U.S. Natural Gas Company Reduces Costs and Emissions with Software CEM® from Rockwell Automation

Texas-based midstream gas producer achieves significant operating costs and a 90% reduction in Nitrogen Oxides (NO\textsubscript{x}) emissions through Software CEM and Ultra Low NO\textsubscript{x} Burner and Selective Catalytic Reactor (SCR) technologies.

The Challenge
This gas producer’s central processing plant in Texas faced a unique challenge. The plant’s “grandfathered” operating limits for NO\textsubscript{x} emissions expired. The Texas Commission on Environmental Quality (TCEQ) instituted new levels of detailed emissions monitoring and reporting, requiring the facility to reduce their emissions by 90%. The company would face considerable fines and the potential for reduced production if they could not meet these requirements.

The Results
The Software CEM system helped the plant’s SCR meet NO\textsubscript{x} emissions requirements by providing real-time, accurate and repeatable NO\textsubscript{x} emissions values. The SCR technology and Software CEM work together to reduce NO\textsubscript{x} emissions by more than 90 percent to less than 5 parts per million (ppm) for the gas-fired boiler applications. It accomplishes that through the oxidation of NO\textsubscript{x} with a chemical reaction of Ammonia (NH\textsubscript{3}) and the catalyst.

Overall, the project was highly successful and the system was certified through a Relative Accuracy Test Audit (RATA). Software CEM certified its initial RATA at better than 6% relative accuracy and surpassed the US EPA requirements of +/- 20%.

In addition to helping prevent fines for non-compliance, Software CEM helped this company avoid more than $100,000 per year in costs relative to maintaining a hardware-based CEM system. Additionally, the facility has achieved cost savings through better monitoring, record-keeping and compliance reporting due to the automated, real-time, and on-demand reporting capabilities of the system. Further cost savings will be achieved over the life cycle of the project with the higher reliability and lower maintenance costs of the Software CEM.

In response, the plant, which processes up to 700 MMscf/d of raw natural gas, installed a new boiler with ultra-low NO\textsubscript{x} burners and a Selective Catalytic Reactor (SCR). The SCR is an integral component to the boiler exhaust and uses a specialized catalyst for the reduction of NO\textsubscript{x} emissions. Personnel knew an accurate and reliable measure of NO\textsubscript{x} was critical to the feedback control loop for SCR/Ammonia injection optimization.

However, due to the non-linear NO\textsubscript{x} emissions relative to the performance of the ultra-low NO\textsubscript{x} burner and SCR, the company considered implementing a hardware-based, continuous emissions monitoring system (CEMS) to help them maintain emissions compliance. They recognized challenges with regards to measurement accuracy and reliability with analyzers.
These issues were further exacerbated by: (1) non-linear emissions of the combined Low NOx boiler with the SCR ammonia injections, (2) the inherent low measurement signal-to-noise levels, and (3) the extreme operating conditions within the emission stack. The impact of these challenges meant the potential for penalties or fines associated with down-time, as well as sub-optimal economic control of ammonia usage due to inconsistent and inaccurate feedback measurements.

This gas producer also recognized that replacing their current system with a hardware-based CEMS would require a significant capital investment. Subsequently, the ongoing maintenance needs of the CEMS would produce considerable expenses over its lifetime. The company looked to Rockwell Automation to provide an alternate, cost-effective solution to meet its emissions compliance needs.

A Software CEM® Solution

The company chose Software CEM, a model-based, Predictive Emissions Monitoring System (PEMS) from Rockwell Automation. Software CEM utilizes powerful hybrid models of the process with real-time sensor validation to provide predictive emissions values with unparalleled accuracy. The use of hybrid modeling, through empirical models and first principles knowledge, provides the best representation of process behavior. This approach, compared to competitive approaches that use a look-up table, enables better emissions predictions even in the extreme operating ranges of the unit operations—especially for ultra-low NOx burner boilers and turbines.

Unlike historical reporting systems that provide latent information from hardware-based CEMS, Software CEM operates in real-time using existing process sensor data. These emission values enable the plant to monitor operating conditions that could affect final emissions output. This predictive methodology gives this company the ability to simultaneously incorporate process behavior and feedback into the control strategy of the boiler and SCR, making it the first of its kind to do so.

Key Benefits:

- 90% reduction in NOx emissions, eliminating the need to purchase costly credits
- $100,000+ USD cost savings per year compared to a hardware-based CEM system
- 9% decrease in energy consumption (gas)
- 6% first attempt RATA certification (US EPA regulatory requirement is +/-20%)
- Reduced risk of fines or penalties associated with monitor downtime
- Reduced compliance costs associated with automated monitoring, recordkeeping and reporting