

“Tests and results from cold climate turbines”

Winter Wind, Östersund, 2013-02-13

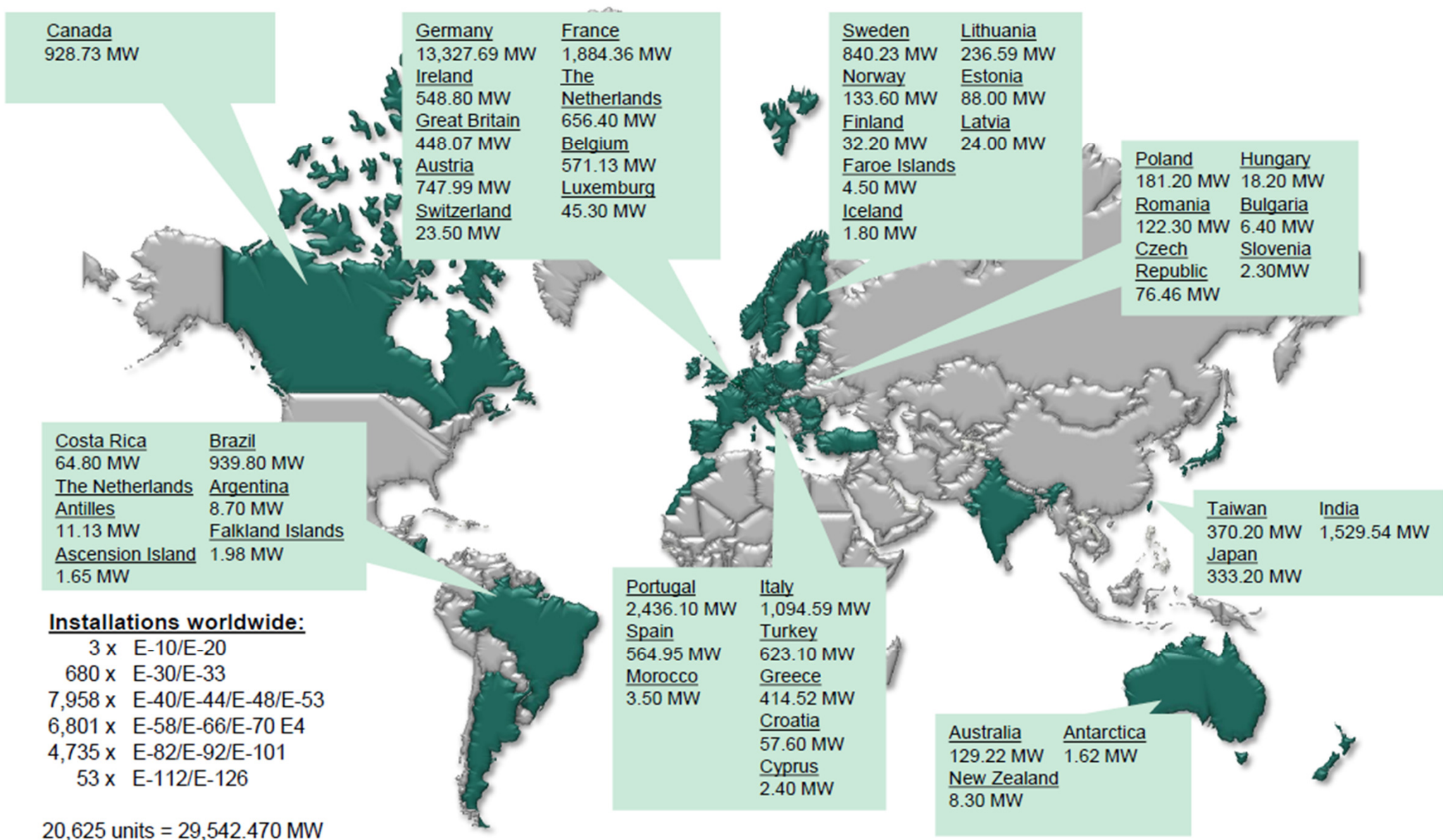
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Installed power capacity according to country



Installations worldwide:

- 3 x E-10/E-20
- 680 x E-30/E-33
- 7,958 x E-40/E-44/E-48/E-53
- 6,801 x E-58/E-66/E-70 E4
- 4,735 x E-82/E-92/E-101
- 53 x E-112/E-126

20,625 units = 29,542.470 MW

Antarctica



Andermatt,
Schweiz



Antarktis

Griessee: 1x E-70, 2465 m.a.s.l. – Europe's highest turbine



Photo: Swisswinds/ SIG

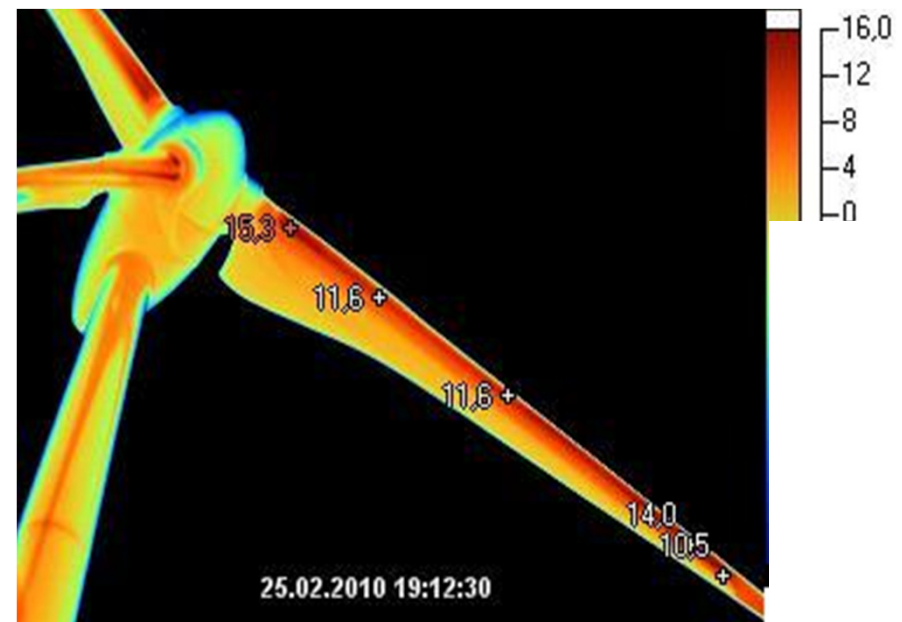
Markbygden – Phase 1 (314 turbines) received green light in 2012



Dragaliden – Pilotprojekt inför Markbygden, november 2010

Fotograf: Jonas Lundmark

- The ENERCON de-icing system is based on a **simple idea** (hot air inside the blades).
- All parts can be **changed** from failure by a technician.
- The technic is **well proven for years**. Third party validation available from Deutsche WindGuard.
- **New models will have this feature** as an option.



- ENERCON's de-icing system **is not affected by lightning strikes.**
- **No crane is needed** to repair or perform maintenance work on the system.
- Air flow is limited to a specific area of the blade but **will heat the whole volume** it travels in.
- **No enhanced risk for electrical malfunction** in or outside of the blade.

