

Detect, Diagnose and Prioritize to Prevent Equipment and Process Failure

World Energy talks to Jim Gagnard, President and CEO, SmartSignal

Chicago-based SmartSignal (smartsignal.com) is the worldwide leader in analytics designed to detect, diagnose and prioritize critical equipment and process problems before they become costly failures. SmartSignal provides predictive analytics for over 10,000 assets, 700 units and 400 plants in eight industries worldwide. SmartSignal and its customers have won more than 20 awards for excellence, including a *Wall Street Journal* Technology Innovation Award and the 2009 Illinois Technology Association Lighthouse Award for excellence in product and services. SmartSignal President and CEO Jim Gagnard talks to *World Energy* about the development of predictive analytics and how this advanced technology helps facilitate success across many different categories of energy production.

World Energy: Tell us a little bit about what SmartSignal does.

Gagnard: Unlike traditional engineering tools that try to predict performance, SmartSignal eliminates failure by uniquely analyzing every piece of equipment individually. The core SmartSignal product analyzes historical sensor data and how they relate to each other for all operating modes and ambient conditions. Real-time data is taken continuously and then is compared to the historical model. As a result, we find subtle differences – anomalies that are usually left unattended and often lead to equipment failure.

World Energy: Can you give us an example of an anomaly?

Gagnard: Well, for example, you could have a turbine running that may have as many as 200 sensors. All those sensors are interrelated in the operation of the turbine. With SmartSignal looking at all the different sensors and at the relationships among them, we can spot the kinds of subtle differences that generally lead to a failure.



Photo by Brook Allen

World Energy: So these are differences that would be within normal operating parameters but not for this piece of equipment?

Gagnard: Exactly. Usually, normal operating parameters are set to ensure that not too many false alarms occur. But most traditional tools look at individual sensors rather than the equipment from a holistic perspective.

World Energy: How do your customers benefit from adding SmartSignal to their stacks?

Gagnard: By using SmartSignal to detect and diagnose potential failures many weeks before they occur, our customers have consistently realized significant value and realized return on their investments in SmartSignal within the first year.

World Energy: Where are you finding these customers? Are they in refining, power generation, oil and gas?

Gagnard: The majority of our customers are in power generation and oil and gas.

World Energy: Okay, let's look closer at the customers in power generation. What exactly are they monitoring? Just the turbines?

Gagnard: Actually, we monitor everything: the turbine and the whole balance of plant. One of the unique characteristics of SmartSignal is that we are totally agnostic when it comes to equipment. We believe it is important to look at the whole unit, not just the particular piece of equipment.

World Energy: As people become more accustomed to predictive analytics, do you think there will be more companies trying to grab a piece of the pie?

Gagnard: Well, I think everyone is attracted to success. We are making the pie bigger by creating new products. One of the challenges you will see in our market is that some of the smaller competitors are focusing on delivering solutions that we delivered three years ago. So we took some of that success from the last three years and invested in building new products.

World Energy: What are some of those products?

Gagnard: There are a couple things we are looking at that we think are going to add real value to the marketplace. One of them is a product called xConnector that tightly integrates our product with the OSIsoft PI System infrastructure, which is the market leader worldwide for information infrastructures.

So, xConnector is going to make it easy for over 10,000 OSI PI users to connect to SmartSignal through their own OSI user interface. The whole idea is to make it easier for people who have made an investment in OSI to use our product.

World Energy: What else is on your plate right now?

Gagnard: There's another new product, which is called CycleWatch, that we think is going to be very innovative. It has to do with solving a specific problem in the gas-fired plant, namely, how do you monitor the start-up and shut-down process of gas turbines?

This is a very common and complicated problem; in fact, probably 50 percent of the outages that occur in gas-fired plants occur in the gas turbine. So we are using unique technology to build CycleWatch, which will analyze those very tight start-up and shut-down cycles.

World Energy: What kinds of inroads are you making in oil and gas?

Gagnard: We have had strong success with Chevron, namely with a huge implementation for its CNAEP business unit, which is Chevron North American Exploration & Production. It is going very well, and without getting into the financial specifics, it has already documented multimillion-dollar value generated from SmartSignal implementation.

