

MAKING LIFE EASY -  
OVER ~~100~~ 250 TURBINES IN FIELD  
UNDER FOS4X ROTOR ICE CONTROL

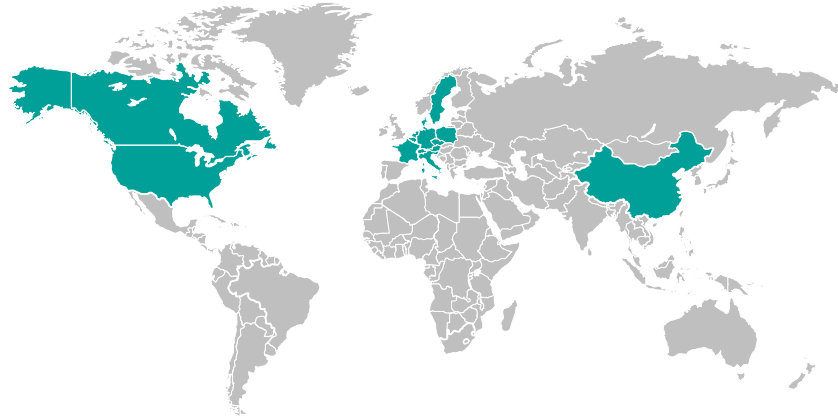


Poster presentation

Winterwind in Åre, February 2018

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fos4X had a strong growth in its 8-year history and has finished series integrations with  
initial customers

Over 2,650 sensors in 14 countries



Reliable partner for lasting cooperation

"Through the successful audit, the confidence in fos4X and the quality of their products are reaffirmed."

Stefan Grundmann, Quality Assurance, Nordex

"We chose Rotor Ice Control from fos4X as we are convinced of the reliability and performance of the system."

Moritz Regehr, Technical Management wpd Windmanager

2012 | 2013 | 2014 | 2015 | 2016 | 2017



## Technical Solution

### Turn-key solution

- Available as retro-fit solution or installation ex factory
- Robust series hardware
- Precise vibration data from fiber optic sensor
- Sophisticated data fusion algorithms

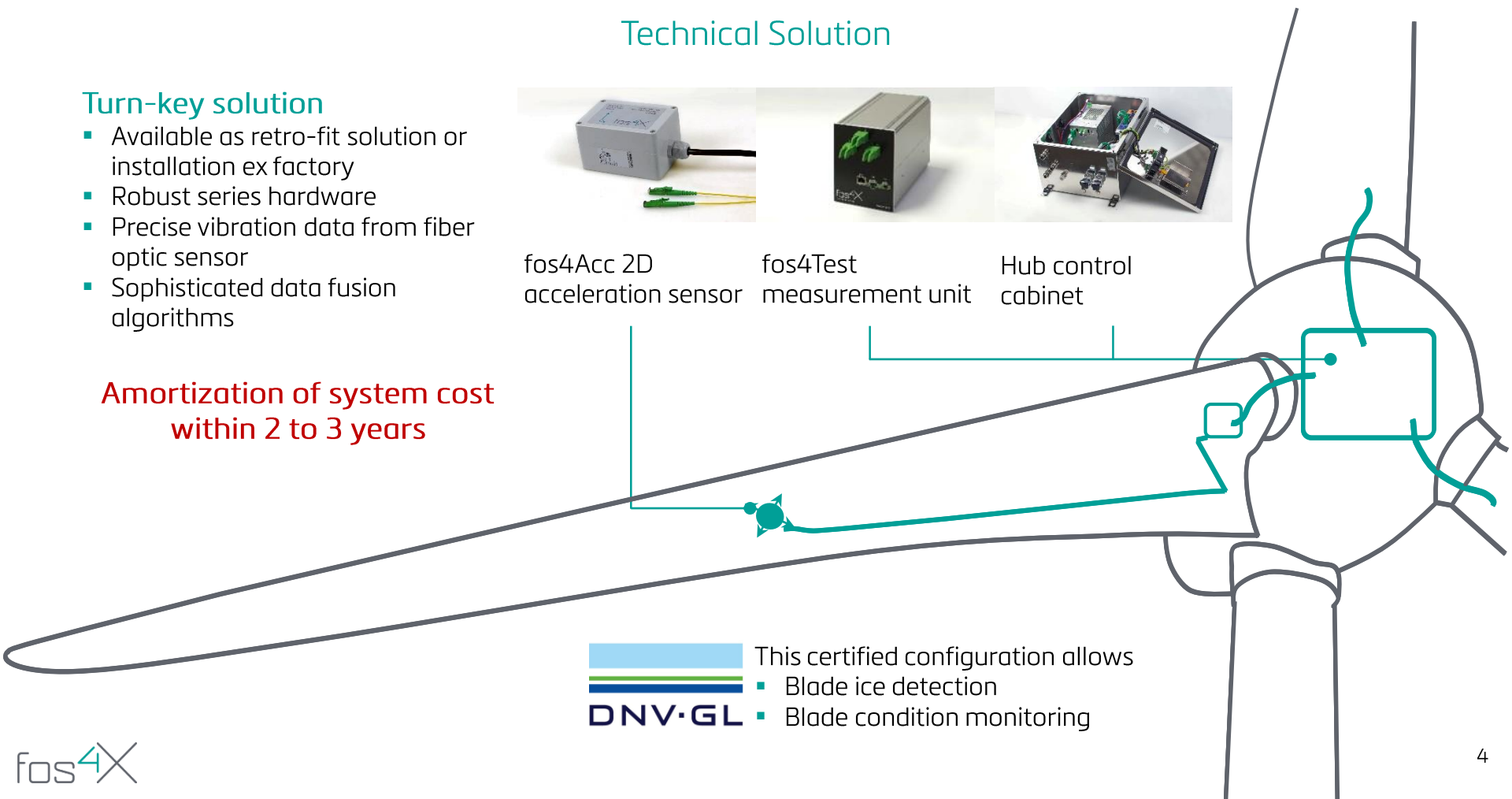
**Amortization of system cost  
within 2 to 3 years**



