OPTIMUS - Demonstration of Methods and Tools for the Optimisation of Operational Reliability of Large-Scale Industrial Wind Turbines

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Project Background

OPTIMUS is a 36 month EU funded FP7 project with 12 partners participating from six countries across Europe. The project follows on from the recently completed NIMO FP7 project.

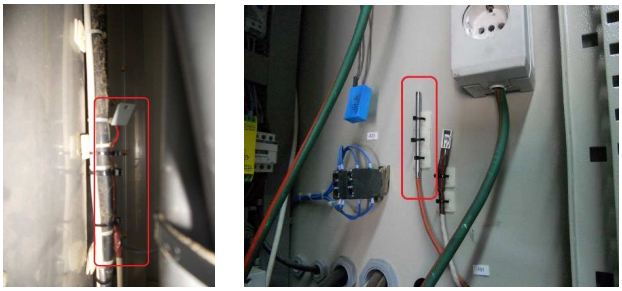
The power output from wind turbines has increased dramatically over the past 30 years from 50kW to 6MW and beyond. State-of-the-art condition monitoring systems, such as vibration-based systems and temperature sensors, are able to monitor and evaluate the current condition of components.

Due to varying wind loads, the generation of false alarms or even misinterpretation of the data collected is common place. In addition, commercially available condition monitoring systems offer no or very limited prognostics capability with regards to the remaining lifetime of a component before a serious fault occurs. Therefore, evolution to predictive maintenance strategies is currently impossible. Experience has shown that by combining disparate data sources successfully, wind farm operators will be able to move from a common reactive maintenance approach to a more cost effective risk-based operation and maintenance strategy with a high level of predictive maintenance scheduling.

TERNA Energy's Chilikoka wind farm where the OPTIMUS drive-train condition monitoring system is being tested

Project Objectives

1. To improve reliability within the wind power generation industry by delivering the prognostic technology necessary to evolve to predictive maintenance strategies, substantially reduce unexpected wind turbine failures and unnecessary costs and minimise downtime
2. Improvement in the efficiency of maintenance procedures and operational reliability of wind turbines
3. To support the implementation of the European Wind Initiative of the SET-Plan and contribute significantly towards achieving the reliability, socioeconomic and environmental targets that have been set for the European wind energy industry by 2020



Temperature sensors installed in power converter cabinet by INGETEAM Service in an AW-1500

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Work Package Highlights To Date

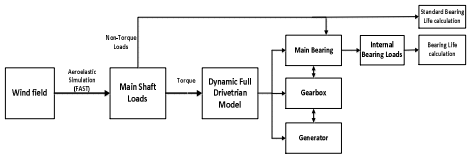
WP1 - Analysis of general failure modes of wind turbines
1. Collected failure data from a selection of onshore wind farms
2. Assessed existing commercial condition monitoring systems
3. Developed an energy costing model

WP2 - Gearbox reliability
1. Performed gearbox design reliability review
2. Executed failure root cause analysis
3. Developed drive-train simulation and analysis
4. Developed prognostic life models for drive-trains

WP3 - Condition monitoring of wind turbine electrical and power control systems
1. Instrumented a number of large-scale wind turbines for data collection
2. Carried out computer modelling and simulations
3. Implemented condition monitoring methodology for power electronics

WP4 - Load-independent condition monitoring of wind turbines
1. Analysis of variable load effects on condition monitoring measurements
2. Filtering variable load effects through novel signal processing methodology

WP5 - Cost-effective condition monitoring technology for wind turbines
1. Assessed condition monitoring requirements for wind turbines
2. Developed data fusion condition monitoring technique for demonstration



Dynamic Drivetrain Model from WP2

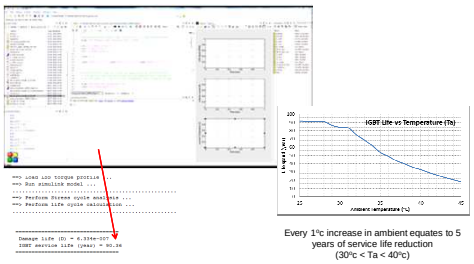
Next Steps

WP4 – Load-independent condition monitoring of wind turbines
1. Demonstrate load-independent condition monitoring methodology under actual conditions

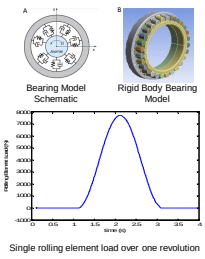
WP5 – Cost-effective condition monitoring technology for wind turbines
1. Demonstrate prognostics methodology for key components influencing reliability
2. Demonstrate reliability level achieved based on the new tools and methods developed

WP6 – Dissemination and exploitation of knowledge
1. Disseminate and exploit key project results through numerous channels

WP7 – Training
1. Assess existing standards and prepare training procedures for relevant personnel



Converter/Device Prognosis Model from WP3



Main Bearing Modelling from WP2

Project Partners

ORE Catapult, University of Birmingham, Feldman, ACCIONA Energia, TERNA ENERGY, ROMAX, UCLM, ISQ, D2S, University of Sheffield, INGETEAM Service, INDRA, and Kyungpook National University (associate member).

http://optimusfp7.eu
http://ore.catapult.org.uk