

INDUSTRY: POWER_

SMARTSIGNAL RAISES POWER INDUSTRY
AVAILABILITY AND EHS PERFORMANCE



DEMAND FOR POWER CONTINUES TO GROW, WHICH IS PUTTING NEVER-BEFORE PRESSURE ON POWER PLANTS TO MAXIMIZE AVAILABILITY.

LEAN STAFFING, RETIRING WORKFORCES, AND AGING EQUIPMENT ONLY MAGNIFY THE CHALLENGE. SMARTSIGNAL® PROVIDES THE EQUIPMENT-PERFORMANCE INTELLIGENCE NEEDED TO MITIGATE OR ELIMINATE MANY CAUSES OF FAILURE THAT IMPAIR AVAILABILITY. SMARTSIGNAL'S CUSTOMERS HAVE ACHIEVED AVAILABILITY INCREASES OF AS MANY AS 12 PERCENTAGE POINTS WHILE DECREASING THEIR COSTS AND IMPROVING THEIR EHS OUTCOMES. EVERY PERCENTAGE POINT OF INCREASED AVAILABILITY TRANSLATES INTO MILLIONS OF DOLLARS OF REVENUE. THIS PAPER ILLUSTRATES HOW SMARTSIGNAL PREDICTS, DIAGNOSES, AND PRIORITIZES OUR CLIENTS' EQUIPMENT AND PROCESS PROBLEMS, HELPS THEM AVOID MINOR AND MAJOR CATASTROPHES, AND HELPS RAISE AVAILABILITY AND EHS PERFORMANCE.

INDUSTRY CHALLENGES

Unplanned downtime is an expensive fact of life for power plants. Plant managers are under constant pressure to bring it under control. Even the best managers struggle to increase availability and reliability, optimize EHS outcomes, maximize return on capital deployed, meet performance targets, and maintain healthy relationships with regulators. And, with lean and aging workforces and aging equipment, the challenge is tremendous—to do a lot more with a lot less.

Most companies have reached a performance plateau deploying conventional tools and techniques. They seek a solution that will prevent emergency shutdowns; reduce derates; increase periods between outages; reduce overall maintenance requirements; improve scheduling of downtime and labor; and provide for better inventory control. They need more effective ways to predict their equipment failures, anticipate process failures, diagnose the causes of the failures, and prioritize them. The key to better plant performance lies in making better decisions based on existing plant data. Plant personnel face reams of data, along with cascading alarms. They need a way to evaluate the data to find the “needles in the haystack.”

Many plants use traditional time-based condition-monitoring tools to try to control their equipment, process, and EHS problems. But, traditional tools fall short because they:

- _ require a great deal of expertise to deploy, maintain, and use,
- _ analyze only a part of the problem,
- _ trigger too many false alarms,

- _ are difficult to calibrate to changing ambient conditions and loads, and
- _ miss the unique characteristics of each individual piece of equipment.

THE SMARTSIGNAL SOLUTION

SmartSignal provides equipment-performance *intelligence* needed to mitigate or eliminate many causes of equipment and process failures. Our advanced asset analytic solution leverages your OSI PI data and works on all critical rotating and non-rotating power plant equipment to provide your staff with equipment-performance insights that help them make better decisions.

Importantly, SmartSignal focuses limited plant resources on the highest-value problems with the greatest impact on operations and revenue generation. SmartSignal deploys rapidly, is easy to use, and eliminates unnecessary work. By detecting problems automatically, SmartSignal allows your people to focus subject-matter expertise on what needs to be done, rather than look for problems in the confusion of mountains of data, charts, and false alarms. SmartSignal finds the “needles in the haystack.”

Exhibit A depicts some of the types of coal and combined-cycle power plant equipment that are analyzed by SmartSignal and faults that are detected.

SPECIFICALLY, SMARTSIGNAL:

- _ predicts impending power plant equipment and process failures,
- _ diagnoses the causes of the failures, and
- _ prioritizes the severity of the failures.

SmartSignal analyzes all critical equipment 24/7, detects problems, and provides plant personnel with notifications of issues that could lead to degradation of plant performance. SmartSignal works on an exception basis and directs plant O&M personnel to only the equipment they need to review. It focuses their efforts on problems only, reduces their workload, and maximizes their results.

Across all ambient temperature conditions and load ranges, SmartSignal understands each piece of equipment's unique operating characteristics. It works on all equipment, all OEM's, with all sensors. It can take readings at any time, including different time slices for different pieces of equipment. And, importantly, it works seamlessly on top of our data infrastructure partner, OSI PI™.

SmartSignal overcomes the deficiencies of traditional condition-monitoring tools. It addresses the top three concerns of the customers SmartSignal serves. SmartSignal provides:

- _ operational relevance: high-quality, actionable intelligence,
- _ speed-to-value: quick implementation, within a matter of weeks, and payback within a matter of months, and
- _ ease of use: SmartSignal deploys, tunes, and maintains the software and notifies plant personnel of impending problems.