World Energy: Is that an upstream or a downstream implementation?

Gagnard: That is upstream. We also recently closed a major deal with BP Alaska to be the predictive-analytic solution for the North Slope.

World Energy: You have done a lot of work with BP, haven't you?

Gagnard: We have had some great successes with BP worldwide and have done a lot of work with BP across most of its refineries. Right now, we are doing work with BP Alternative Energy and are implementing a project in the Gulf of Mexico.

World Energy: Can you speak to what you have done with BP's alternatives group?

Gagnard: Well, our most interesting work with BP is in wind energy. We are providing predictive analytics for one of its small wind plants.

World Energy: So, what parts are you looking at?

Gagnard: The problems with wind energy are both straightforward and complicated. I mean, you have the turbine, you have the gear box, and you have the generator. And what makes it complicated is that they are geographically remote and under constantly changing operating conditions. So one of the challenges that most of the OEMs have had is coming up with a solution that can deal with the changing operating modes.

One of SmartSignal's strengths has always been its ability to deal with different ambient conditions and operating modes. So, BP Alternative Energy has gotten started on that. Actually, we just added a couple more new customers in the wind area, as well.

World Energy: Today's customers must be highly efficient both at generating power and at getting oil and gas out of the ground. You could say that companies need predictive analytics today more than ever.

Gagnard: You're right; our customers need to generate more product, more efficiently, from aging equipment, with fewer people. And add to that, very few coal plants are being built, no U.S. nuclear plants have been built for 30 years, and no new refineries have been built in over 35 years. Now, the big bets are with wind energy, which, because it is very geographically dispersed, will require as much early failure detection as possible. So when you add up all the factors, you need a way to operate your equipment more effectively. What better way to do that than to have earliest-possible warning of potential equipment failure?

World Energy: I think companies are also cutting back on operational budgets. If this actually generates more efficiency and reduces the need to shut down for maintenance, this would cut their costs pretty significantly.

Gagnard: Absolutely. The last thing you want to do is perform a maintenance operation on something that doesn't need to be fixed. And, at the same time, you definitely *want* to perform maintenance on something that *needs* to be fixed.

World Energy: You would think that would be common sense.

Gagnard: It is – but if you don't have a view of what's actually going on with the equipment, taking into consideration all the sensors involved, then sometimes you are just guessing.

World Energy: How do you think the industry's needs are changing?

Gagnard: The energy industry is affected by the dynamics of contraction or expansion just like any other industry. For example, a company that has chosen to expand through the acquisition of plants has to figure out how it will provide a standard language to use to look at how its fleets are operating.

We are seeing the emphasis on gas-fired plants, which are going to be running a lot more than they have with very lean staffs. Most of these gas-fired plants run with, maybe, 24 people. So they are going to need software to understand how their plants are operating, because, frankly, they don't have enough people to commit to that kind of continual monitoring.

World Energy: Wind is a big part of President Obama's plans for renewables. He says he wants energy supply to be 20 percent renewable by 2020. That's just 11 years from now, which means this space really has to grow. How does this affect your business?

Gagnard: It affects us in a lot of ways. We have a product called WindAPS that we deliver to the wind-energy space, and we think it will add real value to it.

Here's another area that many people don't address: What do we do with coal-fired plants to make them more green? A study by the World Energy Council said if you could take the entire coal fleet and move it up to top-quartile availability, that would reduce the carbon emission by 4 percent. So, even in coal-fired plants, there is a chance to reduce CO₂. Another area to think about is making plants run more efficiently. We know that gas-fired plants generate half the CO₂ emissions that a comparable coal-fired plant would.



SmartSignal Availability and Performance Center

So, as we deliver solutions to these gas-fired plants, we are going to assist in that way, also.

And finally, we have seen increased interest from nuclear operators to implement predictive analytics, so recently we have added customers including Entergy Nuclear, GDF Suez and Bruce Power. They're all premier nuclear operators, and they are all stepping up now to the idea that they need technology to better understand not just how the core is operating, but the whole balance of plant in a nuclear plant.

World Energy: So your company is really based across the entire energy spectrum?

Gagnard: Without question, it is.

