

Research and Education in the Field of Wind Energy at the Technical University of Denmark

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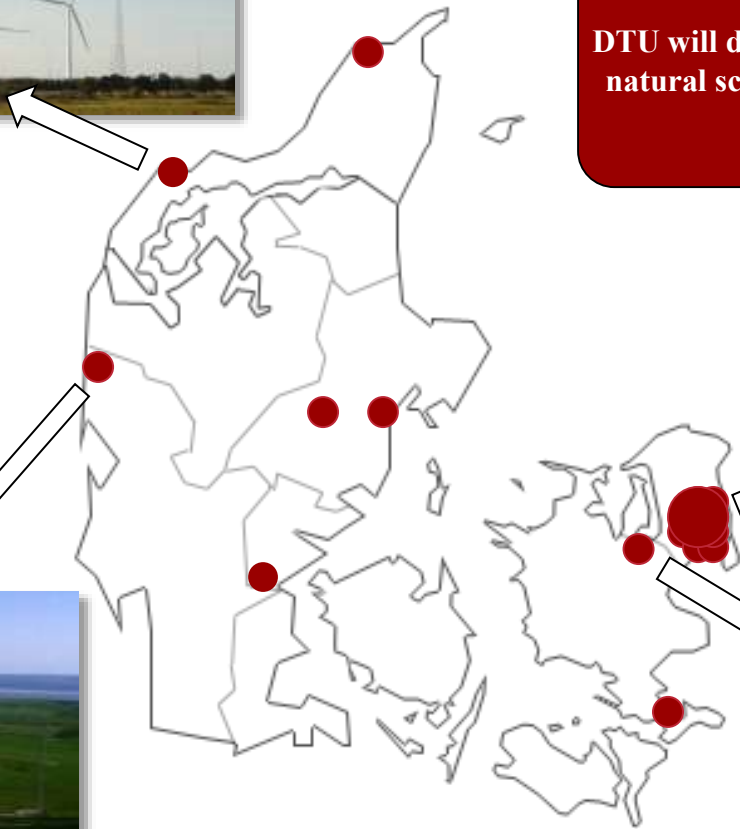
Head of Section of Fluid Mechanics
DTU Wind Energy



DTU Wind Energy

- The department, which was established January 2012, is composed of the former Wind Energy Division at Risø, two groups from DTU Mechanical Engineering whose core activities are fluid dynamics and composite mechanics, and two groups from the Risø DTU Materials Research Division where the research is focused on composite materials and metals.
- DTU Wind Energy has more than 230 staff members, including 150 academic staff members and approximately 50 PhD students, and the department comprises 8 sections. Research is conducted within 12 research programmes organized into three main topics: Wind energy systems, Wind turbine technology and Basics for wind energy.

DTU – Excellence since 1829



MISSION
DTU will develop and create value using the natural sciences and the technical sciences to benefit society



Research at DTU Wind Energy

Wind power systems

Wind resources and siting

Wind power integration and control

Offshore Wind power

Wind power and society

Wind energy technology

Aeroelastic design methods

Structural design and safety

Mechanical components

Elektronic components

Basics for Wind energy

Aero- og hydrodynamics

Meteorology and turbulence

Light, strong materials

Remote sensing and measurements

Sections at DTU Wind Energy

- **Fluid Mechanics**
- **Meteorology**
- **Aeroelastic Design**
- **Wind Energy Systems**
- **Test and Measurements**
- **Composite and Materials Mechanics**
- **Materials Science and Characterisation**
- **Wind Turbine Test Site at Østerild**

