

A landscape photograph of a wind farm at sunset. The sky is a mix of deep blue and orange, with wispy clouds. Silhouettes of several wind turbines and a line of evergreen trees are visible against the horizon. The word 'LINNOVATION' is overlaid in the center, with 'LIN' in orange and 'NOVATION' in grey. A trademark symbol is at the end.

# LINNOVATION™

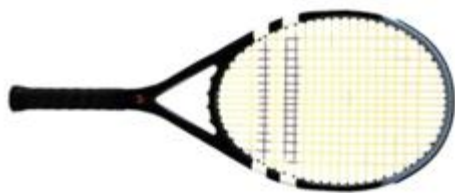
Game changer for wind turbines in cold climates

# Linnovation AB

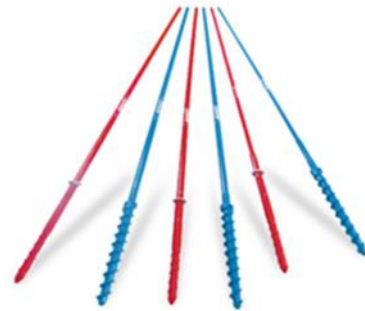
- Founded in 2006 by the innovator Kjell Lindskog
- Innovation/product company, focus on heating solutions, composites
- Located in Skellefteå, Sweden
- Develop and manufacture heating products based on Linnovations patented technique
- Based on technique from previously "self developed" and commercialized products



*Security case*



*Tennis racket in composite*



*Foldable slalom stick*



*Secure weapon box*

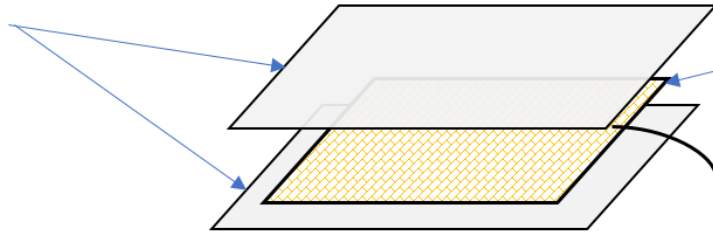


*Kjell Lindskog*

# Linnovation heating panels

## Design of the heating panel

Surface layers  
(Epoxy/glass fiber)



Copper mesh  
(resistance depends on design,  
number of wires and type of wires )

Power supply  
(>230 volt AC)

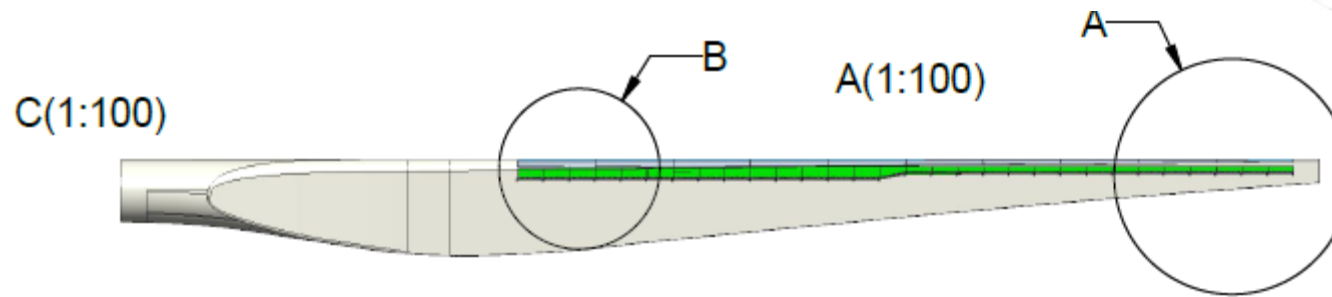
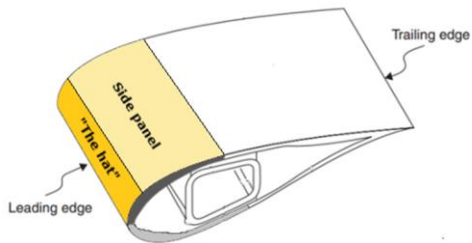
- Heating panels: copper meshes and pre-preg epoxy layers
- Design of copper mesh determine the heat distribution
- Dual use, both for heating and temperature measurements
- Patented





