

Optimize Cracking Furnace Performance and Energy Efficiency

Strategy

The operation of an ethylene plant's cracking furnaces sets the total plant throughput, yield, and fuel consumption – essentially driving the overall profitability of the entire complex. All ethylene cracking furnaces, independent of design, have similar operating objectives to maximize plant profitability:

- Control heater charge rate to a target or operate at a maximum limit
- Control heater severity for maximum yields
- Control a target dilution steam ratio for each pass
- Balance the loads on each pass to equalize the coking rate across the furnace

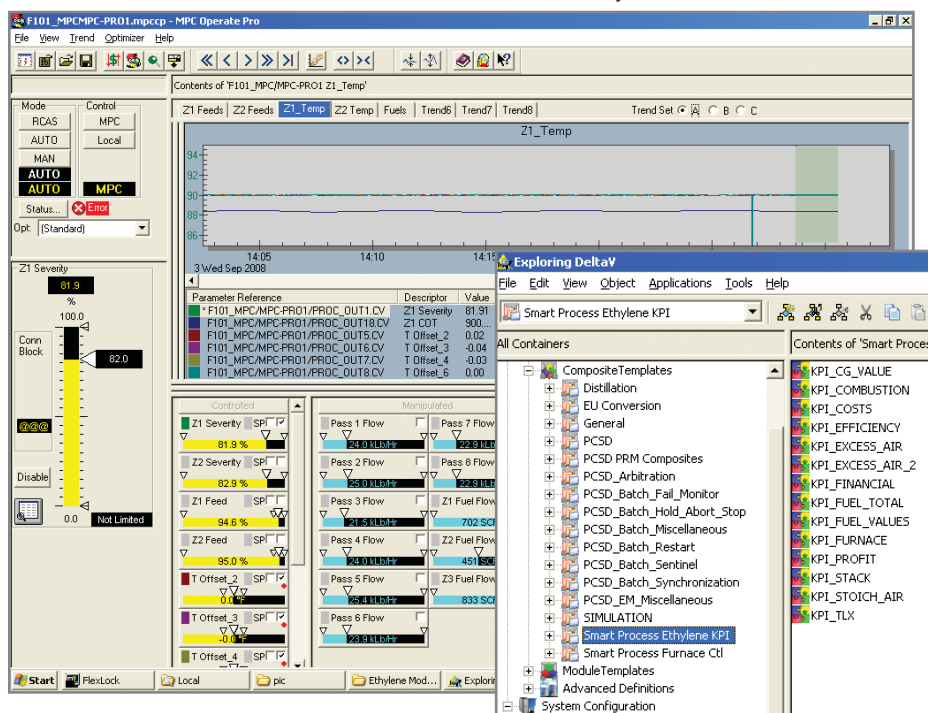
- Control excess air to maximize energy efficiency
- Maintain the furnace within all process operating limits
- Manage start/stop/decoke transitions for safe, consistent and efficient operations

In most cases, furnace severity should be maximized to achieve a desired furnace charge profile and run length. Operating on the target trajectory between decoking cycles is critical to achieving the most from the plant. Over-cracking results in accelerated tube fouling and shorter run-lengths, while under-cracking results in lower yields. Improved process stability leads to fewer hot-spots, reduced coking rates and better yields.

SmartProcess benefits

For a typical, world-scale ethylene complex with 10 furnaces producing 800 kMT/yr, the potential benefit for the SmartProcess Ethylene Furnace solution is estimated to be more than \$2.5 million per year. These benefits primarily come from the following sources:

- Longer furnace run lengths
 - All passes coke at same rate
 - Estimate 1 extra day of run length per furnace
- Improved ability to meet production plan
 - Better visibility into the furnace operation, coking and yields
 - Improve planning margin 0.2%
- Reduced unplanned furnace downtime
 - 4 hours less downtime per year per furnace
- More stable and reliable operations
 - 0.1% ethylene yield improvement.



SmartProcess solution

The SmartProcess Ethylene Furnace solution provides a built-for-purpose library of configuration templates to optimize ethylene furnace operation. The application solution is built in a modular fashion and allows accommodation of different furnace designs and configurations including:

- Multiple process cracking zones
- Multiple firing zones
- Multiple Transfer Line Exchanger (TLE) analyzers.

Key module components include:

- Advanced regulatory controls
 - Master charge rate control
 - Master steam ratio control
 - Severity calculation
 - Combustion control & overrides
- Advanced controls
 - Pass balancing
 - Severity control
 - O₂ control
- Key performance indices (KPIs)
 - Furnace efficiency
 - Furnace duty
 - TLE duty, fouling factor
 - Stack gas estimated composition
 - Stack gas daily total tons exhaust for CO, CO₂, S, N, etc.

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Consulting services & ethylene expertise

Emerson Process Management has provided automation solutions to some of the largest ethylene complexes in the world. Our consultants and engineering teams have the experience and know how to bring your operating performance to the next level using advanced automation. Emerson can assist with the full journey, from project identification and justification studies to turnkey solutions.

Emerson's PlantWeb Performance Package

The SmartProcess Ethylene Furnace solution is part of a suite of offerings that covers the entire ethylene complex and includes best practices from the full breadth of all of Emerson Process Management. Whether it's severe service, fast-acting surge valves, precision flow meters or cracked-gas analyzers and sample systems that are mounted directly on the transfer line, Emerson leads the industry in innovative technologies and solutions.

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