

WindScanner.eu

WindScanner.eu sees the wind

THE CHALLENGE

Wind energy is about to become the leading electricity generating technology all across Europe. However, a massive increase in installed wind power capacity is still required to meet the political goals for this sustainable energy system. The energy system of tomorrow must provide secure, affordable and climate-friendly

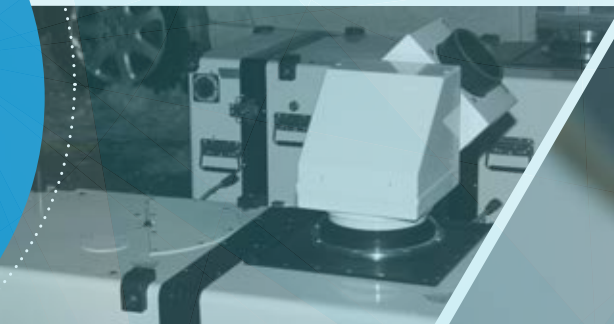
energy, while at the same time creating new jobs and growth.

Huge progress in lowering cost of energy (LCOE) has already been achieved, but there is still potential for cost reductions, through market development and research and innovation, for wind energy to reach its full potential.

Fact

Modern wind turbines continue to increase in size, and today wind turbines soar hundreds of meters into the sky. Their driving winds can no longer be characterized from met mast measurements but require detailed measurements of the entire 3D wind fields, upwind and in their wakes.

Full scale experimental investigations with 3D WindScanners are therefore now needed to take the next steps into exploiting wind energy via science and technology.





ADDRESSING THE CHALLENGE

*Dr. Peter Hauge
Madsen, Head of
Department at DTU
Wind Energy, DK*



»» "The WindScanner technology enables the wind energy sector to experimentally investigate the complex flow and turbulence that create loads and cause fatigue on wind turbines and wind plants. The WindScanner.eu makes the technology available to all of Europe and will directly support the sector's R&D."

WindScanner.eu is conceived as a new unique European distributed, mobile research infrastructure. WindScanner.eu is established to address the needs of the European wind energy community for measurements of the 3-D wind field surrounding today's huge wind turbines, wind farms, bridges, buildings, forests and mountains. Detailed measurements are essential to optimize wind turbine design and siting and thus an important driver for making wind energy become cheaper and more reliable for the benefit of society. The European WindScanner facility was included in the ESFRI Roadmap for research infrastructures of pan-European interest in 2010, hence recognizing the scientific merit and European added value.

DISTRIBUTED RESEARCH INFRASTRUCTURES

Dr. Stephan Barth,
Managing Director
ForWind – Center for Wind
Energy Research, Germany



»» "WindScanner can become for the wind industry, what X-Ray became for the medical sector. For the first time it's possible to unmask the complex and up to now basically invisible turbulent flows in and around wind farms. By joining forces, knowledge and lidar systems in a distributed research infrastructure we can literally switch on the light in the black box, which the resource wind in many aspects is still today."

WindScanner.eu will be a legal entity, based on the European Research Infrastructure Consortium model (ERIC), jointly owned by the participating Member States. The Research Infrastructure will consist of a set of National Nodes from leading European wind energy research organizations, with mobile WindScanners, linked together by the WindScanner Central Hub providing a unique one-point-of-entry WindScanner e-Science and User Platform.

WHAT THE RESEARCH INFRASTRUCTURE CAN PROVIDE

WindScannereu can provide services tailored to the needs of the wind energy research society and users:

- Planning, coordination and implementation of WindScanner measurement activities
- Coordination of purchasing, commissioning, calibration and maintenance of WindScanner equipment
- Training and education in WindScanner operation and data analysis
- E-science facilities for campaign design, documentation, data management and data analysis
- Provide access to research data
- Coordination of WindScanner funding opportunities, dissemination of achievements and foster optimal stakeholder collaboration



