



EDF Renewable Services

Romax vibration detection and analytics deliver ROI through improved O&M and enable more confident warranty claims

Client

Operations and Maintenance (O&M) group for EDF Renewable Energy; the largest provider of third party O&M in North America, servicing over 7,400 turbines, 40+ equipment types and 720+ inverters, generating over 9,300MW of electricity.

Challenge

Improve detection and provide new insights into wind turbine damage at multiple locations - to inform planning of inspections and maintenance, and support end of warranty claims.

Solution

Partnering with Romax - including innovative portable vibration detection equipment, access to expert personnel and proven expertise in analytics.

Benefits

Improved fault detection and identification across multiple fault/damage types, enabling a better targeted and more cost-effective inspection and maintenance process; more focused remedial action to help extend wind turbine lifecycle; more effectively supported warranty claims; ROI of up to 20:1.

An industry leading provider of Operations & Maintenance (O&M) services in North America, EDF Renewable Services (EDF RS) wanted to identify damage in wind turbines more effectively to support end of warranty campaigns and enable improved planning for inspections and maintenance. As a result, EDF RS partnered with Romax, acknowledged experts in vibration and condition monitoring services for onshore and offshore wind turbines, and are using its innovative portable vibration system. The benefits soon became clear: two projects quickly identified planet bearing damage subsequently confirmed by inspection, with a blade alignment issue also detected and corrected. Owners were provided with an overall machinery health baseline, delivering a solid basis for planning scheduled inspections in the following three years.

"With the planet bearing damage that we identified in our joint campaign, we supported a warranty claim of US\$600,000 – a return on investment in the region of 20:1," says Mike Cookson, EDF Renewable Services. "The ability to know which turbines to target means we have a much better process in place for managing inspections and maintenance."

An industry-leading approach

At end of warranty, wind farm owners need to identify and gather evidence for warrantable claims as well as gaining a thorough understanding of the condition of their equipment for refined O&M cost forecasting and budgets. Used in isolation, borescope investigations of the gearbox may not identify many issues, such as ring tooth cracks below the oil line or bearing damage in hard-to-access locations. At the same time, "standard" approaches to using vibration signal processing to detect faults typically fail to identify most problems - having a negative impact on industry confidence in this approach. "Results from many suppliers were poor," says Dr. Ashley Crowther, Romax Technology. "We are working to rebuild industry acceptance of portable vibration in the only way possible: by yielding real results. Two elements underpin this. First, our many years' experience developing techniques specifically customised for wind. Second, investing in the time required to do this type of work properly." Cookson says, "We chose Romax because of its software expertise and impressive technologies. Romax seemed the obvious choice because of its vast experience in condition monitoring and extensive array of current projects." EDF Renewable Services carries out the measurements using Romax' portable vibration system, with Romax performing specialist analysis to identify issues with drivetrain systems and producing a data-driven inspection list. EDF RS then carries out inspections and confirms damage to support any warranty claims.

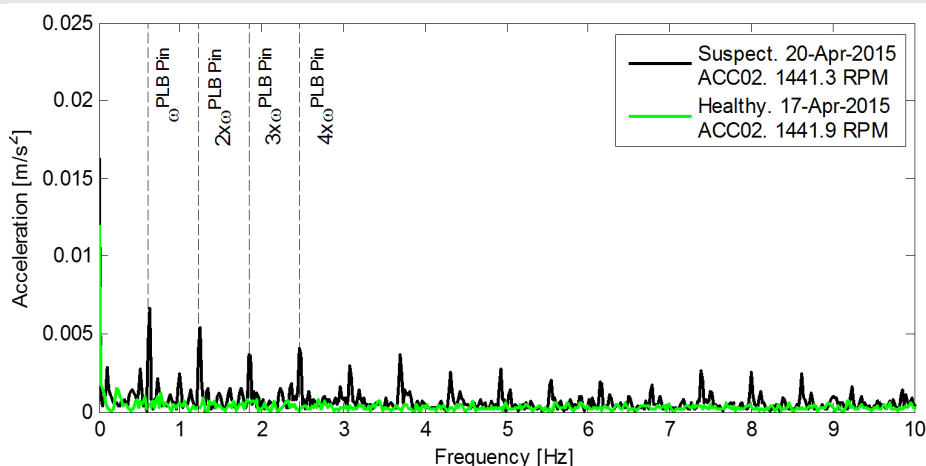


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Mike Cookson
EDF Renewable Services



Romax engineer installing PVS equipment



Repeating harmonics at planet pin (shaft) rotation

Identifying different damage types

With EDF RS fully appreciating that renewable energy facilities represent a substantial investment, the company takes an "owner-operator approach" to deliver maximum returns on these assets. A key challenge is that wind turbine gearboxes are subject to a diverse and difficult-to-pinpoint range of issues. For example, tooth cracking and eventually separation can occur when gears have inclusions in their steel, or teeth have been ground with an improper temper. Bearings can develop axial cracks, which eventually lead to the race spinning on the shaft after cracking through. Planet bearings (rotating elements) suffer from rolling contact fatigue manifested as spalling of the raceways and typically near wear out later in life. Bearings throughout a gearbox can develop micropitting, with the damaged region eventually progressing into macropitting. Planet ring (annulus) gears, when through hardened, are softer than debris generated from other gears and bearings, and the debris damage sometimes leads to tooth fracture. Main bearings that transmit thrust load through spherical rollers often suffer micropitting, with the debris leading to race macropitting and eventually edge cracking. All of these types of damage are detectable using Romax' portable vibration system.

Innovative technology combined with domain expertise

Specifically designed for wind turbines, Romax' portable vibration system is easy to install, rugged and reliable. "It was created based on sophisticated vibration analysis techniques we developed for a major turbine model where the detection rate of damage is very high," Ashley Crowther says. Working with EDF technicians, Romax installs its portable vibration system on each turbine. After data collection, Romax vibration engineers identify the damaged components, focusing on high cost repairs such as main bearings, planet bearings and blade damage.

"The expertise offered by Romax staff is particularly impressive," says EDF's Mike Cookson. "Sometimes, we want to make improvements to our process, so discuss these with the Romax experts, who then offer a flexible approach to implementing these improvements going forward, and ensure we can further increase efficiency in future projects. Sometimes the conditions we want to detect are incredibly hard to find, but conversations with the Romax technical team allow them to be located and improvements made to the whole process."

He adds, "Our intent was to manage the entire inspection scope of work. Instead of arbitrarily checking machines, we can now target machines that have performed badly in inspection results. We know in advance which machines are going to require maintenance, and can target those particular offenders and confidently enter into warranty claims - supported by the Romax results."

In one case, the Romax approach was applied to a 63-turbine wind farm in the US Midwest coming out of warranty. EDF technicians carried out site-wide drivetrain measurement using Romax' portable vibration system, and Romax analysts applied sophisticated algorithms to determine which planet bearings were failing – focusing attention on one specific gearbox model, in the planetary stage, based on the team's expectations of higher failures. Among the various problems identified, rectified or claimed, the standout result was identifying issues with two planet bearings, with physical evidence gathered by inspection. The resulting warranty claim exceeded US\$600,000.



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