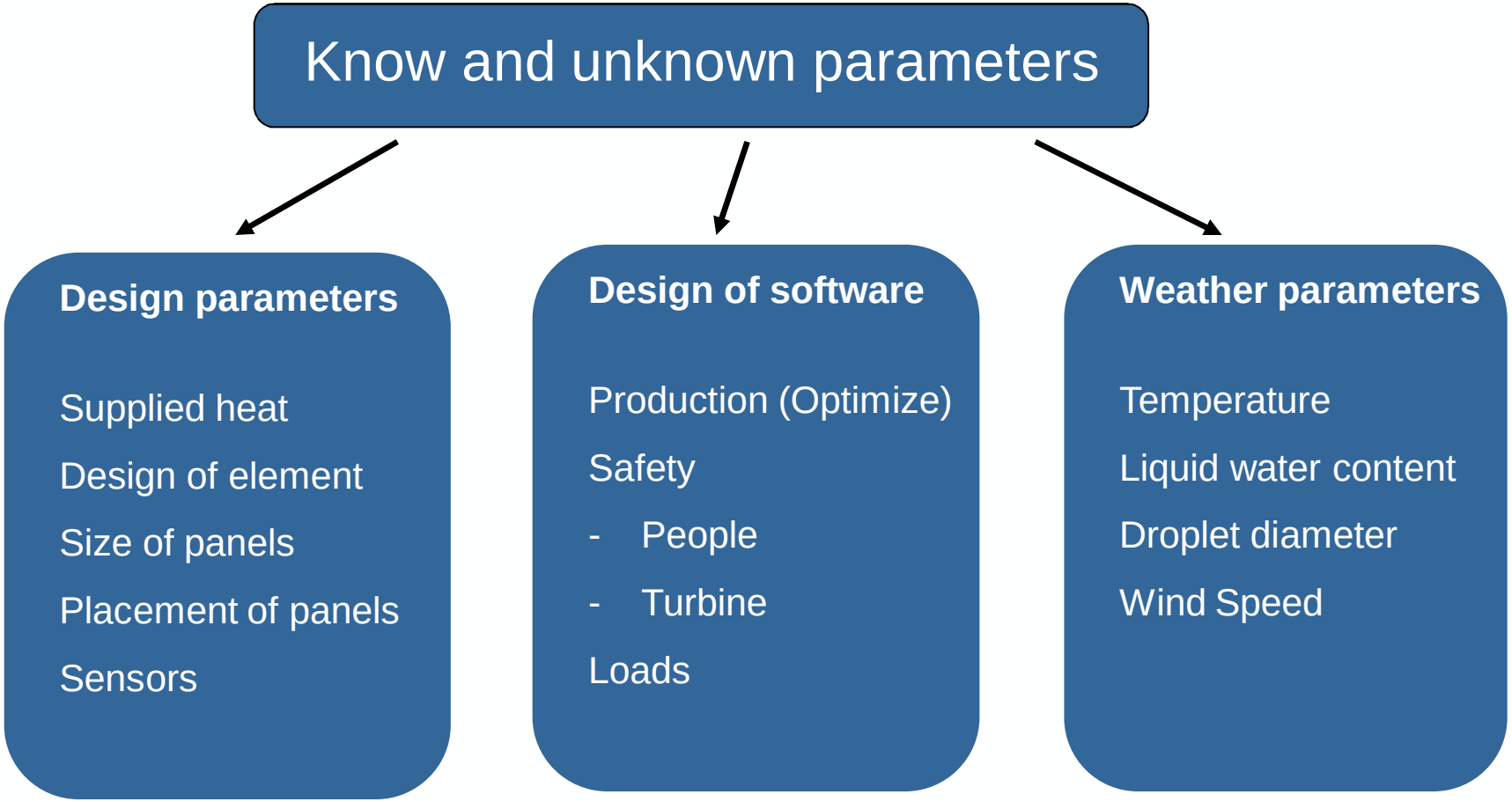
The SWP blade de-icing system consists of three elements



Control strategy for Anti and De-icing

Unknown factor – weather !



