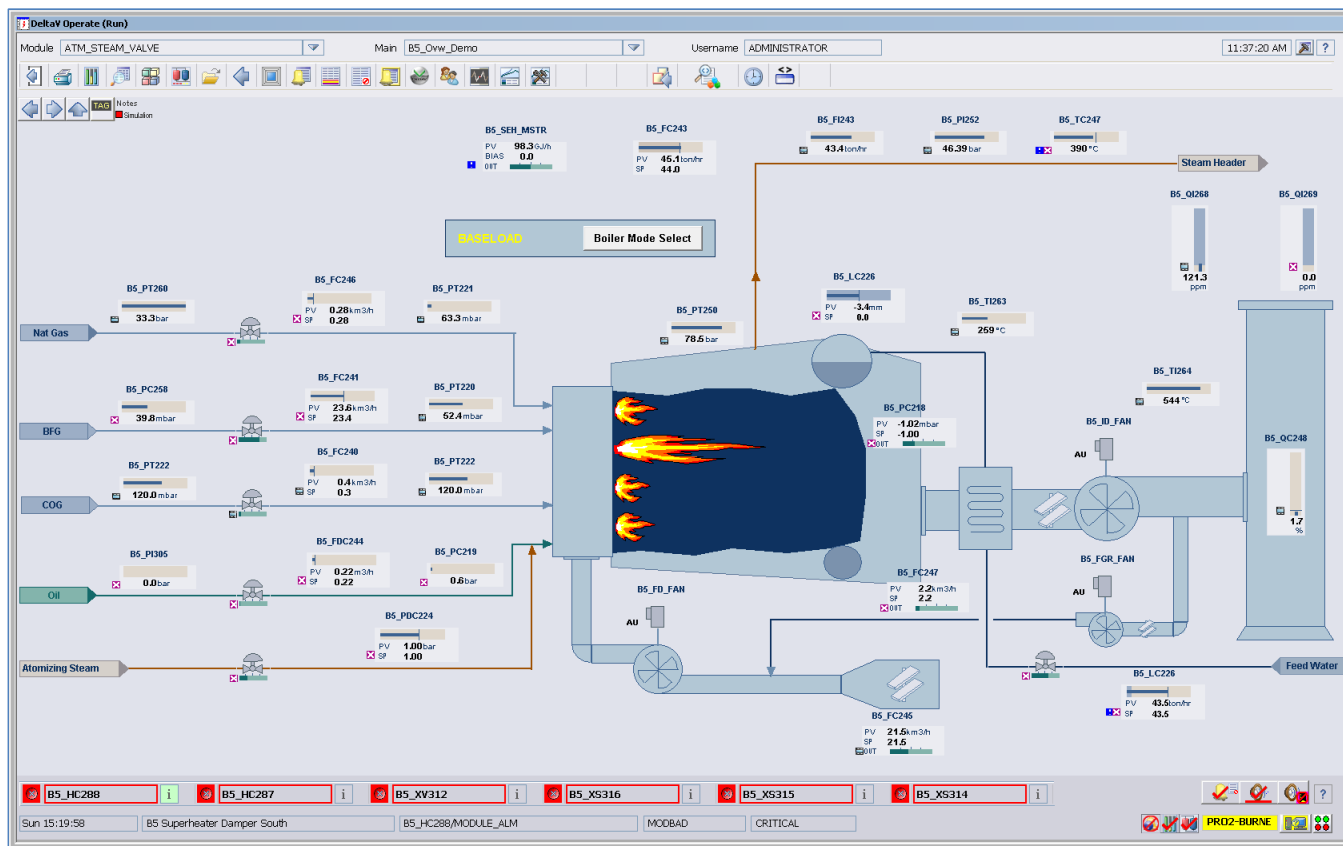


SmartProcess™ Boiler



Maximize Alternate/Waste Fuel Use and Stabilize Boiler Operation using Emerson's SmartProcess Boiler

- Maintain header pressure with minimal deviation while maximizing alternative fuel use
- Optimize efficiency by reducing excess air
- Meet all emission constraints
- Eliminate need for continuing operator manual intervention
- Only typical boiler instrumentation is used by the solution

Introduction

Multi-fuel power boilers are used in many industries to provide cost effective steam for process use and on-site electrical generation. In addition to fossil fuels (gas, oil, and coal) it is common that these units be fed with alternate fuel streams such as biomass, waste wood, waste liquids, refinery offgases, biogas, excess Hydrogen, Coke Oven Gas (COG), or Blast Furnace Gas (BFG). In today's competitive business environment, it is critical that multi-fuel boiler operation be optimized such that steam is produced for the least cost possible.

Emerson delivers a combustion control solution that supports excellent boiler operation in terms of reliability, responsiveness, and cost. Payback is measured in improved steam header pressure control, and lower operating (fuel) cost.

Benefits

The bottom line is that SmartProcess Boiler makes money for a boiler owner. Typical results from an implementation are:

5-15% additional steam generation from alternate fuel

2-4% thermal efficiency increase

Minimized emission constraint excursions

Product Description

Emerson's SmartProcess™ Boiler is a solution used to optimize multi-fuel and alternate fuel fired Power Boiler Processes by stabilizing unit performance on automatic control, reducing emissions production, increasing the efficiency of the boiler, and maximizing the quantity and stability of steam produced through burning of the least cost fuel (typically off-gases, waste fuels, or biomass).

SmartProcess Boiler provides complete automatic control of the boiler at all times including start-up, and the system allows a Multi-Fuel Boiler to follow fluctuating steam demand while burning least cost fuels. SmartProcess Boiler is a robust real-time control application that runs directly in a DeltaV controller.

SmartProcess Boiler incorporates combustion control techniques that improve on traditional methods of alternate fuel firing.

