

## **Title: Gearbox Life in Wind and Tidal Turbines: Solutions and Novel Monitoring Techniques**

### **Abstract – Professor Jon Wheals (Ricardo UK)**

The presentation describes the basis for differences in component loading arising in speed *reducing* gearboxes used in most industrial applications (that meet life expectations), and the speed *increasing* gearboxes used in wind and tidal turbines subject to fluctuating multi-axis loads (that do not meet life expectations). Accepting the advantages of speed increasing drivelines, and the universality of failure modes of bearings, the following new technologies are discussed:

- Theory and experimental results are presented from a device to isolate the gearbox from non-torque loads and to limit such torque loads in conjunction with the slow-acting pitch system.
- Rig results are presented for a device now deployed in a 600kW wind turbine that prolongs the life of standard planet bearings within the epicyclic stage.

A second aspect of work relates to early detection of faults and the practicality of installing ultrasonic and acoustic emission (AE) sensors on gearboxes, namely:

- Ultrasonic detection of roller/raceway load, in addition to detection of oil film.
- Transfer path analysis to compare accelerometer and AE signals through bearing and mesh paths

A third aspect of work relates to experimental replication of bearing failure, and an understanding of the differences between standard bearing life models and those subject to different operating regimes.

Concluding remarks conflate the evidence and solutions as recommendations as a path for a quantified reduction in CoE.

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