THE CHALLENGE
Refiners are faced with an increasingly connected global market. These market dynamics lead to a competitive environment that is unprecedented in the history of the industry. Most refineries operating today were designed with the minimum degree of process automation to run the plant in a basic fashion. Today’s operational demands require breakthrough performance, and Emerson Process Management can enable refiners to achieve new levels of safe performance in key operational areas.

Improving Crude Unit Operations with the Smart Refinery
The Crude Unit is the gateway to all other process units in a typical refinery, yielding intermediates and finished products that drive bottom line refinery business results. It can also be the bottleneck, if not operated safely and in optimum balance with refinery and market demands. The keys to profitability in crude unit operations often depend on operational excellence in the areas of safety, energy efficiency, optimal process unit utilization, and consistent and reliable unit operations, day after day. Emerson Process Management has a long history of providing total automation solutions that improve performance in these key operating areas. The result is a competitive advantage that puts you ahead of other refiners in today’s changing refining marketplace. Read on to see how we can work with you to move your refinery toward top quartile performance.

<table>
<thead>
<tr>
<th>Performance Challenges</th>
<th>Business Consequence</th>
<th>Improvement Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency</strong> impacted by:</td>
<td></td>
<td></td>
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<tr>
<td>• Tube fouling leading to inefficient heat transfer</td>
<td>Increased Energy Costs</td>
<td>Reduce energy costs through improved measurement of fuel gas flow, heater pass flow, flue gas O₂, CO, and combustibles content and tighter control of combustion air.</td>
</tr>
<tr>
<td>• Poor combustion air control</td>
<td></td>
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<tr>
<td>• Burner tip plugging leading to poor heat distribution</td>
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<tr>
<td><strong>Crude Unit Utilization</strong> impacted by:</td>
<td></td>
<td>Increase quality and yields with better regulatory controls that improve temperature control, separation efficiency and desalter operations.</td>
</tr>
<tr>
<td>• Frequent crude switching leading to suboptimal product draw rates</td>
<td></td>
<td></td>
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<tr>
<td>• Poor desalter operation leading to downstream corrosion and fouling</td>
<td>Reduced Utilization</td>
<td></td>
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<tr>
<td></td>
<td>Reduced Product Quality</td>
<td></td>
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<tr>
<td><strong>Field Asset Reliability</strong> impacted by:</td>
<td></td>
<td>Maximize reliability with device diagnostics to predict field asset failures and enhance visibility into the health of rotating and fixed equipment.</td>
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<tr>
<td>• Lack of visibility to rotating and fixed equipment health</td>
<td></td>
<td></td>
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<tr>
<td>• Unplanned slowdowns and shutdowns</td>
<td>Reduced Production</td>
<td></td>
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<tr>
<td></td>
<td>Increased Maintenance Costs</td>
<td></td>
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<tr>
<td><strong>Safety, Health, &amp; Environment</strong> impacted by:</td>
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<td>Improve plant and community safety and operate within increasingly stringent environmental regulations with automation solutions that deliver better measurement, control, and diagnostic information.</td>
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<tr>
<td>• Regulatory agency codes and standards</td>
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<tr>
<td>• Operator and maintenance training</td>
<td>Increased SH&amp;E Risks</td>
<td></td>
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<tr>
<td>• Inconsistent startup and shutdown practices</td>
<td></td>
<td></td>
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<tr>
<td>• Unreliable emissions monitoring</td>
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Refining Application Solutions Guides are available on the following applications:

- Crude Unit
- Fired Heater
- Hydrocracker
PlantWeb digital plant architecture offers leading edge technology giving you a greater view to your process operations and equipment health. The crude unit is at the beginning of the refining process, and is the gateway (or bottleneck) to all other process units. The key process challenges in a crude unit, which can drive down total refinery performance, are optimizing unit utilization, improving overall process unit reliability, and increasing energy efficiency, all with safety as a first concern.

Emerson Process Management provides best-in-class field devices, final control elements, analytical products, safety solutions, asset management, and control platforms to address your key operating challenges. These elements, integrated together in PlantWeb, enable you to achieve breakthrough performance. DeltaV™ provides one platform for control, APC and asset management, and provides best control loop response for tighter, robust control. Breakthrough performance is also achieved through APC applications embedded into DeltaV, seamlessly integrated predictive diagnostic from critical production assets, one common database, operator display, and an engineering toolset for basic process control to safety systems, including training simulator.

### Utilization

SmartProcess® fractionator optimization applications improve crude unit operation efficiency with greater yield flexibility. These applications are pre-engineered, embedded multi-variable control that allows the unit to safely operate closer to constraints without violating them. Although the applications are pre-engineered for faster implementation and lower cost, trained refinery staff is still able to customize, implement, and maintain the configurable applications ensuring long-term use. One key benefit with these multi-variable control applications is the ability to minimize transition time and disruption during crude switching.

