

# The Wind Energy Department

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Head of Department

The origin of our field of work is the nature of the atmosphere and its effects here on Earth. One particular aspect of the atmosphere keeps us busy: The wind and the energy that may be extracted from it.

The Wind Energy Department seeks to meet the needs for scientifically based knowledge, methods and procedures from government, the scientific community and the wind turbine industry.

Our research and development activities range from boundary layer meteorology, fluid dynamics and the mechanic as well as the dynamic quality of structures, to power and control engineering, and wind turbine loading and safety. The Department's activities also include research into atmospheric physics and environmental issues related to the atmosphere.

Our assistance to the wind turbine manufacturers serves to pave the way for technological development and thus further the exploitation of wind energy worldwide. The means to this end are research, innovation, education, testing and consultancy services as well as development of procedures for operation and maintenance.

A significant proportion of our activities are on a commercial basis: Wind energy mapping, technology development, consultancy on wind energy projects and capacity building. Other commercial activities are the development of software and measurement systems, and accredited testing of wind turbines.

Many of our projects involve international collaboration, and we take part in the solution of problems that are encountered worldwide in the application of wind energy, for example grid connection and integration. The Department also houses the administration of the Danish Certification Scheme for Wind Turbines and participates in the development of standards, both national and international.

The Department is organized in six units according to the main scientific and technical activities, and employs a total of about 100 people, most of which are scientists.

## Meteorology

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The Meteorology unit is aimed at basic research in the fields of boundary layer meteorology, assessment of wind resources for power generation, and wind loads on turbines and various other structures. Our day-to-day work ranges from the development of models and software, field measurements and both in-house and externally commissioned assessment studies. We also study environmental problems related to the transport of airborne pollutants and the turbulent exchange of matter during the interaction between the atmosphere and terrestrial or marine surfaces.

## Aeroelastic Design

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The key issues for this group are the research, development and application of aeroelastic programs, computational fluid dynamics (CFD) code and software design tools for aerofoils and wind turbine blades. The programs are used for establishing design load bases for wind turbines, in furthering the development of the three-bladed wind turbine concept, and for the development of new wind turbine concepts. Furthermore, this group undertakes wind tunnel measurements of aerofoil section flows.

## Wind Turbines

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The purpose of this unit is to develop new and to improve current methods for wind turbine loading and safety design, and in addition to develop new design methods and to identify new technical and economic applications. Two key elements are experimental verification, and technical and economic analysis of the utilization of wind energy in grids and in hybrid energy systems. This research supports our consultancy activities in wind energy projects for Danish and international authorities, industry, banks and investors. It also supports our participation in the development of international standards.

We carry out pre-research for the development of new standards, and we are involved in the

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formulation of both national and international standardization. This unit also includes the secretariat for the Danish Certification Scheme for Wind Turbines.

### **Wind Energy Systems**

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An important aspiration of this group is to lower the cost of energy derived from the wind by optimizing the wind turbine together with the grid interface and the operation of power systems. Our work includes such topics as system integration, control concepts for wind turbines, electrical components, grid connection and large-scale wind energy penetration, hybrid power supply systems, and energy storage in relation to renewable energy sources.

Risø Wind Consult is another activity of this unit, aimed at utilizing the knowledge and state-of-the-art tools available at Risø in providing consultancy and technical advice for international projects concerning the development and application of wind power technology.

### **Test and Measurements**

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The research of this unit is aimed at the development of instrumentation and new methods for experimental determination of wind turbine characteristics, including test methods for the wind turbine industry. This group also represents departmental expertise in organizing and conducting field meteorological measurements, and in providing instruments as well as data systems and data management for the Wind Energy Department and outside clients.

The Test and Measurement unit also operates a test station for large wind turbines at Høvsøre on Jutland's west coast. This area has excellent conditions, with high wind speeds and flat terrain. We can therefore verify both performance and the wind turbine design bases for all operating conditions relevant to large wind turbines. The test station operates five test beds for wind turbines.

### **Wind Energy Educational Programme**

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The educational activities of the Wind Energy Department aim to support PhD, Master and Bachelor degrees within areas of relevance for wind power production, so that:

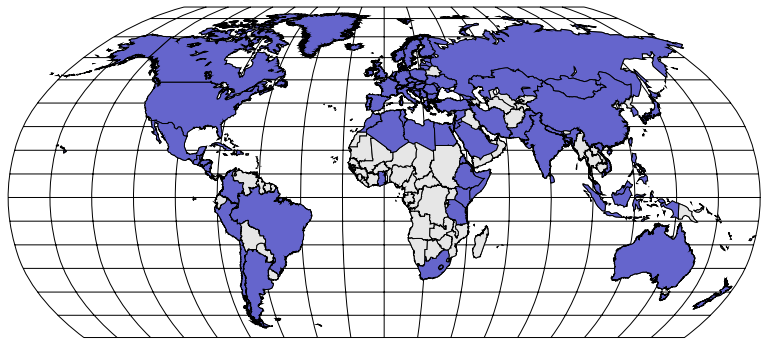
- The wind energy industry can continue to have qualified personnel available within the necessary areas of expertise.
- The research activities within the various units of the department are supported by Bachelor, Master and PhD student projects.

The Department presently participates in several national and international academies and networks, involving the exchange of, and schools for, PhD students and young researchers, who may give lectures, summer schools, student and post doc exchanges, and of course financial support.

Current and recent student projects at the Wind Energy Department may be found on our website at <http://www.risoe.dk/vea/>.

### **International cooperation**

The Wind Energy Department has collaboration partners and customers in more than 100 countries and territories around the world.



As of 1 January 2007, Risø National Laboratory, the Danish Institute for Food and Veterinary Research, the Danish Institute for Fisheries Research, the Danish National Space Center and the Danish Transport Research Institute have merged with the Technical University of Denmark (DTU) with DTU as the continuing unit.