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Combustion Optimization for Lowest Cost Generation

Heat-Rate improvement incentives with coal at \$100+/ton are attractive by themselves. Factor in fuels flexibility and Environmental factors and then they become even more easily justified. So what are the benefits of getting the furnace inputs optimized? At \$100/ton and a typical heat rate of 10,000 Btu/kWh and 10,000 Btu/# fuel, A 550 MW coal unit's fuel cost will be about \$160 million dollars yearly in fuel cost alone. So, the advantages of burner belt combustion optimization are very significant. Among the benefits for combustion optimization:

- Improved Heat-Rate
- Reduced NO_x
- Reduced Slagging
- Better Reliability from reduced tube failures (Water wall tube wastage or superheater/ Reheater tube overheating)
- Improved fuels flexibility
- Reduced airheater fouling
- Reduced SCR fouling
- Reducing popcorn ash plugging of the SCR's
- Reducing reheat desuperheating spray water flows and consequent turbine blade deposition

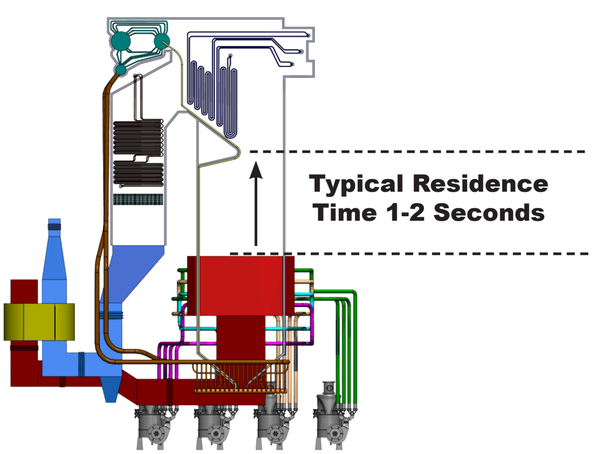


Figure 1

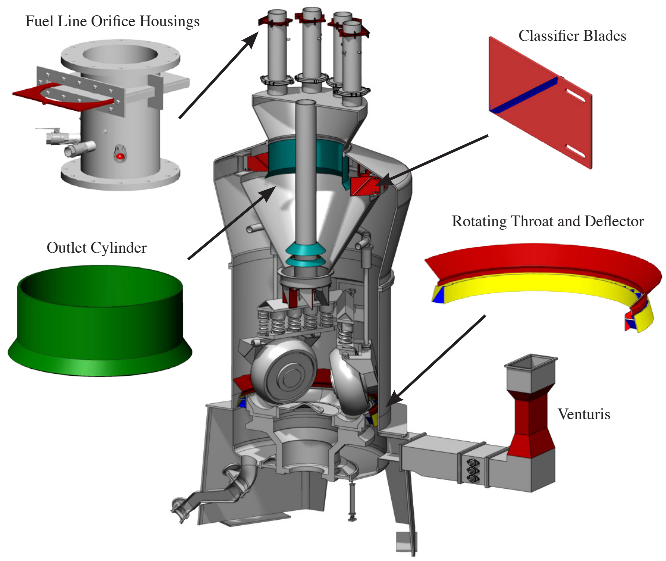
Let's return to the basics of optimizing furnace combustion one more time. Please note Figure 1. There is only one or two seconds of residence time from the instant a coal particle leaves the burner nozzle, until the combustion products of that particle of coal pass over the first superheater tubes. So, getting the fuel lines balanced and fuel fineness at the required levels is not optional today. It is absolutely required.

This Newsletter includes several products that Storm Technologies, Inc. has designed and manufacture to work toward the best possible utilization of the available time for combustion in the furnace. Storm recommends an eight step process for fuel line balance. The steps to furnace optimization are:

1. First, conduct baseline tests to identify the opportunities for improvement.
2. Internally inspect the pulverizers and document the condition, grinding element preload, tolerances and critical dimensions.
3. Install components to optimize internal velocities, vectors and flows.
4. Perform "Hot-K" factor calibrations of the primary airflow measuring elements. Provide Primary airflow measurement and control for repeatable fuel distributions through each coal pipe.
5. Balance fuel lines on clean air using fixed orifices on a carefully conducted clean air test. This is to achieve exactly the same system resistance for each fuel pipe.
6. Achieve 75% minimum coal fineness passing a 200 mesh sieve and less than 0.2% remaining on a 50 mesh sieve. In essence, we need zero number of coal particles above 50 mesh. These large particles are serious trouble for slagging,

fuel balance and water wall wastage.

