Proceedings of The Fifteenth (2005) International Offshore and Polar Engineering Conference
Seoul, Korea, June 19–24, 2005

ISBN 1-880653-64-8 (Set); ISSN 1098-6189 (Set)

Certification of Offshore Wind Farms

M. Klose[1], *P. Dalhoff*[2]
[1]Department Rotor Blades and Civil Engineering, [2]Department Project Certification (Onshore/Offshore), Germanischer Lloyd WindEnergie GmbH.
Hamburg, Germany

ABSTRACT

This paper shows the potentials and risks of energy production using offshore wind turbines (OWTs). It gives examples of executed projects and presents the benefit of independent certification within project realization. The certification process is described in detail.
The paper also presents results from research projects concerning OWTs and the implementation of these results in design rules and guidelines for the construction of offshore wind farms.

KEY WORDS: Wind Energy; Certification; Guidelines; Wind Farm; Offshore; Wind Turbine; Support Structure.

INTRODUCTION

Due to the world's rising energy consumption and the limited existence of fossil energy sources, attention has been drawn on the exploitation of renewable energy. Among the various fields of renewable energy sources, the wind energy sector has gained a significant growth within the last two decades. This development was possible because of a fast progression of the wind turbine technology and has been encouraged by financial incentive in some countries.
After having conquered the landscapes onshore, the wind industry is now looking at the high potential of wind energy beyond the coastline. Now that a small number of offshore wind farms have been erected and first experience has been gained, one sees that a lot of additional tasks have to be solved, compared to onshore wind turbines as well as conventional offshore constructions. The experience of both fields cannot be directly adapted without changes.
For the construction and operation of an offshore wind farm, requirements are defined by investors, insurance companies, authorities and public interests concerning the reliability and safety of the machinery units and support structures.
The confirmation of these requirements can be given by independent third-party investigations by certification bodies like the "Germanischer Lloyd WindEnergie GmbH" (GL Wind) who have worked in the field of wind energy certification from the very beginning and have developed their own guidelines for the design and construction of wind turbines and wind farms onshore and offshore which are accepted worldwide.

In the following, the development of the wind energy business and the potential of offshore wind energy is described in short words. After that, some examples of technical challenges concerning offshore wind farms are presented.
A focus is put on the development of standards and guidelines with the aid of European research projects and experiences gained by the first offshore wind farms.
One section of the paper explains the certification procedure and the single parts of wind farm certification according to GL Offshore Wind Guidelines.
The benefit of third-party surveillance is comprehended within the conclusions.

DEVELOPMENT OF WIND ENERGY INDUSTRY

Design Concepts and Turbine Size

Various design concepts for wind turbines have been developed in recent years. Starting especially in Denmark and Germany, a "standard" turbine, consisting of a three-blade rotor and a horizontal-axis drive train on a tower-like structure has been well proven and has spread around the world since the early 1980s.
Basic differences in the design concepts still exist nevertheless. Some of them are listed below, for further details, see Hau (1998), or Gasch (2005):

- Power Regulation by stall effect or pitch control of rotor blades
- Fixed or variable rotor speed
- Direct drive or gearbox transmission
- separated or integrated drive train
- Tubular steel tower, concrete or lattice tower

For offshore wind farms, additional aspects have to be considered in wind turbine design, e.g. protection against corrosive environment, mounting and repair of turbines on site, transport and erection of support structures.
As shown in Fig. 1, the size of wind turbines has grown significantly within the last 20 years. One of the most relevant limiting factors was the possibility of producing large rotor blades made of fiber-reinforced