Challenges in the Reliability and Maintainability Data Collection for Offshore Wind Turbine
Z.Hameed, J.Vatn
Norwegian University of Science and Technology, Department of Production and Quality Engineering N-7491 Trondheim NORWAY

Introduction

- More Wind available offshore
- Complex Operation & Maintenance
- Social reasons

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
<th>Capacity %</th>
<th>Availability</th>
<th>Power %</th>
<th>Power production</th>
<th>Power production %</th>
<th>Power consumption</th>
<th>Power consumption %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1000</td>
<td>5%</td>
<td>95%</td>
<td>85%</td>
<td>850 GWh</td>
<td>850 GWh</td>
<td>1200 GWh</td>
<td>1200 GWh</td>
</tr>
<tr>
<td>2011</td>
<td>2000</td>
<td>10%</td>
<td>90%</td>
<td>90%</td>
<td>1800 GWh</td>
<td>1800 GWh</td>
<td>2400 GWh</td>
<td>2400 GWh</td>
</tr>
<tr>
<td>2012</td>
<td>3000</td>
<td>15%</td>
<td>85%</td>
<td>85%</td>
<td>2550 GWh</td>
<td>2550 GWh</td>
<td>3600 GWh</td>
<td>3600 GWh</td>
</tr>
</tbody>
</table>

(From: G. Twidell, et al, "Offshore wind turbines")

Proposed database

- RAMS Database (Reliability, Maintainability, Availability, and Safety)

Challenges

- Adaptness with novel concepts

Need for database

- Failure behavior of offshore wind turbines is still under investigation!
- Logistics, Accessibility weather dependent
- Expensive and complex maintenance in offshore
- Higher lifting costs in offshore (at least 5 times more)

Objectives of database

- Collect and exchange operating experience
- Promote reliability engineering
- Develop a reference for the collection and analysis of reliability data
- Develop cost-efficient data collection methods and tools
- Feedback of operating experience to the equipment manufacturers
- Co-operate with other organizations and research

Existing database

- WindStats Newsletter – Denmark & Germany (quarterly, 7000 WT)
  - Failure data are specified per component (e.g. yaw system, gearbox, brake), but not per wind turbine size or type
  - Every month failures, but not always failure causes, of about 7000 turbines are reported
- LWK – Germany (yearly, >50 WT, closed 2005)
  - Contains output data and number of failures per system of all WTs
- WMERP – Germany (yearly, >1500 WT, closed 2009)
  - Detailed information about reliability and availability of WTs
  - The most reliable characteristic values regarding reliability (MTBF, MTTR)
- Vindstat (VPC) – Sweden (yearly, 723 WT before 2005)
  - Production and downtime, provides information for wind power
  - Incomplete reporting which made the statistical processing invalid
- VTT – Finland (yearly, 105 WT)
  - Contains data of performance, failures, and downtimes for wind power plants
  - Quality of the data might be insufficient for making conclusions
  - Failure reporting is mandatory
- OWMEP for Offshore Wind Turbines
  - Concept stage
  - Partly included O & M aspects
  - Aiming at implementing reliability techniques

Conclusions

- RAMS database will act as reliability enhancement tool
- Design improvement
- Access, logistics and transportation issues could be planned in an accurate way in offshore environment

Contact Information

NTNU Valgrinda
Inst. for produksjons- og kvalitetstek. 7491 Trondheim NORWAY
T: 0047 735 97102
F: 0047 73 59 71 17
Email: zafar.hameed@ntnu.no