The development of a suitable Condition Monitoring System (CMS) for the damage detection in gearboxes is especially important for offshore applications. Gearboxes are among the components with the longest down times in wind turbines (WT). Service and maintenance are - especially in the offshore sector - associated with high costs. For this reason, more and more gearboxes are being equipped with oil sensors which, as part of an on-line CMS, monitor the condition of gearboxes and give timely fault reports to operators. In this way, the risks of damages could be reduced and gearbox breakdowns could be avoided. However, oil sensor technology reliability at present does not meet the high demands of WT operators as in the field false reports often occur resulting in unnecessary and costly maintenance operations.

Oil Quality as Condition Indicator

The sensors can detect faults or defects based on the oil quality. Various studies on Oil-Condition-Monitoring have detected the relationship between the gearbox condition and the oil quality. However, it is still unclear, whether sensors can ascertain the gearbox oil condition reliably.

Suitable testing facilities are required for ensuring oil sensor reliability and at the same time increase WT availability. In order to achieve this objective, oil sensors must undergo rigorous testing before they are installed in WT gearboxes.

New Test Methods for Oil Sensors

The main focus of the BMU project „DegradO“ at the Fraunhofer IWES lies in the area of WT degradation under the influence of offshore environmental conditions. At present, in the growing wind industry there is a lack of procedures for the simulation of load and environmental conditions. The aim of DegradO is to develop new testing methods for investigations into the degradation processes in WT and their components. By using suitable test facilities, the reproducibly.
simulation of the environmental conditions under realistic conditions will be possible. One of these test facilities is an oil sensor test stand, whereby Fraunhofer IWES reproducibly simulates the operating conditions of a WT gearbox oil circuit. In order to test the performance of different oil sensors, two oil ageing stages are simulated. The sensors are tested under changing operating conditions and contaminating pollutants such as wear debris, water, dust and air. In this way, the capability of the oil sensors to provide reliable values can be assessed. The main objective is the development and subsequent provision of standardised oil sensor tests for the industry.

**Services**

In agreement with customers, the sensors can be tested for different gearbox oil operating and ageing conditions. By employing various oil contaminants and operating conditions, real-life scenarios can be recreated. The focus of the tests are reliability, accuracy and oil sensor operational capability under the effects of influences such as particles, water or air in the oil. If required, additional vibration and temperature tests can be carried out under realistic conditions in a HALT (Highly Accelerated Life Test) / HASS (Highly Accelerated Stress Screen) test chamber.

**Target groups**

- Wind farm operators
- Wind turbine manufacturers
- Gearbox manufacturers
- Oil sensor manufacturers
- Oil producers

By means of a propose-designed oil sensor test bench, Fraunhofer IWES evaluates the performance of various types of oil sensors that can be used in the gearboxes of modern wind turbines. By recreating several operating conditions in the test bench for different oil aging stages, oil sensors can be tested intensively. These tests also include the artificial contamination of the oil through metallic particles, water, dust, among others.

- Oil types: mineral oil, PAO, PAG. Tests with Fresh and aged oil possible
- Temperature: 30 °C -100 °C
- Flow rate: up to 15l / min
- Oil pressure: 10 bar
- Insertion of contaminants: water, Ferromagnetic and non-Ferromagnetic particles. Analysis of air-oil-dispersion possible by Flender gears
- Installation options: 6 sensors in the horizontal pipe, 4 sensors in the vertical pipe. Possible variation depending on the size of the sensors