The View from SmartSignal Customers

BP recently introduced SmartSignal into some of its operations. Here, BP Chief Technology Office Director Paul Stone and Zaid Rawi, Engineer, Refinery of the Future, talk to *World Energy* about the benefits and challenges of deploying predictive analytics into their business system.

World Energy: What key strategies does BP see predictive analytics addressing?

Stone: Predictive analytics provides the capability to extract more information from data already obtained through BP's business operations at relatively small additional cost. Information identified through pattern-recognition techniques can help improve performance and safety by identifying hitherto unknown relationships, hazards and interactions, and allowing effective action to be taken.

World Energy: How does SmartSignal fit into the picture at BP?

Stone: SmartSignal effectively uses predictive analytics to determine if a machine is operating normally. It's able to predict when an abnormality is likely to lead to equipment problems, and it can do so weeks and sometimes months before the actual issue would occur. So, BP is able to plan effective remedial action ahead of a problem, rather than react after the fact. This lets us reduce and sometimes eliminate the cost of equipment issues, reduce lost revenue from equipment downtime and increase safety by reducing incidents and the amount of time personnel are working on equipment problems.

World Energy: What areas of BP's business are benefiting from SmartSignal?

Stone: Our refining business was the first to implement SmartSignal following proof-of-concept trials that demonstrated value. Our exploration & production business is currently implementing at specific sites, while our wind business achieved an industry first with the implementation of SmartSignal on turbines at the Silver Star wind farm in Texas. Our pipeline organizations are also performing trials here in the United States.

World Energy: Categorically, what sorts of benefits have been realized?

Rawi: SmartSignal's "early warning system" has markedly increased the reliability, integrity and performance of equipment in BP's operations through detections such as fouling, cavitations, surge, seal issues and lubrication system problems. By conducting planned rather than emergency maintenance, BP has been able to adapt operations to reduce revenue losses and increase equipment availability, while significantly reducing repair time and cost. Most important, the technology has improved safety performance by avoiding catastrophic failures, which may be accompanied by dangerous fires and explosions.

World Energy: Are the benefits different for offshore production as opposed to, say, refining?

Stone: I would say that benefits track the issues that the various facilities are experiencing. Offshore facilities often experience greater variability of equipment operation in terms of starts/stops, etc. SmartSignal relies on having previous data that adequately describe normal equipment operations, so implementation may take a little longer to even out offshore, but, fundamentally, the opportunity for benefits is similar.

World Energy: What have been the challenges in getting systems like SmartSignal implemented and accepted by the business?

Stone: While the SmartSignal value proposition is simple and straightforward, the software uses complex mathematics and statistics and is difficult for many to understand. Ultimately, people want the value to be demonstrated before taking the plunge. While it is relatively easy to demonstrate how SmartSignal can indicate a developing issue, it is more difficult to quantify the benefits. Action taken early avoids more serious problems, for instance, but how do you know the more serious problem would ultimately have occurred?

World Energy: Is there a significant change-management element to these projects?

Rawi: Change management is extremely important to the success of any technology project, but probably more so with SmartSignal, given the different approach to equipment-monitoring being employed.

World Energy: How did BP address this?

Rawi: Through successive technology proof-of-concept trials and pilots, and by involving the individuals with whom the responsibility to use the resultant information would ultimately reside, BP was able to understand how the technology could be integrated into existing processes and ensured that the technology was able to deliver on its promise.

World Energy: How long do these implementations typically take?

Rawi: From a technology standpoint, an implementation and trial need take no longer than four months. But depending on individual business situations, levels of instrumentation and business cycles, elapsed time can be longer.

World Energy: What sort of resources did BP need to provide to support the deployment?

Rawi: A mixture of engineering, operations and IT support resources, with management support, were involved with each implementation.

World Energy: What about ongoing support?

Rawi: Ongoing support consists of resources required to analyze the output from the SmartSignal software, usually referred to as "monitoring the WatchList," and the IT infrastructure to run the software. For the most part, we are using SmartSignal in both capacities.

World Energy: What would you do differently if you were starting again?

Stone: SmartSignal complements traditional vibrational analysis approaches already in use. It's important that the engineering and technical staff essential to the success of the implementation understand that SmartSignal is not a silver bullet but makes all other approaches more effective.

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