“Within one year of deployment, we achieved the highest level of availability within the history of the plant.”

_ SMARTSIGNAL CUSTOMER



BENEFITS

SmartSignal provides the intelligence to reduce or eliminate many of the failures that trouble power plant operators' most critical pieces of equipment. SmartSignal allows O&M personnel to shift unplanned maintenance to planned and to lengthen maintenance intervals. This translates into:

- _ increased equipment availability and efficiency,
- _ improved profits and return on capital employed, and
- _ improved EHS outcomes.

EXAMPLES OF SMARTSIGNAL'S SUCCESS

Our customers rely on us to analyze more than 5,000 assets operating in over 400 units and in more than 250 plants worldwide. Our results include:

- _ 16 hours early warning of a transition piece failure in a gas turbine,
- _ 400 hours early warning of generator stator cooling water plugging,
- _ Three days early warning of a bearing failure in a coal pulverizer mill,

- _ Two months early warning of reactor coolant pump seal degradation,
- _ \$1 million in lost generation savings due to early detection of a fan motor problem,
- _ \$412,000 in savings due to early identification of a problem with an air heater drive motor,
- _ \$1.5-4 million in lost-generation savings due to early warning of a support bearing failure, and
- _ \$820,000 in savings due to early detection of a feed water heater tube leak.

ROAD FORWARD

SmartSignal works with your team to evaluate how our advanced asset analytics can improve your performance. Easy on your time, our process enables your team to discover what SmartSignal can do for your power plant operation. There are three phases to the process:

1. Discovery Analysis: The goal of the Discovery Analysis is to allow your team to find out more about SmartSignal and for the SmartSignal team to find out more

about your plant(s), assets, and business processes. Based on the outcome of this analysis, a decision to proceed or not to proceed to the next phase is made.

2. Value Analysis: The goal of the Value Analysis is to develop an initial value premise for your company's asset base. SmartSignal employs a methodology that identifies the major asset opportunities and then quantifies expected value based on annual savings and revenue improvement.

3. Test Drive: The goal of the Test Drive is to allow your team to experience SmartSignal before making a decision to invest in it. SmartSignal has implemented over 60 Test Drives, and the feedback from our customers is that a Test Drive is a highly efficient and effective way for a team to conduct a detailed assessment before making a "go/no go" decision.

Exhibit A: Power Equipment & Faults	Operational Issues	Unforeseen Issues	Performance Degradation	Bearing Failures	Lubrication Problems	Mechanical Damage/Wear	Motor/Drive Problems	Leakage/Seal Failures	Fouling	Thermal Problems	Flow Problems	Electrical Problems	Combustion Problems
Steam Turbines	x	x	x	x	x	x			x	x	x		
Combustion Turbines	x	x	x	x	x	x			x				x
HRSG	x	x	x					x	x	x	x		x
HRSG Feed Pumps	x	x	x	x	x	x	x				x		
Boiler Feed Pumps	x	x	x	x	x	x	x				x		
Boiler Fans	x	x	x	x	x	x	x		x				
Generators	x	x	x	x	x	x		x				x	
Pulverizers	x	x	x	x	x	x	x						
Air Heaters	x	x	x	x	x		x	x	x	x	x		
Feed Water Heaters	x	x	x					x	x	x	x		
Condensers	x	x	x	x	x			x	x	x	x		

SmartSignal eliminates more failures on more equipment than do traditional methods.

"SmartSignal analyzes every 10 minutes what it used to take 65 engineering hours to do."

_OPERATOR OF 33 POWER PLANTS

"We have 120 guys here around the clock, and nobody noticed these problems, and there were no alarms. I think it's pretty cool that SmartSignal could detect the problems sitting up there in Chicago."

_POWER PLANT MANAGER

"SmartSignal helps us focus on the important 'exceptions' to improve our operations with a lean staff."

_SMARTSIGNAL CUSTOMER

"So far, 100% of the time that SmartSignal alerted us to a potential problem, there was a problem."

_SMARTSIGNAL CUSTOMER



ABOUT SMARTSIGNAL

SmartSignal maximizes worldwide industry equipment performance, availability, and reliability by predicting, diagnosing, and prioritizing equipment and process issues before they become costly failures. Drawing on 45 patents, SmartSignal turbocharges basic similarity-based modeling and delivers specific, relevant, and actionable intelligence that makes people more proactive and productive. SmartSignal serves customers in power generation, oil and gas, mining, refining, aviation, pulp & paper, and other process

industries worldwide. Over the years, SmartSignal and its clients have won over twenty awards for excellence, including the *Wall Street Journal* Technology Innovation Award.

901 WARRENVILLE ROAD, SUITE 300
LISLE, ILLINOIS 60532

P: 630_829_4000

W: SMARTSIGNAL.COM



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