hrl:

Wind tower bolts

expertise in action

hrl: enables improved corrosion mitigation for large wind turbine operator

Challenge

Wind energy has become the dominant renewable energy source in Australia with over 77 wind farms currently operating, totaling in excess of 4000 MW of capacity, and more to be installed. Many of these farms are situated near coastal environments and at altitudes that are constantly saturated.

This wet environment often causes corrosion issues with the foundation bolts, posing a significant risk to the tower's integrity. Foundation bolts are the only component of the system that cannot be changed out over the life of a wind tower, so their integrity limits the safe operating life of the wind turbine.

A major wind farm operator discovered alarming levels of corrosion of foundation bolting, located just below the concrete to flange interface of a tower's base. This corrosion of threaded bolts set in concrete, grout, or similar substances reduces their effective cross-sectional area reducing bolt strength and consequently component integrity. Traditional non-destructive testing methods have not been able to detect and measure the extent of corrosion without removing the surrounding concrete, which is an intensive and costly exercise. The client needed a quick and non-invasive inspection technique to identify and monitor hidden corrosion issues in the foundation bolting.

Solution

The client engaged HRL to develop an effective, specialist in-situ inspection technique that would detect and quantify the hidden corrosion of bolts. Advanced ultrasonic inspection techniques were developed using Phased Array Ultrasonic technology. HRL used its suite of advanced inspection tools and knowledge to develop techniques to scan bolts while in-situ, enabling the collection and analysis of large amounts of data from many bolts.

In the process, HRL also developed new methods for calibration and evaluating phased array ultrasonic data to quantify the corrosion wastage of the affected bolts. This inspection technique was then implemented over multiple towers at many wind farm sites, enabling HRL to collect and analyse repeatable scan data to identify and quantify corrosion wastage.

Results

After this initial phase of work, the client engaged HRL on an ongoing basis to complete multiple, repeatable inspections on numerous wind farms over several years. The data collected and analysed identified corrosion issues with several wind towers, and over multiple inspections corrosion wastage rates have been established.

The client benefited from the corrosion assessment. By engaging HRL the client now has visibility of a previously hidden issue, and the insights needed to better plan corrosion mitigation strategies and determine the likely remaining life of its wind turbine fleet.

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