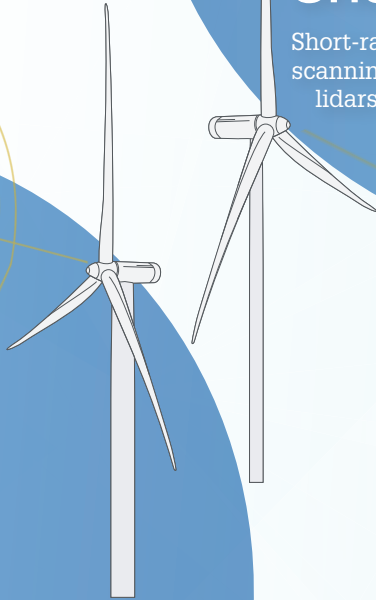
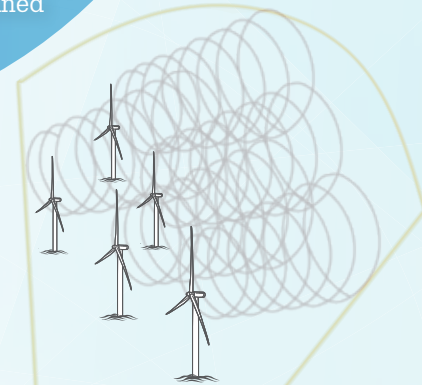
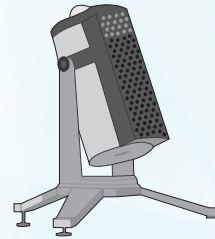
Measuring wind



Short-range WindScanners installed at the Lysefjord Bridge

Short-range WindScanner ■

Short-range WindScanners are ground-based velocity field scanning lidars built from steerable continuous wave wind lidars. Entire wind and turbulence velocity vector fields are scanned in 3D space and time along user-defined scan trajectories or in predefined scan planes at high repetition rate at ranges up to 300 m.

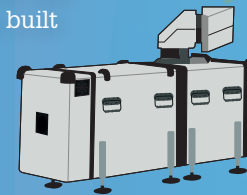


SpinnerLidar ■

SpinnerLidar is an entire rotor-plane 2D upwind and wake-scanning lidar. SpinnerLidars are special Short-range WindScanners designed for installation in the tip of the rotating spinner or on top of the nacelle.

Long-range WindScanner ■

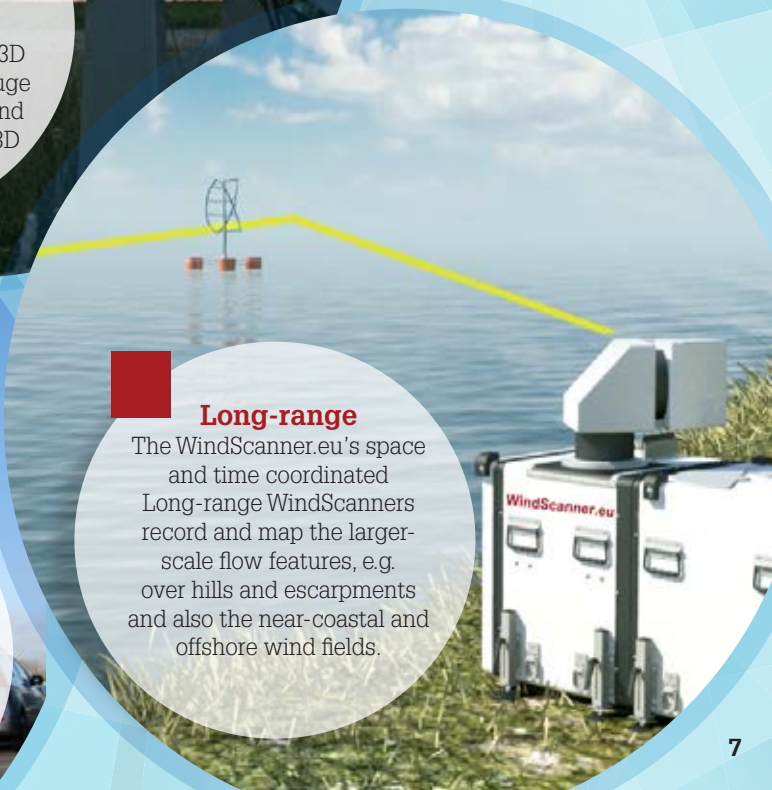
Long-range WindScanners are on and offshore wind field scanning lidars built from steerable pulsed wind lidars. Wind fields are scanned along user-defined scan trajectories or along predefined scan sweeps at extended ranges up to 5-10 km.





Short-range

Newly developed 6" telescopes now ensures 300 m measurement range. Applications include validation experiments of 3D inflow and wake around huge operating wind turbines and high-resolution scanned 3D wind and turbulence.



Long-range

The WindScanner.eu's space and time coordinated Long-range WindScanners record and map the larger-scale flow features, e.g. over hills and escarpments and also the near-coastal and offshore wind fields.



SpinnerLidar

Integrated with the turbine control systems SpinnerLidars contribute to the reduction of daily operation load and hence to extending the turbine lifetime.

