

Journey to a New Paradigm in Utility Condition-Based Maintenance

Ben Lawrence, Jacob Loverich, & Lorne Poindexter



Abstract

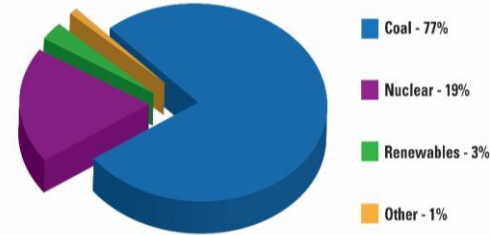
National security risks and the scope of catastrophic failures mean utility companies have been among the most conservative and aggressive with time-based maintenance. Thanks to new EPRI guidelines, utilities now have the chance to combine PI and continuous online machine health monitoring tools such as SmartDiagnostics® to reduce maintenance intervals and optimize machine performance. This new approach is poised to dramatically shift the maintenance and reliability paradigms that utilities have followed for decades. But are utility companies ready for this shift? What are the implications of introducing new technology and data analytics into a traditional maintenance model? In this session you'll learn how Ameren has already saved \$798,000 by avoiding a plant down power and discovered ways to build a safer, more predictable utility plant. See how PI is helping Maintenance and Reliability professionals optimize America's utility infrastructure.

Ameren Missouri

Integrated Electric & Gas Utility

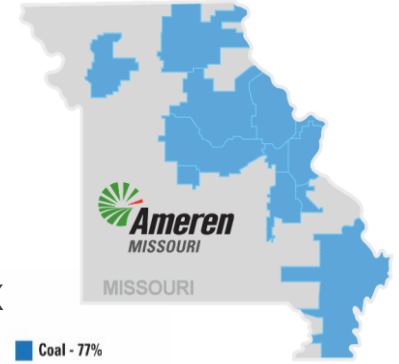
- 1.2 million electric customers
- 130,000 natural gas customers
- 24,000 square miles of service territory
- 2,900 miles of electric transmission lines
- 33,000 miles of electric distribution lines
- 10,200MW of generation
- Service to 64 counties and more than 500 communities
- ~ 3,600 employees

2017 Fuel Mix



Other Generation Sources include:

- Natural Gas
- Methane Gas
- Wind Energy
- Solar energy



Opportunity

Online monitoring enables early detection of pending failures that often go unnoticed using infrequent time-based inspections

Continuous online equipment health monitoring eliminates the need for expensive time-based tasks **without increasing risk**

EPRI's Continuous Online Monitoring (COLM) Quick Guides describe the sensors and analysis methods needed to eliminate preventative maintenance tasks

