PETRONAS - Integrated Asset Monitoring and Optimization

Abdelmadjid Aissani & Timur Tashkenbaev
Outlines

• PETRONAS Overview and Vision
• Message from PETRONAS Management
• Business challenge and Solution
• PI System Application in PETRONAS
• PI System Implementation details
• Way forward: PI-AF and PI Vision
• Demo
• Results and business impact
Company Overview

Petroleum Nasional Berhad (PETRONAS) is Malaysia’s fully integrated oil & gas multinational with proven capabilities in a broad spectrum of the petroleum chain value. Established in August 17, 1974, PETRONAS vision is to be a Leading Oil and Gas Multinational of Choice.

PETRONAS mission statement are:
• We are a business entity
• Petroleum is our core business
• Our primary responsibility is to develop and add value to this national resource
• Our objective is to contribute to the well-being of the people and the nation
"To remain competitive, digital solutions in Petroleum Engineering isn’t one of the options, it’s the only option…"

"Past Success Does Not Guarantee Future Success…………………
Combining People, Technology and Process via Digital Technology"

"Maximizing Value from data driven organization"

"The requirement of pace, value and risk in decision making is crucial. Moving towards digital will make these integrated as ONE and improve efficiency"

"Data Integration, Workflow automation and Standardization of processes is essential for deployment of digital solution"

"PI system enables to maximize the oil recovery from the field by improving the efficiency in well surveillance and enable to trigger the well problems and as well as provides safe operation envelopes"

"PI provides us an endless creativity to automate and customize our in-house technical solutions through the established IO environment"

Message from PETRONAS
Business Challenge

Is there a way to automate this?
Integrated Solution

Knowledge Information Data

- Process
- Technology
- People
- Value
- Improved HSE
- Enhanced HC recovery
- Sure, Let’s Go Digital

- Best practices
- Guidelines
- Expertise
- Capabilities
- Execution
- Decision Making
- Workflows
- Collaboration
- Optimization
- Modeling
- Software
- Hardware
- Data historian

Reduced Cost
How to make it happen?
PI System Implementation in PETRONAS

25 Assets have implemented in Upstream PETRONAS

Malaysian Asset

International Assets
ROADMAP of Transformation Journey

- **PI System Installation**
  - Q2 2016
  - PI Processbook Conversion Steps
    - Basic Surveillance
    - Simple logic PI Calculation
  - Q3 2016
    - Establishing Alarm System
    - Introduction of Dashboards

- **Phase 1 Upgrade**
  - Q1 2017
    - Introduction of additional several workflows for surveillance and optimization
    - Establishing connection with Corporate Database

- **Phase 2 Upgrade**
  - Q2 2018
    - Introduction of additional workflows for surveillance and optimization
    - Autonomous workflow
    - Introduction of Well Advisory
    - Enhanced Dashboard

- **Phase 2 Upgrade**
  - Q2 2018
    - PI AF Formula
    - PI Vision Dashboard
    - Intuitive Visualization with Voice Command
Solution Components

Overall Overview

Platform by Platform view

Action & optimization

Opportunity Summary

Surveillance & Monitoring

Well test validation & Model update

Gas Lift diagnostic

Action & optimization
Integrated Workflows and Features

- **Advanced Surveillance & Monitoring**
  - Operating limit
  - Slugging and surging detection
  - Sampling and well test data display

- **Action and Optimization at well level**
  - Automation of integrated workflows (GLOP, Sand, LPS, Choke)
  - Auto generation of recommendations and estimated values

- **Well Test validation** (integrated with EC data, real-time data, systematic model matching/recalibration and advisory system)

- **Development an advisory system based on expertise and guideline**

**Hi Sir, How can I assist you...**
### Business Values

<table>
<thead>
<tr>
<th>Surveillance and Monitoring</th>
<th>Well Test Validation dashboard</th>
<th>Gas Lift Diagnostic dashboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Quick identification of issues, well behavior underperforming wells, downtime</td>
<td>□ Improve the efficiency/accuracy of well test validation</td>
<td>□ Continuous monitoring of total/dual string</td>
</tr>
<tr>
<td>□ Quick analysis, troubleshooting and actions</td>
<td>□ Standardize procedure and workflow</td>
<td>□ Quick identification of underperforming gas lifted wells.</td>
</tr>
<tr>
<td>□ Reduce downtime</td>
<td>□ Systematic well model update</td>
<td>□ Fast corrective actions</td>
</tr>
</tbody>
</table>

