Source: *EPRI: Electric Power Research Institute.* Statistical Use of Existing DCS Data for Process Optimization. (August 21, 2008). Retrieved November 19, 2012, from http://my.epri.com.

Statistical Use of Existing DCS Data for Process Optimization

StatSoft Power Solutions was awarded a contract from the Electric Power Research Institute (EPRI's Cyclone Interest Group) for a project to demonstrate the effectiveness of (historical) data driven and data mining methods for achieving stable flame temperatures.

Abstract

This report demonstrates the way in which historical data describing normal and abnormal operations of cyclone furnaces can be leveraged for furnace optimization. The project centered around the optimization of cyclone barrel temperatures for all seven cyclones of Unit 4 at Alliant's Edgewater Generating station in Sheboygan, Wisconsin—a late-1960s vintage 340-MW variable-load cyclone-fired unit.

Objective

The purpose of this project was to demonstrate effective methods for leveraging the large amount of information that is stored in historical databases, recording often minute-by-minute values of hundreds of parameters describing the operation of the boilers. Using historical data and existing control technology (for example, digital control systems (DCS)), operations can be fine-tuned and optimized to achieve significantly better operations without the need to undertake expensive engineering projects.

Approach

Approximately nine months' worth of 6-minute interval operational data describing coal flows, loads, and primary, secondary, and tertiary air flows as well as cyclone flame temperatures—more than 140 parameters in all—were extracted for the project. After careful data cleaning and validation to remove erroneous and unreliable data points, various nonlinear (data mining) modeling algorithms were applied to the data, followed by specialized optimization algorithms. These algorithms were intended to achieve robust cyclone barrel flame temperatures with smaller than historical variability and generally higher cyclone barrel flame temperatures, with which fewer slagging and other reliability- and emissions-related issues are expected.

Results

The results show that the data analysis and optimization methods effectively identified specific ranges for a relatively small subset of operational parameters. Significantly improved and stable operations resulted for all cyclones.

Application, Value and Use

These methods provide a way to achieve cost-effective and "realistic" (virtually immediately obtainable) boiler optimization given the existing data and control systems—without the need for further boiler modifications or hardware and/or software purchases—requiring only modifications to the parameters and "equations" guiding existing control system software.

EPRI Perspective

The methods described in this report for performance optimization can be expected to achieve robust performance so as to make key performance parameters (such as flame temperature, NOx, CO, and emissions) less sensitive to uncontrollable operational inputs and variability such as changes in fuel quality and variations in crusher or pulverizer performance. By applying these methods systematically to all critical systems of a unit (for example, systems for NOx reduction and overfire air), overall improvements in system performance and robustness can be expected.