Digital Transformation in Oil & Gas: Optimisation

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We address both lifecycles in the markets we address through the key elements of our platform.
Agenda

- Global Market Environment
- Optimisation Technology
- Wisdom and Knowledge
- Extending Scope
- Summary
- Q&A
The Oil & Gas Value Chain is Under Pressure…

**Market Environment**
- Lower prices
- Sustained demand & shift to gas
- Geographic shift in production
- Shift in feed and product
- “Great crew change”

**New Technologies**
- Analytics and workflow software
- IoT standards, technologies enabling low cost connectivity
- High volume of unstructured, multi-source data
- Online deployment & usage models (Cloud, Mobility)

**Workforce Dynamics**
- Workforce training, knowledge retention
- Mobile workforce enablement
- Work transformation to maximize productivity
- Increased contracting
Big Data – High Performance Graphics, Enterprise, Mobile
The Refinery Challenges

Shifts in feedstock, processing and products from design

Refinery/Chemicals Integration - Optimization

Raw Material Acquisition

Refined Material Costs

Product Values

Refining Costs

Raw Material Costs
Olefins Plant Challenges

Shifts in feedstock, processing and products from design
What is Real-Time Optimisation? And What are its Benefits?

- Trust-worthy unit optimization solution
- Maximizing optimization benefit
- Fast time to benefit
- Enabling accelerated optimization program roll-out to site-wide / enterprise-level
- Low technical manpower requirement
- Performance Management for both technical and business users

Potential value at a typical refinery:
USD 6 – 40 million/year
Sustain Benefit of Real Time Refining Applications

Benefit of Real-Time Optimization

<table>
<thead>
<tr>
<th>Unit</th>
<th>Typical Size (Kbbl/day)</th>
<th>Benefit Range $K/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Vacuum</td>
<td>135</td>
<td>113 - 226</td>
</tr>
<tr>
<td>FCCU</td>
<td>38</td>
<td>120 - 240</td>
</tr>
<tr>
<td>Reformer</td>
<td>25</td>
<td>42 - 84</td>
</tr>
<tr>
<td>Hydrocracker</td>
<td>26</td>
<td>55 - 110</td>
</tr>
<tr>
<td>Site</td>
<td>330 - 660</td>
<td></td>
</tr>
</tbody>
</table>
Olefins Unit Real-Time Optimization System

Optimize Process
- COT/Severity/Conversion
- Steam-HC
- Furnace loading
- Compressor loading (inter-stage pressures)
- Column separation (dirty vs. clean)
- Fuel/Steam balance
- Honoring control and physical constraints
- Complex contracts and economics
- Feedstock evaluation
- Support LP model validation and update
What Fuel should I use for my Boilers, How much should I purchase?

How much Steam do I want to sell?

What load should I run the boilers?

What load should I run my GTG?

How is the equipment performing? Is Maintenance needed?

How much Steam do I want to sell?

What is the lowest operating Cost?

What is the best way to meet the energy demand?
Unit Performance Monitoring

Track equipment and unit performance against design based on current real-time data
Update Planning Tool to Improve Feedstock Purchasing

Enabled by Open-Equation Models, Link to LP Modeling Tools

- Allows quick and efficient LP gain updates when needed (several times per year), instead of every 2-3+ years

1. Import Plant Data
2. Run DataRec Model Tuning
3. Run Sensitivity Analysis Tool to Generate LP Gains File
RTO Requires a Comprehensive Solution

Flowsheet Modeling Environment
- First principles models for rigorous and accurate simulation of plant
- Thermodynamic and component knowledge for refining properties and chemicals
- Equation-based allows solving large and complex applications robustly
- Capability to quickly auto-tune against real-time and historical data — eliminate need for engineering to run models to current plant conditions
- Multiple variable multiple constraint optimization (like APC and LP models but rigorous non-linear)

Using and Providing Big Data
- External Data Interface - read measurements, controls and economic data
- External Data Interface – output optimization results
- Handle any type of data source - PI, PHD, OPC, ODBC, OLEDB, InSQL, etc.
- Screen bad data
- Data reconciliation of measurements
- Gross error detection
- Monitor process performance
- Automate acquiring data and running simulation for continuous improvement
Refining Operations Management

Real-time Model and Sequences
- Market leading, proven technology and methodology
- Single model for online and offline applications

Role-based Contextual Visualization
- Visualize process unit
- Visualize optimizer
- User/role/security group management

Embedded Standard Workflow
- Robust integration of operational data system
- Streamlined work processes for notification, review and approval

Make informed decisions to maximize adoption and contribution of optimization unit
Expanding Knowledge and Wisdom Scope

Performance Manager
- Dashboards
- Reports
- KPIs
- Workflows
- Microsoft Excel export
- Trends
- Decision Management
- Calculations
- Application Views
- Data Warehouse

Real-Time Optimization
- Plan & Schedule
- Offsites Optimization
- Balancing Yield Accounting
- Predictive Analytics
- Advanced Controls

Application Integration
- SOA/Web services
- ESB
- Orchestration
- Semantic Translation

LIMS
Logbook
etc.
# Real-Time Optimisation Technology Corporate Partners

<table>
<thead>
<tr>
<th>Client</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExxonMobil</td>
<td>World-wide</td>
<td>2004</td>
</tr>
<tr>
<td>Shell NA (US, Canada)</td>
<td>All NA Refineries</td>
<td>2005</td>
</tr>
<tr>
<td>Idemitsu</td>
<td>Corporate Wide</td>
<td>2007</td>
</tr>
<tr>
<td>Thai Oil</td>
<td>Corporate Wide</td>
<td>2009</td>
</tr>
<tr>
<td>Shell Global Services</td>
<td>All Worldwide Refineries</td>
<td>2010</td>
</tr>
<tr>
<td>PetroBras</td>
<td>Corporate Wide</td>
<td>2011</td>
</tr>
<tr>
<td>Citgo</td>
<td>Site Wide Lake Charles</td>
<td>2011</td>
</tr>
<tr>
<td>Reliance</td>
<td>Corporate Wide</td>
<td>2012</td>
</tr>
<tr>
<td>Tonen General</td>
<td>Corporate Wide</td>
<td>2012</td>
</tr>
<tr>
<td>SK Innovation</td>
<td>Corporate Wide</td>
<td>2013</td>
</tr>
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## Real-Time Optimisation Install Base

<table>
<thead>
<tr>
<th>Optimizer Applications</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Units (some incl. VCU)</td>
<td>40+</td>
</tr>
<tr>
<td>FCCU</td>
<td>30+</td>
</tr>
<tr>
<td>HCR/HTR/Reformers</td>
<td>20+</td>
</tr>
<tr>
<td>Hydrogen Balance</td>
<td>4</td>
</tr>
<tr>
<td>Gas Processing</td>
<td>5</td>
</tr>
<tr>
<td>Utilities</td>
<td>9</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>12+</td>
</tr>
<tr>
<td>Performance Monitoring (Refining, Upstream, Power, Gas)</td>
<td>40+</td>
</tr>
<tr>
<td>Material Balance</td>
<td>7</td>
</tr>
<tr>
<td>Shell/ExxonMobil</td>
<td>dozens+</td>
</tr>
</tbody>
</table>
Summary

- Refineries and olefins plants are challenged with sustaining and improving margins operating in conditions beyond originally designed.
- Trend towards more data less people to optimize production.
- Real-time optimization based on rigorous simulation of process auto-tuned to plant conditions provide continuous improvement with limited engineering.
- Advanced application require easily digestible interface for quick understanding of process and actionable information.
- Reporting and dashboards are best achieved through self-service configuration.
Questions?