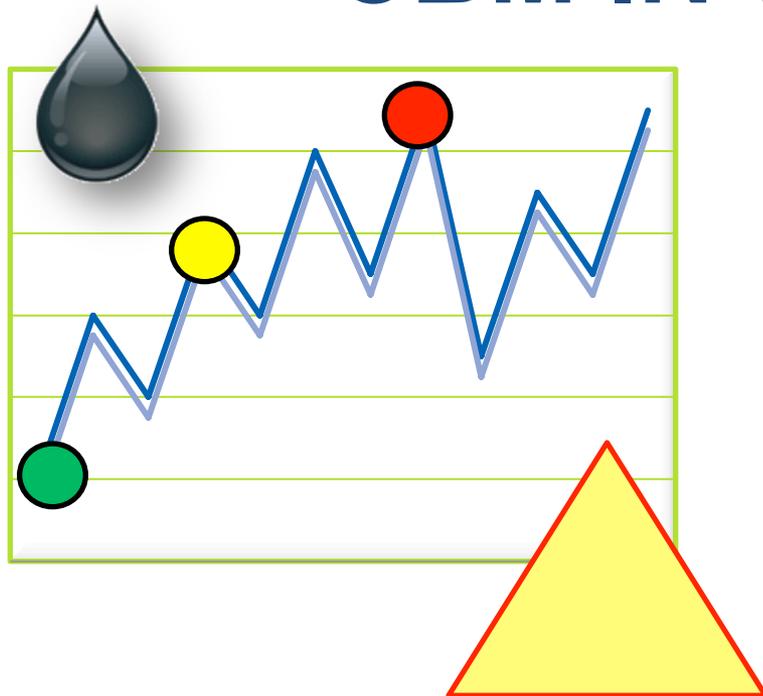




CBM IN WIND TURBINES: PITFALLS & CONCERNS



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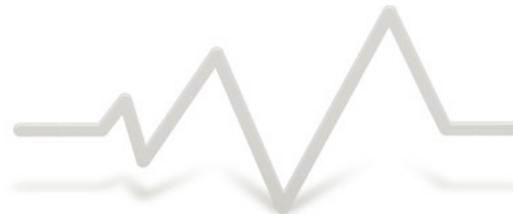


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SYSTEMS CURRENTLY USED

❖ Types of Systems

- Vibration
- Oil Debris
- SCADA
- Combinations

SYSTEMS CURRENTLY USED

❖ Vibration Analysis

- This technology is widely used and accepted in other industries but their cost v benefit is hindering in Wind.
 - This type of system can monitor nearly every component on the turbine
 - Early warnings are somewhat of a down fall
 - Requires expertise to interpret data
 - Need to develop the proper time for notifications to avoid “Crying Wolf”

SYSTEMS CURRENTLY USED

❖ Oil Debris

- Oil Debris is effective but only for the gearbox
 - Cost is acceptable
 - Easy to install
 - Easy to interpret data

SYSTEMS CURRENTLY USED

❖ SCADA Data

- SCADA has much information and often is not mined effectively
 - Production data
 - Certain temperatures
- This data can be used to correlate CM data
 - High levels of vibration can be explained by unusual production spikes caused by wind gusts
 - Spikes in Oil Debris are connected to start ups

SYSTEMS CURRENTLY USED

❖ System Combinations

- Combining technologies can be very useful
 - Vibration/Oil Debris: Oil Debris can give confidence when a Vibration sensor detects a developing bearing defect, driving down the number of “False Positives” and gaining the much needed faith of the Field personnel.
 - Backing up CM data with SCADA data is also very helpful in diagnosing operational issues.

EXPERIENCES

❖ Our Experience

■ Pitfalls

- Field Support has been varied
- Skeptical about Vibration in general because of early flags
- “False positives” that are not yet detectable by
 - Visual or bore-scope
 - Audible detection
- “Run to Fail” mentality

■ Successes

- Hits by
 - Vibration
 - OD
 - SCADA
 - Combinations

EXPERIENCES: PITFALLS

❖ Pitfalls

- Field Support can be mixed depending on their initial experiences
 - They become skeptical of Vibration detections because the notification to the site comes before it is actually visible.
 - These “False positives” can be avoided by holding off with site notifications until a level of vibration is detected which justifies an investigation.
 - Visual or bore-scope inspections as well as Audible detection are all necessary in order to prompt any real maintenance activity in the field
 - A “Run to Fail” mentality has become the norm for some in the field simply because of their perception of how useful these systems are to them
 - Another critical part is maintaining the CM equipment. Sensors fail, requiring troubleshooting and diagnostics
 - This is an area needing much consideration when deploying Condition Monitoring in order to achieve success with your program.

EXPERIENCES: SUCCESSES

❖ Success

- Successful hits are what give our CBM program life. Without them there would be no way to sell their value to customers and asset managers. With them we realize cost savings by reducing the severity through early detection.
 - Our successful hits by
 - Vibration:
 - » Many successful detections on the parallel section of the gearboxes
 - Intermediate and High Speed Shaft bearings have been detected prior to complete failure allowing for up tower repairs in many cases.
 - » Other components up tower are monitored by Vibration
 - Generators, Towers and Main Bearings can be included and provide valuable information as well.
 - OD:
 - » We have detected many gearbox bearing failures with enough time to plan and perform unscheduled maintenances
 - Bearing replacements (many up tower replacements)

OUR CUSTOMERS

❖ Growing Interest but using Caution

■ Concerns

- Difficulty in providing acceptable cost justification to asset managers has been slowing the widespread installation of any technology.
 - The payback is most evident when CM is instrumental in identifying a defect before it runs to failure
 - The discussion amongst insurance carriers is increasing and may be a driver in the future
- Deciding on which technology(s) are your best solution is a serious consideration and impacts progress for sure
 - Questions about entry level options and their cost is definitely a key factor, as well as “will this solution be sustainable over time” or “should we commit to a larger investment in the beginning” to realize the best value over time.
- These are all valid concerns and worth consideration for your future.

SUMMARY

❖ In Summary

- Condition monitoring is an essential consideration moving forward in order to have any level of predictability, which gives an element of control for planning and budgeting.
- Where does the money come from and which system or systems are the best value and most powerful for your application? That is something that must be decided by you.
- Investigations are an important part of any successful condition monitoring program. This budget will diminish over time but must be considered in the planning and budgetary phase.

Thank You for Your Time