

Associated Electric Cooperative Inc.

A Touchstone Energy® Cooperative 🔨



Interested in Improving Heat rate? Start with the Pulverizers!

EPRI HEAT RATE CONFERENCE

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RESULTS

Outline

- •Plant Overview & History
- •Periodic Test Program
- •Test Results that Led to Heat Rate Improvement
- •Reasoning behind Heat Rate Improvement
- •Final Results and Conclusions





Plant Overview & History

- •Thomas Hill has three coal boilers onsite
 - Units 1 and 2 are B&W cyclone boilers
 - Unit 3 is a 670MW B&W pulverized coal boiler equipped with MPS-89 pulverizers
- •Unit 3 burns PRB coal through 49 low NO_X burners.

•Associated Electric has always had a focus on maintaining good performance, reliability and heat rate as part of its annual goals which has helped them to have an average heat rate of ~7% lower than the industry average in recent years.







Periodic Test Program

•As part of AECI's commitment to excellence in performance, Storm Technologies, Inc. became involved with the facility in 2008.

- •A comprehensive testing program was initially conducted to evaluate:
 - Clean air balance
 - Fuel line air balance
 - Fuel balance
 - Fuel fineness
 - Air/fuel ratios

- Primary air flow accuracy
- Mill outlet temperatures
- Secondary air and Overfire air accuracy
- Furnace exit conditions
- Flyash LOI's













Initial Test Results

- •Both fuel line air and fuel balance needed improvement
- •Plant airflow measurement devices needed to be calibrated
- •Imbalances were measured in the upper furnace leading to some localized slagging





RESULTS STORM

Performance Improvements

- •Orifice boxes were installed and clean air was balanced within ±2%
- •Storm worked with existing pitot tubes and airfoils to calibrate all airflows to be accuracy within ±3%
- •Fuel fineness has historically been very good (~75% through 200 mesh and 99.8% through 50 mesh)









Performance Monitoring

- •Annual pulverizer performance testing is completed by Storm Technologies' test teams. However, periodic fineness sampling is completed by plant personnel to monitor and track pulverizer performance in between.
- Performance irregularities have been identified and corrected as a result







Mill Outlet Temperature

- •Mill outlet temperature is often a minor detail in the performance optimization of the pulverizer that gets overlooked
- •December 2016 testing revealed that the mill outlet temperatures were being operated at 128°F
 - Most boilers firing PRB are limited to mill outlet temperatures of 135 °F based off of limitations on hot air available to the mill.
 - An increase was able to be made without adjusting the air/fuel ratio.
- •Mill outlet temperature ranges are often determined by the percentage of volatile matter in the coal



Volatile Matter - Accelerates the heating of the fixed carbon to its ignition temperature.





Mill Outlet Temperature

•A 7°F increase in mill outlet temperature resulted in better fuel line air balance, improved fineness and less tempering air flow bypassing the air heater (i.e. improved X-ratio)











Mill Outlet Temperature

- •The improved pulverizer performance as a result of higher mill outlet temperature affected the following:
 - Better balance in the burner belt
 - Better combustion in the lower furnace
 - Improved upper furnace conditions
 - Reduction in slagging/fouling in the superheat and reheat areas
 - This equates to less soot-blowing and improved pressure drop which are both stealth heat rate factors
 - Minimized popcorn ash that may impact SCR and APH performance downstream



RESULTS

Heat Rate Improvement

• Heat rate improvement of over 100Btu/kWh was achieved beginning in February 2016.

• Annual fuel savings were ~\$1,200,000.





Conclusions

- Every Btu counts when it comes to heat rate improvement
- A 7°F increase in temperature is not going to effect every boiler the same. AECI has taken a comprehensive approach to monitoring and improving performance which is why we agree that the increased mill outlet temperature had such a positive affect on heat rate.
- The pulverizers are the heart of the combustion system and when reviewing opportunities for heat rate improvement in the boiler you should start with reviewing their performance
- Periodic performance testing can help prevent major combustion related problems that could impact the efficiency and reliability of the boiler.

	Controllable Variable Quantaties	
Reduction of Air In-Leakage		240_Btu/k\//b
Reduction of Coal Rejects		40 Btu/kWh
Reduction of Air Heater Leakage		60 Btu/kWh
Reduction of Carbon in Ash		100 Btu/kWh
Reduction of De-Superheating Spray Water Flows		60 Btu/kWh
Achieve By:		
-Primary Airflow Optimization		
-Pulverizer Optimization and Improved		
Fuel Line Balance		
Total		500 Btu/kWh





Thank You!



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