Fuel Optimization

SmartProcess Boiler utilizes a price entered by site operations for each type of fuel used in the boiler to calculate unit fuel costs. The system then allocates the individual fuel demands to minimize the overall fuel cost. Heat release is calculated and controlled by individual fuel so that a one for one Btu exchange is accomplished and boiler stability is not compromised. In addition, the response rate of the individual fuels is adjusted to account for the fact that various alternate fuels and fossil fuels have dramatically different characteristics and therefore cannot all be burned effectively using a single set of tuning parameters. Experience has shown that a key to success in optimizing boiler processes is to configure the controls such that they are tuned to match the response characteristics of each fuel and its delivery equipment.

Implementing control using a cost based heat release algorithm allows burning of alternate/waste fuels to be specifically enhanced and optimized based on the changes in that fuel that are seen over time. For example, based on the Btu that is being calculated at any particular moment, adjustments in air splits or total air on the boiler can be made. Once tuning specific to the alternate/waste fuels is achieved, performance of the boiler on those fuels is improved to the point that they can be used more effectively in the overall Powerhouse energy strategy.

With alternate/waste fuel optimization, it is typical that these low cost fuels would be used to maintain header pressure to a large extent. In the event that the lowest cost fuel becomes supply limited or constrained (from drop in supply, handling issues, etc.) and the header pressure drops, the next lowest cost fuel will pick up to maintain the boiler load. Once the constraint has relaxed, the higher cost fuel will back out and will be replaced by the lowest cost fuel. This is accomplished without operator intervention.

Fuel Quality Calculation

SmartProcess Boiler makes a calculation relating to the quality of the waste/alternate fuels being seen at the Multi-Fuel Boiler. This calculation is an indication of Btu being realized per volume of fuel. As the available Btu in an alternate fuel changes, adjustments must be made to the boiler process in order to realize maximum performance under all conditions. Based on the fuel quality calculation SmartProcess Boiler may make process parameter adjustments including:

- Set point for boiler excess oxygen
- Primary/secondary or undergrate/overfire air splits
- Distribution air for alternate fuels
- Fuel flow rates

Btu Based Firing Using Consumed Air

The amount of air being consumed in the combustion process is continuously calculated by SmartProcess Boiler from a measurement of the Excess Oxygen in the flue gas and an allowance for tramp air. Air being consumed by alternate fuel is determined by calculating the air being used for auxiliary fuel and subtracting it from the total. From the air calculation, a determination of Btu value of the alternate fuel is made on an ongoing basis by calculating stoichiometric combustion and solving for Btu. This is used to ratio fuel feed and other set points such that variations in the fuel are continually compensated for.

Air and Fuel Control

Primary/secondary or undergrate/overfire air ratios are automatically controlled to set points which are set based on load, characterization curves, the Excess Oxygen set point, and the alternate fuel quality calculation.

The alternate fuel delivery equipment is provided a set point based on load and the fuel quality calculation. Bias adjustments are available to operators during automatic operation to modify air splits and to change ratio set points in cases where profiling is desired or required.

Automatic Heat-Up

Start-up of the boiler process is accomplished by SmartProcess Boiler as an automatic function. This ensures that boiler equipment is protected from stress due to excessive heating while the boiler is put on-line either as quickly as possible or in a time period that matches production needs.

Single Input Operator Interface

To maximize stability and efficiency of the Power Boiler process SmartProcess Boiler provides Single Input Operator Interface for times when the boiler is operated as a base loaded unit. The Single Input function allows the boiler load to be ramped up or down in full automatic at a rate selected by operations. In addition to maximizing efficiency, ramping the unit under full automatic minimizes emissions by making smooth transitions with all process parameters in balance. The system will not allow a ramp rate that cannot be accomplished within the manufacturer's equipment limits or physical equipment arrangements.

Efficiency Calculations

A calculation of boiler thermal efficiency is continuously made by SmartProcess Boiler. This value can be used to monitor changes in boiler performance on an ongoing basis and to determine the most cost-effective method of overall Powerhouse operation.

Open Access

Emerson believes strongly in the concept of open access and that our client sites have the right to maintain and modify delivered systems in the manner which best suits process operation. All configuration supplied is completely documented. Detailed descriptions of all calculations and control algorithms used are provided. Site personnel have direct and immediate access to documentation. Emerson does ask to be informed of changes to the system that are being considered such that full ramifications of such can be considered and so that we are in the best position to provide support if questions should arise.

System Compatibility

SmartProcess Boiler is available on DeltaV v10.3 or higher systems.

Ordering Information

Quote requests may be directed to PSS.Proposals.NA@Emerson.com with a copy to SmartProcess.Support@Emerson.com

Related Products

- **Fisher Control Valves and Regulators.** Control fuel gas and air supply accurately and consistently.
- **MicroMotion Density, Specific Gravity and Mass Flow Meters.** Measure heating value variability and mass flow measurement for boiler fuels.
- **Rosemount Analytical Stack Gas Analyzers.** Maintain the optimum ratio between the fuel sent to the burner and the oxygen required to burn available fuel by measuring stack O₂.
- **Rosemount Annubar Flowmeters and Primary Elements.** Provides an accurate air flow measurement across a wide load range, has low permanent pressure loss, a relatively low installed cost and mounts easily in all shapes of duct.
- **Rosemount 5300 Series Guided Wave Radar.** Reliably measures boiler drum levels with Dynamic Vapor Compensation to correct measurement errors under all conditions and reduce the error rate to less than 2 percent.
- **SmartProcessFlame.** Provides a fully code-compliant Burner Management System (BMS) solution for a multi-fuel boiler, i.e., multi-burner / multi-train boiler.

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