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Optimization System Increases Profitability of Southern Mississippi Electric Power Association

Goals

- Improve the performance of the Riley turbo-fired units
- Improve the mill’s impact on the energy efficiency of the furnace
- Lower NOx emissions

Challenges

- Improve heat rate and boiler efficiency while maintaining low NOx emissions

Solutions and Products

- SimSci-Esscor™ Connoisseur™ Online Optimization

Results

- Expected heat rate improvements of 1.5%, providing a project payback of less than one year
- Expert System at soot blower maximizes heat transfer area in the furnace
- Model Predictive Control provides increased boiler efficiency while maintaining steam temperatures and remaining within NOx specifications



Hattiesburg, Mississippi – The Southern Mississippi Electric Power Association (SMEPA) uses the Model Predictive and Neural Network Based controller, Connoisseur™ to improve efficiency at their Hattiesburg station.

At SMEPA's R.D. Morrow Generating Station, improving heat rate while maintaining low NOx emissions was extremely important. To this end, a supervisory control system was installed over the modern DCS to improve performance for these Riley turbo-fired units with ball mills. Both furnace and ball mill controls were optimized with coordinated multivariable control. Heat rate improvements were achieved through reduced dry gas losses and lower loss-on-ignition (LOI). In addition, the improved mill regulation increased maximum generation capability, particularly for lower grade coal.

An Optimizer is to determine the most profitable operating point

The SMEPA generating plant in Hattiesburg utilizes two parallel boiler-turbine units with a capacity of 204 MW at 2400 psig. The Riley Stoker Corporation manufactures each steam generator unit. Each has a turbo-furnace design with balanced draft operation, and is front and rear fired. Nominal steam conditions at HP turbine inlet are 2400 psig at 1005 DEGF and 1000 DEGF at the IP turbine inlet. Maximum continuous steam rate is 1,575,000 lbs/hr.

The fuel is pulverized coal from three Riley double-end ball tube mills fed by six Stock Gravimetric feeders. There are twelve Riley diffusion burners. Two forced-draft fans and two induced-draft fans deliver combustion air and provide balanced furnace draft to the scrubber. Dampers at each fan regulate airflow. One recirculation fan returns flue gas to the bottom of the furnace combustion zone, also regulated by a fan damper.

The objective of the Optimizer is to determine the most profitable operating point for the boiler and mills, as defined by a set of values for the controlled and manipulated variables in the process model. To drive the process to this point, the optimizer passes these values to the controller – the optimum values of the controlled variables (CVs) become set points for the CVs in the controller and the optimum values for the manipulated variables (MVs) become targets for the MVs in the controller.

An Expert System Soot Blower Advisory supplements the heat rate benefits of applying Connoisseur™ by suggesting which blower to activate in order to maximize heat transfer area in the furnace. Ball mill optimization improves the grind in the mill, lowers LOI and improves the mill's impact on the energy efficiency of the furnace.

Connoisseur™ runs in a separate platform so that the security of the existing DCS is not compromised. The application at SMEPA is designed to revert to the DCS based control seamlessly, with minimum disruption to the process, in case the operator decides to "take over" control.

An Effective Technology for Increasing Boiler Efficiency

For this application, Model Predictive Control has provided an effective technology for increasing boiler efficiency while maintaining steam temperatures and remaining within NOx specifications. Operator acceptance has been excellent due to the stable performance of the system and the smooth interface with the existing ARC controls on the boiler.

Depending on the load, potential heat rate improvements up to 1.5% are expected. This benefit will provide a project payback of less than one year.



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