### Action and Optimization dashboard

<table>
<thead>
<tr>
<th>□ Real time optimization</th>
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</table>

- Auto generation of recommendation (opportunities) such as Optimization (bean up, GLOP, GIVC), Flow assurance and integrity (sand erosion, choke performance) and debottlenecking (LPS candidate, Backpressure identification)
- Auto check of compliance (Sampling frequency)

### Advisory System

<table>
<thead>
<tr>
<th>□ Uses expertise, knowledge and guidelines</th>
</tr>
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- Develop capabilities.
- Help for decision making
Way forward: PI-AF and PI Vision

Digital Solutions: Plug and Play Concept

Current Stage

- PI ProcessBook
- Engine
  - + VB
  - + Technical Software
  - + Corporate Database
  - + Automated Workflows
  - + Dashboard View

Future Stage

- PI ProcessBook
- PI AF
- PI Vision
- Engine
  - + PI AF formula
  - + Technical Software
  - + Corporate Database
  - + Automated Workflows
  - + PI Vision Dashboard
PETRONAS Digital Collaboration Center (PDCC)
DEMO

PI_Plug and Play
Field Level- Asset Overview
Field Level - Platform Overview
Well Level- Surveillance & Monitoring Dashboard
Well Level- Well Test Validation & Model Update

- **Well Test Parameters Trending**
  - CHP-WT, THP-WT, FLP-WT
  - Date: 19/05/2018 11:07:56 AM

- **Last Accepted WT data**
  - Date: 19/05/2018 11:07:56 AM
  - Status: ACCEPTED

- **Run Modification**
  - Option: ADVISE ME
  - Formula: GL Rate + TTB Rate
  - Remarks: One or more of the key parameters ( choke, FTTH, CHP, GUR ) deviated (>10%) compared with the last accepted well test, steps to be done:
    1. Run well model/system calculation, then check the difference between calculated liquid rate vs measured.
    2. If the difference is within tolerance range then Accept the welltest/Change PGPS/Welltest Status to Accepted.
    3. Update the model with new parameters (WCT, GOR, ...) and update the ratio.
Well Level- Dual Gas Lift Diagnostic dashboard
Optimization & recommendations
Conclusion

• PI ProcessBook is more than just trending and alarms.

• PI System is a powerful tool used in digital field.

• Moving to PIAF and PI Vision is vital, which will bring enormous benefit in terms of process standardization, real time data integration and visualization

• Integrated Asset optimization using PI System shows a tangible value in terms of production gain, reduce deferment and cost, as well as improve on decision making
# CHALLENGE

- Very little utilization from the user of the full capability of the PI system, limited to only display some trends in individual manner.
- With a large amount of data at high frequency, searching relevant information is quite complex and time consuming, complicating the decision making process.
- Slow troubleshooting, analysis and reporting reduced productivity and cost the company significant money.

# SOLUTION

- PI System was used as platform to develop a solution which integrate real time data, data from different sources (EC, LIMS, SQL Server...) and software (nodal analysis, erosion...).
- Advanced well surveillance with an advisory system based on guidelines and operating envelop was developed.
- Work process was converted to automated workflows run on Real-time basis and provide the engineers a tool for diagnosis and optimization.

# RESULTS

- Accessing data to troubleshoot problems and generate opportunities on realtime basis.
- Platform operators and on-shore engineers can collaborate to troubleshoot problems using the same Interface.
- Optimization and diagnosis workflows run on real-time basis, generating opportunities and value.
- The Solution will be used in PDCC (PETRONAS Digital Collaboration Center).
• Abdelmadjid Aissani
  • Senior Production Technologist
  • PETRONAS
  • aissani.madjid@petronas.com.my

• Timur Tashkenbaev
  • Production technologist
  • PETRONAS
  • timur.tashkenbaev@petronas.com.my
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