

Maximum number of participants is 35. Please contact us for information on rates and availability of hotels. A course-dinner will be organised on Thursday evening for delegates and lecturers. Early bird fee up to 22 September 2009.

For more information, please contact Sylvia Willems on 015-2785170, S.M.Willems@tudelft.nl or visit our web-site: www.duwind.tudelft.nl

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Registration:

Name
Company
Street or PO-Box
City
Zip code
Country
Tel _____ Fax _____
E-mail _____
VAT number of company (only for payment by invoice)

- Course attendance € 990 (includes coffee breaks and lunch)
 Course attendance € 940 (register before 22 September 2009)
 Dinner on Thursday evening € 50

Payment*

- Credit card

In case of payment by credit card you will receive an extra form by fax where you have to fill in your credit card details and signature.

- Invoice

An invoice can only be sent to a company address and when the VAT-number is provided.

* Your payment needs to be received before the start of the course

Technology of Offshore Wind Energy

9th edition of a Short Course given by Duwind

22 & 23 October 2009

The wind energy industry has enjoyed very successful decades across Europe, with improvements in the technology, reductions in costs and a large increase in the size of the industry. This technology is currently being taken offshore.

The DUWIND Institute at Delft University of Technology will be giving a 2 day intensive course on the 'Technology of Offshore Wind Energy', aimed at professionals with an interest in this industry. The course has a very technical content and focuses on the activities of project engineers and designers.

The course covers wind turbine, electrical and offshore engineering aspects. The technology of offshore wind energy will be treated on all levels, ranging from the fundamentals of hydrodynamic loading to integrated design methodology. The audience will be encouraged to look beyond its own field of expertise to other disciplines involved in offshore wind farms.



Contents (Day 1)

Introduction to course and to current wind turbine design

The first lecture presents a very brief summary of the principles of wind energy conversion and of some design recommendations. This lecture is particularly intended for those who enter the field of offshore wind energy with a different background than wind energy. The overview comprises basic aerodynamic theory, control strategies and systems, rotor dynamics and energy yield. As an introduction to the subject 'offshore wind energy' the terminology to be used is discussed.

Offshore wind climate and loading

No wind energy, without wind. But what are the properties of the wind at offshore locations and what is their effect on the wind turbine? After a general description of the origin and character of the wind the specific properties for the offshore environment are highlighted and illustrated with measurement data. The relation of the offshore wind with energy yield and important loading phenomena are explained.

Offshore wave and current climate & loading

No one can overlook the importance of wave and current climate for offshore wind energy. However, how to deal with this in the design process is not a straightforward issue. This lecture will examine the generation and development of waves and the nature and mathematical description of sea states. Different models for the water particle kinematics are presented and their suitability for different situations is discussed. Finally, the calculation of structural loading from the wave kinematics is treated.

Long-term loading situation

In the previous lectures wind, waves and current are treated as separate phenomenon. In the long-term these loading situations are correlated in magnitude and direction. This lecture describes how this correlation can be determined and how it can practically be presented. Several examples illustrate the long-term correlation between some environmental parameters. This lecture concludes with requirements for knowledge of long-term environmental conditions for load and performance analysis.

Offshore soil conditions and foundations

Due to several reasons foundations for offshore wind turbines not only differ from their onshore counterparts, but also from other offshore structures. The lecture on offshore ground conditions and foundations deals with these differences and addresses several foundation types and construction methods. Special attention is given to the behaviour of pile foundations under axial and lateral loading.

Offshore support structure

Offshore support structures are very site specific, resulting in a large variety of structures for the oil and gas industry. The experience obtained with these structures are summarised and translated to lessons for offshore wind energy. Finally, this lecture describes the candidate concepts and a design approach for support structures for wind turbines.

Contents (Day 2)

Dynamics of an offshore wind turbine

The structural dynamics of an offshore wind turbine are important, as well as complicated. To facilitate the understanding of the dynamics of the entire system an introduction of dynamics presents the relevant issue of mechanics. Following the analysis of the differences with other offshore structures and onshore wind turbines, the importance of structural dynamics of offshore wind turbines is explained. An overview is given of typical offshore aspects of the dynamic behaviour and of various analysis methods. Special attention is paid to the subject of fatigue loading, which is often a design driver for the support structure.

Operation and maintenance

Operation and maintenance is one of the less 'hard core technology' aspects of this course. This lecture provides a systematic approach toward analysis and planning of operation and maintenance activities. Relating issues that show up are system reliability, access methods, lifting equipment and maintenance strategies. The importance of these issues is illustrated with examples from existing offshore wind farms and a model of operation and maintenance.

Electrical systems

This lecture consists of three parts namely the electrical system of the turbine, the electrical system of a wind farms and aspects of grid integration. The first part covers the conversion of mechanical power into electrical power. In this part the principles, characteristics and types of generators and power electronics are shown, in which emphasis is given to the role of the electrical components in a wind energy conversion system. In the second part the functionality of the electrical infrastructure and some of the constraints are reviewed such as transmission capacity of cables and transmission by AC and DC. Several configurations and types of clustering and provides examples of their costs and efficiency. The last part concerns the integration of wind power into the grid. The functions and operation of the power grid is reviewed. The effect of injection of wind power is considered with respect to voltage stability, faults, islanding and power quality is addressed shortly.

Integrated windfarm design

This lecture gives a schematic representation of several design approaches. The abstract ideas are illustrated with examples from existing projects. The integrated design approach is identified as the most promising approach and discussed in more detail, emphasizing on the conceptual design phase. The lecture then focuses on key aspects of the integrated approach such as availability and levelised production costs. Some technical issues are singled out to demonstrate the importance of interactions between sub-systems.

Round-up of the course

The summary looks back at experience gained with design and implementation of current offshore wind farms and looks ahead at future perspectives. A context is given for the development of offshore wind farms in the medium and long term future.