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Grid Interconnected Reliable Offshore Wind Energy Prediction Models

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Abstract

The methodology for analysing OWT in the early design phase, using surrogate data, has applied, and in this first phase of research has produced comparative reliability results. The five generic drive train designs have been modeled, and reliability calculations have been completed on the basis of one year's operation as non-repairable systems, without maintenance.

The results of our comparative analysis of reliability characteristics for the 5 turbine drive- train sub-assemblies has concluded that the electronic-based hardware is the most vulnerable to failure within the one year period. The highest predicted failure intensity (failure rate) has been shown for the electronics of pitched rotor blades, converter AC/AC, generators and brakes.

The physics of failure approach, coupled with reliability predictive models have been developed and will help advance the entire industry by leading to new robust designs of OWTs. The reliability models can be used to assess life expectancy of wind turbine components under anticipated life cycle loading conditions, as well as under accelerated stress test conditions.

Objectives

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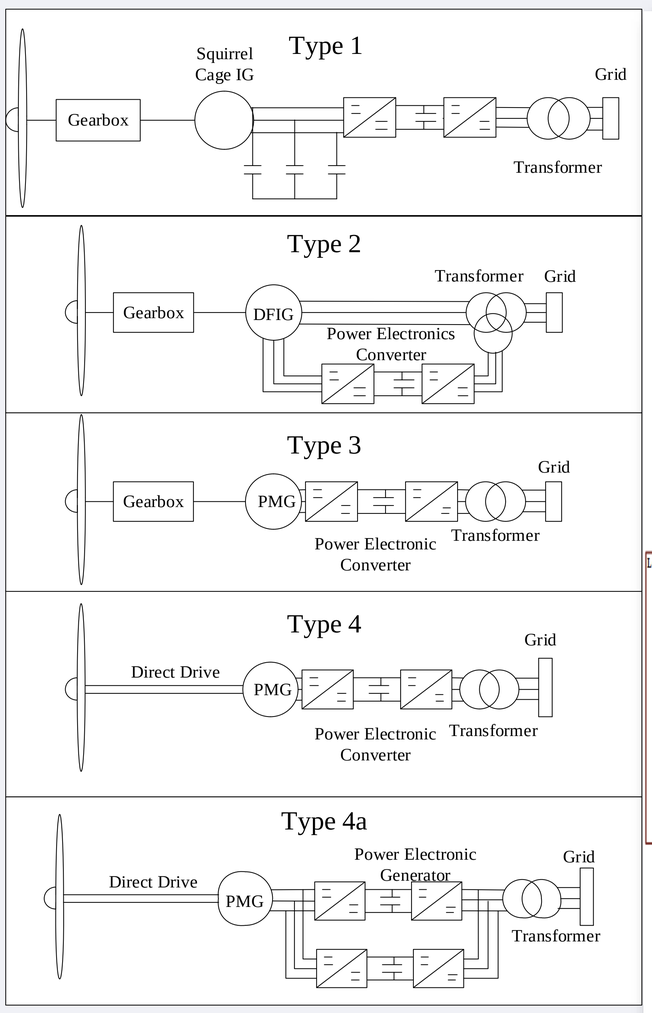
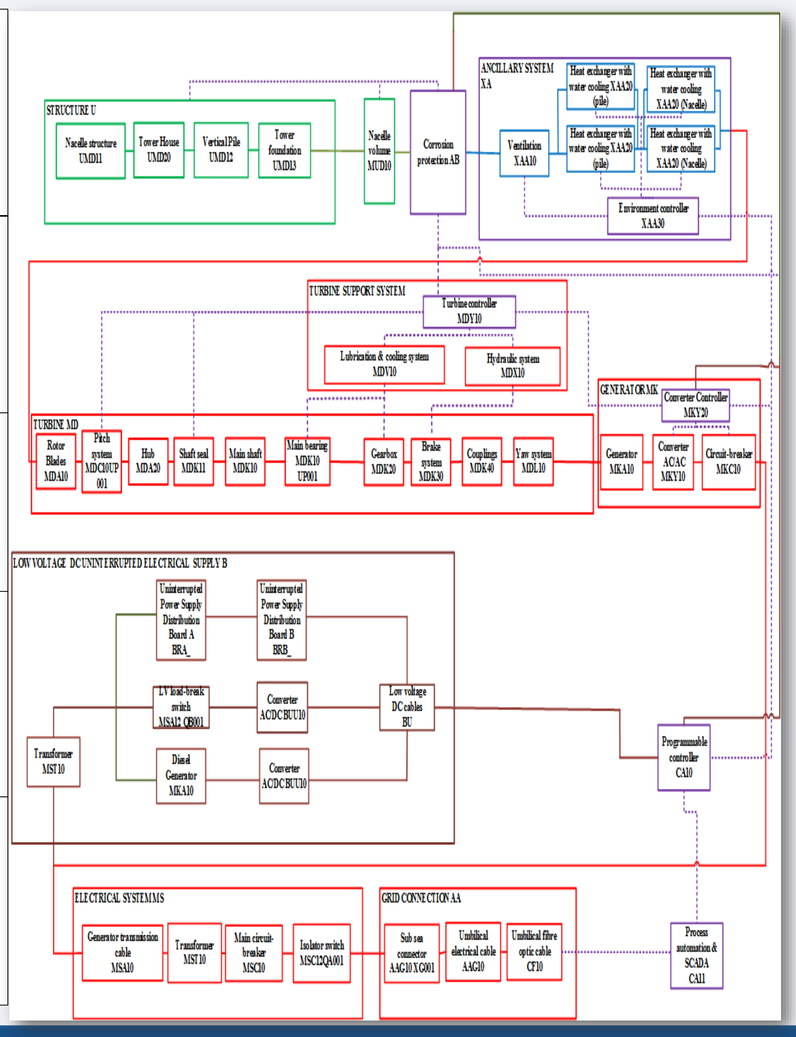
There are more than 20 designs of OWTs that are currently being deployed. However, there is a lack of reliability prediction data, which makes the selection of a specific OWT technology very risky. Global acceptance of OWTs will depend on achieving high reliable performance.

