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# Experiences with Certification of Offshore Wind Farms

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## ABSTRACT

Within this paper, recent developments in offshore wind energy are presented from the certification body's point of view. A focus is put on the design basis for the structure and the design-driving parameters within the environmental conditions such as wind and wave data, ambient temperatures and soil conditions.
Typical structural details are shown in examples in order to identify the specific considerations necessary for offshore wind farm design

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

## INTRODUCTION

Offshore wind farms will play an important role in the world's energy supply in the upcoming decades. In some European countries, the development of large offshore wind farms was started, e.g. the German government expects 20-25,000 MW of wind power to be installed offshore until 2030. Experience with the first offshore wind farms in Northern Europe has been gained and is implemented in the technological development. Plans for offshore wind farms outside Europe are developed e.g. in the United States, Canada and Korea.

Certification is an integral part to secure safety and reliability for offshore wind farms.
Germanischer Lloyd WindEnergie (GL Wind) is the precursor in Offshore Wind Energy. As early as 1995 Germanischer Lloyd (GL) published the Regulations for the Certification of Offshore Wind Energy Converters. In 2005, GL Wind published a completely revised standard for offshore wind turbines (OWTs). The new edition builds on experience from executed offshore wind farm projects or type approvals for turbines and results from EU-funded research projects. Some aspects of the guideline have been presented at the ISOPE 2005 Conference in Seoul. During the last year new experience was gained by GL Wind.
Although the number of executed projects still is quite small, an insight of the upcoming challenges may be given as many project planners decide to involve the certification body at an early stage of their projects in order to clarify requirements and technical details

## RECENT DEVELOPMENTS IN WIND ENERGY

### Companies and Turbine Types

Recent development of the supply side has been characterized by a shake-out, including the merging of companies as well as the access of large corporate groups like *General Electric* or *Siemens* into the wind energy business.
As a consequence, the four largest wind turbine manufacturers account for nearly 80% of total supply. Counting the ten largest suppliers, 96% of the installations worldwide are covered according to BTM studies (2005).
The technological development comprises the setup of a handful of prototype wind turbines with a capacity in the range of 3 to 6 MW while the average wind turbine lies between 1.5-2 MW.
These new types of turbine are especially developed for offshore applications, taking into account the harsher environment and lower accessibility compared to onshore wind turbines.

### Markets

The total capacity of global wind power grew to almost 48,000 MW during 2004 according to BTM (2005) with an annual installation of 8,000 MW in the last year. More than 60 countries have been involved. Europe has the largest market share with 73% of all new installation in 2004. As shown in Fig.1, Europe is expected to maintain its leading role for the next few years, but the Americas as well as South and East Asia will increase their contribution.
On the other hand, it has to be pointed out that the development is strongly influenced by political boundary conditions.

### Offshore Projects

Earlier predictions of the development of offshore wind energy have lately been corrected as the offshore development lost pace. Due to technical as well as financial problems, only one new project was installed in 2004.
Some project developers are waiting for reliable results from the prototype tests of recently erected 5 MW turbines before proceeding