fos4Acc 2D  
acceleration sensor

fos4Test  
measurement unit

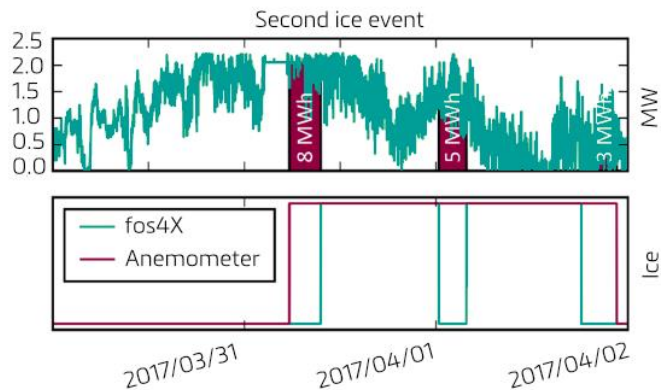
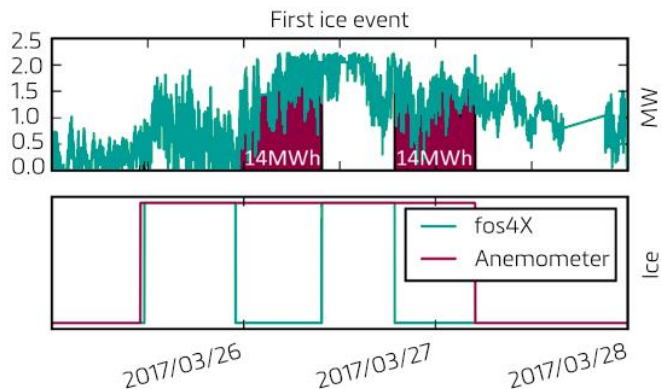
Hub control  
cabinet



This certified configuration allows

- Blade ice detection
- Blade condition monitoring

## Exemplary ice event

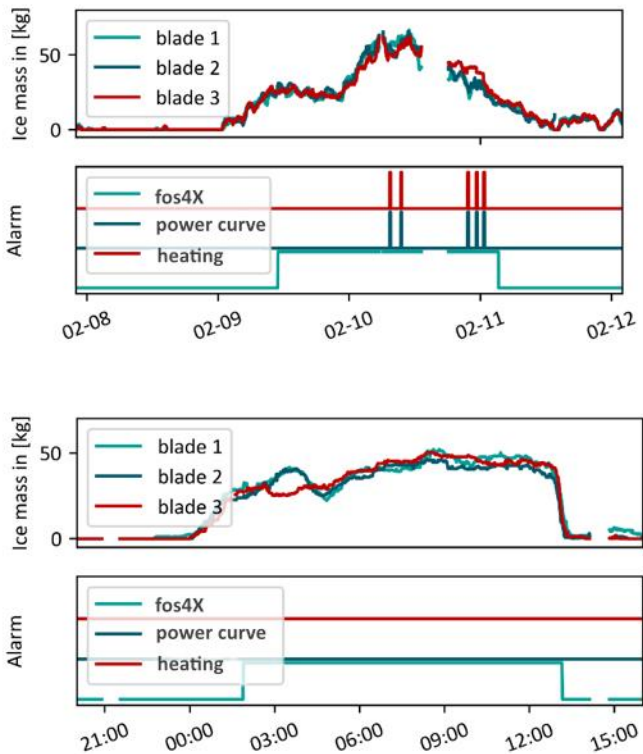


fos4X	Ice Event 1	Ice Event 2
Saved standstill beginning	0,75 h	4 h
Saved standstill during event	11 h	3 h
Saved standstill ending	8 h	4,5 h
Additional yield per Event	28,5 MWh	15,2 MWh

### Increase of energy yield

- Charts show energy production of a WEC during ice two events
- Anemometer controlled ice detection system decreases energy yield significantly
- Potential increase of energy yield 15%

## Exemplary ice event II



### Disadvantage of non blade based ice detection

- Upper chart show ice mass detected by fos4X
  - Lower chart shows ice alarm of fos4X and power curve as well as heating system
  - Power curve is used to control heating system (to short heating periods)
  - Power curve needs to restart the turbine to detect ice (many unnecessary restart cycles)
- 
- Systems runs for hours with ice on the blade due to insufficient values from the power curve
  - Heating system is not activated

## Benefits of fos4X Rotor Ice Control

### Benefits for restricted sites



Mitigation  
of ice throw risk



Automatic  
stop and restart

### Benefits for unrestricted sites



Reduced  
operation mode



Control  
of De-icing system

### Benefits of the measurement principle



No premature nacelle  
based ice detection



Ice detection direct  
on the blade

### Benefits of fos4X in general



Intrinsic lightning  
protection



Standard telecommuni-  
cation components

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