



# **Winwind cold climate and ice prevention experience**

Real life experience and future development

*Winter, Spring, Summer or Fall !*



# What is 'Cold Climate'

Cold climate means for us that the temperature goes below – 20 Celsius and can stay there during a significant time.

This creates in many cases increased technical and operational demands:

- Accessibility
- *Wind measurement*
- **Low temperatures (technical design)**
- "Weather windows"
- Grid connection
- **Icing**
- *Safety issues*
- *Availability*
- *O&M*
- *Life-time*



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# Low temperature design, below -20C

## Minimum requirements

Low temperature steel

Low temperature sensors

Increased insulation

Component survival

Heating possibilities of hydraulic  
oil and lubricants

Safety issues a o



# Why de-icing and ice prevention systems

Health and Safety

Loss of production

Increased loads

Increased noise

NO PRODUCTION



# WinWind Ice prevention system.

- Partnering with VTT research centre. Experience in cold climate wind energy since early 1990's (sub-megawatt and 1MW machines).
- 2008 Skellefteå Kraft Uljabuouda contract and pilot project development of a modern Ice prevention system.
- Erection of 10 x WWD 3 MW turbines, S80, D90 in 2009/2010 at the Uljabouda mountain in Lapland. All turbines fitted with the new developed WinWind ICE PREVENTION/ DE-ICING SYSTEM
- Lessons learnt:
  - Ice detection was a challenge in the beginning, but it has been adjusted to get more reliable detection
  - Power levels have been adjusted according to the experiences
  - Lightning strike considerations: Improved design and blade service methods have been developed
- WinWind 3 D120 3MW Arctic:
  - Planned 12/2012

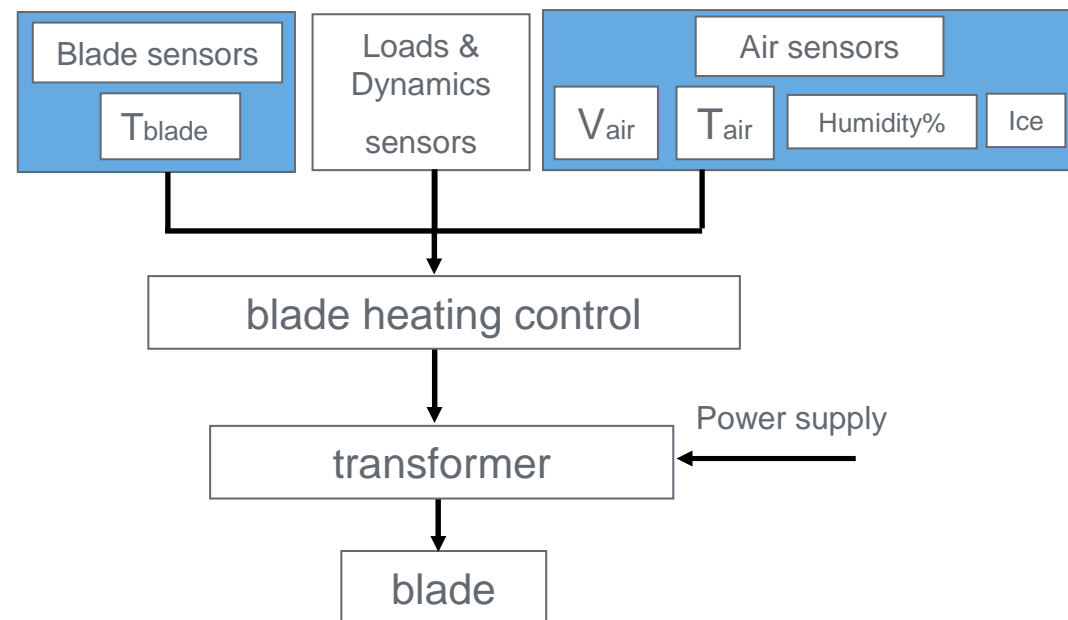


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# Winwind ice prevention/de-icing system

- Improved assessment of icing conditions based on multiple sensors:
  - Wind velocity
  - Air temperature
  - Relative humidity
  - Independent Ice sensor
- Smart operation of blade heating
- Low consumption
- Fast and effective ice buildup prevention.
- Robust, maintenance friendly surface heating.



# Our Uljabouda experience, power consumption

Ratio Blade Heating Power Consumption to Total Production [%]											
Uljabuouda Turbines	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	All Turbines Average
All available data, mean of all months	0,70%	0,57%	0,61%	0,44%	0,65%	0,54%	0,49%	0,46%	0,64%	0,72%	
1 full year from 01.09.2010 to 31.08.2011	0,91%	0,74%	0,68%	0,45%	0,60%	0,62%	0,26%	0,66%	0,96%	0,96%	0,68%
1 full Year - from last year: 2011	0,39%	0,41%	0,44%	0,27%	0,49%	0,53%	0,40%	0,17%	0,35%	0,49%	0,39%

**160 months of operational experience**





## The WinWind future in cold climate regions

The southern part of Finland is on the same latitude as South Greenland and 25% of Finland is north of the arctic circle.

Starting in 2012/13 we will be able to deliver the worlds largest turbine and rotor adapted for cold climate and icy conditions

**The new WinWind 3 with 120m rotor and 120m hub height will provide great wind energy utilisation also in our part of the world.**



Ready for production 2012

## WinWinD 3

Simply productive!

Thank you

### WinWinD 3 Advantages

- Light nacelle weight – 80 t
- **120 m rotor diameter**
- Exceptional productivity
  - especially at low wind speeds
- Proven concept with 30 % less moving parts than conventional drive train system
- Designed for high availability
- Maximal grid compliance



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