

# The Value of Predictive Diagnostics to Fossil-Fuel Power Plants



# The Value of Predictive Diagnostics to Fossil-Fuel Power Plants

## Fossil-Fuel Utilities are Sitting on Over \$1 Billion/Year in Savings

By moving to a proactive, data-driven operations strategy, fossil-fuel plants can save, on average, over \$670,000/year/generating unit. This translates to an industry-wide annual savings of over \$1 billion.

Leading companies can improve operations, optimize reliability, and increase availability with today's predictive technologies. A recent survey showed that fossil-fuel-based generators can dramatically increase their uptime through use of a GE SmartSignal predictive-diagnostic solution. In doing so, they can significantly reduce forced outages and more intelligently manage maintenance operations.

SmartSignal solutions can improve availability and reliability because they can tell utility operators about impending problems in time to act proactively before the problems impact operations.

## A Few Trends and Observations Emerge From the Survey:

**The average benefit of using a SmartSignal solution is approximately \$672,000 per unit.** (See Figure 1.)

Yearly Benefits for Average Unit of GE SmartSignal Software				
	Maintenance Expense Reduction	Fuel Expense Reduction	Revenue Improvement	Total
Average Generating Unit	\$237,180	\$233,000	\$201,475	\$671,655

**Figure 1** This chart shows the value derived from maintenance reduction, fuel reduction, and revenue improvement for an average fossil-fuel unit.

**Benefits are similar regardless of generating unit size.** In the survey, the largest unit had a capacity of 1,140 MW, while the smallest was 66 MW. Beyond a few outliers, there was slight variance in the average annual savings of \$150,000 per 100 MW of generating capacity.

## Industry, though not company, benefits are balanced.

Generating companies find that a SmartSignal solution provides three types of benefits: maintenance reduction, fuel reduction, and revenue improvement. As an industry, it appears that

the benefits are balanced (see Figure 1), though for individual generators within companies there are large and erratic variances that change year-to-year.

**Savings quoted are conservative.** The research was conservative in estimations and catches. Even so, the ROI from purchasing a SmartSignal solution is measured in months.

**Operator and maintenance errors contribute to future problems.** More problems than would be expected are caused by mistakes in maintenance procedures. Mistakes range from incorrect levels of lubricant being used to the improper re-installation of certain equipment.

## Maintenance Reduction

Because a SmartSignal solution is able to proactively spot problems, maintenance labor costs can be reduced for most pieces of equipment by moving unplanned maintenance to planned, decreasing the amount of time a maintenance procedure takes, and extending the intervals between maintenance procedures. (These steps and benefits represent the first portion of a proactive maintenance program; future benefits and maintenance labor-cost reductions are not included in this analysis.)

The second leg of decreased maintenance costs is represented by less spending to repair or replace parts that are damaged. Many replacements of a large motor, pump, fan, etc. can be prevented if the proper information is available when the signs of failure are spotted.

For one prospective customer, a pump outage caused a 375 MW derate and hundreds of thousands of dollars of extra maintenance costs as well as the need to purchase replacement power. Had SmartSignal software been installed, it would have detected in advance problems including vibration and leaks, leading to a proactive repair.

## Fuel Reduction

A by-product of ensuring that all the pumps, motors, etc. are working optimally is a reduction in fuel costs. For example, a defect or a clog in a fuel nozzle can impact efficiency. A motor that uses excessive lubricant or draws more electricity than expected represents both a potential future failure point as well as a productivity drain. Though this type of benefit may appear negligible, the analysis of a large base of generators shows this not to be the case. The utility industry can save as much from fuel reduction and running its equipment more efficiently as it can from maintenance cost savings.

## Revenue Improvement

Another finding of the study is the large amount of revenue improvement that can be expected from using a SmartSignal solution. Downtime is often a year-round concern for utilities, not just a summertime issue. In fact, a large part of corporate profit for some utilities comes from the selling of excess (and high margin) power during winter months.

## Detailed Example of Value

Figure 2 details the estimated actual annual value of a SmartSignal solution for a sample, random unit. In addition to the maintenance, fuel, and revenue categories, it shows value derived from subcategories: shifting unplanned maintenance to planned, increasing interval extensions, and reducing heat rate. This unit would garner the greatest maintenance reduction by switching unplanned minor failures to planned maintenance operations. However, when revenue improvements are examined, it is seen that a focus on major failures would deliver the greatest overall value to the unit.