7. Perform Isokinetic Coal Sampling from each coal pipe and evaluate the fineness and distribution on a mass weighted average basis.
8. Mechanically tune the pulverizer for best fuel fineness and distribution and also tune the controls for repeatable performance at the optimum settings. Especially, primary airflow rates and air/fuel ratios.



What are the typical savings that can be realized by implementing a “Comprehensive Combustion Optimization Program”? The figures shown in Figure 2 are typical of many plants. Much of the savings have to do with pulverizer optimization, airflow measurement and control, air heater performance improvements and reduction of air in-leakage on balanced draft boilers.

Are these changes worth the time and expense to install, test and tune? At today’s energy costs they sure are!

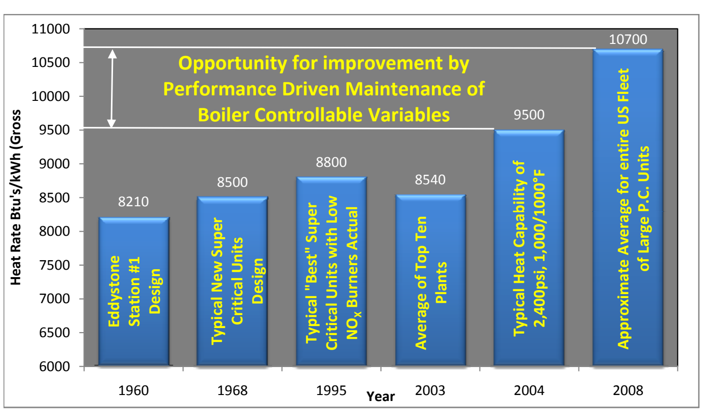


Figure 2

Typical Heat Rate Variation from a typical plant in the NE, Capable of 10,000Btu/KwHr.

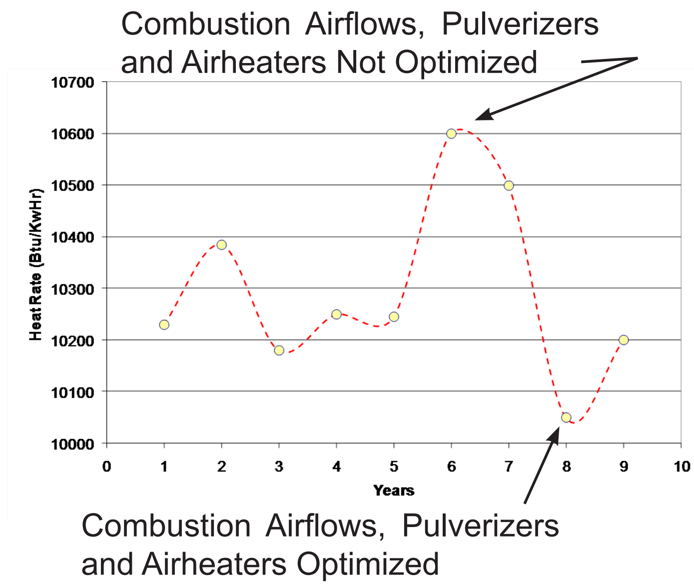


Figure 3

Typical Opportunities	Controllable Variable Qualities
Air in-leakage	**200 Btu/kWh**
Primary Airflow Optimization	**50 Btu/kWh**
Pulverizer Optimization and Improved Fuel Line Balance	100 Btu/kWh
Reducing Air Heater Leakage	**80 Btu/kWh**
Reduced Coal "Pyrites" Rejects	40 Btu/kWh
Reduced Carbon in Ash	50 Btu/kWh
Reduction of de-superheating spray water	50 Btu/kWh
Total	**570 Btu/kWh**

Figure 4

A comprehensive test combined with follow up performance improvements can yield very cost effective Results. Several Storm product flyers are enclosed which outline various testing and performance improving products. Call, email or write us for further information.

Yours very truly,

Richard F. Storm, PE