Products and Services

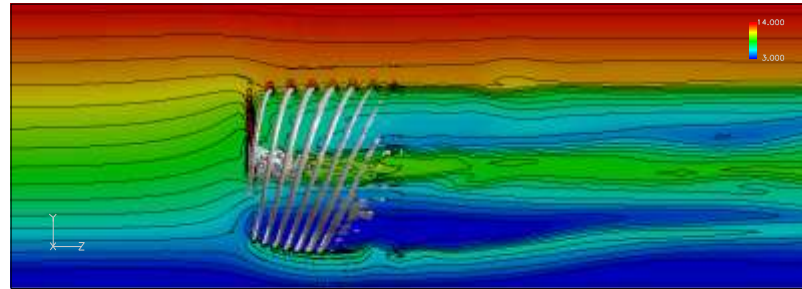
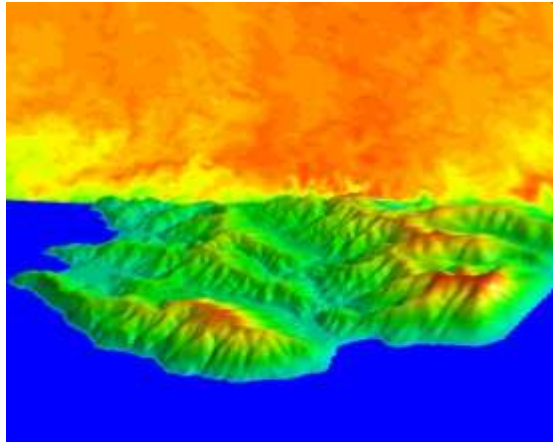
- **Aerodynamic Noise Codes**
- **Aeroelastic Wind Turbine Simulation tools**
- **Aeroelastic Stability Prediction Tools**
- **Blade and Airfoil Design**
- **Database on Wind Characteristics**
- **Guidelines for Design of Wind Turbines**
- **Verification of Rotor Design using CFD**
- **Dispersion Models**
- **Rodeo – Risø Online Database**
- **WAsP Software**
- **WAsP Engineering**
- **Wind Atlas**
- **Høvsøre Test Site**
- **Terrain Induced Wind in Complex terrain**
- **Data Acquisition Systems**
- **Wind Tunnel Testing**

Wind Turbine Aerodynamics

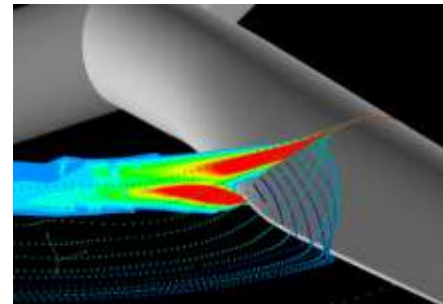
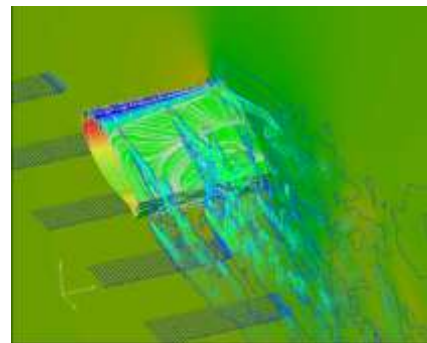
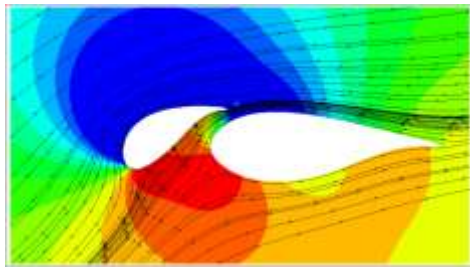
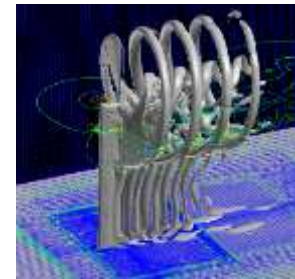
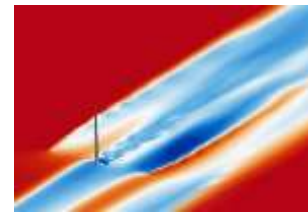
Examples of on-going projects:

- **Center for Wind Turbine Aerodynamics and Atmospheric Turbulence (DSF)**
- **Program for Research in Aeroelasticity (EUDP)**
- **Wind Power Systems in Complex Terrain (DSF)**
- **Dynamic Wind Turbine Model – from Grid to Wind (DSF)**
- **Ocean Energy Research Program (Statkraft)**
- **Design of Next Generation Wind Turbine Rotors (EUDP)**
- **Database on Wind Power (IEA)**
- **Simulation of Wakes behind Wind Turbines (IEA, EU)**
- **Topfarm: Topology optimization of wind farms (EU)**
- **Analysis of Vortex Generators (DSF)**
- **Rotor Blade with Flaps for Reducing Oscillating Loads (HTF)**
- **Experiments on Rotor in Wind Tunnel (IEA, EU)**