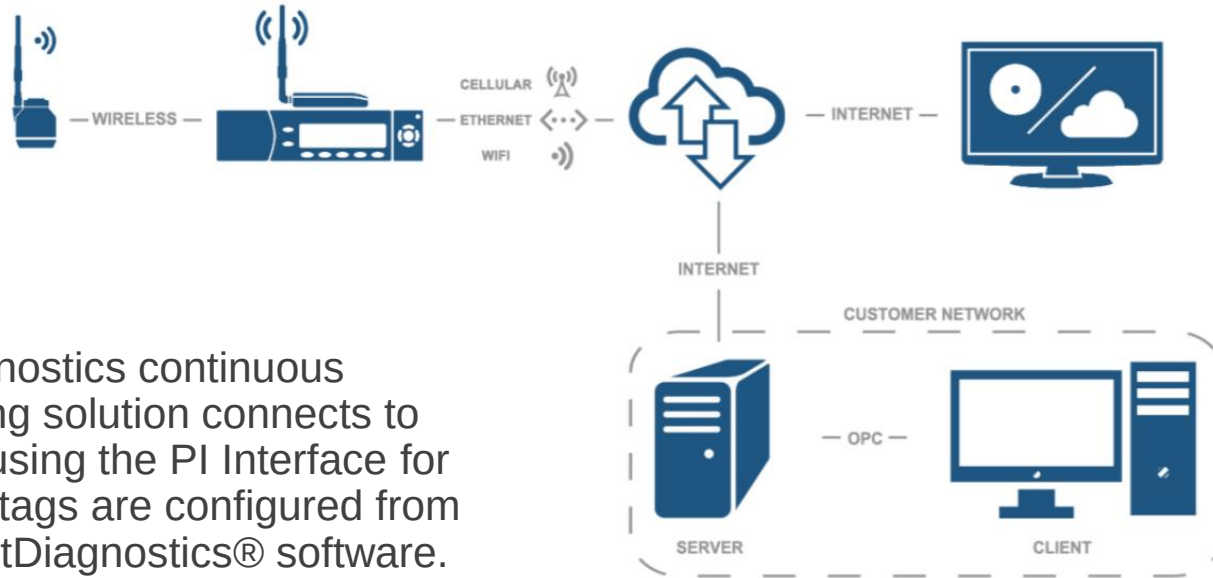


Sensor detectability must be **at least equal to or greater** than current PM task effectiveness

SmartDiagnostics paired with the PI System enables continuous online asset health monitoring

