Coping With Rejection
DCP Midstream’s Operator Decision Support System

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Presentation Outline

• Introduction and background
• System features
• System architecture
• Project execution
• System acceptance
• System results
• Support and sustainment
• Conclusions
Introduction and Background

• Diagnostic evaluation for operational excellence
• Recently commissioned plant
• Extract more value from the control infrastructure
• Collaboration among subject matter experts
• Identified several opportunities
• Optimizing ethane rejection best opportunity
• Ethane margins negative
• Propane margins positive
• Plant designed with ethane rejection mode
• Operators require guidance
  • Key set points for optimal split between ethane and propane
  • Honor constraints such as residue gas heating value
• Current product pricing from commercial
• Reconciled model to determine optimum conditions
System Overview
System Features

• Collects real-time plant data
• System detects process steadiness and runs automatically
• Uses current specific pricing and nominations from the commercial departments
• Runs a reconciled first principles (rigorous) model of the plant process
• Determines an optimum profit and optimum set points
• Reports the optimum key variable values corresponding to controller set points
• System tracks operators utilization of recommended targets and tracks actual profit improvement

The optimization technology was selected as a system to provide operator decision support for today’s ethane rejection challenges as well as operating the plant in the most profitable fashion in the future under any economic scenario.
Advisory, open-loop rigorous optimization system capable of providing timely information to DCP midstream personnel to optimize operations against existing constraints, equipment performance and economic conditions.

Sections of the gas plant included in the scope:

- Feed Metering
- Simplified Inlet Gas Compressors
- Simplified CO$_2$ Removal and Dehydration
- Gas Chiller
- Demethanizer including Side and Bottom Reboilers
- Warm Gas to Gas Exchanger
- Gas/Product Exchanger
- Reflux Condenser
- Expander/Compressor
- Trim Reboiler
- Cold Separator
- Simplified Residue Compressor
- Plant Recycle
Overall System Architecture

Texas A&M University-Kingsville Society of Petroleum Engineers Student Chapter “Student Driven” Research Symposium for Oil and Gas Operations
Once the data has been stored to the Plant Historian it becomes available to all the standard outputs from the Plant Historian.
The designated users providing the commercial data input to the system access a pre-built manual data entry form on the Info Server within a browser based interface.
The operators are in control of the optimization variable on/off status and limits. The optimized targets and benefits are displayed and the operators utilization of the targets is measured. The operators can provide feedback.
# Key Performance Indicators

<table>
<thead>
<tr>
<th>KPI Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>% Steady State Detected</td>
<td>Sliding Average of the Percentage of Steady State Detected (over the last 24 hours, calculated hourly)</td>
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<tr>
<td>% Convergence</td>
<td>Sliding Average of the number of converged runs relative to total number of runs attempted (over the last 24 hours, calculated hourly)</td>
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<tr>
<td>% Operator Utilization (over the last 24 hours)</td>
<td>Sliding Average of the weighted Averages for all actual Set Points relative to the MV Targets (over the last 24 hours, calculated hourly)</td>
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<tr>
<td>% Difference between the Optimal and the Current Ethane Recovery</td>
<td>Difference between the optimum ethane recovery determined by the optimizer and the current ethane recovery (monthly average, calculated daily)</td>
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<tr>
<td>% Difference between the Optimal and the Current Propane Recovery</td>
<td>Difference between the optimum propane recovery determined by the optimizer and the current Propane recovery (monthly average, calculated daily)</td>
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<tr>
<td>Profit Margin from Optimizer</td>
<td>Difference between current operating and optimum profit in $/day</td>
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Project Execution

- Project kickoff and data collection
- Functional design
- Application development
- Factory acceptance testing
- Site installation and configuration
- Site acceptance testing and commissioning
- Final training and documentation
- Support and ongoing maintenance and modifications
System Acceptance

- Acceptance earned at multiple organizational levels
- Operations engaged in the design and testing of the model
- Commercial group engaged in the development of the objective function
- Created alignment between commercial and marketing guidelines to specific operating conditions of the facility
- Continuous communications after commissioning to instill confidence in the system advice
• Discovered that some of the commercial targets and plant nominations could be increased to improve plant profitability and throughput.

• These are the types of opportunities that increase acceptance and allow for justification of similar technologies in other facilities.

• Benefits between 8% and 10% additional dollars per unit of feed basis ($/scf) to the plant’s bottom-line revenue.

• Additional unattained 2% potential uplift.

• DCP midstream is working on identifying and resolving the bottlenecks that have prevented the extra uplift.
Support And Sustainment

- Accuracy of instrumentation
- Stream analyzers
- External data sources
- Plant layout modifications
- Continuous system monitoring
- Communications with all parties involved

Though maintenance of the system and the underlying plant data infrastructure does require time and effort, the system has proven to be highly maintainable and the rewards far outweigh the cost and effort required to keep the system running and current.
Conclusions

• The overall expectations of the system have been met.
• The system paid back within the first 4 months of its installation.
• DCP Midstream operations now recognizes the value of leveraging the model suggestions into their operating strategies, as it has improved the plant’s profitability and also helped identify new operational and business constraints.
• DCP Midstream commercial has expressed interest in expanding the system’s capabilities to an asset based optimization model.
Questions