Detailed Yearly Benefits for Sample Unit of GE SmartSignal Software				
	Maintenance Expense Reduction	Fuel Expense Reduction	Revenue Improvement	Total
<b>Shift Unplanned to Planned</b>				
Catastrophic Failure	\$28,875		\$37,669	\$66,544
Major Failure	\$66,188		\$111,726	\$177,914
Minor Failure	\$95,138		\$64,688	\$159,826
<b>Interval Extension</b>				
Major Inspection	\$30,667		\$7,140	\$37,807
<b>Heat Rate Reduction</b>				
0.25% Reduction	\$0	\$177,390	\$0	\$177,390
<b>Annual Total</b>	<b>\$220,868</b>	<b>\$177,390</b>	<b>\$221,223</b>	<b>\$619,481</b>

Sample generating unit; benefits vary by unit. November 2007

**Figure 2** This chart shows details of value derived from a GE SmartSignal solution for a sample, random, fossil-fuel unit.

## Customer Success with GE SmartSignal Software

### Typical Example of Accelerated Benefits

Like all electricity providers, the customer had its fair share of both large and small disruptions. After deciding that it wanted to embark upon a predictive-maintenance program, it decided to evaluate the GE SmartSignal software to see if it could have detected a prior major failure.

A major coal unit's condensate pump had failed, causing the power-generation loss of over 80,000 MW. Repairs to the unit cost over \$150,000, and the economic loss of the failure was pegged in excess of \$2 million. As there was no visible sign of failure prior to the event, this was seen as a perfect example to test the validity of the software.

With an operational model for the pump and over a year's worth of data, the SmartSignal solution showed how it would have notified operators months before the failure because

a condensate pump was not drawing the amount of current it should have during a start-up operation. In addition, the associated discharge pressure for the same pump was low during the same period.

Since installing the software, the customer has been able to catch multiple anomalies that would have led to increased downtime and higher maintenance costs. One potentially large catch occurred when temperature on a support bearing was beyond limits, triggering a SmartSignal notification. It was determined that the system was 3.5 gallons low on oil. Once oil was filled to standard levels, the support bearing's temperature came down to normal. The previous failure of a similar air-heater support bearing at the unit led to approximately 139,000 MW lost generation.

# The Value of Predictive Diagnostics to Fossil-Fuel Power Plants

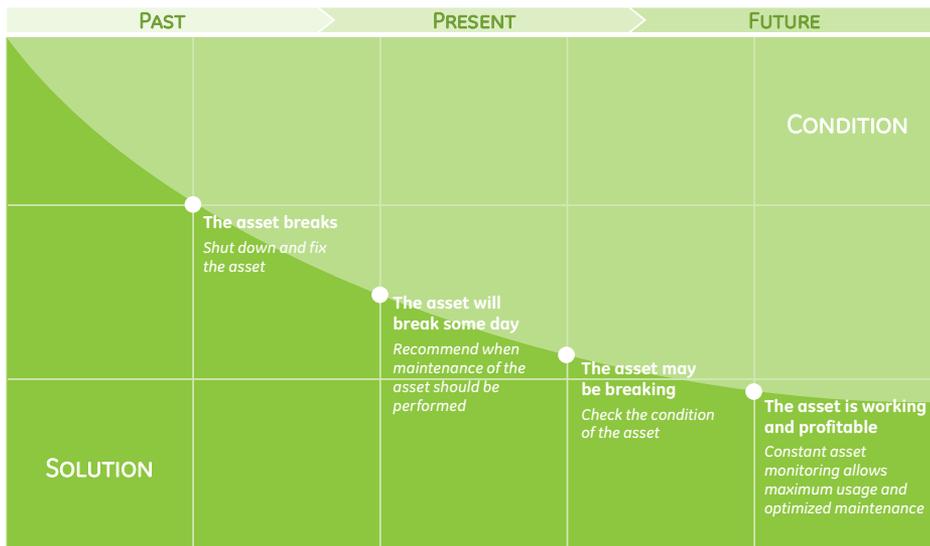
## What's Wrong with Traditional Maintenance Strategies?

With traditional maintenance strategies, most calls tend to be either reactive or part of a scheduled maintenance (see Figure 3). Both of these are expensive and unnecessary. Reactive calls are often the most expensive and disruptive, especially when an asset already has broken and the facility must be shut down.

