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Leading Fertilizer Company Improves Asset Uptime with AI

A leading fertilizer company operates the world's largest single-site export of urea and produces 5.6 million tons (MT) of urea and 3.8 MT of ammonia annually. With 6 world-class plants, the company aims to become the world's largest urea producer by 2030. With a commitment to safe and efficient asset operations, the company is using AI to predict and prevent failures: transforming its operations and condition maintenance strategy to achieve goals of increased asset availability and reduced maintenance costs.

Prior to partnering with BakerHughesC3.ai (BHC3), the company took a predominantly reactive approach to asset maintenance. However, due to an aging fleet, these assets frequently experienced unplanned downtime, forcing the maintenance crews to perform costly emergency repairs. Unplanned downtime also introduced significant risks to production continuity. As a result, the company faced reliability and performance losses 60% higher than their operational target. To improve asset uptime and reliability, the company needed an innovative solution that could integrate data from various sources, focus attention on the relevant information, predict potential failures, and provide actionable insights.

The company decided to partner with BHC3 and deploy BHC3 Reliability, an AI-powered predictive maintenance application, to improve the reliability of critical rotating equipment. With BHC3 Reliability, reliability engineers and other team members can predict potential issues 2 months in advance, allowing the team to increase asset uptime by 1.8% and avoid up to 460 hours of unplanned downtime per year.

Project Objectives

- Enable predictive monitoring to improve asset uptime of critical equipment such as compressors and turbines
- Integrate and unify data from available sources, including historical and live data
- Apply advanced AI to predict potential failures and enable early warnings for 27 assets across 4 plants
- Configure the BHC3 Reliability user interface and expose actionable AI insights
- Deploy the sensor health module within BHC3 Reliability to monitor sensors in near real-time

Results

1.8%
increase in asset uptime

62 days
of average lead time for predictable events

460 hours
of downtime avoided per annum

Challenges

Rotating equipment such as compressors and turbines play a critical role in the company's manufacturing operations. Reliability of these equipment directly impact the productivity and efficiency of asset operations.

Despite the criticality of these assets, the fertilizer company relied on a reactive strategy for maintenance and often ran assets to failure. However, the aging fleet of assets frequently experienced unplanned downtime. As a result, maintenance crews were forced to perform costly emergency repairs. Catastrophic asset failures also introduced significant disruptions to production. In 2022, the company saw that reliability and performance losses due to equipment failures were at 8.3%: 60% higher than the target goal of 5%. The company needed to improve asset uptime and reliability to achieve top quartile performance for equipment failures at or below 5%.

However, the company could not accurately predict potential failures to reduce unplanned failures. The company relied on direct control systems and physics-based condition monitoring systems that could not provide early warning or a comprehensive understanding of machine behavior and operational usage. The company needed an advanced AI solution that could integrate with its existing rules-based analytics to enable early warning and improve decision making. The company also needed a platform that could leverage the high volume of data from its enterprise systems and plants, focus on the relevant information to predict potential failures, prioritize risks, and provide actionable insights to prevent failures.

About the Company

- Largest single-site exporter of urea
- 6 world-class plants
- 5.6 MT of urea and 3.8 MT of ammonia produced annually

Project Highlights

- 27 assets across 4 plants
- 1.3B historical records integrated
- 3.5 million incremental records from 2,400 sensors ingested daily
- 233 ML models in production
- BHC3 Reliability user interface configured
- Co-deployed with Baker Hughes Cordant Platform
- Planning to scale to additional 92 assets
- 10 users onboarded

Approach

Over a 24-week period, the BHC3 team partnered with the fertilizer company to configure BHC3 Reliability to enable predictive monitoring for 27 production assets across 4 plants.

First, the team identified high-priority rotating equipment across 4 key asset types (e.g., compressors, turbines) and the relevant data sources. The team integrated over 5 years of historical data along with live sensor data from Baker Hughes Cordant Platform to create a unified, federated data model of the asset fleet. During data ingestion, the platform's normalization engine improved data quality by imputing missing data and reordering time series data.

Using the unified data image, the BHC3 team configured machine learning models to predict system failures and detect anomalies for the 4 key asset types. BHC3 machine experts guided the model development process by identifying significant signals and anomalies that were incorporated into each asset class's anomaly detection models.

BHC3 data scientists then further fine-tuned the AI models to ensure the desired accuracy, reducing noise and false positive alerts. After completing user testing of the configured application, BHC3 team onboarded 10 users, with plans of onboarding 30 more.