EXPERIMENTAL INVESTIGATIONS

NO CLIMATE TOO COLD - NO CLIMATE TOO HOT

Measurement campaigns based on the WindScanner scanning Lidars have already been carried out in Europe and in North America, including hot and cold regions, flat and complex terrain sites and on and offshore:

- Short-range WindScanners were deployed in an air field during winter conditions in Norway to map the downwash underneath hovering rescue helicopters.
- Short-range WindScanners engaged with wake dynamic measurements behind a 50 m diameter vertical axis wind turbine (VAWT) during strong Mistral wind conditions in Southern France.
- Combined sets of short and long range WindScanners were deployed in mountainous complex terrain during extremely hot conditions, in Perdigão, Portugal.
- Six sets of Long-range WindScanners were synchronized to operate in concert scanning over hilly terrain at Rödeserberg Hill near Kassel, Germany.
- Long-range WindScanners are installed on the coast line and also offshore platforms in the North Sea to measure local offshore wind resources and wind conditions.
- Combined sets of two Short-range and one Long-range WindScanner were deployed to measure wind load from turbulent inflow on a Norwegian suspension bridge.
- Detailed wind and turbulence profiles have been scanned in front of and over steep hill escarpments in Denmark and Canada.



Photo Credit: Lee Jay Fingersh, NREL 34979

APPLICATIONS

WindScanner is a World-first unique research infrastructure operating sets of three or more time and space synchronized scanning wind lidars ■

WindScanner operate at short (10-300m) and at Long-range (5-10 km) ■

SpinnerLidars provide prevision of inflow for advanced feed-forward turbine control ■

WindScanners operate also inside wind tunnels during scaled tests ■

The WindScanner has its primary application for field measurements around large wind turbines, on and offshore. However, it also serves other purposes such as atmospheric boundary-layer research, air safety, wind loads on buildings and bridges, wind circulation in streets and the urban environment in general, which are all examples of activities with high priority in the years to come.

- Sets of WindScanners measure 3D wind velocity field structures in user-defined scan planes around huge wind turbines.
- WindScanners provide reference inflow and wake measurements for both Horizontal and Vertical Axis Wind turbines.
- WindScanners integrate in wind turbines.
- WindScanner-based touchless velocity measurements are able to calibrate cup anemometers to less than 0.1% uncertainty.

INTERNATIONAL COLLABORATION

WindScanner.eu is collaborating with National, European and also Trans-Atlantic research institutes and industries.

In collaboration with the National Renewable Energy Laboratory NREL, Colorado USA, a DTU Wind Energy SpinnerLidar was successfully operated during a 1-year test period

on top of the nacelle on the NREL CART3 research turbine for testing of advanced feed-forward control.

The WindScanner Research Infrastructure has also delivered a Short-range WindScanner to the Canadian WindEEE Research Institute in London, Ontario.

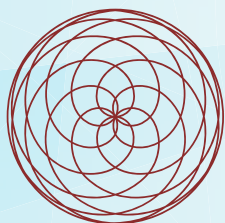


Professor Horia M. Hangan, Director at WindEEE Research Institute, Canada



“WindEEE and the Canadian wind research community consider the new European WindScanner.eu research infrastructure as an interesting and complementary research facility to wind tunnel scaled research. In Canada we see WindScanner as an interesting new collaborative partner for new technological developments and products in wind and turbulence measurements both inside wind tunnels and in the open air. The WindEEE Research Institute looks forward to collaborating with the WindScanner research infrastructure team.”

EUROPEAN PARTNERS



WindScanner.eu



Website: www.windscanner.eu

Contact: Søren Knudsen, (sknu@dtu.dk), DTU Wind Energy, coordinator for WindScanner.eu Preparatory Phase

Pictures by: Mikael Sjöholm, Andrea Vignaroli, Torben Krogh Mikkelsen, Guillaume Lea & Lee Jay Fingersh

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About WindScanner.eu

Measure 3D Wind Velocity
Joint European Research
Coherent Structures

Turbulent Spectral Content
3D Turbulence

Atmospheric Science
Boundary-Layer Meteorology

European Collaboration

Joint Research Infrastructures

Industry Collaboration

WindScanner Innovation Products

User Training

Open Access

Measure Induction Zone

e-Science and Networking

Analysis of Huge Data Sets

Dynamic Wakes

Distributed Research Infrastructure

Wind Resources and Conditions

Turbine Control

The Sky Is The Limit....



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