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Maintaining Indonesia's National Energy Security with AVEVA™ PI System™ and AVEVA™ Predictive Analytics

**PERTAMINA** – Indonesia National Energy Company (NEC)
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Pertamina as the National Energy Company and one of the largest State-Owned Enterprises in Indonesia has developed an integrated business network that covers a range of services, from the upstream to downstream.

On 12 June 2020, 6 (six) Sub Holdings were established under Pertamina, i.e., Subholding Upstream (SHU), Subholding Gas (Gas), Refinery and Petrochemical (R&P), New & Renewable Energy (NRE), Commercial and Trading (C&T), as well as Integrated Marine Logistics (IML).
PT Kilang Pertamina Internasional

PERTAMINA conducts business activities in refinery operations and development under Refining and Petrochemical Sub-Holding.

PT Kilang Pertamina Internasional (KPI) was appointed as the management of Refining & Petrochemical. As a Sub-Holding company, PT KPI is responsible for the investment and PERTAMINA business ventures related to the refining business, processing, and petrochemical refinery megaprojects.

PERTAMINA has Six Refinery Units (RU), with a total capacity of 1,058 MBOPD:

1. RU-II Dumai
2. RU-III Plaju
3. RU-IV Cilacap
4. RU-V Balikpapan
5. RU-VI Balongan
6. RU-VII Kasim
The Journey Implementing Predictive Analytics Solution in 5 Refineries of PERTAMINA

**CHALLENGES**
- Managing Six Refinery Units across Different Islands and Time Zones with Limited Connectivity and Varied Historian Systems
- Data Fragmentation due to Refineries Operating in Different Locations and Time Zones
- Addressing Data Format and Communication Protocol Differences across Refineries' Historian Systems
- Limited Internal Expertise in Developing Predictive Analytics Tools
- Overcoming Resistance to Adopting New Technology for Existing Processes
- Safeguarding Against Cybersecurity Threats

**SOLUTION**

**AVEVA PI System**
- Standardizing Connections via PI OPC Data Access
- Utilizing PI Data Archive for a Unified Historical Data Platform
- Structuring Critical Equipment Data with PI Asset Framework

**AVEVA Predictive Analytics**
- Generating Robust Predictive Analytics for Asset Maintenance
- Real-time Monitoring Dashboard for Enhanced Oversight

**Cybersecurity Measures**
- Employing Operational Technology (AVEVA PI System & Predictive Analytics) as an Alternative to Internet of Things Technology

**BENEFIT**
- Real-time Monitoring of Approximately 90 Critical Assets across Five Major Refinery Units via Predictive Analytics
- Notable Cost Savings: $2 million (2020), $3 million (2021), and $6 million (2022) from Mitigated Production Losses owing to Unplanned Shutdowns
- Potential Annual Reduction of Maintenance Costs by 15%
- Elevated Company Reputation through Deployment of a Leading-Edge Solution, with Emphasis on Cybersecurity Implementation
From 2012 to 2019, RU 6 Balongan Experienced Numerous Unplanned Shutdowns Caused by 10 Main Equipments

The three out of ten

MAB & WGC ARE CRITICAL EQUIPMENT IN RESIDUAL CATALYTIC CRACKER (RCC) UNIT

- Main Air Blower (MAB) (15-K-101) Experienced 4 endogenous failures in the range 2013 to 2018

- Wet Gas Compressor (WGC) (16-K-101) Experienced 3 endogenous failures in the range 2013 to 2018

RGC IS CRITICAL EQUIPMENT IN PLATFORMER (PLT) UNIT

- Recycle Gas Compressor (RGC) (32-K-101) Experienced 2 endogenous failures in the range 2012 to 2019
The image contains a flowchart and text that describes a solution architecture for Predictive and Prescriptive Maintenance. The architecture involves the integration of various components such as OPC UA agents, OSI PI agents, and PHD Honeywell devices, with connections managed by an RTS Agent Manager. The flowchart illustrates the data flow from the Plant Network through OPC UA Tunneler and OSI PI AF Connector to the Pertamina Data Center. 

