Advantages of Rod Pump Control Systems on San Juan Basin Coalbed Methane Gas Wells

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Outline

• San Juan Basin overview
• Demonstrate the need for rod pump controllers (RPC)
• Establish the program goals
• Review findings
• Summary
The San Juan Basin

Coalbed Methane Fields, Lower 48 States

The most prolific CBM reservoir in the world > 17 TCF produced to date!
ConocoPhillips Rod Pump Completions in the San Juan Basin

- \(~1,250\) rod pumps
- \(~75\%\) have natural gas engines
- About 1,110 Fruitland Coal completions (89%)
Why Rod Pump Controllers?

Typical rod pump lifting capability is 35-40 Bwpd

• Mature coal reservoir is mostly dewatered
• Average well only produces 4-5 Bwpd
• 24 hour runtimes result in very low pump fillage
• Goal is ~25% pumping time / ~75% shutdown time
The Goals of the Program

- Decrease failure rates & associated repair costs
- Maintain production
- Lower operating costs
- Allow active well surveillance
- Conserve fuel gas
- Reduce emissions
- Health, safety, & environmental benefits
Failure Rate Reductions

Failure Rate Reduction and Production Impact Analysis 2010 – 2012
Definitions and Terms

- **RPC** – Rod Pump Controller, Pump-off Controller, etc.
- **Runtime** – Length of time a pump runs in a cycle (hrs)
- **Downtime** – Length of time between pump cycles (hrs)
- **Runlife** – The time a pump has been running from installation to failure (years)
- **Failure Rate** – the frequency of failures for a given well (failure/well/year)

Runlife = 1/Failure Rate

A 4 year runlife is equivalent to a 0.25 failure rate
### Failure Rate Comparisons by Year

#### 2010 RPC Upgrade Program – 70 wells

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre-RPC</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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<tbody>
<tr>
<td>Failure Rate</td>
<td>0.37</td>
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#### 2011 RPC Upgrade Program – 69 wells

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Failure Reduction Analysis

2010 Program (70 wells)

- Average historical failure rate = 0.37 failures/well/yr
- Projected failure rate after RPC = 0.20 failures/well/yr
- Actual (2011) = 0.16 failures/well/yr
- Actual (2012) = 0.07 failures/well/yr

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- Failure rate reductions indicate >30 failures prevented since RPC installed on these 70 wells
- ~2 MMcfd incremental sustained production
Less Failures = Sustained Production

• The concept of sustained production explained

Example Coal Well Production History

By postponing failures we keep more production in the pipeline over time
Validation of Sustained Production

2010 RPC Program 70 Wells (Normalized)

~100% runtime
~25% runtime

RPC installed
Incremental Production Gain Case

2010 RPC Program 70 Wells (Normalized)

RPC installed

~2MMcf sustained production

~100% runtime  ~25% runtime
Lease Operating Expense Reductions

Lease Operating Expense Analysis
2010 – 2012
2010 RPC Program - OPEX Reductions

Analyzed monthly cost data from 2009-2012

• Operational concern that adding more equipment would result in more maintenance and reliability issues
  - Older systems were problematic and unreliable

• Determined that monthly operation expense actually decreased by 9% on average

• Notable benefits
  - Less routine equipment maintenance
  - Less wear and tear on equipment
Benefits of Monitoring Well Performance
Well Surveillance Advantage

Use software to remotely monitor well performance

• Catch downhole problems early
  – Dynamometer cards
  – Pump function, rod parts, tagging, etc.

• Trend well performance, see optimization opportunities
  – Runtime/downtime
  – Pump fillage
  – Pumping speed
  – Cycles/day
Other Advantages

Additional Benefits of the System
Fuel Gas Conservation and Emissions Reduction

Reduce runtimes = less fuel gas burned

• Decreasing gas engine runtimes by 50-75% leads to fuel gas savings

Reduce runtimes = reduce emissions

• Decreasing gas engine runtimes by 50-75% can reduce emissions of NOX, CO, and CO₂
• Helps achieve compliance with permitted emissions limits
Engineering controls actively monitor operations and will automatically stop the unit if preset criteria are violated

- **Tubing pressure and casing pressure monitors**
  - High pressure kills prevent surface facility failures

- **Tank level and pit level monitors and kills**
  - Avoid costly spills and environmental remediation
The benefits of Rod Pump Control systems for ConocoPhillips San Juan Basin CBM Operations:

- Failures rates have been reduced significantly
- Average operating costs reduced by 9% per well
- Remote surveillance, optimization, and early problem detection capabilities maximize well delivery potential
- Less fuel gas burned, less emissions
- Engineering controls offer environmental protections
- We have maintained and arguably increased production
Thank You!

Questions?
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