Wind Solutions®

GUIDE

How to Increase Operational Reliability

Top 3 Condition Monitoring Practices to Implement in Your Wind Farm

Contents

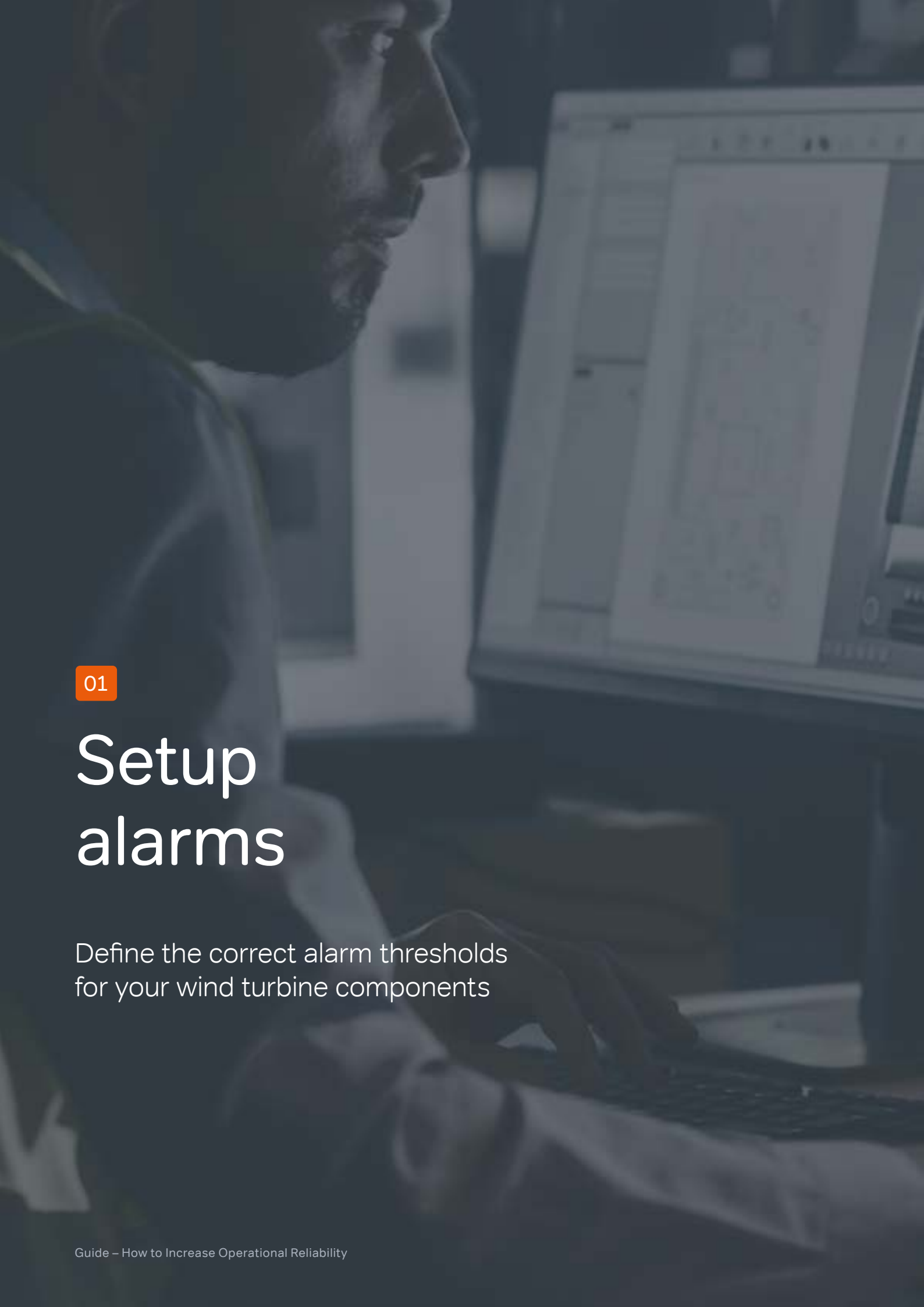
INTRODUCTION

Increase your wind farm's operational reliability

The need for a reliable condition monitoring strategy has never been more pertinent than now. The current global materials shortage has resulted in longer lead times on spare parts. This means owners and operators across the globe need to stay on top of emerging component faults to ensure that maintenance costs do not spiral out of control and avoid unnecessary downtime.

A condition monitoring strategy focused on increased operational reliability is core to building a solid knowledge base that prepares you for decisions regarding maintenance, service contract negotiations, end-of-warranty assessment, lifetime extension etc.

In this guide, we have gathered three essential condition monitoring practices that will improve your operational reliability and decision-making; reducing your wind farm's operating expenses and levelized cost of energy (LCoE).



01

Setup alarms

Define the correct alarm thresholds for your wind turbine components

Gain a full overview
You might not always have a complete overview of how your core components are faring. When you acquire or take over a wind farm after the OEM warranty or even an ageing fleet, it can be challenging to determine the health of core components in the drivetrain. Shifting to a more preventative and condition-based O&M strategy will improve your overview.

Retaining a detailed overview of changes to vibrational behaviour will help you understand whether or not vibrations deviate from the original operational mode. Ultimately, this comes down to if you set the correct alarms to react to changes in vibrations.