Advanced Wind Turbine Aerodynamics -modeling and exp. validation



Exp. validation



Collaboration with industry

DTU offers

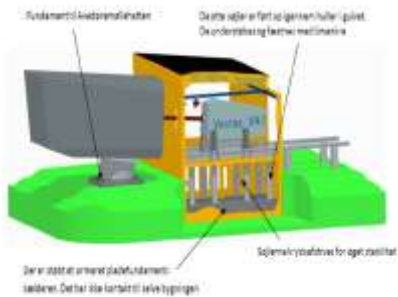
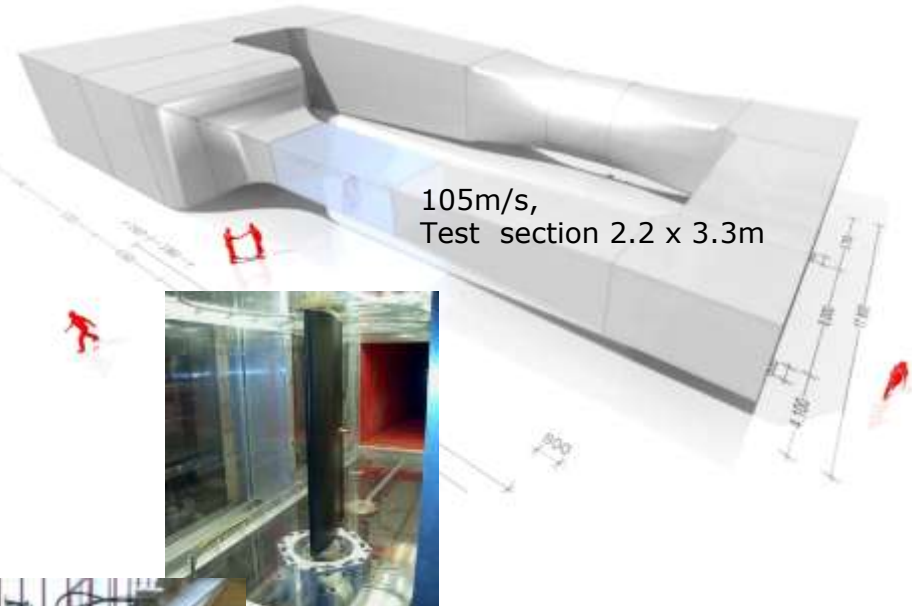
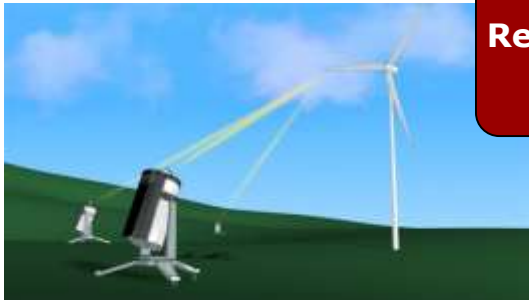
- Research cooperation
- Software with training
- Licenses / patents
- Technology development services
 - Applied R&D
 - Consulting: Analysis and studies
 - Testing & measurements
- Education and training
 - PhD programmes
 - Training courses
- Dialogue & access to Danish wind cluster and international network

Industry partners

- Wind Turbine manufacturers
 - Vestas
 - Siemens
 - Gamesa
 - Repower
 - GE
 - Envision
 - ...
- Energy companies
 - Dong Energy
 - Vattenfall
 - EON
 - ...
- Component suppliers
 - LM
 - ...

Experiments, Validation and Test

Research and test facilities



Wind turbine blade testing



Commercial testing at Blade Test centre A/S, a private limited company with the following shareholders:

Det Norske Veritas AS
Technical University of Denmark
FORCE Technology



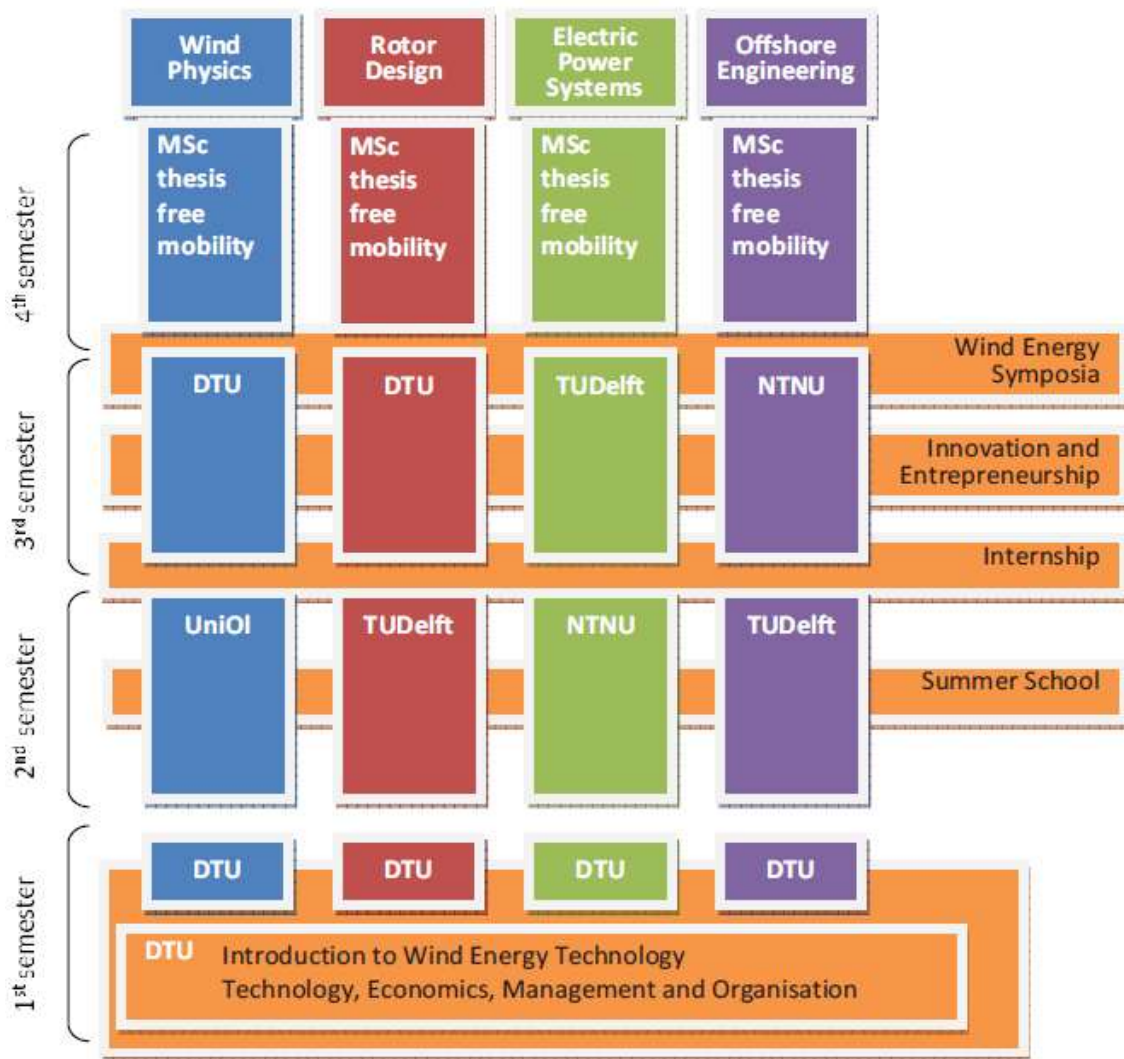
Wind Energy education programmes at DTU

- **Int. M.Sc in Wind Energy:**
 - Two tracks: Mechanical and Electrical Engineering
 - About 50 thesis work per year
- **Nordic Master's programme in Sustainable Energy**
- **European Erasmus Mundus Wind Master**
- **PhD research school (DAWE):**
 - about 50 PhD students at DTU/Risø
- **European Academy of Wind Energy**
- **Various Training and Post-graduate Courses**

European Wind Energy Master

- **Initiative taken by TU Delft**
- **The programme consists of four tracks:**
 - **Wind Physics**
 - **Rotor Design**
 - **Electrical Power Systems**
 - **Offshore Engineering**
- **The programme is a double-degree programme, i.e. the student receives diplomas from two universities**
- **Partners: TUDelft, Univ. of Oldenburg, NTNU and DTU**
- **Erasmus Mundus application granted with start fall 2012**
- **Expected number of students: 120-150 per year**

European Wind Energy Master



Danmarks

Figure A.1.3.1 – Structure and mobility of the programme and specialisations tracks.

Thanks for your attention

Any Questions?