Improving Equipment Reliability and Availability through Real-time Data

Presented by Nada Khalfan Al Meqbal
Praveen Bangari
We are one of the world's leading energy producers, and a primary catalyst for Abu Dhabi’s growth and diversification.

12th
The largest oil producer in the world

3
million barrels per day

151
oil transportation & support vessels
ADNOC Business

- **Exploration & Production**: We produce about 3 million barrels of oil per day, and over 9 billion standard cubic feet of gas per day, which places us among the largest energy producers.

- **Processing & Refining**: We positively impact the lives of millions of people throughout the world; generating the energy that is driving Abu Dhabi’s development.

- **Marketing & Distribution**: We are a trusted and reliable global energy provider. Our oil, gas, refined and petrochemical products are sold on six continents.
ADNOC Business

Exploration & Production

We produce about 3 million barrels of oil per day, and over 9 billion standard cubic feet of gas per day, which places us among the largest energy producers.

3.0 million barrels of oil per day
9.8 billion cubic feet of raw gas per day
ADNOC Onshore

We are the leading onshore producer within ADNOC Group, producing 1.6 million barrels of oil and 5.6 billion cubic feet of gas per day.
ADNOC Onshore Digital Transformation

Operations  Production Optimization  Maintenance & Integrity

Terminal Operations  Remote Monitoring  HSE & Energy
Business Case

Production Sustainability

Challenge

- Manual data entry of equipment run hours & status and manual calculation of KPI's related to equipment reliability and availability.
- No effective condition monitoring of equipment’s

Solution

- Automated the capturing of equipment run hours & status in Asset Management System and equipment’s KPI’s calculation
- Developed an effective condition monitoring with smart notifications for equipment’s
OSIsoft PI - Maximo Integration

Overview

DCS/SCADA
- PROVIDES ACTUAL EQUIPMENT STATUS
- PROVIDES ACTUAL ASSET PARAMETERS

OSIsoft PI
- MONITORS EQUIPMENT
- PROVIDES INTERFACE TO ENTER EVENT REASONS
- CALCULATES EQUIPMENT KPIs
- PROVIDES VIEWS & REPORTS
- PROVIDES ALERTS WHEN EQUIPMENT HAS STOPPED
- INTERFACES TO MAXIMO

Asset Management System
- RECEIVES ACTUAL STOP REASON FROM OSI PI
- PERFORMANCE-BASED PM & WORK ORDERS
OSIsoft PI - Maximo Integration Architecture

PI Modular Database ➔ PI ACE ➔ Output in PI Process Book
OSIsoft PI - Maximo Integration Architecture

The calculations are based on the definitions provided in ISO-14224
OSIsoft PI - Maximo Integration

Architecture

Maximo Meters

<table>
<thead>
<tr>
<th>TSO-Meter</th>
<th>TSO-Meter</th>
</tr>
</thead>
</table>

MAXIMO WebServices

getAssets: Provides a list of participating Maximo Assets, the Web Service will respond with a list of Asset

addMeterReading: Allows adding asset meter reading.

changeAssetStatus: Allows changing a specific asset status.
OSIsoft PI - Maximo Integration Application
OSIsoft PI - Maximo Integration

Equipment Status Capturing
OSIsoft PI - Maximo Integration

Notifications - Escalation Matrix

Operator
Level 1 Escalation
24 Hours

Engineer
Level 2 Escalation
48 Hours

Manager
Level 3 Escalation
72 Hours
## OSIsoft PI - Maximo Integration

### Notifications - Escalation Matrix

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Operator</td>
<td>24 hours</td>
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<td>Level 3</td>
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<td>72 hours</td>
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</table>

**Email Example:**

**From:** OSIsoft PI-PM Team

**To:** OSIsoft PI-PM Team

**Subject:** Level 2 Equipment Escalation Message for Asset A

**Message:**

*Good day,*

*This is the Operation Engineer and Team Leader level equipment status message for Asset A.*

*The following selected major rotating equipment being monitored and have unprocessed stop/run events that have been pending for more than 48 hours.*

**Total number of equipments:**

- Pump 1 - pending for 24 hours
- Pump 2 - pending for 24 hours
- Pump 3 - pending for 48 hours
- Pump 4 - pending for 48 hours

*The following equipment have unprocessed stop/run events that have been pending for more than 24 hours.*

**Total number of equipments:**

- Pump 1 - pending for 24 hours
- Pump 2 - pending for 24 hours
- Pump 3 - pending for 48 hours
- Pump 4 - pending for 48 hours
Condition Monitoring
Rotating Equipment

Rate of Change
Alarm Condition
Trip Condition

Real-time Data Analytics

Alert
Real Time Data Analytics

- Elements
  - Asset 1
  - Asset A
  - Pump 1
  - Pump 2
  - Pump 3
  - Pump 4

1500+ Analysis, 500+ Notifications
Component Level Monitoring Alerts

<table>
<thead>
<tr>
<th>Pump Component Level Monitoring</th>
<th>Motor Component Level Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Rotor Condition</td>
<td>▪ Rotor Condition</td>
</tr>
<tr>
<td>▪ Bearing Condition</td>
<td>▪ Stator Condition</td>
</tr>
<tr>
<td>▪ Seal Condition</td>
<td>▪ Bearing Condition</td>
</tr>
<tr>
<td>▪ Cooling Fan</td>
<td>▪ Casing Condition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seal Oil System Component Level Monitoring</th>
<th>Lube Oil System Component Level Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Seal Oil Pump</td>
<td>▪ Lube Oil Pump</td>
</tr>
<tr>
<td>▪ Seal Oil Cooler</td>
<td>▪ Lube Oil Cooler</td>
</tr>
<tr>
<td>▪ Seal Oil Cooler Fan</td>
<td>▪ Lube Oil Cooler Fan</td>
</tr>
</tbody>
</table>
Component Level Alerts Details

Asset Details
- Asset Name
- Asset ID
- Asset Tag & Asset Description (Static information coming from PI AF Elements/Equipment Attributes)

Process Parameters Status
- Real-time - Value, Condition/Status
- Alarm Set Point Value & Trip Set Point Value (Static: PI AF Elements/Equipment Attributes)

Probable Effects & Proposed Solutions
- Static Data Entered in the PI AF Template per Equipment Type

Dynamic Links
- PI Coresight & Maximo (Unique links are generated for every equipment)

Spare Parts
- Details - Name, Spare Part Code & Installed Quantity
- Data Source - Static Data Entered in the PI AF Template per Equipment Type
Component Level Monitoring Alerts
Smart Notification Benefits

Lube Oil System

**Tank Level**
- Water Ingress (Level Increase)
- Required Oil Quantity (Level Decrease)

**Drop Rate/Day**
- Oil Leak Prediction (Design vs Actual)
- Tank Level Prediction (Inventory Planning)
Way Forward

- Migration of OSIsoft PI – Maximo Integration to PI AF and PI Coresight
- Extend the Smart Notifications to all the pump types
- Implementation of Smart Notifications for monitoring the Performance of the Equipment (Energy Optimization)
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Questions

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