Avoiding equipment failure with AI-infused AVEVA Predictive Analytics in the cloud: PETRONAS saves $17.4M and delivers 14x ROI

PETRONAS - www.petronas.com
Industry - Oil & Gas

Goals

- Improve reliability of the rotating equipment in plants

- Reduce downtime at both onshore and offshore facilities

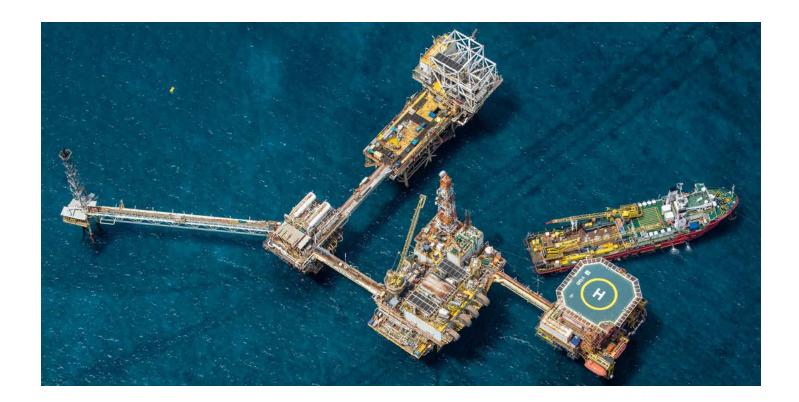- Boost operational efficiencies and output

Challenges

- Refineries were at risk of critical equipment failure

- Lack of information to warn of impending problems

AVEVA solution

- AVEVA Predictive Analytics, PI System™

Results

- Saved $17.4M (RM73.1M) in the first year as a result of reduced unplanned downtime, from 51 warnings, of which 12 were considered high-risk

- Delivered 14x ROI within the first year

- Increased uptime as a result of the 51 avoided lost-time incidents

- Safer working environment

- Increased asset utilization, via the identification of underperforming assets and pre-emptive improvement actions

- System expansion using cloud across 10 new sites with more planned

Petroliam Nasional Berhad (PETRONAS) is Malaysia's fully integrated oil and gas multinational company, producing 2.4M barrels of oil equivalent per day. With the commitment to achieve net-zero carbon emissions by 2050, PETRONAS recognized the importance of plant stability to achieve its sustainability goals. Its engineering division, which was keen to optimize equipment performance to improve plant reliability and reduce downtime, turned to AVEVA's asset performance management (APM) solutions.

Risk of equipment failure and unscheduled downtime

All industrial organizations that operate machinery naturally need to factor in maintenance strategies and activities to ensure all equipment operates smoothly in order to avoid unplanned downtime, which can result in entire plant shutdowns and lead to catastrophic consequences. As a leading energy producer, PETRONAS recognized that having forewarning of impending equipment failure via an APM solution would enable the plant operators to proactively respond to issues and fix the equipment before bigger problems ensued.

"Digital transformation is the innovative way information is combined with technology to raise human and machine performance. Ultimately, we want digital to be entrenched in the way we work, intuitively using the tools just as we do in our personal lives."

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Wan Shamilah Saidi,
Chief Digital Officer, PETRONAS (2020)

Early detection of equipment problems

Following a successful POC to evaluate AI-infused AVEVA Predictive Analytics, PETRONAS implemented a pilot project in their corporate cloud, running on Microsoft Azure, at four upstream platforms and two downstream plants.

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AVEVA Predictive Analytics is an asset performance management solution that provides early warning notification and diagnosis of equipment issues days, weeks, or even months before failure. This helps asset-intensive organizations, such as PETRONAS, to reduce equipment downtime, increase reliability, improve performance and safety, and reduce operational and maintenance expenditure. At PETRONAS, the solution works in conjunction with the PI System from OSIsoft, now part of AVEVA, which gathers data from critical assets in the plant. The PI System collects and structures this data for historization and analysis. The data is used by AI-based AVEVA Predictive Analytics models to highlight any anomalies, trends, potential incidents or failures, and enable the teams to undertake improvements as needed.

Data collected by the sensors in the instrumentation and equipment pinpoint the tiniest deviations in what the AI has trained the software to consider as 'known good behavior.' This is more effective than setting high and low thresholds that trigger an alarm when reached, because, by then, operations have already spun out of control. PETRONAS' AVEVA Predictive Analytics solution spots the problem as it grows away from 'known good behavior' before it leads to a catastrophic failure.

"We've been using the PI System as our standardized data historian platform for many years. We were looking to add further value to the data gathered to optimize plant operations throughout our business. We chose cloud-based AVEVA Predictive Analytics not only because of its ability to accurately predict equipment failures in advance, but also because it easily integrates with the PI System and because of its intuitive look and feel which helped our teams get up to speed quickly."

