ESP Recirculation System: Productive in Granite Wash Gas Well

L. C. Reid, Baker Hughes Incorporated

L. M. Irish, XTO Energy Inc.
Topics:

- ECU 1-7-4 Well Information
- ESP Test Proposal
- System Design (ESP Recirculation System)
- Valued Results
- Lessons Learned
Well Information

Perfs

9,476 – 9,525’

9,594 – 9,810’

9,969 – 10,040’

PBTD @ 10,105’

65 ft rathole
Average Production

Flowing
Plunger
Rod Pump
EFP
Gas
H₂O
Oil

MCFD
BLPD

2005 2006 2007 2008 2009 2010 2011 2012 2013

MCFD  BWPD  BOPD
ESP Test Proposal

- 60 day test
  - Low risk to operator
  - Option to purchase
  - Web-based control/monitoring
ESP System

• The ESP and gas issues
  • Gas locking
  • Head reduction
  • Cycling

• The three methods for success:
  • Avoid
  • Separate
  • Handle
Avoiding Gas

- **Set pump below perfs:**
  - Traditional motor jacket shroud
  - Recirculation system

- **Set above perfs**
  - Inverted shroud
  - Various dip-tube/stinger techniques
Gas Avoiding Systems

Standard ESP shroud jacket system

ESP recirculation system

Feb. 27 - Mar. 2, 2011

2011 Gas Well Deliquification Workshop Denver, Colorado
ECU 1-7-4 Challenges

**Inflow**
- Low flow (<400 BLPD)
- High GLR (>1600)
- Scale/corrosion likely

**Well geometry**
- Deep well (~10,000 ft)
- Shallow rathole
- Small CSG (5-1/2 in. 17#)
- Long length of perfs
Esp-rs advantages

physical
- shorter
  - allows lowest pump setting location
- scale resistance
  - easy capillary tube deployment

practical
- most economic
  - allows use of larger single motor
- track record
  - proven in deep wells
### ESP Recirculation System

<table>
<thead>
<tr>
<th>Component</th>
<th>Model/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift pump</td>
<td>400 series P4 (tandem)</td>
</tr>
<tr>
<td>Recirculating pump</td>
<td>400 series P8</td>
</tr>
<tr>
<td>Gas separator</td>
<td>400 series GSVX</td>
</tr>
<tr>
<td>Seal</td>
<td>400 series FSBDB</td>
</tr>
<tr>
<td>Motor</td>
<td>450 series FMH</td>
</tr>
<tr>
<td>Downhole sensor</td>
<td>400 series Centinel™</td>
</tr>
<tr>
<td>Recirculating conduit</td>
<td>90 ft 3/8 in. low profile recirculation tube</td>
</tr>
<tr>
<td>Cable</td>
<td>#4AWG CPLF 10,300 ft and 70 ft of #6 CPLF MLE</td>
</tr>
<tr>
<td>Variable speed drive</td>
<td>Electrospeed™ 3</td>
</tr>
<tr>
<td>Step-up transformer</td>
<td>260 KVA</td>
</tr>
<tr>
<td>Web-based monitoring service</td>
<td>SPVision™</td>
</tr>
</tbody>
</table>
Results

- Minimal gas issues
- Sustained increase in production
  - 115% Mcf production increase
- Proven value over rod system
  - 151% value increase
Lessons Learned

• Value of optimization
• Value of data monitoring/control
20 Month Trend
Conclusions

– ESP-RS can be economic solution for deep gas wells.
– ESP-RS can be successful in low flow gas well deliquification.
– Web-based monitoring/control is essential.
Questions?
Copyright

Rights to this presentation are owned by the company(ies) and/or author(s) listed on the title page. By submitting this presentation to the Gas Well Deliquification Workshop, they grant to the Workshop, the Artificial Lift Research and Development Council (ALRDC), and the Southwestern Petroleum Short Course (SWPSC), rights to:

- Display the presentation at the Workshop.
- Place it on the www.alrdc.com web site, with access to the site to be as directed by the Workshop Steering Committee.
- Place it on a CD for distribution and/or sale as directed by the Workshop Steering Committee.

Other use of this presentation is prohibited without the expressed written permission of the author(s). The owner company(ies) and/or author(s) may publish this material in other journals or magazines if they refer to the Gas Well Deliquification Workshop where it was first presented.
Disclaimer

The following disclaimer shall be included as the last page of a Technical Presentation or Continuing Education Course. A similar disclaimer is included on the front page of the Gas Well Deliquification Web Site.

The Artificial Lift Research and Development Council and its officers and trustees, and the Gas Well Deliquification Workshop Steering Committee members, and their supporting organizations and companies (here-in-after referred to as the Sponsoring Organizations), and the author(s) of this Technical Presentation or Continuing Education Training Course and their company(ies), provide this presentation and/or training material at the Gas Well Deliquification Workshop "as is" without any warranty of any kind, express or implied, as to the accuracy of the information or the products or services referred to by any presenter (in so far as such warranties may be excluded under any relevant law) and these members and their companies will not be liable for unlawful actions and any losses or damage that may result from use of any presentation as a consequence of any inaccuracies in, or any omission from, the information which therein may be contained.

The views, opinions, and conclusions expressed in these presentations and/or training materials are those of the author and not necessarily those of the Sponsoring Organizations. The author is solely responsible for the content of the materials.

The Sponsoring Organizations cannot and do not warrant the accuracy of these documents beyond the source documents, although we do make every attempt to work from authoritative sources. The Sponsoring Organizations provide these presentations and/or training materials as a service. The Sponsoring Organizations make no representations or warranties, express or implied, with respect to the presentations and/or training materials, or any part thereof, including any warrantees of title, non-infringement of copyright or patent rights of others, merchantability, or fitness or suitability for any purpose.