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Featuring insight from Salim Sumormo, custodian of rotating equipment at PETRONAS

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The power of predictive analytics

Multinational oil and gas company PETRONAS saved $17.4 million in just 12 months after deploying AVEVA Predictive Analytics in the Microsoft Azure cloud to accurately predict and resolve equipment failures before they happen

Headquartered in Malaysia, Petroliam Nasional Berhad (PETRONAS) is a multinational oil and gas company that produces 2.4 million barrels of oil equivalent per day. The organisation aims to achieve net-zero carbon emissions by 2050 but to help it move closer to attaining this sustainability goal, it needed to find a way to optimise the performance of its plant equipment to make it more reliable and stable.

Like any industrial organisation that operates machinery, PETRONAS must ensure its equipment runs smoothly at all times to be able to serve customers. Although PETRONAS was able to schedule maintenance activities in advance, it faced unexpected critical rotary equipment failures that can result in unplanned downtime, potentially shutting down an entire plant and leading to catastrophic consequences.

PETRONAS's plants were at risk of critical equipment failure because the engineering division did not have access to the right information to gain advance warning of problems. Keen to optimise the performance of equipment to improve plant reliability and reduce the risk of downtime, the engineering division wanted to implement an asset performance management (APM) solution. This would give plant operators an insight into impending equipment failures and empower them to proactively fix the equipment before bigger problems ensued.

Consequently, PETRONAS opted for AVEVA Predictive Analytics, an APM solution that provides early warnings and diagnoses of issues with

equipment days, weeks or even months before it fails. This helps asset-intensive organisations such as PETRONAS to reduce equipment downtime, increase reliability, improve performance and safety, and decrease operational and maintenance expenditure.

PETRONAS trialled AVEVA Predictive Analytics running in the Microsoft Azure during a six-month proof-of-concept (POC) project at selected upstream facilities and downstream plants. The focus of the project was to evaluate how effective the solution was at detecting and providing early warnings of machinery issues. Following a successful POC, PETRONAS implemented a pilot at four upstream platforms and at two downstream plants.

Systems integrator Trisystem Engineering (TSE) was hired to deploy the solution across various sites. Working closely with PETRONAS, TSE implemented the solution using an agile methodology via sprint planning, grouping together equipment that performs similar functions. Each sprint typically includes seven to ten pieces of equipment. As AVEVA Predictive Analytics comes with purpose-built artificial intelligence that has been customised for the energy industry, TSE did not need to code anything and could follow a templated approach to ensure the solution could be deployed efficiently and scaled quickly. In each case, the solution was operating and delivering value within two months.

"Our digital transformation strategy at PETRONAS is to add value quickly, as this has a faster impact on our sustainability goals and on profitability," says Mohd Nazrin Zaini, senior engineer of rotating equipment at PETRONAS. "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 return on investment (ROI)."

AVEVA Predictive Analytics works in conjunction with PI System from OSIsoft (now part of AVEVA), which PETRONAS already used to gather data from critical assets in the plant. PI System collects and structures this data for historisation and analysis. The data is used by AVEVA Predictive Analytics models to highlight any anomalies, trends, potential incidents

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MOHD NAZRIN ZAINI, PETRONAS

or failures, and to enable the teams to undertake improvements as needed.

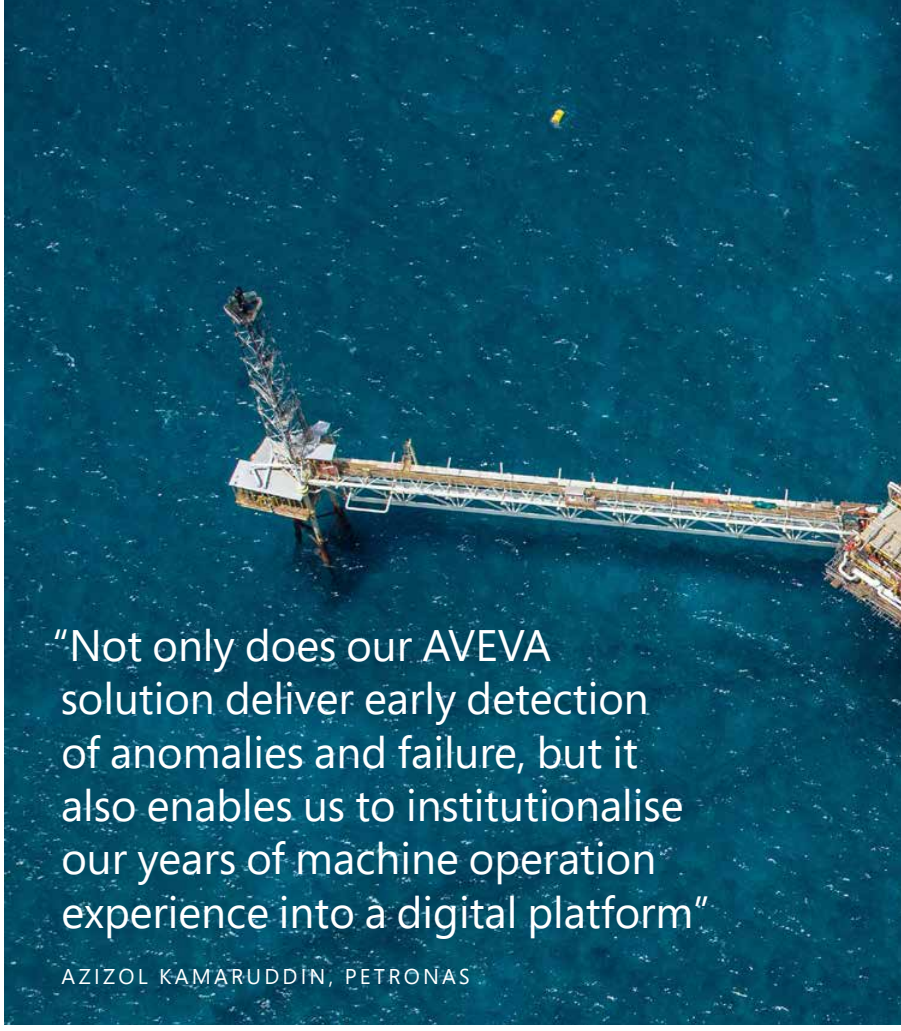
Data collected by the sensors in the instruments and equipment pinpoints the tiniest deviations from what PETRONAS has trained the software to consider as 'known good behaviour'. This is more effective than setting high and low thresholds that trigger an alarm when reached, because by then, operations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