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Salim Sumormo,
Custodian (Rotating Equipment), PETRONAS

Rapid time to value

PETRONAS hired Trisystem Engineering Sdn Bhd (TSE), a systems integrator, to deliver the project. TSE worked closely with the team at PETRONAS to deploy the solution across various sites. In each case, the solution was up and running, delivering value within two months.

AVEVA Predictive Analytics comes with out-of-the-box purpose-built AI that has been customized for each industry, meaning that no coding is required. This enabled TSE to follow a templated approach that ensured the solution could be scaled quickly, deployed efficiently, and deliver the high time to value that PETRONAS sought.

"Our digital transformation strategy at PETRONAS is to add value quickly, as this has a faster impact on our sustainability goals and on profitability. We do this by identifying discrete projects with tangible deliverables and then cascade the same approach elsewhere, having learned valuable lessons along the way. AVEVA Predictive Analytics allowed our teams to adopt a templated approach that enabled us to quickly deploy the solution in other sites, ensuring high time to value and fast ROI."

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Mohd Nazrin Zaini,
Custodian (Rotating Equipment), PETRONAS

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New ways of working

The maintenance and reliability engineers at PETRONAS use AVEVA Predictive Analytics for their day-to-day tasks, to monitor assets across the sites. All levels have visibility of the systems, from technicians to plant managers as well as management teams. With these capabilities in the cloud, PETRONAS can remove silos and build new and more collaborative ways of working. In elevating digital fluency to its people, PETRONAS expects these successful pilot programs to spread the word in their digitalization journey. The approach is not about convincing employees, but rather immersing them in new ways of working through digital solutions.

Predictive analytics drives business value, saving $17.4M (RM73.1M)

The pilot implementation accurately predicted failures in advance that enabled PETRONAS' team to fix issues ahead of actual failures. In 2020 (the first year of deployment) with 200 models deployed, the solution accurately identified 51 major early warnings, creating a value of RM73.1M, equivalent to savings of US$17.4M, and 14x ROI. Out of the 51 warnings, 12 were identified as high-impact warnings. Resolving these ahead of actual failure has reduced unscheduled downtime and saved PETRONAS millions of dollars.

Many of the catches helped to reduce critical rotating equipment failure and downtime and have led to improved reliability through proactive asset monitoring and maintenance.

For example, an instrumentation fault was identified leading to a catch in a liquid separator that saved PETRONAS $222K (RM934K) in potential asset failure and wasted material. A potential motor failure was also caught when AVEVA Predictive Analytics identified increases in the motors lube oil temperature, the winding temperature, and the hot air temperature, saving $82K (RM344K) in equipment replacement. In another situation, a mechanical fault was identified allowing maintenance engineers to pinpoint a water supply temperature out of specification along with an increase in bearing temperature. Catching this issue before it cascaded into a major equipment failure saved Petronas $48K (RM 202K).

Reduced maintenance costs, a safer plant, and improved equipment utilization

Part of value creation at PETRONAS comes from cutting maintenance costs. Using the AVEVA APM solution on their Azure cloud platform enabled the team to streamline day-to-day operations and regular maintenance cycles. They can analyze the problems in detail and take further proactive action to reduce the chance of reoccurrence, which further contributes to reduced maintenance costs. Avoidance of equipment failures and unplanned shutdowns has also contributed to better safety records and a safer working environment.

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Improved asset utilization and faster decision-making drive efficiencies

AVEVA Predictive Analytics uses AI to highlight the slightest deviation from normal operational profiles. Through detailed analysis, the team has been able to identify underperforming assets and take remedial action to improve equipment efficiency.

"Not only does our AVEVA solution deliver early detection of anomalies and failure, it also enables us to institutionalize our years of machine operation experience into a digital platform. We've integrated the PETRONAS failure mode and effects analysis (FMEA) methodology into AVEVA Predictive Analytics, and the solution prescribes the corrective actions each time anomalies are triggered. This eliminates the need for manual time-consuming investigations and decisions can be made quickly, which in turn, boosts productivity."

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Azizol Kamaruddin,
Principal (Rotating Equipment), PETRONAS

What's next for PETRONAS?

Following the successful pilot across four plants, PETRONAS has deployed AVEVA Predictive Analytics at an additional 10 plants with a total of 150 equipment trains. PETRONAS aims to continue rolling out the APM solution in the cloud to all its assets to enjoy similar results across the business. PETRONAS also uses cloud-based AVEVA Unified Supply Chain to optimize its entire supply and distribution network, cutting crude evaluation time and reducing margins.

"The PETRONAS Machinery Monitoring and Prescriptive Diagnostics system – based on AVEVA's advanced analytic tools that utilize machine learning and artificial intelligence – will be scaled up across our business. We therefore expect the value delivered to PETRONAS from our AVEVA solution to increase accordingly, as we continue to collaborate with our technology partners to support our Moving Forward Together strategy."

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Azlan Ayub,
P-MMPD Lead, PETRONAS

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