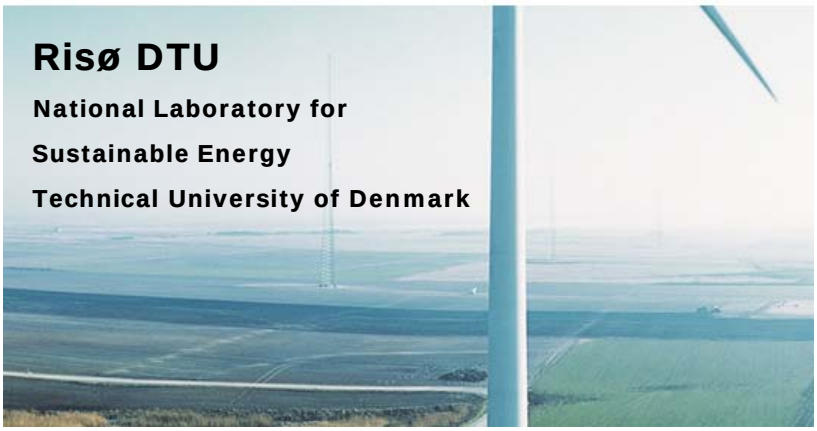
Wind Energy Division



Risø DTU

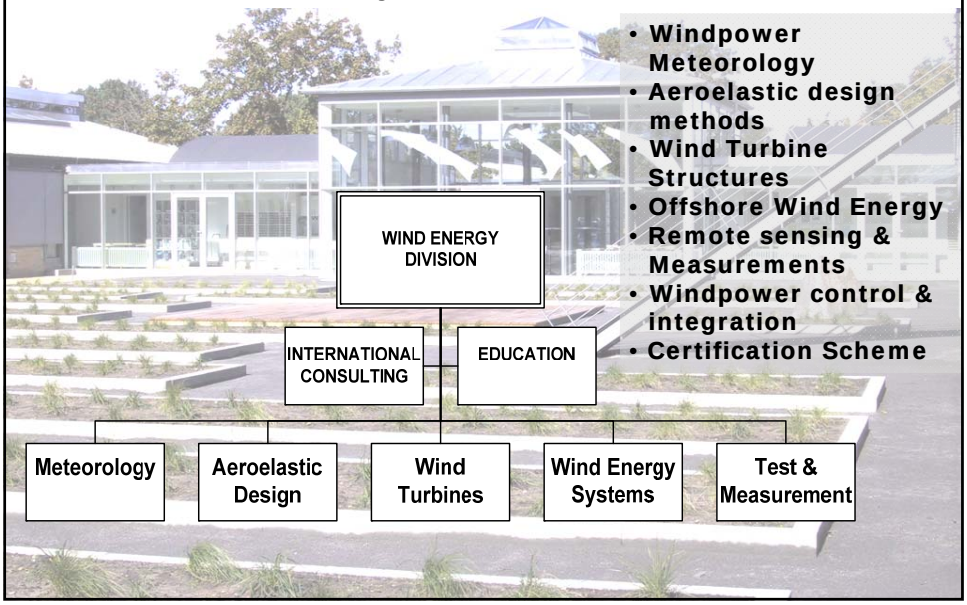
National Laboratory for

Sustainable Energy

Technical University of Denmark

Risø DTU, Technical University of Denmark

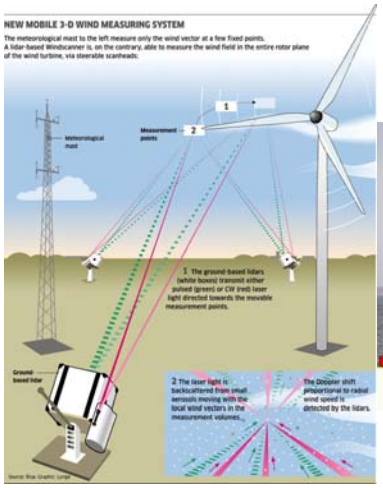
Wind Energy Division - Risø DTU Technical University of Denmark

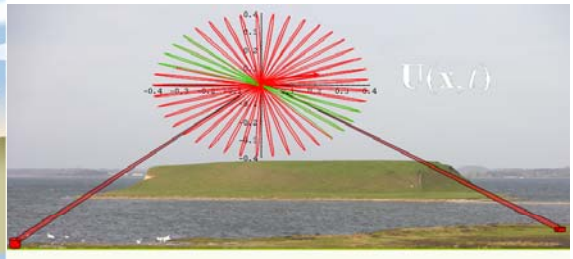


- Windpower Meteorology
- Aeroelastic design methods
- Wind Turbine Structures
- Offshore Wind Energy
- Remote sensing & Measurements
- Windpower control & integration
- Certification Scheme

