Monitoring Offshore Wind Energy Use in Europe - Offshore~WMEP

ESTABLISHING A COMMON DATABASE FOR WIND TURBINE FAILURES

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- Introduction
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  - WMEP

- Offshore-WMEP
  - Background
  - Different concepts

- Other activities
  - EVW-project
  - IEA-Task 33 “Reliability data”

- Conclusion & Outlook
Introduction
Motivation

Starting Point: Modern wind turbines achieve high availability
Number of faults cause unplanned downtimes $\rightarrow$ high maintenance efforts and costs

Offshore: drop of availability expected

Average availability onshore
Introduction

WMEP


193,000 monthly operation reports
and 64,000 Incident reports
from 1,500 wind turbines

Technology development

Learning curves

Reliability
Introduction

WMEP
Introduction
WMEP

- For differential analysis distinctions regarding size, technical concepts, site conditions, etc. must be made.

WMEP 1453 SWT
>3. year of production
527 SWT

1.-3. year of production
926 SWT

- $P < 500$ kW
- 500 kW $\leq P < 1000$ kW
- $P \geq 1000$ kW

asynchronous
584 SWT

synchronous
199 SWT

- coast line
102 SWT
- highlands
33 SWT
- lowlands
64 SWT

Turbine type???
Year of operation???
Introduction

WMEP
Offshore~WMEP

Concept

- The project is a follow-up project to the onshore wind energy monitoring program ‘Scientific Measurement and Evaluation Program’ (WMEP) and accompanies the offshore wind energy deployment in Germany
- Funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Offshore-WMEP
General monitoring

- Core issues
  - Site-specific offshore conditions
  - Installation
  - Energy output
  - Reliability
  - Availability
  - Facility concepts
  - Operation and maintenance concepts
  - Investment and operating costs
Offshore-WMEP
Participant specific analyses
Offshore-WMEP
Participant specific analyses
Offshore~WMEP
Participant specific analyses

- **Optimization of intervals**

- **Constitute priorities**

- **Optimization of strategies**

- **LCC prediction**

Source: IZP Dresden
Offshore-WMEP

Concept of confidentiality

analyses

public

group results

individual results

Highly aggregated anonymous Benchmarks

At least 3 different WF

Reliability characteristics

Single wind farm analyses

Maintenance optimisation

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Offshore-WMEP
Concept of data acquisition

Design
- verification
- modification

Strategy
- reactive
- time based
- condition based
- reliability based

Planning
- improvement
- consolidation
- interval opti.
- responsibility

Event
- failure
- fault
- inspection
- repair

Analysis
- MTBF, MTTR
- weak points
- expenses
- life cycle cost

Documentation
- subassembly
- cause
- time steps
- cost

Archiving
- core data (RDS-PP)
- in-service data
- event data (ZEUS)

Accurate, detailed documentation
Consistent naming of components
Unified description of irregularities and activities

Use of operating experiences

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Other activities
EVW (Increasing availability of WTIs)

- Funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

- Task: Knowledge management and maintenance optimization as methodical base for increasing the availability of wind power plants
Other activities
EVW (Increasing availability of WTors)

- Developing a test and demonstration system
- Preparing recommended practices for reliability based maintenance
- Technical guidelines / standards (Federation of German Windpower)

- Expand common database (onshore and offshore)
Other activities

65th IEA Topical Expert Meeting TEM (IEA Wind Task 11)
International statistical analysis on wind turbine failures

- TEM in Kassel / Germany, March 2011: 23 experts from Denmark, Finland, GB, Germany, Netherlands, Norway, Sweden, USA; (16 presentations)
- It was decided to launch a new IEA Wind Task on Databases for Wind Turbine Failures
- Task Proposal was prepared by Fraunhofer IWES in cooperation with SINTEF, NTNU and Chalmers University of Technology
IEA Wind Task Proposal – Reliability Data

Future work and key questions

- Priorities for future work defined at the TEM:
  - Standardization of the structure databases (DB)
  - Definition of subassemblies and failures
  - Level of detail of the DB
  - Confidentiality and access to the DB
  - Harmonization of data analysis

- Key questions:
  - Which data are to be collected?
  - What data are needed for the different analyses?
  - How to implement a system to collect information in an appropriate, structured, detailed and strongly automated way?
IEA Wind Task Proposal – Reliability Data

Objectives

The objectives of the proposed IEA Task are threefold:

1. Provide an international, open platform for regular and continuous exchange of experience and progress from individual research projects and existing activities on failure statistics on wind turbines.

2. Development of *Recommended Practices for Reliability Data* during the course of the Task.

3. Identify areas for further research and development as well as standardization needs.
Conclusions & Outlook

- Potential for availability improvement and for reducing maintenance effort exists
- Common database needed due to parameter diversity
- Different concepts are necessary
  - Overall data structure
  - Standards and definitions
  - Accessibility of information
- Harmonization will take place in the new IEA-Task
- Offshore~WMEP is going from concept phase to the first implementation phase ➔ database will be filled