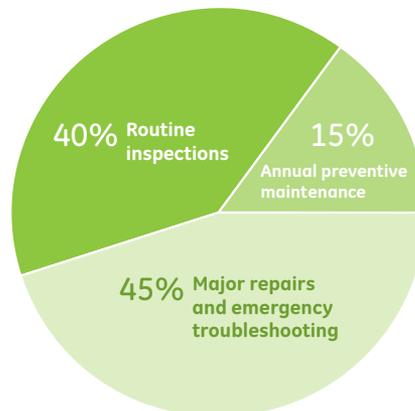
Standard scheduled maintenance can be a wasteful practice for two reasons. First, often the maintained device does not require maintenance, thus making scheduled maintenance a wasted operational practice. Second, often failure catalysts are introduced into properly working equipment. Devices often fail immediately after they are maintained.

To better control costs, companies have started an aggressive campaign to minimize such operations by focusing on self-help and device visibility. These types of techniques are well-used in the computer and information-technology industries, where a communications infrastructure and embedded capabilities permit many service requirements to be performed remotely.

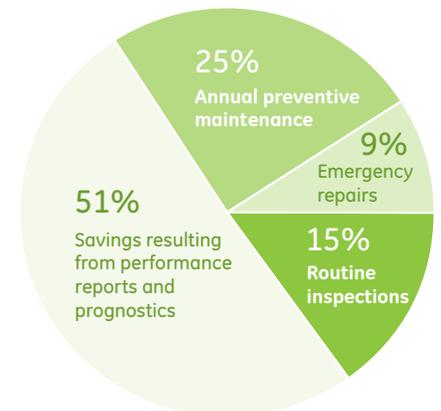
Studies from the Center for Intelligent Maintenance Systems indicate that approximately 50 percent of maintenance calls/time could be curtailed by using an automated and optimized service capability (see Figure 4). Predictive technologies, like the SmartSignal solutions, can significantly improve both availability and reliability while lowering costs.



**Figure 3** Moving from reactive to proactive helps control costs.



**Figure 4** Typical work breakdown in a service agreement *without* Prognostics and Diagnostics.



Typical work breakdown in a service agreement *with* Prognostics and Diagnostics.

## Customer Success with GE SmartSignal Software

### International Company Increases Availability

Since equipment unavailability at its 3,200 MW facility can result in millions of dollars of lost-generation revenue each year, the company wanted to better understand what outages were preventable in this facility as well as others worldwide. As a result, the company added a SmartSignal solution to its monitoring program, using the software for advanced, predictive warning of emerging problems.

The SmartSignal software has identified many equipment problems for this company. For example, the software discovered a potential bad bearing on a 6,000 HP motor and notified the customer of the problem. The plant prepared a maintenance team and ordered appropriate parts so a short derate of eight to nine hours would occur on the unit. However, continued readings indicated that the bearing was

about to fail, so the plant stopped the motor immediately before any damage occurred. By stopping the motor, the plant prevented collateral damage that likely would have scored the motor's shaft and forced replacement of the motor.

Ironically, the unit had been spot-checked by maintenance workers only one week prior to this alert. In this example, without the SmartSignal software, this customer likely would have incurred hundreds of thousands of dollars in extra maintenance and power-generation costs.

Within one year of going live with the SmartSignal solution, the customer recouped its investment by catching nearly 40 problems that most likely would have been missed by maintenance operators.

### Summary

It is imperative to squeeze every megawatt possible from every generating unit. By increasing reliability and availability and reducing maintenance and fuel costs, a power generator can grow revenue and accelerate return on equity. These benefits come at a needed time from a financial perspective. With average annual savings over \$670,000/generating unit, maintenance programs using SmartSignal software as a backbone can add hundreds of basis points to the top line over a period of years.



#### **About GE**

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry. [www.ge.com](http://www.ge.com)

#### **Contact information**

Americas: 1-855-YOUR1GE (1-855-968-7143)  
[gedigital@ge.com](mailto:gedigital@ge.com)

**[www.ge.com/digital](http://www.ge.com/digital)**

©2015 General Electric. All rights reserved. \*Trademark of General Electric. All other brands or names are property of their respective holders. Specifications are subject to change without notice.