To ensure high user adoption and value, BHC3 conducted a series of training workshops, provided documentation, enabled executive visibility, and implemented change management strategies. The

BHC3 team developed a workflow and a business process document to close the last-mile connectivity gap to the customer's notification and work order management system to ensure that alerts could be addressed on time based on the criticality of the asset, priority of the alert, and impact to business. Alert statistics were included in quarterly executive reviews, which bolstered the success of the program. Finally, the BHC3 team supported customer adoption by implementing change management strategies during each stage of implementation to help them achieve the desired asset uptime improvements.

Today, the condition monitoring and asset reliability team leverages AI-based performance metrics from BHC3 Reliability alongside rule-based analytics for dynamic decision making. Through this combined approach, the fertilizer company has enabled a proactive asset lifecycle management strategy that prevents untimely equipment failures, extends asset lifespan, and allows the operations team to make timely replacement decisions.

Solution Architecture

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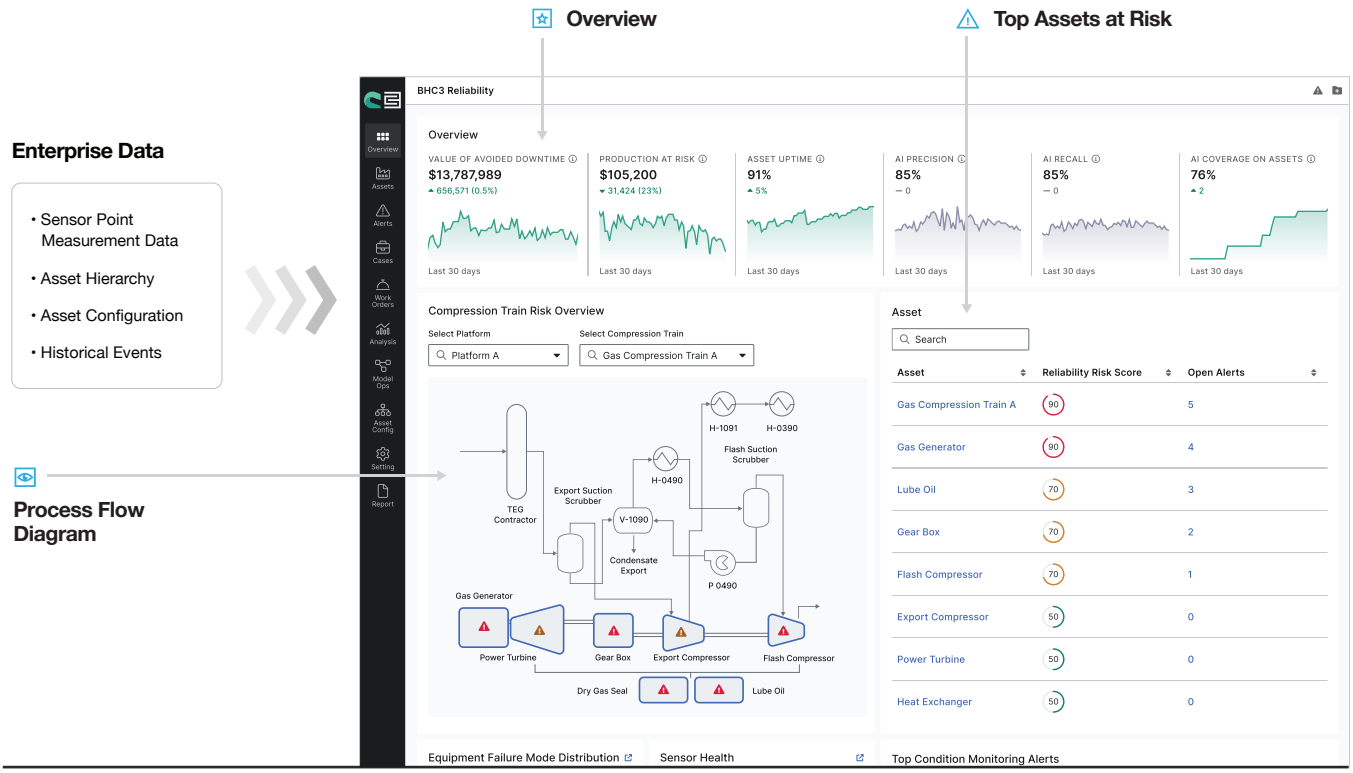
BHC3 Reliability



Benefits

Increase

asset availability and uptime by 1.8%.

Reduce

unplanned downtime and plant shutdowns.

Decrease

time to repair with improved visibility on contributing features and failure modes.

Improve

operational efficiencies of personnel through remote monitoring.

Enable

predictive and comprehensive asset health monitoring with AI-based alerts.

Scale

deployment of advanced AI models across assets in hours.

Proven Results in 6-Month

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