Installation of Pump-Off Control Technology in Goldsmith-Cummins Deep Unit

Marietta College
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Background
Goldsmith-Cummins Deep Unit (GCDU) is located near Goldsmith, a small town in West Texas and is operated by Anadarko Petroleum Corporation. Located in the Permian Basin, the GCDU was discovered in 1950. The field has been under constant production for over fifty years. It produces primarily oil and formation water, has been the subject of radical infill drilling in the past 20 years and also uses a five-spot water-flood for enhanced recovery. Over 90% of the 140 producing wells on artificial lift use a rod-pump system.

Problem
The problem the operators of the GCDU face is the current well run-control system, which are percentage timers. Infill drilling and the injection program lead to fluctuating production rates that vary from day to day. This system does not allow for run-time customization and therefore leads to excessive costs. These costs materialize in the form of wasted electricity, rod failures and premature pump failures.

Solution
The solution to this problem is pump-off control technology installed on every rod-pumped well in the Goldsmith-Cummins Deep Unit. The benefits of this improved run-time system is that the pump-off control technology reduces run time by sensing unnecessary loading in the rod string during pumping. This reduces electricity costs by up to 23.5%, rod failures by 39% and pump failures by 19%. An added benefit of pump-off control technology is the ability to diagnose down-hole problems and reduce lost production from down time.

Technical Description
The rod-loading pump-off controller consists of three main parts: load cell, position sensor and control interface. The load cell measures the load of the rod string during pumping, the position sensor measures position of the rod string and the control interface processes the data and controls well run time. Several tools, parameters and alarms can be accessed and set from the control interface.

Field Criteria and Compatibility
There are three requirements for pump-off controllers to be beneficial. The first is primarily liquid production. The second criterion is a rod-pumping system. Finally, the pump-off controller technology can not survive without excessive maintenance in inhospitable environments. The GCDU meets all three criterion.

Cost
The cost of an individual unit totals $3,030.00, which includes the control interface with full graphics display, load cell, continuous position device, load cell cable and installation. The entire program is split into two parts in order to help split up the investment. The test program totals $76,250.00, includes equipment and installation for twenty-five wells and the required training session. The full program totals $318,150.00 and includes equipment and installation for the remaining 105 wells. Total cost for the project is $423,980.00. Potential savings with pump-off control technology is outlined in Table 1. The potential savings in one year for one well is $15420.00, leading to a payout of seventy-two days.
Method
The program will take place in two steps. The test program will be completed within one month of approval and will involve twenty-five problematic wells in the field with a history of premature equipment failure. Training for all operators and an extensive training session for the production technician will take place at this time. The technology will be evaluated after six months and if it has achieved tangible results, the remaining 105 wells will be outfitted with the technology. Total project timeline is eight months.

Qualification
Through my education at Marietta College in petroleum engineering, I have gained knowledge on rod-pumping systems and dynamometer cards. I also interned with Anadarko Petroleum Corporation in Summer 2004 in a field near the Goldsmith-Cummins Deep Unit that was outfitted with pump-off controller technology. I received the training session on pump-off control technology and worked extensively with the technology during my internship.

Conclusion
The next step is an Authorization for Expenditure to eProduction Solutions for twenty-five pump-off controllers and training session. Rod pumping is best optimized by pump-off control technology by reducing excessive run-times and in turn reducing energy costs and premature equipment failure.

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Cost</th>
<th>% Reduction with POC</th>
<th>Cost after POC Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rod Failures per year</td>
<td>3</td>
<td>$ 25,500.00</td>
<td>39%</td>
<td>$ 15,555.00</td>
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<td>Pump Failures per year</td>
<td>2</td>
<td>$ 18,000.00</td>
<td>19%</td>
<td>$ 14,580.00</td>
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<td>Electricity Usage per year (kW)</td>
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<td>$ 13,000.00</td>
<td>23.50%</td>
<td>$ 9,945.00</td>
</tr>
</tbody>
</table>

$ 56,500.00 $ 40,080.00

Table 1 - Potential Savings with Pump-Off Control