SWORDS

Automated Analytic Solution for Well Opportunity Identification

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Well Portofolio

- Expected Value of each wells
- Shows unprofitable wells
- Ability to screen wells
- Easy to select well priority

EV/COST ($/$)
SAVING:

193 K$ per year head cost

94% of time for well review process
Where is the value added?

T1 = Time to Detect the event
T2 = Time to Analyze and Diagnose the event
T3 = Time to Take actions

Value added by detecting and analyzing faster

Production Rate

T1 T2 T3

Time
Solution Approach | Process Flow

- Knowledge Base
- Technical Analysis
- Chance of Success
- Economic Analysis

Analytic Hierarchy Process (AHP) 

Dynamic vs Static

Problem Analysis
Technical Analysis | Analytic Hierarchy Process (AHP)
## Scale Problem | SIPOC Diagram

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>INPUT</th>
<th>PROCESS</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application/Database</strong></td>
<td><strong>Data Source</strong></td>
<td><strong>Data Type</strong></td>
<td><strong>Condition/Check/Problem Signature</strong></td>
</tr>
<tr>
<td>P2</td>
<td>Pressure Data</td>
<td>Downstream Flowline Pressure (X)</td>
<td>Is (X-A or B) &gt;30 psi</td>
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<tr>
<td></td>
<td></td>
<td>Average Downstream Choke WHP-A Wells (A)</td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average Downstream Choke WHP-B Wells (B)</td>
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<tr>
<td></td>
<td></td>
<td>Well Head Pressure (Y)</td>
<td>Is (Z-Y) &gt; 30 psi</td>
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<td></td>
<td></td>
<td>Upstream Choke (Z)</td>
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<tr>
<td><strong>WELLVIEW</strong></td>
<td>Well Intervention Report</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Scale Indication</td>
<td>If Scale Indication present in WI Report</td>
<td></td>
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<tr>
<td><strong>PROSPER</strong></td>
<td>Well Model Matching</td>
<td>Scale Indication</td>
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</table>

**SCALE**

**Condition/Check/Problem Signature**

- YES
- NO
- OR

**Process Result**

- Scale in Flowline
- Scale in Tubing
- Choke Optimization or Repair Choke
- Choke Optimization (Bean up) or Choke Repair
- Not Scale Problem
Technical Analysis | Dashboard

**Recommend Interventions**

**Technical Screening**

<table>
<thead>
<tr>
<th>REVIEW</th>
<th>RANK</th>
<th>STRING</th>
<th>ZONE REVIEW</th>
<th>ZONE STATUS</th>
<th>TECHNICAL POTENTIAL GAS mcfd/yr</th>
<th>TECHNICAL POTENTIAL OIL b/d/yr</th>
<th>CONSTRAINTS</th>
<th>OPPORTUNITY</th>
<th>OPPORTUNITY REVIEWED</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>WELL-F2</td>
<td>Z1</td>
<td>Active</td>
<td>237.05</td>
<td>1.00</td>
<td>Production Packer</td>
<td>BCO_Workover</td>
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<td>Z4</td>
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<td>WELL-B6</td>
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<td>Gas Lift Constraint</td>
<td>Gas Lift Valve Change/Increase Gas Lift Rate</td>
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<td>10.68</td>
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Chance of Success | Historical Success & Risk Quantification

**Historical Success**
- Field’s Intervention History Study

**Risk Quantification**
- Calculation of Subsurface and Operational Risk Factors

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### Subsurface Risk
- High Produced Water, 70%
- Interfered by Adjacent Wells, 50%
- Saturation Risk, 30%
- Commingle Zone, 15%
- Skin, 20%

### Operational Risk
- 2" Gas Lift Supply Line Availability, 50%
- Liquid Unloading Process, 40%
- Scale or Sand Production Issue, 10%
- Plug Leak, 10%
Historical Success Rate & Risk Assessment

<table>
<thead>
<tr>
<th>SAKA Activity</th>
<th>Estimate Execution Days</th>
<th>Estimate Cost</th>
<th>Target Gas Rate (MCF/day)</th>
<th>Target Oil Rate (bbl/day)</th>
<th>Incremental Gas Rate (MCF/day)</th>
<th>Incremental Oil Rate (bbl/day)</th>
<th>Gas-Historical Success</th>
<th>Oil-Historical Success</th>
<th>Number of Cases</th>
<th>Historical Success</th>
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<tbody>
<tr>
<td>Flowline Acidizing</td>
<td>3</td>
<td>10,000</td>
<td>1000</td>
<td>50</td>
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<td>120</td>
<td>0%</td>
<td>100%</td>
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<td>50%</td>
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<td>Tubing Acidizing (Wellbore Clean out)</td>
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<td>929</td>
<td>125</td>
<td>193</td>
<td>90</td>
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<td>Open SSD (BCO)</td>
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<td>Water Shut-Off (Squeeze of Chemical)</td>
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<td>Fishing Job</td>
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<td>279</td>
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<td>Gas Lift Deepening</td>
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<td>266</td>
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<td>50%</td>
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<td>Workover</td>
<td>14</td>
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<td>50%</td>
<td>63%</td>
<td>5</td>
<td>57%</td>
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</table>

Operational Risk Evaluation Queries

- 1. Last HUD (Held up depth) from last Well Intervention is higher than top of perforation. 30%
- 2. Do we have scale sample from previous intervention? 30%
- Is Well Header to Upstream Choke > 30 Psi: Last 3 days 20%
- For WHP-A, if Downstream Choke to MP Separator > 75 psi; For WHP-B, if dS Choke Pressure to MP Separator > 50 psi 20%

Risk Category: Scale/ Sand Production Issue
NPV | Gain and Cost

NPV calculation

FTP
Tax Rate
Total Cost
DMO
Cont. Split
Total Gain
Discount Factor

Cost of Workover/Intervention
- CAPEX Cost
- Total Cost
- OPEX Cost
  - Lost Cost
  - Cost due to production loss
  - Cost to handle fluid across production system

Post Workover
Last Rate
Oil & Gas Forecast
T. P.
Expected Value (EV)

\[ EV = \text{NPV}_{\text{gain & costs}} \times (1 - \text{Risks}) \times \text{Historical Success} \]
Conclusion | Result

- Perform full well optimization, workover, and intervention candidate review across 196 completions within a week.
- Executed Swords results in 7 wells.
- Improved the decision making in term of speed and accuracy.

**Impact**

- simple and quick to apply
- gives immediate impact to production

**Conventional vs SWORDS Gain Estimation (Dummy)**

- Production Gain (MMscfd) vs Target Gain (MMscfd)
- Orange dots represent Conventional
- Green dots represent SWORDS
Appreciation to

pgm SAKA power to discover

Schlumberger