**Notes:**
- Pertamina to ensure the availability of the connection from the plant historian to the Pertamina Data Center.
- The following is required for the data communication between PPMS and Plant Historian:
  - OPC UA protocol/Matricon OPC UA Tunneler for the integration with PHD Honeywell
  - PI-AF Connector for the integration with OSI PI

The diagram shows the integration of existing apps and Pertamina with AVEVA, indicating the use of AVEVA's PA Client and PA Web for BI Reporting and Power BI.
Implementation Details (Solution)

PERTAMINA Digital Transformation & It’s Holistic Approach

**PROCESS (Business)**
- Top Equipment Prioritized
- Revise Maintenance Procedure
- Roadmap to Scale-up Implementation

**TECHNOLOGY**
- Best-In-Class P Solution
- Reliable IT Infrastructure
- Integrated Solution

**PEOPLE (Organization)**
- Change Management
- Personnel Improvement
- Design Thinking
Implementation Details (Solution):
End to end Predictive Maintenance Development & Implementation

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Implementation Details (Solution)

Technical Working Principle

Specific, but holistic model approach

- Dedicated models to monitor different performance areas
- Minimize noises and confusions
- Best approach to keep high model accuracy
Implementation Details (Solution)

32-K-101 (Recycle Gas Compressor)

Model Parameters:

- 32-FI-006A  Comp Gas Flow
- 32-FI-006B  Comp Gas Flow
- 32-FI-006C  Comp Gas Flow
- 32-VXE201  Comp Radial Vib Outboard 1
- 32-VYE201  Comp Radial Vib Outboard 2
- 32-ZE-201  Comp Axial Disp

Model Objective:
Monitor compressor mechanical performance, issue early warning to users about potential problems that causes machine mechanical performance deviations.

Training dataset:
1st Jan - 2018 ~ 31st Dec 2018

Validation dataset:
1st Jan 2019 ~ 31st Aug 2019
Implementation Details (Solution)

32-K-101(Recycle Gas Compressor) Model Result

Deviation contribution: compressor outboard bearing vibration sensors started shifting up in late Jan
Implementation Details (Solution)

32-K-101(Recycle Gas Compressor) Model Result

Deviation contribution: displacement showed some minor deviation in Feb and Mar, suction flow showed low deviation in Mar.
Implementation Details (Solution)

AVEVA PA System Monitoring

- Hybrid GUI with asset selection, parameters and graphical PA trends
- Integration with AVEVA PI infrastructure read data sensors every 5 mins
- Configurable time window to check data history and run PA
Implementation Details (Solution)

**AVEVA PA Web Application**

- **User friendly GUI** help personnel to monitor specific
- Personnel can **monitor** current alert and active cases
- **Integrated with AVEVA PI** Infrastructure to monitor sensor connection

- Personnel can monitor more 90 assets in 5 Refinery Units, with active cases
- Integrated with AVEVA PI Infrastructure to monitor sensor health and connection
**Benefits on Cost of Avoidance**

**Jan 2022**
AVEVA PA help Pertamina to avoid surging due to high air temperature discharge on a critical asset with cost of avoidance **$0.3 Million**

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**Feb 2022**
AVEVA PA send an alert to repair journal bearing and winding temperature motor on three critical assets with cost of avoidance **$1.1 Million**

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**Feb 2022**
AVEVA PA help Pertamina to avoid catastrophic failure due to high vibration and temperature on two critical assets with cost of avoidance **$1.3 Million**

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**Mei 2022**
AVEVA PA help Pertamina to avoid catastrophic failure due to malfunction of bearing temperature sensor on a critical asset with cost of avoidance **$0.65 Million**

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**Jun 2022**
AVEVA PA help Pertamina to avoid catastrophic failure due to spike vibration on a compressor with cost of avoidance **$3.2 Million**
“You are more beautiful than you think.”

Thank You