Emerson's Ovation™ Advanced Power Application Improves Steam Temperature Control at Tennessee Eastman's Kingsport Cogeneration Plant

RESULTS

- 55% improvement in standard steam temperature deviation from setpoint (3.43 to 1.55)
- 53% improvement in standard deviation of spray flow and valve movement (9.9 to 4.7)
- Provides quick and accurate control to setpoint and maintains operation at desired temperature

APPLICATION

16-18 megawatt coal-fired cogeneration plant with a Riley wall-fired boiler with low NOx capability.

CUSTOMER

Eastman Chemical Company, Tennessee Operations, Kingsport Cogeneration Power Plant located in Kingsport, Tennessee.

CHALLENGE

Eastman Chemical's Tennessee Operations is one of the largest chemical manufacturing sites in North America. The on-site Kingsport Cogeneration Power Plant produces steam for the site's chemical processes, while the surplus energy is used to power the complex's more than 550 buildings. Boiler 31 went into service as a first of its kind in 1994. The boiler has good maneuverability and is often called upon to quickly ramp up to produce additional steam to meet increased demand from the adjacent chemical processes. Concerns with steam temperature stability, turbine life, excessive spray valve movement, and significant temperature excursions below setpoint had Tennessee Eastman exploring solutions that would reduce steam temperature variability and thus improve the boiler's operational performance.

"Our operators were amazed at the results of the Ovation advanced steam temperature optimization application. We are continuing to benchmark the unit's performance to further illustrate a rapid return on our investment . We expect the plant will experience improvements in operational efficiency over time. We also expect that the improved steam temperature stability will reduce thermal stress and subsequently help extend the life of the unit."

Lem Mixon
Technical Associate
Eastman Chemical Company
Tennessee Operations
Kingsport Cogeneration Plant

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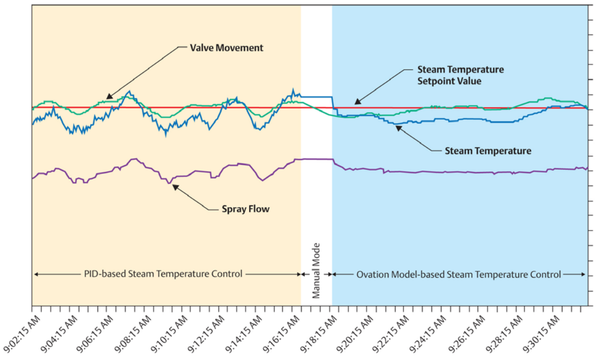
SOLUTION

Tennessee Eastman turned to Emerson, whose Ovation™ control system was already being used to monitor and control vital equipment and processes at the Kingsport cogeneration facility. Emerson implemented its Ovation steam temperature optimization application, part of a suite of advanced, integrated solutions offered by Emerson.

This model-based application regulates temperature variations through the development of steam temperature process models. Application-specific algorithms are used to execute a step-response model that accurately reflects the relationships of controlled variables, manipulated variables, and disturbance variables to quickly and accurately achieve temperature setpoint. The overall goal is to provide precise optimal control of the boiler temperature by providing predictive control of changes in the heat release due to load, fuel BTU quality, radiant energy absorption, pass dampers, burner tilt, and spray valve performance.



When Tennessee Eastman switched from PID-based steam temperature control to the Ovation steam temperature optimization application at the Kingsport Cogeneration Plant, the results were immediate. The predicable step-response of the model-based technology adjusted the steam temperature more quickly, efficiently and accurately to achieve targeted setpoint.

By considering current plant operating constraints and response factors, the model provides optimal results over the dispatchable range of load and operational characteristics. This technology has the ability to dynamically control processes, even while the plant is moving through load ranges. The Ovation steam temperature optimization application runs in a specific loop execution cycle based on process-developed criteria and is fully integrated as a new mode of operation within the Ovation control system. This technology supersedes conventional PID-based strategies, which offer a less accurate, linear response to reaching setpoint.

The project kick-off at Tennessee Eastman took place in 2010. Operators provided input to Emerson regarding the operating range of the boiler. This was followed by valve tests to check for seat erosion and to obtain flow characterization for linearization. The results of this testing gave Emerson the data necessary to build a model for the steam valve movement's effect on steam temperature. The models were successfully installed and tested, and have been running since April 2011.

Tennessee Eastman saw immediate improvements in steady-state operation, including the ability to quickly and accurately reach setpoint, and then maintain operation at the desired temperature. With the model running, Tennessee Eastman has seen a 55 percent improvement in standard deviation of temperature versus setpoint (3.43 to 1.55), as well as a nearly 53 percent improvement in standard deviation of spray flow and valve movement (9.9 to 4.7).

Tennessee Eastman was also concerned about the potential for equipment damage due to saturated steam entering into the turbine when it ran too far below the steam temperature setpoint. This concern was addressed through the saturation protection component of the steam temperature optimization application. On superheat loops, steam saturation priority-lower signals are integrated into the control logic, protecting against the introduction of saturated steam into the turbine.

For more information:
www.Emerson.com/Ovation

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