Controlling Production Fluids in Gas Wells

Tom Tonkins – President - Well Control Technologies Inc.
The Scenario


• The patents and initial working capital were acquired with private equity funding

• The original design was for a 7” diameter well utilizing an ESP (Electrical Submersible Pump) as the artificial lift system

• Our “Holy Grail” was to redesign the DLLC system to operate with Pump Jack wells, in 4.5” casing with 2.4” production tubing, install this new design in test wells and then commercialize the system

• Production goals: Increase gas yield, reduce well tender visits, reduce servicing and general well maintenance, prevent over pumping & under pumping, all by installing the DLLC system to accurately control production fluid
Original prototype DLLC after 3 years operation

Cross section of Liquid Level Control Device used with an ESP
How Gas yield Improved

A DLLC System was installed in June 2011 (CBM Well WPA)
Gas Yield improved from 42 MCF to 224 MCF, an increase in yield of > 5.7 times
The system was removed and examined in December 2013, after cycling an average of 11 cycles/Day, > 10,000 times
The Problem

Existing techniques are all indirect methods of measuring production fluid levels in a well

- **Timers** – Best described as experienced guess work. The artificial lift system is switched on and off by setting “on” run time and “off” down time. This method often leaves production on the table (under-pumping) or can lead to over-pumping which would cause gas to be drawn into the production fluid intake

- **Strain Gauges** – Measurement of change in strain of the pump rods is indirect measurement of production fluid in the well. This measurement is indirect and can be affected by friction from rods rubbing on the casing

- **Change in Motor Amps or Pump Speeds** – Measuring change in motor/pump speeds again is an indirect measurement of change in fluid levels in a well. This can be affected by engine wear, pumps clogging or friction from rods rubbing on the casing

*Significant unrecognized production exists because of improper dewatering with current techniques*
The Facts

No well is pumped to its maximum potential output

• The pump should turn on just under the lowest production perforations and turn off just before the pump fluid intake at the base of the production tubing. This cycle routinely for the life of the well

• Wells are often under-pumped to extend the life of the artificial lift system
  • This leaves production on the table

• Over-pumping causes gas to be drawn into the production tubing and subsequently to atmosphere from fluid storage tanks... this leaves production on the table and results in gas emissions to atmosphere and lost gas/revenue

• Over-pumping leads to pump wear and added well service costs...... this leaves $$$$ and production on the table
The Solution

The DLLC is a simple and precise method of production fluid level measurement and control

• It does not interpret production fluid levels, it directly controls them

• It signals the pump when to start AND stop based on real time direct fluid measurement in the well

• It tells you accurately how much production fluid is being produced daily

• It is built and designed to last for the life of the well and is a one time investment that will serve the well until it is shut down

• It has very low power requirements and can be operated from a solar panel or a 12 Volt battery

• Systems can be installed as part of a normal service cycle
Installing the redesigned DLLC
Average Gas Well Field Curve

- Blue line: Av Production
- Red line: Well Count

Year

MCF/Day

Well Count
Example of Lost Revenue

- Start Volume: 89.4
- Stop Volume: 110.4
- Days Impaired: 667
- Delta Sum: 17,024
- Example Pricing: $4.00
- Deferred Revenue: $68,097
- Delta %: 18.3%
## Cost savings & revenue increase/well

Assume 10 years of well operation

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer visits to the well</td>
<td>$400.00/month</td>
</tr>
<tr>
<td>Less Well Servicing</td>
<td>5 less services</td>
</tr>
<tr>
<td>Less Equipment Replacement</td>
<td>Saving $1,500/year</td>
</tr>
<tr>
<td>Production Increase</td>
<td>5% @ 10 Mcf/Day</td>
</tr>
</tbody>
</table>

**Cost Savings & Revenue Increase**: $169,250.00

**DLLC System Cost**: $9,500.00

**Installation**: $5,000.00

**Net Revenue Increase/Well**: $154,750.00

**ROI in less than 1 year**

*Based on $2.50/Mcf @ an Average of 200 Mcf/day increasing to 210 Mcf/Day*
Conclusions

For the lifetime of the well

• We have a system that automatically controls production fluid
• Over-pumping and under-pumping are prevented
• Service intervals can be determined by increase or decrease in pump rate
• Manual adjustments and system “tweaking” are eliminated
• Service and maintenance costs are reduced by as much as 50%
• Production fluid can be measured directly and accurately
• It is likely gas yield will increase
• The DLLC can be installed in new and existing wells
• Significant costs savings can be realized