Business challenge

When a critical asset fails in one of Santos' operations, the result can be lost revenues and more time on the road for engineers. Could Santos find a way to identify faults before failures occur?

Transformation

To maximize production uptime and promote safe, efficient maintenance, Santos predictively models data from assets connected to the Internet of Things, providing early warnings of equipment failure.

Steven Benn
Manager, Exploration and Production Technologies
Santos Ltd.

Business benefits:

AUD 10m+
in potential annual savings by increasing production uptime

Optimizes
maintenance scheduling and use of materials, reducing costs

Improves
safety by cutting the time engineers spend in remote locations and traveling

Santos
Saving millions with a predictive asset monitoring and alert system

Santos Ltd. is one of the leading oil and gas producers in the Asia-Pacific region, serving the energy needs of homes, businesses and major industries across Australia and Asia. Santos reports annual revenues of AUD 4 billion (USD 2.9 billion).

"We are opening up a whole new approach for predictive and prescriptive analytics in oil and gas."

Steven Benn
Manager, Exploration and Production Technologies
Santos Ltd.

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Servicing a vast infrastructure

Santos operates one of the largest exploration and production businesses in Australia. Its extensive operations rely on a huge and highly complex network of assets, including thousands of kilometers of pipeline, wells, pumps, compressors and other equipment. Keeping this specialist infrastructure in working order is a key priority for the company, as any downtime can interrupt production and limit profitability.

Steven Benn, Manager of Exploration and Production Technologies at Santos Ltd., says: "Like all oil and gas companies, one of our central aims is to increase production rates, which means minimizing downtime. We have teams of expert engineers that spend their time maintaining, optimizing and repairing our infrastructure. This is not a straightforward job because our network extends over a vast geographic area – much of it in remote and even hostile environments such as the Australian Outback."

Drilling down to what matters

For Santos, the problem was not a lack of data; it had already been leveraging Internet of Things (IoT) technologies such as SCADA to collect information from thousands of sensors across its asset network for many years. These technologies allow the company to measure temperature, vibration, voltage and more on an asset-by-asset basis – potentially providing a hugely rich source of insight.

The challenge was to harvest and sift through this data, recognize the patterns that indicate a high likelihood of asset failure, identify the most urgent issues, and get the right information to its engineers with enough lead time for them to take effective action.

"Before, we only used between 10 and 12 percent of the operational data we collected, which is the industry average," comments Benn. "By the time we had searched for, collated and forwarded the right information to the right people, we might respond too late to avoid impact to operations, or have to make last-minute changes to our maintenance schedule, which reduces efficiency. Our challenge was to provide right-time, actionable, effective information proactively, rather than in a reactive or look-back assessment."

"What we wanted was a way to identify patterns in that sensor data that would give us an early warning of asset failure. We saw an opportunity to use analytics technology to extract greater value from the systems and data we already possessed, which would help us to, for example, avoid preventable failures and potentially save millions of dollars.

Predicting rather than reacting

To create an effective alert system for equipment failure, Santos looked to predictive modeling. Embarking on a pilot project with help from IBM® SPSS® Lab Services, the company pulled structured and unstructured data from multiple sources including: the equipment trends database, which tracks SCADA data such as the speed at which a compressor is operating; the operator shift log, a system in which field operatives record their activity; the computerized maintenance management system, which maintains a record of assets and their maintenance history; and the asset loss and availability system, an accounting solution used to trace the sources of production losses.

Steven Benn says: "We can now identify issues from overall pattern-matching and analysis across all relevant data streams using signals from multiple sources. It is this holistic picture that we analyze to generate warnings and notifications for our engineers and field operators. The majority of these warnings cannot be derived from single source or point sensors, and so would otherwise remain undetected."

Benn continues: "Using IBM SPSS Modeler, we were able to identify consistent trends across our enterprise data and build effective predictive models that provide early warnings for equipment malfunction and operational efficiencies. Our models predict asset failure with upwards of 87 percent accuracy, with some models consistently providing 100 percent accurate results."

"We use this insight to empower the experts—our engineers and field teams— with the information they need to do their jobs to the best of their ability. By giving them a better understanding of what we can expect to happen and when, they can make better decisions about where and how to spend their time, prioritizing the most urgent maintenance tasks."