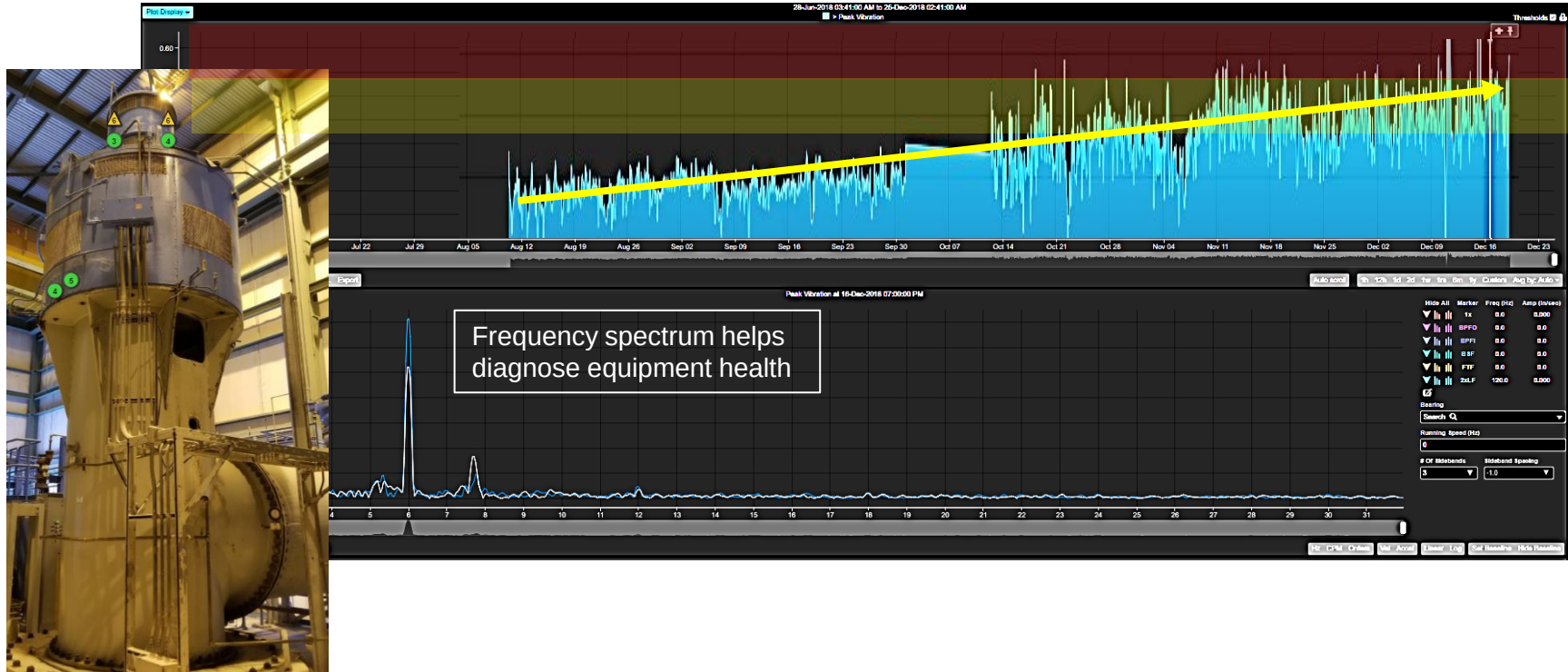


SmartDiagnostics cloud is connected to on-premise PI using a PI interface for OPC DA

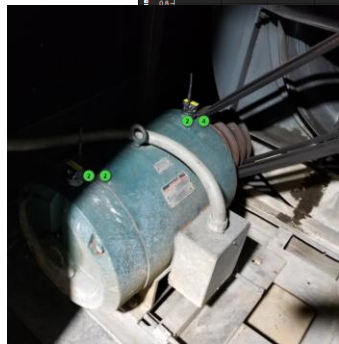


The SmartDiagnostics continuous online monitoring solution connects to the PI System using the PI Interface for OPC DA. OPC tags are configured from within the SmartDiagnostics® software.

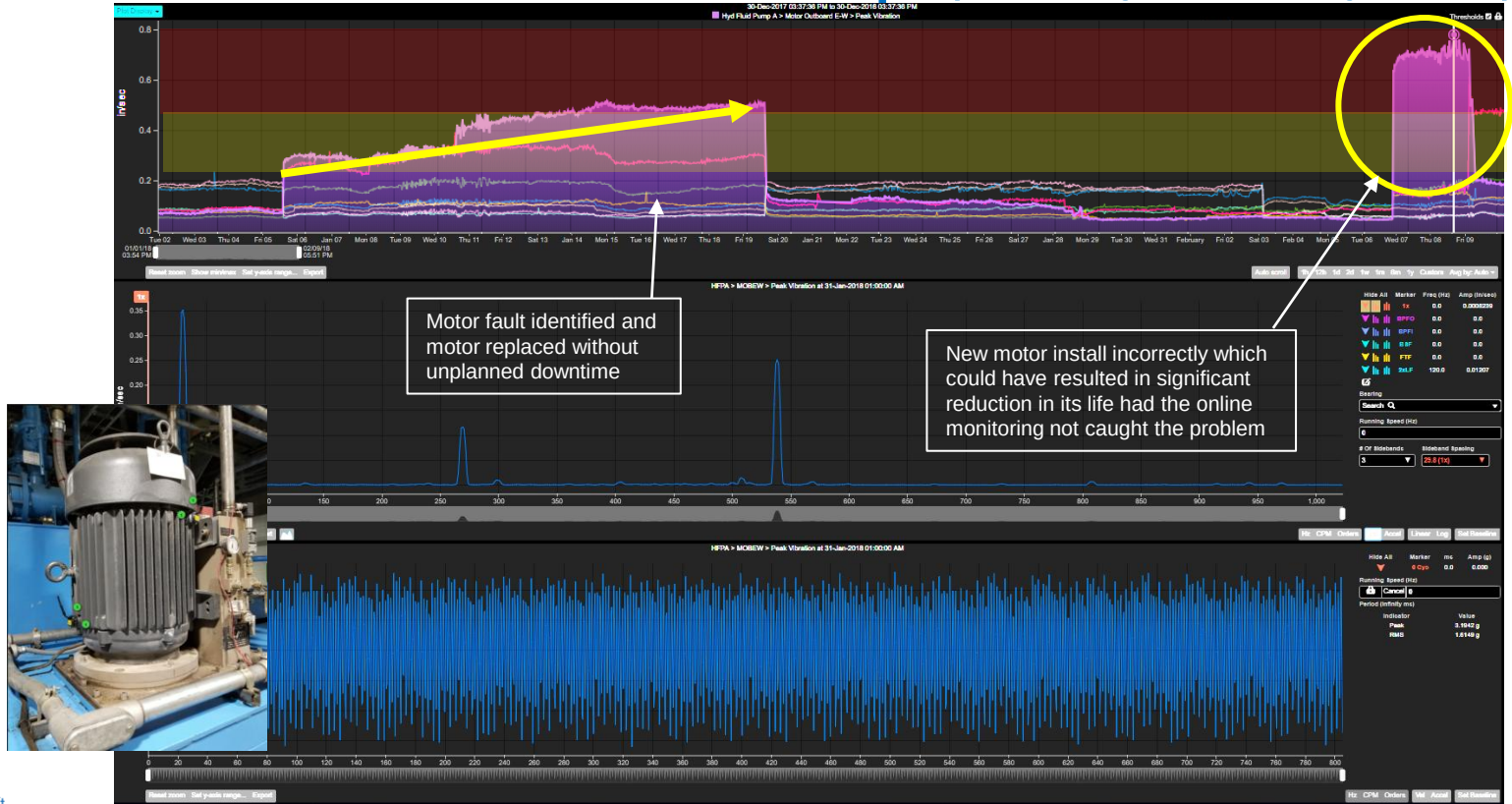
Circulation Pump (Aug 2018 – Dec 2018)



