

CUTSFORTH CONDITION BASED MONITORING

This paper may be used in conjunction with Cutsforth™ Monitoring Integration Professional Development Webinar from August 27th 2020. You can find the recording at Cutsforth.com/CBM

⚡ INTRODUCTION

This paper is intended for power generation facilities looking for more information about generator monitoring systems. The below information is the combined efforts of Cutsforth™ and [WSC, Inc.](https://www.wscinc.com)

Cutsforth is committed to innovative technologies for the power industry, especially in developing condition - based monitoring systems.

WSC, Inc assists the power industry in implementing, improving, and deploying monitoring programs and monitoring and diagnostic centers.



⚡ EQUIPMENT RELIABILITY PROCESS:

The Equipment Reliability Process (ERP) refers to the actions taken to measure the condition of plant assets. The most important aspect of the ERP is the implementation of monitoring systems to accurately report asset health. It includes a good condition - based maintenance program centered on real - time monitoring systems, and a maintenance and diagnostic (M&D) center. This M&D center analyzes the data produced by continuous online monitoring (COLM). The COLM translates the data into actionable information, which improves the timeliness of maintenance events and reduces the risk of unplanned outages. The goal is to repair equipment before it fails catastrophically.

⚡ WSC MONITORING INSTALLATION PROJECT

The company in this WSC led study determined to reduce the risk of equipment failure. The company realized they simply did not have the resources to collect and process enough data to create models for failure conditions.

That's where WSC, Inc came in. They worked with the plant to come up with a business plan, installed tens of thousands of sensors over thousands of assets. The result was a comprehensive remote monitoring program that ingests data from disparate sources and the analytic tools to forecast maintenance events. The combination of automation and analytics affords the company to plan better and spend its capital more efficiently.

	DATA		INFORMATION	INSIGHT
Assets	Sensors	Data Acquisition / Plant Servers	Integration & Visualization	Monitoring & Diagnostics
10,000+	33,000+	2,400+ Nodes / 50+ Plant Servers		11,000+ APR Models
Turbine Critical Equipment Steam Turbine Combustion Turbine Generator Boiler Balance of Plant Motors, Pumps, Gearboxes, Fans Transformers Iso-Phase Bus Ducts Electrical Buses	Phase I = Base Installation Temperature Accelerometers / Vibration Turbine Vibration Monitoring (VOMS - Vibration Diagnostics Monitoring System) Proximity Oil Analysis Phase II = Critical Asset Sensors Cameras Thermal Cameras Infrared Sensors (IR) Electro Magnetic Signature Analysis (EMSA) Motor Current Signature Analysis Sensors (MCSA) CT (foreign object & leak detection) Phase III = Performance Sensors Gaps in performance monitoring (combustion monitoring, etc.) Operational Sensors Focuses on reducing operational risk, event free index	Signal Conditioning Equipment & Common Data Acquisition System Computer Servers	Advanced Data Analytics Software Component Health Dashboards	Integration of Sensor Signals to enhance APR models Thermal Performance Modeling Software Application



GENERATOR MONITORING

Generator monitoring lags turbine and motor monitoring. The question is why?

Corrective Maintenance vs. Preventative Maintenance:

Often, corrective maintenance trumps preventative maintenance, which trumps condition - based monitoring (CBM) maintenance activities. The basic psychology underpinning this hierarchy is simple: if a failure occurs, negative consequences follow. While preventative maintenance and condition monitoring can reduce or eliminate the risk of failure, the time and investment is not immediately evident. In short, the pay back will be in reduced maintenance events or longer lead times between maintenance events. Both require time to realize the benefit.

Reactive vs. Proactive:

There is an exodus of knowledge happening in the power industry as many people with decades of experience are retiring. Online monitoring can assist those few experts who remain to train the next generation of experts. This next generation, while inexperienced by comparison, have significant information processing skill sets and are comfortable implementing algorithm driven analytics. However, even if a technology - based approach is undertaken utilizing only periodic measurements, the risk remains that failure conditions will elude the subject matter experts or the analysts. Continuous data collection is the only method that ensures early failure conditions are not overlooked due to infrequent sampling. Continuous monitoring provides the data necessary to properly develop prognostic forecast tools for the generator.

HOW TO START A GENERATOR MONITORING STRATEGY

There are several recommended steps when creating a business plan to start a generator monitoring strategy:

- **Failure Mode Analysis**
 - » Determine which failures have already occurred, and if the plant was able to predict these failure modes ahead of time
- **Financial Analysis**
 - » Determine what a significant failure would cost, weighing that against the cost of a continuous monitoring program
- **Pilot Plant**
 - » Great opportunity to gather and test comprehensive analysis on a specific plant
- **Share the Value**
 - » Include the management team with every step of the process, sharing the data analysis and trends within management, outage scope, and performance meetings.

GENERATOR CONDITION MONITORING SUMMARY

Condition - Based Monitoring programs shouldn't just be the future of the power generation industry. They should be implemented today.

These programs reduce costs; reduction in failure risk, maintenance costs, and manpower costs are all achievable using technology that has steadily decreased in cost over time.

Better information affords operators the benefit of planning outage cycles more accurately and efficiently.

Plants are able to better optimize capital allocations for manpower and O&M.

"If [plants] don't have generator monitoring systems installed today, [they] will in five years, and will for sure in ten years."
- Bill Woynshner, President, WSC, Inc.