The streamlined data integration between AVEVA's APM solution on Microsoft Azure and the PI System was a significant success factor in the project. "We've been using PI System as our standardised data historian platform for many years," explains Salim Sumormo, custodian of rotating equipment at PETRONAS. "We were looking to add further value to the data gathered to optimise 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 PI System and because of its intuitive look and feel which helped our teams get up to speed quickly."

AVEVA's solution also works in parallel with PETRONAS's existing traditional plant control (DCS) system. Operation engineers use the DCS system to operate the plant, while maintenance and reliability engineers use AVEVA Predictive Analytics for their daily tasks and monitor assets across the sites. Everyone in the team has visibility of the systems – from technicians to plant managers and management teams. With these capabilities in the cloud, PETRONAS can remove silos and build new and more collaborative ways of working.

In the first year of pilot implementation (2020) with 200 models deployed, AVEVA's solution accurately identified 51 major early warnings of impending equipment failures, including 12 high-impact warnings. PETRONAS's team was able to resolve these issues ahead of actual failure, significantly decreasing unscheduled downtime and saving the organisation a total of US$17.4 million. This also generated 14 times ROI.

Many of these warnings helped to reduce critical rotating equipment failure and downtime, indicating that proactive asset monitoring and maintenance leads to improved plant reliability. For example, an instrumentation fault was identified leading to a catch in a liquid separator that saved PETRONAS $222,000 in potential asset failure and wasted material. AVEVA Predictive Analytics also saved $82,000 in equipment replacement costs by detecting potential motor failure via increases in the temperature of the hot air, winding and lube oil in the motor. In another situation, the solution found a mechanical fault, allowing maintenance engineers to pinpoint and resolve issues with the temperatures of a water supply and a bearing. Catching this issue before it turned into a major equipment failure saved PETRONAS $48,000.



"Not only does our AVEVA solution deliver early detection of anomalies and failure, but it also enables us to institutionalise our years of machine operation experience into a digital platform"

AZIZOL KAMARUDDIN, PETRONAS

Another benefit is that using AVEVA's APM solution on its Microsoft Azure cloud platform has enabled PETRONAS to streamline day-to-day operations and regular maintenance cycles. The decrease in equipment failures and unplanned shutdowns has also contributed to a safer working environment and better safety reports.

AVEVA Predictive Analytics has improved asset utilisation and enabled faster decision-making too. It uses artificial intelligence (AI) to highlight the slightest deviation from normal operational profiles, enabling the PETRONAS team to

closely monitor operations, spot anomalies and generate early warnings. Through detailed analysis, the team has been able to identify underperforming assets and take remedial action to improve equipment efficiency.

PETRONAS's use of AVEVA Predictive Analytics has also improved collaboration between the plant operators and specialists at the PETRONAS Centre of Excellence, which acts as a centralised remote monitoring centre. The business units can constantly share updates and feedback related to the detected faults and when the operators spot deviations from normal operations, the subject matter experts at COE can quickly recommend corrective action via the case management feature. They can analyse problems in detail and take further proactive action to minimise the chance of reoccurrence, which has also contributed to reduced maintenance costs.

"Not only does our AVEVA solution deliver early detection of anomalies and failure, but it also enables us to institutionalise our years of machine operation experience into a digital platform," says Azizol Kamaruddin, principal for rotating equipment at PETRONAS. "We've integrated the PETRONAS failure mode and effects analysis 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."

Following a 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 Microsoft Azure cloud to all its assets and enjoy similar results across the business. The organisation also uses cloud-based AVEVA Unified Supply Chain to optimise its entire supply and distribution network, cutting crude evaluation time and lowering margins.

"The PETRONAS Machinery Monitoring and Prescriptive Diagnostics (P-MMPD) system – based on AVEVA's advanced analytic tools that utilise machine learning and AI – will be scaled up across our business," says Azlan Ayub, P-MMPD lead at PETRONAS. "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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