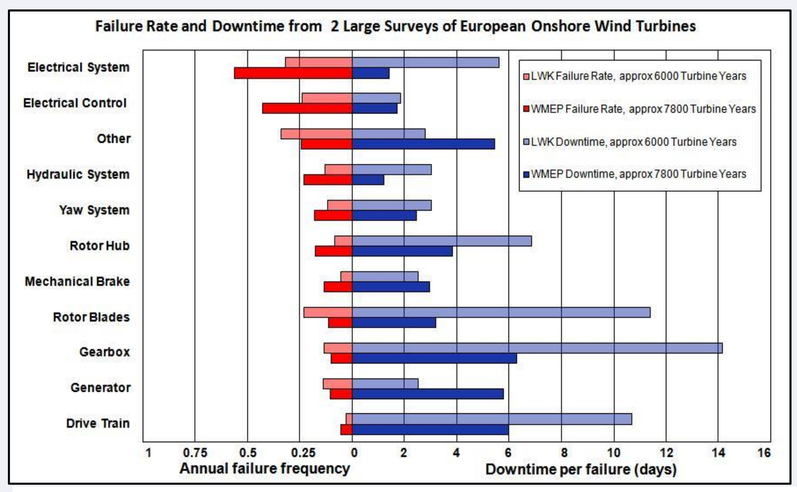


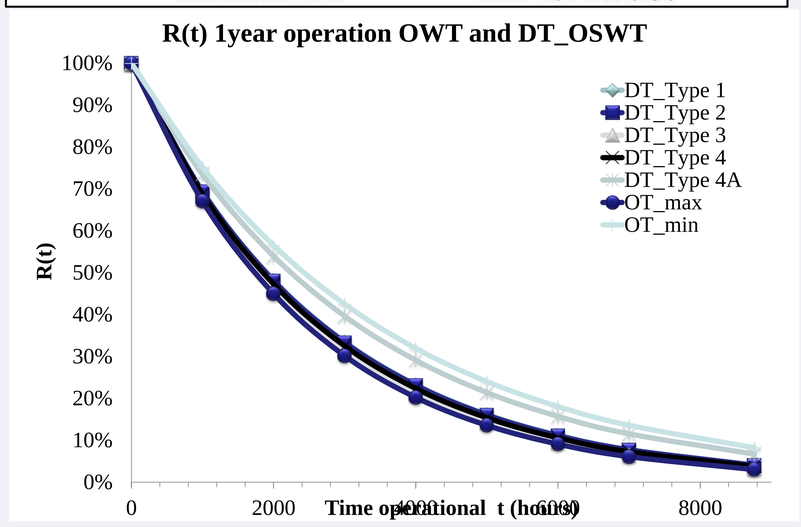

Methods and Results

- 5 Types of OWTs (Types1-4a) - horizontal axis turbines (3-6 MW) were selected for reliability modelling & technology comparison.
- Develop a system-reliability comparison model as the basis for the comparison of the reliability of these 5 types









Conclusions

CONCLUSIONS:

- A methodology for analysing OWT in the early design phase, using surrogate data, has produced comparative reliability results.
- These calculations have been done on the basis of one year's operation as a non-repairable system, with no maintenance.
- Failure rates are relatively high and survivor functions low (5-10% after one year)

References

1. RIAC & DACS. System Reliability Toolkit, A Practical Guide for Understanding and Implementing a Program for System Reliability. US Department of Defence, Arlington, VA, 2005.
2. OREDA, Offshore Reliability Data Handbook. SINTEF Industrial Management. Det Norske Veritas, Norway, 1984-2002.