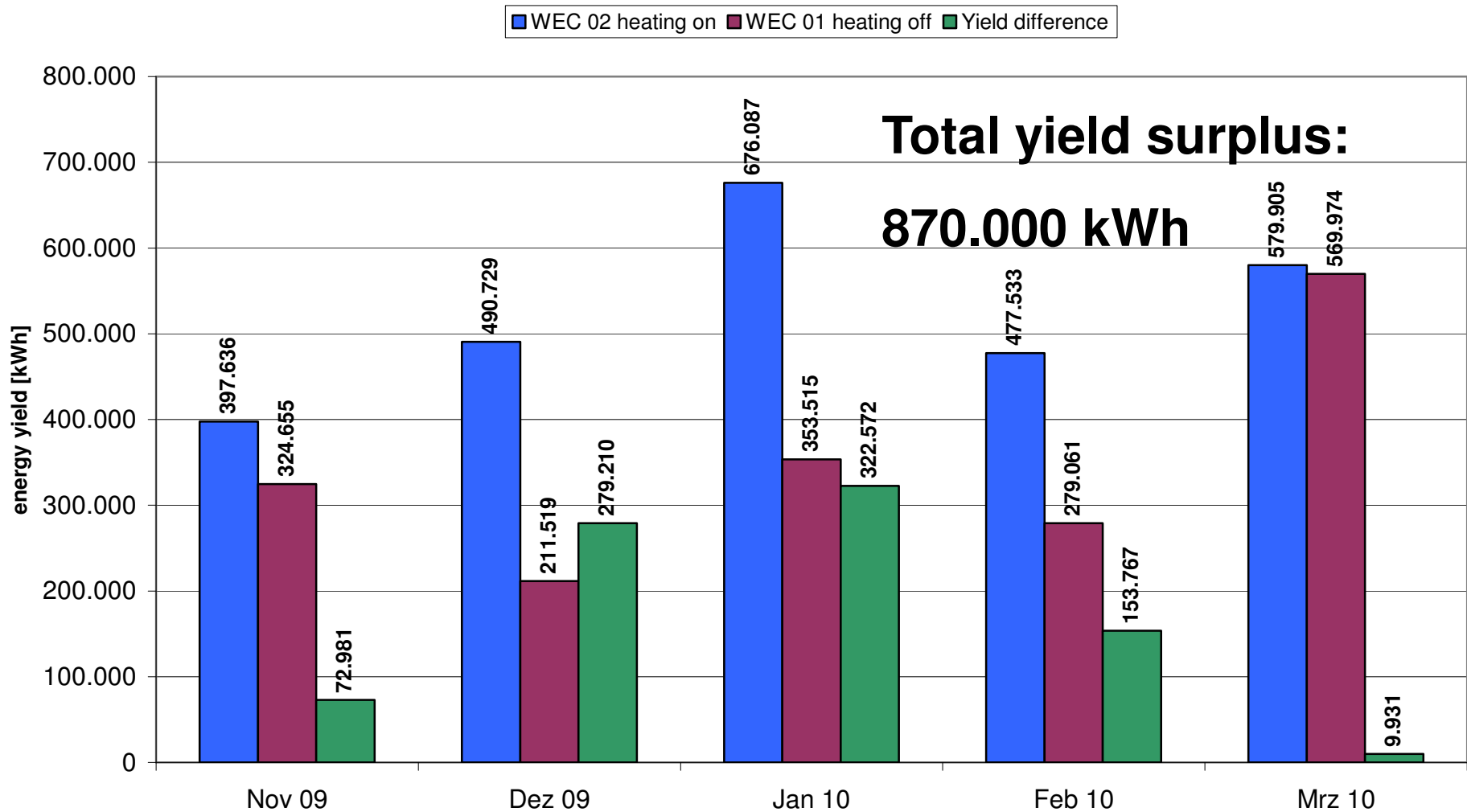
- ENERCON's de-icing system can be **repaid in just a couple of months** (depending on the site).
- Spare parts can be installed, changed, up-dated and repaired with **small effort**.
- Costs for maintaining the de-icing system are **low**.

- **It's a cheap way of increasing the availability!**

- ENERCON's first ice detection and de-icing system was installed in 2004.
- During 2009 – 2010 ENERCON added de-icing during operation of the turbine. This was a huge improvement.
- According to the validation performed by Deutsche WindGuard our customers can estimate to minimize the icing losses and **gain 10 – 15 % in annual energy production** due to the efficient de-icing system during operations.
- **On severe icing sites the gain from minimized icing losses can even add up to 25% of additional energy yield.**


Energy yield surplus due to Rotor blade de-icing Dragaliden energy meter readings

Difference in yield per month between heated and unheated WEC E-82 2MW at location in Dragaliden (SE)



Main advantages with ENERCON rotor blade heating are ...

- All systems are safe against lightening
- There are only two additional approved components
- There is no need to use specially designed blades
- Inexpensive
- Easy to handle for maintenance (all components are exchangeable)
- High efficiency to reduce energy yield loss due to icing
- System can work while rotor is rotating => leads to minimize the power consumption from the grid



Thank you for your attention!

Simplicity

Safe

Low cost

Efficient

Visit us at our Booth in the foyer!

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