Complementing its work with IBM, Santos has also collaborated with researchers from the University of Oxford. Professor Stephen Roberts, Head of the Machine Learning Research Group at the University of Oxford, comments:
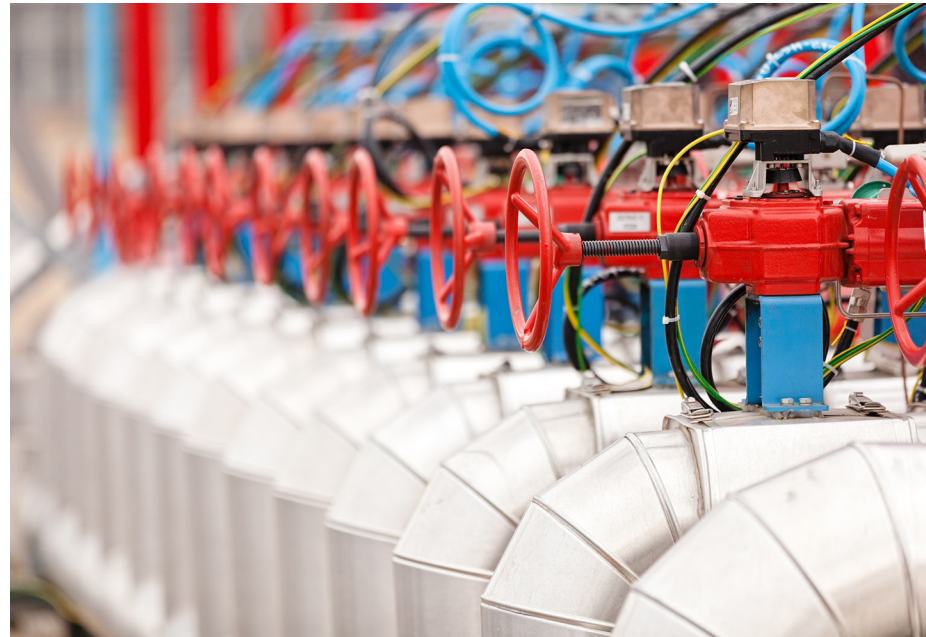
"The grand challenge of achieving a scalable, integrated, end-to-end predictive analytics system is, to the best of my knowledge, unique to Santos. The Santos system, combining real-time monitoring across multiple assets and decision theory for automatic notification shows that this can be scaled to thousands of assets."

Insights in action

Santos relies on a combination of ROC batteries and solar panels to keep its well heads operating. Using predictive models, the company can generate early warnings of any faults, and has gained insight into new ways to optimize power supply for greater efficiency.

Benn elaborates: "Before, we used batteries that cost AUD 5,000 each, and lasted about 18 months to two years. With a deeper of understanding of power usage at each of our 1,000 wells, driven by the IBM solutions, we have been able to switch to batteries costing AUD 2,000, which should last us up to four years.

"By avoiding production downtime and optimizing power supply, we estimate that we will realize benefits of around AUD 3 million per year. The best part is, the same models can be re-used to analyze other types of power systems that drive other parts of our infrastructure, so we could see even greater savings and better performance in other areas too. These models are adaptable and scalable."

Elsewhere, Santos has enabled early alerts when its corrosion inhibitor tanks are about to run dry, and when pumps are operating abnormally. Corrosion inhibitor is a mix of chemicals that oil and gas companies pump into pipelines to protect them. If it runs out, the pipelines can gradually get corroded and damaged, so it is important to keep the tanks topped up regularly.

By monitoring tank volume and injection rate, Santos can predict when its field teams will need to drive out to refill the tanks, and can help them plan the most efficient routes between tanks – reducing the time they need to spend on the road in remote and possibly hazardous areas.

"Today, we have 30-day, 14-day and one-day alerts for inhibitor tank refills, helping our field teams prioritize and optimize their schedules and inhibitor stocks," says Benn. We've also found that we can inject inhibitor periodically rather than keeping the pumps running continuously – which will create potential annual savings of AUD 1.1 million.

"Again, we can generalize this model to other parts of the business, such as injection of soap, with huge benefits for our business.

"We're already looking to expand to a further ten use-cases – getting analytics embedded everywhere is really our end goal," says Benn. "So far we have just been looking at the up-stream operations part of our business – if we extend it to our downstream assets as well, we expect we could deliver significant additional savings."

Leading the way

As Santos continues to discover new applications for its predictive modeling capabilities, it lengthens its lead against the competition.

Benn concludes: "Our use of IBM Analytics and the Internet of Things has helped us get ahead of the game within the oil and gas industry, continually providing opportunities to boost production uptime and operational efficiency. By giving us the tools to bring the Santos innovation mindset to life, we are finding ways to make our company run better than ever before."

Solution components

- IBM® SPSS® Collaboration and Deployment Services
- IBM SPSS Lab Services
- IBM SPSS Modeler Desktop
- IBM SPSS Modeler Server
- IBM SPSS Statistics Desktop

Take the next step

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