Iso Phase Fans (June 2018)



Hydraulic Fluid Motor/Pump (January/February 2018)



Main Feed Pump

- Avoided a Plant downpower from 100% to 65% to remove Main Feed Pump from service
- Downpower from 1250 MWe to 812.5 MWe is a loss of 437.5 MWe per hour
- $437.5 \text{ MWe} \times \$38 \text{ per Megawatt} = \$16,625 \text{ per hour in lost revenue}$
- Main Feed Pump repaired and returned to service in 48 hours would have resulted in \$798,000 in lost revenue

Lessons Learned

- Most degradation mechanisms can be measured by sensors.
- Sensor detectability must be equal to or greater than current time-based preventative maintenance task effectiveness in order to be accredited.
- Continuous monitoring doesn't mean measurements every second. Once per minute or even once per hour is sufficient.

Lessons Learned - continued

- Continuous online monitoring is primarily focused on fault detection while diagnosis can be done through a targeted inspection.
- Severity 1 degradation mechanisms which can progress rapidly are unique and require additional levels of sensor coverage.
- EPRI offers an approach but a utility may determine degradation mechanisms/influences to be less severe based on their internal OE or may accept a higher level of risk for component failure.

Vision - continued

- Ameren Callaway is looking at a plan that will fully implement continuous online monitoring on 4 or 5 systems in 2019.
 - Condensate pumps/motors, Heater Drain pumps/motors, Service Water pumps/motors, Circulating water pumps/motors, and Intake pumps/motors.
- The monitoring will provide better data for an Advanced Pattern Recognition (APR) software to run analytics.
- With better data we get single point alarm capabilities for detection plus analytics can provide true predictive maintenance.

Vision for Ameren Callaway and Wolf Creek

- The key to continuous online monitoring is early detection of problems to allow more portable sensors to be deployed if necessary to fully troubleshoot the developing problems.
- The most important question we need answered is “Do I need to work on this today”.
- Detection, analytics, and advanced troubleshooting will allow planned maintenance within acceptable windows.

KCF Technologies & Ameren

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CHALLENGE

Historically, utility risk aversion has limited adoption of condition-based maintenance practices despite their promise for improving reliability and reducing preventative maintenance cost.

- Preventative maintenance activities carried out on a time basis are often the wrong work at the wrong time.

SOLUTION

Continuous online monitoring in collaboration with advanced analytics can enable early problem detection, maintenance planning, and ultimately true predictive maintenance.

- Wireless online machinery monitoring integrated with PI using OPC DA
- PI provides a collaborative data sharing supporting advanced analysis

RESULTS

At the Callaway site \$798k in cost avoidance was recorded over from January 2018 to December 2018.

- Main Feed Pump problem addressed without plant interruption
- A 65% downpower was avoided

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