Production increase due to De-icing of turbines

Raftsjöhöjen

Kyrkberget

Korpfjället

Korpfjället 20 – 23 jan 2012
Power production in icy conditions

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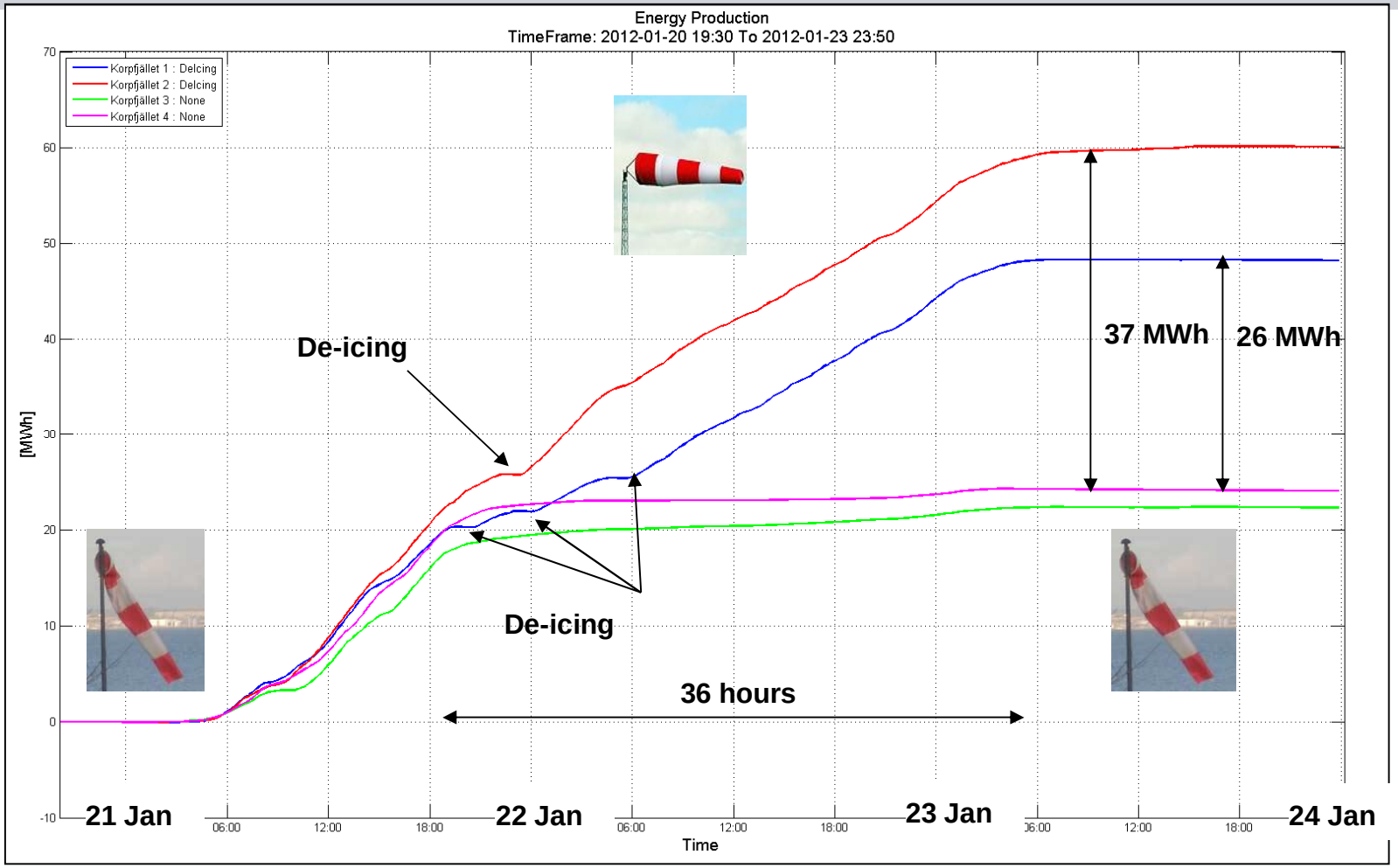
3 days of production with de-icing



Metrology installation on the nacelle

Metrology test station mounted at Korpfället and Brahehus together with O2 and Gören Ronsten (Project manager on behalf of O2)

To learning and adjust the turbine controller for operating more efficient to improve energy production in cold climate

The blade de-icing system will be available for the main onshore turbines

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SWT-2.3-101

- Rating 2.3 MW
- Rotor Ø 101 m (blade B49)
- Geared turbine
- De-icing system installed in early 2011

SWT-3.0-101

- Rating 3.0 MW
- Rotor Ø 101 m (blade B49)
- DD turbine
- De-icing system is available

SWT-2.3-113

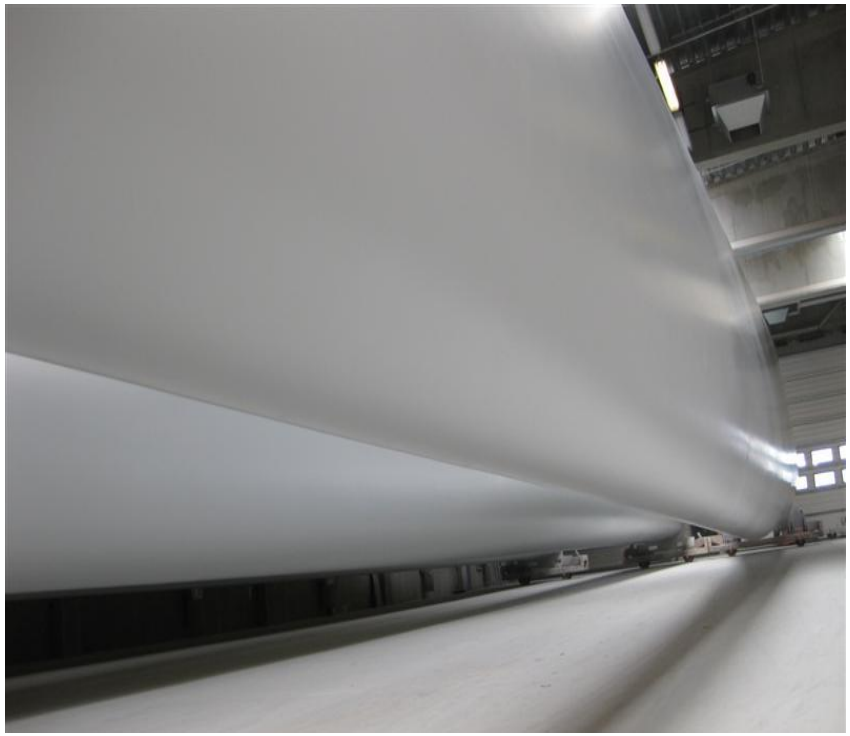
- Rating 2.3 MW
- Rotor Ø 113 m (blade B55)
- DD turbine
- Wind parks with de-icing to be installed in 2012 and 2013

SWT-3.0-113

- Rating 3.0 MW
- Rotor Ø 113 m (blade B55)
- DD turbine
- De-icing system is available

Siemens Blade De-icing system

- Robust and proven technology.
- Power connections at the root end.
- Full retention of the aerodynamic profile.
- No effect on noise levels.
- Control system based on existing sensors.



Finished blade with De-Icing

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Thank you for your attention!