Combustion Tuning Systems for Control of Unburned Carbon

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Good combustion practices reduce variability of unburned carbon and produce higher quality saleable ash as well as reduced carbon losses. Next to coal fineness, good combustion, characterized by good mixing and adequate air supply and time-at-temperature is essential to minimizing unburned carbon. With NO_x regulations driving boiler operation towards more air-lean conditions, unburned carbon levels can rise and become more variable. While sufficient boiler excess oxygen is generally present to complete burnout, the day-to-day changes in fuel and air distribution within the furnace can cause local fuel-rich conditions and an exponential rise in local unburned carbon levels. Unfortunately, increasing total airflow to the boiler to minimize these localized conditions results in increased NO_x emissions and sensible heating losses. The preferred way to address this is to tune the burner air distribution in order to balance spatial combustion conditions in the furnace. This has historically been done with manual boiler tuning services but can now be accomplished by operators using GE's new online combustion tuning systems. The technologies featured in this paper include a burner coal flow balancing system and a combustion tuning system. With these systems, operators can manage unburned carbon without raising total boiler excess oxygen levels. This maintains carbon burnout performance without increasing NO_x emissions and sensible heating losses. Other benefits of balancing spatial combustion and operating at minimum excess oxygen levels include reducing fuel-rich gas associated corrosion and slagging, reducing average and peak furnace exit gas temperatures and associated slag formation, reducing tube metal thermal fatigue and sootblowing and associated tube leaks, reducing steam attemperation as well as generally improving boiler operation and availability. This paper presents the demonstration of GE's combustion tuning systems and their performance impacts on a 380 MWe coal-fired boiler.

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