Monitor without kinematic data
If you have acquired older wind turbines, you might not have access to the turbine's kinematic data. Failure mode related frequencies can be deduced from the kinematic data, which helps determine the failure modes of the mechanical components. Without it, you won´t get a comprehensive overview of the components' health.

To prevent this situation, you can choose a CMS service provider that can monitor your components independent of kinematic data and takes a fingerprint of the current vibrations. This patented, unique approach adds a layer of security to your condition monitoring, allowing you to calculate alarm thresholds across the whole frequency domain of the vibration spectre of your components. Essentially, increasing the reliability of your condition monitoring operation.

Fast track

- **Changes to vibrational behaviour will help you understand whether or not vibrations deviate from the original sound operational mode.**
- **Kinematic data are important as they can help deduce failure mode related frequencies, which help determine the failure modes of the mechanical components.**
- **Choose a CMS service provider that can monitor independent of kinematic data.**

02

Identify fault patterns

Focus on increased vibrational behavior

Focus on fault modes and patterns
A typical corrective maintenance approach may entail performing yearly or half-yearly service inspections. However, faults in the drivetrain may develop rapidly between inspection intervals, and challenges with limited access due to harsh weather conditions may persist, building a solid case for online condition monitoring.

Different fault modes and patterns can be challenging to identify under varying operational modes and changing environmental conditions. Still, with the rigorous use of a condition monitoring system, you can make the process easier. Fault patterns occur due to component defects, erosion or in response to maintenance procedures.

An example is increased vibrations related to the blade pass frequencies, which might correlate with the service date and the service team leaving the wind turbine with incorrect pitch offset settings. This might not lead to an immediate component failure but can impact midterm overloads on other drivetrain components–and ultimately decrease energy production.

Flag unusual vibrational behaviour
Utilizing a CMS solution, you can track the wind turbine drivetrain's overall operational vibrations and behaviours and flag things that seem out of the ordinary. Emerging fault patterns might originate not only from the sensor located close to the monitored component but also from other unmonitored components.

For example, abnormal vibrations detected around the main bearing could even originate from a nearby external pump. When reviewing service logs, you can cross-check whether or not there might be a correlation that can account for the changes in vibrational behaviour.

Fast track

- **Different fault modes and patterns can be challenging to identify, but with the correct use of a condition monitoring system, you can make the process easier.**
- **Fault patterns occur due to component defects, general wear and tear, unusual high load situations or in response to maintenance procedures.**
- **Track the wind turbine's overall operational vibrations and behaviours, and flag anything that seems unusual.**

03

Apply fault prognosis

Minimize lead times and reduce spare part costs

Maintenance optimization
Like many monitoring and O&M professionals, you are most likely looking for an approach or system that can help you optimize your maintenance operations.

Determining more accurately when components need replacing before they disrupt energy production is essential if you want to order spare parts and schedule service maintenance in advance.

If you operate an offshore wind farm, the equipment, permits and staff costs will set you back $10,000 in starting costs—before the actual maintenance work has commenced. Fault prognosis can drastically reduce O&M costs while ensuring a detailed view of your wind turbine fleet's health.

Use a condition monitoring service with prognostics
An exact date for component replacement cannot be predicted, as this depends on how the wind turbine is utilized and production needs. However, a condition monitoring service can help you identify a component's estimated remaining lifetime.

Previously, you might have received reports with recommended maintenance actions to incorporate into your maintenance plans. Now, it is possible to go even further. Using aggregated maintenance data and machine learning, CMS service providers can determine the probability of maintenance needs and repairs for a given component.

This allows you to plan maintenance and repairs based on accessibility to spare parts and seasonal weather conditions. For example, suppose there is a significant probability that the main bearing needs replacing in February, during wind season. In that case, you can set the given wind turbine in curtailment mode until April, when you are out of the wind season.

Fast track

- **Determining when components need replacing is essential if you want to order spare parts and schedule service maintenance in advance.**
- **Choose a CMS service that can determine the probability of maintenance needs and repair work on a component.**

SUMMARY

Choosing a monitoring service provider

Building your in-house monitoring workforce can be challenging, as it demands a specific fleet size to be efficient. There is no doubt that the benefits of choosing an external condition monitoring service provider outweigh the costs for small to mid-size operators.

Moreover, choosing a condition monitoring service allows you to access wind turbine vibration specialists with in-depth knowledge and expertise of individual turbine models. At the same time, you avoid investing in new staff that require onboarding and training. In other words: you can get high-quality condition monitoring that helps you increase operational reliability and secure your wind farm's profitability.

Next steps

At KK Wind Solutions, we have 25+ years of experience developing condition monitoring systems for the wind industry. Our flagship condition monitoring solution, TCM® (Turbine Condition Monitoring), is an industry frontrunner in developing new monitoring practices that help secure the operational reliability of your wind farm.

Our condition monitoring service, TCM® Monitoring, identifies early damages and faults across your entire wind turbine fleet, providing you with recommended actions. With our unique patented approach, we can set up accurate condition monitoring alarm thresholds independent of the wind turbine brand and with or without the kinematic data.

With over 15 years of condition monitoring data at our hands, our service provides you with an accurate fault prognosis—improving your operational decisions that help reduce turbine downtime and increase power production.

Contact us if you want to know how we can help you improve your wind farm's operational reliability and profitability.