First Digital Oil Field implementation in Kazakhstan Case Study

Bekzhan Alimbayev
Reservoir Engineer
Agenda

• Company overview
• Strategic goals
• Project roadmap
• Solution Architecture
• Project overview and workflow examples
• Project value
Company overview

- Oilfields discovery: 1989
- Establishment of the company: 1993
- First oil production: 1996
- Today's production ~ 50,000 bbl/d: Present
- Production License: 2024

Regional structural map top of PZ:
- Aksai
- Nuraly
- South Aksai
- South Akshabulak
- Central Akshabulak
- East Akshabulak
Company overview

Annual oil production (bbl)

Well count by lift types

Number of production wells in September 2019

<table>
<thead>
<tr>
<th>Type</th>
<th>Active</th>
<th>Natural flow</th>
<th>ESP</th>
<th>Rod pump</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>230</td>
<td>30</td>
<td>183</td>
<td>17</td>
</tr>
</tbody>
</table>
Strategic goals

- Monitoring and analysis of well performance to increase mean time between failures for ESP wells
- Obtain specialized tools to identify wells prone to unplanned shutdowns
- Time reduction of data gathering, processing and reporting
- Increase the quality of oil allocation due to virtual flow meter
- Obtain a single consolidated operational database that provides seamless data gathering, processing, integration and visualization
**Project roadmap**

**Infrastructure preparation**

**Results**
1. Modernization of metering group unit on Askhabulak, Nuraly fields to improved quality and accuracy of metering
2. Modernization of electrical networks, to improve the reliability of power supply;
3. Modernization of telecommunication system. Increased data transfer capacity.

**Studies**
1. Pre-project studies.
2. Analysis of processes, people and technology
3. Identification of operational problems, setting goals and objectives of DOF project;
4. Wireless coverage on the fields.

**Actions**
1. Drilling monitoring system

**DOF project implementation**

**Project start**
1. Implementation of the PDMS platform to create an integrated field database;
2. Implementation of remote well control system at Akshabulak;
3. Remote control of metering group unit obtained;
4. Centralized complex of automated process control system
5. Command and control centers.

**Implementation**
1. Visualization and Decision Support System;
2. PDMS integration with telemetry system and analytical tool.
3. Shortfall Management
4. Virtual flow meter
5. Automated Reports

**Development**
1. Implementation of remote well control system at Nuraly and Aksai;
2. Implementation of remote well control system at injection wells.
3. Automated workover candidates selection

**Idea**
1. Search of technology on the way of DOF project.

**2012**

**2013**

**2014**

**2015**

**2016**

**2017**

**2018**

**2019**
**Project roadmap (DOF project implementation)**

**Monitoring, surveillance and analytics**
Valuation dashboards, shortfall management, advanced well test analysis, report automation and reservoir surveillance and monitoring

**Integration with Subsurface model**
Seamless data integration from central database into subsurface geological model

**Production network model**
Multiphase network model in PIPESIM to optimize production

---

**2017**

**Production data management**
Standardization and automation of hydrocarbon allocation and centralization of production and operational data into single common database

**2020**

**Well models**
Creation of ~220 well models with automated calibration workflow. Models results used for ESP monitoring and surveillance, virtual flow metering

**PDMS integration with SCADA**
Seamless integration of real time data from SCADA directly into PDMS to minimize human factor
# Solution Architecture

<table>
<thead>
<tr>
<th>Source</th>
<th>Local telemechanics (automated)</th>
<th>Data storage</th>
<th>Online monitoring</th>
<th>Platforms and software</th>
<th>Monitoring of integrated system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wells</td>
<td><img src="image1" alt="Wells Diagram" /></td>
<td>Control stations</td>
<td><img src="image2" alt="Online Monitoring Diagram" /></td>
<td><img src="image3" alt="Avocet" /></td>
<td><img src="image4" alt="Multiphase Flow Simulator" /></td>
</tr>
<tr>
<td>Metering group unit</td>
<td><img src="image5" alt="Metering Group Unit Diagram" /></td>
<td>Hardware blocks</td>
<td><img src="image6" alt="SCADA" /></td>
<td><img src="image7" alt="Reservoir Surveillance" /></td>
<td><img src="image7" alt="Reservoir Surveillance" /></td>
</tr>
<tr>
<td>Processing units and facilities</td>
<td><img src="image8" alt="Processing Units Diagram" /></td>
<td>Dispatchers room</td>
<td><img src="image9" alt="Visualization" /></td>
<td><img src="image10" alt="3D Reservoir Modeling and Simulation" /></td>
<td><img src="image10" alt="3D Reservoir Modeling and Simulation" /></td>
</tr>
</tbody>
</table>

- **Data transfer**
- **Control**
- **Visualization**
Unified Integrated Data Workspace and Team Collaboration

**Operational Data Center (Field)**
- Response to shutdowns
- Data Quality Check
- Making Report

**Center for analysis and planning (office)**
- Data Analysis, Analytics
- Production planning
- Recommendations on workovers

**Field equipment**

**Field operations data**

**AVOCET**
- Centralized field-based database
- Production data calculation
- Oil allocation
- Autocalibration of well models
- Virtual flow meter

**Web Portal**
- Web dashboards
- Automatic Web-reports

**Reservoir Surveillance / 3D Simulation**

**Top management**

**Business decision-making**
Web-reporting in One Click

Time-saving up to 600 working days per year

List of reports:
- Daily: 16
- Monthly: 12

Example: Daily production report
Web-dashboards: Asset Overview

KPIs: (plan/actual)
- Oil production
- Oil Sales
- Water Production
- Gas Production
- Water Injection
- Polymer Injection

Well stock by field

Wells below target

Production shortfall
Web-dashboards: Well Test Analysis

ABC diagram

Well test summary by wells
Web-dashboards: Well performance analysis (ESP)

Virtual flow meter

1 click access to well model

Pump performance curves

Pump operation diagnostic diagram

Nodal analysis
Web-dashboards: Downtime shortfall analysis

Mean time between failures (MTBF) in ESP wells increased up to 3%
A unique workflow to identify wells prone to unplanned shutdowns

1. Nodal analysis
   - Well identification with decreasing outflow
   - Accuracy: 67%
   - Reliability: 14%

2. Pump operation
   - Increase model reliability based on pump operations history
   - Accuracy: 50%
   - Reliability: 20%

3. Models
   - Further increase in model reliability using well model results
   - Accuracy: 50%
   - Reliability: 43%

$\sim30\text{Kbbbl}$

$\sim$1.6 M

A unique workflow to identify wells prone to unplanned shutdowns in order to reduce oil production losses.
Mean time between failures (MTBF) in ESP wells increased up to 3%  
Potential additional production up to 30K barrels of oil ($1.6 mln) due to unique workflow

Time reduction of "quality" data gathering, processing and reporting  
Increase the quality of oil allocation due to virtual flow meter

A single consolidated field-based database obtained  
Automation of workflow – (time-saving up to 600 working days per year)  
Increased the value of management decisions
Thank you!