# Linnovation AIS

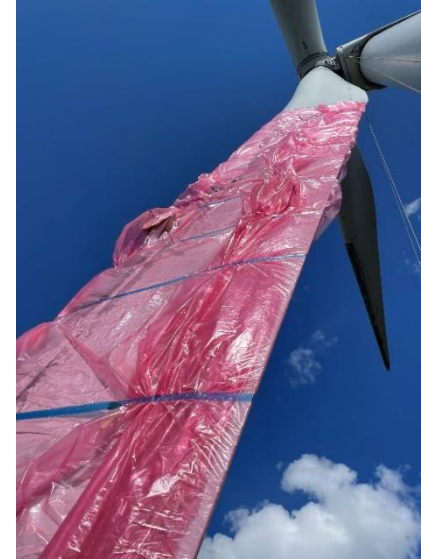
- Covers 2/3 of the length of the blade
- Individual temperature configuration per section/side
- No need for temperature sensors
- Lightning conductor integrated in the panels
- Possible to use as retrofit or in original blade manufacturing
- Real tests on WTG last three years



# Linnovation AIS, installation process

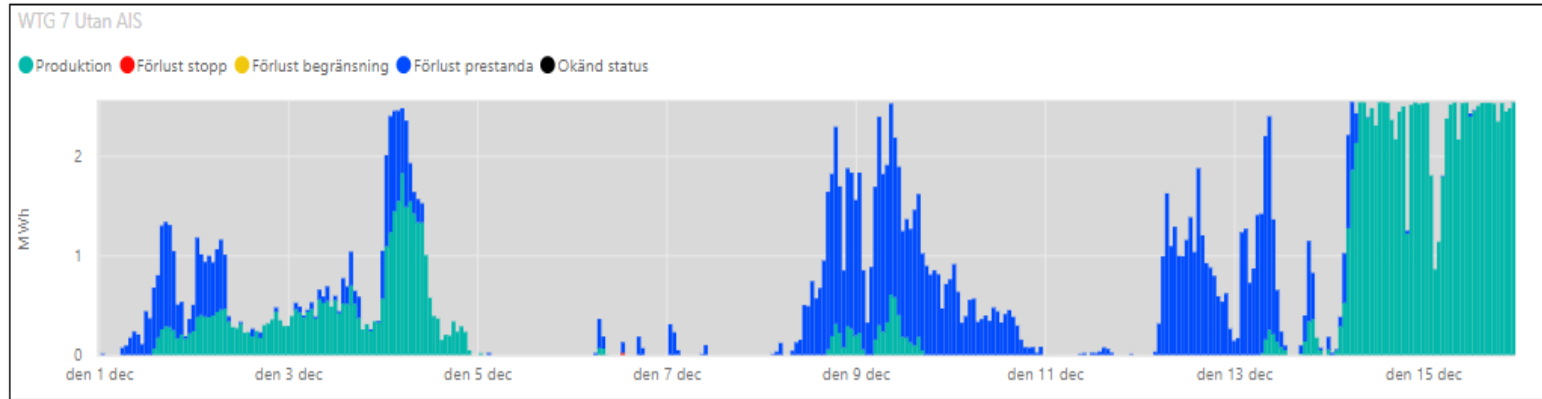
## New Installation or retrofit

1. Preparation of the blade
2. Electrical installation of control electronics and power supply
3. Assembly of heating panels on the blade
4. Use heating system to cure the panels
5. Test and verify the installation
6. Clean up the blade