### Energy Efficiency

Inefficiency in energy management is one of the greatest contributors of high operating costs. Crude oil heating costs are among the highest of any operating unit. SmartProcess heater optimization combines advanced regulatory and combustion control modules to operate at maximum efficiency while maintaining safe operations. PlantWeb allows you to get the most efficient use of energy by improving heater combustion, managing energy efficiency of process equipment, and operating with tight and robust temperature control.
Safety

Safety, health, and protecting the environment are top priorities in every operation. There are two reasons that a strong safety, health, and environment program is “Job One” in virtually every refinery: The risks are real, and the consequences serious.

Emerson provides SIL-rated transmitters, final control elements, and logic solvers, as well as the engineering expertise to deliver an integrated safety instrumented system in accordance with your safety requirement specifications.

<table>
<thead>
<tr>
<th>Recordable Injury Frequency</th>
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<tbody>
<tr>
<td>2.0 1.5 1.0 0.5 0.0</td>
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</table>

Customer Proven

“We converted two crude units from pneumatics to PlantWeb and added a third unit to our refining process. We increased capacity by 30% without additional personnel. We saved four jobs with the new system. Our production is now limited only by our permit.”

Jody Verrett
Operations Manager
Calcasieu Refining Company

“The technology around instrumentation wasn’t up to the challenge of the 21st century. So the path was set to achieve what we needed to achieve from a business standpoint. We needed to focus hard on enabling future operators to run the plant in a way that is required to deliver the products to the marketplace, to meet specs and to do it in a competitive way.”

Jeff Funkhouser
Operations Manager
Motiva Norco
CRUDE UNIT CHALLENGES

- Crude switching is a challenge for optimal operation.
- Variability in heater outlet temperature causes process disturbances.
- Fluctuating fuel gas composition causes operational disturbances.
- Spurious trips caused by malfunctioning instruments and control upsets.
- Environmental impact and energy efficiency depend on good combustion control.
- Low NOx burners are a maintenance challenge.
- Pump seal failure can cause a release of hazardous material and possibly fires.
- Safe and effective start-up, operation, and shutdown are critical.
- Fractionator flooding disrupts operations.
- Measurements are missing that enable me to fully optimize the plant.
- Poor desalter operation leads to exchanger and fractionator tray fouling and overhead system corrosion.

You can achieve a safely optimized crude unit that is reliable and energy efficient.

Emerson Process Management has the technology and expertise to make it happen.
alert you to potential problems. With the right intelligence, your field assets not only provide more precise and improved output.

Field Intelligence

With PlantWeb, Emerson’s field intelligence allows you to harness the power of predictive intelligence and the information that drives it. PlantWeb’s unmatched capabilities enable you to:

- Identify critical equipment failures
- Understand the impact of device failures
- Improve system reliability
- Assist in troubleshooting
- Enhance safety performance

Predictive Intelligence and the Power to Use It

Emerson’s PlantWeb digital Smart Refinery architecture enables your process to operate more efficiently, safely, and effectively.

Control, Protection, and Asset Optimization

The PlantWeb smart digital control, smart safety, and smart asset management systems provide PlantWeb by enabling safe, reliable, and efficient process operation.

Features:

- Best cost performance through high reliability
- Continuously learning diagnostics for a digital instrument
- Clear direction on which assets – including automation, electrical, process, and rotating equipment – need to operate closer to theoretical limits

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SERVICES & SUPPORT

Emerson’s extensive global experience in petroleum refineries helps customers create sustained operational improvements worldwide.

Consulting Services
Emerson’s consulting expertise covers the full life of an automation investment from conceptual design and justification to on-going control performance audits, including:

• Master Plan Consulting – Multi-year automation investment analysis
• Pre-FEED Consulting – Conceptual design, benefit, and cost estimates
• Advanced Process Control Consulting – Design, justification studies, and implementation services for APC projects
• Control Performance Audits – Expert control loop testing, troubleshooting, and tuning
• Smart Turnaround – Instrumentation and asset reliability audit, turnaround planning, and realization
• Safety – Largest staff of certified functional safety experts and professionals, following IEC 61511 certified procedures

Education and Training Services
Emerson’s 65 years of training experience result, delivered through a global network of certified training centers, result in effective learning that provides a framework for maximum availability, sustainability, and operational excellence.

• Specialized training in Maintenance, Safety, Engineering, and Operator Training Solutions
• Award winning services and training
• Customize training to meet site specific needs
• Flexible delivery options – Instructor-led courses either on-site or off-site, virtual-Learning and eLearning

Modernization and Migration Services
Emerson helps maximize return on automation investments by providing Total Migration Solutions – combining best-in-class technology, systems expertise, consulting, and project services.

• Flexible Approach – Migration solutions and capabilities to work within your operating and budget constraints
• Platform Expertise – Extensive knowledge of Emerson and non-Emerson control systems
• Migration Experience – Proven migration solution from planning to implementation
• Automated Conversion Tools – Reduces the risk of improperly converting your existing system data
• Business Case – Assist in developing the justification for migration/modernization projects based on site specific needs

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