Danish National test facility for large wind turbines

Risø DTU's WINDSCANNER methodology is based on 3-dimensional scanning with wind lidars to determine the instantaneous turbulence fields:





Full Scale Laser Wind Scanner

Since 2005 wind lidar technology has enabled replacement of tall (>100m) met masts

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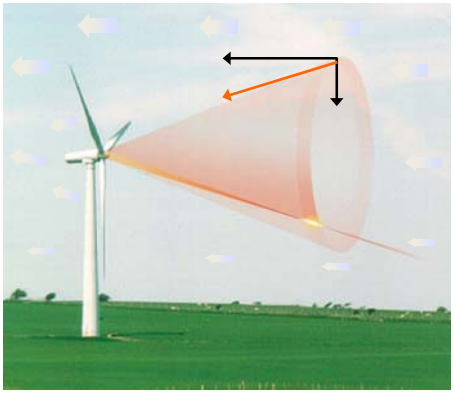
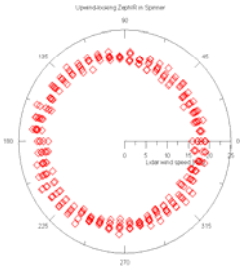
WINDSCANNER:

Pro-active wind turbine control from upwind measurements by lidars integrated in the nacelle… :





Collaboration between Risø DTU and Natural Power, UK

ICEWIND

Icing of turbines

Icing on an NM82 (V82) in Aapua, Övertorneå municipality in the county of Norrbotten, Sweden, From Mapping of icing for wind turbine applications by Göran Ronstein, Elforsk 2008

Integration of wind in Iceland

- 75% hydro
- 25% geothermal
- 100% renewables
- Wind ressource
- No connections

Offshore operation and maintenance

Photos ELSAM A/S and REpower

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IceWind project – key figures

- Title: **Improved forecast of wind, waves and icing**
- Project period 1. September 2010 – 31. August 2014
- Overall budget 20.8 mill NOK
- Financial support TFI 12.3 mill NOK
- Ekstern financing 8.5 mill NOK
- Partners: 13
- 375 man-months (45,000 hours) over 4 years
- Coordinator Risø DTU, Denmark
- 4 PhD projects planned: Two in Iceland, one in Denmark and one in Sweden

Risø DTU, Technical University of Denmark

IceWind objectives

The overall objective of the project is to support the development and integration of wind energy in the five Nordic countries by focussing on three main areas:

1. Icing on wind turbines (atlas, forecasting and losses)
2. Integration of wind energy on land (Iceland)
3. Offshore wind energy (forecasting and access)

A key issue is to share knowledge among the five Nordic countries and to work in areas where differences in know-how exist and where barriers or challenges prevent or slow down a large penetration of wind energy in the Nordic grid.

IceWind Partners

- Risø DTU (DK)
- Vestas (DK)
- Kjeller Vindteknikk (NO)
- Met.no (NO)
- Statoil (NO)
- AGR§ (NO)
- Offshore windservice (NO)
- VTT (FI)
- Gotland Universitet (SE)
- Icelandic Met Office (IS)
- University of Iceland (IS)
- Landsvirkjun* (IS)
- Landsvirkjun Power (IS)

§ Offshore services for O&M

* National Power company of Iceland

IceWind work packages

- WP 1 Icing (lead VTT)
  Atlas of icing for Iceland and Sweden, forecast of icing, estimate of losses due to icing
- WP 2 Iceland (lead Iceland met office - IMO)
  Wind atlas, identification of sites, technical and market integration studies
- WP 3 Forecast and O&M (lead met.no)
  Offshore meso-scale effects of large wind farms incl. wakes, short term forecasting, maintenance strategies and availability issues
- WP 4 Power and energy aspects (lead Risø)
  Spatial and temporal variability of wind resource, forecast errors and their impact on the Nordic power grid and balance market.

Expected results

- Better forecasts of wind and waves
- Maps of icing occurence and losses
- Better knowledge on wake losses in very large wind farms
- Wind and ice atlas of Iceland
- Integration study of wind in Iceland
- Better understanding of the interaction between hydro and wind in the Nordic system


Energy for the future