

Reliability of marine energy converters

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Work stream 8: Reliability

Key Factor Reliability

To make Wave Energy Converters (WECs) a future energy option devices need to be cost-effective created. "Survivability and reliability represent key challenges for marine renewables, due to the economic consequences of catastrophic failures and/or long periods of unavailability." [1, p. 25]

Reliability analysis

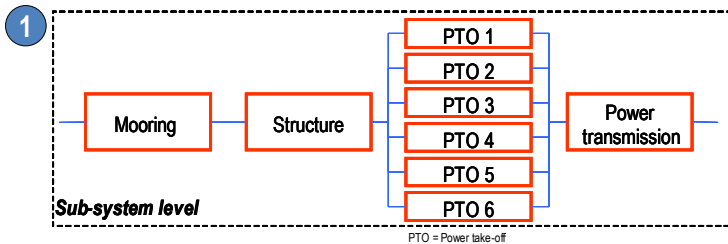
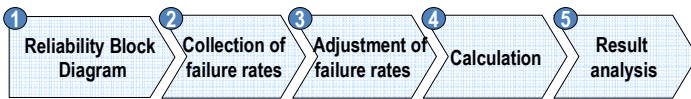
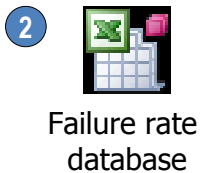


Fig. 1: Generic WEC Reliability Block Diagram



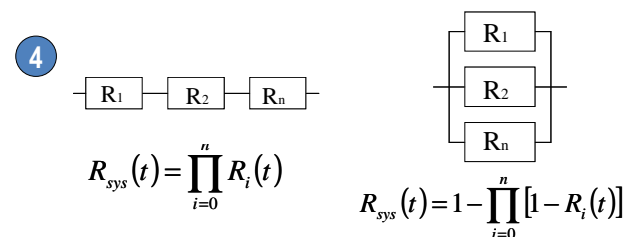
- Offshore reliability data (OREDA) [2]
- Military Handbook Reliability Prediction (MIL-HDBK-217F) [3]
- Failure rate data in perspective (FARADIP) [4]
- ...

$$\lambda_C = \lambda_B \cdot \pi_E \cdot \pi_{FM} \cdot \pi_{DS}$$

Component failure rate λ_C ; Base failure rate λ_B

Adjustment factors:

- Operating and environmental condition π_E
- Specific failure mode π_{FM}
- Uncertainty data source π_{DS}



Result analysis

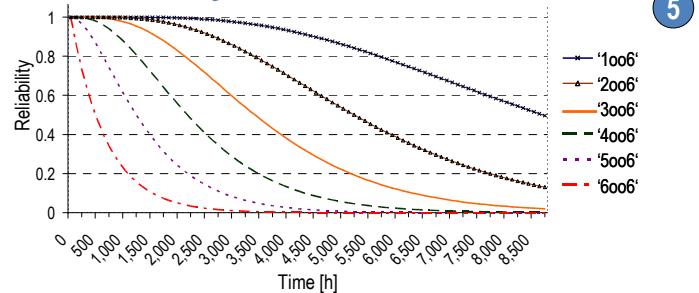


Fig. 2: Reliability Hydraulic PTO for different generating capacities (noo6 units)

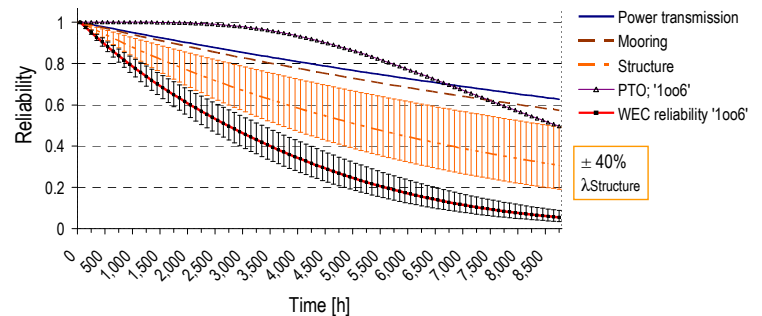


Fig. 3: System reliability and effect of uncertainty

Identifying critical sub-systems

Criteria: Cost, Failure frequency, Uncertainty

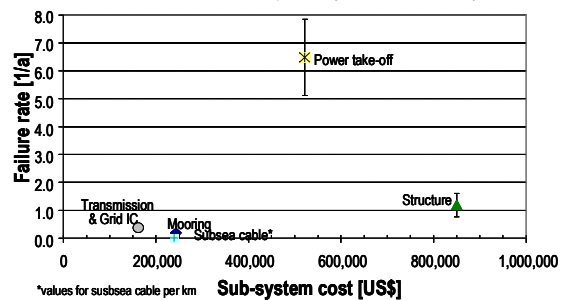


Fig. 4: Sub-system criticality matrix

Further Work

- Developing a reliability/availability model for MECs, relating the uncertainty of failure rates to economic viability
- Developing statistical methods to update reliability models for MECs
- Investigating the applicability of service-simulation component testing for MECs

References

1. Boud, R. (2006). *Future marine energy*. [Carbon Trust report].
2. Det Norske Veritas [DNV]. (1997) *Offshore reliability data handbook (OREDA)*. 3rd ed.
3. Department of Defense (1991). *Reliability prediction of electronic equipment, MIL-HDBK 217F*.
4. Technis (2006). *FARADIP.THREE, Failure rate data in perspective, Database, Issue 4.1*