# Linnovation AIS, performance during ice events

*Reference WTG without AIS*



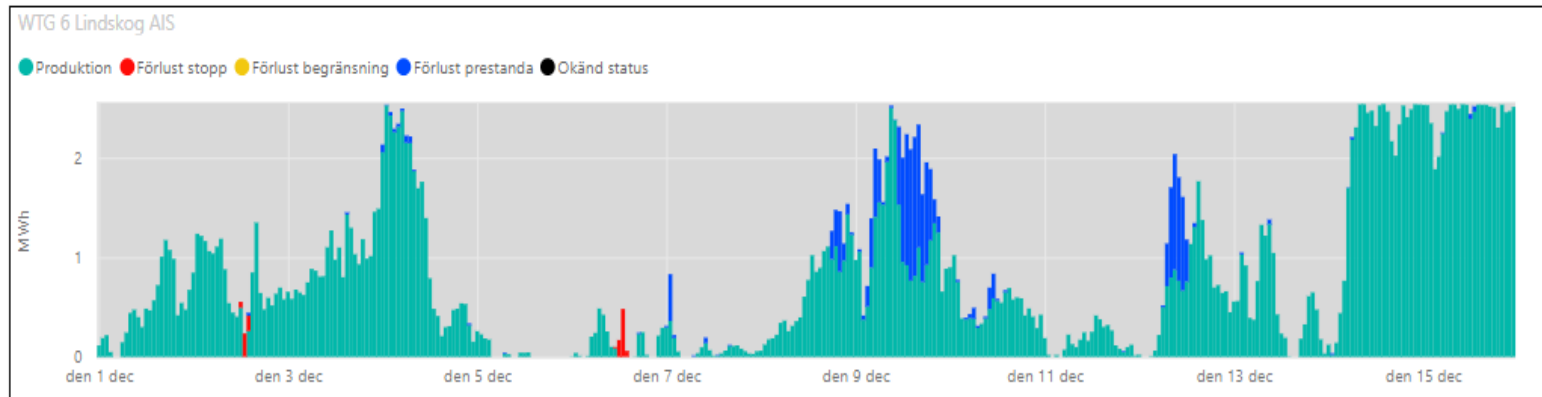
2021-12-01

2021-12-15

**111,95**

Prestandaförlust [MWh]

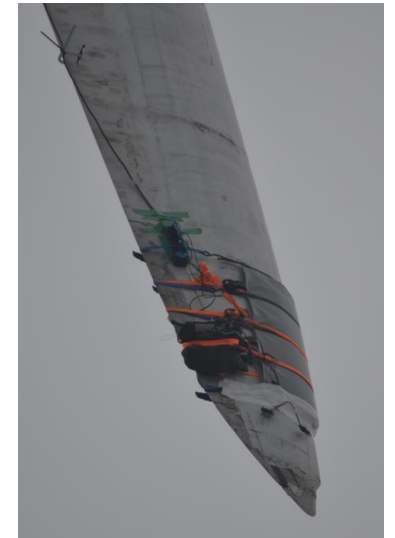
*WTG with Linnovation AIS*

**20,60**

Prestandaförlust [MWh]

# Cold climate repairs

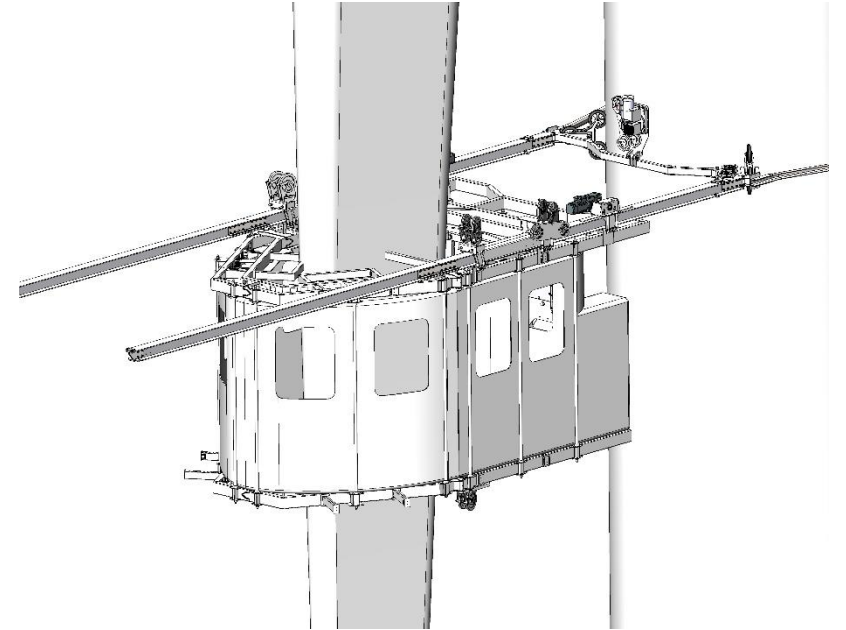
- Epoxy composite repairs in cold climates
- Linnovation's solution:
  - "Filler material" (epoxy pre-preg + epoxy layers)
  - "Repair-kit" (epoxy pre-preg + copper mesh)
  - Self regulating heating mat
- Process
  1. Clean the area of the damaged blade
  2. Apply the filler material and repair-kit
  3. Cure material for 16 to 24 hours with the heating mat
  4. Clean up the blade (grinder or similar)





# The service platform

- Weather protected service platform concept
- Prolongs the “repair season”
- “Indoor climate” for “outdoor repairs”
- Hydraulic opening for “easy access”





# **“Linnovation, the game changer”**

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